Official Journal of
ARRL
The national association
for AMATEUR RADIO

QST

devoted entirely to
AMATEUR RADIO

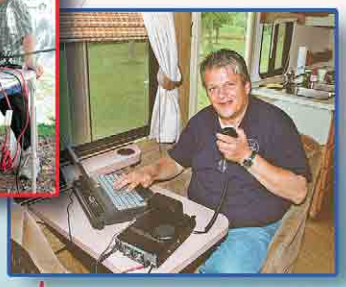
June 2004

QST reviews

Kenwood TS-480SAT and TS-480HX HF+50 MHz Transceivers

12/17 meter transverter

A multiband vertical



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FIELD DAY 2004

val•ue (văl´yo͞o) n from L valuta, worthy

1. a fair return in money or another medium of exchange for something. *"My Icom dual band mobile radio was well worth the money, a great value."*

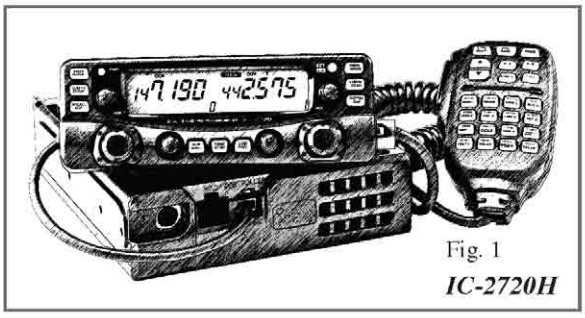
Fig. 1
IC-2720H

2. the exact monetary worth of something. *"My Icom dual band amateur radio is a great value especially since the remote head cable comes standard; a savings of over $50.00".*

3. the relative worth, importance, or usefulness of something to somebody. *"My Icom dual band radio is invaluable to our local emergency communications preparedness".* **<positive value for the money> <the value of unimpaired communications during an emergency>**

4. a. a numerical quantity that is assigned or is determined by calculation or measurement **<the value of x>** *"If I have ten Icom dual band mobile radios, and I take away four, I am in extreme sorrow, and I am left with a value of six Icoms – which is still a hundred times better than any other radio, let me tell you!"* **b.** precise signification **<the word value of something>** *"My Icom dual band mobile radio is beyond measurable value when it comes to emergency preparedness."*

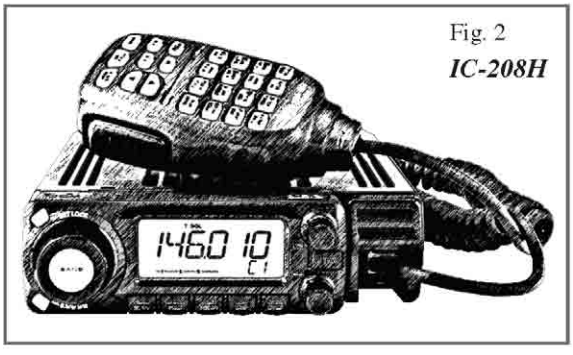
Fig. 2
IC-208H

5. a. the real or perceived duration of time a musical note is held. *"The clarity of sound my Icom dual band mobile gives is music to my ears."* **b.** the written representation of the quality of tone or a spoken sound. *"My Icom IC-208H has 2 Watts of audio output."*

6. a. the lightness or darkness of a color: LUMINOSITY **b.** the relation of one part in a picture to another with respect to lightness and darkness *"The amber value of my Icom's LCD display is adjustable to the environmental needs, and is perfect to see day or night."*

7. something (as a principle or quality) intrinsically valuable or desirable **<sought material values instead of human values>** *"I value my Icom dual band mobile radios above any other."* value verb

Inflected Form(s):

val·ued; val·u·ing; got to have one

See your favorite dealer.

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!

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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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- UPS Shippable • High Wind Rating • Fiberglass Radome • DC Grounded • Stainless Hardware

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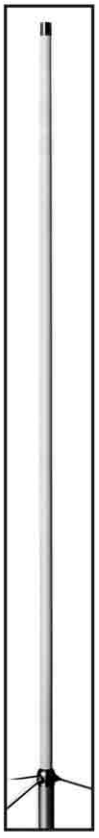
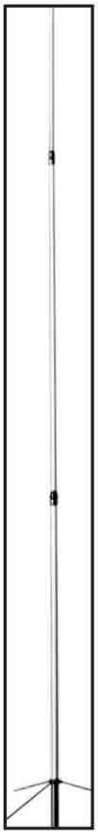
X500HA (UHF-Conn.)
X500HNA (Type-N Conn.)
Ruggedized Base/Repeater Antenna



X50NA



X500HNA

X50NA

The X50NA is an excellent choice where ruggedness is required in a medium–gain, dual-band, base/repeater application.

Features

- Wide frequency bandwidth
- Heavy duty fiberglass radome
- Stainless steel mounting hardware and radials
- Type–N Cable connection
- Compact size for easy mounting/installation

Specifications:

Freq.: 2m: 144–148MHz
70cm: 440-450MHz
Power: 200 watts
Wind Rating: 135 MPH (no ice)
Height: 5.6 feet

X500HNA

Diamond Antenna's best base station repeater antenna. Designed for strength and performance, the X500HNA is pretuned to achieve maximum gain in both the 2m and 70cm amateur bands.

Features

- Heavy duty fiberglass radome
- Overlapping outer shells for added strength
- Stainless steel mounting hardware and radials
- Strong, waterproof joint couplings
- Type–N Cable connection
- Wide band performance

Specifications:

Freq.: 2m: 144–148MHz 70cm: 440-450MHz
Power: 200 watts
Wind Rating: 90 MPH (no ice)
Height: 17.8 feet

COAX CONNECTION AT BASE END

HEAVY DUTY BASE/ RADIAL ASSEMBLY

STRONG JOINT COUPLINGS

DIAMOND Mono-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
CP22E [1]	144	200	UHF	9.0	70
DPGH62 [1]	50	200	UHF	21.0	78
F22A	144	200	UHF	10.5	112
F23A	144	200	UHF	15.0	90
F718A [2]	440	250	N	15.0	90
G200	2.4GHz	–	N	4.8	135

DIAMOND Dual-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
X50A	144/440	200	UHF	5.6	135
X50NA	144/440	200	N	5.6	135
X200A	144/440	200	UHF	8.3	112
X510NA [3]	144/440	200	N	17.2	90
X510MA	144/440	200	UHF	17.2	90
X500HNA	144/440	200	N	17.8	90+
X700HNA	144/440	200	N	24.0	90
U200	440/1240	100	N	5.9	135

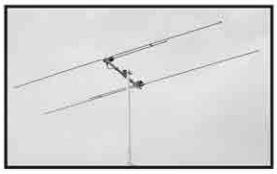
DIAMOND Tri-Band Base/Repeater Antennas

MODEL	BAND (MHz)	WATTS	CONN.	HT. FT.	RATED WIND MPH (No. Ice)
V2000A [5]	52/144/440	150	UHF	8.3	110
X3200A [4]	146/222/440	100/200	UHF	10.5	112
X6000A	144/440/1240	100/60	N	10.5	112

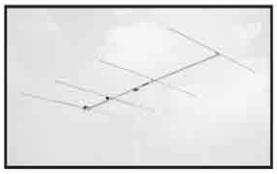
Most requirement: 1.4"-2.4"

DIAMOND Yagi Antennas

MODEL	BAND (MHz)	WATTS (PEP)	CONN.	BOOM LNTH.	ELEMENT PHASING
A502HB	50	400	UHF	2.6'	2 element
A504HB	50	400	UHF	10.7'	4 element
A144S5	144	100	UHF	37.5"	5 element
A430S10	432	100	UHF	43"	10 element
A430S15	432	100	UHF	89"	15 element



A502HB



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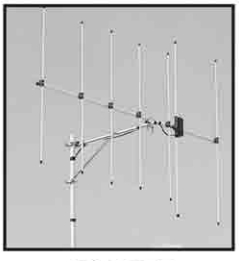

A144S5

NOTES:

1. Heavy duty aluminum construction.
2. F-718A: 440-450MHz., F718L: 420-430MHz.
3. X510NJ: 144-147/430-440MHz.
4. 2m: 146-148; 100 watts
5. 52-54MHz. only

BAND: 144=144-148MHz., 222=222-225MHz., 420=420-430MHz.,430=430-440MHz., 440=440 450MHz., 1240=1240-1300MHz.

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June 2004 ♦ Volume 88 Number 6

CONTENTS

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Technical

66

28

News and Features

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QST Workbench

51

83

92

102

Operating

Departments

Our Cover

Field Day fun is just around the corner—June 26-27. Will you be ready? These folks were during FD2003! At the top: Congresswoman Heather Wilson and two of her children all made FD contacts at N5VA, the Albuquerque ARC FD station. Facing her is Steve Richey, KD5RHR, who organized the GOTA station, and at the left is Paul Richey, AG3B (photo by Art Priebe Jr, N5ART). Top right: John Kochanski, KB9SXH, operates the LeFrog (Local Emergency Field Radio Operating Group of Milwaukee, Wisconsin) 2 meter SSB station, W9VBQ (photo by Leroy Skalstad, WD9HOT). Background: Bob Bruninga, WB4APR, demos a homebrew satellite system to Anne Arundel RC Jr, KI3DS.

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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All Other Countries: Membership in the ARRL, including a one year subscription to *QST*, $62, payable in US funds. Life Membership, including a subscription to *QST* is available at $1550.* Libraries and institutions, $62 per year.

*Payment arrangements available. Please write for details.

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

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

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NEW from Kuranishi Instruments LTD, Japan

BR-200 Professional-Grade SWR/Antenna Analyzer

NEW

Perform SWR and impedance measurements with confidence! The BR-200 is a laboratory grade precision test instrument providing a wide-band RF signal source for analyzing antenna systems and other equipment without the need for a separate transmitter. • 1.8-170MHz • High precision meter • 500mW 50 Ohm dummy load included • Impedance measurements: 12.5 - 300 Ohm • Connector: SO-239

COMET & Maldol

Dualband and Multiband Base Antennas

COMET GP-15 • Tri-band 52/146/446MHz Base Repeater Antenna • Wave: 52MHz 5/8 wave • 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 4 • Max Pwr: 150W • Length: 7'11" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239 • 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

COMET CX-333 • Tri-band 146/220/446MHz Base Repeater Antenna • Wave: 146MHz 5/8 wave x 2 • 220MHz 5/8 wave x 3 • 446MHz 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

COMET GP-3 • Dual-band 146/446MHz Base Repeater Antenna • Wave: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Max Pwr: 200W • Length: 5'11" • Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

COMET GP-6 • Dual-band 146/446MHz Base Repeater Antenna • Wave: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2" • Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

NEW

Maldol NEW HVU-8 Ultra-compact 8 band HF/VHF/UHF vertical antenna 80/40/20/15/10/6/2M/70cm Only 1/2 the traditional size and weight of vertical HF antennas, and it includes 2M/70cm! Unique radial system rotates for balcony installations, the radials can all be rotated to one side. • HF and 6M: 1/4 wave-length • 2M: 1/2 wave-length • 70cm: Two 5/8 waves in phase • Impedance: 50 Ohm • Max Power: HF 200W SSB • 6M–70cm: 150W FM • Conn: SO-239 • Height: Only 8'6" • Weight: 5lbs. 7ozs.

COMET GP-9/GP-9N • Dual-band 146/446MHz Base Repeater Antenna • BEST SELLER! • Wave: 146MHz 5/8 wave x 3 • 446MHz 5/8 wave x 8 • Max Pwr: 200W • Length: 17'8" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

COMET GP-24 The standard high gain 2.4GHz access point antenna for maximum range/signal strength • 2400-2500MHz • Length: 5'10" • Weight: 2lbs. 9ozs. • Conn: Gold-plated N-female • Construction: Heavy-duty white fiberglass radome

COMET GP-24-3 The same physical high gain 2.4GHz antenna as the GP-24, but with a 3-degree electrical downtilt to concentrate the signal to the horizon and below

COMET GP-24-S Medium gain access point antenna for applications where maximum distance is not as important as a solid signal around and directly below the antenna. • Length: 3'9" • Weight: 1lb. 14ozs. • Conn: Gold-plated N-female • Construction: Heavy-duty white fiberglass radome

Wi-Fi/802.11b/LAN/HSMM Access Point Antennas

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AIRWAVE SUPERIORITY

Never before has a compact HT offered as many features, and such high powered performance as the TH-F6A. Arm yourself with one today and gain your own airwave superiority.

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- Receives 2 frequencies simultaneously even on the same band
- 0.1~1300MHz high-frequency range RX (B band)[1]
- FM/FM-W/FM-N/AM plus SSB/CW receive
- Bar antenna for receiving AM broadcasts
- Special weather channel RX mode
- 435 memory channels, multiple scan functions
- 7.4V 1550mAh lithium-ion battery (std.) for high output[2] and extended operation
- 16-key pad plus multi-scroll key for easy operation
- Built-in charging circuitry for battery recharge while the unit operates from a DC supply
- Tough construction: meets MIL-STD 810 C/D/E standards for resistance to vibration, shock, humidity and light rain
- Large frequency display for single-band use
- Automatic simplex checker
- Wireless remote control function
- Battery indicator • Internal VOX • MCP software

[1]Note that certain frequencies are unavailable. [2]5W output

TH-F6A
TRIBANDER

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Omnibus

On April 15, that most auspicious of days on the American calendar, the FCC released a long-awaited Notice of Proposed Rule Making (NPRM) and Order addressing many aspects of the Amateur Radio Service rules. In fact, the NPRM had been awaited for so long that many had forgotten it was coming and initially confused it with license restructuring, a separate issue that is a long way from the NPRM stage.

Dubbed an omnibus proceeding because it deals with a great variety of topics, the NPRM and Order disposes of 19 separate petitions for rule making and one informal request submitted to the FCC by individuals and groups, including the ARRL, over a two-year period. A dozen petitions and portions of others were denied outright because the FCC was not persuaded that the proposals were either necessary or in the public interest. The remaining proposals, along with several offered by the FCC on its own motion, have been offered for public comment with a deadline of June 15 and a reply comment deadline of June 30.

One significant proposal is the so-called "refarming" of the Novice bands. Ever since the Technician license became the route of choice into Amateur Radio and especially since the Novice license became unavailable, the HF CW bands where Novices are authorized to operate have been underutilized relative to the rest of the HF bands. Radio spectrum access is a precious resource, and it would be poor spectrum management to maintain the *status quo*. So, following a 2001 survey that garnered more than 4700 responses, the ARRL proposed to put the 80, 40 and 15 meter Novice bands to better use. Impressed by the scope of the survey and the volume of responses, the FCC said it had decided to propose what the ARRL had requested (although there are a few minor discrepancies in the proposed rules that will have to be sorted out). If adopted, the following changes will result:

- *75 and 40 meters*: Additional 25 kHz of phone/image for Extra and Advanced licensees, and 50 kHz for General licensees, in each band.
- *15 meters*: Additional 25 kHz of phone/image for General licensees.
- CW, RTTY and data operators would benefit from the dropping of the 200 W power limit that now applies to all operators in the 80, 40 and 15 meter Novice bands.
- Novice and Tech Plus operators would be able to use CW (but not RTTY or data) in the General and Advanced (but not the Extra) portions of the 80, 40 and 15 meter bands, and CW, RTTY and data in that portion of the 10 meter band, at a power of not more than 200 W.

Another significant proposal comes from the FCC itself, to eliminate rules originally adopted in 1978 to address the so-called "CB linear" problem. Opposed at the time by the ARRL and equipment manufacturers as regulatory overkill, these rules have prevented the marketing of legitimate amateur amplifiers for use with HF QRP rigs, as well as some amplifiers for 6 meters.

A proposal that originated with Kenwood Communications Corp would make it possible for amateurs to use the "Sky Command" feature offered on some Kenwood equipment. Under this proposal, auxiliary stations would be permitted to operate on 2 meters above 144.5 MHz, except in the 145.8-146.0 MHz segment that is designated by band plan for satellite operations. Of course, the rule change would apply to all amateur stations, not just to Kenwood owners, and would facilitate the operation of amateur stations by remote control.

Other proposals included in the NPRM address the following topics:

- Use of spread spectrum by amateurs in the 222-225 MHz band (as proposed by the ARRL) and in the 6 and 2 meter bands (as proposed by the FCC on its own motion).
- Retransmission of communications from the International Space Station (ISS).
- Designation by amateurs of an Amateur Radio club to receive their call sign, *in memoriam*.
- Prevention of an abuse of the vanity call sign program by applicants who increase their chances for a specific call sign by filing multiple applications for the same call sign.
- Elimination of the requirement that the locations and times of amateur examinations be publicized in advance.
- Extension of Morse code examination credit to Technician licensees who have passed the Morse exam, regardless of when their Technician license was issued.
- Technical amendments involving the definition of data emission types to include narrowband image emissions; rules for the 902 MHz band in Colorado and Wyoming; space station launch notification; public service, emergency and RACES communications; communication on behalf of unlicensed third parties, and some editorial updates.

The FCC's NPRM and Order in WT Docket No. 04-140 is 71 pages long and includes much more detail than can be summarized here. Many amateurs will be interested in reading about the proposals that were denied, including several from the ARRL. The complete document is available at the FCC Web site, **hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-79A1.doc** or **hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-79A1.pdf**.

If you're interested in filing comments, read the document carefully—at least the portion that deals with the topic you wish to address—and follow the instructions. Remember that FCC rule making is not a simple nose-counting exercise; one solid argument outweighs a ream of comments of the "I support xxx" or "I oppose yyy" variety.

Of course, the ARRL will be filing comments as well. In the coming weeks the ARRL Executive Committee, with input from the rest of the Board, will carefully review the entire document. As always, your ARRL Director will be pleased to hear from you about any concerns you may have.—*David Sumner, K1ZZ*

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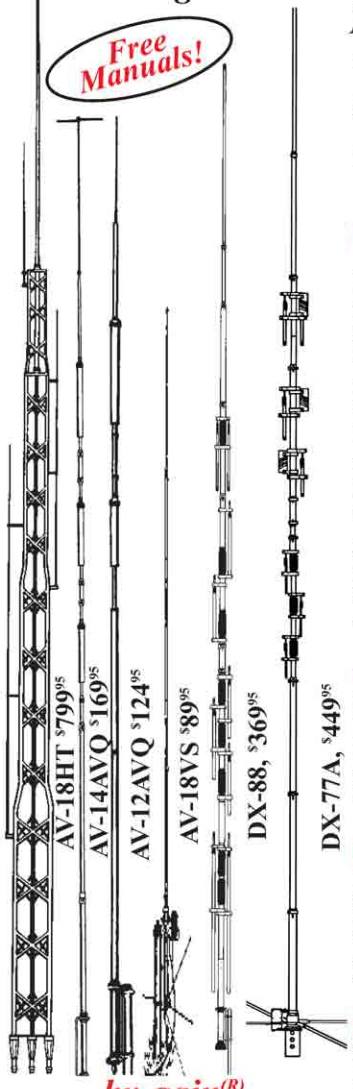

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AV-18VS, $89.95. (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

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AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
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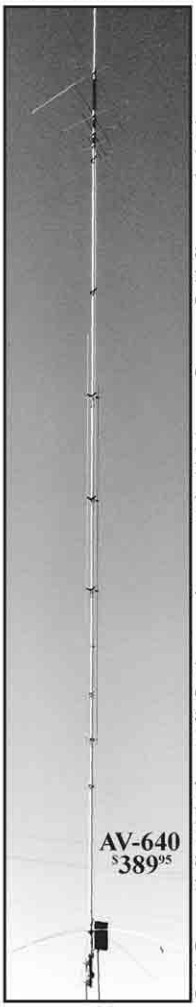

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ARRL in ACTION

***YOUR* membership at work**

By Dave Hassler, K7CCC, dhassler@arrl.org

Haynie Discusses BPL on National Radio Program

ARRL President Jim Haynie, W5JBP, was a guest on the syndicated radio program Coast to Coast AM for an hour and a half March 20, talking about Broadband Internet over Power Lines issues. Art Bell, W6OBB, hosted the show and ARRL Life Member Joe Walsh, WB6ACU, of the band The Eagles, joined Haynie on the air to explain BPL and its potential problems.

"Bell is genuinely concerned about BPL," Haynie said. "We had planned an hour, but the topic ran for another half hour after that. Art had done his homework on the issue. Joe had listened to BPL signals before and it was good that he could lend his help in the presentation."

ARRL

ARRL President Jim Haynie, W5JBP.

Haynie said the show went out to millions of listeners on 465 affiliates of the syndicated program. "I thought all three of us had a good dialog. I was very happy to be able to tell our side of the story to so many people," he said.

California Club Gets Friendly

With flyers distributed to local businesses and to other area clubs, the North Hills Radio Club of Sacramento, California held a "Bring a Friend Night" April 20. The special meeting was open to the public and the club invited everyone to come to learn about Amateur Radio. "There were demonstrations of many types of equipment as well as several modes of operation," said Sacramento Valley Section Manager Jettie Hill, W6RFF. The club gave demonstrations of satellite, PSK31, SSB and CW operating on HF, VHF and UHF equipment. A group that uses Amateur Radio during a 100-mile horse race through the Sierra Nevada demonstrated the equipment they use to keep track of the horses and riders. Hill answered attendees' questions at an ARRL information table and handed out ARRL membership forms.

"Roll Your Own" Membership Card and Certificate

Just a couple of clicks of the mouse can net ARRL members a handsome certificate that lets all who enter the shack know that you're a proud League member. The ARRL has set up a Web page that allows members to download a free color certificate and a replacement membership card, should they need one.

Point your Web browser to **www.arrl.org/members-only/memcert.html** to make your certificate and card. There you'll find instructions to obtain and print an Adobe PDF file that contains the certificate and the membership card. Set your printer to output at photographic quality, click "print" and create an attractive piece of wallpaper that lets others know you're a League member.

OK Web Site Keeps Members Informed

In the 10 months he's been at the helm, Oklahoma Section Webmaster David Maas, N7HRT, has taken a good thing—the Oklahoma Section's official Web pages—and made it even better, said Oklahoma Section Manager Jim Thomason, WB5SYT. "The site is maintained and effectively managed by Dave to keep Oklahoma Section members informed on national issues, section direction, and issues such as BPL and congressional legislation."

Modeled after the ARRLWeb, the Oklahoma Section Web site provides useful links at the top of the page and allows the browser to scroll through dozens of news items of interest to Oklahoma members.

Maas also posts news of current section activities, including hamfests, operating activities and entry points to use League resources on the stylish and well-organized page. "Between the Web page and the e-mail reflector, the information seems to be meeting the needs of the section," Maas said, noting the page has averaged 150 discrete visits each month. He said he would like to expand the site to contain more club events and information so that the section will have a better idea of what everyone is up to. You can visit the Oklahoma Section Web site at **www.qsl.net/wb5syt/**.

League Represented at AES Show

ARRL membership got a nice boost at the 10th annual AES Superfest in Milwaukee, Wisconsin April 2-3. Many hams stopped by the ARRL booth, with 60 amateurs completing a membership application. Central Division Director Dick Isely, W9GIG, even took in an ARRL Life Membership request.

ARRL

From left, ARRL Marketing Manager Bob Inderbitzen, NQ1R; Central Division Director Dick Isely, W9GIG; Wisconsin Section Manager Don Michalski, W9IXG, and Central Division Assistant Director (Wisconsin) Richard Polivka, N6NKO, staffed the ARRL booth at AES Superfest.

ARRL Marketing Manager Bob Inderbitzen, NQ1R, conducted a forum for 75 people entitled "Planning for Ham Radio's Future: ARRL's License Restructuring Proposal," drawing from a presentation prepared by ARRL First Vice President Joel Harrison, W5ZN. Inderbitzen said staff at the ARRL booth answered plenty of questions about license restructuring, and that those visiting the booth expressed support for ARRL's handling of the threat from BPL.

Ireland Instructs International Group on Value of Amateur Radio

ARRL Technical Relations Specialist Walt Ireland, WB7CSL, gave two presentations at a National Telecommunications and Information Administration-hosted training course for foreign nationals in spectrum management March 30-31 in Washington, DC. The course was presented under the auspices of the United States Telecommunications Training Institute, a non-profit organization.

Ireland's gave two talks, one on Amateur Radio as a national resource and another on disaster communications. "I have been doing this for about five years now, and [ARRL Chief Technology Officer] Paul Rinaldo, W4RI, gave the presentations before me," Ireland said. NTIA invited Ireland to give the presentations, and the ARRL Washington, DC staff also hosted a small reception for the students. Upper-level NTIA officials also attended the reception.

"This class had 20 students, primarily frequency managers in their national administrations, but few knew anything about Amateur Radio, and in most cases, our presentations give them a better understanding and appreciation for amateur radio and what amateurs do as a public service," Ireland said. Under the auspices of USTTI, the ARRL Washington, DC, staff also gives a one-week "Amateur Radio Administration Course" at ARRL Headquarters annually.

Ohio Section Gets Bearing on BPL

When on March 2, Cinergy Corporation announced BPL was being initiated in two Cincinnati neighborhoods, an announcement which even made *The Wall Street Journal*, Ohio Section Manager Joe Phillips, K8QOE, asked for a small group of advisors to begin sailing into uncharted waters. But what heading to take?

"It started with a teleconference," Phillips said. Five local hams got their bearings by hooking up with veteran BPL action groups from Raleigh, North Carolina and Rochester, Minnesota. BPL interference expert ARRL Lab Manager Ed Hare, W1RFI, and Ohio Section Official Observer Coordinator Alan Cook, N7CEU, also participated.

Phillips said the next task is to develop an interference investigation plan that's regular and credible. "It is our hope that eventually the utility will understand that some of the data measurements we obtain in the field will be information not available elsewhere," he said. "The ham radio community alone must take the leadership to make sure such evidence is available and sent to proper channels."

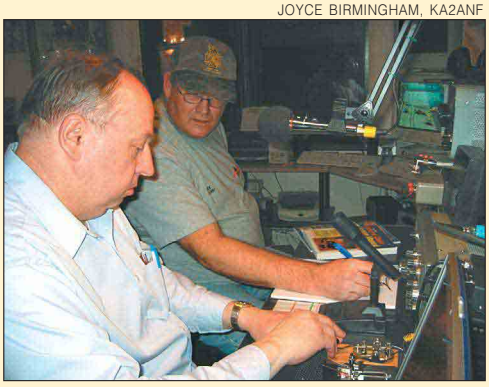
VE Team Pairs Up New Hams with Mentors

If you're a VE-tested ham, you may remember this scenario: You walk into the room, take your exams and then go back out into the hallway to sweat a little. Finally, the examiner comes out to tell you you've passed. Wow! Great! Cool! Your feet barely touch the pavement getting to your car to drive home. But then a thought crosses your mind—"...uh, now what?"

When ARRL Hudson Division Vice Director Joyce Birmingham, KA2ANF, restarted the Ridgewood, New Jersey-based 10-70 Repeater Association's VE team in 2000, she began pairing up new hams with current club members with common interests in an effort to reduce the frustration of the "what now" factor.

"More often than not, your new Technician leaves a VE session with such a great feeling that ultimately turns to great fear and frustration if they don't have someone to show interest in their achievements," Birmingham said. "I saw so much of that and decided to help these new hams." The effort has netted many new League members, 10-70 club members and other hams in the club's VE team.

JOYCE BIRMINGHAM, KA2ANF



Mike Snuffer, W2MLS (right), copies Morse code practice while his mentor, George Hall, N2CG, sends. Hall has been Snuffer's mentor for over a year and he has helped Snuffer set up a station. Snuffer passed his Morse code test in April and is studying for the General class exam.

ARRL-Sponsored Ham Robot Team Wins Awards

ARRL Southwestern Division Director Art Goddard, W6XD, visited the inaugural robotics regional competition in Phoenix, Arizona March 12 to cheer on the team from the Carl Hayden Community High School from Phoenix. The school specializes in computer science and marine biology. Many CHCHS robotics team members also belong to the school's radio club, KC7KFF. ARRL sponsored the CHCHS Robotics Team.

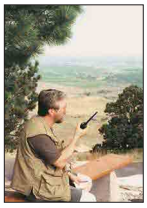
A key advisor to the Amateur Radio and robotics activities at the school is ARRL Educational Advisor Allan Cameron, N7UJJ. Cameron was pleased with his team's performance, which included winning the Engineering Inspiration Award, and team member Sharon Preiss, KD7PLA, won two scholarships. Goddard said Cameron is always looking to the future: "Allan quipped, 'Now if Marcos the Robot could only pass the Technician class license test...' "

ART GODDARD, W6XD

The ARRL-sponsored robotics team from Carl Hayden Community High School won the Engineering Inspiration Award at a regional robotics competition.

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

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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 . . .

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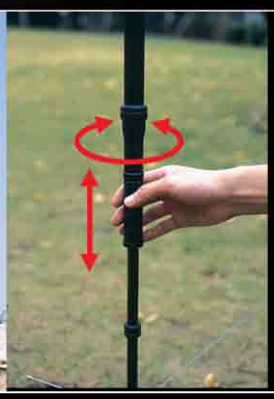

ATAS-25 Manually-Tuned Portable Antenna

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!

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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)

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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.

UP FRONT IN QST

Cruisin': As WW II cargo ships go, the SS *Lane Victory*, berthed at San Pedro, California, *is* something special. For one thing, thanks to a staff of dedicated volunteers, she offers summer cruises around Catalina Island. For another, she has a working RCA 4U, consisting of three transmitters, three receivers and an auto-alarm system. The emergency transmitter was designed to function off of batteries stored nearby in case of emergency. The ultimate last resort is a crystal set. The ship, a National Historic Landmark, is owned and operated by the US Merchant Marine Veterans of World War II, and is dedicated to the memory of civilian Merchant Marine and Naval Armed Guard lost at sea. Cruises for the coming season are scheduled for July 17 or 18, August 14 or 15 and September 11 or 12. For more information, see **www.lanevictory.org**.—*Jan Michalis, KE6CJM*

USMMV

SS *Lane Victory*, veteran of World War II, Korea and Vietnam, heads out to sea.

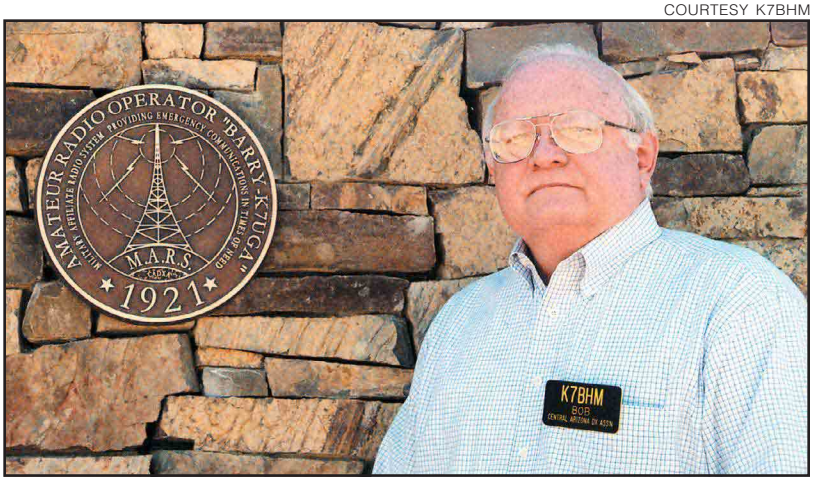
USMMV

Volunter Jay Flynn, WB9AWX, at the *Lane Victory*'s massive 4U console during a cruise off Catalina Island.

K7UGA Memorial Park Dedicated

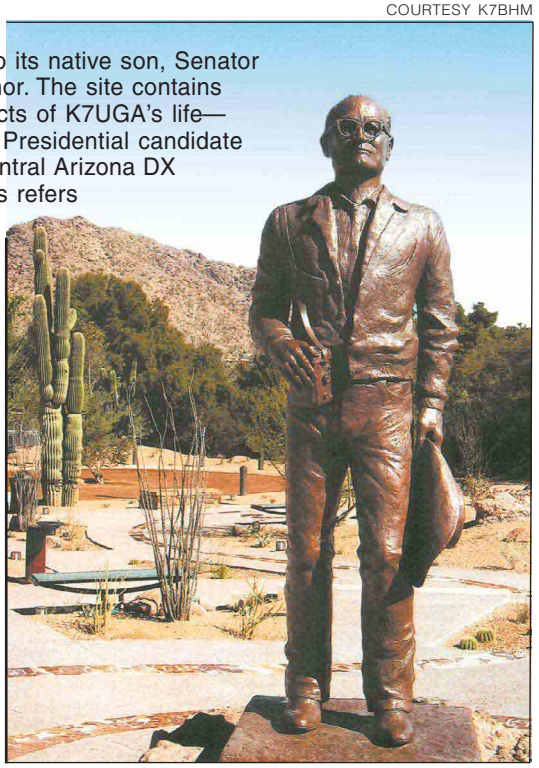
On February 14, 2004, the Town of Paradise Valley, Arizona, paid homage to its native son, Senator Barry Goldwater, K7UGA, by dedicating a 1½ acre memorial park in his honor. The site contains historic references, including eight bronze medallions showing various aspects of K7UGA's life—aviator, explorer, native American photographer, 35 years as a US Senator, Presidential candidate and, of course, active Amateur Radio operator. Through the efforts of the Central Arizona DX Association, of which K7UGA was a life member, one of the eight medallions refers to his activities with MARS and as an Amateur Radio operator who always introduced himself only as "Barry, K7UGA."—*Bob Davies, K7BHM*

COURTESY K7BHM



Bob Davies, K7BHM, with the medallion at the K7UGA memorial park that commemorates Senator Goldwater's long-time service to the Military Affiliate Radio Service and Amateur Radio.

COURTESY K7BHM



Barry Goldwater watches over the newly dedicated memorial park in Paradise Valley, Arizona.

BOB SHELBY, W7FPY

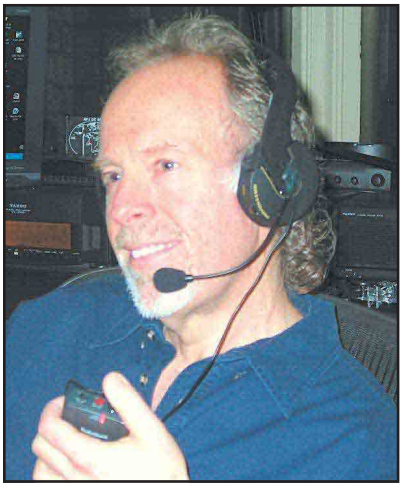
Field Day weekend is June 26-27: Groups looking for a prime Field Day location need look no further than Eugene, Oregon, where Bob Shelby, W7FPY, found this source of sustenance (top). Below, the Michigan City Amateur Radio Club kept warm through the long night last Field Day with this proud display of their station call sign.

COURTESY W9LY

ALAN KAUL, W6RCL

Kid's Day is coming: **Twelve-year-old Ryan Kaul, of LaCanada, California, chatted about video games, soccer and junior baseball with other young people from his dad's station, W6RCL, during Kid's Day in January. Find a kid or two—your own, even!—to activate your station June 19. There's more about Kid's Day in the article beginning on page 55.**

CINDY PEVAR



The author in the shack, about 15 feet away from the station.

Going Truly "Wireless"

~ By Alan Pevar, W6BAK

Have you ever wanted to leave your operating position even for just a moment, but were afraid you would not be there when the other op came back to you? Have you ever wanted to wander even further away from the shack, and still be able to carry on your QSO?

I have, so I went "wireless with my wireless."

For my roving headphones, I chose the Sennheiser HDR 8-9, a high-end model available at many audiophile shops. They are extremely lightweight and comfortable, and have an easy-to-get-to gain control on one of the earpieces. The small rechargeable NiCd battery is easily changed, with an extra one in a charger ready to be used. The small 900 MHz transmitter for the headphones plugs into the transceiver's audio or speaker output, and believe it or not, actually sits on top of my 1 kW Yaesu Quadra linear amplifier with *no* RF problems whatsoever.

Surprisingly, the best sounding mic turned out to be the one utilized in an inexpensive telephone headset used with wireless telephones. By surgically removing the flexible boom from the telephone headset's earpiece, I fastened it directly to the *wireless* headset with Velcro.

The thin cable that comes out of the end of the flexible mic boom is then connected to the input (via mini plug) of a small, pocket size, 900 MHz transmitter (RadioShack no. 32-1252). The matching 900 MHz wireless receiver for the mic is plugged into the "phone patch" input of my Yaesu 1000MP transceiver. As an extra bonus, the mic's receiver has built-in bass and treble controls, making it sound really great.

With the now *wireless* mic fastened to the *wireless* headset, the mic's small transmitter in my pocket, and the transceiver's VOX switched on…voilà, I'm free to roam!

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Clockwise from left: Jack Burchfield (seated), K4JU, President; Gary Barbour, AC4DL, VP/Engineering Director; Scott Robbins, W4PA, Sales & Marketing Manager; Larry Worth, WA4BSM, Production Manager; Paul Clinton, WD4EBR, Service Manager

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KILO-WHAT?

♦ Thank you for publishing the excellent article, "Use the Right Phonetics" [May 2004, page 63], by J. D. Harper, K6KSR. I would like to add my personal gripe to the list: stations using KILOWATT as a phonetic. Having something of an electronics inclination (as do many hams), I'm not sure whether the other station meant to send K or KW. Worse yet, I find that if I ask for a fill or confirmation (Now, is that KILO WHISKEY CHARLIE 9 ALPHA SIERRA INDIA?) because I'm not sure of their call sign, typically the operator will repeat it verbatim, sending that confusing KILOWATT again.

I should note that mostly I hear this practice on a wide coverage 2 meter repeater, where 95% of the time signal reports are Q5 and full quieting for a 60+ mile radius (85 miles typically). Please help me encourage our fellow League members and everyone else on the bands to send something less confusing, especially when they are asked for clarification—and especially those who've earned their 1×2 or 2×1 call.—*William Baguhn, KC9ASI, Madison, Wisconsin*

♦ John Harper's article on Phonetics goes right to the point, and I for one am certainly glad he wrote it and you published it. I once gave a talk at a local ham club meeting about the same subject, and I, too, gave some ridiculous ones. The best (worst) I have come up with for my call is KNACK FIVE MNEMONICS AUGMENT TSUNAMIS.—*Bill Wageman, K5MAT, Albuquerque, New Mexico*

LET US USE WHAT WE HAVE!

♦ We as hams have battled diligently against those who would take our frequencies, and we must press on. How do we do that? *Use what we have*. The old adage "lose it or use it" has come into play.

Everyone has reasons why they got their Amateur Radio license. I got mine because I thought it would be cool to talk to someone in another state or another country without wires, using a station I built. Many who get their licenses were so excited when they passed the test after all that studying and the day they got their own call sign. Now, time has passed and the excitement has come and seemingly gone, but where did it go? Having no time seems to be the biggest issue. But ask yourself where do you spend most of your time when you are not at work? In front of the TV is the answer for most.

I don't know why we get distracted and seem to think we don't have time for something we love, or once have. We have lots of places to operate such as our cars, and even at work. So time shouldn't be an issue. Amateur Radio is a wonderful hobby, and has done more for people than just being able to talk on the radio. Being able to create something of your own design and see it work is absolutely one of the greatest things to us. It allows us to learn, grow and expand our minds, not only in electronics, but also in learning about other cultures. What is that worth in money?

Why not get on the air tonight, or right after you're done reading this? You, as one individual, will be doing more than being happy you are back on the air. You, as one individual, will help save our hobby, and because of our hobby, individuals have saved lives and paved the road to the future. Don't make the mistake of thinking you as an individual won't make an impact, because individuals added together will make an impact. Make the move, and get on the radio tonight on your favorite band and call CQ or find some old friends and talk to them, even if it's just to say hello. We have spectrum, so let's make good use of it.—*Ben Naber, KB9LFZ, Rapid City, South Dakota*

LOOK IT UP!

♦ There has been a trend for a while of amateurs sending book messages to fellow amateurs via the NTS. This is a good thing—it keeps the traffic flowing, it gives great practice for the new hams in message handling, and keeps the skills honed for the veterans. I wish a few more of us would handle traffic, but that is another story.

There are some stations out there sending book messages that are not looking up the call sign in updated databases. Instead, they are using outdated Callbooks or whatever they have to get an address to the ham who will receive the message.

It is very uncomfortable to deliver one of these and have the person on the phone tell you that Joe or Jane has been a Silent Key for three years. What is even worse is when Joe or Jane has been a SK for less than a year and you hear the sudden sadness in their voice. It has happened to our group here more than once, and word of this issue needs to be spread.

If you are going to use the system, look up the station's current status. If you want to use the system, send them to your ham buddies. Then you can see how long the message took to get from sender to the receiver—it's a good system check. —*Pat Conway, WA6JGM, Christian County EC, Ozark, Missouri*

W6QYT (SK)

♦ I was saddened to see Dr O. G. Villard's (W6QYT) name on the Silent Keys list in the April 2004 issue of *QST*. Although I hadn't been in touch with him for many years, I have fond memories of him from when, as a student at Stanford University, I worked under him on a meteor research project.

Our objectives were to determine meteor velocities and ionospheric column velocities by bouncing radio signals off the columns. My involvement was in 1949 and 1950. One objective of the study was to try to determine if any meteors had sufficient velocity to have come from outside our solar system. Another objective was to find the upper atmospheric wind velocities from the drift rate of the columns.

I was not an active ham then, as my license, W6PUQ, had expired after WW II, where I had done five years of active duty as a USNR Radioman, mostly on radio intercept work. I recall that Mike was quite an active ham. I also know he wrote articles for *QST*. He must have inherited some of his writing ability from his father (also named Oswald Villard), who had written several popular books. Mike was often seen around the campus driving a then-ancient Hupmobile named "Gargantua." He was well liked by everyone I knew and we will miss having him as a fellow ham.

After an all night meteor search session I sometimes found myself nodding off in class the next day. As one would expect, we were most active during periods when there were meteor showers—and sometimes the most sleep deprived. Although I wasn't directly involved, I know that the data reduction with the mechanical calculators available then was quite a laborious process.

My present call, AA6AO, was obtained in 1986, after 40 or so years off the air and two years after retirement. Naturally, with my Navy background, I prefer CW. It is heartening to tune in the HF bands and hear so many good CW operators, especially during contests. CW is by no means dead or even dying.—*Sherwin Rodman, AA6AO, Northridge, California*

PAGE 1 PUBLICITY

♦ Congratulations to the ARRL staff who assisted the *Wall Street Journal* with its ham radio story on page 1. The story by Ken Brown of the *WSJ* staff is the breakthrough we have been looking for in getting Amateur Radio's Broadband over Powerline objections in the national debate. It was a major triumph for ham radio in general and the ARRL in particular. The technical side of the BPL issue, long ignored by the nation's media despite our previous efforts, has now been recognized by a major national newspaper of record.

While some may have problems with part of the author's approach, this article was read by decision-makers throughout the United States. Now, when BPL is discussed, the technical problems must be part of that story, as well as any economic developments. And the ARRL will be part of that national debate from now on. This is a super accomplishment.

To anyone who objects, I would please ask what page 1 stories they have seen on BPL recently. All of us would have worded that story differently. But that story broke the ice and put us into a national debate where we belong.

Again congratulations for this accomplishment. Hams should hold their heads high today.—*Joe Phillips, K8QOE, ARRL Section Manager, Fairfield, Ohio*

WAS NOSTALGIA

♦ The article in the April issue of *QST* ["From Whence Came WAS, WAC and DXCC?" pages 48-52] took me on a trip down memory lane. I guess that younger hams operating now from countries outside North America don't realize just how tough a qualification WAS could be when it was first announced. I attempted it from England pre-war but couldn't achieve more than 42 states. There were about a dozen difficult ones, but the real tough holdouts were the "desert states" of Arizona, Nevada and New Mexico. It's laughable now, but the appearance of a ham in one of those states was a subject for discussion at club meetings back then. Of course, mobile operation was in its infancy, so no help there.

Thanks for reviving pleasant memories.—*John Wightman, ZL1AH (ex-G3AH), Tauranga, New Zealand*

QSL—QUICKLY

♦ If a club or individuals can take the time to plan, advertise, set up and operate a special event operation, they should also allow time and take the responsibility to reply to the QSLs they receive in a timely matter. I suspect the majority of the requests arrive soon after the event. —*David L. Glass, W8UKQ, Alliance, Ohio*

THIS MAY BE THE YEAR

♦ I was finally happy to see that there is other Earth-Sun-Earth activity out there! ["ESE—A New Frontier," Apr 2004, pages 53-55]. I have been bringing my ESE setup out to Field Day for many years now, and have had no complete contacts so far but it looks like this may be the year.

It is very frustrating bringing all of my dishes out there every year for nothing. By reading the article, I have also learned that my focal length was not adjusted correctly. I seem to be a few million miles off.

I also purchased one of the Plasma Generator kits mentioned, and found that I was igniting too many treetops at our Field Day location, so I had to cut off some limbs before I used it the following year.

I will be ready this year, however, and will be looking for the Tampa Bay group via Earth-Sun-Earth!

By the way, I sure enjoyed this April article and I look forward to the April issue every year! Keep up the great work.—*Larry Shaunce, WDØAKX, Albert Lea, Minnesota*

JUST VOLUNTEERS?

♦ Every time a problem arises within a group comprised of volunteers, I always hear the same excuse: "We are just volunteers—what do you expect?" Why is it that "volunteer" has to be associated with incompetent or inefficient?

I know many volunteers who do an outstanding job. I also know from having been, and currently being one, that it is often a thankless and unappreciated position. If a person is out to inflate their ego, volunteer work is not for them!

It has nothing to do with being a volunteer, and everything to do with attitude. If you do not want to be a volunteer, then do not volunteer! If you volunteered and discovered you can not handle the job, find a different job to do instead. There is no shame in failure; excusing it by discrediting the organization or group is a different matter.

It is very difficult to get volunteers for anything nowadays. What we do not need is the image of those who do volunteer being tarnished by others who excuse their blunders because "they are just a volunteer"!—*Duane Fischer, W8DBF, Flint, Michigan* QST

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By Steven C. Hageman

Give That Drake Receiver a New Lease on Life

The venerable R-4 is a terrific receiver and is widely available, but it requires a separate crystal for each band segment. Replace all those crystals with this synthesizer and revive your Drake.

The Drake R-4 series receiver owner could obtain crystals to cover any of fifteen 0.5 MHz frequency segments from 1.5 to 30 MHz. That still left much of the HF spectrum unreachable. Drake's solution to the problem was the FS-4, which synthesized all the required crystal frequencies, allowing full HF coverage from a single R-4 receiver. FS-4s are not very easy to come by, however, and command top dollar when they can be found.

Since I like to listen to all the HF bands but haven't won the lottery yet, I set about designing a modern FS-4, which I call the Drake 4-Line Crystal Eliminator. The completed synthesizer is shown in Figure 1, alongside my own R-4B receiver. This project will convert any R-4 series receiver (including the SPR-4) to full 1.5 to 30 MHz receive capability—the equivalent of 57 separate crystal bands.

Since low-cost, powerful, single-chip microcontrollers and alphanumeric LCD and VFD[1] text displays are among the lowest cost parts available today, I added several features that makes this synthesizer much more user-friendly than Drake's original. As shown in Figure 2, the Crystal Eliminator display includes the lower band edge frequency like the FS-4 did, as well as the common designation of the band being received and exact preselector settings for each of the 57 synthesized frequencies.

receivers shown alongside one of these popular receivers (an R-4B). The synthesizer allows any band within the receiver's frequency range to be tuned without crystals.

How It Works

Drake set the receiver's frequency by premixing a 4.955 to 5.455 MHz PTO with a fixed frequency crystal such that the output of the pre-mixer was 5.645 MHz higher than the desired receive frequency:

Crystal Frequency = Lower Edge of Receive Band + 11.1 MHz

The band edges are spaced 500 kHz apart since the VFO is designed to tune by that amount. To tune from 1.5 to 29.5 MHz the crystal frequencies must range from 12.6 to 40.6 MHz—a 3.2 to 1 frequency ratio. Typically the best noise performance in VCOs is obtained when they are designed for frequency ratios less than 2 to 1. How to cover a 3:1 frequency range with a 2:1 VCO?

The problem was solved using the circuit design shown in the block diagram of Figure 3. A 50 to 100 MHz VCO is controlled by a PLL—the output divided by either 2 or 4—before being fed to the receiver for pre-mixing. For example: If the desired output is 12.6 MHz (to receive at 1.5 MHz), then the VCO frequency is programmed to 12.6 × 4 = 50.4 MHz and the output dividers set to divide the signal by 4. The next band at 2 MHz requires a crystal frequency of 2 + 11.1 = 13.1 MHz and a VCO frequency of 13.1 × 4 = 52.4 MHz. For the 14.0 to 29.5 MHz bands, the output dividers are set to divide by 2 and VCO frequency is varied from 50.2 to 81.2 MHz.

Since the PLL divides the VCO output by integer values, the reference frequency to the phase detector sets the minimum channel spacing (R divider in the block diagram). To change bands, the output frequency must change by 500 kHz. Since the minimum output divisor is 2, this requires a VCO change of 1 MHz between bands.

The actual output frequency must be 12.6 MHz, 13.1 MHz, etc, to correctly emulate the crystal frequencies. The greatest common divisor of all output frequencies is 100 kHz. Since the minimum output divisor is 2, the phase detector reference input must be 200 kHz. Dividing the 10 MHz reference oscillator by 50 produces a 200 kHz reference frequency to the phase detector and the VCO output is programmable in 200 kHz increments. This is quite advantageous, as the higher reference frequency allows a higher loop bandwidth and less total multiplication of the reference frequency, resulting in a lower total phase noise design.

With the proper selection of the VCO divide ratio, N, and output dividers, the output can be correctly set at 12.6, 13.1, 13.6, etc, all the way up to 40.6 MHz, thus generating all of the frequencies required for full HF coverage.

[1]Notes appear on page 34.

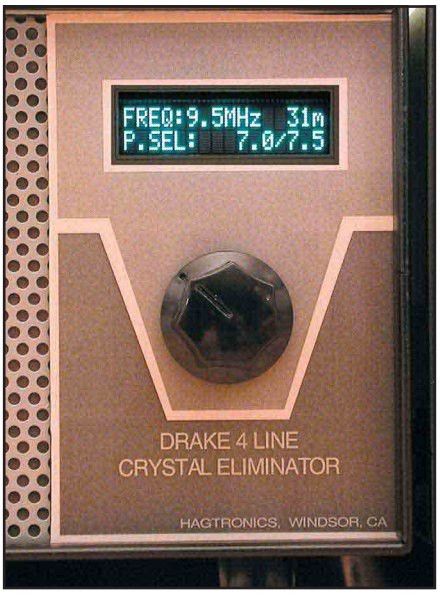


Figure 2—The Crystal Eliminator's display shows the frequency band being received with the more common wavelength (meter) designation, and the receiver's preselector setting.

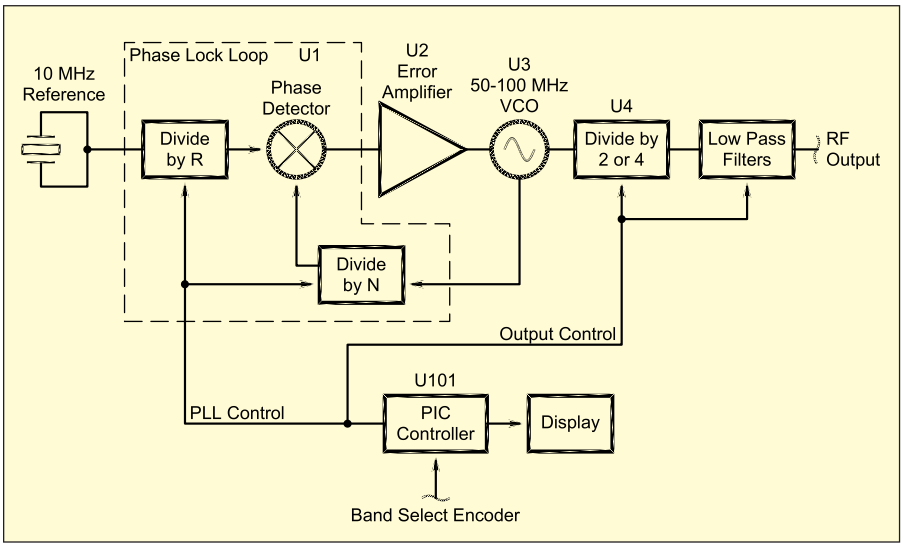


Figure 3—The synthesizer circuit design is based on the Motorola MC145170 PLL IC, U1. A 10 MHz crystal is used as the reference, U2 is the integrating error amplifier, U3 is a 50 to 100 MHz Mini-Circuits modular VCO and the 74AC74 D flip flops (U4) are used as the dividers. These outputs are then low pass filtered to remove harmonics before being passed via coax to the receiver.

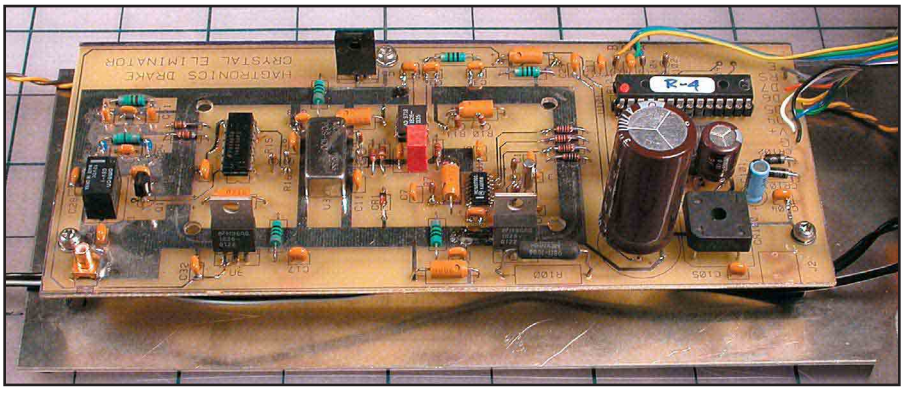


Figure 4—The entire synthesizer is constructed under a die cast box which acts as a shield. The box sits on the large rectangular circuit track in the center of the PC board. The shield also acts as a heat sink for linear regulators U6 and U100 seen at the lower edge of the PC board.

Synthesizer Circuitry

The completed synthesizer circuit board is shown with its shield housing removed in Figure 4. It was designed to be low in cost by using readily available parts while every effort was made to maximize performance. The PLL is based on the Motorola MC145170 PLL IC[2] and a Mini-Circuits modular VCO.[3]

The PLL contains the R and N dividers and has a push-pull, tri-state phase detector output. The output is converted to a current by the resistors R7 and R8. This current is integrated by capacitor C8 and op amp U2. Loop feedback is a standard lead-lag configuration that is adjusted for a nominal crossover frequency of approximately 1 kHz. Capacitors C7 and C11 serve to reduce the reference frequency spurs on the VCO tuning line and hence on the frequency output of the VCO.

To keep the complexity and cost of the synthesizer down, a standard 50-100 MHz Mini-Circuits VCO was used. Using a premade VCO has the advantage of good performance—eliminating the problem of acquiring precision components for the LC tank circuit. There is also the guarantee that it will work!

The output dividers extend the range of the VCO, reduce phase noise, strip the output of any AM modulation and buffer the VCO output. The low-pass filters reduce the harmonics of the square-wave output. The Drake preselector circuitry also acts to tune the premixer output, which further filters the local oscillator output and the harmonics of the premixer.

To aid in debugging the PLL circuitry a jumper can be grounded on pin 21 of the microcontroller (U101). At power-up, if this pin grounded, the following PLL output pins are enabled:

LD—Lock detect

F_r—Reference frequency from the R divider

F_v—Output from the N divider

These signals can be useful for diagnosing problems. For exact information on these functions see the Motorola MC145170 data sheet. Normally the debug pin should be left open to disable these outputs. This helps to reduce spurious signals from being introduced into the synthesizer.

A die cast box that is assembled around the completed PC board shields the entire synthesizer.

Microcontroller Circuitry

The microcontroller used in this project is the PIC16F876 produced by Microchip Technology.[4] It handles the user interface and controls the PLL synthesizer circuitry. I chose the 16F876 as the cost is low and it uses flash memory—it doesn't require an ultraviolet PROM eraser to be programmed. As far as memory utilization goes, the text displays use a lot of program memory and nearly the full memory capability of the 16F876.

The microcontroller uses the same 10 MHz oscillator as the PLL. Running the PIC at the full 10 MHz keeps the number of subharmonics of the reference frequency to a minimum; this helps to eliminate any undesired signals from being introduced into the receiver.

The band is selected by the rotary en-

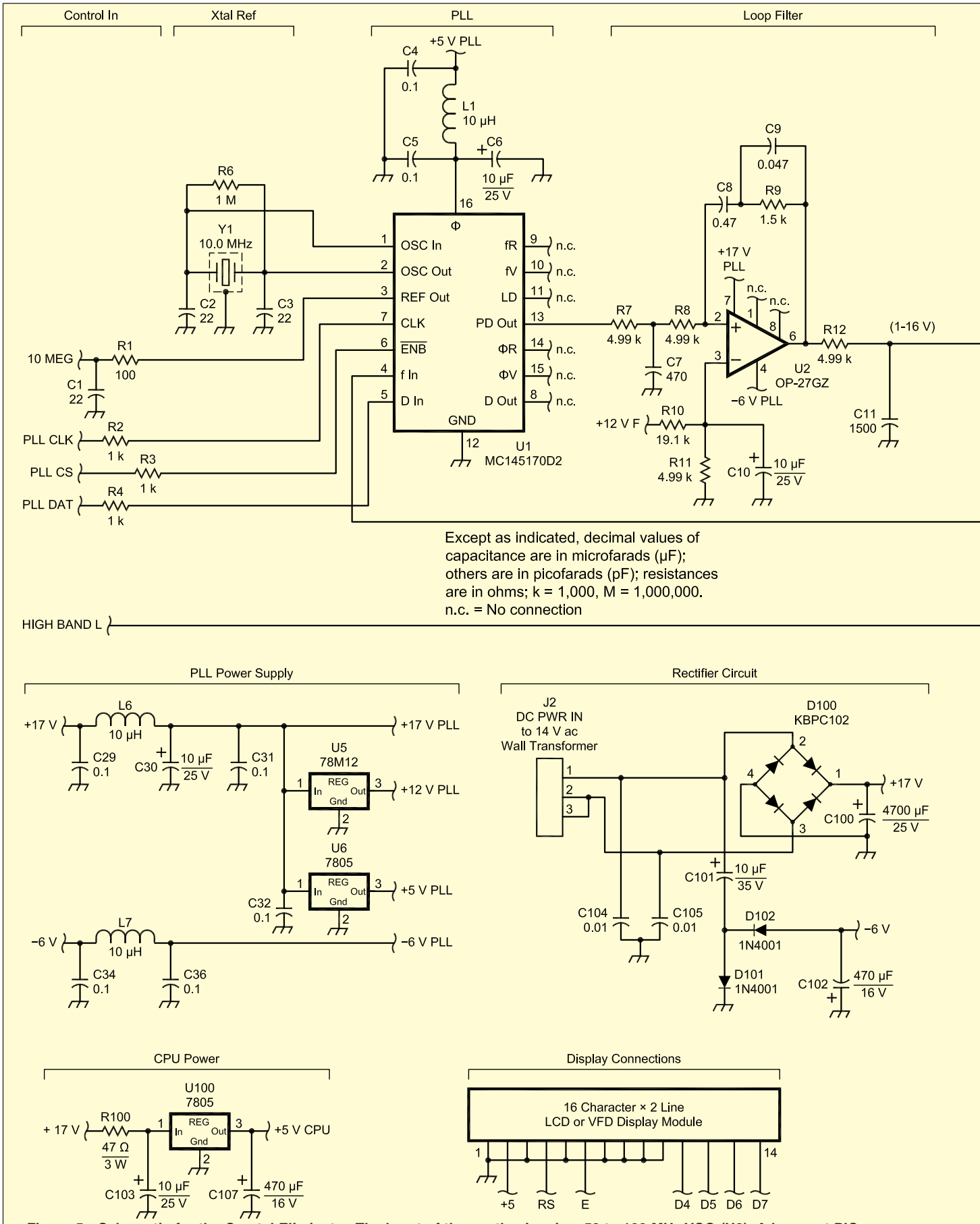
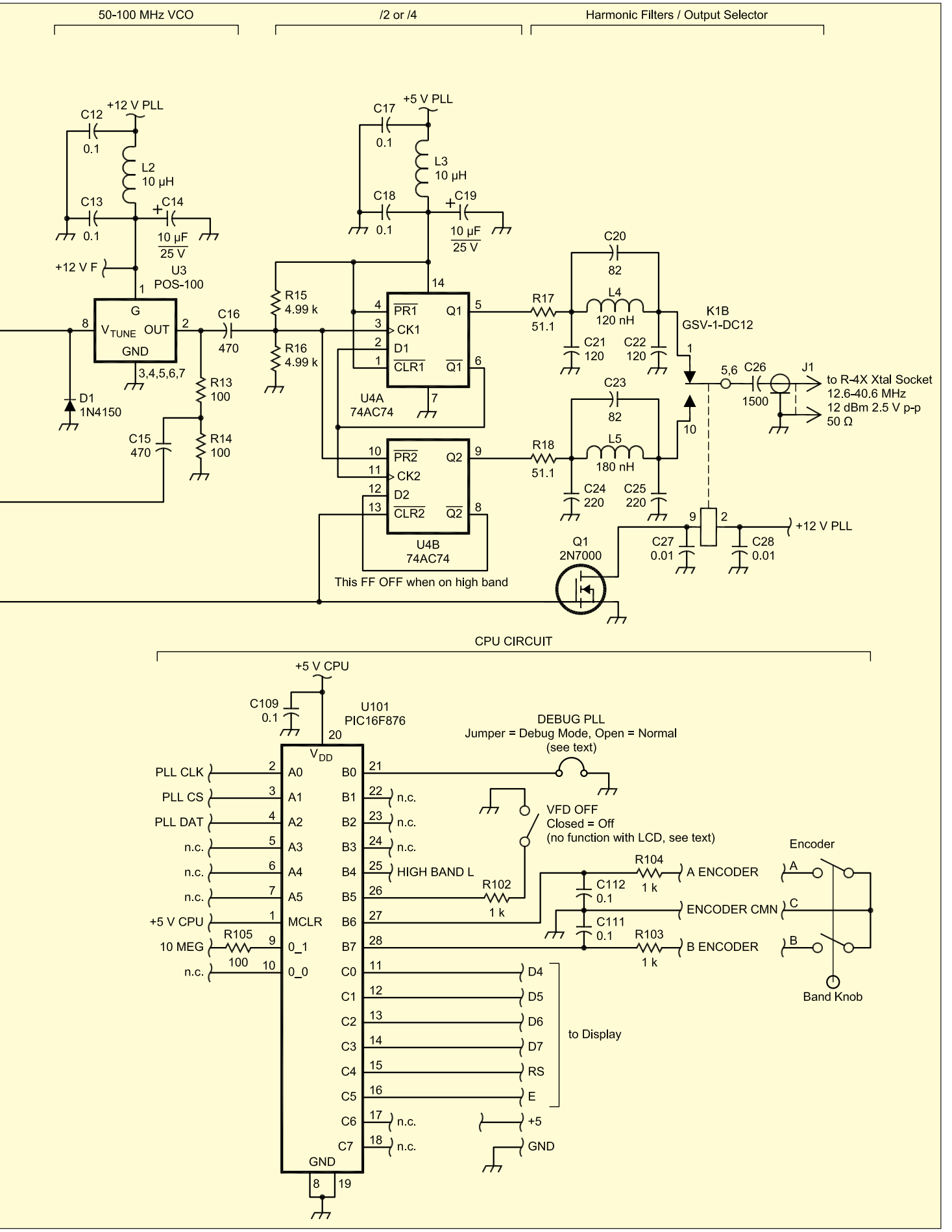


Figure 5—Schematic for the Crystal Eliminator. The heart of the synthesizer is a 50 to 100 MHz VCO (U3). A low cost PIC microcontroller (U101) reads the band select encoder, controls the PLL (U1), and displays frequency and tuning information within the display. Refer to the Parts List sidebar on page 32.


50-100 MHz VCO
/2 or /4
Harmonic Filters / Output Selector
+12 V PLL
C12
0.1
L2
10 µH
C13
0.1
C14
10 µF
25 V
+12 V F
U3
POS-100
G
VTUNE OUT
GND
3,4,5,6,7
C16
470
R13
100
R14
100
C15
470
D1
1N4150
+5 V PLL
C17
0.1
L3
10 µH
C18
0.1
C19
10 µF
25 V
R15
4.99 k
R16
4.99 k
U4A
74AC74
PR1 Q1
CK1
D1
CLR1 Q1
U4B
74AC74
PR2 Q2
CK2
D2
CLR2 Q2
This FF OFF when on high band
R17
51.1
R18
51.1
C20
82
L4
120 nH
C21
120
C22
120
C23
82
L5
180 nH
C24
220
C25
220
K1B
GSV-1-DC12
5,6
C26
1500
J1
to R-4X Xtal Socket
12.6-40.6 MHz
12 dBm 2.5 V p-p
50 Ω
Q1
2N7000
C27
0.01
C28
0.01
+12 V PLL
CPU CIRCUIT
+5 V CPU
C109
0.1
U101
PIC16F876
VDD
GND
DEBUG PLL
Jumper = Debug Mode, Open = Normal
(see text)
VFD OFF
Closed = Off
(no function with LCD, see text)
PLL CLK
PLL CS
PLL DAT
n.c.
+5 V CPU
10 MEG
R105
100
A0
A1
A2
A3
A4
A5
MCLR
0_1
0_0
B0
B1
B2
B3
B4
B5
B6
B7
C0
C1
C2
C3
C4
C5
C6
C7
HIGH BAND L
R102
1 k
R104
1 k
R103
1 k
C112
0.1
C111
0.1
A ENCODER
ENCODER CMN
B ENCODER
Encoder
A
C
B
Band Knob
D4
D5
D6
D7
RS
E
to Display
+5
GND

Parts List for Figure 5

C1-C3—22 pF, COG, 50 V, ceramic (Newark 92F1694).
C4, C5, C12, C13, C17, C18, C29, C31-C36, C109, C111, C112—0.1 µF, X7R, 50 V, ceramic (Newark 89F3212).
C6, C10, C14, C19, C30, C103—10 µF, 25 V tantalum (Newark 87F5007).
C7, C15, C16—470 pF, COG, 50 V, ceramic (Newark 89F3207).
C8—0.47 µF, 63 V, 5% polyester (Mouser 75-MKT1826447064).
C9—0.047 µF, X7R, 50 V, ceramic (Newark 95F7178).
C11, C26—1500 pF, COG, 50 V, ceramic (Newark 95F4941).
C20—82 pF, COG, 50 V, ceramic (Newark 50N791).
C21-C23—120 pF, COG, 50 V, ceramic (Newark 50N793).
C24, C25—220 pF, COG, 50 V, ceramic (Newark 50N796).
C27, C28, C104, C105—0.01 µF, X7R, 50 V, ceramic (Newark 89F3220).
C100—4700 µF, 25 V, aluminum (Newark 91F3280).
C101—10 µF, 35 V, aluminum (Newark 91F3282).
C102, C107—470 µF, 16 V, aluminum (Newark 91F3262).
D1—1N914, 1N916, 1N4148 silicon switching diode (Newark 38C7708).
D100—KBPC102, 200 V, 6 A, bridge rectifier (Newark 06F8773).
D101, D102—1N4001, 50 V, 1 A, diode (Newark 09F3576).
K1—Relay, Orion G5V-DC12 (Newark 52F3869).
L1-L3, L6, L7—10 µH, 10%, inductor (Mouser 70-IMS5-10).
L4—120 nH, 10%, inductor (Mouser 70-IM2-.12).
L5—180 nH, 10%, inductor (Mouser 70-IM2-.18).
Q1—2N7000 transistor (Mouser 512-2N7000D26Z).
R1, R13, R14, R105—100 Ω, 1/4 W, 1% resistor.
R2-R4—1 kΩ, 1/4 W, 1%, resistor.
R6—1 MΩ, 1/4 W, 1%, resistor.
R7, R8, R11, R12, R15, R16—4.99 kΩ, 1/4 W, 1%, resistor.
R9—1.5 kΩ, 1/4 W, 1%, resistor.
R10—19.1 kΩ, 1/4 W, 1%, resistor.
R17, R18—51.1 Ω, 1/4 W, 1%, resistor.
R100—47 Ω, 3 W, 10%, resistor.
R102-R104—1 kΩ, 1/4 W, 1%, resistor.
U1—MC145170D2, SOIC PLL (Newark 95B4172).
U2—OP27GP, operational amplifier (Newark 05F8613).
U3—POS-100, 50-100 MHz VCO (Mini-Circuits POS-100).
U4—74AC74PC, dual D flip-flop (Newark 34C8075).
U5—L78M12CP, 12 V regulator (Mouser 511-L78M12CP).
U6, U100—L7805ACP, 5 V regulator (Mouser 511-L7805ACP).
U101—PIC16F876-20 processor, programmed for R-4 or SPR-4 (see notes).
Y1—10.000 MHz crystal, 18 pF load (Digi-Key 300-5016-ND).

For SPR-4 receiver substitute the following:
C8—3.3 µF, 63 V, 5%, polyester.
C9—0.47 µF, X7R, 50 V, ceramic.
C11—0.01 µF, X7R, 50 V, ceramic (Newark 89F3220).

Miscellaneous

J1—SMB RF connector (Jameco 167311).
J2—2.5 mm power socket (Mouser 163-5003).
14 V ac wall adapter (ac/ac) (Jameco 171854).
Encoder, 8 position, Grayhill (Newark 16F7290).
Knob (Mouser 45KN014).
Die-cast shield box with cover (Jameco 11957).
SMB/SMB 50 Ω RF cable, 1 foot (Jameco 175177).
LCD display, 16×2 (Digi-Key 73-1025-ND) or
VFD display, 16×2 (Digi-Key 286-1002-ND) (use either type; see text).

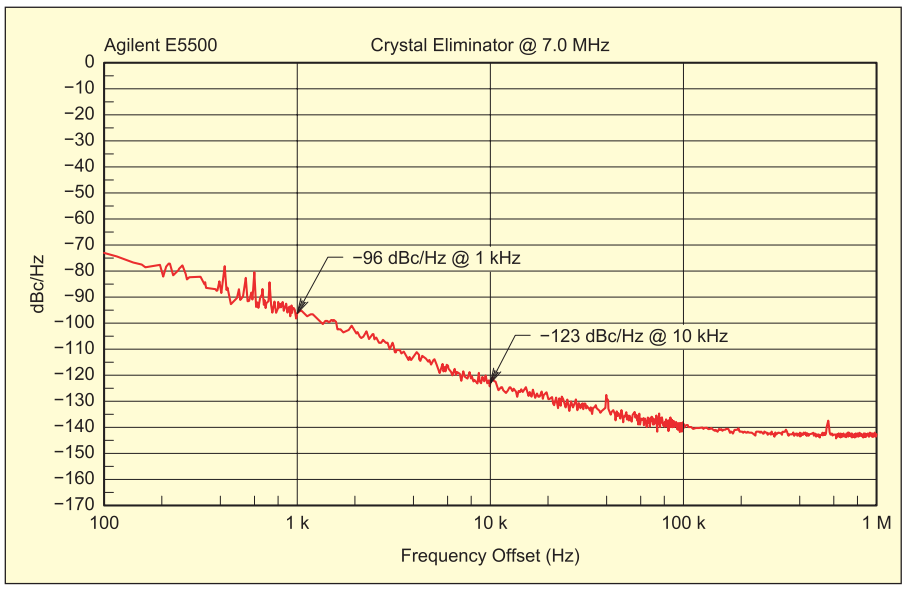


Figure 6—SSB phase noise was measured with an Agilent E5500 Phase Noise Test System. The noise from this simple synthesizer is quite good and measures –96 dBc/Hz at a 1 kHz offset and –123 dBc/Hz at a 10 kHz offset.

coder connected to port B of the PIC. Port B is special in the PIC—it has built-in pull-up resistors that may be turned on or off under program control. Using them saves components in the design by eliminating external resistors.

Either a liquid crystal display (LCD) or a vacuum florescent display (VFD) may be used in this project. This is purely a matter of price and esthetics, as the displays otherwise perform the same. When the VFD OFF pin (U101 - pin 26) is pulled low during operation, a command is sent to the VFD display to turn it off. This should be useful since VFD displays have a tendency to reduce their segment intensity when they are powered for long periods of time. A front panel mounted SPST switch (connected to this pin) can turn the display on and off at will. The pin is not functional when an LCD display is used.

As with all of my PIC projects, I used a low cost C compiler.[5] This compiler allows faster code development than is generally possible with assembly language. It outputs a Microchip-compatible HEX file that is usable with nearly any PIC16F876 programmer. The C source code and HEX programming files are available from the ARRL download site.[6] Other pertinent details relative to construction of the synthesizer are available here, as well. The schematic, together with a parts list, can be found in Figure 5.

The power supply for the Crystal Eliminator is a 14 V ac wall transformer. This ac/ac adapter allows the generation of all the positive voltages needed in the design (+17, +12 and +5 V dc) as well as the –6 V dc needed by the PLL loop filter amplifier (U2).

Performance

The R-4 series is a high performance, low noise and largely spur free receiver. Low cost synthesizers, on the other hand, have a way of being neither low noise or low in spurious content. This synthesizer is a good compromise between low cost and with performance good enough to complement the performance of the R-4.

The synthesizer output is clean enough to avoid degradation of the performance of the receiver. Figure 6 shows that the close-in phase noise floor is below –123 dBc/Hz at a 10 kHz offset. Figure 7 shows a spectrum plot of the synthesizer output. The reference spurs are below the spectrum analyzer's noise floor. Figure 8 shows the synthesizer output waveform looking into a 50 Ω load. The waveform is clean—without oscillation, ringing or spurious signals.

There are no adjustments that need to be made to the crystal eliminator. This may seem odd since the reference in most

Using the Crystal Eliminator with the SPR-4

The SPR-4 was a solid state version of the Drake R-4 series receivers. This radio has a built-in speaker so the synthesizer was built in a small external enclosure. Since the SPR-4 extended the frequency range to 200 kHz, Drake made some slight changes to the IF frequency. This changes the crystal frequency equation as follows:

Crystal = Lower End of Receive Band + 11.09 MHz

This changes the PLL synthesizer somewhat, as the frequency of operation is now 11.59 to 40.59 MHz to receive 0.5 to 29.5 MHz. The greatest common divisor of the PLL phase detector reference frequency changes to 20 kHz to be able to program these frequencies. This requires a corresponding change in the PLL loop filter components (see the parts list). The SPR-4 also labeled the preselector differently than the R4 series so the tuning information is adjusted accordingly. Since the display and the PLL programming parameters are different, there is a version of the microcontroller program specifically tailored to the SPR-4.

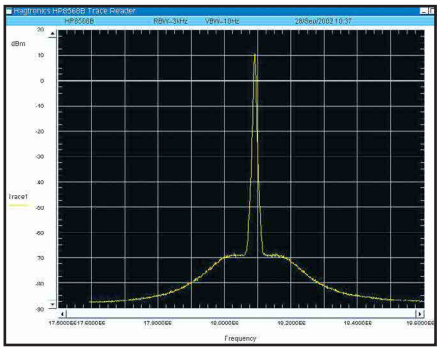


Figure 7—The synthesizer output is free from spurious signals. The output amplitude is approximately +12 dBm throughout the full range of synthesizer output frequencies. The span is 1 MHz and the "noise shelf" close to the carrier is the phase noise of the HP 8568B Spectrum Analyzer.

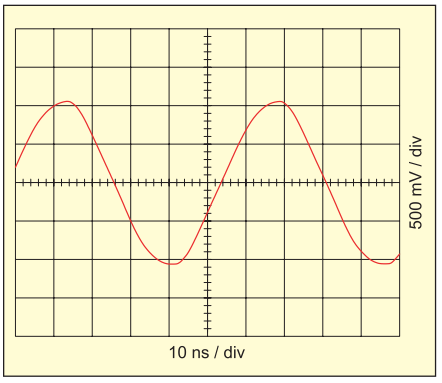


Figure 8—With a 50-Ω load, the Crystal Eliminator output waveform is free from spurious oscillations, ringing and significant harmonics.

synthesized systems must be tweaked to get the frequency readout dead on. However, the main tuning dial of the Drake receivers can be "slipped" to adjust for the correct frequency. Since each band in the Crystal Eliminator is derived from one 10 MHz crystal, each band has the same error. Once you adjust the receiver dial to be correct, it is correct for the entire tuning range. The only variation is in the linearity of the PTO, which on my receivers is much better than ±1 kHz over the entire 500 kHz tuning range.

After many hours of on the air listening tests—switching between the Crystal Eliminator and standard crystal operation—I can't hear any difference between the two, even in the very crowded 7.0 MHz band.

Construction

The first thing that needs to be decided is whether to use a VFD or LCD display. The VFD is brighter as it emits light instead of just reflecting it and the color nearly matches the blue color of the Drake dials. The code in the microcontroller is the same for either display.

A preprogrammed microcontroller is available from FAR Circuits for either the R-4 or SPR-4 receivers.[7] The source code and programming files are available free from the ARRL files Web site (**www.arrl.org/files/qst-binaries/drake_synth.zip**) for those who have the ability to program the microcontroller themselves.

Construction is straightforward as a PC board and a partial kit is available from FAR Circuits (referenced earlier). The only surface mount part is the MC145170 PLL chip, since the through-hole part can be hard to find. All the other parts can be obtained from just a few suppliers. The critical parts that should not be substituted are the semiconductors and the parts in the RF path and the *error amplifier*. Otherwise, the parts are noncritical.[8]

Assembly is straightforward and the parts may be assembled in nearly any order. I solder the semiconductors last as this keeps them protected against ESD for the longest period of time. The FAR circuit board is silkscreened and assembly drawings may be downloaded from the ARRL Web site, as mentioned earlier. The FAR circuit boards do not use plated through holes, so where there are traces on both the top bottom pads of a component hole, the leads will need to be soldered on the top and the bottom to connect the traces.

The VCO is installed with the pin that has the blue dot on the square pad. The top of the VCO package has *MCL* stamped on it in one corner. This should correspond to the "M" on the silkscreen.

Crystal Y1 has two leads, but you will see that the PCB has three holes in it. The center, slightly offset, lead is connected to ground. You should attach and solder a discarded resistor lead to the side of Y1 and then solder it in the center pad provided. This serves two purposes: 1) It provides mechanical support to Y1 which helps to prevent mechanical vibrations from adding noise to the crystal oscillator and 2) It acts to shield the oscillator by tying the crystal case to ground—greatly reducing stray 10 MHz radiation.

The finished PCB is sandwiched between the cover and base of a die cast box, as shown in Figure 9. The base of the box needs to be notched in a few places to allow the resistors and inductors laid out along the periphery to straddle the inside and outside of the box. I marked the box with a felt pen and used a small mill to cut the clearance holes, but a file will work just as well, as the aluminum material is easy to work. The shield serves two purposes: 1) It keeps any stray signals from interfering with the sensitive PLL circuitry and 2) It keeps unwanted radiation from the 10 MHz reference and dividers from escaping and causing interference to the receiver.

The 5 V dc, TO-220 regulators, U6 and U100, are placed close to the shield and can be affixed with a small drop of epoxy or attached to the shield itself. They only dissipate a small amount of heat so this little bit of heat sinking is all that is needed. The tab of these regulators is at ground potential so no insulation is required between the tab and the die cast box.

The VFD display uses quite a bit more power than the LCD display. If this option is chosen, R100 should be mounted about $^1/_2$ inch above the board. This resistor dissipates about 1.4 W and gets quite warm to the touch. With the LCD display the dissipation in R100 is negligible.

I built two versions of the Crystal Eliminator. The first one used a Drake MS-4 speaker enclosure. The speaker was remounted to the left side of the chassis and a panel was added such that the display and encoder can peek through to the right (as seen in Figure 1). The other version I built was housed in a Hammond type 1454K small instrument chassis. Since the heat and RF emissions are quite low, a suitable plastic enclosure could also be used.

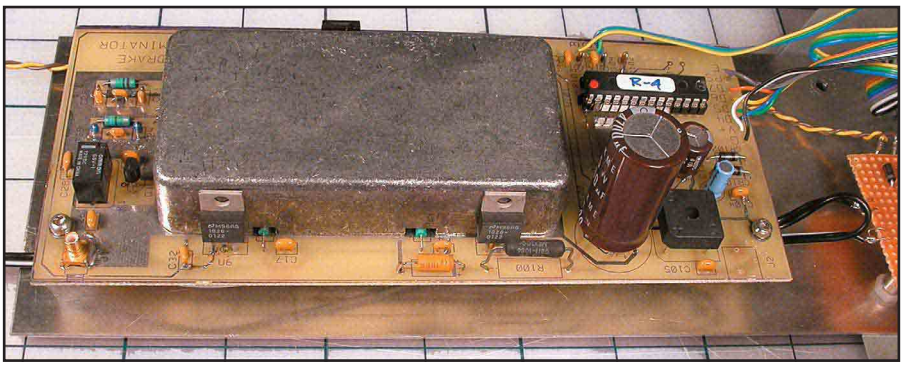


Figure 9—The shield must have some notches cut at its base to clear the components that penetrate the shield walls. Connections to the VFD display and rotary encoder are visible at the right. The PCB was mounted to a scrap piece of aluminum that acts as a subchassis.

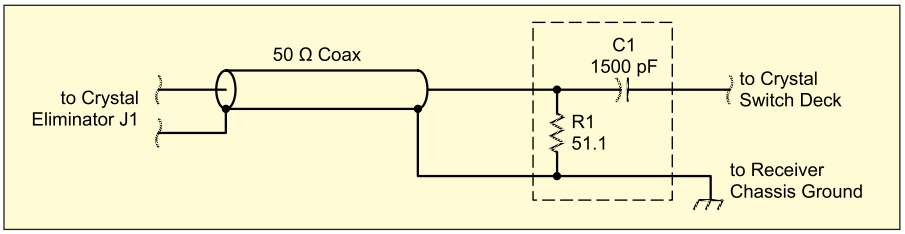


Figure 10—The Crystal Eliminator is interfaced to the receiver with a terminating resistor and a dc blocking capacitor as shown.

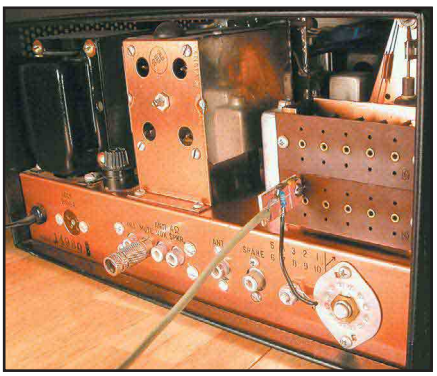


Figure 11—The interface is built on a small piece of scrap PC board. A leftover part lead fits easily into the crystal holder.

Interfacing to the Drake Receiver

The Crystal Eliminator is connected to the receiver by attaching to a spare crystal input. On the R-4 series, these crystal plugs are conveniently located on the rear panel. On the SPR-4, the top cover must be removed—the crystal deck is located in the middle of the receiver. I used a piece of copper-clad material and made a small plug out of it. The plug used a leftover component lead that was the right size to fit into the crystal holder. A terminating resistor and a dc blocking capacitor are needed on the adapter, as shown in Figures 10 and 11.

The adapter may be positioned any reasonable length from the synthesizer via a length of 50 Ω miniature coaxial cable. You can either use the SMB connectors specified in the materials list or solder the coax directly to the synthesizer board.

The R-4A, B, C and SPR-4 versions of the receiver use the same oscillator arrangement. The Crystal Eliminator output center conductor is plugged into the common stator connection of the crystal deck/switch. You can determine the common connection by looking behind the switch board and finding the common crystal connections (they are all wired together).

The coax shield (ground return) can be attached to one of the crystal deck mounting screws. On the SPR-4 these mounting screws are not present, so a suitable ground connection can be made at the solder lug located on the side of the PTO module.

Since the Crystal Eliminator essentially takes control of the crystal oscillator, when it is attached, the front panel crystal position switch may be left in an unused position.

The one exception is the first version of the R-4 (no revision letter). That oscillator used a grounded crystal connection. The Crystal Eliminator center conductor must then be connected to the ungrounded side of the crystal switch and the shield lead attached to chassis ground, as before.

Operation

Once attached, the crystal eliminator controls the operation of the receiver crystal switching. Select the desired 500 kHz band segment with the tuning encoder. Then, tune the preselector as directed on the Crystal Eliminator display. The display shows the nominal tuning settings for the center of the band. On some bands the tuning may need to be adjusted at different points in the band.

Preselector tuning is a two-step operation. As shown in Figure 2, the preselector data shows two numbers separated by a slash. The first number is the preselector band switch position. These follow the regular ham bands (1.5, 3.5, 7.0, 14.0, 21.0 and 28.5 MHz). The second number is the preselector tuning knob position, labeled 1 through 10 on the R-4 series.

Enjoy your newly synthesized Drake receiver and discover all those newfound HF bands that your receiver was previously unable to copy!

Notes

[1]Acronyms used in this article:
ESD (electrostatic discharge).
LCD (liquid crystal display).
PIC (programmable interface controller) made by Microchip Technology.
PLL (phase locked loop).
PTO (permeability tuned oscillator). The Drake VCO is tuned by moving a ferrite rod in and out of a coil; changing the assembly's permeability and thus its inductance. The PTO is a precision low drift and low noise VCO.
VCO (voltage controlled oscillator).
VFD (vacuum fluorescent display).

[2]For more information on the MC145170, see **www.motorola.com**.

[3]Mini-Circuits Web site and product information: **www.minicircuits.com**.

[4]Microchip Web site and product information: **www.microchip.com**.

[5]The author uses the *PCM C Compiler* from CCS, Inc for code development. See **www.pic-c.com** for more information.

[6]Source code, programming files and PCB assembly drawings may be downloaded from the ARRL Web site at **www.arrl.org/files/qst-binaries/drake_synth.zip**.

[7]The following may be ordered from FAR Circuits. Please see **www.farcircuits.net** for more information. The programmed PIC, PC Board, Mini-Circuits VFO and (2) 7805 are available for $46. The programmed PIC only is $14. The PC board only is $16. Be sure to specify the R-4 or SPR-4 version receiver when ordering. FAR Circuits, 18N640 Field Ct, Dundee, IL 60118; fax/tel 847-836-9148.

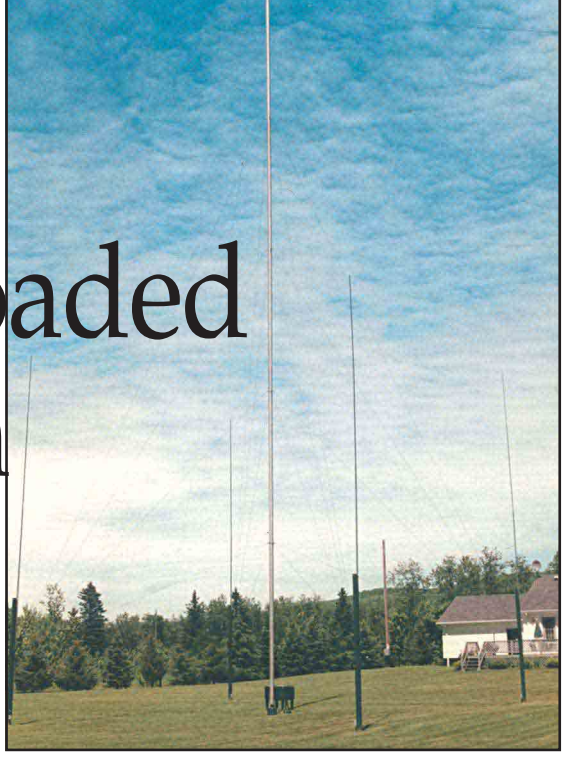
[8]A word of caution: Don't use Z5U dielectric capacitors anywhere near a PLL synthesizer. Aside from the poor temperature performance, Z5U capacitors are actually piezoelectric and the slightest mechanical movement or vibration will cause all sorts of noise on the VCO's output.

All photos by Rachel Hageman

Steve Hageman, although not a ham, has been an "analogoholic" since the fifth grade. Captivated by the magic of receiving signals out of the ether, he has spent his time since designing radios, communications test equipment, embedded systems, analog function modules and power supplies. Steve maintains a project Web site at **www.analoghome.com**. *You can reach him at 9532 Camelot Dr, Windsor, CA 95492;* **shageman@sonic.net**.

By Dave Bowker, K1FK

A 75 foot Top Loaded Vertical Antenna



Some ideas and techniques for constructing and installing a large vertical element antenna system for 160 and 80 meters.

I have used this 75 foot top-loaded vertical ground plane antenna for several years now. The construction and installation techniques described can be adapted to similar designs.

Main Element Construction

The main element is constructed of 5 inch diameter (0.08 inch wall thickness) aluminum irrigation pipe, an 80 meter trap, four sloping top loading wires for 160 meters, and a four-point guy system that enables the element to be erected safely by a single person. Four 30 foot lengths of pipe are required—three to construct the main element and splices, and one for use in erecting the completed assembly. Two 30 foot lengths and a 15 foot length of pipe comprise the main element structure for an overall height of 75 feet. Top and side views are shown in Figure 1.

The lengths of irrigation pipe are modified for splicing sections together by removing the end couplings from each end with a hack saw.

The splice couplers, consisting of 48 inch long doublers made from the same pipe, are prepared by removing a 1/2 inch wide linear strip along the length of the section. The coupler is compressed to a smaller diameter by hose clamps, lubricated liberally with WD-40 and driven 24 inch into one end of the main element using a sledge and a piece of wood to protect the driven end of the doublers as shown in Figure 2. The clamps are progressively loosened and moved towards the driving end as the coupler is inserted into the main element.

After insertion into the main element, the coupler is riveted into place using eight 1/8 inch pop rivets spaced equally around the circumference of the element and spaced 1/2 inch from the end, as shown in Figure 3. Another set of eight rivets is placed 22 inches from the end of the main element to secure the lower end of the coupler to the main element. Finally eight rivets are placed linearly along the coupler seam, four equally and alternately spaced along each side of the seam.

The other end of the coupler is compressed with the hose clamps and the next main element section is driven onto it until the two main element sections mate. The riveting procedure described above is repeated to finish the spliced joint. Details of the rivets placed along the coupler seam can be seen in Figure 4.

Trap Construction

The trap serves to decouple the 160 meter top loading wires from the main element on 80 meters and allows the element to function as a 75 foot vertical on that band. The trap is constructed of a 12 inch length of 4 inch Schedule 80 CPVC pipe (outside diameter = 4 1/2 inch) wound with 7 3/4 turns of PVC jacketed RG-213 coax.[1] Schedule 80 CPVC pipe is required for its mechanical properties (greater wall thickness) to support the top loading wires which also function as top guys. If only Schedule 40 PVC pipe is available, two pieces may be used, one slit and formed into a doubler similar to the doublers used to splice the main element sections, and bonded into place with CPVC cement.

[1]Notes appear on page 39.

A 1/2 inch diameter hole is drilled into the top of the form approximately 1 1/2 inches down from the top to anchor the top end of the coax winding. Starting with an 11 foot length of coax, wind 7 3/4 turns onto the form and mark the position where the bottom of the winding will be terminated, remove the coax and drill another 1/2 inch hole to terminate the bottom of the winding. Prepare one end of the coax by stripping 4 inches of insulation from it and extracting the inner conductor from the braid as shown in Figure 5. Insert this end into the bottom hole of the form so 1/2 inch of insulation protrudes inside the form and tightly wind the 7 3/4 turns toward the top of the form. Insert the top end of the coax into the terminating hole and pull taut. Cut the coax inside the top of the form so 4 1/2 inches remains and again remove the winding from the form and prepare the remaining end of the coax as described above.

The coax is now ready to be permanently wound onto the form using CPVC cement to bond each turn to the form as it is applied. Insert one end of the winding into the bottom termination hole with 1/2 inch insulation protruding inside the form and apply a liberal amount of cement in a strip about 1 inch wide around the circumference of the form and wind two turns tightly, holding in place while the cement sets. Continue this process until the top of the form is reached but do not cement the top turn to the form. Insert the top end of the winding into the top termination hole.

Temporarily connect the coax leads inside the form to effect a parallel tuned trap and check for resonance around

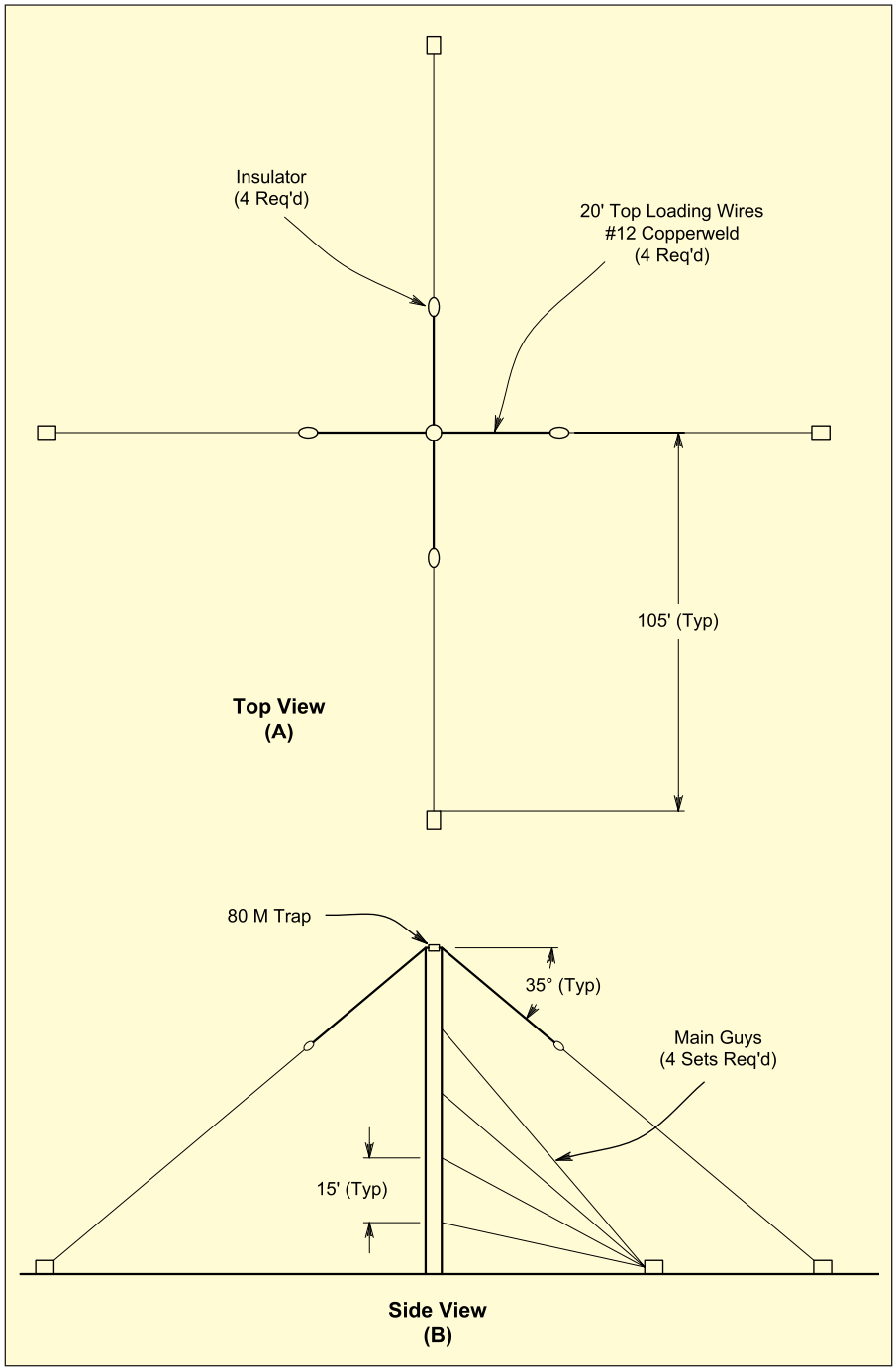


Figure 1—Top view (A) and side view (B) of the vertical antenna.

3.6 MHz using a grid drip meter, adjusting the spacing of the top turn to achieve resonance in this frequency range. Once resonance is achieved, the top turn may be cemented in place. Check for final resonance then apply several liberal coats of CPVC cement over the entire coax winding and seal the termination holes in the form as shown in Figure 6.

The trap leads are permanently connected and soldered inside the form, wrapped with PVC electrical tape and given several coats of CPVC cement. The

Figure 4—The guy clamp attached to the main element.

Figure 5—Preparation of the coax trap ends.

Figure 6—Completed 80 meter trap assembly ready to install.

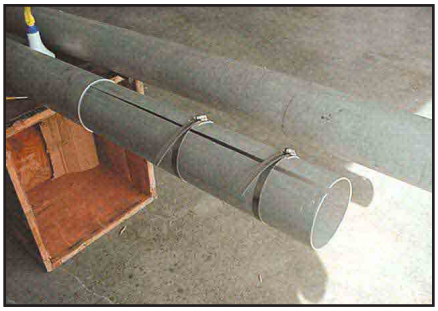


Figure 2—The doubler ready for insertion into the main section.

Figure 3—The doubler riveted into place.

Figure 7—The 80 meter trap installed on the main element.

bottom of the trap is connected to one of the three bolts which will attach the trap to the inside of the main element. Four leads of flexible braid are soldered to the top of the trap. Four 1/4 inch diameter holes are drilled 3/4 inch from the top of the form to four eyebolts that secure the top loading wires. Another hole is drilled next to each eyebolt to pass a lead from the top of the trap and connect to each loading wire.

The trap is bolted into the top of the main element, leaving a spacing of approximately 1 inch between the bottom of the trap winding and the top of the element, as shown in Figure 7. An aluminum cover is installed over the top end of the trap to prevent rain, snow and bird droppings from entering into the element connections. The trap-to-element joint is sealed with RTV adhesive.

Guy Brackets

Four sets of guy brackets are constructed from 0.040 inch 6061-T6 or equivalent aluminum sheet and stainless hardware as shown in Figure 8. Each bracket consists of four sections configured to support the cable thimbles to prevent chafing of the 3/16 inch double braided black Dacron rope guys. The brackets are attached to the main element at 15 foot intervals. After aligning and bolting into place with the bracket bolts, eight rivets are installed to prevent slippage of the bracket—shown in Figures 4 and 8.

Top Loading Wires

The top loading for 160 meters is constructed from four thimbles inserted into the eyebolts, four lengths of #12 copper weld wire and four end insulators. The trap leads are silver soldered to the loading wires, leaving sufficient slack in the flexible leads to facilitate movement without breaking during installation. The wires are cut to length and insulators attached. The exact length of the loading wires depends upon several factors, including their slope angle as shown in Figure 1, the surge impedance of the main element and ground system parameters. The lengths may need adjustment during installation and testing to bring the element into resonance at or near the 160 meter band.

Information for calculating top loading and loading wire length for various configurations is available in the amateur antenna literature.[2] The exact frequency of resonance is not critical. The base impedance of the final installation will be measured. An L network is designed and adjusted to match the final base impedance to the 50 Ω transmission line.

Base Insulator, Guy Anchors and Guy Lines

The vertical requires four guy anchor points arranged in a square and four sets of main guys constructed of 3/16 inch double braided black Dacron rope. Each of the guys must be adjusted to precise lengths to facilitate raising the element to the vertical position. The top set of guys holding the 160 meter top loading wires should be anchored at a distance from the center of the square which will maintain the proper angle. For a 35° angle this distance will be 105 feet, as shown in Figure 1.

The base insulator pier must be located in the center of a square, the corners being the guy anchors. The location of the guy anchors relative to the insulator pier can

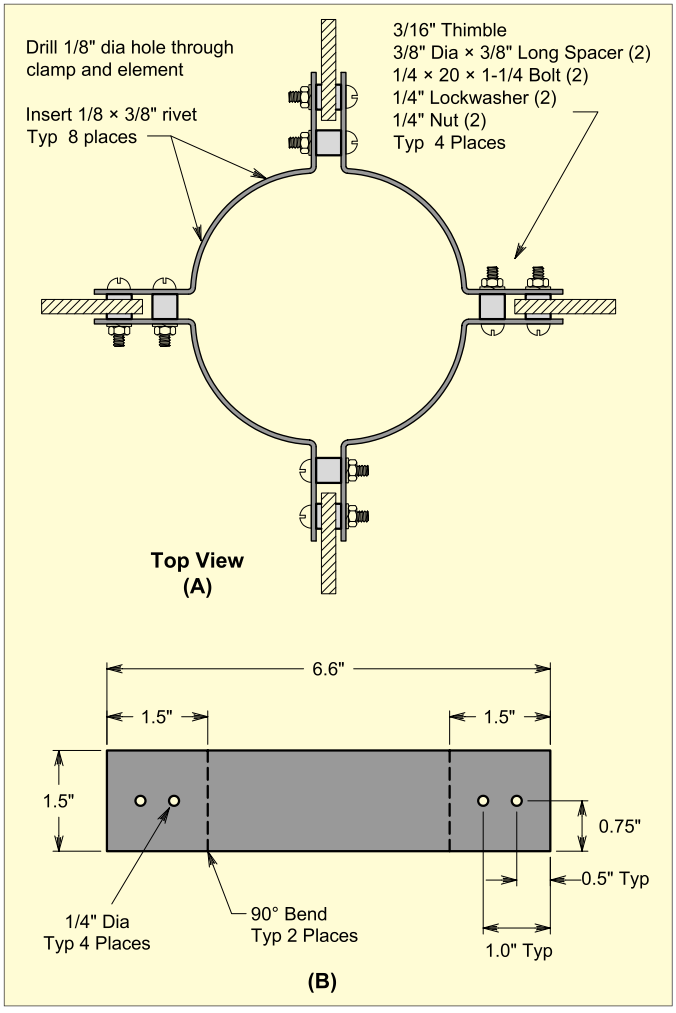


Figure 8—Guy clamp assembly details. At A, top view of complete guy clamp assembly. At B, guy clamp section flat pattern layout (four required per clamp assembly).

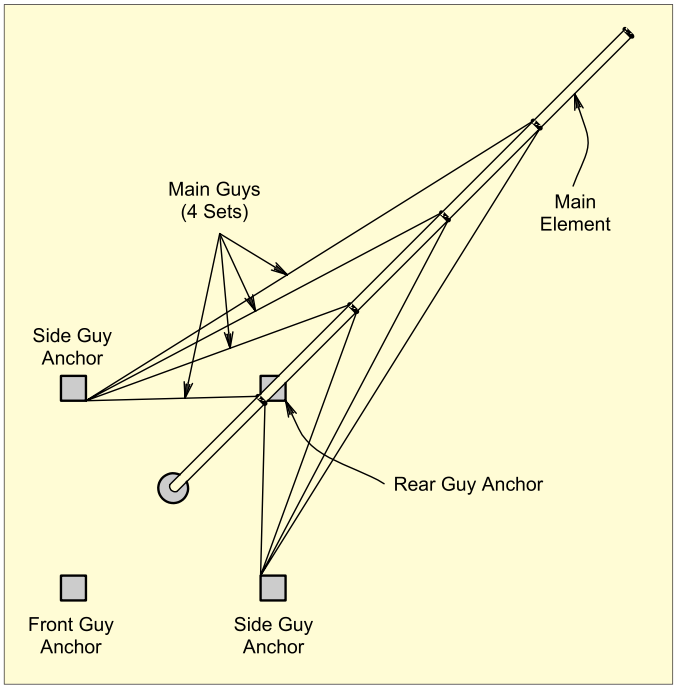


Figure 9—Layout for cutting and attaching guys. Top loading wires and guys are attached, but are not used for raising the element. They are not shown here. Only the side guys are shown to enhance clarity. The front and rear guys are the same length as the side guys.

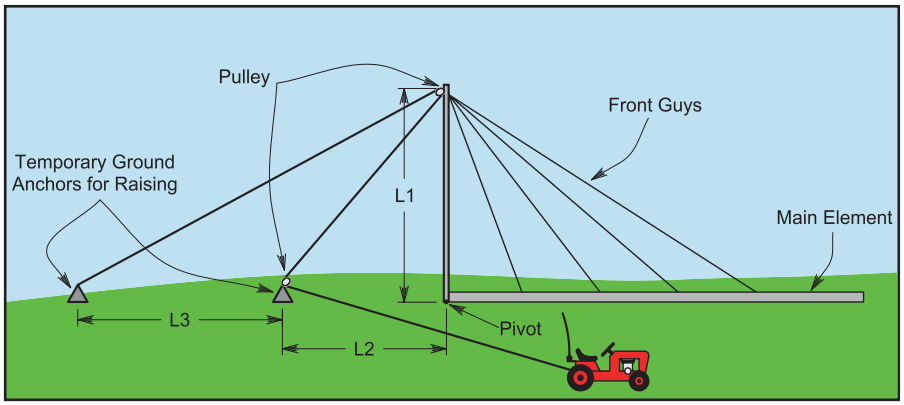


Figure 10—Layout of derrick for raising the element. L1=the length of the derrick boom. L2=L1. L3=any length greater than L2.

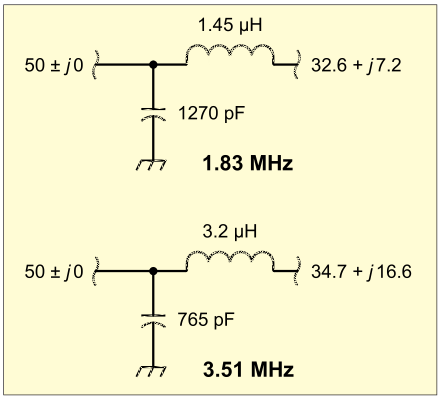


Figure 13—Typical L network values for matching.

Figure 11—Raising the element.

Figure 14—L-network for 160 meters (right of center) and 80 meters (far right of center).

Figure 12—Two views of the pivot fixture for positioning the base insulator.

be any convenient distance. The length of each guy may be calculated—alternatively, the base of the main element may be positioned over the insulator pier with the element laid across one of the guy anchors. Each guy rope is attached to the element and stretched taut to the side anchors as shown in Figure 9. The front and rear guys are cut to the same lengths as the side guys and the rear set of guys is attached to its respective anchor. The front set of guys will be attached to the derrick boom at a distance equal to the distance from the pier to one anchor. The top loading wires and guys are attached to the trap but are not used for raising the element to the vertical position.

The base insulator I used can be seen just below the pivot fixture in the right side photo of Figure 12. It consists of a surplus porcelain insulator and a machined aluminum plate upon which the main element rests. A substitute insulator can be made from a 4 inch length of 2 inch diameter (or larger) Schedule 80 CPVC pipe and two end caps.

Installation

The element is raised using a derrick, a 2:1 mechanical advantage block and tackle, a pivot fixture and a garden tractor. The derrick boom length should be at least equal to half the length of the main element and arranged to pivot with the element at the base insulator pier. Figure 10 illustrates the mechanical arrangement of the derrick boom, block and tackle, and garden tractor.

The derrick boom is guyed to the two side guy anchors for lateral stability during erection. The front guys are attached to the derrick boom at a distance up the boom equal to that from the base insulator pier to the front guy anchor. Figure 11 shows the actual raising of the element in progress.

Once the element is vertical (and the derrick boom horizontal), the front guys are removed from the derrick boom one at a time, starting with the lower guy, and attached to the forward guy anchor. After all guys are secured to their respective anchors, two hydraulic jacks are placed under the pivot pin, the pivot fixture is unbolted from the base insulator pier, and the main element is raised with the jacks sufficiently to permit the pivot fixture to swing out to the side while the base insulator is bolted into place. The jacks are then lowered to position the element onto the insulator and the pivot pin is removed. See the photos in Figure 12.

Matching Network

After the main element and ground system installation is completed, the feed point impedance is measured at the center of the operating frequency range on both bands. An L-network is designed, fabricated and installed at the base of the element for each band. Design of the L-networks may be accomplished with the aid of formulas in *The ARRL Antenna Book*[3] or readily available computer software.

The ground system consists of 120 1/4-wavelength radials laid in the sod. My ground scheme also takes advantage of the additional ground system of my 40 meter phased array, that consists of an additional 120 1/2-wavelength radials under each element. The two ground systems are bonded together wherever they cross and form a very low loss system. The measured feed point impedance of my vertical working against this ground system is 32.6 + *j*7.2 at 1.83 MHz and 34.7 + *j*16.6 at 3.51 MHz. The networks required to match these impedances to the characteristic 50 ± *j*0 impedance of the feed line are shown in Figure 13.

Completing the installation, the matching networks are contained in the same doghouse as the phasing and matching networks for my 40 meter phased array and Beverage switching components. They are shown on the right side of the doghouse in Figure 14. Vacuum variable capacitors and vacuum relays are used for reliability under extreme environmental conditions.

Acknowledgments

Thanks to Tony Trice, WØTY, for his suggestions in fabricating the splice couplers and review and critique of the manuscript.

Notes

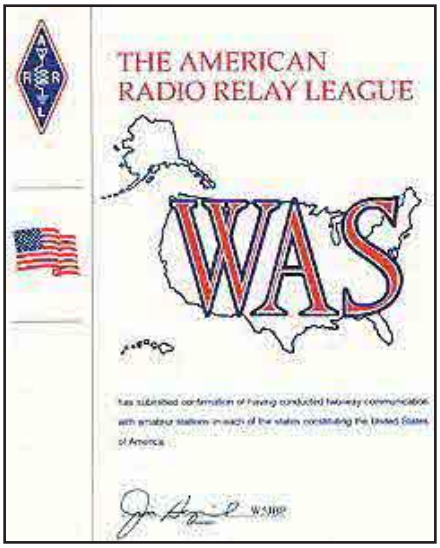
[1]Belden 8267 or equivalent. Coaxial trap construction details can be found in Chapter 7 of the latest edition (20th) of *The ARRL Antenna Book*, p 7-15.

[2]*ON4UN's Low-Band DXing*, Third Edition, The American Radio Relay League, 1999, §3.6.3. Available from the ARRL Bookstore for $28 plus shipping. Order no. 7040. 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 the ARRL Bookstore for $39.95 plus shipping. 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**.

Dave Bowker, K1FK, has been a licensed and active ham for half a century and is an ARRL member. A retired aerospace electronics engineer and manager, he is an exclusive CW operator and enjoys low-band DXing, contesting, designing/building homebrew equipment, and consulting. You can reach the author at 119 Bradbury Rd, Fort Kent, ME 04743; **k1fk@arrl.net**.

STRAYS



◊ The Worked All States award is given for submitting confirmations from all 50 states. Aside from the basic certificate for any combination of bands/modes, specialty certificates are issued for a variety of different bands and modes such as Satellite, 160 meters, SSTV, Digital and each VHF band. Available endorsements include CW, Novice, QRP, Packet, EME and any single band. The Digital and Phone awards are available for the various modes. They will be dated but not numbered. Cards are checked by a volunteer ARRL HF Awards Manager affiliated with ARRL Special Service Clubs (although QSL cards can be checked at HQ, absent an awards manager). To encourage increased activity and station improvement throughout the bands, the 5-Band WAS certificate (and plaque) is available for working all states on 5 amateur bands (except 10/18/24 MHz). Cards for 5BWAS can be checked by your local HF Awards Manager or at ARRL HQ.

QST congratulates...

◊ The Shenandoah Valley ARC 10 meter AM net, which has operated continuously since 1947. The net meets Sundays at 12:30 PM Eastern Time on 29.200 or 29.205 MHz. *—Warren Rudolph, W4OHM, Winchester, Virginia*

◊ Dick Beaton, N7RB, of Helena, Montana, who celebrates 70 years as an Amateur Radio operator this month. At age 86, Dick is active on CW using the faithful J-36 semi-automatic key, and is also on PSK31. You will find him almost daily on 20 meters typing away on PSK31, and he has served as a Volunteer Examiner since the program's inception. *—Bill Erhardt, K7MT, Helena, Montana*

◊ Chuck Rexroad, AB1CR, of Bolton, Connecticut, who has been named Technician of the Year for 2003 IBM Software Group Americas Field Sales.

SARA ON THE AIR AWARD

◊ The Society of Amateur Radio Astronomers (SARA), the largest Amateur Radio astronomy organization in the US, has more than 100 members who are licensed hams. With this in mind, SARA offers a new award specifically designed to encourage contacts between its licensed members and other amateurs. Basic requirements to earn the SARA ON THE AIR (SOTA) Award include working *10* SARA-ham members using any mode and any amateur frequency, and get their SARA membership number. "Waterhole" frequencies of ±15 kHz from the well published QRP frequencies will serve to collect SARA hams into a general area to help those chasing this award. There is no cost for the award, certificate, or its preparation.

Individuals or clubs who receive this award will have their call sign (ham) or name (SWL) posted on the SOTA award page for all to see. Full details can be reviewed at **www.K5DZE.net**.*—Bob Patterson, K5DZE*

WALTER SHARP JR

Congratulations! **When Christopher and Kandis Sharp were married recently near Lancaster, Pennsylvania, the wedding party included (from the left) proud father of the groom Tom, WA9OXY; the bride; the groom, KC7PCX; Jesse Harrison; David, KC7TYG; Nicholas, KC7SKK, and Charles, KC7OVX. Each of the men in the photo is also an Eagle Scout.**

By William S. Berger, K6INJ

The Ten-Tec 6 Meter Transverter on 12 or 17 Meters

Does your older gear lack 12 or 17 meter capability? Modify an inexpensive transverter and discover what you're missing.

I am the proud owner of a Yaesu FT-901DM all-mode transceiver and it is a great performer on all of its operational frequencies. It does have one deficiency, however—it was born before the 12 or 17 meter bands became available for amateur use. It occurred to me that there are probably thousands of excellent HF transceivers still being used with the same problem. After hearing the good comments from other hams about 12 and 17 meters, I decided that I needed to design a transverter for these bands.

While doing a few paper designs, I ran across an older *QST* product review describing the Ten-Tec[1] model 1208 6 meter transverter kit for less than $100.[2] It was hard to understand how so complete a kit could be sold at such a reasonable price, especially since my own design looked like it would cost considerably more.

The kit was ordered and assembled, then put on the air. My first 6 meter contact was with Dennis, W1HOG, in New Hampshire, with a 59 report, while running approximately 8 W RF output on SSB. I made many more exciting contacts on the "magic band" while completing the design, construction and testing of the 1208 conversion to 17 meters.

My first 17 meter contact with the newly modified transverter was with Bo, K1BO/W4ZCV, in North Carolina—another big thrill. Some time later, I converted a second transverter to 12 meter operation, and my first contact on that "new" band was with Dave, AA9YE, in Wisconsin. Both of the converted units work very well and I've made many worldwide contacts on 12 and 17 during the last few years. An exciting aspect of the project was low power operation—that was the most rewarding of all.

[1]Notes appear on page 44.

The Conversion

The original circuit remains the same. The transverter modifications consist of changes to the local oscillator (LO) and radio frequency stages; the low pass, band pass, bypass filters and 1/4 wave filters, as well as the changes to a few coupling capacitors and bias resistors. For 17 meters the LO is at 11 MHz and the RF stages are at 7.0 MHz. For the 12 meter band, the LO is at 21 MHz and the RF stages are at 3.9 MHz. The coupling capacitor and bias changes were required because of the increased impedance and gain at the new lower operational frequencies.

The schematic diagram of the completed transverter appears in Figure 1. Table 1 lists the required parts changes necessary for both the 12 and 17 meter modification. Both the schematic and the printed circuit board layout highlight the components that are changed.[3] Both should be followed, along with Table 1, during construction. I recommend that you first carefully read the Ten-Tec instruction manual, and then incorporate and highlight the conversion data into the manual.

A view of the interior of the transverter, before modification, appears in Figure 2. If your transverter hasn't been built yet it would be advisable to build the 1208 and get it working on 6 meters before you modify it for 17 or 12. That will limit the number of variables involved in the conversion. Above all… have fun!

The basic ideas behind the modifications are the following:

- *The 17 meter band*—convert an 18 MHz received signal to 7.0 MHz or a transmitted 5 W, 7.0 MHz signal to an 18 MHz, 8 W output signal. The band edges will read 7.068 to 7.168 MHz on the transceiver to cover 18.068 to 18.168 MHz.
- *The 12 meter band*—convert a 24 MHz received signal to 3.9 MHz or a transmitted 5 W, 3.9 MHz signal to a 24 MHz, 8 W output signal. The band edges will read 3.890 to 3.990 MHz on the transceiver to cover 24.890 to 24.990 MHz.

Coil Winding

Figure 3 shows details of the coil winding operation. The winding directions should be followed as shown in order for the inductance values to be proper and also that the inductors properly fit the PCB. As a winding example, consider the following:

For a desired inductance of 0.500 µH, using a T68-6 iron core toroid, use 8 turns of 22 gauge enameled magnet wire and wind it over a span of 175°. The number of turns refers to the number of times the wire passes *through the center* of the core. The coverage angle (span) refers to the arc of the core circumference occupied by the winding with the turns tightly wound and evenly spaced. Figure 3 can be used as a template for coil winding. Center the wound core on top of the diagram of Figure 3. Place the *outside* start winding at the 0° mark; then adjust the *outside* finish winding to the specified arc angle with the turns evenly spaced.

Instruction Manual Progress Tests

The Ten-Tec assembly manual is divided into construction groups or *phases*. The following additions and modifications to the assembly manual refer to the "Progress Test" portion of those phases, except for Phases 5 through 7, which relate to general assembly details.

Table 1

Ten-Tec 1208 12 and 17 Meter Conversion—Component Changes

[Bracketed] components and coil turns refer to the 17 meter conversion. (See article notes on page 44 for supplier contact information.)

Schematic Part Designator	*Manual Step Number*	*Was / **Change To***	*Part Number or Equivalent*	*Notes*	*Supplier*
C1-6	1-40, 1-41, 1-42, 1-43, 1-44, 2-22	0.01 µF / ***0.1 µF***	Disc ceramic	100 V dc	Digi-Key[4]
C7	3-21	120 pF / ***560 [220] pF***	Disc ceramic	100 V dc COG	Digi-Key
C8	3-22	560 pF / ***1200 [1200] pF*** ***(change for both bands)***	Disc ceramic	100 V dc	Digi-Key
C15	1-12	47 pF / ***150 [150] pF*** ***(change for both bands)***	Disc ceramic	100 V dc	Digi-Key
C16	1-8, 1-25	47 pF / ***150 [180] pF***	Disc ceramic	100 V dc COG	Digi-Key
C18	1-16	120 pF / ***270 [560] pF***	Disc ceramic	100 V dc	Digi-Key
C20	1-13	33 pF / ***68 [100] pF***	Disc ceramic	100 V dc COG	Digi-Key
C21	1-25	47 pF / ***100 [180] pF***	Disc ceramic	100 V dc	Digi-Key
C23	1-7	100 pF / ***68 [22] pF***	Disc ceramic	100 V dc	Digi-Key
C26, C32	3-29, 3-46	150 pF / ***470 [560] pF***	Disc ceramic	100 V dc	Digi-Key
C27, C31	1-7, 1-13, 3-28, 3-47	39 pF / ***68 [120] pF***	Disc ceramic	100 V dc COG	Digi-Key
C35	3-27	47 pF / ***100 pF [150] pF***	Disc ceramic	100 V dc	Digi-Key
C38, C40	4-18, 4-19	33 pF / ***100 [120] pF***	Disc ceramic	100 V dc COG	Digi-Key
C39, C41	4-16, 4-17	3 pF / ***[10] pF***	Disc ceramic	100 V dc COG	Digi-Key
C42	4-21	150 pF / ***560 [470] pF***	Disc ceramic	100 V dc	Digi-Key
C43	4-20	39 pF / ***120 [150] pF***	Disc ceramic	100 V dc	Digi-Key
C60	5-59	62 pF / ***180 [220] pF***	Disc ceramic	100 V dc COG	Digi-Key
C61, C62	5-60, 5-61	120 pF / ***220 [270] pF***	Disc ceramic	100 V dc	Digi-Key
C63	5-62	47 pF / ***68 [68] pF*** ***(change for both bands)***	Disc ceramic	100 V dc	Digi-Key
L1, L2, L5	1-36, 1-37, 3-14	100 µH / ***330 [220] µH***	[M8041-ND] M8043-ND	Vertical mount Miller	Digi-Key
L3	3-16	1.3 µH / ***4.7 [2.7] µH***	TK1415-ND	**(Reference 1)** Toko	Digi-Key
L4	3-23	15 µH / ***56 [33] µH***	M8034-ND [M8031-ND]	Miller	Digi-Key
L6, L9, L10, L14	1-1b, 1-51, 1-52, 3-36	3.3 µH / ***6.8 [10] µH***	M8023-ND [M8025-ND]	Miller	Digi-Key
L7	1-23	0.56 µH / ***0.82 [1.39] µH***	[M8013-ND+ M8008-ND] M8012-ND	Series-connected	Digi-Key
L8	1-9	1 µH / ***Delete (jumper) for both bands***	0.0QBK-ND (Yageo)	Insulated jumper	Digi-Key
L11, L12	3-37, 3-39	0.25 µH / ***0.660 [0.770] µH (nominal)***	143-15J12S [143-17J12S]	Coilcraft	Coilcraft[5]
L13	3-33, 3-34, 3-35	6T, 18 gauge / ***0.550 [0.750] µH***	T68-6 toroid	**(Reference 2)**	Amidon[6] (iron core)
L15	4-6	15 µH / ***33 [47] µH***	M8031-ND	Miller	Digi-Key
L16, L17, L18	4-8, 4-9, 4-10	0.25 µH / ***0.416 [0.660] µH (nominal)***	143-10J12S [143-14J12S]	Coilcraft	Coilcraft
L22, L23	5-64, 5-65	5T, 18 gauge / ***0.500 [0.750] µH***	T68-6 toroid	**(Reference 3)**	Amidon (iron core)
L24	5-26	5T, 18 gauge / ***0.440 [0.590] µH***	T68-6 toroid	**(Reference 4)**	Amidon (iron core)
R34	1-4	680 Ω / ***Delete (open) for both bands***	—	—	—
R53	5-50	100 Ω / ***330 [270] Ω***	Carbon film	1/4 W	Digi-Key
Y1 Crystal	1-3	36 MHz / ***21.0000 [11.0000] MHz***	HC-49/U (Parallel-mode crystal)	Capacitive load, 32 pF	International Crystal[7]
Misc	—	Add	Dry 1/8 inch transfers	Datamark K63-White	Datak[8]

References

1) L3—Using an ohmmeter, check for the two active pins of this variable inductor. Cut off the other three pins. The shielded inductor will now fit the PCB correctly.
2) L13—Tightly wind 8T [10T], 22 gauge, enameled magnet wire evenly spaced over 120° [165°] of the circumference of the T68-6 toroid.
3) L22, L23—Tightly wind 8T [10T], 22 gauge, enameled magnet wire evenly spaced over 175° [165°] of the circumference of the T68-6 toroid.
4) L24—Tightly wind 7T [9T], 22 gauge, enameled magnet wire evenly spaced over 150° [190°] of the circumference of the T68-6 toroid.

(The number of turns refers to the number of times the wire passes *through the center* of the core.)

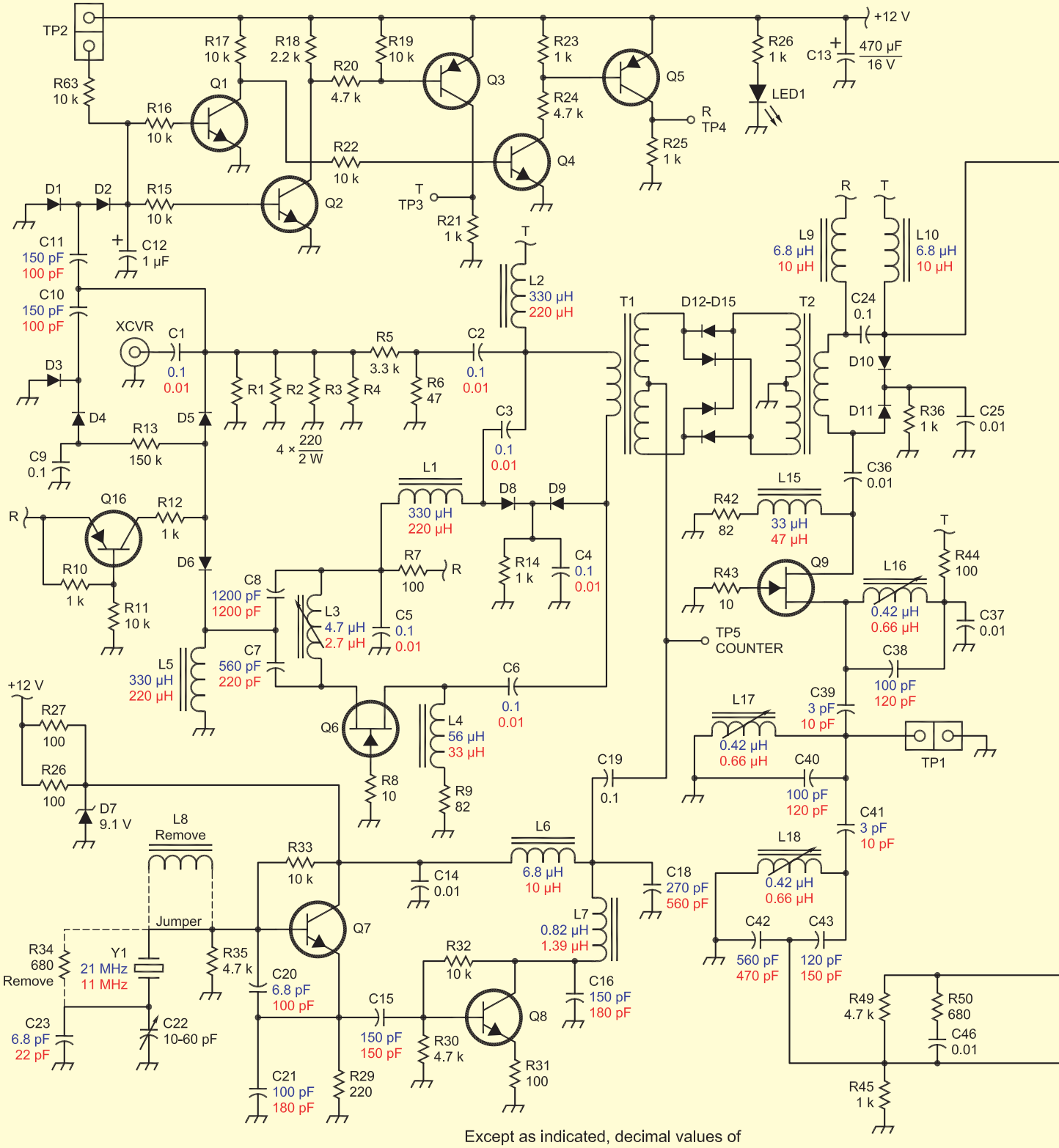
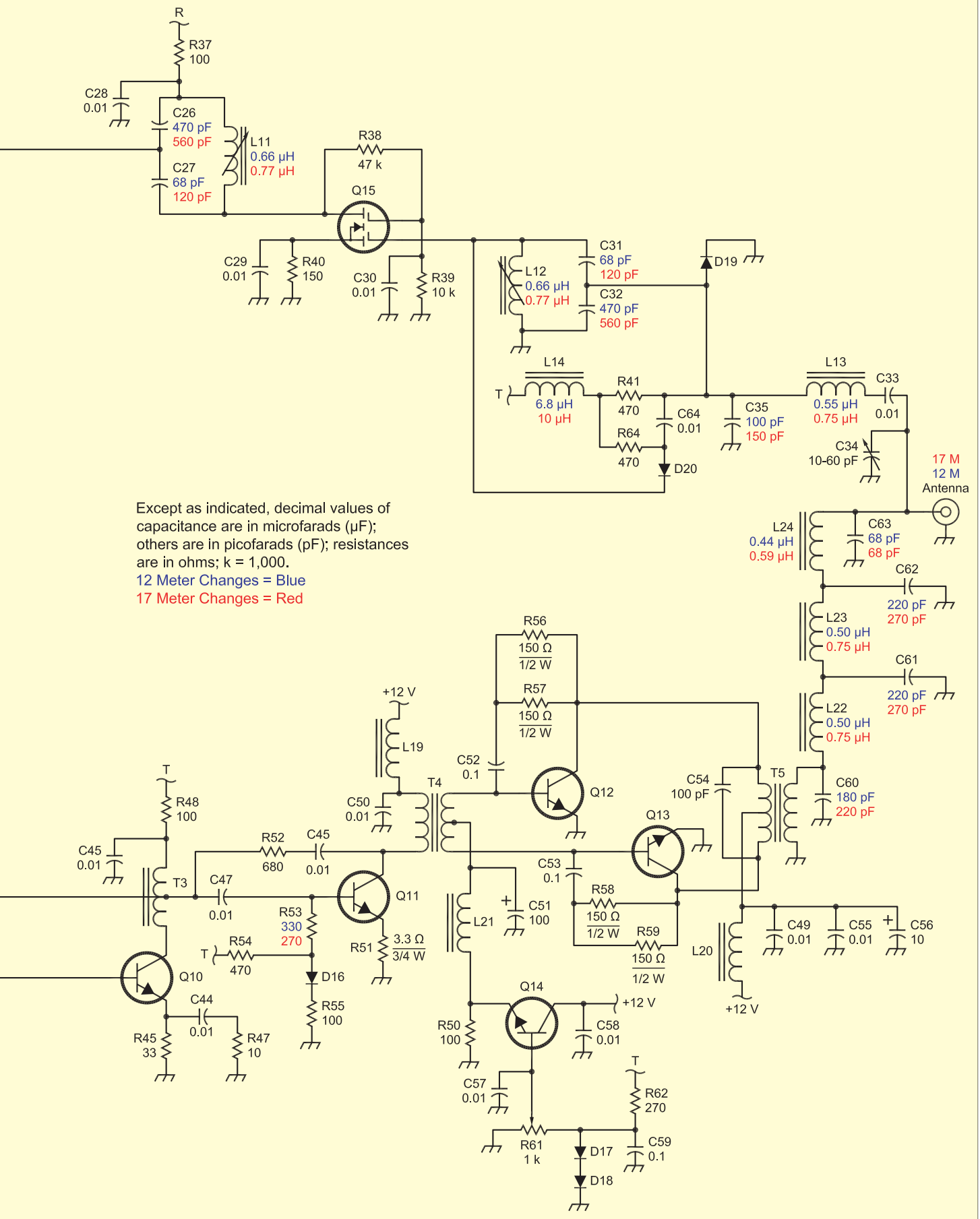


Figure 1—Schematic of the modified transverter. Note the highlighted part changes.


R
R37
100
C28
0.01
C26
470 pF
560 pF
C27
68 pF
120 pF
L11
0.66 µH
0.77 µH
R38
47 k
Q15
C29
0.01
R40
150
C30
0.01
R39
10 k
L12
0.66 µH
0.77 µH
C31
68 pF
120 pF
C32
470 pF
560 pF
D19
L14
T
6.8 µH
10 µH
R41
470
R64
470
C64
0.01
D20
C35
100 pF
150 pF
L13
0.55 µH
0.75 µH
C33
0.01
C34
10-60 pF
17 M
12 M
Antenna
Except as indicated, decimal values of capacitance are in microfarads (µF); others are in picofarads (pF); resistances are in ohms; k = 1,000.
12 Meter Changes = Blue
17 Meter Changes = Red
L24
0.44 µH
0.59 µH
C63
68 pF
68 pF
C62
220 pF
270 pF
L23
0.50 µH
0.75 µH
C61
220 pF
270 pF
L22
0.50 µH
0.75 µH
R56
150 Ω
1/2 W
R57
150 Ω
1/2 W
+12 V
L19
C52
0.1
Q12
T4
C50
0.01
C54
100 pF
T5
C60
180 pF
220 pF
Q13
T
R48
100
C45
0.01
R52
680
C45
0.01
T3
C47
0.01
Q11
R53
330
270
R54
470
R51
3.3 Ω
3/4 W
D16
R55
100
Q10
C44
0.01
R45
33
R47
10
C53
0.1
R58
150 Ω
1/2 W
R59
150 Ω
1/2 W
L21
C51
100
L20
C49
0.01
C55
0.01
C56
10
+12 V
Q14
+12 V
R50
100
C58
0.01
C57
0.01
T
R62
270
R61
1 k
D17
D18
C59
0.1

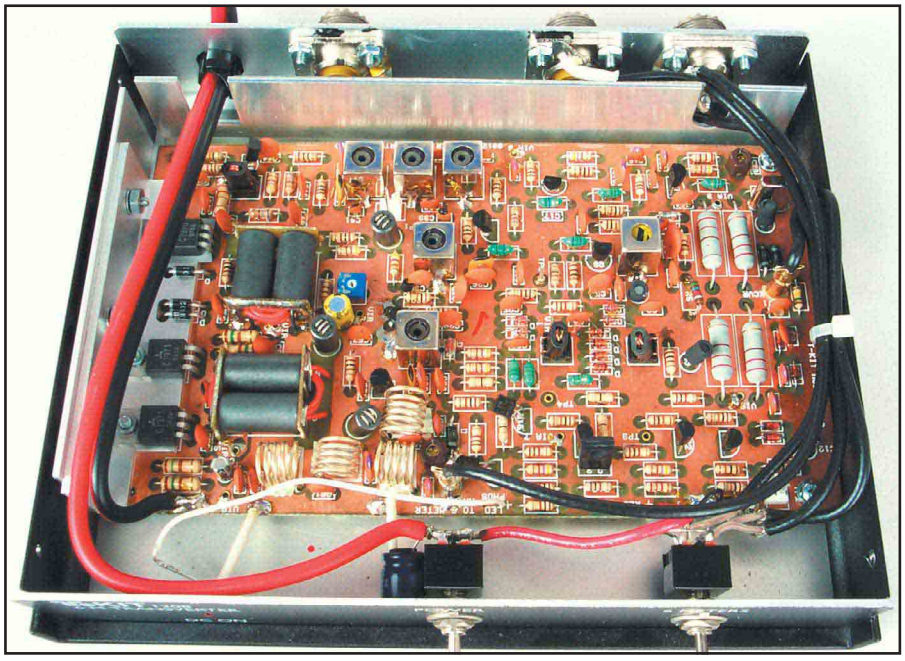


Figure 2—A view of the transverter main board before conversion. Note the air-wound coils L13, L22, L23 and L24 in the lower left. These are replaced by toroid inductors.

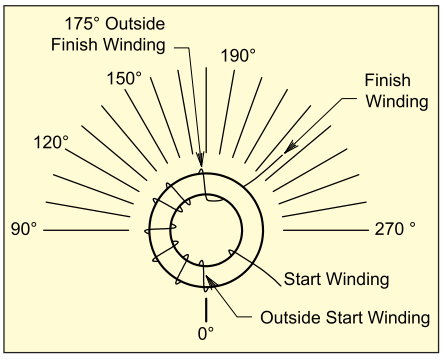


Figure 3—Coil winding diagram and template for winding the toroid inductors. This should be closely followed to ensure creation of the proper inductance values.

Phase 1.0

Follow step 5 in the manual except connect a frequency counter to test point TP5. Adjust trimmer C22 for a reading of 11.000000 MHz if you are modifying for 17 meters or 21.000000 MHz for 12 meters (per the maximum resolution offered by your counter). I used an MFJ-259 Analyzer in the frequency counter mode.

Phase 2.0

Follow steps 1 through 8 except use a low power 3-5 W test signal from your HF transceiver. Temporarily connect this to the input jack in place of the called-for handheld transceiver. The RF sensing TR control circuit does not care what frequency is applied to the transverter input, as long as it does not exceed 5-6 W.

Phase 3.0

Follow alignment steps 3-54 through 3-59, except in step 3-58 tune the receiver to where you expect to hear a signal (7.120 to hear 18.120 MHz for 17 meters or to 3.940 to hear 24.940 MHz for 12 meters). Adjust the receiver frequency until you hear a signal (you will probably hear several). See References 1-4. Delete steps 3-33 and 3-34.

Phase 4.0

Optional—Change the reference to "50 MHz" to read "18 MHz" or "24 MHz" and "6 meters" to read "17 meters" or "12 meters" depending on which modification you are doing.

Phase 5.0

Delete step 5-63 and refer to notes 1 through 5.

Phase 6.0

Follow steps 6-1 through 6-25 except substitute 17 meters or 12 meters for "6 meters" in step 6-14. In step 6-18 substitute "7 MHz" for the 17 meter modification or "3.9 MHz" for the 12 meter modification. See References 1-4.

Phase 7.0

In step 7-34, replace 14 MHz with 7 MHz or 3.9 MHz for 17 meters or 12 meters, respectively. In step 7-35, replace "6 meter" antenna with either "17 meter" or "12 meter" antenna, depending on which modification you are doing. Change step 7-36 to read "7.120 MHz" for the 17 meter modification or to "3.940 MHz" for the 12 meter modification. Change step 7-37 to read "in the 17 meter" or "…12 meter" position. Delete step 7-42. Change step 7-43 to read "11.000000 MHz" for the 17 meter modification or "21.000000 MHz" for the 12 meter modification.

Some Useful Information

Mask off any front and rear panel information you want to save and then spray the front and rear panels with satin black paint. After removing the masking tape use the Datamark dry transfer labels for any desired nomenclature on the panels.

The Ten-Tec 1208 Transverter Kit now sells for $109. The parts cost for the conversion to 17 or 12 meters (if all are purchased new) is about $110. The Coilcraft inductors are the major cost item. I purchased the M102 *Inductor Kit* directly from Coilcraft for $60. This kit contains the variable inductors required to build both the 17 and 12 meter transverters plus enough left over to supply many future projects. Have fun and enjoy your "new" frequencies![9]

Notes

[1]Ten-Tec, Inc, 1185 Dolly Parton Pkwy, Sevierville, TN 37862; 865-453-7172; **www.tentec.com**.

[2]"Product Review," *QST*, Jun 1996, pp 62-64.

[3]A layout of the printed circuit board can be found at **www.arrl.org/files/qst-binaries/6mtransverter.zip**.

[4]Digi-Key Corp, 701 Brooks Ave S, Thief River Falls, MN 56701; 800-344-4539; **www.digikey.com**.

[5]Coilcraft, 1102 Silver Lake Rd, Cary, IL 60013; 847-639-6400; **www.coilcraft.com**.

[6]Amidon, Inc, 240 Briggs Ave, Costa Mesa, CA 92626; 800-898-1883; **www.amidon-inductive.com**.

[7]International Crystal Manufacturing Co, PO Box 26330, Oklahoma City, OK 73126; 405-236-3741; **www.icmfg.com**.

[8]Datak Co, 3660 Publishers Dr, Rockford, IL 61109; 815-874-2301; **www.philmore-datak.com**. (Datamark dry-transfer labels are also available from Ocean State Electronics, 6 Industrial Dr, Westerly, RI 02891; 800-866-6626; **www.oselectronics.com**.)

[9]Both 12 and 17 meter converted transverters were tested in the ARRL Lab and were found to meet current FCC emission standards for spectral purity on their modified frequencies.—*Ed.*

William S. Berger, K6INJ, was first licensed in 1954. A retired EE, Bill spent 35 years as a designer of video monitors and other products for military and civilian use. He can be reached at 3153 E Virginia Ave, West Covina, CA 91791; **gemcap13@aol.com**. QST

By Dave Hassler, K7CCC

A Picture of You

A recent survey profiles a typical *QST* reader and finds out how ARRL members view their membership journal.

You've changed some—at least since 1991, when the ARRL first commissioned a study about *QST*'s readership. The latest study, completed in December 2003 for the League by Readex, a Minnesota research company, shows a shift in operating habits over the intervening decade, how we use computers, what *QST* columns we devour and items we could stand to see less of.

"We're member-driven," said *QST* Editor Steve Ford, WB8IMY. "We have to know what members want and don't want in their journal. History has shown us that this scientific survey is one of the best ways to find this out. It's very valuable."

In fact, one of your favorite columns in *QST*, The Doctor is IN, was introduced because a past Readex survey said you wanted a Q-and-A forum on technical topics. Short Takes was created in response to survey data that said you wanted more product information. In this article, we're going to take a look at just who we ARRL members are and what we do with Amateur Radio, the trends that emerge from the data, and what we think about *QST*.

As you can see, *QST* has gone through some physical changes over the years. Shown top, from left, are issues from 2003, 1980 and 1960; bottom: 1946, 1935 and 1925.

Meet Joe Hamm

First off, meet Joe, our statistically generated typical 2003 member. Joseph X. Hamm is a typical League member, according to the data in the survey. Joe, who's been a ham for 25 years, recently retired from an engineering and management career, although he still consults occasionally for his old firm. He's a 59 year old with a ticket that allows him HF privileges, although 2 meter FM operation is as popular with him as sideband phone on 20 and 40 meters. Joe recently built a simple interface for HF digital modes and now spends a little less time operating Morse and a little more with PSK31. Joe spends about five and a half hours on Amateur Radio activities every week, both on and off the air.

The computer is used a lot in Joe's shack for digital modes, call sign lookup, logging and general Internet access. He's been using the Internet so much lately that he's thinking about going with a broadband connection soon. Joe picked up a couple of pieces of gear last year, mail ordering a new dual-band VHF/UHF mobile rig from an out-of-state ham radio dealer, and he's pretty fond of that Collins 75-A2 receiver he found at one of the two area hamfests he attended. In all, he kept his spending under $800 in 2003 and Joe's complete station is worth about $4400.

When you compare Joe to the average League member of 1991, Arthur Q. Amateur, you can see that some things have changed a bit. Essentially, Joe is older and less likely to be working. In 1991, typical League member Art was 52 years old, employed in a technical field and held an Advanced class license. Art operated a bit more sideband phone on 10 and 20 meters than Joe does today. Active for 18 years, he spent a significant amount of his radio time using Morse code, almost 50% more than Joe does now. Art spent a similar percentage of time on 2 meters as Joe, but he was three times as likely to run a packet station as Joe, usually from an Intel-based DOS box or even a Commodore 64! Art spent about half of what Joe spends on equipment, while having essentially the same real income.

What *You* Think about *QST*

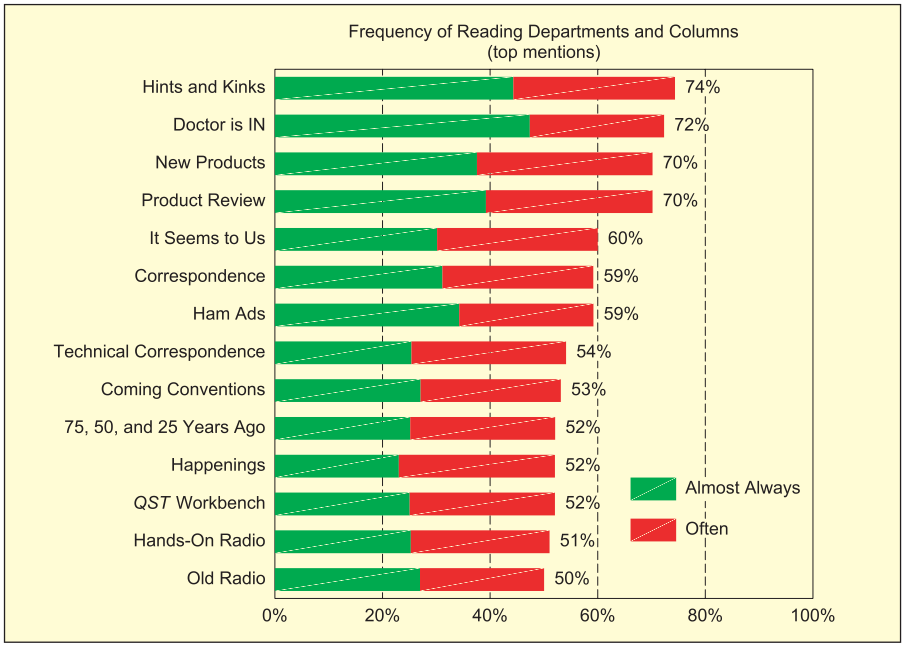
One thing is very clear from the 2003 survey results: you like antenna articles. With 61% of you asking for more antenna pieces, you also want to see more construction projects (49%) and articles on electronics theory (43%). That's not surprising, as these broad topics are of interest to most hams, no matter what specific activities they enjoy.

As the previous four surveys proved, the 2003 data shows that the things you want to read about the least are articles and columns on such specialized subjects as contest rules and results (29%), microwave operating (27%) and traffic handling (22%). A new item appeared on the "least wanted" list in 2003—articles about voice over the Internet (EchoLink, IRLP, eQSO, etc), coming in at 26%, although 22% of you would like to see more about it.

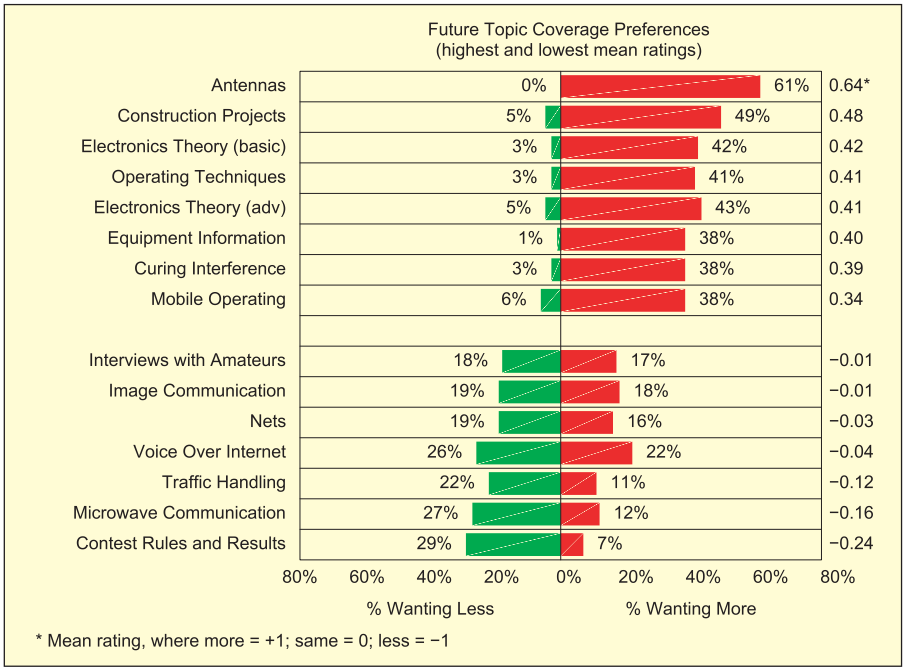
Concerning what's already in *QST*, articles and columns of general interest not surprisingly continue to top the list of what you like best. Hints and Kinks is the leader, with 74% of you reading the column either always or almost always. The Doctor is IN is next at 72% and both New Products and Product Review are well read by 70% of you. Product Review turns out to be a valuable feature for members, as 64% of you said that tests done by the

ARRL Lab and hands-on reports by *QST* staff are important considerations when you're looking to buy a new piece of gear. It's interesting to note that only 63% of readers are aware of *QST*'s advertising screening policy. The journal doesn't accept an ad blindly; we make sure that advertisers have legitimate goods and services to sell.

The information in *QST* was found to be useful by 85% of respondents. The majority—51%—found the content to be "just right"; 28% of you said the journal is a little too technically advanced but still useful, and another 6% thought it was too elementary but still useful. Another interesting fact that shows up is that 72% of you keep all of your issues for future reference, while 26% of you give them up to another ham, a club or school. Readers find the magazine to be presented attractively, neither too dull (3%) nor too splashy (1%). In general, *QST* seems to cover your particular interests pretty well, with 44% giving a rating coverage of "4" on a 5-to-1 scale, and another 25% believe the coverage of their interests to be a "5." Another 22% said coverage was okay, while 6% gave a "2" and just 2% rated *QST* a "1." We continue to hear from members who wish *QST* carried a lot more about their favorite niche of ham radio; keep those cards and letters coming, folks, as that's another way we determine how *QST* will grow.



Hints and Kinks and product reviews have been the most-read sections of *QST* for decades, with the relatively new The Doctor is IN also standing tall in your eyes.



The statistics bear it out: everyone would like more information on antennas! There's also a strong voice for more construction projects and explanations of electronics theory and operating techniques.

Included in the 2003 survey was a question about the Workbench section of the journal, which includes The Doctor, various projects, Hands-On Radio, Help Desk and Hints and Kinks. Over two-thirds (68%) of you want to see more simple, evening or weekender kinds of construction projects appear in the Workbench section. Also, explanations of using certain types of gear, operating modes and software are desired by 57% of you. More than half of respondents said they'd also like to see articles on equipment service and maintenance, basic electronic theory and explanations of how certain equipment operates.

The staff of *QST* strives to include something on each of the more popular topics in every issue. But if we miss something, it could be because we just don't have enough good material on a particular topic that's ready for publication. If you're qualified to help fill a gap in coverage that you see, consider this your invitation to submit an article or other item. The *QST Author's Guide* can be downloaded from the ARRL Web site at **www.arrl.org/qst/aguide/**.

More about the Reader Profile

We noted earlier that our typical Joe Hamm was 59 and recently retired. To clarify this a bit, 41% of respondents said they are retired, a higher percentage than any other possible response to the employment question. This means, of course, that nearly 60% of ARRL members are either employed or seeking employment. The percentage reporting they are retired is up from the 26% in this category in the 1991 survey, however.

Taking a look at those currently employed, 20% of all respondents are engineers or in some other professional position, 8% are technicians and the remaining 29% work in a wide variety of fields.

Only 4% of League members are female, the same as in 1995—but that's up from 2% in 1991's original survey. While the median age of ARRL members is 59, 60% are age 55 and older, with 14% over age 75; only 3% of respondents are under age 35.

The 2000 survey showed a large spike

A Sample of Ham

Readex, a Stillwater, Minnesota company, has conducted research on behalf of publications for over 50 years.

"Readex is tops in the field of publications research and the results pretty well reflect the ARRL population," said *QST* Editor Steve Ford, WB8IMY. "We also see this reflected in feedback we get from visiting with members at hamfests and reading correspondence. Also, having hard, verifiable data helps prevent personal bias in determining what goes into *QST*. Readex data helps keep us on track with our readership."

The survey sample of 1200 Full (licensed) Members was selected in systematic fashion from the 140,051 ARRL members who have domestic mailing addresses. In order to ensure enough surveys were returned from each license class to enable segment level analysis, the sample was stratified by the six FCC license classes: Extra, Advanced, General, Technician Plus, Technician and Novice. Responses were weighted in tabulation to restore true population proportions.

The questionnaire consisted of a 12 page booklet with 54 questions, which covered the areas of readership and opinions of *QST*, operating habits, equipment, antenna and accessory ownership, and plans to purchase and demographics.

In late October 2003, Readex mailed each member of the survey sample a letter alerting them of the survey to come. Two days later survey kits were mailed, which included a cover letter signed by ARRL CEO David Sumner, K1ZZ; the questionnaire; an ARRL decal and a stamped reply envelope to Readex, all in an outgoing ARRL envelope. Three weeks later, non-respondents were mailed another survey kit, similar in nature to the initial kits, except for an updated cover letter and no decal incentive.

In early December 2003, the field period was closed with 705 usable returns received—a 59% response rate. The margin of error for percentages based on 705 returns is ±3.7%, at the 95% confidence level. That is, 95% of the time we can be confident that percentages in the actual population would not vary by more than this in either direction. The margin of error for percentages based on smaller sample sizes—for example, license class—will be larger.

A common question regarding all scientific surveys is "Why don't you ask *all* the members what we think, instead of a small fraction?" ARRL President Jim Haynie, W5JBP, said the answer is simple. "It's all but impossible. Imagine what it would take to tabulate 150,000 responses. Statistically, we don't have to. There are solid, accepted mathematical models that give us very accurate results," Haynie said. "When I compare what I see and hear as I travel to various ham events, it matches up very well with the [survey] results."

Ford concurred: "We can't rely on non-scientific polls like the ARRL Web site poll or other random surveys. We need information that we know is reliable," Ford said. "Readex is not the prime mover of our decision-making for *QST*, but it does possess some weight. We trust it and have found that when we take action on a thing, we've found that it really did reflect the desire of the readership. Readex has been reliable for us time and time again."

in the number of hams upgrading to an Amateur Extra class license, and the numbers continue to grow. Today, there are more Extra class members than ever before at 41%. Computers are found in 92% of members' shacks—used mostly for call sign lookup, logging and HF digital modes—and 90% are connected to the Internet. Since 1995, Morse code operating has dropped among readers from 54% to 36%, but digital operating—especially PSK31—is up sharply. PSK31 operating has doubled since 2000, with up to 15% of you working in the mode. Packet operation continues its decline: 40% in 1995, 18% in 2000 and 13% of you use it today. While it's still the most popular band, there was a marked decrease in 2 meter operation, which peaked at 84% in both 1995 and 2000; only 71% of respondents reported using the band today. In 2003, 8% of ARRL members do not operate at all. This is just about the same as in 1991 (9%), and the vast majority of ARRL members remain among the most active hams.

The survey also revealed some interesting trends in equipment ownership. Although ownership of the traditional desktop HF-only transceiver among members is 73% today compared to 83% in 1991, today's members have a wider variety of equipment. About 37% own an HF+6 m transceiver, 38% have an HF mobile transceiver and 17% report owning a QRP transceiver. VHF equipment ownership has changed as well. In 1991, 66% of members owned a VHF/UHF handheld transceiver, and 56% owned an FM mobile. By 2003 there has been a shift toward more handhelds (76%), with a decrease in VHF mobiles (44%).

Test equipment of some sort is found in the shacks of 81% of you, while printed QSL cards are there only 45% of the time. When buying any ham item, readers said "best price" was the prime consideration at 75%, followed by dealer reputation (72%) and customer service (71%). Apparently, we want it all! And where do you get used gear? Interestingly, it's not usually eBay. Ham radio dealers (50%) and hamfests (38%) are the two major sources of equipment, while on-line buying sites account for 23% of purchases.

Dave Hassler, K7CCC, once met typical League member Joe Hamm at an Amateur Radio convention and (typically) haggled over price with him on a power supply; he reports that he keeps a regular sked with Art Amateur, as well. Hassler remains addicted to his "hollow-state" gear, although the Swan Cygnet 270 gets a rest when he works the digital modes or 6 meters. Hassler is the News Editor of QST and ARRLWeb and he can be reached at **dhassler@arrl.org**.

NEW PRODUCTS

HEAVY DUTY FIBERGLASS MAST FROM THE MAST COMPANY

◊ The Mast Company has announced the availability of a 32 foot fiberglass telescopic pole suitable for supporting vertical wire antennas and lightweight dipole arrays. The dark green color is intended to blend in with background vegetation. This is constructed with a $^{5}/_{16}$ inch top section and each of the 10 sections has a wall thickness of $^{1}/_{16}$ inch. The pole collapses to 46 inches for storage and transportation. Other telescopic pole sizes are also available. Introductory pricing of the 32 foot pole is $115 including application notes and shipping to continental US addresses. For more information, contact Henry Pollock, K4TMC, at The Mast Company, PO Box 1932, Raleigh, NC 27602, or see **www.TMastCo.com**.

By Bill Leahy, KØMP

An Inside Look, Christmas Island, 2003

The author's return to T32, from November 24-December 7, 2003, succeeded because of the team, the antennas and, oh yes, two years of advance planning.

It had been five years since I had last visited Christmas Island. As I stepped off the plane, the island, or more correctly the atoll, seemed much the same. This was my third trip to T32 and it seemed like a homecoming. The heat and high humidity that immediately gets your attention and friendly people were just the way I had remembered them. From a radio point of view, however, things would be a little different this time.

In 1998, four of us went to Christmas Island to DX and participate in the CQWW SSB Contest. As organizer of this, my first DXpedition, there was a steep learning curve. I started planning a year in advance making special cables, color taping antennas for easy assembly, programming laptops, etc. As I look back, it was a typical DXpedition: two stations consisting of ICOM IC-756s, Alpha 76 amplifiers, low, triband Yagis on push poles, a nine band vertical and a top loaded monoband vertical for 160 meters. We made over 11k contacts during that week, won Oceania in the CQWW and made over 500 QSOs on 160 meters. This far exceeded our expectations, and for all of us it was an adventure of a lifetime.

Figure 1—Counting baggage at the T32 airport...It's all here!

The Plans Take Shape

It wasn't hard to put the 2003 team together. Two of the original 1998 team would be going in 2003: Barry Mitchell, NØKV, and myself. Pam Leahy, WØNF, and Pete Schumacher, AE7C, would not be able to join us due to their work schedule. The balance of the team would be made up of members of the Western Wireless Contest Club and Mile High DX Association: Larry Agabekov, N2WW; Greg Dunn, WØZA; Tim Sanders, NØZM; Cheryl Muhr, NØWBV; John Muhr, KTØF, and Paul Sobon, NOØT.

Barry and I decided that we wanted to spend more time on T32, so we made plans for a two week, three station, DXpedition. I wanted to participate in the CQWW CW Contest in the Multi-2 category, so that was also included in my plans. During the last five years, Barry and I had upgraded our original IC-756s. Barry would bring his station consisting of a '756PROII and Alpha 76 amplifier. I would bring two stations consisting of a '756PRO, '756PROII and an Alpha 76. Greg, WØZA, would bring his Alpha 78. The antennas? For the most part, homebrew!

I have been more than a little interested in DXpeditions since the very successful VKØIR Heard Island operation. When I started planning our small DXpedition in 1998, I was a frequent visitor to the Heard Island Web site and especially their equipment list. This was the way I made sure I didn't forget anything really important my first time out. I can tell you that although I didn't need everything on their list, this strategy worked perfectly.

Choosing Antennas

Lately, with the advent of the "Microlite" DXpeditions, great success has been attained using vertical dipole array antennas. Barry Mitchell, NØKV, had been experimenting with a single vertical dipole on some camping trips. This dipole was made from a 33 foot fiberglass, telescoping mast with wires attached by electrical tape. The antenna was fed through a 1:1 balun. He seemed to be very excited about the fact it needed no radials, was very easy to erect, was small and compact, and worked DX very well for its size.

Hmmm...the antennas of the "Microlite" DXpeditions using vertical

Figure 2—20 meter antenna ready for T32.

Figure 4—T32WW in foreground and T32KV during CQWW CW.

dipole arrays are made of aluminum tubing. What if I experimented with the fiberglass mast technique and made a "Parasitic Vertical Dipole Array"? On T32, I would be in a semi-friendly environment with no ice or high winds to worry about so the antennas could be very light. This would take some testing, but it was worth a try. As insurance, I already had two new tribanders with new 25 foot masts.

Last fall, before the first snows came to Denver, I made the first PVDA for 20 meters and erected it in the front yard. After investigating several fiberglass masts, I settled on the DK9SQ mast marketed by Kanga. After a little pruning of the wires to maximize it for the CW portion of the band, I was surprised to find the PVDA kept its SWR less than 1.5 to 1 over the entire 20 meter band. I hooked up an FT-1000MP to it, ran 100 W and proceeded to work DX, mostly on the first call. Then I made some tests against a 3 element triband Yagi mounted at 25 feet to simulate DXpedition conditions. Signal strengths were, in some cases, better on the PVDA, but were never worse than the Yagi.

Some further testing with my good friend Larry Agabekov, N2WW/UA6HZ, a world class operator, confirmed these results, and I went ahead and made PVDAs for 20, 17, 15, 12, 10 meters. All the antennas exhibited the same characteristics as the first one.

I still wasn't totally convinced…at least to bet an expensive, eight operator, DXpedition on them. I bought a copy of the *EZNEC Windows* software by Roy Lewallen, W7EL, and modeled the PVDA. This was a valuable exercise to see what made this antenna tick. I combined this knowledge with what I had read and it all seemed to make sense. The idea of using a PVDA is that there will be fewer propagation hops between you and the DX. The fewer the hops, the less attenuation of your signal so you can have less gain in the antenna but make up for it by fewer hops…simple. The reason for fewer hops is that this antenna has a very low take-off angle, especially so when next to salt water. I was able to verify this with *EZNEC* by changing to different ground conditions and watching the parameters change. I did a virtual comparison of a PVDA with a low Yagi.

There was no comparison in take-off angle; the PVDA beat the low Yagi hands down. The key here is *low* Yagi. Many DXpeditions use Yagis at 20 to 30 feet, as I did in 1998. Since low mounted Yagis make for higher take-off angles, the PVDA outperforms a low, small, DXpedition type Yagi in a salt water DXpedition scenario.

Figure 3—The PVDAs, with the 160 meter vertical in the foreground.

Performance

What makes these antennas perform so well in the Pacific? Salt water for sure; however, there are other characteristics that are equally important. PVDAs are much easier to erect, much lighter, more compact and more inexpensive to ship. Parts are interchangeable should something break. You can use the antenna as a single vertical dipole if need be.

In an effort to reduce weight and bulk, Tim, NØZM, suggested we use "Mason's Twine" for guys instead of my usual $^{3}/_{16}$ inch Dacron rope. All of our antennas were monobanders, which would mean a lot of bulky rope. At first I hesitated, but looking into it, I could buy two 800 foot rolls very inexpensively; I could discard the twine when we were off the air. The twine was made of nylon and would not stretch, was very strong for the lightweight PVDAs and was much more compact to ship than all that rope.

We had forecast that 30 meters would be a key band for EU, and that forecast came true. We wanted to be as strong as possible on 30 meters, so Barry, NØKV, constructed a traditional phased, 2 element vertical array made from the same fiberglass masts for not only 30, but also 40 meters. These antennas used radials and worked very well.

The 160 and 80 meter antennas were top loaded Gladiator verticals. These antennas were the lone commercially made antennas we erected. They both had tuned, raised radials. The 160 antenna was a veteran of the 1998 campaign. It worked well then and it continued to do so. It took some "tiptoeing" through the fish net beacons to

Typical DXpedition Day on T32

It seemed, and this is no surprise, that the best operating times were at the graylines. A description of a typical operating day is as follows, starting with that magic time of sunset. Two or three of us would be up all night working the low bands. I can speak from experience here as I did the bulk of the 160 work. At grayline, the 160 station had priority over all operations. I actually started at sunset with a CQ EU. I was not able to work EU on 160 during our stay, but the effort was made.

Next came scattered Qs with the US west coast, mostly 6s and 7s. Dinner was served about 7 PM on T32. If we had a good run going on any band, the operators attending dinner would bring back a plate to the operator so he could continue the run. On 160 more scattered Qs were made until the northern hemisphere, east coast sunrise. From that time on, I could feel the sun come up over the entire US and Canada. An exciting time for a 160 op! First the 1s, 2s and 3s. Then 4s. Then 8s and 9s, then home…the Øs and some "atta boys" from friends and 5s. Then the West Coast with the 6s and 7s. One region would fade out and the next would start to come up over the noise and fish beacons (well, nothing was as strong as the fish beacons!). I hated to see one region go away but I was rewarded with another in minutes.

I don't want to forget my JA, VK and ZL friends who would keep me company during the long nights either. They were right in there also, some with QRP. About 5 AM, T32 time, we night owls would start to get company in the shack. It was just about time for the 20 meter long and/or short path opening to EU—a highlight of the day. This opening was about the time my 6s on 160 would fade and I was giving a last CQ EU at sunrise.

Breakfast was at 6 AM, so all would be up by that time. We worked breakfast the same as dinner. We would bring back a breakfast plate to the operators who were running EU so as not to miss this opening. At that time, the night crew would go to bed and the "day crew" would operate. The operating emphasis of the DXpedition was to work EU, low bands, the 30/17/12 meter bands and specialty modes in that order. The daytime operators would run 20-10 meters with that in mind. By noon, the night operators would be up and all ops would go to lunch. In the afternoon, all eight operators would take turns as required.

It was always a welcome sound to the night owls to hear a "Thanks" for the night time operations on the high bands. And there was always the inquiry, "Will you be on the low bands again tonight?"

make QSOs on 160 meters, but the ICOMs did an admirable job of pulling signals out of the noise. I mounted the 160 vertical in the same position as in 1998. The 80 meter antenna, a clone of the 160 antenna, also performed admirably.

Another goal of the DXpedition was to make T32 rare. How? Make sure we had a good presence on the low bands, the 30/17/12 meter bands and modes like RTTY. With the ARRL DXCC/DX Challenge award programs gaining popularity, there were many DXers who needed T32 on several particular band/modes that had not been activated in quite a while. Some maybe never…30 or 12 meter RTTY?

How would we make sure we were on the right bands at the right time? Not long ago I met Dick Buckner of ACE-HF. Dick manufactures propagation forecasting software using VOACAP technology. I purchased a copy from Dick several months before leaving for T32 and got two licenses for the software, one for KØMP and another for T32MP.

Dick and Jay Terleski, WXØB, were kind enough to make a PVDA antenna profile for me to use with the *ACE-HF* software. I studied the program and made "Operations" books for each of the three stations on T32. The books consisted of operational characteristics of the stations; T32/Zulu Time conversion table; low band strategies; band plans for T32, JA, NA and EU, and an hour by hour plot of openings to various parts of the world, with both short and long paths. This prior planning and forecasting was responsible for many more QSOs for the deserving. At times, we would run across an opening to somewhere in the world and we would "reverse check" the Operations book. Sure enough, more times than not, the opening would be listed.

Teamwork Pays Off

You now have a good idea of our equipment, but what of the most important aspect of a DXpedition…the people. I could have said "operators" in the previous sentence but there is more to a successful DXpedition than operating. Our DXpedition required not only good CW operators; it required that our individuals take an active role in the DXpedition before, during and after we returned. Pre-DXpedition meetings were held to familiarize ourselves with the equipment, packing of equipment, how the baggage would be distributed, making sure everyone had their visas, licenses, tickets, reservations, and so on.

One of my cardinal rules of DXpeditioning is to have *fun*. For everyone to have fun, everyone needs to do their share of the station/antenna setup before any RF is radiated. Our group members were selected with this requirement in mind. All of us knew all the equipment and antennas from previous experience. The station went up without any problems, with all pitching in.

During the CQWW CW contest we finished with a score of 10.6M points and over 7600 QSOs in the M-2 category. We also elected to compete in the ARRL 160 Contest and Larry, T32WW, made 369 QSOs. We closed the DXpedition with over 31k contacts, almost 1000 of them on 160. We had some first time DXpeditioneers with us, and they all performed at the highest standards. I'm proud of them, and they have expressed a desire to do more DXpeditions in the future. So DXpeditioneers, be enthusiastic about your DXpeditions when you return home. You may help add to the numbers of DXers, and you may even be fortunate enough to help create a new DXpeditioneer or two.

Before we left, we announced that we would participate in the ARRL's Logbook of The World (**www.arrl.org/lotw/**). Most of our contacts are now on LoTW. I hope that more DXpeditions will use this new, powerful DXing tool.

All photos by the T32 DXpedition team.

Bill Leahy, KØMP, has been licensed continuously since 1964. Bill owns Scientific Systems, Inc, a video sales company. Always an avid DXer, Bill holds the ARRL's DX Challenge award. He is a past president of the Mile High DX Association and current president of the Western Wireless Contest Club. Bill has served on the ARRL DXAC (Rocky Mountain Division) and is currently an ARRL Assistant Director for the Rocky Mountain Division. You can reach the author at 310 Amanda Pines Dr, Parker, Colorado 80138; **ssi2@mindspring.com**.

STRAYS

I would like to get in touch with...

◊ anyone with a late 1960s-era QSL card from KJ6BZ on Johnston Atoll. It depicted the typical South Pacific Island, complete with a palm tree and attached antenna, and had my nickname, MERC, and WA8MWW at the bottom corner.—*Mercel D. Skaggs (MERC), KD4AIF, 320 Ayrlee Ave NW, Leesburg, VA 20176;* **poppopmds@netzero.net**.

By Gordon West, WB6NOA

Weekend Ham Class Success

How the author, a veteran instructor, along with a group of San Diego ham volunteers, produced a successful weekend ham class—despite Murphy's appearance on the scene.

DON WILSON, N9ZGE

Figure 1—After a couple of logistical near-disasters, all 125 students had table space on both sides of an 8 foot table under a tent set up in a marine store parking lot.

Although I've been teaching Amateur Radio evening and weekend licensing classes for 30 years, this particular class, in San Diego, was notable for its logistical challenges. The class was tailored for a group of sailors heading to Mexico. We run a class each year on the first weekend in October because it is the gathering time and place for boaters waiting for the hurricane systems to pass (and for boat insurance to kick in). This provides a concentration of radio enthusiasts wanting to add ham radio capabilities to their already installed marine single sideband installations.

The weekend class runs from Friday afternoon through Sunday night. The key to the class success are the pre-study materials and the completion of the pre-study workbook. Mariners were sent tapes, books, manuals, workbooks and a full-blown computer course to take them from no license to the minimum of a Technician class license. With solid preparation, some students passed the code test and Element 3 written test to qualify for the General license.

Test Prep

The weekend class serves as a test preparation session, not a cram course. Those of the 125 who did not start or complete their home study before class were encouraged to get a class refund and wait for another session. If they insisted on staying, they were told they could not qualify for the General license during the weekend.

The 125 sailors did a good prep job before class. Part of the program is checking their progress regularly, and they all felt confident of the theory and were groaning through learning the Morse code. Yet they *knew* they had to learn the code because of recent "revelations" about the exchange Mexican license, which was under scrutiny by Airmail Winlink operators who were finding a few Technician class sailors working Winlink on HF under guise of a Mexican permit. This hubbub surfaced a month before class, and added impetus for the sailors to indeed pass their 5 WPM Morse code exam on Sunday evening.

The class filled quickly by means of the sailors, marine radio nets and local publicity at San Diego marine stores. The class was to be held at a huge marine store in San Diego. It had an indoor training location that would *just* accommodate all of our students sitting at rented tables. Everything seemed on course—the ARRL plus Kenwood, Yaesu and ICOM America all sent additional training materials several weeks in advance. The special edition of *QST*, frequency charts, band charts, log books, radio maps and pens would be at each student's desk when they came in Friday afternoon for the three-day class. Bob Heil was kind enough to come in with a Heil sound system that would allow us to cover the classroom, saving me and several ham volunteer instructors from needing to shout and lose our voices.

A "Lot" of Murphy

With the preparation going so well, it was time for the challenges to present themselves. About two weeks before class, I was informed that our marine store training area was no longer available. Store

expansion brought in so much new merchandise that there was no longer room for us. None of the local San Diego hotels had meeting rooms available, either.

But I was ready for this—we would rent a 30×40 tent and teach in their parking lot. Everyone agreed that this idea might work. Everything was rented, including enough tables and chairs so every student would have a spot at a table. My wife, Suzy, N6GLF, made all the arrangements for feeding the 125 class members on Friday night, all day Saturday and Saturday evening, as well as all day Sunday and Sunday evening. ARRL Southwestern Division Vice Director Tuck Miller, NZ6T, and his wife Evelyn, N6EVE, were on hand all day Saturday, helping with some of the class instruction and inviting students to join the ARRL on successful class completion on Sunday evening. Many did!

On Monday before the class began on Friday, more bad news hit on the tent setup. The parking lot wouldn't work because the store expansion plan also included tearing up 80 percent of the parking spaces—and Monday before the start of the class on Friday was the day the heavy earth movers moved in and our selected tent location went out.

It was suggested we simply cancel the class, but this was not an option—we have always been able to overcome this type of problem in the past (one time teaching a big class in our backyard under multiple tents!).

Making the Sound Barrier

A compromise was reached—the tent would be 20 feet wide by 50 feet long to accommodate 3 rows of 8 foot tables. One side of the tent would butt up to the side of the facility, and the other side of the tent facing the torn-up parking lot would be lined with communication vehicles, providing a sound barrier for construction (destruction) activity Friday afternoon. It would also provide a safety barrier in case any of their big equipment or other vehicles in the few remaining parking spaces should roll backward.

Our students would need to park at alternate locations, some as far as a quarter mile away. Don Wilson, N9ZGE, and his wife, Linda, KB9OLC, would use multi-use radio service and FRS radios for vehicle traffic control. They were assisted by Paul, ND6Q, who would keep students from accidentally pulling into the parking lot and taking up the few spaces reserved for outside customers. To keep us within the rules, we use the MURS and FRS radio bands for class preparation. Ham radio is only permitted as part of the instruction process.

The tent went up without much difficulty. The PA system saved the day for the back rows, almost 60 feet away. A front table would hold all of the demonstration equipment and the touch-and-feel "stuff" I bring to every class.

Lighting for Friday night, Saturday night and Sunday evening was an afterthought of the tent makers. They came in with the most ridiculous light poles, and it took us a great deal of time to set them up to provide adequate lighting, while keeping any power cords off the floor to prevent a tripping accident. Safety is always our paramount concern.

Let's see—we could talk about ac power loss a couple of times when coffee makers and inside store rope-burning machines were running at the same time...automobile alarms that would go off when we transmitted on HF...the 30º slant due to the non-level training area outside the building causing stiff necks...wind and rain...jet noise...and an all-night watch on all our stuff from midnight to dawn. On the plus side, Suzy provided non-stop food, including a fabulous sandwich lunch and a great Saturday night dinner, plus cost-effective "ham punch."

Coming through the Adversities

You know what? The students were *delighted* for a weekend opportunity to train and earn their Amateur Radio license. This was the first big class we did after the Technician class question pool ballooned from 384 to over 511 questions. By the middle of the second day, some students were becoming overwhelmed but hung in there to get the Tech test completed Saturday evening. Outside examiners included some who drove for more than 2 hours to get to the class, while others lived only a few miles away. We had three outside volunteer examiners who were there "just to monitor"; when they saw all that was going on, they jumped right in and provided invaluable test-grading service.

Class finished up Sunday evening with over 100 earning a minimum of Technician class, and a good number of sailors going up to General by successfully passing the code and theory tests. These new Generals had done their homework months ahead of time, and brought a notebook to class to prove it. You could look over their code copy when they began copying their first element, the letter "E,"

GORDON WEST, WB6NOA

Figure 2—John Foote, K1DOK, of the civil air patrol, demos a homebrew capacitance hat.

DON WILSON, N9ZGE

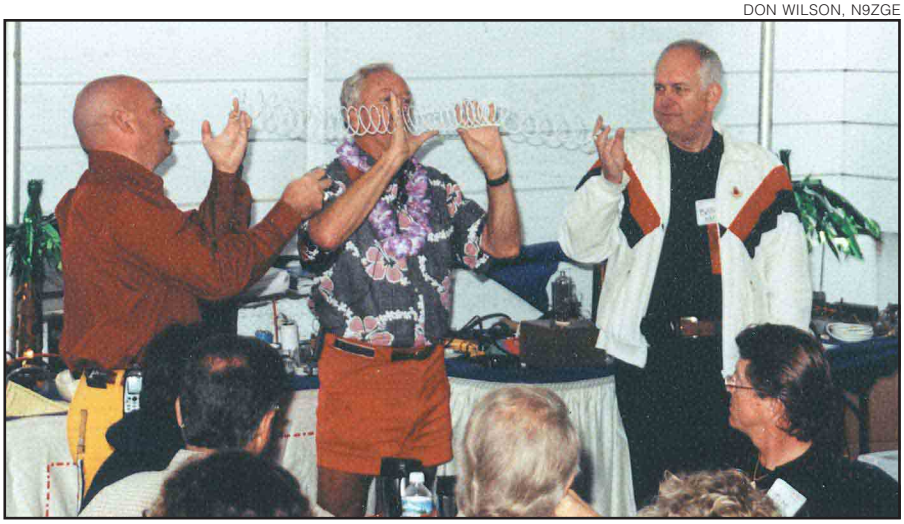


Figure 3—Using a plastic Slinky toy, the author (center) assists local hams demo frequency and wavelength.

DON WILSON, N9ZGE

Figure 4—Students who chose to take the Element 1 test were also required to send a simple CW message. The author shows how it's done.

GORDON WEST, WB6NOA

Figure 5—Suzy, N6GLF, pored over test papers for two days after the weekend class ended.

and then go to the back of their home-study book and see well-decoded sample QSOs.

We also tested for sending, which turned out to be easy for most students, and this gave us a chance to show them proper hand position when holding the CW straight key. Multiple MFJ key and oscillator sets were on every table, so students were able to practice throughout the three-day class.

Maritime mobile operation centers around sending e-mail on HF, using Airmail Winlink 2000. We had three complete Winlink stations for students to learn how to hook up the equipment, and how to take advantage of this free ham radio service. For those who needed to send commercial messages via e-mail, we gave them details on how to sign up for the $200 a year service called SailMail, based in the Bay Area with stations throughout the world.

By the following Friday, a week after the exam, students received their call signs. They were requested to join a net I run daily on 7250 kHz to begin developing good radio procedures. It would also provide the ability to give out radio checks among boats all in the same marina, 90 miles away. We would encourage students to improve their ground systems using copper foil to an underwater bronze through-hull to beat each other out with the strongest signal received at this end of the skywave circuit. In short, we made it *fun* for them to get on the air for the first time.

The host marine dealer, West Marine (no connection), saw increased business during the class. Many students also sent in their ARRL membership after they received their call letters.

Thanks!

My thanks go to the many hams who helped make this class a success, and to those 125 sailors who put up with last-minute tent quarters and a classroom that was relatively warm during the day and quite cool at night. No complaints—mariners are accustomed to roughing it in the field, and that is exactly what this class was all about!

Gordon West, WB6NOA, of Costa Mesa, California, has been a ham for more than 40 years, holding the Amateur Extra class license. Gordon teaches evening ham radio classes and offers weekend licensing seminars on a monthly schedule in Southern California and across the US. These seminars cover entry level and upgrade licenses in ham radio, as well as marine electronics. He offers a free instructor's book (see **www.haminstructor.com**). *He also has served on the faculty of Coastline College and Orange Coast College. Gordon is a regular contribution to ham radio, marine and general aviation magazines. He is a fellow of the Radio Club of America, and a life member of the ARRL. The ARRL presented Gordon with its "Instructor of the Year" award. Through his own organization, Gordon West Radio School, he has trained newly licensed hams with his classes, books and audio tapes over the last 35 years. You can contact the author at* **wb6noa@arrl.net**. QST

FEEDBACK

◊ In the schematic in "A Data to PC Interface (or…New Life for an Old Mouse)" [May 2004, Figure 1, page 67], P3 (the DB9F connector) erroneously has two pin 4s. The lower one should be pin 5 (GND); it should go to pin 2 of U1. The upper pin (DTR) is shown correctly.

NEW PRODUCTS

HT STAND FROM NIFTY HAM ACCESSORIES

◊ Nifty Ham Accessories has announced the Nifty! HT Stand. It's designed to hold a hand-held radio equipped with a belt clip through use of its adjustable stand. The stand holds the radio upright and steady at a convenient viewing angle.

The stand is made of steel with soft rubber feet designed to resist a remotely connected antenna or microphone cable from dragging the radio around on a desk. Antenna, power and microphone wires are held in place using a quick release cable clamp. The radio snaps to the support plate using the HT's belt clip and is supported by the adjustable shelf.

Price: $30.85. For further information see **www.niftyaccessories.com**, or contact Nifty Ham Accessories, 1601 Donalor Dr, Escondido, CA 92027, tel: 760-781-5522.

MACMEMORIESMANAGER V0.4 FROM DOGPARK SOFTWARE

◊ Dog Park Software has announced the release of version 0.4 of *MacMemoriesManager* for Macintosh computers. It can now be downloaded from **www.dogparksoftware.com/MacMemoriesManager.html**. *MacMemoriesManager* manages radio memories allowing multiple memory files for use in different situations, and allows switching from profile to profile. Radio memories can be transferred to and from disk profile files or interactive lists through drag and drop.

Supported radios include Kenwood TH-F6, TS-570 and TS-2000 the AOR AR3000A, ICOM IC-756 and the Yaesu FT-817 and FT-897 . The software requires Mac 10.2 operating system or higher and a serial port/USB serial adapter and cable for the radio interface.

MacMemoriesManager must be registered to work beyond the five minute time limit and for some features to work. To order on the Web see **order.kagi.com/?XOB**. Price: $67.

For more information, contact Dog Park Software, **dagro@dogparksoftware.com** or see **www.dogparksoftware.com**.

By Bruce Frahm, KØBJ

Nominations for the ARRL International Humanitarian Award Now Due

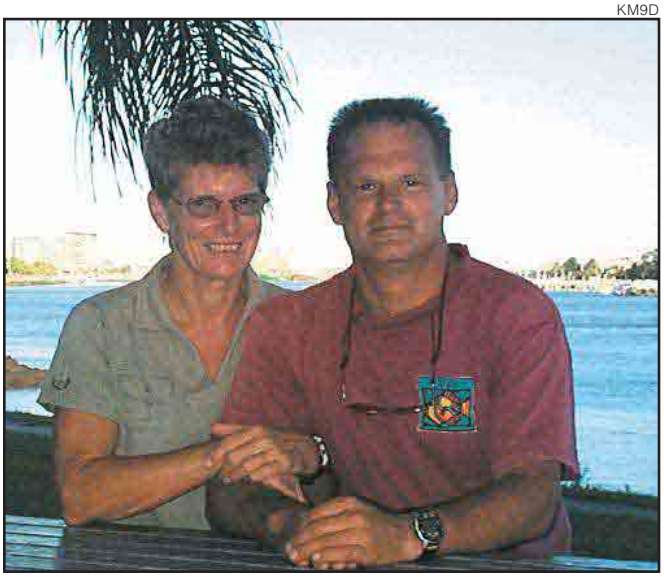
A March *QST* item reported that Charles Mike Young, KM9D, and Jan Heaton, KF4TUG, shared the spotlight as winners of ARRL's 2003 International Humanitarian Award. The two DXers learned the news while waiting out the Pacific hurricane season moored in Queensland, Australia, in their yacht *Don Henry*. It's their sixth year circumnavigating the globe—Mike from Indiana, and Jan, a veteran mariner from England.

Things were considerably more hectic in April 2003 when they helped save a life at sea. The cargo/passenger ship *Te Taobe* was due in, but reported engine trouble. The crew was watching over a young woman who had become unconscious and was losing a substantial amount of blood. Mike and Jan, while anchored near Kanton Island, provided communications to the ship.

With the Kanton government's patrol boat undergoing repairs, Jan and Mike were asked if they could take medical supplies to the drifting *Te Taobe*. In under an hour, just beating the tide advancing into Kanton lagoon, the duo was underway in *Don Henry*. Mike kept skeds with hams, learning that the US Coast Guard *Polar Sea* was also heading to *Te Taobe*, but was many days away. With the aid of stiff winds, the *Don Henry* closed with the hapless freighter in 35 hours, on a moonless night. Those winds now became an enemy, as Jan maneuvered *Don Henry* within 25 feet of the drifting vessel, contending with a 1 meter swell, allowing Mike to secure a line cast from *Te Taobe* to the supply bags.

Their job accomplished, Jan and Mike returned to Kanton, taking five days against the winds. While still en route home, they heard welcome news that the woman was recovering. This trip was the public service/emcomm highlight of KF4TUG and KM9D's continuing adventures, in addition to providing QSOs for more than 15 shore-based DXpedition call signs.

KM9D



Jan Heaton, KF4TUG, and Charles Mike Young, KM9D, helped save a life while at sea, and were honored with the 2003 ARRL International Humanitarian Award.

KM9D and KF4TUG were nominated for the Humanitarian Award by ARRL DX Advisory Committee member "Pick" Pickard, WA5PAE. Last summer Pick learned he had cancer—he wrote the nomination letter on November 5, and became a Silent Key on the 23rd. Upon hearing of their selection and Pick's role, Mike said, "Pick was a real proponent for people and the Amateur Radio hobby. He would be very pleased at the outcome of his nomination. Jan and I are proud of our performance and humbled by the recognition awarded."

If you think someone deserves the Humanitarian Award, go to **www.arrl.org/FandES/field/awards/humanitarian.html** to check the terms of reference and find the directions to follow. This award is dedicated to Amateur Radio operators who are "unsung heroes" who, through Amateur Radio, are devoted to promoting the welfare of mankind, worldwide. Any radio amateur or group of amateurs worldwide who has provided extraordinary service through their Amateur Radio skills for the benefit of others in times of crisis or disaster is qualified to receive the award. To nominate, send a brief description in English of the events and actions (as well as contact information for the nominee) to ARRL International Humanitarian Award, 225 Main St, Newington, CT 06111. Nominations and support material must be received by ARRL Headquarters by December 31.

Bruce Frahm is ARRL Midwest Division Vice Director. He and his wife, Janice, spent time with Mike and Jan in Grand Cayman, when Bruce signed ZF2CM and encountered 60 dB over 9 signals. You can contact the author at **bfrahm@arrl.org**.

By Mark Spencer, WA8SME

Kid's Day 2004

But, Mom, there's nothing to do! Answer: Kid's Day, June 19.

How many times have parents heard those dreaded words from their children? On June 19, 2004, kids of all ages will be shown that there *is* something to do…ham radio. Kid's Day is one way that you can share the fun, excitement, and learning opportunities of ham radio. Many hams participate with their own children, grandchildren, nieces and nephews. This event isn't just for relatives though. Consider inviting the people you work with and their children, or your neighbor's family. Inviting adults and youth may result in future ham radio operators.

The best way to learn about ham radio is to *do* ham radio. The Kid's Day operating event is centered on kids so if you want kids to have a great time (and be ready to come back for more) allow them to dictate the pace and duration of the event. Kid's Day should be fun for both of you. Do the kids appear to be losing interest while you tune around looking for a strong signal? Why not let them try their hand at tuning? If they are ready to leave, accept it. It is better to do 15 minutes of ham radio fun than to be forced into spending 1 hour at the ham radio transceiver when they want to be somewhere else. Besides, kids change their mind so often in a few minutes they may be sitting beside you again.

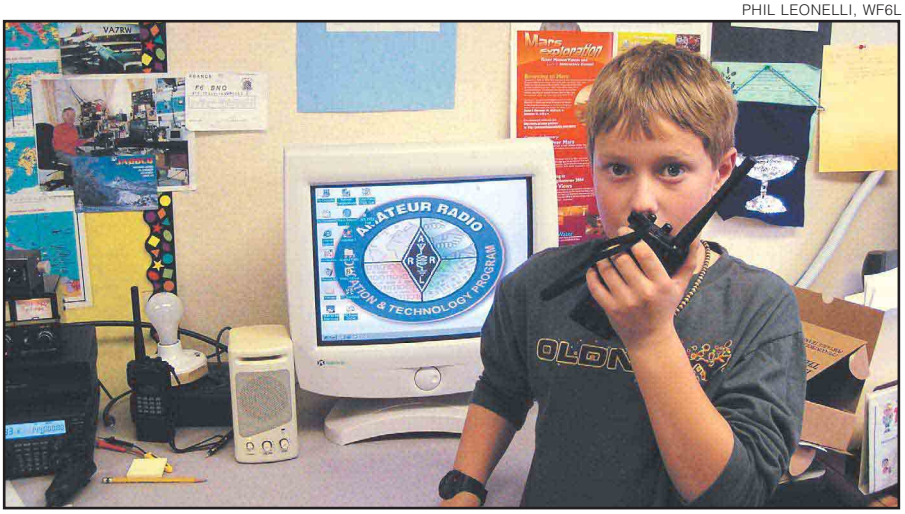
Since Kid's Day began in 1994, the comments from hams and kids haven't changed much:

"My son Eric operated from my station (K1RU). He's 11 years old and in sixth grade. Once he got going, he thought it was great. This forum really provides a great way to introduce young people to the hobby.

"He worked people from the ages of 2½ to 92! Working W1AW and W5RRR at the Johnson Space Center were highlights. Ended up with 104 QSOs, 21 states and 4 countries.

"He already wants to know when the next one is. I told him it's more fun with your own license. Hit the study guide!" *(Gene, K1RU)*

PHIL LEONELLI, WF6L



This young man was hooked after his first ham contact.

Kid's Day Rules

Purpose: Kid's Day is intended to encourage young people (licensed or not) to enjoy Amateur Radio. It can give young people on-the-air experience so they might develop an interest in pursuing a license in the future. It is intended to give hams a chance to share their station with children.

Date: *Saturday*, June 19, 2004.

Time: 1800 to 2400 UTC. No limit on operating time.

Suggested exchange: Name, age, location and favorite color. You are encouraged to work the same station again if an operator has changed. Call "CQ Kid's Day."

Suggested frequencies: 28,350 to 28,400 kHz, 21,380 to 21,400, 14,270 to 14,300 kHz and 2 meter repeater frequencies with permission from your area repeater sponsor. Observe third party traffic restrictions when making DX QSOs.

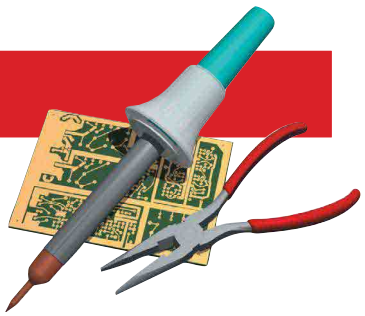
Awards: All participants are eligible to receive a colorful certificate (it becomes the child's personalized sales brochure on ham radio). Please visit **www.arrl.org/FandES/ead/kids-day-survey.html** to complete a short survey and post your comments. You will then have access to download the certificate page or send a 9×12 self-addressed stamped envelope to Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009.

"My daughter Katie's first contact of the event was Eric! She had a blast. Only did about 2 stations, but that was mainly because she took breaks fairly regularly. [grin]" *(John, W5NNH)*

"Kid's day is great, and one of the few reasons for having a mic." *(Derek, AA5BT)*

"My twin 7 year old son (Avi) and daughter (Rosie) had a lot of fun for the two hours they operated (after getting over some initial mic shyness). I hope they didn't confuse people as they kept changing their favorite colors (they observed that the most common favorite color was blue). They had a blast addressing envelopes and affixing stamps for the QSL cards they sent to everyone they worked. They are now waiting anxiously for some QSL returns." *(Ian, KZ7N)*

The author is ARRL Education and Technology Program Coordinator. He can be reached at **mspencer@arrl.org**.



The Doctor is IN

Q Here's a practical question from Harry Woods, W2PAL: Standing on the ground, is there any way I can estimate the height of a tree or an antenna support structure?

A There are several methods for doing this; we'll present two. Both involve the application of a little trigonometry. Each method assumes flat and level terrain around the unknown structure and both involve sufficient sunlight such that a shadow is cast.

The first method requires the date and time at the location where the measurement is made. It further requires Internet access or some other convenient way to obtain solar position data. First, obtain the altitude of the Sun (in degrees) for the day and time that you wish to make the measurement. You can conveniently obtain this information from the US Naval Observatory Web site. Under *Positions of the Sun and Moon*, select *Altitude and Azimuth of the Sun or Moon During One Day* (**aa.usno.navy.mil/data/docs/AltAz.html**). You will need to enter the date and your location by city or town. The database currently contains about 22,000 locations, so if your town is not listed, choose the closest location.

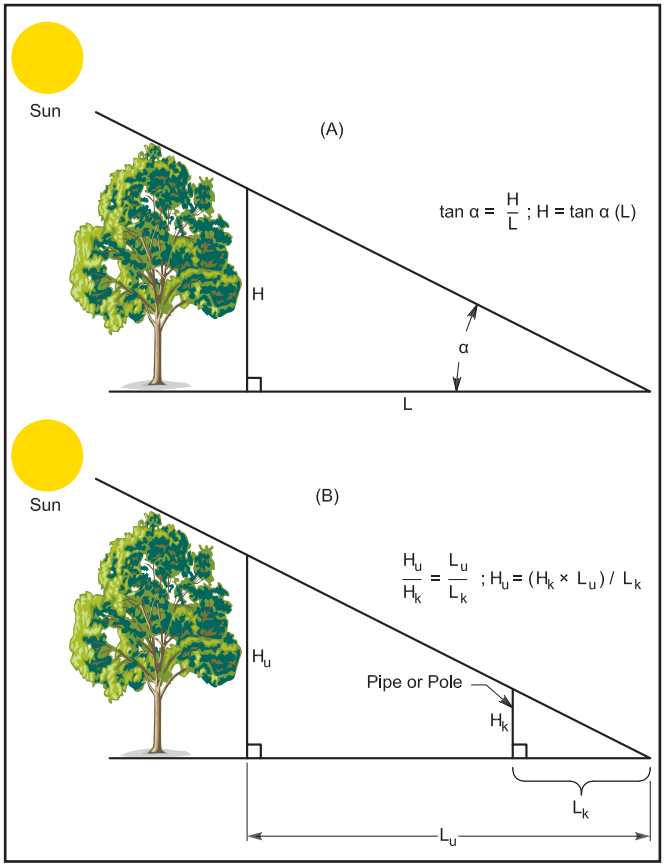


Figure 1—Using the Sun's angular position in degrees, it is relatively easy to calculate the height of an unknown object, as in A. Similarly, in B, the height can be calculated by comparing the shadow length of a known object with one of an unknown. Note that the pipe shadow should *not* be in the tree's shadow; it is shown that way on the drawing for brevity. Both shadow measurements need to be done at the same time. Use this method when the Sun's angular position isn't immediately available.

The rest is easy. Simply measure the length of the shadow being cast by the unknown structure at a convenient time selected from the Sun's data. The height of the unknown structure can now be determined by looking at Figure 1A:

$\tan \alpha = H / L$

where:
α = Sun's altitude (in degrees)
H = height of unknown structure
L = shadow length of unknown structure
then:
H = tangent of Sun's altitude in degrees (α) × shadow of unknown structure (L).

As an example: The Sun's altitude is 53.38° at the time, date and location of the measurement. The shadow cast by the unknown structure is 70 feet, 9 inches or 70.75 feet. The height (of the unknown structure) = tan 53.38 × 70.75 = 94.9 feet, or 94 feet, 11 inches.

The second method requires a structure of known height such as a pipe or pole. Install (or have a helper hold) the pipe perpendicular to the Earth's surface. A level or a plumb bob should be used. Now simply measure the length of the shadows being cast by the known and unknown structures. Be sure to make both measurements as simultaneously as possible. The height of the unknown structure can now be determined by the trigonometry of similar triangles, as shown in Figure 1B:

$H_u / H_k = L_u / L_k$

where:
H_u = unknown structure height
H_k = known structure height
L_u = unknown structure shadow length
L_k = known structure shadow length
then:
$H_u = (H_k \times L_u) / L_k$

As an example: The shadow of the unknown structure is 70.75 feet. The shadow of the known structure is 8.95 feet. The height of the known structure is 12 feet. Height of the unknown structure = (12 × 70.75) / 8.95 = 94.9 feet.

Q Dick, KF4NS, asks: Why are the tabs on rechargeable batteries welded instead of soldered? I am preparing to rebuild a 12 V rechargeable battery pack with 10 cells of the same rating, with tabs already connected on top and bottom. The only problem I see is one concerning the orientation of the tabs. In order to rebuild the pack using the original case, I have to connect the battery tabs at angles other than their pre-welded direction. I have soldered tabs to rechargeable batteries in the past, using whatever conductive material I can find, but what is the proper material to use and of what width and thickness?

A The tabs on battery packs of multiple cells are typically spot-welded. Automatic spot-welding offers a way to make the electrical connections to the cells quickly with robotic assembly equipment and with minimal heat conduction to the cell interior. The heat generated in spot-welding is for a very brief interval and is highly localized.

Battery manufacturers try to build packs that are rugged and, of course, as cost effective as possible. A welded terminal connection is far stronger and easier to implement than a soldered one. Furthermore, the welded connection can conduct peak currents better (it's better suited to thermal loading and it has lower resistivity) compared to a soldered joint. The makers generally use alloy or stainless cases, which would require special flux and solder for a good connection. That connection *can* be made with conventional tin/lead solder and standard rosin flux, but I wouldn't advise it. You'd need lots of heat (not particularly good for the cell) and a very clean surface.

When you are trying to fit cells into an original case, it's best to use a flat conductor, as wires will often intrude and prevent proper cell fit. It's why the manufacturers use strap-like material. Copper strap would probably be easiest to use, but you can also use other flat conductors. The thickness and width are not critical, as the run is short enough so that the resistance of the bonding material will be low.

If you do reuse the tabs from an old battery and solder them, you'll preferably need to use an acid-based solder. A good source for stainless and alloy soldering can be found at **www.ccis.com/home/hn/index.htm**. Make sure you clean the joint thoroughly and completely after soldering to remove all the residual flux (it should be easy to do this on a flat battery). And, of course, keep that acid-based solder *away* from electronic gear, as its corrosive properties will wreak havoc with electronic connections. It does so primarily because there is always some residual acid flux remaining, as it's almost impossible to thoroughly clean a complex shaped soldered joint. The remaining acid will eventually corrode the joint.

Q Jon, KC5LVW, writes: I need high current capability (90 A) for my solid state HF amplifier. I want to use regulated power supplies and not batteries so the question is: Can I parallel two regulated power supplies to give me the current capacity I need? If I can, what should I be aware of or what factors should I look out for?

A It is possible to do this, although I generally don't recommend this approach, except in a laboratory situation. The technique is generally known as *load sharing* and it involves careful voltage matching of power supplies. There are a couple of things to look out for:

1) If the voltage of one supply is marginally less than the other, that supply can act as a load, rather than a source. Conversely, the supply with the marginally higher terminal voltage will be supplying most of the current. Make sure there are steering diodes present to protect against reverse current flow in each supply. Those diodes will account for a voltage drop equal to the diode's forward voltage drop (generally 0.6-0.7 V for silicon-based semiconductors). That diode will have to be a high current device that can handle the full output current of one supply (45 A), along with proper heat sinking for it. In order that one supply doesn't handle most of the current, the supplies will have to be voltage matched within at least 100 mV (0.1 V) and preferably 50 mV (0.05 V). This should be done at the output side of the steering diodes.

2) If there is an imbalance in the voltage between the two supplies, the supply providing the bulk of the current will likely go into *foldback current limiting*. The second supply now must handle the entire load. It, too, will then go into a current limit state and shut down, with the result that there will be no output. There are techniques for ensuring that the two supplies voltage track. Some of these are discussed in a useful application note from Texas Instruments and Unitrode (**focus.ti.com/lit/ml/slup094/slup094.pdf**). One technique involves making one supply a master and the other a slave. The master supply receives voltage sense from the load and it supplies a control voltage to the slave supply.

Because of the difficulty in balancing the supplies and the loss of voltage (and consequent power) from a steering diode, I would avoid this approach if I had other options. If you do decide to go this route, make sure the power supplies you choose have good long-term voltage stability, good voltage-setting resolution, and are capable of accepting a remote voltage sense input.

Q From Lou, W8VU, comes the following: I've got a transmitter problem, and would like a diagnosis. I am restoring a Johnson Viking Valiant, and I have a problem. After tuning up the transmitter in CW with plate current dipped, and the output loaded to the recommended values into a dummy load, tuning the final to resonance (going past the plate current "dip"), the output power actually *increases*! I've neutralized the finals but I'm not 100% confident that it's perfect. At the dip, with plate current at the recommended value, I cannot get the nominal output power of 200 W. Tuning off the dip, however, the output jumps to the nominal value of 200 W. Can you prescribe a course of treatment to cure this ailment?

A The condition you describe is generally attributable to parasitic oscillation or a neutralization problem in the final amplifier. You say that you're not entirely confident that the neutralization is correct and I would suspect that it's not. Neutralization is particularly critical at the higher frequencies and even more so with multiple tube finals (which the Valiant has—with three 6146s). Try adjusting the neutralization capacitor to make maximum power coincide with minimum plate current. Make sure you turn off the plate voltage before you do this! Get it close by ensuring that there is no grid current change with variance of the plate capacitor—remove plate and screen voltage from the amplifier—but apply excitation (drive) to the final. Do this on 10 or 15 meters.

Be sure that all the final tubes are of the same type; *do not* intermix type 6146B tubes with 6146 or 6146A types. The "B" type tubes have different interelectrode capacitances and require different neutralization parameters. Also check the parasitic suppressors in all three final amplifier plate leads—make sure that the suppressor chokes are well soldered. A cold joint here could account for a parasitic in one tube.

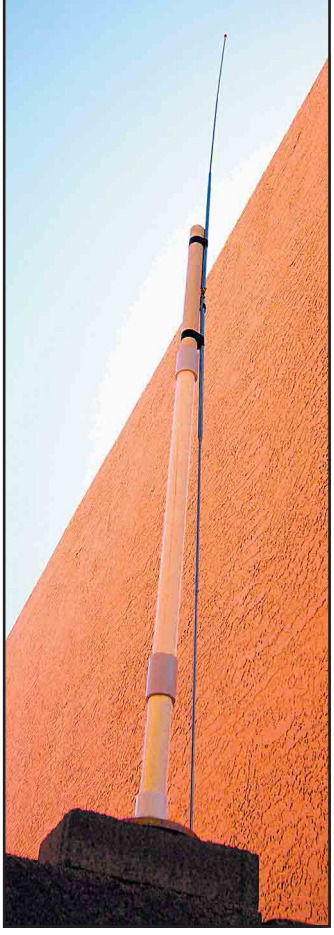
Neutralization can be checked by connecting a low-level signal source to the transmitter output (an RF analyzer). Tune the pi-network (*tune* and *load* capacitors) for a 1:1 SWR on the analyzer, then couple a receiver (through a link or a capacitor) to the final amplifier input grid circuit and detune the neutralization capacitor. Maximize the received signal appearing at the grid circuit with the plate tune and load capacitors; then adjust the neutralization capacitor for minimum response (feedthrough) at the receiver. Do this with the plate and screen voltage *off*.

If you eliminate all parasitics and carefully neutralize the final amplifier, maximum power should coincide with minimum plate current. As an aside, you also might want to check that the three final amplifier tubes are reasonably well matched as far as grid and plate characteristics and transconductance are concerned. Good luck!

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/. QST

By Michael Atlas, N7FC

A Q&D Multiband Antenna



A brick, some PVC tubing and a few other common hardware store items can be transformed into an effective Quick & Dirty RF-launcher—for less than $25!

Having recently acquired a Yaesu FT-817 transceiver, I plunged wholeheartedly into the world of QRP. This was the stimulus to come up with a truly portable station setup. My main objective was to devise some kind of portable antenna—maybe one of those shortened vertical dipoles I had read about. Better yet would be a combination dipole and vertical whip that could be coupled with almost all antenna tuners in use today.

You can build this antenna as described or add your own ideas and technical wizardry. If you build it from the suggestions herein, however, you'll have lots of fun putting together and using this cheap and dirty state-of-the-art plumbing project. It shouldn't take any more than a couple of hours once you have all the parts in hand.

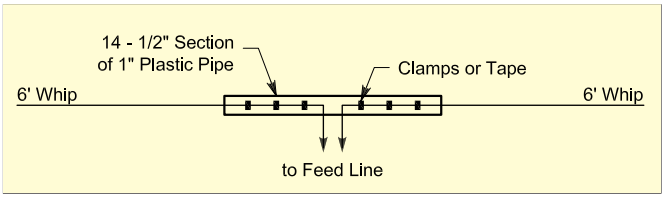


Figure 1—The main section of the antenna consists of a 14½ inch section of PVC with four small holes drilled on each side to make it easy to install the cable clamps that hold the whips in place.

Figure 2—The antenna breaks down easily for storage. Self-supporting and easy to set up, it weighs 8 pounds including base. No water flows through these pipes—only pure RF.

The Amateur Hunter-Gatherer

Armed with this vague idea, I set off to the local Home Depot. I soon found myself among the myriad of tubing, fittings and other exciting accessories for the plumbing enthusiast. As I was standing there in the dazzling brilliance of the glittering off-white plastic, a design idea was coming to the fore as thousands of previously dormant neurons began exploding like firecrackers. I started to pluck tubing, adapters and miscellaneous items from the shelves at a frenzied pace. Visiting the Home and Garden section, I found a very nice red brick to serve as the base for my freestanding vertical/dipole combination. With neurons still furiously firing, I drove a few blocks to a local RadioShack and purchased some 72 inch collapsible whips and coaxial cable clamps, perfect for keeping the two whips in place.

From Mind to Matter

I drilled a couple of holes in the red brick and mounted the floor flange; so far, so good. Now the difficult part—mounting two whips connected end to end and fed at the bottom as a vertical or split at the center and fed as a dipole. I sawed off a 14.5 inch section of pipe and drilled four tiny holes on each side of center where the cable clamps (which hold the two whips in place) attach. This made it easy to hammer the nails that affix the clamps (Figure 1). The whip assemblies can also be fastened with nylon cable ties rather than clamps. Simply wrap and tighten the ties at the indicated points of Figure 1.

I left 1 inch of space between the two whip ends to accommodate 300 Ω twin lead when the antenna is used as a vertical dipole. The collapsible whips each have small mounting holes in their base, enabling the use of tiny metal screws to fasten the whips to the plastic pipe. They also serve as contacts for the twin lead or vertical shorting bar consisting of two small alligator clips and a 1 inch piece of heavy gauge solid wire (Figures 3 and 4).

Assembling the antenna and mounting it on the base is a snap. After screwing the 1 inch adapter fitting into the floor flange and attaching the other previously sawed pieces together, they are then coupled to the floor flange. The antenna becomes self-supporting (Figure 5).

Table 1
Parts List

*Available at most hardware and plumbing supply stores. RS is RadioShack (***www.radioshack.com***).*

1—10-foot section of ¾ inch PVC pipe.
4—female ¾ inch PVC couplings.
1—PVC end cap for ¾ inch pipe.
1—¾ inch PVC female to 1 inch male threaded fitting.
1—1 inch metal floor flange.
1—package cement screws.
1—⅜ inch masonry bit.
1—standard brick.
2—72-inch collapsible whips (RS 270-1408B).
1—package cable clamps (RS 278-1660A).
Tiny metal screws, assorted soldering lugs, jumpers and radial wire (readily available from any halfway decent junk box).

Figure 3—The shorting bar that enables the antenna to be used as a 12 foot vertical.

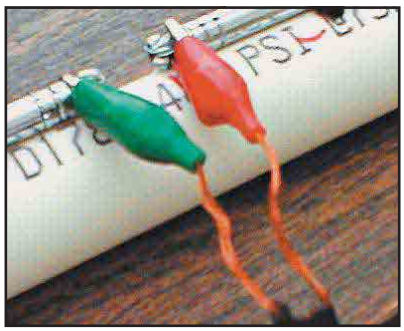


Figure 4—Close-up showing the connection that allows the Q&D antenna to be used as a center-fed dipole.

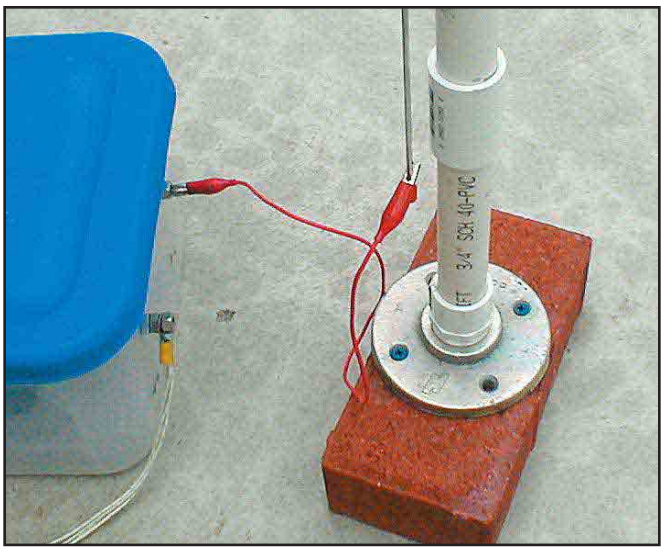


Figure 5—The base and connections to the tuner for operation as a vertical antenna.

Depending on your own circumstances, you can elect to assemble the mast as one piece or cut it into several sections for portability. Instead of a brick base you can devise a clamp or other means to attach the antenna to a railing, gutter, bumper, tripod or other object, depending on the circumstance and the limits of your imagination.

You are not restricted to using 300 Ω line for the dipole. Depending on the tuner, you may want to use 450 Ω ladder line or even coax.

The only somewhat critical dimension is the overall length of the plastic pipe mast, which should be a minimum of 78 inches (not including 14.5 inch antenna section) to allow for clearance of the lower whip when fully extended.

With my arrangement, adding a 6.25 inch section that mounts in the flange enables me to keep a fairly uniform length for the other pieces of pipe with the added benefit of lessening strain on the adapter when dismantling the mast (Figure 2).

The antenna is low profile, which makes it ideal for me and others like me who suffer from CC&R (covenants, conditions and restrictions) constraints. Add (at least) four 33 foot radials, or whatever works best in your particular location. A good rule of thumb is to make your radials at least a quarter wavelength on the lowest frequency on which you intend to operate. Radials are not required for the dipole configuration. The antenna may be loaded using any antenna tuner. For optimal performance, place the tuner at the antenna feed point.[1]

The Smoke Test

A test setup was installed at the home of my friend Dave, KD7V, using an Elecraft K2 with two antenna jacks and running 10 W using the internal tuner. We positioned my antenna approximately 40 feet from Dave's commercial lightweight all band $150 portable vertical. It requires manual adjustment for band change in addition to the radio's built-in tuner. The antenna was mounted on an iron railing around his pool. Radials were deployed for both antennas.

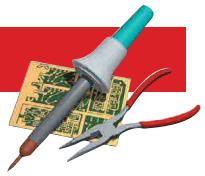
With the help of Don, W3RDF, in South Carolina, I ran several checks on 20 and 17 meters, the only bands open for that path. The result was a draw, with good signals at both ends. Meter readings were almost the same regardless of antenna used. A contact with AH6NJ in Hawaii at 5 W on 40 meters with antenna in the living room was the icing on the cake. Not bad for the N7FC Quick and Dirty Special—and less than $25 spent.

This is an easy project that can provide tons of fun, enjoyment and satisfaction. Oh, by the way, all those agitated neurons are now receiving a much needed rest.

All photos by the author.

Michael Atlas, N7FC, was first licensed in 1947. Michael's fascination with radio began as a toddler—crawling behind the family's Zenith to stare at the red glow coming from the vacuum tube filaments. Although never professionally engaged in electronics, Michael maintains a strong interest in science, technology and Amateur Radio—particularly working CW at 30 to 45 WPM. You can reach the author at PO Box 90436, Tucson, AZ 85752; **n7fc@arrl.net**.

[1]An antenna tuner is an impedance transformer. When it is placed at the transmitter end of the line, it will present a 50 W load to the transmitter, although the SWR on the transmission line remains the same. When SWR is high, additional transmission line losses can be large, especially with coaxial transmission lines. Placing the tuner at the antenna feed point will keep the SWR on the transmission line near 1:1 and greatly reduce SWR losses. For more information, see *The ARRL Antenna Book* available from the ARRL Bookstore for $39.95 plus $8 shipping in the US ($10 elsewhere). 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**. QST



CircuitMaker Student Version

By Don Coltrane, KJ4UC
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I have no formal training in electronics, but I love homebrewing. I've always wanted to try a program that allowed me to model electronic circuits on the computer, both to see if my design worked, and to see what does not work. All the programs I have tried in the past were either too complex, or didn't live up to my expectations. I recently downloaded a program called *CircuitMaker* Student Version that was mentioned in "The Doctor Is IN" (*QST,* January 2004, page 53) and I have fallen in love with it. This is a small program for the *Windows* operating system (only 3.24 MB), so even with a dial-up connection it is no problem to download.

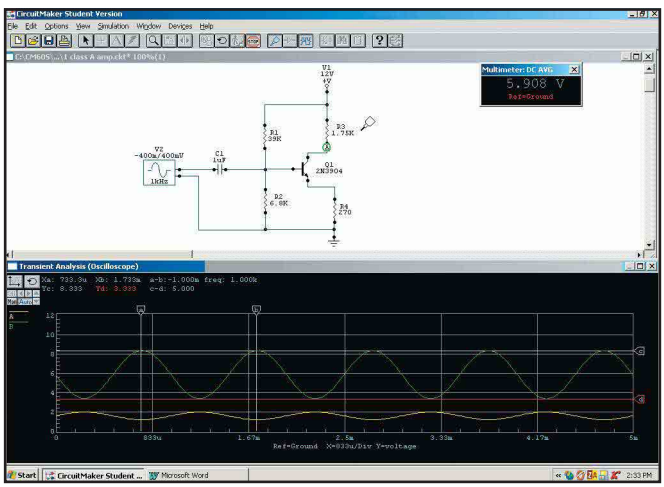
Drawing It Out

When I installed *CircuitMaker* on my computer, I was amazed at how easy it was to learn. You can begin building and testing your own "virtual" circuits within minutes.

When you click on the PARTS icon in the toolbar, a drop-down menu appears showing the parts that are available. If you want to put a transistor in the design area, click on the PARTS icon, select MAJOR DEVICE CLASS and scroll down to transistors. The MINOR DEVICE CLASS box then displays your choices. Everything from Darlingtons to enhancement-mode MOSFETs is available. Click on BJT, for example, and you'll see a list of 50 different transistors to choose from. If you double click on a 2N3904, you will be taken back to the design area. One more click at this point will place the transistor in the design.

Other parts can be placed in similar fashion. You can then drag the parts into position with your mouse. By right clicking the parts, other parameters can be changed such as the orientation or the component value. An option to duplicate the part is also available, which saves a few steps when putting multiple parts of the same type in a circuit.

All of the parts in the design area can be interconnected simply by clicking on the + icon and moving the cursor over the lead of the part you want to wire. When you do, a red box will appear. Click the box and, as you move the mouse, a blue line will trail behind. Think of this blue line as a "wire." As you reach another component lead, another red box will appear. Just click again and the parts will be instantly connected between those two points. If you make a mistake before clicking the second time, press the ESC (escape) key and the operation is aborted. (Another way to erase is by clicking on the DELETE TOOL. The cursor then becomes a lightning bolt. Touch the tip of the lightning bolt to the part or wire you want to remove and it will vanish with a single mouse click.)



Modeling

Now comes the fun part. Let's say that you've completed a circuit for your project, or copied a circuit from *QST,* and you want to see how it works. No need to buy test equipment because *CircuitMaker* will take the measurements for you.

With the circuit displayed on screen, click on the RUN icon and multimeter will open. With the multimeter (PROBE tool), you can check voltage, current and power at any point. You can check waveforms with the *CircuitMaker* oscilloscope by making it active and then holding down the shift key and, for example, clicking the base and the collector of an amplifier circuit. You can see amplification taking place right before your eyes.

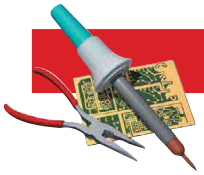
The Verdict

CircuitMaker is a boon to experimenters. You can use it to design, test and learn about the circuits you have been seeing in books and magazines for years. Don't be afraid to try new things. You can design a circuit on a whim, then change components and see what happens. This is all part of the learning process, and the more you use *CircuitMaker* the more you learn.

The student version is free, but it has limitations. The help section in particular is truncated. The student version is also limited to a maximum of 50 devices per design (any type) and the device library is limited to 1000 models. The symbol editor and macro features are disabled as well. Despite these limitations, *CircuitMaker* Student Version has more than enough power to keep you building—and dreaming.

Manufacturer: Altium Limited, 12A Rodborough Rd, Frenchs Forest NSW 2086, Australia. Download from the Web at **www.circuitmaker.com/**. *System requirements:* Windows 98/NT/2000/XP *with a Pentium-class PC with 32 MB of RAM and 40 MB of hard disk space.* QST

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



By Steve Ford, WB8IMY

Scaring Up Contacts

Enjoying a radio conversation is two parts perseverance, one part art.

Surveys tell us that amateurs spend hours listening to their radios. That's probably true, but there comes a time when you must make contact. Otherwise, why go to the trouble of obtaining a ham license at all?

CW and Digital

The best way to start a CW or digital chat is to tune around until you find someone calling CQ. CQ means, "I wish to contact any amateur station." In time you'll learn to recognize the sound of a CW CQ call. It has an unmistakable rhythm! Even digital CQ transmissions tend to have a repetitious, rhythmic quality.

If you can't find anyone calling CQ, perhaps you should try it yourself. Before calling CQ, it's important to find a frequency that appears unoccupied by any other station. This may not be easy, particularly in crowded band conditions. Listen carefully—perhaps a weak DX station is on frequency. Send QRL? several times, followed by your call sign. If no one responds, let 'er rip.

A typical CQ goes like this: CQ CQ CQ DE N6ATQ N6ATQ N6ATQ K. The letter K is an invitation for any station to reply. If there is no answer, pause for 10 or 20 seconds and repeat the call.

If you hear a CQ, wait until the ham finishes transmitting (by ending with the letter K), then call him. Make your call short, like this: WB8SVN WB8SVN DE K1RO K1RO $\overline{AR}$ ($\overline{AR}$ means "end of message").

Suppose WB8SVN heard someone calling him, but didn't quite catch the call because of interference (QRM) or static (QRN). Then he might come back with QRZ? DE WB8SVN K (Who is calling me?).

AM or SSB

As with CW, to get an AM or SSB chat off the ground you have two choices: You can call CQ, or you can answer someone who is calling CQ.

On VHF, there are specific *calling frequencies* where SSB operators in particular tend to congregate (see Table 1). It pays to make occasional CQ calls on these frequencies, even when no one appears to be on the air. VHF operators often monitor calling frequencies, waiting to hear activity that signals a possible band opening. The problem with this approach is that the VHF band could be wide open for DX, but the listeners will never know unless someone takes the time to pick up the microphone and call. That "someone" can be you.

Table 1
VHF/UHF SSB Calling Frequencies

50.125 MHz
144.20 MHz
222.10 MHz
432.10 MHz

No matter what frequency you're operating at, *always listen before transmitting*. Make sure the frequency isn't being used *before* you come barging in. If, after a reasonable time, the frequency seems clear, ask if the frequency is in use, followed by your call. "Is the frequency in use? This is K7CCC." If nobody replies, you're clear to call.

Keep your CQs short. Longwinded CQs drive most hams crazy. Besides, if no one answers, you can always call again. If you call CQ three or four times and don't get a response, try another frequency.

A typical phone CQ goes like this:

"CQ CQ Calling CQ. This is K7CCC, Kilo-Seven-Charlie-Charlie-Charlie, calling CQ and standing by."

And if you're the caller (as opposed to being the "callee"), keep the call short. Say the call sign of the station called once or twice only, followed by your call repeated twice.

"N6ATQ N6ATQ, this is WB8IMY, Whiskey-Bravo-Eight-India-Mike-Yankee. Over."

FM

Striking up a conversation on VHF FM is a different kettle of fish. Most conversations take place through relay devices known as *repeaters* and, generally speaking, you shouldn't call CQ on an FM repeater. Instead, the amateur custom is to say your call sign, followed by the word "monitoring" or "listening." If someone wants to speak with you, they will respond. If not, wait a few minutes and try again.

The Art of Conversation

Most contacts begin with an exchange of basic information: Names, locations, equipment, signal reports and even weather reports. After that, it's up to you. Sometimes you'll find that you have to draw the other person into the conversation. The best way to do that is to ask questions. For example, ask what the person does for a living. She's a doctor? Okay, ask about her specialty, where she practices and more. In other words, get her to talk about herself. If you ask the right questions, conversations will unfold on their own.

Any life worth living has at least one interesting story. You may have to drag this story out of your palaver partner, but it's usually worth the effort. If all else fails, make the following request:

"Look out the window and tell me, in detail, exactly what you see."

You'll definitely throw the other person off guard—that much is guaranteed. If they are in a room without a window, don't let them off the hook. "What would you see if you *did* have a window?" If you are operating a visual mode such as SSTV (slow-scan TV), ask them to *show* you what's outside the window!

Steve Ford, WB8IMY, is the editor of QST. *You can contact him at* **sford@arrl.org**.

Experiment #17: The Phase-Shift Oscillator

Any system having gain and a little output to input feedback can quickly become an oscillator. Anyone who has operated a public-address system can attest to that fact! This month we'll look at a very basic circuit that illustrates the fundamental principles of oscillators—the *phase-shift oscillator*.

Terms to Learn

- *Network*—circuits with multiple sections of similar components and multiple input and output connections
- *Latch*—to enter and remain in a steady state
- *Loading*—changing the performance of a circuit by placing an impedance at the input or output

Background

There is an old saying: "Amplifiers are oscillators that *don't* and oscillators are amplifiers that *do*." An amplifier is at the heart of every oscillator, as shown in the block diagram of the basic oscillator in Figure 1. The feedback network is connected so that some of the output signal is fed back into amplifier's input. If this system is going to work as an oscillator at some frequency, two things must occur. The portion of the signal fed back to the input, βV_{OUT}, has to arrive with just the right phase to reinforce and not cancel the input signal. The amplifier also has to have enough gain, A, to compensate for losses in the feedback circuit.

In the block diagram, the output signal, V_{OUT}, is equal to AV_1. V_1 is equal to the input signal, V_{IN}, minus the fraction of the output signal fed back to the input, βV_{OUT}. This means that the overall gain of the circuit is:

$$V_{OUT} / V_{IN} = A / 1 + A\beta \qquad \text{[Eq 1]}$$

All is nice and stable, unless $A\beta = -1$, in which case gain becomes infinite! When this happens, the amplifier's output heads for infinite voltage, but it reaches the power supply voltage and has to stop. Depending on the circuit's design, the output will either *latch* at that voltage or turn around and head for the other limiting voltage (either ground or the opposite power supply voltage). In the second case, we now have an oscillator because the circuit will continue zoom from one voltage to the other in a continuous cycle.

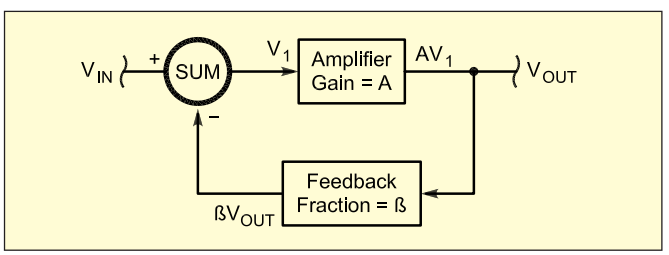


Figure 1—This fundamental block diagram describes an oscillator as a pair of circuits, one providing gain and the other feeding back a fraction of the output signal into the input.

How do we design a circuit such that $A\beta = 1$? Consider that, to a sine wave, multiplying by –1 is the same as adding 180° of phase shift. The requirement for $A\beta$ can then be rewritten to say that the product must be equal to 1 but with a phase shift of 180°. If you assume that all of the phase shift occurs in the feedback circuit and that the amplifier has enough gain to make up for any losses in the feedback circuit, our equation is satisfied and the oscillator *does*!

Figure 2 shows such a circuit, called a *phase-shift oscillator*. To be sure, there are other circuits with better performance, but this one is the closest to the basic circuit we've just discussed. Let's start with the feedback network formed by the three pairs of 10 kΩ resistors and 0.1 µF capacitors. Each forms a low-pass RC filter that shifts the phase of the input signal—0 to 90° as frequency is increased. At some frequency, the phase shift will be 60°. When three identical sections are cascaded, each contributes 60° of phase shift to make 180°, the necessary phase shift to form an oscillator. The frequency at which each section contributes 60° of phase shift is:

$$f = (\tan 60°) / 2\pi RC = 1.73 / 6.28\ RC = 0.28 / RC \qquad \text{[Eq 2]}$$

For our combination of 10 kΩ and 0.1 µF, that frequency is 275 Hz. At the frequency at which 60° of phase shift occurs, the filter also reduces the amplitude of the input signal by half. If three sections are connected back-to-back, then the total reduction in signal level is $^1/_2 \times {}^1/_2 \times {}^1/_2 = {}^1/_8 = 0.125$, which is our value of β. To make $A\beta$ at least 1, A must then be at least 8 and that is controlled by the ratio of R_f to R_i. R_f is made variable to allow for adjustment in gain to account for component variations and other effects, as we shall see.

Working with a Phase-Shift Oscillator

For this circuit, you will need a power supply that can provide both positive and negative dc voltages of 6 to 12 V. Since current draw is low, you can use batteries to provide power.

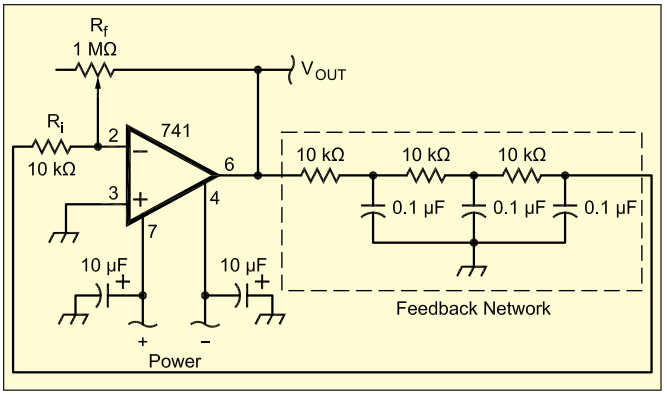


Figure 2—The phase shift oscillator circuit. Each pair of 10 kΩ resistors and 0.1 µF capacitors in the feedback network adds 60° of phase shift at the frequency of oscillation.

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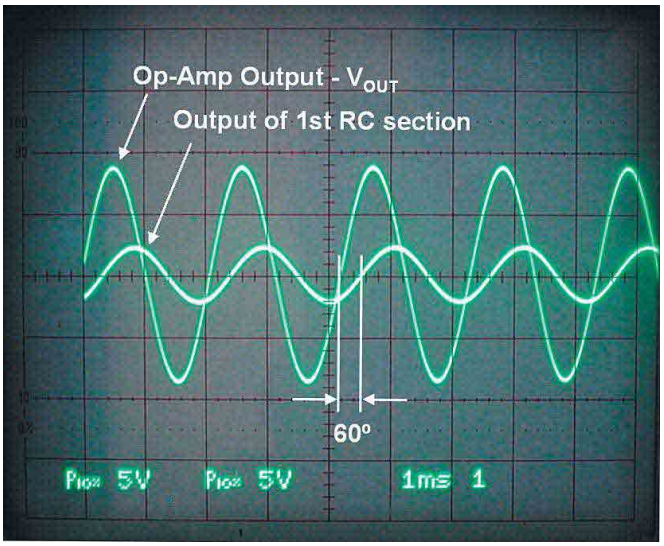


Figure 3—The oscilloscope traces show the output signal from the op-amp and the smaller, phase-shifted signal at the output of the first RC filter section.

- Start by building the circuit of Figure 2. The extra 10 µF capacitors prevent feedback through the op-amp power supply pins. Set the potentiometer for the highest resistance between its connections.
- Connect power and you should see something that looks like a square wave at the output of the op-amp. This shows the op-amp output swinging back and forth between the power supply voltages as it unsuccessfully tries to balance the current in R_f with that coming from the feedback network.
- Reduce the potentiometer resistance to obtain an undistorted sine wave that peaks a volt or so below the power supply voltages as seen in Figure 3. (This may be a touchy adjustment.) If you have a dual-channel oscilloscope, observe the input and output voltages of each RC section and verify that each contributes approximately 60°.
- Measure the period of the output waveform (one complete cycle) and calculate the frequency of the oscillator (f=1/period). Measure the resistance of the potentiometer (R_f) after removing it from the circuit. Compute the amplifier's gain (A=resistance / 10 kΩ).

Design Assumptions

You probably observed that the frequency was a lot different than the initial calculation of 275 Hz—my oscillator's frequency was 476 Hz. The voltage drop across each RC filter section was probably greater than 1/2—my sections reduced the output to about 0.27 of the input. The gain of the amplifier will also be greater than 8 to compensate for that extra reduction. My potentiometer's resistance was 603 kΩ, for a gain of 60.3—approximately equal to 1 / (0.27 × 0.27 × 0.27).

These discrepancies result primarily from assumptions we made in the design process. Each RC section does not contribute exactly 60° because it is loaded by the next section in the network. That causes extra voltage drop and phase shift. The op-amp also contributes its own small amount of phase shift, meaning that the total feedback phase shift does not have to be exactly 180°. These two errors will result in a higher frequency at which $A\beta = -1$.

To see the effects of op-amp limitations, change the feedback capacitors from 0.1 µF to 0.001 µF. At this frequency, a 741 op-amp can't cause its output to change rapidly enough to keep up and the output waveform will change to something that looks more like a triangle wave instead, no matter how you adjust amplifier gain.

Buffered Oscillator

The phase-shift and voltage drop errors caused by the loading effects of each RC section can be eliminated by adding a *buffer* between each section. Replace the single op-amp with a quad op-amp such as the LM324. One op-amp section will replace the existing LM741. Add a *voltage follower* between each RC section by connecting an op-amp's output directly to its inverting input and connecting the input signal to the noninverting input. (This circuit is shown in the on-line reference listed below.)

Because the voltage follower presents a very high input impedance to the preceding circuit, each RC section can act more like the ideal filter we envisioned during the design process. The resulting frequency of oscillation and the gain required to achieve oscillation should be within 20% of the calculated values.

Suggested Reading and a Donated Tool

The ARRL Handbook has an extensive chapter on oscillators, although not much on phase-shift oscillators. The section "How Oscillators Work" is highly recommended. A good application note, "The Design of Op-Amp Sine Wave Oscillators" is available on-line from Texas Instruments at **www.ti.com/sc/docs/apps/msp/journal/aug2000/aug_07.pdf**.

Another reader has graciously donated a software tool for Hands-On readers. Bill, N3TR, created a dandy spreadsheet to calculate resistor values for Pi and T attenuators. Enter input power, impedance and attenuation to get resistor values. The spreadsheet is available on the Hands-On Web site: **www.arrl.org/tis/info/html/hands-on-radio**.

Shopping List

- LM741 (RadioShack 276-007) op-amp and (optional) LM324 quad op-amp (RadioShack 276-1711)
- 1 MΩ potentiometer
- 4—10 kΩ, 1/4 W resistors
- 3 each—0.1 µF and 0.001 µF ceramic capacitors
- 2—10 µF, 16 V (or greater) electrolytic capacitors

Next Month

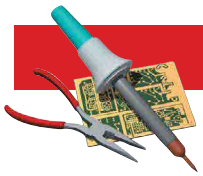
Our next experiment will move from the workbench over to the blackboard as we discuss frequency response and decibels (dB). Understanding the mechanics and terminology of these important concepts is key to being a successful electronic experimenter. QST

NEW PRODUCTS

MACLOGGERDX V3.92 FROM DOGPARK SOFTWARE

◊ Dog Park Software has announced the release of version 3.92 of *MacLoggerDX* for Macintosh computers. It can now be downloaded from **www.dogparksoftware.com/MacLoggerDX.html**. *MacLoggerDX* logs into your favorite Telnet or TNC DXCluster and, as DX Spots are received, tunes your radio to the spot, looks up the call and displays the DX station on the gray line map with distance and bearing from your station. New features in V3.92 include Icom Driver enhancements, added DXCluster and TNC "reconnect automatically" check box and squelched S-meter readout for ICOM IC-703 and IC-706 series radios.

See their Web site for details and the complete features list. This is a free upgrade for registered *MacLoggerDX* V3.5 and later users. For more information, contact Dog Park Software, **dagro@dogparksoftware.com** or see **www.dogparksoftware.com**.



HINTS & KINKS

A PORTABLE SHACK

◊ For years I have enjoyed operating portable, mostly from my motor home, where I had a rather decent station setup that could be used while underway. My Hustler mobile antennas performed wonderfully as I worked the world. I thought it couldn't get any better. Then I discovered QRP—I was immediately drawn to the vision of taking a QRP station almost anywhere and operating from places I'd not considered before.

After selling off all my QRO equipment, I recycled the money into QRP kits and equipment. The smaller, lighter and simpler rigs all fit into easy-to-carry cases and can be set up using lightweight battery power. Many companies produce cases or packs made for particular radios that enable the operator to carry a complete station in one small package. I tried to devise my own compact carrying case using shoulder bags, briefcases and camera bags, but none of these fully satisfied my needs.

I wanted a case to carry the equipment that I need not unpack to operate. My friend Walt, WB8E, had the answer: a station in a portable cooler. After operating portable with Walt a few times, I could see the advantage of his system. His station consists of a Kenwood TS-50 running 5 W through the AT-50 tuner. The audio is filtered through a RadioShack DSP-40. The station is powered by a couple of hefty outboard batteries.

I liked his idea, but I wanted a smaller cooler to fit my somewhat smaller station. I went to the local Kroger store and found several coolers—some too small, some too big and one just the right size.

I bought the Coleman 16 Quart Excursion Cooler. This was the perfect size for my K1, RS DSP-40 and my 6.4 Ah gel cell. I like having the battery in the same container to reduce the baggage to handle in the field. There's no mount for a tuner in my cooler; my K1 has a built-in auto tuner that I disable when using the MP-1 Super Antenna—a wonderful compact radiator.

After some thought about mounting equipment in the cooler, I decided that sheet-metal screws may not hold in the plastic walls of the cooler, so I decided to through-bolt the brackets and clamps. This keeps the equipment secure during a possibly bumpy ride to the operating location. The DSP unit bracket mounts to the side (which becomes the top in the operating position) using two 1/4×20 bolts and nuts.

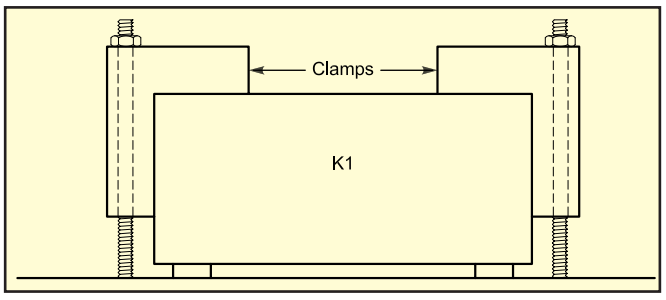


Figure 1—A diagram of the nylon clamps that hold the transceiver in the cooler.

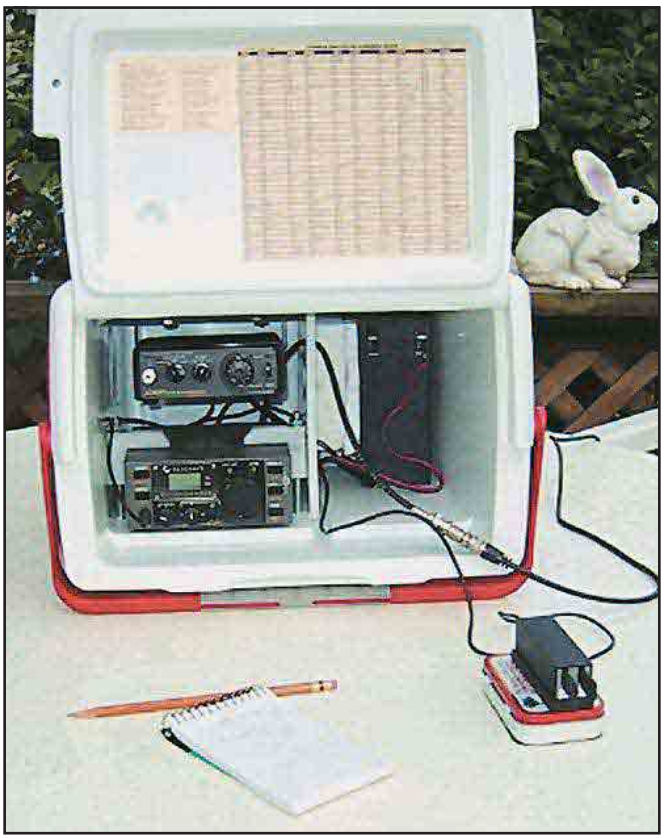


Figure 2—AF8X's portable station built into a portable cooler. The lid holds operating aids: a DXCC list and list of menus for the transceiver.

I didn't want to bolt the K1 down with a homebrew bracket, so I made a couple of hold-down clamps from a piece of scrap nylon block (see Figure 1). I drilled holes in the blocks for the bolts to pass through. To protect the finish on the K1, I lined the contact surfaces with thin rubber sheet. This setup clamps the K1 securely to the cooler and yet makes it easily removable.

The RS DSP-40 needs power to operate so I made up a Y power cable to supply the DSP and the K1 with one cable from the battery. [Remember to fuse the lines.—*Ed.*] The audio cables have 1/8 inch plugs to fit both the K1 and DSP unit. A 1/4 inch mono to 1/8 inch stereo adapter is used for stereo headphones plugged into the DSP unit. The paddle is a Palm Mini Paddle from Germany. The magnetic base of this paddle needs some heavy ferrous-metal to hold it securely while sending. I use an Altoids tin filled with about $8 in quarters for weight. This has the added advantage that some emergency money is handy in case you get hungry or thirsty and can find a snack bar.

The lid of the cooler is hinged and when open is a handy place to keep information needed while operating, such as a list of DX prefixes and in my case, a menu list for the K1 (see Figure 2). I'm looking forward to operating portable with this

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setup, or as Walt calls it, "A Lark in the Park."—*Dick Arnold, AF8X, 22901 E Schafer St, Clinton Township, MI 48035-1875;* **af8x@arrl.net**

ANOTHER PL-259 INSTALLATION TIP

◊ Like many others who dislike or cannot solder PL-259 connectors on to large coax cable, I have tried many techniques to make the job easier. I have found that the soldering is not the problem when using RG-213. The connector is just too difficult to mount on the coax because the diameter of the connector insert is too close to that of the coax (0.405 inch) and the cable jacket makes the job harder than it should be. I have seen many techniques, but none that worked for me until I found that the feed line to my vertical antenna had been sliced in half by an inattentive gardener.

All that is necessary is to take your electric drill and mount a bit that can be used to remove metal. (I have seen "hogging" bits and spiral cutters; I am sure there are many others.) Then make a pass or two with the cutting bit inside of the threaded barrel of the insert to the PL-259 and you will find that the coax maintains a tight fit yet permits you to insert the coax easily. You do not need to remove much of the metal. Now you can use your favorite technique to dress the cable to the dimensions for the technique you are using and insert the dressed cable and solder per directions. Finish up by using some coax sealing material around the barrel to seal the cable and connector at back of the connector.—*Bob Cowan, WB6DAC, 2740 Canary Dr, Costa Mesa, CA 92626-4748;* **wb6dac@attbi.com**

USB, EIA-232 AND AMATEUR RADIO

◊ Many computers now come with no EIA-232 ports, and I've seen a few letters from folks seeking USB-to-EIA-232 converters. There are several on the market, but apparently not all of them implement EIA-232 completely enough to work with transceiver-control software.

Therefore, I would like readers who have working systems to send me information about that system: manufacturer's name, model number and Web site for the converter and transceiver-control software, a dealer where the converter may be purchased and the make/model of transceiver with which the system operates. In a few months, I'll gather the responses and publish them here.

This problem highlights another: It's time for Amateur Radio operators and manufacturers to begin supporting the USB standard. If you're planning or building an accessory, watch for the May/June issue of *QEX*. There, Dick Lichtel, KD4JP, tells how to implement a slow USB interface using the Microchip 16C745 PIC. Figure 3 shows the completed interface controlling a VFO. The parts cost for the interface is only about $20. I've placed the article on the *QEX* Web page as a sample at **arrl.org/qex/qx5lichtel.pdf**.—*Bob Schetgen, KU7G, ARRL Senior Technical Editor;* **ku7g@arrl.org**

DICK LICHTEL, KD4JP, AND DYER MATLOCK, N4PZM

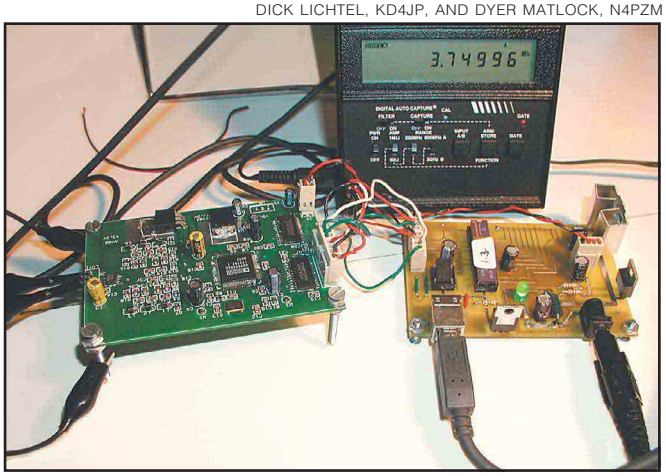

Figure 3—The photo shows the 3.75 MHz output of a AD9854-based VFO that is controlled by a Microchip PIC16C745 USB microcontroller(right). The USB controller requires no additional drivers to interface with a PC.

CUSTOM-FITTED HEADPHONES

◊ Many of you may be in the same situation as I was: endlessly searching for a set of headphones that feel right, block out enough ambient noise enough yet permit your spouse's voice to get your attention, remain cool in the summer and warm in the winter. My chosen headphones developed an intermittent connection and I found that repairing them was impossible: It required soldering a very small and easily melted foil tab under the speaker cone.

Rather than simply buying another pair, I found a set of small "ear buds" that came with a commercial receiver I bought a couple of years ago. The devices simply stick on your ear and have very good fidelity. Unfortunately, they readily dislodge if you move your head quickly. An ideal solution would be to place the devices into an appliance fitted to the exterior part of my ear, but I figured such a thing would cost much more that I was willing to pay.

I found the solution at a sporting goods store. A product called "Ear Putty" (Santa Barbara Medco, **www.sbmedco.com/ear_putty.asp**) is for swimmers' use. I took a finger full of the material and formed it around each ear bud, then placed the buds in a comfortable position on the exterior of my ear while conforming them to the contours of my ears. These are the perfect headphones for about $3 and a set of ear buds that were otherwise of no use. The material has a sticky consistency and is made from silicone. When they become dirty or too misshapen, I will make new ones; the package contains enough to make three or four more pairs.—*Bob Cowan, WB6DAC, 2740 Canary Dr, Costa Mesa, CA 92626-4748;* **wb6dac@attbi.com**

BATTERY LEAKAGE REMOVER

◊ At one time or another, most of us have left batteries in a device for too long—only to open the device and find a mess. This happened to me recently and I tried a product now widely available called "CLR" (an acronym for calcium, lime and rust). It comes as a liquid and a spray foam. I sprayed CLR on the battery holder section of the equipment case and the mess went away in less than five minutes. After a quick rinse and air dry the battery compartment was clean. I then attacked the battery-negative contact spring, which was covered with battery drainage and rust. Again, in five minutes it was clean. I lightly sanded the contact point and reassembled the device. It works fine. The repair was cheap, quick and effective! —*Dave Routzon, W5GT, 6917 Post Oak Dr, North Richland Hills, TX 76180-3418;* **w5gt@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

Two from Kenwood—TS-480SAT and TS-480HX HF + 50 MHz Transceivers

By Rick Lindquist, N1RL
ARRL Senior News Editor

Decisions, decisions. Automatic antenna tuner or 200 W output? That's the choice facing prospective Kenwood TS-480 buyers. The SAT version offers 100 W plus a competent internal auto tuner, while the HX model trades off the tuner for 200 W output, making it the *smallest* radio on the market at that power level. In all other respects, the units are identical. Supersize me? Or auto tune me? Whichever way you go, you are likely to think you made the right choice.

In a very literal sense, Kenwood strayed outside the box in designing the TS-480. While it appears to have drawn upon a heritage that includes not only the TS-50 but the TS-570 and the more recent TS-2000, you've never seen a transceiver quite like the TS-480. It's the first to arrive in two pieces (at least intentionally). There's a "remote control panel" and what Kenwood calls the "TX/RX unit"—the radio body.

The advantages for mobile and portable installations are obvious. Nonetheless, more, uhh, traditional hams may not readily buy into this two-piece transceiver concept. Judging from scattered early-buyer comments on the Internet, a few hams still prefer their radios to come as *one* box, preferably a substantial one with a flashy display and scores of knobs, buttons, dials and meters to confer swagger rights. Interestingly, the manual describes a "portable bracket" that holds the two pieces together, but it is offered only in the European market. Perhaps Kenwood will offer it in the US for those who see a need to put the pieces together.

Maybe this is why otherwise impressive computer-controlled radios with "virtual" front panels (the short-lived but capable Kachina 505DSP comes quickly to mind) never made a big dent in the ham radio market.

Where's Your *Radio*, Dude?

Welcome to a piece of Amateur Radio's future, where your entire station need no longer occupy an entire room or corner of the basement. The TS-480 could finally kick off an era of mini ham shacks containing little more than a control head, a mike and/or a keyer paddle, a few accessories and maybe a PC. Indeed, in the case of the TS-480, your "station" can be somewhere else entirely, since you can control the transceiver remotely via the Internet.

Figure 1—View of the major assemblies of the Kenwood TS-480SAT. The 'HX appears identical in this view.

Not Just Another Mobile

Kenwood's excellent *Instruction Manual* describes mobile installation *first*, suggesting the manufacturer primarily intended the TS-480 for that application. Could the TS-480 *really* be the long-awaited follow-on to the now-venerable TS-50/TS-60—putting HF and 6 meters into a single box? Given that the TS-480 is light years ahead of the TS-50 and a very decent performer, this carries more than just a ring of logic. Perhaps it's true, but Kenwood's not saying.

This is a great little home station rig too, especially for amateurs who value a minimalist, attractive, contemporary space-saving installation or whose spouses don't want "all that dirty old junk" in plain view. While using any of the current crop of small radios with detachable front panels as fixed station transceivers often means compromising features (remember, the TS-50 included neither VOX nor CW keyer, much less an antenna tuner) and performance for size, that's not the case with the TS-480.

The more I played with these radios the better I came to appreciate them and what they can do. These are not the perfect radios for everyone, nor are they small-box superstations, but I came away much more impressed than I'd initially expected—and, in the interest of full disclosure, my wife and I already own three Kenwood transceivers between us.

Bottom Line

A competent HF + 50 MHz performer in two flavors—200 W or 100 W with automatic antenna tuner—the TS-480's flexible two-piece design and manifold features make it appropriate virtually anywhere.

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

No Big Ugly Radio

Liberated from ever having to be attached to a radio body, the TS-480 remote control panel is free to find its own shape, which veers away from the typical clean rectangle and the staid, linear layout we've come to expect from detachable front panels. The stylish, modernistic result—its protruding main tuning knob flanked by buttons reminiscent of Kenwood's TS-2000—may not enjoy universal appeal, but it's sensibly laid out and, by and large, easy to see and access.

It's also larger than the typical detachable front panel, which, by definition, can't be any wider or taller than the radio box itself. The TS-480's TX/RX unit alone is larger than other radios in this class—bigger than an entire IC-706 or TS-50, for example. The remote control panel is approximately $3\times7\times2^{1}/_{2}$ inches (counting the tuning knob).

The back-lighted amber/black text display measures about $4^{3}/_{4}\times^{7}/_{8}$ inches, and the main frequency readout numerals are a smidge over $^{1}/_{4}$ inch tall. Even the much-smaller legends are readily readable some distance away. The display offers excellent clarity from above and laterally; visibility does fade rapidly when it is viewed from below. Four levels of display brightness (plus "off") are available via the menu, as is the option to illuminate the numerous buttons.

One minor layout complaint: The PF, ATT/PRE and AT buttons on the left side are slightly raked and rounding the curve of the panel's edge. This makes them a bit less easy to read, but once you know what each does, it's no longer an issue. I also had to get used to the AF/SQL control being on the left instead of the right.

Most of the front panel controls are buttons—or keys, as Kenwood calls them. There are 34 in all (as opposed to just six rotary controls plus a little lever to tighten the tuning dial tension), and a lot of these keys access more than a single function. Press and release a button to enable its primary function; press and hold it one second for a secondary one or to change the main function's setting. In a few cases, the function of a button changes with mode.

Form Follows Function

Kenwood has grouped controls by function and done so in a way that draws your eye right to the one(s) you want. Contesters will be happy to see in the upper right hand corner a *dedicated* RIT knob and associated CL (clear), XIT and RIT buttons.

Five of the seven buttons immediately adjacent to the main tuning knob—three on the left, four on the right—access tuning and memory-related functions, such as the A/B and A=B keys. The other two are MODE and MENU/F.LOCK buttons you'll likely be using a lot. Placing them next to the tuning knob makes perfect sense.

To the left just below the virtual meter on the display is a "pad" of a dozen keys. In addition to letting you punch in a particular frequency (very handy), these keys each have their own specific functions, so Kenwood's made the most of the available real estate. This means you don't always find yourself jumping to the menu to, say, set your CW sending speed (just press the KEY key) or to turn the VOX on or off or change its settings (just press, or press and hold, the VOX button). Very, very convenient! Some radios of this genre force you to scroll through multiple menus to get at the same controls—although in all fairness, most of those radios also have smaller front panels.

In that same vein, having a dedicated menu button is a real treat and greatly eases user stress. Better still, the TS-480 lets you set up not one but *two* full configurations of all 60 menu items. This can accommodate operator preferences in a multioperator station as well as for differing operating environments—casual vs contesting or mobile vs fixed, for example. You can also set up a "Quick Menu" of functions you use a lot.

Accompanying each menu item is a text crawl in *real* English to describe the function. No more jumping back and forth between the radio and the manual!

A diamond-shaped cluster of buttons between the main tuning knob and the keypad buttons facilitates functions dealing with interference: DNL (digital noise limiter), FIL (filter), BC (beat cancel—a heterodyne eliminator) and NR (noise reduction). More on how (and how well) these work later. One quibble: The noise blanker (NB) is among the keypad buttons rather than within the interference fighting cluster.

Rounding out the key complement are the FINE/STEP, SCAN/SG.SEL (SG.SEL = scan group selection) and the sizable, uniquely shaped ∨ down and ∧ up buttons, primarily for changing bands or menu settings. You also can set up the down and up buttons to serve as a TF-SET (transmit frequency set) button while operating split, although swapping VFOs by pressing the A/B key does the same thing. By the way, the display can show both receive (main) and transmit frequencies in split operation.

In addition to the AF/SQL and RIT rotary controls, the TS-480 includes concentric MULTI/IF SHIFT knobs. As its name implies, the MULTI knob, a feature of many earlier Kenwood radios, has multiple functions. Unless you're in a menu or changing a setting, it lets you zip across the band in large steps.

Getting Up and Running

Making the transition from packing box to first QSO is pretty painless. Experienced hams can be putting contacts into their log in almost no time at all. (This radio is a good choice for less-experienced hams, as well.)

Of course, a mobile installation likely will take additional planning and execution. Wiring to a vehicle's battery with the supplied 6 foot long fused twin power cables could mean mounting the radio "body" a lot closer to the front of the vehicle. An optional 23 foot long power cable is available as an accessory, but you'll need two of them for the HX model. The required 13.8 V at 41 A for the HX can come from a single battery in a mobile or, in a fixed installation, from a single heavy-duty power supply or two comparable lighter-duty units. If you have one from an earlier 100 W transceiver, it likely can be half of the power system, so you don't need to buy a new 41 A supply and relegate your earlier supply to doorstop duty.

At home the remote control panel can go just about anywhere. Ham shack in a closet, anyone? The radio body can be tucked away out of sight—although you must ensure adequate ventilation, especially for the higher-power model.

The approximately 13 foot long cable connecting the remote control head with the radio body should be ample for most any installation (an optional extension is available), but *all other electrical connections* with the exception of headphones must be made to the radio body, and this could present some challenges. These include the microphone, key/paddle and extension speaker lines. There's a jack for headphones on the remote control panel as well as a speaker. It's rear firing, but it sounds quite decent. Kenwood reasons that the sound will reflect from whatever surface is behind the remote control panel.

I've always appreciated the convenience of being able to connect the microphone directly to the removable faceplate of my IC-706, or to choose to connect it to the radio body, depending on mounting configuration.

Initially, I placed the TS-480's radio body on the floor, but it was not very handy for plugging in my Heil headset (Heil makes an adapter for these radios). The provided mobile microphone with its coiled cord kept wanting to slip off the table and join the body on the floor. Again, optional extension cables are available.

The radio body has connections on both

Table 1
Kenwood TS-480HX, serial number 50800363[1]

Manufacturer's Specifications

Frequency coverage: Receive, 30 kHz-60 MHz; transmit, 1.8-2, 3.5-4, 5.25-5.45, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.

Power requirement: Receive—1.5 A; transmit—TS-480HX, 41 A (max); TS-480SAT, 20.5 A.

Modes of operation: SSB, CW, AM, FM, FSK.

Measured in the ARRL Lab

Receive[2] and transmit, as specified.

Receive—1.0 A; transmit—TS-480HX, 35 A; TS-480SAT, 17 A. Tested at 13.8 V.

As specified.

Receiver

SSB/CW sensitivity, bandwidth not specified, 10 dB S/N: 0.5-1.7 MHz, <4 µV; 1.7-24.5 MHz, <0.2 µV; 24.5-30, 50-54 MHz, <0.13 µV.

AM sensitivity, 10 dB S/N: 0.5-1.7 MHz, <32 µV; 1.7-24.5 MHz, <2.0 µV; 24.5-30 MHz, 50-54 MHz, <1.3 µV.

FM sensitivity, 12 dB SINAD: 28-30 MHz, 50-54 MHz, <0.22 µV.

Blocking dynamic range: Not specified.

Two-tone, third-order IMD dynamic range: Not specified.

Third-order intercept: Not specified.

Receiver Dynamic Testing

Noise floor (MDS), 500 Hz filter:

	Preamp off	*Preamp on*
1.0 MHz	–115 dBm	–122 dBm
3.5 MHz	–133 dBm	–141 dBm
14 MHz	–133 dBm	–141 dBm
50 MHz	–131 dBm	–143 dBm

10 dB (S+N)/N, 1-kHz tone, 30% modulation:

	Preamp off	*Preamp on*
1.0 MHz	12 µV	5.0 µV
3.8 MHz	1.4 µV	0.57 µV
50 MHz	1.8 µV	0.47 µV

For 12 dB SINAD:

	Preamp off	*Preamp on*
29 MHz	0.74 µV	0.16 µV
52 MHz	0.76 µV	0.17 µV

Blocking dynamic range, 500 Hz filter:

spacing:	20 kHz *Preamp off / on*	5 kHz *Preamp off / on*
3.5 MHz	122/117 dB	98/92 dB
14 MHz	123/115 dB	98/91 dB
50 MHz	123/117 dB	97/91 dB

Two-tone, third-order IMD dynamic range, 500 Hz filter,

spacing:	20 kHz *Preamp off / on*	5 kHz *Preamp off / on*
3.5 MHz	97*/99* dB	76/72 dB
14 MHz	98*/99* dB	75/71 dB
50 MHz	96*/81 dB	75/69 dB

Intercept:	*Preamp off / on*	*Preamp off / on*
3.5 MHz	+24/+11 dBm	–18/–31 dBm
14 MHz	+26/+12 dBm	–18/–32 dBm
50 MHz	+26/–14 dBm	–18/–35 dBm

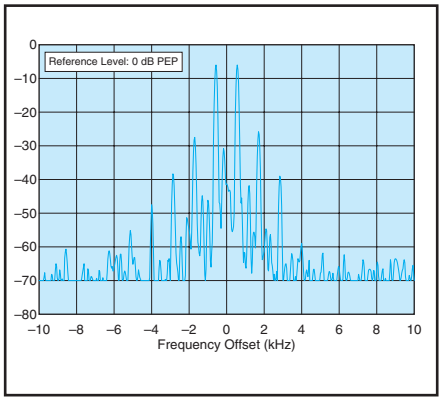

Figure 2—Worst-case spectral display of the Kenwood TS-480HX during HF two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 26 dB below PEP output, and the worst-case fifth order product is down approximately 39 dB. The transmitter was being operated at 200 W PEP output at 24.950 MHz.

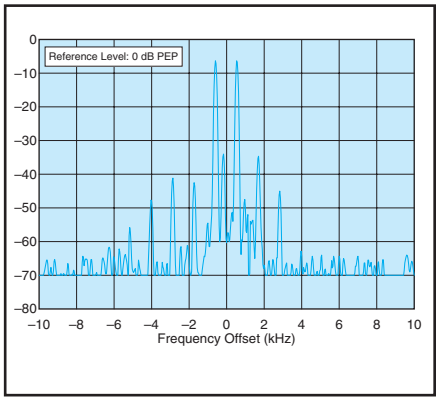

Figure 3—Worst-case spectral display of the Kenwood TS-480HX during VHF two tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 35 dB below PEP output, and the worst-case fifth order product is down approximately 42 dB. The transmitter was being operated at 100 W PEP output at 50.200 MHz.

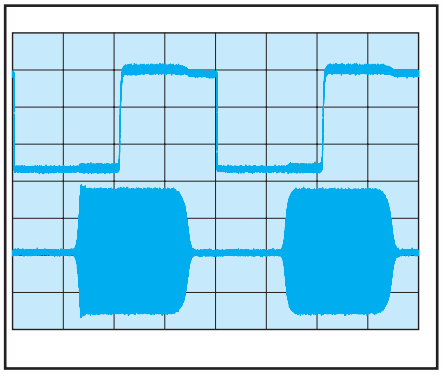

Figure 4—CW keying waveform for the Kenwood TS-480HX showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure (indicated by the drop in key voltage at the left edge); the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 200 W output at 14.2 MHz.

Manufacturer's Specifications	Measured in the ARRL Lab
Second-order intercept: Not specified.	Preamp off, +64 dBm; preamp on, +63 dBm.
FM adjacent channel rejection: Not specified.	20 kHz channel spacing, preamp on: 29 MHz, 78 dB; 52 MHz, 75 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing, preamp on: 29 MHz, 78 dB*; 52 MHz, 70 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 87 μV; preamp on, 18 μV.
Squelch sensitivity: SSB, 0.5-1.7 MHz, <18 μV; 1.8-30 MHz, <1.8 μV; 50-54 MHz, <1.1 μV; FM, 28-30, 50-54 MHz, <0.2 μV.	At threshold, preamp on: SSB, 14 MHz, 3.6 μV; FM, 29 MHz, 0.1 μV; 52 MHz, 0.1 μV.
Receiver audio output: 2.0 W at 10% THD into 8 Ω.	2.5 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth): CW (500 Hz filter): 508-1114 Hz (606 Hz); USB: 205-2815 Hz (2610 Hz); LSB: 175-2781 Hz (2606 Hz); AM: 102-3132 Hz (3030 Hz).
Spurious and image rejection: 70 dB.	First IF rejection, 14 MHz, 106 dB; 50 MHz, 70 dB; image rejection, 14 MHz, 122 dB; 50 MHz, 115 dB.

Transmitter	Transmitter Dynamic Testing
Power output: HF—SSB, CW, FM, 200 W high, 5 W low; AM, 50 W high, 5 W low; VHF—SSB, CW, FM, 100 W high, 5 W low; AM, 25 W high, 5 W low.	HF—CW, SSB, FM, typically 203 W high, 4.7 W low; AM, typically 44 W high, 4.3 W low; VHF—CW, SSB, FM, typically 107 W high, 4.5 W low; AM, typically 25 W high, 3.0 W low.
Spurious-signal and harmonic suppression: HF, ≥50 dB; VHF, ≥60 dB.	HF, 58 dB; 50 MHz, 66 dB. Meets FCC requirements.
SSB carrier suppression: ≥40 dB.	>53 dB.
Undesired sideband suppression: ≥40 dB.	>62 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figures 2 (HF) and 3 (VHF).
CW keyer speed range: Not specified.	10 to 60 WPM.
CW keying characteristics: Not specified.	See Figure 4.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 23 ms.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 12 ms; FM, 14 ms. Unit is suitable for use on digital modes.
Composite transmitted noise: Not specified.	See Figures 5 (HF) and 6 (VHF).

Size (height, width, depth): main unit, 2.8×7.0×10.9 inches; control head, 3.0×7.2×2.6 inches.

Weight: main unit, 7 pounds; control head, 1.1 pounds.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.
*Measurement was noise-limited at the value indicated.
Third-order intercept points were determined using S5 reference.
[1]Kenwood TS-480SAT, serial number 50800556, similar except power level is 100 W on all bands and transmit current is as shown.
[2]Receive sensitivity degrades below 0.1 MHz.

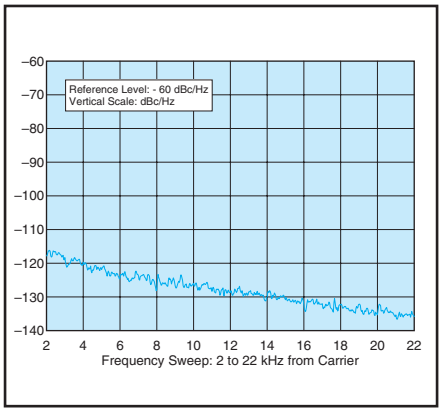

Figure 5—Worst-case spectral display of the Kenwood TS-480HX transmitter output during HF composite-noise testing. Power output is 200 W at 14.020 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

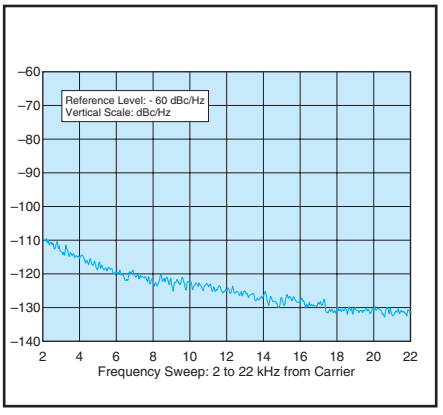

Figure 6—Worst-case spectral display of the Kenwood TS-480HX transmitter output during VHF composite-noise testing. Power output is 100 W at 50.020 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

ends. A cooling fan (or fans in the case of the HX) is on the "rear" end. Two antenna jacks are at the ends of short pigtails.

Once everything's hooked up, operating the radio will prove largely intuitive for most—although I did need to consult the *Instruction Manual* to figure out how to put the radio together (so to speak). Otherwise, the manual thoughtfully includes a two-page section called "Your First QSO" that will have you on the air in a flash.

The control-head-cum-radio motif does present one basic issue—how to keep the comparatively lightweight remote control panel down on the desk when you're punching buttons and twirling knobs. The four little protective rubber pads affixed to the little oval base don't prevent it from sliding on finished surfaces.

A station I worked who was using his new TS-480 at home said he weighted it

down. Other choices include "temporary" adhesive products, tilting the remote control panel up slightly, mounting the base to a larger platform or, if you desire, attaching it right to the operating desk with small screws.

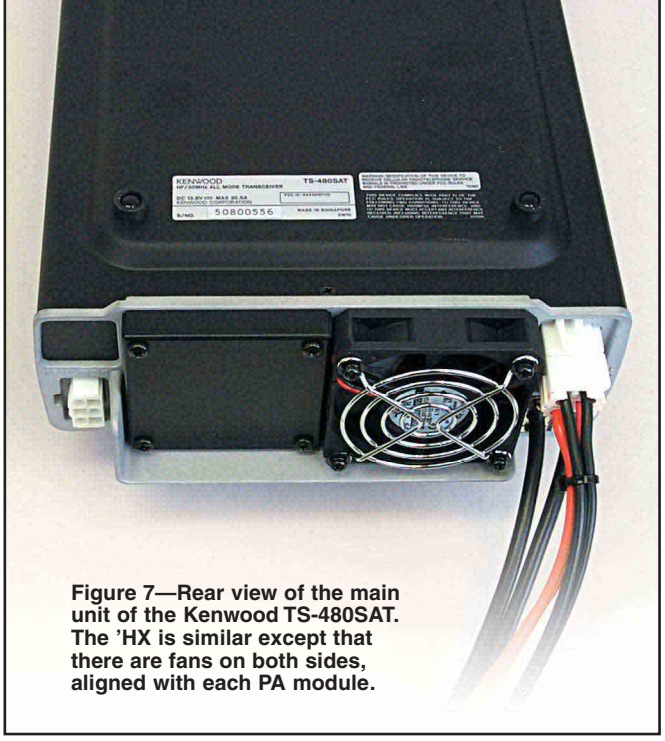

Figure 7—Rear view of the main unit of the Kenwood TS-480SAT. The 'HX is similar except that there are fans on both sides, aligned with each PA module.

Confronting the Good, the Bad and the Ugly

The TS-480 combines crystal IF filters and audio-level digital signal processing (DSP) to enhance selectivity, reduce extraneous noise and null heterodynes. The processor is a 16-bit fixed-point chip running at 100 MHz. The noise reduction (NR) system is adaptive and generally beneficial, but it's not something I'd engage without a specific need.

There are two modes. NR1 is intended for SSB, CW, FSK, AM or FM. You can set NR1 at AUTO or choose settings between 1 and 9 that yield varied results. NR2 is a SPAC (speech processing by auto correlation) system that, oddly enough, Kenwood recommends solely for CW. It takes some getting used to. Adjustable from roughly 2 to 20 ms, the manufacturer says it can "suppress noise at the same frequency as the target signal, allowing it to pull a weak target signal out from the surrounding noise." Whatever. It can and does improve readability under rough-copy CW conditions—sometimes dramatically.

NR1 and the digital noise limiter (DNL) are a big help when atmospheric static rears its ugly head. NR works on all modes; DNL works on all modes but FM. One or the other or a combination of the two won't eliminate all the noise, but it considerably ameliorates the annoyance. The trade-off is that the NR affects audio quality on voice modes. The DNL also can distort received audio at its top setting.

Using the NR and/or DNL will roll off top end audio response on nearly every setting, muddying the audio. It can be a tricky trade-off. You can overcome this somewhat via the RX EQ menu, another excellent feature.

The RX EQ complements the DSP and crystal filters by applying predefined equalization curves to the received audio. There's an adjacent and similar TX EQ menu to tailor transmitted audio, too. The choices on both menus are FLAT (off), HIGH BOOST 1 and 2 (think Richard Simmons), FORMANT PASS (Kenwood says this improves clarity by suppressing audio frequencies outside the normal voice range), BASS BOOST 1 and 2 (think Barry White), CONVENTIONAL (slightly trims audio above 2 kHz) and USER-DEFINED (via the PC control software). Incidentally, this radio sounds really great on AM, especially on the FORMANT PASS setting.

In addition, the DSP filter lets you customize the receive audio passband—up to a full 5 kHz (0 on the low end, 5000 Hz on the upper)—for voice modes, a very nice touch indeed. On SSB, it's possible to crank down the SSB filter considerably and still copy the audio—helpful in contesting. The IF shift also is effective, much more than the "tone control" found on some transceivers. There are special DSP filters for PSK31 and other digital modes.

Although the TS-480 lacks a true IF notch, the beat cancel (BC) feature is marvelous. While trying to work a 6Y8 with someone tuning next to him, I pushed the BC key, and voilà, there he was in the clear. If the offending signal is strong enough, however, beat cancel can degrade the desired signal, and, in any event, the carrier will continue to activate the AGC—and, thus, show up on the S meter.

There are two BC settings. One works on continuous tones, the other on intermittent tones like CW. But they only work in voice modes. You can't use BC while in CW to, say, notch out a nearby signal. You *can* use the crystal and digital filtering, however.

Memory Lane

The 100 memory channels will hold receive and transmit frequency, mode and step size as well as CTCSS and tone frequencies and memory name. You can lock out specific memories for scanning purposes. The TS-480 also has 10 scratchpad or "Quick Memory" channels. These are handy for storing frequencies on the fly on a first-in/first-out basis. Say you hear a multiplier you need in a contest, but conditions aren't there yet for you to break the pileup. The Quick Memory feature lets you mark the spot (and nine others) so you can easily keep an ear on them and pounce when the chance arrives.

The three standard CW memories hold 50 characters, and they are "recording" memories. Whatever you send, the memory will parrot it back at the press of a button. You can interrupt the memory playback to, say, insert a serial number or to add a customized response or message. A message interval time for repeat playback can be set from zero to 60 seconds.

Twirling the Knob

You can adjust the tuning step for coarse or AM and FM channel tuning for 10 and 6 meter repeaters or for tuning across the AM broadcast band. You can select a tuning rate of 250, 500 or 1000. These numbers—the default is 500—represent the number of pulses the tuning encoder generates in a complete revolution of the tuning knob. The actual frequency depends on the step size for the mode.

In SSB and CW, the step size is 10 Hz, so a tuning rate of 250 represents 2.5 kHz per full spin (in actual practice, it's a bit more than that). Pushing the FINE button shifts the decimal point one place to the left, so you're down to a languid 250 Hz per rev—very nice for precise tuning. There are ample choices to find a tuning rate just right for you.

Antenna Tuning on the Fly

The built-in automatic antenna tuner worked rather well on the SAT model, although you do incur some loss. In the ARRL Lab, we measured from a low of 12 percent loss on 10 meters up to a high of 21 percent on 6 meters going into a nonreactive 50 Ω load—although this only represents around 1 dB or less. It would not tune my multiband antenna on 160 meters (it's a half-wave there), but my TS-850S/AT would. In fairness to the '480, it is only spec'd for up to a 3:1 SWR.

In general, I found the TS-480's relay-type autotuner less flexible than the motorized capacitor unit in my TS-850S/AT in matching the weird sorts of loads my multiband antenna presents. You can select the tuner for receiving via the menu. By the way, the Morse implications of

WRC-03 aside, operators still need to know a bit of Morse code when using this (and other) Kenwood radios. The audio tuner sends SWR if it cannot get a match and T if it can. Hey, that's four letters right there!

Remote Control

You can remotely control the TS-480 using the free Kenwood *ARCP-480* software, which lets you control all transceiver functions via your PC. One problem, however, is that Kenwood installed a male serial jack on the radio, so you'll need a serial cable with female connectors on each end. In fact, one station we worked was using his laptop to control his brand-new TS-480SAT.

But wait! Remote control via the Internet or over a network also is possible using the Kenwood Network Command System radio host program *ARHP-10* on the computer connected to the radio. Then, you can control it using the *ARCP-480* software from a remote PC. Voice transmission is via Voice over Internet Protocol (VoIP); CW is possible using the keyboard.

A Brief Encounter of the Mobile Kind

To simplify testing (my Kenwood HF mobile rig was not plug compatible nor heartily enough wired), I connected the TS-480—the HX model in this case—to a deep-cycle marine battery (the boat was in dry dock). It easily ran the unit at full output. This exercise presented an opportunity to check out radio features of greatest importance to us mobileers.

For starters, the NB worked *very* well on the slight bit of ignition noise my engine generates plus full-tilt HVAC fan noise on 20 meters and 40 meters. I ran the NB all the way up to its most aggressive setting (10) with no signal impairment on CW. Since it will degrade audio on SSB, however, it's best to throttle the NB back to the lowest setting that does the job.

The DNL also drastically cut into the ignition noise, and the DNL and NB in tandem were terrific on CW. It's not a good idea to run the DNL at its most aggressive setting (3) on SSB either, since it starts to distort the received audio. I found it's best at 1 or 2.

The NR provides an added benefit in cutting the other sorts of noise one encounters while under way. I did not find it essential for mobile work, but it's there if you need it.

The radio is plenty sensitive, even on a mobile antenna. I generally find it best not to run a preamplifier while mobile. Although the TS-480's preamp boosts the desired signal by about 8 dB, that can come at the cost of undesired noise.

The stations I worked on both CW and SSB were unable to detect much of a difference between 100 W and 200 W, but it might make the operator *feel* louder. It represents one-half S unit in terms of power. (Another mobile I worked was running a full kilowatt. Talk about loud!)

Let's Do the Numbers

Kenwood credits a quad-JFET mixer for receiver "dynamic range equivalent to that of the TS-950 class (at 50 kHz separation)." Briefly, dynamic range measures a receiver's ability to hear weaker signals in the presence of stronger ones. Kenwood's parenthetical qualifier is important, for 50 kHz is a *lot* wider than the typical roofing filter. That said, the TS-480 acquits itself quite well in terms of dynamic range at the ARRL Lab's 20 kHz spacing standard. Two-tone third-order IMD dynamic range (see Table 1) on 14 MHz was 98 dB noise-limited (preamp off). At the same spacing—equivalent to the typical roofing filter—the third-order intercept (TOI) for the TS-480 is a quite creditable +26 dBm—slightly better than the +23 dBm we calculated for the top-end Ten-Tec Orion. Many consider TOI an indicator of strong-signal handling capability, an overall measure of receiver quality. So far, so good!

Crunch time arrives at the 5 kHz spacing test—something a lot closer to real-world conditions. There, the TS-480 came in at 75 dB (preamp off), and the TOI was –18 dBm. Contrast that with the Orion's 92 dB two-tone, third-order IMD dynamic range and +22 dBm TOI for the same band and spacing.

Even so, the TS-480's numbers are superior to those of Kenwood's TS-2000. On that transceiver, we measured 94 dB of two-tone, third-order IMD dynamic range at 20 kHz spacing, and 69 dB at 5 kHz. The TOI for the TS-2000 was +19 dBm at 20 kHz and –15 dBm at 5 kHz.

All other factors being equal, dynamic range and TOI for the TS-480 also are substantially better than other transceivers in this category.

Other Really Keen (or Not) Stuff

• Borrowing from a feature Kenwood first included in the TS-570, the TS-480 has a CW TUNE button. This automatically zero beats a CW signal—provided it's reasonably strong. Don't try this on that weak and watery DX signal you're attempting to tune in.

• The PF key can be set to something you might adjust a lot. As the manual suggested, I set it to transmit a "tune" signal—about 30 W of carrier—very handy to get the manual tuner set up.

• To get 200 W (HX model) with a 13.8 V supply, Kenwood uses a splitter feeding identical 100 W output modules followed by combiner. (The output on 6 meters is 100 W.)

• It's annoying to have step through most of the modes (you can select either FM and AM) to get (back) to the one you want. Most operators will be using CW or SSB and maybe FM. A menu setting that lets you "lock out" certain modes would be a real plus. The NR selections also work this way.

• The separate key and paddle jacks were great touch and something I wish *my* radio had.

• Some on-the-air reports indicated that keying was softer than my TS-850's, but I had the opportunity to work someone who was using a TS-480 on CW, and it sounded just fine to my ear. The transceiver supports full break-in.

• The TS-480 has probably the best VOX I've ever used. It's just superb. The anti-VOX system is automatic, so there's not nearly as much diddling to get the settings just right.

• Not expecting to find one, I nearly overlooked the first-rate transmit monitor early on.

• There's a linear-switching relay (with menu-selectable delay settings), but you can disable it.

And in Conclusion . . .

Some minor issues aside, I grew quite fond of the TS-480 and have added it to my personal wish list. The radio offers the sorts of features and flexibility you'd expect to find only in a higher-end rig.

The extra 100 W the HX model offers doesn't buy you much, but I'll give it at least partial credit for helping me to snag 3B9C (Rodrigues Island) on 40 CW and on 12 SSB. It does allow you to run at the 30 meter limit, as well as drive some linear amplifiers that need more than 100 W for full power. On the other hand, that auto tuner sure comes in handy. *Decisions, decisions*.

Thanks to Bob Heil, K9EID, of Heil Sound for his assistance with the headset adapter.

Additional information about this and other Kenwood radios as well as software downloads are available at the Kenwood Information & Communication Products Web page, **www.kenwood.com/i/index.html**.

Manufacturer: Kenwood Amateur Radio Products Group, 3975 Johns Creek Ct, Suwanee, GA 30024-1266; 310-639-4200; **www.kenwood.net**. Typical street prices: TS-480HX, $1080; TS-480SAT, $970; optional 500-Hz CW filter, $120. QST

TECHNICAL CORRESPONDENCE

NOTES ON MODELING LPDAS IN *MININEC*

By L. B. Cebik, W4RNL, 1434 High Mesa Dr, Knoxville, TN 37938-4443;
cebik@cebik.com

◊ In his excellent LPDA article ("Practical High Performance HF Log Periodic Antennas," *QST*, Sep 2002, pp 31-37), author Bill Jones, K8CU, warns against trying to model LPDAs in *MININEC* (3.13). The crucial issue is the phasing line, which he notes that *MININEC* programs will not handle properly. *NEC* programs, with suitable reservations, make easy work of handling phase lines with the TL facility.

Until very recently, I would have agreed completely with Bill's advice, and at a practical level, may still concur with it to a great extent. However, in fairness to the continuing development of *MININEC* 3.13, I should note that the advice is not quite absolute. It is possible to model an LPDA accurately with a suitably developed version of *MININEC* 3.13.

Modeling an LPDA in *NEC* (-2 or -4) takes the general form shown in Figure 1. We construct a model using one element for each actual element. For *NEC-2*, we must use the precalculated uniform-diameter equivalent element for the actual HF element, which would usually use a tapered diameter schedule. *NEC-4* can usually handle the taper schedule directly. In either case, the element center wire uses an odd number of segments to permit placement of the TL line at the exact center. We place the source on the center segment of the shortest wire, if we are working with a pure LPDA design. There is a reversed TL transmission line from each element center wire to the next.

NEC LPDA models have the advantage of being compact. They require the assignment of wire segments only to the elements, since the TL facility is a nonradiating addition that simply calculates the effect of the line at its assigned electrical length and characteristic impedance. The limitation of the TL facility is that all lines are *lossless*. The result is that *NEC* models run quickly, which is an advantage of no small proportions if the modeler is performing a frequency sweep from 10 to 30 MHz using very small frequency increments.

A *MININEC* model requires a different method of construction, one form of which is illustrated in Figure 2. We model as wires both the elements and the phase-line sections. Ordinarily, we would use the structures shown in the illustration, with the phase line oriented vertically to separate the element halves from contact with each other. We must have or calculate the physical dimensions of the phase line. *MININEC* has two advantages over *NEC* for the total physical modeling project. First, it handles the element diameter taper schedule directly, with no need for substitute elements having a uniform diameter. Second, it handles the junctions of the fat element centers and the thin phase-line wires without error.

However, the LPDA model has several features that disable most (but not all) versions of *MININEC* 3.13 from yielding accurate results. First, the phase line may consist of wires that are very closely spaced, a problem for the public domain *MININEC*. Second, the *MININEC* code contains a frequency bias, that is, an offset that grows with increasing frequency. Uncorrected, a simple quad loop resonant in *NEC* at about 28.5 MHz will be resonant in native *MININEC* at about 28.67 MHz. Third, the right-angle junctions yield accurate results only if the segment lengths at the junction are very small to overcome a corner-clipping effect.

Unless a version of *MININEC* treats all of these symptoms in its calculating code, it is likely to yield results that diverge significantly from those produced by *NEC*. The numerous available versions of *MININEC* 3.13 in both *DOS* and *Windows* tend to treat from none to two of these limitations. Hence, the general advice to avoid *MININEC* 3.13 is sound.

However, one recent *Windows* version of *MININEC*, *Antenna Model*, by Teri Software, has overcome all of the symp-

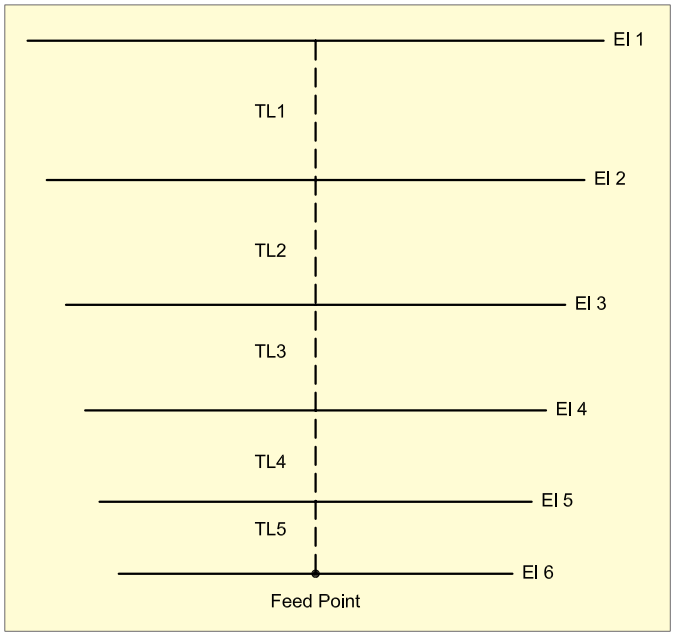

Figure 1—The general layout of a *NEC* model of an LPDA.

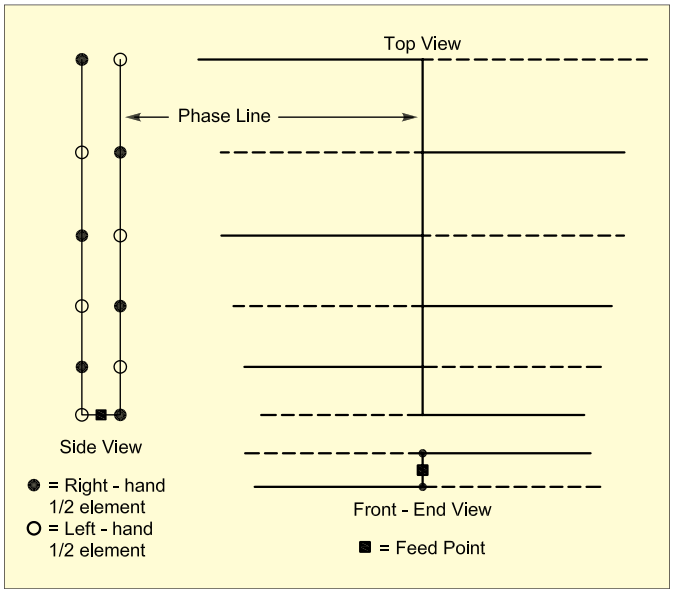

Figure 2—The general layout of a *MININEC* model of an LPDA. Solid lines connect to top phasing line, dashed lines to the lower phasing line.

Bob Schetgen, KU7G ♦ Senior Assistant Technical Editor ♦ tc@arrl.org

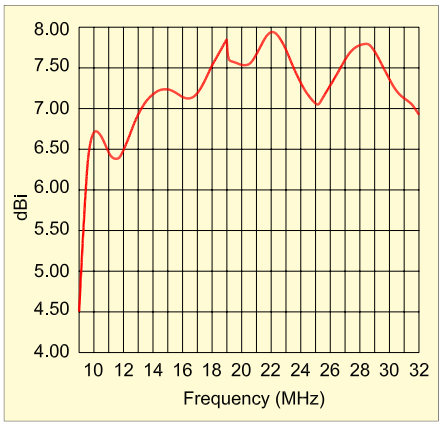

Figure 3—The free-space gain (in dBi) of the K8CU LPDA from 9 to 32 MHz.

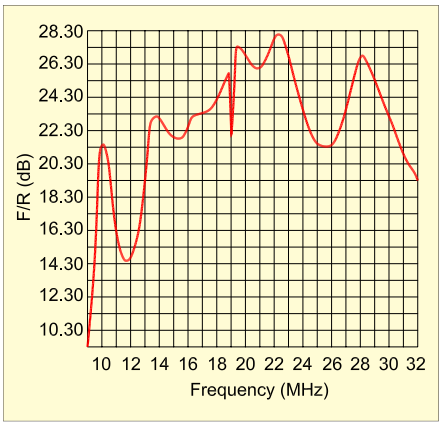

Figure 4—The front-to-rear ratio (in dB) of the K8CU LPDA from 9 to 32 MHz.

toms and does yield an accurate model of the K8CU LPDA. A copy of the model created by the Teri Software folks is available for download.[1]

Antenna Model originally appeared in a *DOS* version about a decade ago. It has undergone continuous refinement and re-emerged as a *Windows* program close to a year ago. In the intervening period, Jack Louthan and his staff have revised and refined the algorithms so that the program is capable of handling not only the K8CU LPDA, but a host of other antennas that previous implementations of *MININEC* miss by margins that range from small to immense. I have run a series of benchmark tests on various types of antennas at frequencies from 1 to 500 MHz, and found the results of free-space *Antenna Model MININEC* models to coincide closely with the results of equivalent *NEC-4* models.

As evidence of the coincidence, see Figures 3 and 4. These graphs of the free-space gain and the front-to-back ratio of the K8CU LPDA closely replicate the curves published with the original *QST* article.

We purchase such accuracy at a cost in the model size. The *Antenna Model* geometry construct contains 160 wires—including the shorted stub used in the design. The construction method uses variables (symbols) to define each wire junction, and the total runs to about 210. (Earlier *DOS* version of *MININEC* initially upheld the *BASIC* code limitation of 256 segments in a model, but rewrites of the code in the latest languages have lifted the segmentation limit altogether for most practical purposes.) The size and complexity of the model may lead some modelers to prefer *NEC* techniques to those of *MININEC*.

However, a preference is not a rule. The *Antenna Model* version of the K8CU LPDA demonstrates that an up-to-date—meaning highly modified over time from its original form—version of the *MININEC* 3.13 code can handle an LPDA. Unfortunately, none of the other versions of *MININEC* 3.13 available to me passes all of the benchmark tests, and hence I cannot recommend the use of any one of them for the K8CU array.

My review of the subject of modeling an LPDA with *MININEC* has no vested interests attached. Rather, my interest stems from my continuous study of antenna modeling and the programs available to make this activity possible. I hope only to update the information available about what various programs can and cannot do.

[1]You can download this package from the ARRL Web **www.arrl.org/files/qst-binaries/**. Look for 0406Cebik.zip.

SAFETY AND THE AC WATTMETER

By Kenneth Exworthy, NØAWMI N2564 Shore Dr, Marinette, WI 54143

◊ I read with interest the article "Could You Use A Low Power AC Wattmeter?" in *QST* (Jan 2004, p 56). A device such as this is handy in the ham shack as well as in other applications around the home. It has the power-factor problem as ably explained by Stu Cohen in the sidebar. As discussed in the April 2004 Technical Correspondence column, it may produce erroneous voltage readings if used with a DMM that does not display true RMS readings due to harmonic currents that flow into many electronic devices. This problem is significant enough in wiring systems to rate a section of the *National Electrical Code (NEC)* and that should be taken into account. If in doubt about a reading, the current waveform can be viewed differentially on a scope.

There is a far more worrisome problem, however: electrical *safety*. Since the device is meant for connection to a 120 V ac power system, it is subject to *NEC* requirements. For operator safety, every piece of touchable metal on the outside of the box must be grounded. This means that the test leads should not have accessible metal during connection. The plastic box may be a fire hazard because it contains a power resistor that could conceivably carry 20 A when connected to an ordinary house circuit. I suggest the following for a code-compliant project:

1. Go to the local electrical supply store and purchase a metal duplex outlet box, two cable clamps for nonmetallic-sheath cable and a blank cover. The three-wire extension cord should be rated for 20 A, or you may buy SO cord in bulk and the necessary male and female connectors to make a cord.

2. For the test leads, order safety plugs and jacks offered by Pomona Electric or their equivalents. The Pomona #6721 is a sheathed right angle plug; the #5931 is a sheathed panel jack. These can be ordered from any of the Pomona sales outlets listed on their Web site such as Mouser at **www.Mouser.com/pomona**. Use adequately insulated (600 V minimum) test-lead wire to connect to the meter.

3. Order a power resistor that can be mounted on the inside surface of the box. One such would be Vishay RH-50, 1%, 50 W. Use a 0.1 Ω value, which will result in a scale factor of 100 mV/A. This is well within the range of common DMMs and will be accurate enough to read directly with no calibration. This type of resistor has adequate insulation from its grounded mounts, directly solderable terminals and will dissipate 40 W at 20 A.

4. During construction, clamp the inlet and outlet cords securely in the ends of the box. Connect the green wires together at a secure connection to the box. Connect pigtails into the other wire junctions that will then connect to the jacks. Install the jacks into holes in the cover (or sides) of the box as desired and screw the cover on the assembly. The box will get hot during use if the current is near 20 A. It may be a good idea to bolt it to an insulating backing board. Otherwise, use it only on nonflammable surfaces.

This should result in a secure, electrically safe assembly.

Technical Correspondence items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given idea will work for your situation, we make every effort to screen out harmful information.

Letters for this column may be sent to Technical Correspondence, ARRL, 225 Main St, Newington, CT 06111, or via e-mail to **tc@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 a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents. QST

FCC Seeks Comments on Proposed Wide-Ranging Amateur Rule Changes

The FCC on April 15 released an "omnibus" *Notice of Proposed Rule Making* (*NPRM*) that seeks comment on a wide range of proposed Amateur Service (Part 97) rules changes. The *NPRM* is *not* related to the three recent amateur licensing restructuring petitions—including one from ARRL (see "FCC Pondering Comments on Restructuring Petitions," below). The FCC also denied several proposals aimed at altering portions of the Amateur Radio regulatory landscape, and it ordered minor changes in Part 97 that become effective June 1. The *NPRM* is a result of a dozen petitions for rule making, some filed more than a year ago and a few dating back as far as 2001. Among other proposed changes, the FCC recommended adopting the ARRL's March 2002 "Novice refarming" plan.

"Because the ARRL petition addresses the operating privileges of all classes of licensees on these Amateur Service bands, we believe that the ARRL petition provides a basis for a comprehensive restructuring of operating privileges," the FCC said. The Commission is considering comments on restructuring but has not acted on the matter. "We note that, as proposed, no licensees would lose any spectrum privileges and that General, Advanced, and Amateur Extra Class licensees would gain spectrum for phone emissions, one of the most popular operating modes on the HF bands." The ARRL incorporated its Novice refarming proposal into its recent *Petition for Rule Making*, RM-10867.

The FCC also has proposed essentially eliminating its rules prohibiting manufacture or marketing of Amateur Radio Service power amplifiers capable of operating between 24 and 35 MHz. The current rules "impose unnecessary restrictions on manufacturers of Amateur Radio equipment and are inconsistent with the experimental nature of the Amateur Service," the FCC said.

The FCC proposed amending its Part 97 rules to permit auxiliary operation on 2 meters above 144.5 MHz, with the exception of the satellite subband 145.8 to 146.0 MHz, in addition to frequency segments already authorized. It also proposed adopting an ARRL request to extend the bands available for spread spectrum experimentation and use to include 222-225 MHz. On its own initiative, the FCC proposed allowing SS on 6 and 2 meters. Current rules limit SS emissions to frequencies above 420 MHz.

The Commission also proposed to prohibit acceptance of more than one application per applicant per vanity call sign; permit retransmission of communications between a manned spacecraft, including the International Space Station, and associated Earth stations; allow current amateurs to designate a specific Amateur Radio club to acquire their call signs *in memoriam;* eliminate the rule requiring a public announcement of volunteer examiner test locations and times; and to provide Element 1 (5 WPM Morse) credit to any applicant holding a Technician license granted after February 14, 1991, who can document having passed the telegraphy examination element.

The Commission ordered some changes in Part 97 without requesting comment. They become effective June 1. Among other actions, the FCC revised the definition of an "amateur operator" to reflect that entry in the FCC Universal Licensing System, not a license document, determines whether a person is an Amateur Radio operator. The FCC adopted a technical change specifying that the mean power of any spurious emission from a new amateur station transmitter or amplifier operating below 30 MHz be at least 43 dB below the mean power of the fundamental emission, regardless of power output.

The FCC turned down a proposal to establish CW and phone subbands in the 160 meter band. Also denied were petitions that would have imposed restrictions on the time, length or transmission frequencies of bulletins or informational transmissions directed at the amateur community and an ARRL request to add to the special event call sign system certain call sign blocks designating US territories and possessions that lack mailing addresses.

The FCC *Notice of Proposed Rule Making* in WT Docket 04-140 is available on the FCC Web site.

Comments on the *NPRM* may be filed via the FCC Electronic Comment Filing System, **www.fcc.gov/cgb/ecfs/**. Click on "Submit a filing." To view the full petition and filed comments, click on "Search for filed comments."

FCC Pondering Restructuring Comments

The FCC is considering comments on three plans—one from the ARRL—to reshape the Amateur Service and a fourth petition that focused solely on the Morse requirement. Each *Petition for Rule Making* responded to World Radiocommunication Conference 2003 actions that made changes to Article 25 of the international *Radio Regulations*. While differing substantially in other aspects, the three restructuring petitions call for modifications at Amateur Radio's entry level and for a three-tiered license structure. One petition recommended additional changes to amateur testing and HF digital privileges. All three license restructuring plans call for changes to the present HF subbands. Interested parties had posted some 1300 comments on the four petitions before the April 23 filing deadline.

ARRL's petition, designated RM-10867, asked the FCC to create a new entry-level license class—being called "Novice" for now—offering limited HF CW/data and phone/image privileges on 80, 40, 15 and 10 meters plus certain VHF and UHF privileges. The League plan also would consolidate Technician, Tech Plus (Technician with Element 1 credit) and General licensees into a new General license that no longer would require a Morse examination. Current Technician

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

FCC News

IOWA AMATEUR GETS BACK LOST, REASSIGNED CALL SIGN

A four-month long ordeal is over for Bill Sorsby, N5BU, of Cedar Rapids, Iowa. In 2001, Sorsby lost the call sign he'd held since 1976 as a result of what the FCC termed "filing errors" in its Universal Licensing System (ULS). Not only did the FCC erroneously cancel the ARRL member's call sign, it compounded the mistake by reassigning it two years later to another amateur. When Sorsby realized earlier this year that his ticket was gone, he immediately contacted the FCC to find out what had happened and to get it back.

As the FCC tells it, in December 1999 it received requests to modify the contact information for the amateur license from the title holder of an aircraft with the call sign "5BU." (The ULS uses an abbreviated format for aircraft call signs that omits the initial "N.") In the process, the title holder inadvertently also associated its FCC Registration Number (FRN) with Sorsby's N5BU amateur license. The FCC blamed the problem on "confusion between the aircraft station call sign and its registration marking—or 'N number.'"

After the aircraft was sold in 2001, the title company requested cancellation of 5BU and, later, N5BU. The second action effectively canceled Sorsby's ham ticket. ARRL member David Willard of Ft Smith, Arkansas, filed for N5BU two years later and was granted the call sign. Sorsby said Willard "graciously" yielded the call sign when he learned of the error.

The Iowa amateur was philosophical about his "frustrating" four-month ordeal getting N5BU back. His consolation, he told ARRL, is that now he'll have a tall tale to spin for years to come. To reduce the likelihood of similar problems, ARRL strongly encourages Amateur Service licensees to associate their Amateur Radio call sign with their FRN.

FORGET YOUR CORES/FRN PASSWORD?

It's possible to reset your CORES/FRN (Commission Registration System/FCC Registration Number) password via the FCC Web site for electronic application filing. This might come in handy if you have forgotten your password, need to change it to another password or were automatically registered for CORES through a Volunteer Examiner Coordinator and don't know your password. Visit the secure "Forgot your Password" Web site, **https://esupport.fcc.gov/password.htm**, and complete all the required fields. You will need to supply your FCC Registration Number (available via ULS or through many on-line call sign servers, such as ARRL's) as well as your Taxpayer Identification Number, typically your Social Security number. Applicants also will need to supply name, e-mail address and telephone number.

Amateur Enforcement

♦ **FCC proposes $11,000 fine for California amateur:** The FCC has issued a *Notice of Apparent Liability for Forfeiture* (*NAL*) to Daniel Granda, KA6VHC, proposing to fine the Whittier, California, man $11,000 for allegedly "willfully and repeatedly" violating the Communications Act of 1934 and Amateur Service (Part 97) rules. The FCC asserted that on at least eight occasions, Granda, 58, "willfully and maliciously caused interference to other stations and conducted activity in an effort to obtain exclusive use" of a 1.25 meter repeater pair.

"Specifically, we find Mr Granda apparently liable for failure to respond to official Commission correspondence and causing intentional interference to amateur radio communications," the FCC said in the *NAL*, released March 31.

The *NAL* said agents from the FCC's Los Angeles office used direction-finding techniques to track interfering signals to Granda's residence. FCC agents inspected his station on April 15, 2003, and found radio equipment capable of transmitting on all of the frequencies involved. The FCC says Granda "orally admitted" that he had received the warning notices from the Commission. The *NAL* says Granda told the agents he was "trying to prevent anyone from using 'his' frequency by re-transmitting 147.49 MHz signals on 222.24/223.84 MHz to 'keep the channel occupied.'" The following day, an FCC agent observed that audio from 147.49 MHz was being retransmitted onto 222.24/223.84 MHz from Granda's residence, the *NAL* said.

Based on the evidence, the FCC said, it determined that Granda had operated radio transmitting equipment "in willful and repeated violation" of the Communications Act as well as the Amateur Service rules "by failing to respond to Commission correspondence and causing malicious interference and transmitting signals in an attempt to exclusively use a frequency."

The FCC proposed fining Granda $4000 for failure to respond to Commission correspondence and $7000 for causing interference. The FCC gave Granda 30 days to pay the proposed forfeiture or file for a reduction or cancellation.

Last August, the Wireless Telecommunications Bureau set aside the grant of renewal of Granda's Amateur Extra class license, which expired last November. His renewal application has reverted to "pending" status.

and Tech Plus licensees automatically would gain General privileges, and Advanced license holders automatically would be upgraded to Extra without further testing. Applicants for Amateur Extra would still have to pass a 5 WPM Morse code examination, but the General and Extra written exams would stay the same.

In a wide-ranging petition, RM-10868, an "unincorporated grassroots organization" calling itself the Radio Amateur Foundation (RAF) asked the FCC to modify the Technician ticket to allow limited HF phone, image, data and CW privileges on portions of 160, 15 and 10 meters. The group also proposed retaining the 5 WPM Morse requirement for General and Amateur Extra applicants, upgrading Advanced class holders to Extra, and Novices to Technician. The Radio Amateur Foundation said it sees no need to change licensing requirements for General or Amateur Extra applicants.

The RAF also advocated scrapping existing Amateur Radio question pools and starting over from scratch, keeping the new question pools out of the public domain and requiring a 10 day waiting period before retesting. In addition, it would permit only Generals and Amateur Extras—or Technicians licensed more than two years—to request vanity call signs. The RAF also asked the FCC to permit digital experimentation from 29.0 to 29.3 MHz at bandwidths of up to 15 kHz.

In a two-page petition designated RM-10869, Ronald D. Lowrance, K4SX, called on the FCC to retain the 5 WPM Morse code requirement for General class applicants and to raise the Morse requirement to 13 WPM for Amateur Extra class applicants. He called Morse code "the most reliable mode of communication"

NOTABLE SILENT KEYS

● **Robert I. "Bob" Sutherland, W6PO, SK:** Moonbounce pioneer Bob Sutherland, W6PO (ex-W6UOV), of San Mateo, California, died January 11. He was 78. An active VHF-UHF operator in the 1960s through the 1980s, Sutherland was on the West Coast end of the first Amateur Radio moonbounce (EME) contact in 1960 when the Eimac Radio Club's W6HB and W1BU worked each other on 1296 MHz EME. An employee of tube manufacturer Eimac for nearly 50 years, Sutherland developed some of the better-known Eimac tube-based amps. An ARRL member, Sutherland authored several articles for *Ham Radio* magazine and *QST*. His *Eimac EME Notes* remain in circulation along with his amplifier designs.

● **Alvino Rey, W6UK, SK:** Musical pioneer and band leader Alvino Rey, W6UK, of Sandy, Utah, died February 24. He was 95. An ARRL member, Rey was a well-known musician for several decades and was considered "the father of the pedal steel guitar." He performed at more than one ARRL Southwestern Division convention.

● **Clifford E. Fay, K7BQ, SK:** One of the oldest members of the amateur community, Cliff Fay, K7BQ, of Peoria, Arizona, died February 28. He was 100. An ARRL member, Fay remained active on the air until shortly before his death. Fay's family requests memorial donations to the Sierra Winds Charitable Foundation, 17300 N 88th Ave, Box PL 2, Peoria, AZ 85382.

● **Leslie A. Moxon, G6XN, SK:** Les Moxon, G6XN, of Surrey, England, died March 3. He was 95. Licensed in 1928, Moxon was best known for his writings on antennas, in particular his 1982 book *HF Antennas for All Locations*, now in its second edition. ARRL antenna specialist Dean Straw, N6BV, said Moxon was a radio pioneer. "His insights into the effects of terrain were one of the factors that got me interested years ago in this aspect of HF radio work," Straw said. During World War II Moxon was involved in top-secret work to develop radar and later worked for the government as a radio specialist. Moxon authored articles for *QST* and *Ham Radio* magazine.

in an emergency.

The National Conference of Volunteer Examiner Coordinators (NCVEC) wants the FCC to establish a new "Communicator" entry-level license. Its petition, designated RM-10870, reiterated the NCVEC's call—made last fall in RM-10787—to altogether eliminate the Morse code testing requirement. The NCVEC plan would upgrade all current Novices to Communicator class, all current Technician and Tech Plus (Technician with Element 1 credit) licensees to General and all Advanced class licensees to Amateur Extra without further testing. The Communicator ticket would permit voice and digital modes on 80, 40, 15 and 10 meters plus VHF and UHF up to 70 cm at modest power output levels.

FEMA APPEARS TO BACKPEDAL IN BPL "CLARIFICATION" LETTER

After expressing "grave concerns" to the FCC last fall about the interference potential of Broadband over Power Line (BPL) systems, the Federal Emergency Management Agency (FEMA) in January appeared to be backing away from that strong stance. Now a part of the Department of Homeland Security, FEMA filed comments December 4 in response to the FCC's April 2003 *Notice of Inquiry* in ET Docket 03-104. Many have cited those remarks in their own comments opposing BPL deployment. In a January 8 letter that's now part of the BPL *Notice of Proposed Rule Making* (*NPRM*) in ET Docket 04-37, Michael D. Brown, the US Department of Homeland Security's under secretary for emergency preparedness and response, told FCC Chairman Michael K. Powell that FEMA wanted to "clarify the record" to ensure that its filing was not "misunderstood or misconstrued."

"We have become aware that certain distinct approaches to BPL may have the potential to cause interference to FEMA's high frequency radio communications system," Brown said in his January letter. "However, we continue to study the BPL proceeding and have not concluded that there is a material interference problem or that all of the distinct technological approaches to BPL pose a risk of interference." The FEMA official said his agency expects that there may be ways to provide BPL's benefits "without compromising the emergency communications capabilities available to FEMA."

FEMA's January letter stands in stark contrast to its predictions last December that "the introduction of unwanted interference from the implementation of BPL technology into the high frequency radio spectrum will result in significant detriment to the operation of FEMA radio systems." Saying such interference could "directly impair the safety of life and property," FEMA also had recommended the FCC beef up its Part 15 rules to ensure no increase in interference levels to existing FCC or NTIA-licensed communication systems.

ALAN ERICKSON, WBØOAV

A BPL connection and box at a field trial in Cedar Rapids, Iowa.

"The purported benefits of BPL in terms of expanded services in certain communications sectors do not appear to outweigh the benefit to the overall public of HF radio capability as presently used by government, broadcasting and public safety users," FEMA asserted last December in comments filed on the agency's behalf by Chief Information Officer Barry C. West.

BPL also could render such "essential communications services" as the Radio Amateur Civil Emergency Service (RACES), the Military Affiliate Radio System (MARS) and the Civil Air Patrol (CAP) useless, FEMA said then. FEMA and ARRL are signatories to a *Memorandum of Understanding* that focuses on how Amateur Radio personnel may coordinate with the agency to support emergency communications functions. FEMA's December comments also referenced ARRL's "Interference to PLC systems from Amateur Radio Operation."

Brown's January letter conveys a much milder, conciliatory tone. "We know that the FCC shares our appreciation for the importance of reliable communications in the context of disaster recovery and are confident that the Office of Engineering and Technology's technical assessment,

as well as the Commission's regulations implementing BPL, will be sensitive to this issue," he concluded.

The deadline to file comments in response to the FCC BPL *NPRM* in ET Docket No 04-37 is May 3; reply comments are due June 1. Comments may be filed via the Internet using the FCC's Electronic Comment Filing System (ECFS), **www.fcc.gov/cgb/ecfs/**.

ARRL RECOMMENDS CLOSER FCC-NTIA SPECTRUM MANAGEMENT COLLABORATION

The ARRL has suggested that FCC and National Telecommunications and Information Administration (NTIA) spectrum management professionals work more closely and cooperatively. It also called for more open allocation proceedings where federal/non-federal spectrum sharing is involved. The League offered the recommendations in comments filed on an NTIA *Notice of Inquiry*, "United States Spectrum Management Policy for the 21st Century," **spectrumreform.ntia.doc.gov/notice.htm**. While the FCC oversees private and commercial spectrum, the NTIA—part of the US Department of Commerce—administers spectrum allocated to federal government users. It also advises the White House on telecommunications issues. ARRL said the current bifurcated spectrum management system has benefits and drawbacks.

"A significant advantage of maintaining the present scheme...is that the separate functions provide a system...of checks and balances," ARRL said in addressing whether spectrum management should be centralized. On the other hand, the League added, this separation can "delay needed action and promotes somewhat parochial and divergent priorities."

The FCC "has acted as a self-described 'cheerleader' for new, typically unlicensed, technologies without a firm grasp of technical compatibilities and incompatibilities," the League said. On the other hand, ARRL continued, the NTIA has tended to see its role as protector of the noncommercial spectrum it administers.

The FCC has been "inconsistent at best" in spectrum protection, ARRL said, while NTIA spectrum managers regularly provide "professional and impartial evaluations of new technologies" and their interference potential. Amateur Radio shares some of its allocations with federal users, especially in the UHF and microwave spectrum.

Given "competing goals and interests," ARRL suggested the FCC and NTIA return to the approach used in years past when spectrum management officials of both agencies "worked closely and cooperatively," and there was regular staff-level communication.

The ARRL cited the proceeding that led to the Amateur Radio 5 MHz (60 meter) allocation to emphasize its belief that spectrum management and sharing should operate according to "negotiated rule making procedures" in which all stakeholders participate. Last-minute NTIA intervention led to the current five-channel allocation at 5 MHz instead of the band the ARRL had sought and the FCC was poised to grant.

"The process for considering new federal and non-federal sharing plans should be more open," the ARRL asserted. "There was no procedure for ARRL, FCC and NTIA (or the individual agencies concerned about this allocation) to meet and address potential concerns." Lacking any public procedure, the League said, the NTIA and FCC instead agreed to a compromise that was "inadequate for the purpose."

The ARRL said a negotiated rulemaking procedure could address such issues more quickly and efficiently than current procedures permit.

BILL FISHER, W4AN, SK

Bill J. Fisher, W4AN (ex-KM9P), of Alpharetta, Georgia, died unexpectedly April 4. He was 41. An ARRL Life Member, Fisher was an enthusiastic radio amateur whose call sign often graced the upper echelons of the contest results. Fisher and fellow Georgian John Laney, K4BAI, took the silver medal at World Radiosport Team Championship '96 in the San Francisco Bay area. The pair also competed in WRTC-02 in Finland. Fisher's death came as the contesting community was still recovering from the untimely death of Jim White, K4OJ, in February.

GENE WALSH, N2AA

Bill Fisher, W4AN, after competing in WRTC-2002 in Finland.

"I knew of nobody as generous with his time and with as unique a personal touch as Bill," said Dave Pascoe, KM3T, whose friendship with Fisher extends back more than 20 years. "Many will

Media Hits

■ A feature in *The Wisconsin Rapids Daily Tribune* spotlighted Jack Lukes, WB9QXO, who was honored for 27 years of ham radio public service activity. Until he "retired" in 2003, Lukes was Wood County ARES Emergency Coordinator and was especially active during weather emergencies. The Wood County Emergency Management Director was quoted as saying "Jack and his people are on the front line." Lukes' replacement is Mike Podawiltz, KF9X.

■ After an article on BPL appeared in Alabama's *The Huntsville Times*, Randy Moore, KS4L, asked ARRL for advice on responding with a letter to the editor. Aided by a sample letter penned by ARRL PR Committee member Rich Moseson, W2VU, his submission soon appeared in print. Moseson's sample letter is on the League's Public Relations Web page in the March issue of *Contact!*

■ Minnesota's Rochester Amateur Radio Club got some airtime on NBC affiliate KTTC-TV. A news segment taped at the shack of Stewart Lewis, WØSHL, covered the importance of ham radio and the contributions club members make during emergencies. According to ARRL Public Information Officer Chuck Gysi, N2DUP, the TV piece resulted from a routine news release reporting the club's new officers.

■ California's *Ventura County Star* covered a mock emergency communications drill at the East Valley Sheriff's Station in Thousand Oaks. ARRL Emergency Coordinator Ken Larson, KJ6RZ, and Bruce Elbert, K6ZB, were interviewed during the drill at the new ham radio communications center at the sheriff's station. The story pointed out that during times of emergency, ham radio operators "fill the gap" when normal means of communications fail.

In Brief

● **SWLs may file BPL interference complaints:** FCC Part 15 rules prohibit interference to licensed services from unlicensed devices. This means that, with limited exceptions, short-wave listeners (SWLs) may file formal complaints if broadband over power line (BPL) signals interfere with their reception. "There is no doubt that international broadcast listeners have standing to complain about interference to the reception of foreign broadcast signals," says ARRL General Counsel Chris Imlay, W3KD. "One does not have to be a licensee of a transmitter in order to receive harmful interference from a United States-based RF source and have standing to complain about it." Listeners to international short-wave broadcasts have standing to complain, if they are the target audience for such broadcasts. Imlay says that while FCC and court cases involving standing to file are complex, "the cases are clear that the allegation of suffering actual electromagnetic interference to reception of a broadcast service, even one generated internationally, from a domestic RF source, is sufficient in every case to demonstrate standing to file a complaint." International Telecommunication Union *Radio Regulations* require member nations to "take all practicable and necessary steps to ensure that the operation of electrical apparatus or installations of any kind, including power and telecommunication distribution networks, but excluding equipment used for industrial, scientific and medical applications, does not cause harmful interference to a radiocommunication service."—*tnx Gary Pearce, KN4AQ*

● **New Morse "@" character official as of May 3:** The International Morse code officially gained a new character on May 3. That's when the now-familiar "@" symbol was set to join the Morse lexicon as the letters "AC" run together (·––·––·). Known as the "commercial at" or "commat," the @ symbol never rose to the level of usage that demanded a unique Morse character until it gained currency as a critical component of e-mail addresses during the past decade or so. Last December, the International Telecommunication Union Radiocommunication Sector (ITU-R) Study Group 8 agreed on the wording of a *Draft New Recommendation ITU-R M.[MORSE]* that specifies the international Morse code character set and transmission procedures and includes the new Morse code character. The pending change attracted some attention in the media, including mentions on National Public Radio's *All Things Considered* and in *The New York Times*. As of press time, the draft new recommendation was completing the rounds of ITU member-states under a new procedure that provides for simultaneous adoption and approval, and there were no apparent objections. At the suggestion of the International Amateur Radio Union, the new recommendation also calls on ITU-R to define the international Morse code specification after May 3. The Morse specification previously had fallen under the purview of the Telecommunication Standardization Sector (ITU-T), which is responsible for the public telephone and telegraph network.

● **Congressman-ham gets father's call sign:** Rep Greg Walden (R-OR), one of the two hams in Congress, has a new call sign. With the assistance of ARRL, Walden was able to obtain his father's former call sign, W7EQI, via the vanity call sign program. A General class licensee and an ARRL member, Walden formerly held WB7OCE. The congress-man's father, Paul E. Walden, died in March 2003. He had been licensed since 1934. Rep Walden, a former broadcaster, is a member of the House Subcommittee on Telecommunications and the Internet.

● **Wyoming gets new Section Manager:** Bill Edwards, WU7Y, of Gillette, Wyoming, was appointed as ARRL Wyoming Section Manager, effective April 1. He'll complete the term of Jay Ostrem, W7CW, who has moved out of the section. The present term expires March 31, 2005. Field and Educational Services Manager Rosalie White, K1STO, made the appointment after consulting with Rocky Mountain Division Director Walt Stinson, WØCP, and Vice Director Rev Morton, WS7W.

● **Gary Gordon, K6KV, wins *QST* Cover Plaque Award:** The winner of the *QST* Cover Plaque Award for March is Gary Gordon, K6KV, for his article "Build a Puff-and-Sip Keyer." Congratulations, Gary! 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!

● **TAPR/ARRL 2004 Digital Communications Conference seeks papers:** The 2004 TAPR/ARRL Digital Communications Conference (DCC) will be held September 10-12 at the Airport Holiday Inn, Des Moines, Iowa. There's more information on the TAPR Web site, **www.tapr.org/dcc/**. The DCC has issued its first call for papers, **www.tapr.org/dcc/dcccallforpapers.html**, for the conference *Proceedings*. Authors do not have to be present at the conference to have their papers included in the Proceedings. Send submissions by August 10 via e-mail or USPS mail to Maty Weinberg, KB1EIB, **maty@arrl.org**, ARRL 225 Main St, Newington, CT 06111.

never know nor comprehend the amount of time and resources he poured into this hobby of ours."

Fisher was the founder of the Contesting.com Web site and helped to establish the popular eHam.net Amateur Radio site in 1999. In addition, he personally supported contesting reflectors via his own servers. Mike Gilmer, N2MG, eHam's site manager, said he would miss Fisher's leadership. "Bill had a way of low-pass filtering the noise from both the users of eHam and the site team and trying to maintain focus," he said.

Fisher had established a top-flight contesting station on a hilltop in the mountains of north Georgia. When not contesting, he operated the station from his home via a telephone link, since antenna restrictions prevented him from putting up outdoor antennas. More recently he was planning to establish a contest superstation with Tom Rauch, W8JI.

A member of the South East Contest Club, the South East DX Club, the First-Class CW Operators' Club (FOC) and the A-1 Operator Club, Fisher also was an avid bicycle racer. Fisher was founder and vice president of Concentric Systems Inc—a supplier of custom-built PCs. He also established and was president of Akorn Access Inc—an Internet service provider and consulting company.

Survivors include his wife, Dana, and their young sons Graeme and Erik. The W4AN Memorial Fund for Graeme and Erik Fisher has been established to benefit Fisher's children. Donations are welcome to North Atlanta National Bank, 10500 Old Alabama Rd Connector, Alpharetta, GA 30022; 678-277-8400. Make checks payable to "W4AN Memorial Account" and include the account number, 20005913, on the check "memo" line. Memorial contributions also are welcome to the Victor C. Clark Youth Incentive Program, c/o ARRL, 225 Main St, Newington, CT 06111. QST

A Book Report

I like books. In fact, I like them so much that I buy them (and sometimes I even find the time to read them, not to mention write them). My bookshelves are overflowing and the floor space in my shack is getting narrower and narrower as the overflow is now stacked on the floor (the cats love it, though!).

I am always considering new software for my computer, but before I plunk down my money to buy software, I read the software reviews that appear in the various computer magazines. If the review leaves me with the impression that the software has potential, I might buy a book about the software to learn more about it. When I get to the book-buying stage, I am very likely to buy the software and may already be waiting for the man in brown to deliver it.

Don't know if you noticed, but lately the "books" that accompany new software are not "comprehensive" (I'm being nice), so you end up buying a third-party book that is more comprehensive. These days, buying a book about software you intend to buy or have already bought is not usually a waste of money.

What book do you buy when you are faced with a lot of choices?

If there is more than one book, I always read the reviews at **www.amazon.com** to help me decide which to buy. Readers like you and me write the reviews, and don't pull punches, especially if the book stinks. I don't know how many times these reviews have saved me from spending big bucks on highly touted books that were not that highly touted by their readers.

Try Something New

So, how about trying some new software for Amateur Radio? How about DSP (digital signal processing), for instance?

"Why DSP?" you ask.

I answer, "If you want to design hardware, avoid the sharp edges and emulate the hardware with software, then DSP is the way to go." I don't know how many times I cut myself building a box to contain a project (why is the box always more difficult than the electronics inside?). With DSP, you can avoid much of the box building, not to mention those nasty solder fumes and burns (I can show you the scars. Here's a WA1LOU quick-tip: Don't solder in shorts!).

Whole radios are being created in software these days, and if you want to tinker, DSP is the way to do it. The ARRL has a great book that will help you tinker: *Experimental Methods in RF Design*, written by some of the great tinkerers of our time: Wes Hayward, W7ZOI; Rick Campbell, KK7B, and Bob Larkin, W7PUA. *Experimental Methods* will allow you to "immerse yourself in the communications experience by building equipment that contributes to your understanding basic concepts and circuits."

Learning how to emulate hardware in software is facilitated by products like the KK7P DSPx Digital Signal Processor Module, which you can see at www.fidalgo.net/shop/~wa7gxd/dspx.html.

The book includes a couple of chapters on DSP, and it comes bundled with a CD-ROM that includes design software, listings for DSP firmware and supplementary articles. To learn more about the book, go to **www.arrl.org/shop/** and select the "Circuit Design" link.

You do need some actual hardware to tinker with DSP. There is only so much you can do with bits, for now. Along with a good book, I recommend the DSPx, which is a DSP module suitable for DSP learning and development. In addition, you can imbed the DSPx into your DSP project.

Lyle Johnson, KK7P, designed the DSPx, and it is available from TAPR (**www.tapr.org**). For more information, visit **www.tapr.org** and/or **www.fidalgo.net/~wa7gxd/dspx.html**. You also might consider KK7P's KDSP10 Interface Adapter Kit, which allows you to use the DSPx module with W7PUA DSP-10 2-meter software defined radio (**www.proaxis.com/~boblark/dsp10. htm**). The KDSP10 is also very useful as a DSP development platform.

Touting My Own Horn

Speaking of books…I cranked out a new one recently and it is on sale at your favorite ham radio store or directly from the ARRL. Entitled *APRS—Moving Hams on Radio and the Internet*, it is a guide to the Automatic Position Reporting System (APRS).

This is my third APRS opus and it brings things up-to-date with new APRS applications and APRS's increasing emphasis on the Internet (today, you can even access APRS without a radio!). When I wrote my previous APRS book, the APRS interface to the Internet was only taking its first baby steps. Today, that interface is mature and offers lots of options that were unthinkable a few years ago. To learn more about my book, go to **www.arrl.org/shop/** and select the "Digital Communications" link.

By the way, I will be presenting an "Introduction to APRS" at the Dayton Hamvention in May and the Des Moines ARRL/TAPR Digital Communications Conference (DCC) in September. To get to those destinations, I will be driving the land barge cross-country, so be sure to watch for my tracks (WA1LOU-8) on your local APRS digipeater or APRS Internet interface.

APRS Internet Interface?

You may be asking, "What's an APRS Internet interface?" An "APRS Internet interface" is a Web page or Web site that is interfaced to a server on the Internet that collects and collates APRS data from all over the world. The data is relayed to the server by APRS stations (digipeaters, weather stations, home stations) that are connected to the Internet.

The APRS Internet interface Web site extracts data from the server and displays it in a useable/user-friendly format (text, tables, maps, etc). N1BQ's APRS Search Page (**www.wulfden.org/APRSQuery.shtml**) is a prime example of an APRS Internet interface. If you know enough about HTML to be dangerous, you can even build your own interface like the one I built for my APRS weather station at **www.tapr.org/~wa1lou/wx.html**.

See you in Dayton! QST

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Early Detection of E_s on 144 MHz and Above

I recently had the pleasure of visiting Ned Stearns, AA7A, while on a business trip to Scottsdale, Arizona. After I congratulated him on finding the 222 MHz opening last summer, one of the few such openings in the history of that band, he replied that it was not an accident and proceeded to describe the system he uses to track E_s maximum usable frequency (MUF). Since the E_s season should now be in full bloom, I thought you might be interested in how he does it. So say hello to AA7A, 6 meter DXer, 6 and 2 meter EMEer and seeker of the elusive E_s opening on 2 meters and above.

There is considerable documentation on the practice of predicting 6 meter sporadic E (E_s) openings based upon the geometry of 21 or 28 MHz E_s openings. If the intensity of E layer ionization increases, the length of the skip path shortens considerably. Thus, when 10 meter skip shortens to below 1000 km, a quick tune to 6 will sometimes result in finding the band wide open. This same practice is often tried to predict 2 meter E_s openings when 6 meter E_s shortens up. However, after many years of trying, this operator has found the success rate to be quite low. Whenever one is fortunate enough to catch an opening, the event is usually short lived and undoubtedly critical time was lost when operators at both ends of the opening did not recognize its existence.

In order to improve the success rate of catching short-duration sporadic E openings on the higher VHF bands, we will describe a technique of monitoring the maximum usable frequency (MUF) of an E_s ionization event. Monitoring the MUF is not an uncommon practice among hams but this column will provide one means for doing so in a more organized manner.

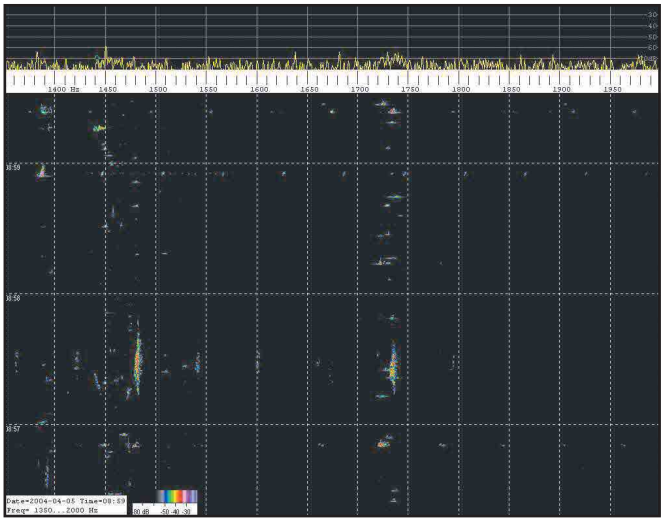


Figure 1—Waterfall display of two distinct VSB carriers. See text.

As the E_s ionization layer intensifies, the maximum frequency that will be reflected from that layer also increases. To determine the highest frequency that is reflected by an E_s layer, one needs to tune the spectrum for distant emitters that are being reflected by that ionized layer. Fortunately for us, there are a number of commercial communication services that use the spectrum between the 6 and 2 meters, and between the 2 and 1.25 meters that can be exploited to find the E_s MUF. Between 6 and 2 meters, there are three principal communication signals/services that can be used for MUF tracking: Vestigial sideband carriers for commercial TV channels 2 through 6; commercial FM broadcast from 88.1 to 107.9 MHz; and airport VOR (VHF Omnidirectional Range) beacons

Broadcast television uses a form of AM called vestigial sideband, or VSB. VSB is simply single sideband with reinserted carrier. A television receiver will lock onto the VSB carrier for synchronization of the color burst signals. For a typical TV broadcast transmission, approximately 50 kW of power is used in the VSB carrier. Thus, every TV transmitter is a powerful VHF beacon that should be exploited by the weak signal advocate for propagation detection. The frequencies for the VSB carriers are provided in Table 1.

The three slightly different VSB carrier frequencies for each channel act to reduce interference in a receiver that might have signals from two TV transmitters. The FCC issues frequency assignments (on either the negative, 0 or positive offset) to minimize cochannel interference. Once again, this is an aid to the VHF weak signal advocate. Even with a local TV transmitter, given a reasonably good VHF receiver you can likely hear the VSB carriers on distant transmitters using offsets other than your local station. Thus you can tell that the MUF has reached the frequency of a TV channel even when you have a local transmitter on that channel. Programming a scanning receiver with a bank of frequencies on SSB mode that will produce a tone on each of the TV VSB channels in Table 1 (less any local stations on their particular offset) will provide an MUF detection system up to 83 MHz. This concept detects works not only for E_s but is also an excellent meteor scatter detection system as well. During a major shower, listening to

This Month

June 4-7	Major Six Club Contest 23Z June 4 until 02Z June 7
June 14-16	June ARRL VHF Party Saturday 18Z until Monday 03Z
June 19-20	2004 SMIRK Contest Saturday 00Z until Sunday 24Z
June 28-29	ARRL Field Day—Saturday 18Z until Sunday 21Z

There are no weekend days with good EME conditions in June*

*Moon Data from W5LUU

Table 1
Low VHF TV VSB Carrier Frequencies

TV Channnel	*–*	*0*	*+*
2	55.240 MHz	55.250 MHz	55.260 MHz
3	61.240 MHz	61.250 MHz	61.260 MHz
4	67.240 MHz	67.250 MHz	67.260 MHz
5	77.240 MHz	77.250 MHz	77.260 MHz
6	83.240 MHz	83.240 MHz	83.240 MHz

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 (tel 301-948-2594) ♦ w3zz@arrl.org

a Channel 2 VSB carrier channel sounds like a fascinating crescendo of tones.

If you carefully monitor the spectrum over a few E_s seasons, you can determine the exact source of a transient VSB carrier. While the stability of the VSB TV carrier frequency is very high, there are some discernible differences between different stations using a stable VHF receiver and DSP software. I have observed more than a 900 Hz spread in the VSB carrier frequencies of stations in the western US. Using DSP software such as Spectrum Laboratory (**www.qsl.net/dl4yhf**), one can easily observe the presence of VSB carriers during a sustained E_s opening or even during short meteor burns. Matching the exact frequency of the VSB carrier to a station providing a viewable TV picture will give additional information about an E_s opening. Figure 1 shows a typical waterfall display showing the arrival of two distinct VSB carrier signals. From years of data collected from monitoring in Phoenix, the lower frequency signal is known to be the VSB carrier of a Houston, TX TV station and the higher one from Little Rock, AR. Without even listening to 6 meters, one can use the waterfall display to determine not only that the band is open, but also the direction of the opening. Using a visual display such as Spectrum Laboratory, one can significantly increase the likelihood of catching an E_s opening while attempting to monitor many bands at once.

During an intense E_s event, you may find that you are receiving signals all the way up to Channel 6 and still find that there are no signals on 2 meters. Here one needs to check the other sources of commercial transmitters listed above. Detecting distant stations (up to 2000 km) on the commercial FM band is a very good tool for predicting E_s on 2 meters. Note that many 2 meter E_s openings are often preceded by posts on the propagation reflectors and packet systems of the appearance of E_s in the FM band. In over 25 years of practice, this author has caught an existing opening or managed to open the band many times when large signals were detected at the upper end of the commercial FM band. Approximately 25 percent of the time when S9 level signals were detected on 107 MHz from stations at or around 1600 km on E_s, the 2 meter band was found to be open as well. No other detection method has been found to be as good.

The first step in using this method is to find a set of "clear channel" stations on the FM band for your area. This may be difficult because of station density in the more highly populated areas of the country. A clear channel is usually described as a frequency that is at least two channel slots away from any other station, both above and below. In Phoenix, AZ, there are only 7 such slots, but they are all very important. The next step is to prepare some tools for determining the direction and distance to the distant stations that are heard on the clear channels when the MUF rises over 88 MHz. When a distant station is heard, the mode of propagation is never quite clear. The best way to identify an E_s signal is by the rate of variation of the signal amplitude. If your receiver has an S-meter, rapid variation in a signal (1 to 2 seconds between peaks) is fair indicator of a signal propagating by E_s rather than slow fading (10 seconds or longer), which is more typical of tropospheric ducting.

Another means of determining the distance and/or direction of E_s propagation is by deciphering information from the program material on the commercial station. The distant station's ID at the top and bottom of the hour can easily provide information about the location of the transmitter. At other times, you must depend on commercials, telephone numbers, local city names or other verbal passages in the program material.

To decipher the location of commercial FM transmitters, this author has built databases that collect information from FCC Web sites about FM Broadcast stations on each clear channel. On these sites, you can launch queries on the location of transmitters in a number of different ways. One approach is to make query the location of commercial FM stations in each state that is in the usual range for E_s. Because E_s on the higher VHF bands tends to be long, a good rule of thumb is to look for stations that are from 1500 to 2000 km away. Searching such FCC databases as **www.fcc.gov/mb/audio/fmq.html** [choose FM List for exact geographic coordinates] for stations in each state within that range provides a somewhat large number of hits. So eliminating all hits for low power stations (under 1 kW) can reduce this to a reasonable list of targets.

The FCC database also contains the coordinates of the transmitter location. Entering station data into a spreadsheet and calculating the bearing to each station on the list provides one additional tool for station identification. [One excellent Windows based distance/bearing program is *WinGrid* Ver 4.0 available at **www.keplerian.com**.] Using a directional antenna for MUF tracking, you can determine the approximate bearing of the incoming signal and, using the spreadsheet, you can narrow the search to stations that lie on the same approximate heading. Information on the bearing and distance to an incoming signal on E_s gives you insight into the nature of the opening. If the signals on the upper end of the FM band are distant (toward 2000 km) it is unlikely that the ionization layer will support propagation on 2 meters. If the signals are from closer stations (toward 1500 km), turn your antenna in the direction of that station and start calling CQ and you may open the band.

Using these two tools for sporadic E detection, this author has caught over 100 E_s openings on 2 meters. If you are fortunate enough to encounter a 2 meter E_s opening, you can use the same technology to check an open frequency between channel 7 and channel 13. Your reward may be to add to the handful of 222 MHz E_s opening ever recorded, as the author did in the summer of 2003 (reported in this column in September 2003 *QST*). Work on using VOR beacons for additional information about openings is ongoing with no success to report to date. The success rate of this approach to E_s detection would clearly improve if stations on the other end of potential openings were similarly alerted to these short and exciting VHF openings using the same technique.

Good luck and see you all of a sudden.

ON THE BANDS

My faithful correspondent Ted, G4UPS, sums up the month of March the best: "These are the worst conditions I have experienced on 6 m since I operated from ZD8TC in 1981—a complete month without a single contact on 6 meters." And for the most part that wasn't only on 6 meters.

6 meters. March 12 supplied about the only excitement this month following a period of high geomagnetic activity caused by transequatorial coronal hole CH84. Following an early (GMT) E_s opening from the northeast into FL, around 20Z W4s and 5s had F2 propagation into the Caribbean, Northern South America and TE to LU. Dale, AA5XE, and Pat, W5OZI (both EM00) were typical with contacts to HP, 9Y, FG, FY and strong backscatter to NV, FL and Mexico. Better yet they and W5s and 4s worked Socorro Island XF4IH (DK48), essentially the only day that rare expedition was heard in the US. Gary NW5E and Ivars KC4PX (both EL98) both worked them. Gary says the heading was skewed to due south and large amounts of backscatter were evident. Jon, NØJK (EM17) also worked them skewed heading with a 2 element beam from a parking garage. The backscatter extended to Al, K7ICW, but no path to XF4IH. On March 22 Bernie, W3UR, at *The Daily DX* reports that the 3B9C Rodrigues Island DXpedition has been working into the Mediterranean, Central Asia and JA on an almost daily basis. Hatsuo, JA1VOK, confirms strong 3B9C signals in Japan and the appearance of FR1AN in western JA on March 28. Also on the 28th, Chuck K5IX (EL29) reported a good TE opening to LW3EX, LU9DFN and other LUs.

Tropospheric ducting. The Gulf tropo season is beginning. Ron K5LLL (EM10) worked KE4YYD EL79 and WA8TTM EL89 in FL on 144 and 432 MHz. The next day he worked NN5DX (DM80) on 144 through 902 MHz and 3 stations in DM84 (KD5RPH,

Table 2

144 MHz Standings

Published 144-MHz standings include call-area leaders as of April 1. For a complete listing, check the Standings Boxes on the World Above 50 MHz Web pages at **www.arrl.org/qst/worldabove**/. To ensure that the Standings Boxes reflect current activity, submit reports at least every two years by e-mail to **standings@arrl.org**. Printed forms are available by sending a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

Call Sign	State	States Worked	DXCC Entities Worked	Grids Worked	DX† (km)
1					
K1CA *	NH	50	112	—	—
K1MS *	MA	50	32	—	2166
AF1T *	NH	50	28	—	2240
W1JR *	NH	50	23	203	2304
W1AIM *	VT	50	18	202	2276
K1UHF *	CT	44	33	275	—
K1SIX *	NH	43	14	201	2501
WZ1V	CT	38	10	279	2700
W1REZ	ME	36	6	182	2587
K1TEO	CT	36	5	226	2420
W3EP/1	CT	36	3	173	2450
W1ZC	NH	35	2	179	2490
W1LP	MA	32	5	135	2340
K1LPS	VT	31	2	96	2273
K5MA	MA	30	2	138	2524
W1GHZ	MA	29	2	94	2363
WA1ECF	MA	28	4	110	2340
AA1YN	NH	28	2	56	2201
2					
K2AXX	NY	40	4	213	2340
K1JT *	NJ	38	15	164	2123
K1NY	NY	38	4	151	2576
WB2CUT	NJ	37	2	149	—
W2MPK *	NY	36	8	—	—
K2OVS	NY	36	5	131	2812
WA2ZFH	NY	24	3	52	2208
3					
W3EME *	PA	50	26	151	—
WA2FGK *	PA	45	36	242	—
W3ZZ *	MD	38	6	235	2538
AE3T	PA	37	3	—	2510
WA3BZT *	DE	36	21	126	662
K3ZO	MD	36	2	137	2282
W3BO	PA	35	3	121	2200
4					
WA4NJP *	GA	50	76	245	—
WA4MVI *	SC	50	66	—	2498
W8WN *	KY	50	61	406	2273
NB2T *	FL	50	5	97	2290
W4WA	GA	42	5	137	—
W4WTA	GA	40	4	175	2413
W4DEX	NC	40	—	—	—
WB5APD	GA	39	7	255	2285
KU4WW	AL	39	3	159	2968
K4QI	NC	37	5	211	—
AA4H	TN	37	3	163	2007
KG4BMH	TN	37	2	135	2019
N4MM	VA	35	5	149	—
K4MM	FL	30	7	128	2347
5					
N5BLZ *	TX	50	101	342	—
W5RCI *	MS	50	38	278	2150
W5ZN *	AR	50	37	312	2400
W5UWB*	TX	50	29	194	2197
K5CM *	OK	50	—	—	—
W5LUA *	TX	50	—	—	—
K5UR	AR	48	5	465	—
NL7CO	OK	40	2	185	2465
N5KDA	MS	39	4	192	2257
NE0P *	OK	39	2	132	2171
W5HNK	TX	37	3	—	2442
WA5JCI	TX	36	5	188	—
AA5C	TX	34	2	184	2202
K5LLL	TX	34	2	151	2442
WA5TKU	TX	32	3	141	2376
K5TN	OK	32	1	128	2025
N5HYV	LA	28	1	150	—
W5OZI	TX	24	2	138	2268
6					
K6AAW *	CA	50	57	371	3831
WA6PEV *	CA	50	52	—	—
K6PF *	CA	43	38	194	4013
K6QXY *	CA	24	8	—	3794
W6TOD	CA	21	3	—	—
7					
W7GJ *	MT	50	110	—	—
AA7A *	AZ	50	54	419	2983
W7MEM *	ID	50	40	283	—
W7RV *	AZ	50	29	257	2937
WA7KYM *	WY	49	30	190	2359
WA7GSK	ID	29	2	203	3635
8					
K8BHZ *	MI	50	45	362	2278
W8PAT *	OH	50	38	214	2207
W8MIL	MI	42	1	—	2200
WB8TGY	MI	40	2	153	2262
WA8EOJ	OH	39	3	199	2198
K8ROX	OH	39	2	150	1984
N8KOL	OH	38	2	165	2035
K2YAZ	MI	38	2	162	2167
WB8XX	OH	32	2	117	1759
9					
W9JN *	WI	43	12	242	2261
KA9UVY	IL	42	2	159	2373
N9NJY	IL	39	4	166	1655
WA9PWP	WI	32	2	140	1940
KJ9I	WI	29	66	—	—
Ø					
WØHP *	MN	50	86	—	—
KØFF *	MO	50	34	267	2185
WØLD *	CO	50	26	167	2373
KMØA *	MO	47	11	387	2780
NØLL	KS	47	3	377	2378
KØSQ	MN	46	3	240	2804
NØPB	MO	45	3	249	2058
WØRT *	KS	45	3	206	2298
KWØA	MO	45	2	245	2501
WØOHU	MN	45	2	181	2040
KØAWU *	MN	45	2	175	2095
NØUK *	MN	44	2	201	2053
KØCJ	MN	44	2	—	2330
WAØKBZ *	MO	43	4	170	—
KØUO	KS	41	3	266	2152
KØVSV	IA	41	2	169	2080
NØVSB	CO	36	4	164	2353
KØRZ *	CO	26	2	108	2390
Canada					
VE3FKX *	ON	41	8	—	—
VE3DSS *	ON	38	3	—	2284
VE3TMG	ON	30	2	156	1918
International					
KL7X *	AK	49	36	177	—
XE2AT		2	2	2	1635

*Includes EME contacts
†Terrestrial
—Not given

KD5RPE and KB5UOT) on 144 through 432 MHz. NN5DX also worked K5VH (EM00) on 902. On 2 meters the opening appeared to extend to K5SW (EM25) to the north and N5HYV (EL59) to the east.

EME. Now that sunspot cycle is headed downward with a vengeance, the only way to work DX will be either via E_s or by EME. Stations like W7GJ and WA4NTP are among the latter. Lance W7GJ received partial information from 3B9C using JT65A but reports that Kjell, SM7BAE, was successful and that others ought to make it. From the DXpedition URL **www.fsdxa.com/3b9c** and the *432 EME and Above News* comes word that the first ever 70 cm EME contact was achieved at 1200Z March 31 between 3B9C and HB9Q. The 3B9C operators, Dave, G4FRE, and David, GØMRF, were running 700 W from a Discovery amplifier using a GS31B to 4 az-el–mounted 19 element F9FT Tonna Yagis.

Meanwhile Mick, W1JJ, describes using two 9KHW Yagis to make 6 meter JT65A contacts with JG2BRI on March 1 and JM1SZY on March 27. Conversely, John, W5UWB, shows what a single 5WL Yagi can do on 2 meters by making a contact with AA9MY and his single 18xxx Yagi. John was also successful with KL7IZW (EM13) who runs only 150 W to a VE7BQH 15WL Yagi.

Shelby, W8WN, notes that Mario, I2PHD, has uploaded a new version of his popular *Spectran* program (V2 Build 212) to his Web site, **www.weaksignals.com**. The newest version of *Spectran* contains many new features and solves certain incompatibility problems by eliminating interfacing with the computer sound card mixer. Shelby also notes that conditions were very good on 2 meters during the recent DUBUS EME contest with lots of JT65 activity.

Microwaves. Howard, WA3EOQ, reports that the K3LNZ/B 1296 MHz beacon is on the air in FM09gg about 200 km west of the Washington, DC area. It runs 5 W ERP to four little wheels on 1296.219 from K3EE's QTH on Backbone Mountain, MD, at a height of 1000 m. Send reception reports to Mark at **k3ee@arrl.net**.

HERE AND THERE

DXpeditions. Jon, NØJK, plans to be active again this year as VP9/NØJK from Bermuda between June 10 and 15. He will have capabilities on 6 and 2 meters and on 70 cm. His preferred frequency during the contest will be 50.121. Jimmy, W6JKV, will activate Dominica (J7) from June 24 to July 5. Jimmy says the location has a good view over water to the US and Europe.

New E-skip Alerting System. In addition to the GoodDX Robot of PE1NWL described last year in this column, Shelby, W8WN, reports a new E_s alerting system for North America—Live MUF—by G7RAU and EA6VQ, which has been in use in Europe for several years and has now been modified to include North America. Information on both of these programs, with links to their Web pages, can be found at **www.qsl.net/w8wn/hscw/papers/esopen.html**.

Major Six Club Contest. The Six Club holds its major contest the first weekend of June beginning 2300Z Friday June 4 and ending 0200Z Monday June 7. The contest is open to everyone. Exchange grid squares and six club numbers (if you have one). Contacts with stations outside your continental country count double. Multiply total QSO points by the total number of grids worked. Further details are at **6mt.com/contest.htm**.

June ARRL VHF QSO Party. This favorite of the E skip crowd runs from 18Z June 12 to 03Z June 14. This is a wonderful opportunity to boost your grid totals, especially on 6 meters. Conditions were excellent last year—let's hope for a repeat this year. Further information can be found in this issue of *QST* or at **www.arrl.org/contests/rules/2004/june-vhf.html**.

2004 SMIRK Contest. The 2004 Six Meter International Radio Klub (SMIRK) QSO Party runs from 0000Z June 19 to 24Z June 20. The exchange is grid square and SMIRK number (if you have one). All 6 meter stations are welcome. Further information can be found at **www.smirk.org/**.

HAMSAT From India

By Andrew C. MacAllister, W5ACM

AMSAT-NA, the Radio Amateur Satellite Corporation, isn't the only group with satellite projects scheduled for launch in the near future. New offerings from domestic and foreign organizations are always vying for opportunities to send their hardware into space. We've all heard of AMSAT-NA's latest project, AMSAT-OSCAR-Echo or just AO-E, but there are other satellites waiting for launch. One of the most exciting is from AMSAT-India called, appropriately, HAMSAT or VUSAT.

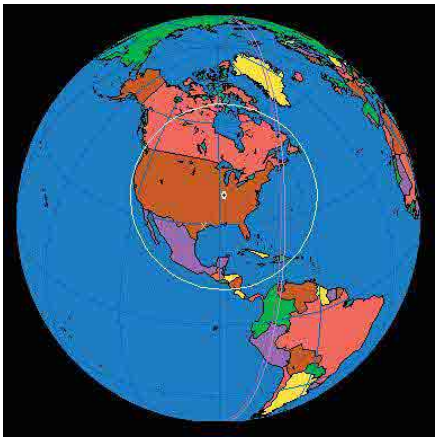
Coming Soon To A Horizon Near You

India is not new to the satellite business. The country's first, Aryabhata, went to orbit in April 1975 on a Soviet launcher from the Volgograd Launch Station. At 360 kg, this was not a small satellite, and it was all built in India. Since then, there have been several satellites from India, and an interest has developed in the Indian amateur community for a homegrown Amateur Radio satellite.

In January 2001, at a meeting of Indian satellite enthusiasts, a plan was drafted for the design, construction and launch of HAMSAT, also known as VUSAT. The amateur call sign prefix for India is "VU." The inspiration for this meeting may date back to an address made by the ISRO (Indian Space Research Organization) Chairman Kasturi Rangan at Hamfest India '98 in Bangalore, India. Dr Rangan suggested that the hams of India consider creating a ham radio satellite with ISRO support. The speech was well accepted and taken to heart by many in attendance.

The success and ease of use of the Mode-B transponder on AMSAT-OSCAR 7 (70 cm up and 2 meters down) obviously impressed the technical members of the group in India. Their plan was to design and build a similar transponder for an Indian satellite to be launched on an Indian launcher. Continued promises of support from the ISRO helped bring the group to action, and the subsequent creation of AMSAT-India (**www.amsat-india.org**).

Early plans for HAMSAT included two Indian beacons, one for telemetry and one for voice messages, an Italian transponder and a Dutch transponder. As with any significant project, some items on the wish list never made it to the finished product. The final configuration did not have the Indian message beacon or the Italian transponder, but work on other fronts has resulted in a simple, yet complex, state-of-the-art communications satellite.



Anticipated coverage circle of HAMSAT on a typical pass over North America using *InstantTrack* software from AMSAT-NA and pre-launch orbital parameter data.

PE1RAH PHOTO

Nagesh Upadhyaya, VU2NUD, and William Leijenaar, PE1RAH, in the Bangalore, India ISRO clean room with the HAMSAT satellite.

Launching HAMSAT

HAMSAT originally had a scheduled launch date of October 15, 2003. This has changed. During final thermal and vacuum tests in September 2003, HAMSAT exhibited some operational problems. A transmitter output filter was showing erratic behavior. The symptoms were observed, but the problem could not be isolated in time for the hoped-for 2003 launch. However, the problem has now been corrected. Launch is now expected in late 2004.

The launcher is an Indian PSLV (Polar Satellite Launch Vehicle). This rocket has four stages and was originally designed to send 900 kg (~2000 lb) Indian Remote Sensing Satellites (IRS) into a 900 km polar, sun-synchronous LEO (Low Earth Orbit) from Sriharikota, India. Since the first successful flight of a PSLV in 1994, there have been several modifications to enhance capabilities for larger payloads and orbital options. A recent PSLV flight inserted a 1060 kg METSAT (Indian Meteorological Satellite) into a GTO (Geosynchronous Transfer Orbit) orbit with a 250 km perigee (orbital low point) and a 36,000 km apogee (orbital high point). The main payload for the flight of HAMSAT is IRS-P5. The orbit for HAMSAT is expected to be in the 800-820 km range. This will provide ground-station acquisition times of 12-16 minutes four to six times a day. Check the AMSAT-NA Web site (**www.amsat.org**) for news about the launch of HAMSAT.

Working HAMSAT

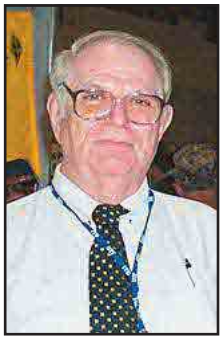
The Mode-B linear transponder format has been very popular since the launch of AO-7 in 1974. If your station can work AO-7 today, it will be just right for HAMSAT. Full duty-cycle modes like FM will work through HAMSAT, but they are not recommended. While the transponders on HAMSAT provide only 1 W output across the 50-60 kHz bandwidth, this is sufficient for a sensitive 2-meter ground-based receiver with a small beam antenna. For the uplink, 10 W on 70 cm to a 10 dB gain antenna should be sufficient. Any sensitivity or power-output differences between the Indian and Dutch transponders are expected to be small, but will be measured after launch during the early testing phases of the satellite.

Congratulations are in order for AMSAT-India, William Leijenaar, PE1RAH, the ISRO and other Indian hams who have come together to build and prepare HAMSAT for launch. Due to the inspired nature and synergy of those involved, more Amateur Radio satellites and launches are expected from India. I'll see you on VUSAT/HAMSAT Mode B soon.

You can contact the author at 14714 Knights Way Dr, Houston, TX 77083-5640; **andrew.macallister@emersonprocess.com**.

International Amateur Radio Union Announces Election Results

In voting completed March 16, the member-societies of the International Amateur Radio Union (IARU) (**www.iaru.org**) overwhelmingly ratified the re-election of Larry E. Price, W4RA, as president, and the election of Timothy S. Ellam, VE6SH/G4HUA, as vice president. Both will serve five-year terms beginning May 9. There were 82 votes cast for Price, with one abstention, and 81 votes for Ellam, with two abstentions. Ellam succeeds Dr David A. Wardlaw, VK3ADW, who has served as vice president since 1999 but was not available for another term.



IARU President Larry Price, W4RA.

Tim Ellam, VE6SH, at the 2002 ITU Plenipotentiary Conference.

President of the IARU since 1999, Price is a past president of the ARRL. He holds bachelor's degrees in electrical engineering (electronics major), a master's in business administration and a doctorate in finance. Price is an emeritus professor of finance and economics at Georgia Southern University, where he served as a professor and department head.

Price was IARU vice president in 1983 and 1984 and served as secretary from 1989 until 1999. He has attended 17 IARU regional conferences—six each in Regions 1 and 2 and five in Region 3—and has represented the IARU at every ITU World Radiocommunication and Telecommunication Development Conference held since 1992 as well as at numerous other ITU meetings. He is a senior member of the Institute of Electrical and Electronics Engineers (**www.ieee.borg**).

First licensed at age 16 in 1951, Price has held elected office in the ARRL continuously for more than 25 years until stepping down as ARRL International Affairs Vice President in January 2000. A resident of Statesboro, Georgia, he was ARRL president from 1984 until 1992.

Ellam is a barrister and solicitor with the law firm of McCarthy Tetrault LLP and is a partner in the firm's Calgary, Alberta, and London, UK, offices. Born in England, Ellam emigrated to Canada in 1972 and holds both Canadian and British/EU citizenship. He earned a bachelor's degree in political science and economics from the University of Calgary and his law degree from the University of Alberta, Edmonton. He's a member of the law societies of Alberta and England & Wales as well as of the International Bar Association.

Ellam has served as an IARU expert consultant since 2000, represented the IARU at the 2002 meeting of the ITU Special Committee on Regulatory and Procedural Matters and the 2002 ITU Plenipotentiary Conference and appeared as a speaker and panelist at the ITU Americas Telecom 2000 in Rio de Janeiro and ITU Africa Telecom 2001 in Johannesburg.

First licensed in 1977 at age 16, he has held executive positions in the Radio Amateurs of Canada (**www.rac.ca**) and one of its predecessor organizations, the Canadian Radio Relay League, starting in 1990. Ellam was a delegate to the 1998 IARU Region 2 Conference and was elected to the Region 2 Executive Committee in 2001. He attended February 2004 IARU Region 3 Conference in Taipei as an observer on behalf of IARU Region 2.

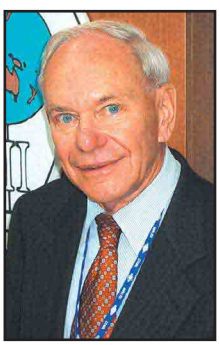
Retiring Vice President Wardlaw was honored last month for his service and accomplishments during his term during the closing Plenary of the IARU Region 3 Conference in Taipei. Wardlaw served as a member of the Australian delegation to WRC-02 and WRC-03, and he represented the IARU at preparatory meetings of the Asia-Pacific Telecommunity, contributing substantially to the favorable outcome for the amateur services.

Briefs

The 12th Conference of IARU Region 3 was held in Taipei, Taiwan, 16-20 February, and was hosted by the Chinese Taipei Amateur Radio League (CTARL). The conference attracted more than 60 participants representing 17 Region 3 member-societies directly, and another 7 by proxy. The International Secretariat was represented primarily by Vice President David Wardlaw, VK3ADW, with assistance from David Sumner, K1ZZ. Region 1 was represented by Secretary Don Beattie, G3BJ, and EC member Hans-H. Ehlers, DF5UG. Region 2 was represented by EC member Tim Ellam, VE6SH (Region 2 Secretary Rod Stafford was also present as ARRL International Affairs Vice President).

While declining numbers of licensees, members and active amateurs were reported by a number of societies, this was by no means universal. Chinese Radio Sports Association (CRSA) and CTARL in particular reported strong growth. WIA reported that the dropping of the Morse requirement had had a positive effect in Australia.

Region 3 Chairman of Directors Fred Johnson, ZL2AMJ, had announced his intention not to stand for re-election as a Director. The other four incumbents, HL1IFM, JJ1OEY, VK2BPN and 9V1UV (along with Secretary Keigo Komuro, JA1KAB) were successful in their bids for re-election. Of the other four candidates, BA1HAM, DU9RG, VU2RCR and ZL2AZ, it was Chandru, VU2RCR, who emerged victorious. VU2RCR is the new President of the Amateur Radio Society of India (ARSI) and had a most fruitful conference as a first-time attendee. In addition to being elected a Director, he served as convenor of the Finance Committee and succeeded in having ARSI's bid to host the next Region 3 Conference in angalore, tentatively in November 2006, accepted.



IARU Region 3's new Chairman, Peter Naish, VK2BPN.

As is the custom in Region 3, the new Directors met briefly to elect the Chairman of Directors while the Conference waited. Peter Naish, VK2BPN, was unanimously elected to replace Fred Johnson. QST

Taking Emergency Communication Training to the Next Level—*Part 2*

By Daniel J. Sullivan, KO1D
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Note: Part 1 of this article appeared in May 2004 QST*, pp 81-83.*

Tabletops, Drills and Full Scale Exercises

The Tabletop exercise is probably the least known to most hams. No radios, no antennas to erect, no weather to contend with, unless it prohibits you from getting to the site of the Tabletop; just a lengthy discussion to resolve a situation using your current plans. Often, when a jurisdiction does this they have multiple tables set up, each with a different function. Fire, Communications, Law Enforcement, Emergency Management, EMS, Environmental Protection, Medical Examiner and others may each have their own table. For our purposes, however, there would be one table with representatives of the served agencies requested to be present as well as various operators who would be assigned as liaisons at each site.

For example, KZ2GGG is assigned to shelter work at the Ludlum School, AA8AA is the EOC operator and Joe Smith is the Emergency Management Director (EMD). At the Tabletop Joe might ask AA8AA, as part of the discussion, how he and KZ2GGG might coordinate a logistics briefing over the air because the EMD needs to place an order with FEMA for more cots. AA8AA and KZ2GGG might explain they would do this over the 2 meter repeater in Anytown, USA. At this point, the facilitator might inquire how they would do this if the repeater were down because of a power outage and a faulty generator. If AA8AA and KZ2GGG know their procedures well enough and know of an alternative, they would respond in kind. If they do not have an alternative or do not know their procedures, then the evaluators (who should be hams familiar with the local procedures) will make a note. During any debrief and After Action Report (AAR) you can determine why that happened and include a resolution of the matter in your AAR.

The Long Haul

After your planning is taken care of in the first quarter, plan to take a day one time in the second quarter of the year and do a Tabletop. Talk through the problem; insert artificial problems and issues that realistically might occur. What do you do when the repeater fails? Does anyone know where the dead spots are in the county on 6 meters? What is the best spot

Table 1
Example of a Year Long Exercise Program[1]

Smithville County, USA ARES/RACES Exercise Training Schedule

Quarter	*Month*	*Item*	*Goals*
Quarter I	January	Tabletop Initial Planning	Establish Exercise Objectives, Scenario, Participants List, Establish a Method for Collecting Data on Participants Performance to be Analyzed, Establish Dates for Tabletop, Tabletop AAR, SET, SET AAR
	February	Tabletop Midterm Planning	Confirm Previous Month's Decisions and Layout Ground Rules for the Event, Draft Inject Ideas
	March	Tabletop Final Planning	Finalize all Preparations for the Tabletop, Confirm Location, Confirm Injects, Prepare Any Handouts, Confirm Participants List
Quarter II	April	**Tabletop Exercise**	Conduct the Tabletop over a 3 to 4 hour period
	May	Draft the Tabletop Report	Draft a Report to be Submitted to the SM, SEC, EMA Training Officer, Relevant Participating Agencies and the EC involved
	June	Present and Finalize the Tabletop Report	Present the Report to the Participants and Work Out a Plan to Make any Adjustments to Compensate for Weaknesses; Give hardcopies of the Final report to the SM, SEC, EC, Relevant Participating Agencies and EMA Training Officer
	June	**Field Day**	Use Field Day to Note any Weaknesses in the Club's/ or Your Personal Equipment
Quarter III	July	SET Initial Planning	Using the Scenario Developed for the Tabletop, Begin to Develop Your SET
	August	SET Midterm Planning	Continue to Develop the SET
	September	SET Final Planning	Finalize All Injects, Participants, Handouts, Notifications, and Locations for the SET
Quarter IV	October	**SET**	Execute the SET
	November	Draft the SET Report	Draft a Report to be Submitted to the SM, SEC, EMA Training Officer, Relevant Participating Agencies and the EC involved
	December	Present and Finalize the SET Report	Present the Report to the Participants and Work Out a Plan to Make any Adjustments to Compensate for Weaknesses; Give hardcopies of the Final report to the SM, SEC, EC, Relevant Participating Agencies and EMA Training Officer

[1]These examples were from the Hurricane Isabel activation in the Virginia section.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

in the region for a portable repeater running 50 W? What would you do if your telephone tree couldn't operate because the phones were down?

Someone should be working with the planning group on assembling a short report on what the scenario was, what issues were noted, what great ideas came forward (often times as important if not more so then the weaknesses), what oversights were revealed and most importantly, establishing the who, when and how of making any revisions to current plans. Present these findings to your group in the third quarter and see what can be done about fixing these issues, if anything at all.

Finally at the end of the year, quarter four, have an SET. Use the same scenario and participants if you can. Encourage a full activation of your group and invite the local Emergency Manager and leaders of local served agencies. Using what you learned at the Tabletop, try and improve upon your performance. Again, take note of any issues same as before. After the exercise, talk to each other about what went right and what needs more attention. Prepare another AAR the same as the first. Establish who will take charge of fixing what issues were revealed and congratulate those who did extraordinarily well.

AARs

Not many of us write up reports after a walk-a-thon, marathon, or even a hurricane, but boy wouldn't it be nice to remember just how Fred, WZ6ZZZ, solved that tricky issue about mounting an antenna at the firehouse? How about seeing if anyone remembers where WX5YGH parked his mobile with the cross band repeater that had great coverage of the incident scene? For whatever reason, no one knows and the operators responsible cannot be contacted. What can you do?

A written AAR has a couple of important benefits. First, if you write a report after each exercise and real time incident you create a library of information that can be referred to and utilized in refining your plans and procedures. Second, documenting your efforts is a great way to show your capabilities to the jurisdiction's emergency management agency (EMA). Have the jurisdiction's EMA Training Officer receive a regular copy of your reports for his/her files. Again, credibility means everything, and if you demonstrate a true effort to mitigating against failure by working on the details ahead of time, you will be far more important and valuable than someone who puts their name on a list and never shows up until the real event, and then cannot understand why they are turned away. Finally, a written AAR is a measure of your improvement as an emergency communications group. You want to show that each year your group improved itself and congratulate yourselves on how far you have come. So why not do it in writing? Sure, it may start rough, but in a few years think of how many refinements can be made.

Editor's note: This article will conclude next month.

Field Organization Reports

Compiled by Linda Mullally, KB1HSV

Public Service Honor Roll
March 2004

This listing is to recognize radio amateurs whose public service performance during the month indicted 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.

525
N9VE
510
N2LTC
470
KC2HUV
462
W2MTA
360
KA2ZNZ
301
N2YJZ
300
KC2MBC
288
AB2IZ
287
KC2DAA
280
W2FPG
265
NN2H
245
KA2GJV
233
K2ABX
225
K9JPS
220
WA2ZCM
K2MPE
KB2CCD
KB2SNP
211
KB2ETO
210
K2AN
W2LC
WA0ZTY
205
KB2DQ
191
KA0DBK
190
KB2KOJ
WI2G
184
WB6UZX
182
KK3F
175
K4RLD
174
WA1QAA
170
KB5JBV
K7UGT
166
N1IST
165
AD5KE
KØIBS
163
KB5ILY
158
KG9B
150
KB2VRO
N2JBA
142
KB2RTZ
140
K7BFL
K9LGU
135
N2HQL
KB3GFC
WB8RCR
132
W5OMG
130
WB2UVB
N2GJ
N8IO
AG9G
KC5OZT
WB5ZED
KA5KLU
AC5XK
VE3EUI
W3YVQ
W4EAT
WB1CHU
128
K2GW
127
W2DWR
126
W3NJ
125
WB2KNS
K9FHI
KA0O
120
K2UL
K5DPG
AC5VN
N2AKZ
N1LKJ
W1GMF
KW1U
AB4XK
W8YS
WB0TAQ
WX4J
KK1A
W6QZ
N5WSW
K6YR
K4IWW
AD4XV
119
NN7H
K4BEH
118
W4NTI
K7EAJ
KC7SGM
115
N3YTD
W8JEB
N5OUJ
W3CB
WA9JWL
114
W5IM
112
KA2YKN
N3RB
110
W2QOB
NF5B
N5KWB
K5MC
KD1LE
N2JWW
N1IQI
W4AUN
W7GB
W9BHL
AG4DL
N7CM
N7YSS
N3SW
W3ZQN
WA5OUV
N5IKN
K3JL
AD5IS
W5GKH
N8FPN
AB0WR
AF4NS
W4DAC
KE4JHJ
109
W4CAC
108
W2CC
106
KC2IYC
105
W8MMN
WA2YBM
WX4H
104
KB9KEG
102
W5PY
101
WD4LSS
100
KB2KLH
KC2GOW
WA8SSI
WA2WMJ
WØHXB
K4SCL
N8FXH
KD4CQJ
WØHXB
KC2EOT
WB2QIX
W9CBE
NR2F
N9MN
W7GHT
KK5GY
WNØY
KB5TCH
N5SIG
K4DND
KV4AN
KG4OTL
AA8SN
W9NXC
KF6OIF
W1QU
WA1JVV
W0UCE
KA4UIV
98
W4ZJY
97
K4BMH
96
KW7DSP
KD5ONS
KO4OL
K8ZJU
95
KC8VIF
N2RTF
N8NMA
AF2K
W7RRC
K3SS
AA3SB
94
KBØDTI
93
WB2LEZ
WB6UZX
91
KA9RZL
90
WA2CUW
N1JX
KF7GC
W2DSX
N8DD
KC8UZL
N2QZ
N3KB
WD8DHC
KA8WNO
W8CPG
W4CKS
KG2D
N2JRS
WB2IJH
K1JPG
KF4WIJ
N7DRP
W3TWV
W5UYH
W5CU
K3CN
K2VX
K8AE
WB4GGS
W4WXA
K4WKT
K4FUM
AA3GV
N3WK
N3OR
K3IN
KA4LRM
89
K8VFZ
KG4OQA
W4LN
88
KB8NDS
87
K2BCL
W6JPH
K2YYF
86
W8IM
85
G4MLD
K8SH
K4KAM
KZ7T
KK7TN
KF4OCU
84
W4YTC
WB7VYH
KC6SKK
K4BG
82
WA2GUP
81
W1ALE
KD1SM
80
KC2ANN
W5NK
WD8Q
WW3JC
K7GXZ
K8KV
KL7OR
WAØLYK
WB4IBK
N3ZOC
AA4YW
77
W1PLW
76
KC4ZHF
W7VSE
KD5OYH
KC8QNE
75
W5XX
W4DLZ
KC6NBI
73
K5ER
KE2SX
72
N4JBP
70
W4DGH
ABØUY

The following stations qualified for PSHR in February, but were not recognized in this column: K7BFL 170, KC8QNE 155, KE4UOF 130, KA4FZI 120, W7GB 110, KD4GR 110, WA2YL 110, K7GXZ 100, WA4EIC 100, KG4CHW 100, AA4BN 94, KG4MLD 85, KG4MLC 80, K6JT 76.

Section Traffic Manager Reports
March 2004

The following ARRL Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, DE, EB, EMA, ENY, EPA, EWA, GA, IA, ID, IL, IN, KS, KY, LA, MDC, ME, MI, MN, MO, NC, NE, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, ORG, SB, SC, SD, SJV, SNJ, STX, VA, VT, WCF, WI, WMA, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports
March 2004

The following ARRL Section Emergency Coordinators reported: AK, AZ, CO, EWA, IL, IN, KS, KY, LA, MI, MN, MO, NC, NFL, NLI, NNJ, NNY, NV, SFL, SJV, SNJ, SV, VT, WMA, WTX, WV, WWA.

Brass Pounders League
March 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*
KK3F	34	2896	2854	54	5838
W4EAT	0	2832	2805	1	5638
W4ZJY	0	2297	2144	0	4441
W1GMF	0	838	2248	35	3121
WB5ZED	40	1320	1293	16	2669
N2LTC	0	1115	1154	48	2317
KA5KLU	0	1064	1199	49	2312
AD6DV	0	936	962	16	1914
N1IQI	0	425	1005	5	1323
WX4H	0	567	681	4	1252
W4DAC	10	583	559	34	1186
K7BDU	12	491	525	4	1032
K9JPS	0	475	35	431	941
N8IXF	-	-	-	-	800
KF4WIJ	6	346	326	46	724
AB0WR	0	342	359	0	706
W7QM	0	305	382	3	690
N5SIG	4	371	263	28	666
KW1U	0	348	303	2	653
W6DOB	0	254	350	34	638
K2JWW	18	278	207	120	623
WB4GGS	304	290	3	0	590
WB2IJH	0	273	272	0	545
W7TVA	33	239	212	60	544
KA2ZNZ	18	260	239	22	539
KB5JBV	0	273	265	0	538

BPL for 100 or more originations plus deliveries: KØIBS 199, N9VE 129, K2YYF 111, W7RRC 107. The following stations qualified for BPL in February, but were not recognized in this column: KD8HB 605, K4FQU 165.

COMING CONVENTIONS

ATLANTIC DIVISION CONVENTION

June 4-6, Rochester (Henrietta), NY

The Atlantic Division Convention (70th Annual Rochester Hamfest and Computer Show), sponsored by the Rochester ARA, will be held at the Monroe County Fairgrounds, 2695 E Henrietta Rd; Rte 15A and Calkins Rd. Outdoor flea market runs continuously for the entire weekend beginning Friday at 6 AM; indoor exhibits open Friday noon to 5:30 PM, Saturday 8:30 AM to 5:30 PM, Sunday 8:30 AM to 1:30 PM. Features include outdoor flea market with 1200 vendors, 150 indoor commercial exhibitors with up-to-date radio and communications equipment, complete computer systems (components, software, shareware), awards banquet (Friday, 6:30 PM at the Holiday Inn Rochester South, 1111 Jefferson Rd; $29, includes registration), full day and a half of programs (Friday and Saturday at the Dome Center), DX card certification, VE sessions (on site Friday and Saturday, walk-ins accepted), limited number of camper-RV hookups are available on the grounds, handicap parking. Talk-in on 146.88 (110.9 Hz). Admission is $9, under 12 free. Outdoor flea market tailgate 10-ft × 20-ft spaces are $10 each. Contact Harold Smith, K2HC, 300 White Spruce Blvd, Rochester, NY 14623; 585-424-7184; fax 585-424-7130; **harold@rochesterhamfest.org**; **www.rochesterhamfest. org**.

IOWA STATE CONVENTION

June 11-12, Sioux City

The Iowa State Convention (Hamboree 2004—28th Annual Hamboree), co-sponsored by the 3900 Club and the Calabash Group, will be held at the Sioux City Convention Center, 801 4th St, in the heart of downtown Sioux City at the W end of historic Fourth St; take I-29 N and S to US Hwy 20 E and W. Doors are open Friday 2-8 PM, Saturday 8 AM to 4 PM. Features include huge 150+ table flea market; new equipment dealers; exhibitors; VE sessions; full slate of seminars; 3900 Club luncheon meeting (Saturday); DXCC card checking; left foot keying contest; Friday eve dinner; Saturday eve banquet with entertainment; Ladies Day activities (Saturday); souvenir tee shirts; featured guest from ARRL HQ; handicapped accessible facility; plenty of free parking; refreshments. Talk-in on 146.91. Admission is $6 in advance with registration for events, $7 at the door (good both days). Tables are $10 and up. Make checks payable to "Hamboree 2004" and send to Tom Brosamle, WBØYNX, Box 2332, Sioux City, IA 51106; 712-252-4107 (10 AM to 5:30 PM, Monday through Saturday); **tands@pionet.net**; **www.3900club.com**.

TENNESSEE SECTION CONVENTION

June 11-12, Knoxville

The Tennessee Section Convention (38th annual event; 2004 theme "Promoting Youth in Amateur Radio"), sponsored by the RAC of Knoxville, will be held at the Knoxville Exhibition Center, 525 Henley St. Doors are open for the electronics exposition on Friday 6-9 PM, and for the main hamfest on Saturday 9 AM to 4 PM. Features include Hamfest and Electronics Exposition, Amateur Radio and computer equipment, fantastic inside dealers, large outside tailgate area, antennas, forums, clinics, exhibits, demonstrations, CW and other contests, free product literature, VE sessions, refreshments. Talk-in on 147.3, 224.5, 444.575, 53.77. Admission is $10 for both days, $7 for Saturday, Jun 12 only. Tables are $20 (8-ft). Contact Carol Whetstone, N4LFR, c/o RAC of Knoxville, Box 50514, Knoxville, TN 37950-0514; 865-673-0475; **whetston@esper.com**; **www.w4bbb.org**.

May 22-23
EMCOMMWEST, Reno, NV*

May 29-30
Wyoming State, Casper*

June 5
Georgia Section, Marietta*

July 16-17
Oklahoma State, Oklahoma City

July 16-18
Pacific Northwest DX, South Everett, WA

August 6-7
Texas State, Austin

August 6-8
International EME, Ewing Twp, NJ

August 7-8
Western New York Section, Williamsville

***See May *QST* for details.**

YLISSB CONVENTION

June 17-20, Nashville, TN

The YLISSB Convention, sponsored by the Young Ladies International Single Sideband System, will be held at Sheraton Music City, 777 McGavock Pike; I-40 E from Nashville to Briley Parkway to Elm Hill Pike, right onto McGavock Pike. Features include Grand Ole Opry, General Jackson Dinner Cruise, VE sessions, banquet (Friday, $32). Admission is $15. Contact Steve Watson, WB4ILS, 511 Edgewood Dr, Tullahoma, TN 37388; 931-393-2880; **wb4ils@charter.net**; **www.qsl.net/yl-issb**.

WEST GULF DIVISION CONVENTION

June 18-19, Arlington, TX

The West Gulf Division Convention, sponsored by Ham-Com 2004, will be held at the Arlington Convention Center, 1200 Ballpark Way, midway between Dallas and Ft Worth, just off I-30. Doors are open Friday noon to 7 PM, Saturday 7 AM to 5 PM. Features include indoor and outdoor flea markets, commercial exhibitors, major manufacturers, dealers, vendors, forums (ARRL, AMSAT, MARS, APRS, ARES, and much more), educational programs (including SKYWARN School, Saturday 3-6 PM), Lone Star DX Luncheon ($30), DXCC card checking, VE sessions (all classes, both days; Ted Richard, AB5QU, 817-293-6745; **ab5qu@arrl.net**), refreshments. Talk-in on 147.14. Admission is $9 in advance, $10 at the door. Tables are $35. Contact Barry Goldblatt, WA5KXX, c/o Ham-Com, Box 12774, Dallas, TX 75225-0774; 214-361-7574 (phone/fax) or 972-596-4669; **chairman@hamcom.org**; **www.hamcom.org**.

NORTHWESTERN DIVISION CONVENTION

June 19-20, Seaside, OR

The Northwestern Division Convention (SeaPac—"The Northwest's Largest Ham Convention"), sponsored by the Oregon Tualatin Valley ARC, will be held at the Seaside Convention Center, 415 1st Ave; take Hwy 101 to 1st Ave, go W on 1st Ave, Convention Center is on your left, just across the river. Doors are open for exhibitor and flea market setup on Friday, June 18 at 11 AM, a workshop at 12:30 PM, and the EMCOMM Workshop at 1 PM; Saturday 8 AM, Sunday 9 AM. Features include flea market; commercial exhibits; new equipment dealers; seminars; forums; "bored spouses" program; VE sessions (Carl Clawson, WS7L, 503-629-5796; **WS7L@arrl.net**); DXCC card checking; RAGS Country Store; luncheons; banquet (Saturday eve); special guests from ARRL HQ (Executive Vice President David Sumner, K1ZZ, and Certification Specialist Dan Miller, K3UFG); refreshments. Talk-in on 146.66. Admission is $7 in advance, $9 at the door; under 13 free. Tables are $15 for 1 day, $25 for 2 days. Contact Will Sheffield, N7THL, c/o SeaPac Ham Convention, Box 219142, Portland, OR 97225-9142; 503-642-7314; **n7thl@juno.com**; **www.seapac.org**.

ARIZONA STATE CONVENTION

July 1-4, Williams

The Arizona State Convention (formerly known as the Fort Tuthill Hamfest), sponsored by the Amateur Radio Council of Arizona, will be held at the Bob Dean Rodeo Grounds, corner of Airport and Rodeo Rd; I-40 to Exit 163, left on Edison to Rodeo Rd. Doors are open Thursday 2-6 PM, Friday noon to 5 PM, Saturday 8 AM to 5 PM, Sunday 8 AM to 1 PM. Features include outside commercial vendors ($30 per space), commercial hall ($85 per space), tailgating ($15 per space), ARCA annual meeting, VE sessions, Saturday night BBQ dinner (6:30 PM), dry camping ($15 per space for the weekend). Talk-in on 146.78 (91.5 Hz). Admission is free. Contact Mark Kesauer, N7KKQ, 16845 N 29th Ave, No 312, Phoenix, AZ 85053; 602-881-2722; **n7kkq@arrl.net**; **www.arca-az.org/arca**.

SAN FRANCISCO SECTION CONVENTION

July 9-11, Ferndale, CA

The San Francisco Section Convention (Redwood Coast Amateur Radio Convention), sponsored by the Humboldt ARC, will be held at the Humboldt County Fairgrounds, 1250 5th Ave; from US 101 take the Fernbridge/Ferndale Exit, Eureka is 20 miles N of Fernbridge; from Fernbridge cross the historic bridge over the Eel River, drive 5 miles to Ferndale. Doors are open Friday 5:30 PM (Wine and Cheese Welcome Ice Breaker), Saturday 9 AM to 5 PM, Sunday 9 AM to 1 PM. Features include swapmeet; commercial dealers; exhibitors; vendors; VE sessions; many educational opportunities; special guest from ARRL HQ Field and Regulatory Correspondent Chuck Skolaut, KØBOG; banquet (Saturday, 5:30 PM hospitality hour, dinner at 6:30 PM). Talk-in on 146.85, 147.09 (103.5 Hz). Admission is $3 in advance, $4 at the door. Tables are $15. Contact Marci Campbell, KE6IAU, 1633 Mike Ln, Eureka, CA 95501; 707-442-3866; **conven@humboldt-arc.org**; **www.humboldt-arc.org**.

Attention Hamfest and Convention Sponsors:

ARRL HQ maintains a date register of scheduled events that may assist you in picking a suitable date for your event. You're encouraged to register your event with HQ as far in advance as your planning permits. Hamfest and convention approval procedures for ARRL sanction are separate and distinct from the date register. Registering dates with ARRL HQ doesn't constitute League sanction, nor does it guarantee there will not be a conflict with another established event in the same area.

We at ARRL HQ are not able to approve dates for sanctioned hamfests and conventions. For hamfests, this must be done by your division director. For conventions, approval must be made by your director and by the executive committee. Application forms can be obtained by writing to or calling the ARRL convention program manager, tel 860-594-0262.

Note: Sponsors of large gatherings should check with League HQ for an advisory on possible date conflicts before contracting for meeting space. Dates may be recorded at ARRL HQ for up to two years in advance.

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

HAMFEST CALENDAR

Attention: The deadline for receipt of items for this column is **the 1st of the second month preceding publication date**. For example, your information must arrive at HQ by **June 1** to be listed in the **August** 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.)

†**Alabama (Fort Payne)—Jun 12**, 8 AM to 3 PM. *Spr:* DeKalb County ARC. VFW Fairgrounds, 18th St N; from I-59 take Exit 222, go E 1½ miles to 18th St, take left onto 18th St, Fairgrounds on left. Tailgate Outing, vendors, VE sessions (11 AM), plenty of parking. *TI:* 147.27 (100 Hz). *Adm:* $3. Tables: $5. Clay Patrie, KG4OZW, 6101-B Mitchel Rd NE, Fort Payne, AL 35967; 256-845-5444; **silentspring42@earthlink.net**; **www.w4gbr.org**.

Alberta (Pine Lake)—Jun 18-20. Bob King, VE6BLD, 403-782-3438.

Arizona (Williams)—Jul 1-4, Arizona State Convention. See "Coming Conventions."

California (Ferndale)—Jul 9-11, San Francisco Section Convention. See "Coming Conventions."

†**California (Santa Maria)—Jun 20**; set up 7:30 AM; public 9 AM to 4 PM. *Spr:* Satellite ARC. Newlove Picnic Grounds; just S of Orcutt and W of Hwy 101, 1.7 miles S of Clark Ave, 4.5 miles N of Palmer Rd. Swapfest, tailgating, vendors, contests, T-hunt, GPS Hunt, demonstrations, Static Displays, Santa Maria-style Beef BBQ, free parking. *TI:* 145.14 (103.5 Hz). *Adm:* $5, under 12 free with adult. Tables: $15. Eric Lemmon, WB6FLY, 4416 Titan Ave, Lompoc, CA 93436; 805-733-4416; **wb6fly@arrl.net**; **www.SatelliteARC.com**.

†**Colorado (Monument)—Jun 12**; set up 6 AM; public 8 AM to 1 PM. *Spr:* Pikes Peak RAA. Lewis-Palmer High School, 1300 Higby Rd; I-25 to Exit 161 (N of Colorado Springs, S of Denver), take Hwy 105 S and E to stoplight, turn S and proceed to Higby Rd, go W on Higby to School on right. Swapfest, vendors, forums (ARRL, ARES, QRP, Satellite, YL), VE sessions (10 AM). *TI:* 146.97 (100 Hz), 146.52. *Adm:* $5. Tables: advance $10, door $15 (plus admission, includes 1 chair). Kate Muniz, WB9BAH, 13360 Cottontail Dr, Peyton, CO 80831; 719-683-7702 (eves) or 719-636-2444 (days); **wb9bah@aol.com**; **www.qsl.net/ppraa**.

†**Connecticut (Newington)—Jun 12-13**; Saturday 9 AM to 4 PM, at ARRL HQ and W1AW Hiram Percy Maxim Memorial Station (225 Main St); Sunday vendor set-up 7:30 AM, public 8 AM to 3 PM, at Newington High School, 605 Willard Ave (Rte 173); from Rte 175 N, go ¼ mile on left. *Spr:* Newington AR League. Saturday: W1AW Operating, tours of ARRL Hq, EmComm Seminar (noon to 4 PM, pre-registration required; Dan Miller, K3UFG, 860-594-0340 or 860-206-3379; **k3ufg@arrl.net**). Sunday: Indoor flea market (8:30 AM), tailgating (8 AM; $10, includes up to 2 admissions with 2 parking spots), new and used equipment dealers, electronics, hourly forums (starting at 9 AM, featuring Jonathan Taylor, K1RFD, EchoLink developer), DXCC card checking, VE sessions (noon sharp, walk-ins welcomed; preregister with special needs), refreshments. *TI:* 145.45, 224.84, 443.05. *Adm:* $6 (for entire weekend). Tables: advance $15, door $20. Make checks payable to NARL and send with SASE to Robert Stanwood, KB1EYZ, 21 Stuart Dr, Bloomfield, CT 06002; 860-242-2784; **kb1eyz@arrl.net**. Contact Dan Miller, K3UFG, 29 Douglas St, Bloomfield, CT 06002; 860-206-3379; **k3ufg@arrl.net**; **www.narl.net**.

†**Florida (Fort McCoy)—Jun 5**, 8 AM to 2 PM. *Spr:* Fort McCoy ARC. Ft McCoy/Eureka Community Center, Hwy 316; take I-75 S to Ocala to Hwy 40E heading to Silver Springs, pass the attractions to SR 315, go left (N) to Ft McCoy, go right to SR 316 (E), go 7 miles to event on left. Outside tailgate. *TI:* 147.36 (123 Hz). *Adm:* $3. Tables: Bring your own. Thomas Bench, W4BTB, 16370 NE 141st Terr, Ft McCoy, FL 32134; 352-546-2448; **w4btb@arrl.net**; **www.qsl.net/w4frc**.

†**Idaho (Rathdrum)—Jun 12**, 7:30 AM to 3 PM. *Spr:* Kootenai ARS. Rathdrum Lions Club, Hwy 53; turn N at I-90 and Hwy 41 junction, go through Rathdrum to Hwy 53; or turn W at Hwy 95 and Hwy 53 junction and go to Rathdrum. Flea market, VE sessions. *TI:* 146.98. *Adm:* Free. Tables: Free. Jim Monroe, N7ESU, 808 North 4th St, Coeur d'Alene, ID 83814; 208-667-4915; **n7esu@arrl.net**.

†**Illinois (Effingham)—Jun 12**, 8 AM to 3 PM. *Spr:* National Trail ARC. Percival Springs Airport, SR 45; S of Effingham on US Rte 45, approximately 6 miles to the airport. Flea market, vendors, tailgating ($5 per space). *TI:* 146.895 (110.9 Hz). *Adm:* Free. Tables: $5. Mark Percival, KB9SSP, Box 903, Effingham, IL 62401; 217-536-9990.

†**Illinois (Granite City)—Jun 13**, 7 AM to 1 PM. *Spr:* Egyptian RC. Southwestern Illinois College Campus, 4950 Maryville Rd; I-270 and IL Rte 203 (Exit 4A). Huge flea market, commercial vendors, SKYWARN and Digital forum, VE sessions, refreshments. *TI:* 146.79 (127.3 Hz), 442.4 (127.3 Hz), 146.76. *Adm:* advance $2 each or 3 for $5, door $4 each. Tables: $10. Bill Dusenberry, N9OQK, 10 Sherry Ln, Fairview Hgts, IL 62208; 618-398-1456 or 618-797-2770; **n9oqk@arrl.net**; **www.w9aiu.org**.

†**Illinois (Peotone)—Jul 4**; set up Saturday 6-8 PM, Sunday 6 AM; public 6 AM for flea market, 8 AM for indoor vendors. *Spr:* Kankakee Area Radio Society. Will County Fairgrounds; I-57 to Exit 327 E. ARES/EMS Theme, air-conditioned building, vendors, electronics, computers, DXCC card checking, handicapped accessible, overnight parking ($10, with electricity), 35 acres of free parking, refreshments. *TI:* 146.94. *Adm:* advance $6 (double stub), door $7 (single stub), under 12 free. Tables: $10 (reserve). Send SASE and check made payable to KARS to Clay Melhorn, N9IO, 122 Country Ln, Bonfield, IL 60913; 815-932-3552; **karsfest@yahoo.com**; **www.w9az.com**.

†**Illinois (Wheaton)—Jun 13**, 7 AM to 2 PM. *Spr:* Six Meter Club of Chicago. DuPage County Fairgrounds, 2015 Manchester Rd, 25 miles W of Chicago; N of Rte 38 (Roosevelt Rd), E of County Farm Rd. All-weather hamfest, 3 buildings; large outdoor flea market; electronics; ARRL, AMSAT, and dealer displays; antique and vintage radios; donation auction (11 AM); VE sessions (9-11 AM; call InfoLine to pre-register); overnight RV parking with hookups ($15, advance registration required); free parking; refreshments. *TI:* 146.97 (107.2 Hz), 146.52. *Adm:* advance $5, door $7. Tables: 8-ft $12 (without electricity); $15 (with electricity). Joseph Gutwein, WA9RIJ, 7109 Blackburn Ave, Downers Grove, IL 60516-3925; 708-442-4961 (24-hr InfoLine) or 630-963-4922; **wa9rij@mc.net**; **www.qsl.net/k9ona**.

†**Indiana (Crown Point)—Jun 20**; set up 6 AM; public 8 AM to Noon. *Spr:* Lake County ARC. Lake County Fairgrounds, Industrial Arts Building, 889 S Court St; take US Rte 231 Exit off I-65 to Main St, left on Main St to South St (first stop sign), right on South St to Court St (1 block), S on Court St to Fairgrounds. Hamfest/Computer Show, commercial vendors of new and used ham radio equipment, indoor flea market, computer hardware and software, electronics and computer parts, VE sessions (walk-ins; for licenses and upgrades), refreshments. *TI:* 147.0 (131.8 Hz), 146.52. *Adm:* $5. Tables: Free (limited number available, reservations suggested). Rich Gilles, KA9SVS, 156 S Ridge St, Crown Point, IN 46307; 219-662-0594; **paris156@yahoo.com**; **www.qsl.net/w9lj/**.

†**Indiana (Indianapolis)—Jul 10**, 6 AM to 3 PM. *Spr:* Indianapolis Hamfest Assn. Camp Sertoma, 2316 S German Church Rd; SE Marion County, US Hwy 52 E (Brookville Rd). Huge indoor/outdoor flea market, commercial vendors, electronics, computers, communications equipment, forums, foxhunt (noon), QSL and Homebrew contests, VE sessions, camping. *TI:* 146.76. *Adm:* advance $6, door $8; under 13 free. Tables: $15 (outdoor covered flea market), $40 (indoor air-conditioned flea market). R. A. Blake, N9FIM, 11064 Indian Lake Blvd, Indianapolis, IN 46236; 317-261-6658; **bob9fim@aol.com**; **www.indyhamfest.com**.

†**Indiana (Wabash)—Jun 6.** *Spr:* Wabash County ARC. Wabash County 4-H Fairgrounds, State Rte 13 N (Manchester Ave); 1 mile S of Rte 24, W side of road, look for signs. Vendors. *TI:* 147.03. *Adm:* advance $5, door $6. John Netro, KB9NSO, 495 Stitt St, Wabash, IN 46992; 260-569-1191; **jknetro@kconline.com**.

Iowa (Sioux City)—Jun 11-12, Iowa State Convention. See "Coming Conventions."

†**Maine (Union)—Jul 10**. *Spr:* Pen-Bay ARC. Thompson Community Center, Rtes 17 and 131. Indoor flea market only (no tailgating), VE sessions. *TI:* 145.49, 147.06 (91.5 Hz). *Adm:* $5. Tables: $3. Scott Ewen, KB1DSW, 408 River Rd, Cushing, ME 04563; 207-354-6809; **blueberryacre@yahoo.com**.

†**Maryland (Frederick)—Jun 20**, 8 AM to 3 PM. *Spr:* Frederick ARC. Frederick County Fairgrounds, 797 E Patrick St; I-70 E to Exit 56 (E Patrick St), follow signs to Fairgrounds. Giant outdoor flea market, tailgating ($5 per space plus 1 admission), indoor commercial vendors, electronics, computers, silent auction, free VE sessions (promptly at 9 AM, pre-registration strongly recommended), plenty of parking, refreshments. *TI:* 147.06 (123.0 Hz), 146.64. *Adm:* $5. Tables: $10 (prepaid by Jun 14), $15 (after Jun 9). Carolyn Moroney, N3VOK, 13597 Old Annapolis Ct, Mt Airy, MD 21771; 301-831-5060; **k3erm@qsl.net**; **www.qsl.net/k3erm**.

Massachusetts (Cambridge)—Jun 20. Nick Altenbernd, KA1MQX, 617-253-3776.

†**Michigan (Midland)—Jun 19**; set up 6:30 AM; public 8 AM to noon. *Spr:* Midland ARC. Michigan Army National Guard Armory, 2300 Airport Rd; US 10, Eastman Rd Exit to Airport Rd. New and used amateur radio, electronics, and computer equipment; trunk sales ($5 per space plus admission); VE sessions (registration 8 AM, exams 9 AM); Friday night camping nearby; refreshments. *TI:* 147.0. *Adm:* $4. Tables: $5 (reserve). Send SASE to MARC Hamfest, Box 1049, Midland, MI 48641-1049; William French, AB8JF, 940 W Stewart Rd, Midland, MI 48640-9167; 989-835-5562; fax 989-835-3205; **ab8jf@arrl.net**; **www.qsl.net/w8kea/**.

†**Michigan (Monroe)—Jun 20**; set up 6:30 AM; public 7:30 AM to 1 PM. *Spr:* Monroe County Radio Communications Assn. Monroe County Fairgrounds, 3775 S Custer Rd; 2 miles W of Monroe on M-50, at corner of Raisinville Rd. Hamfest/Computer Show, indoor/outdoor flea market, trunk sales ($6, 8-ft space; plus admission), vendors, computers and equipment, distributors, overnight camping ($20, electricity included), free parking, refreshments. *TI:* 146.72. *Adm:* advance $6 (with 2 stubs), door $6 (with 1 stub). Tables: $12 (8-ft, plus admission; electricity available in buildings, bring cords). Fred VanDaele, KA8EBI, 4 Carl Dr, Monroe, MI 48162; 734-242-9487 (after 5 PM); **ka8ebi@arrl.net**; **mcrca.org/hamfest.htm**.

†**Michigan (Petoskey)—Jul 10**, 8 AM to Noon. *Spr:* Straits Area ARC. Knights of Columbus Hall, 1106 Charlevoix Ave; on US 31, across the street from Emmet County Fairgrounds. Swapfest, tailgating, VE sessions (1 PM sharp, Red Cross Building). *TI:* 146.68 (110.9 Hz). *Adm:* $5. Tables: $8. Cliff Rosebohm, KC8NVI, 7574 Hedrick Rd, Harbor Springs, MI 49740; 231-526-5645; **kc8nvi@glccomputers.com**; **www.w8gqn.org**.

†ARRL Hamfest

Gail Iannone ♦ Convention Program Manager ♦ giannone@arrl.org

†**Minnesota (St Paul)—Jun 5,** 7 AM to 1 PM. *Sprs:* TwinsLAN ARC and 3M Radio Club. 3M Center, Conway and McKnight Rd; I-94 to McKnight Rd, go N 2 blocks to Conway, go E to hamfest site. Tailgate Swapfest ($5 per space for sellers plus admission), refreshments. *TI:* 146.76 (114.8 Hz; 6:30-9:30 AM). *Adm:* $7 (buyers). Doug Reed, NØNAS, 2014 Radatz Ave, St Paul, MN 55109; 651-777-0064 (eves); **n0nas@amsat.org** or **tailgate@twinslan.org**; **twinslan.org/tailgate.html**.

†**Missouri (Macon)—Jun 12**, 8 AM to 1 PM. *Sprs:* Macon County, Tri-County, and NEMO ARCs. Macon Area Vo-Technical School, 700 N Missouri; 6 blocks S on Hwy 63 from the intersection of US Hwys 63 and 36. Commercial dealers and displays, tailgating (free with purchase of admission ticket), forums, VE sessions (9:30 AM, on site), handicapped parking, refreshments. *TI:* 146.805. *Adm:* $3. Tables: first $10, additional $5 each. Dale Bagley, KØKY, Box 13, Macon, MO 63552; 660-385-3629; **k0ky@arrl.org**; **www.qsl.net/n0pr/hamfest.html**.

†**New Jersey (North Wildwood)—Jun 20**, 9 AM to 3 PM. *Spr:* East Coast Long Wire Assn. Anglesea Firehouse, 2nd and NJ Aves; Garden State Parkway S to Exit 6, head E on Rte 147 into N Wildwood, Rte 147 turns into New Jersey Ave. Air-conditioned hall, VE sessions. *TI:* 147.12. *Adm:* Free. Tables: $20/$10. Tony Cipollono, N2RKX, Box 318, Green Creek, NJ 08219; 609-780-2557; **tonycipoll@yahoo.com**; **www.qsl.net/eclwa**.

†**New York (Bethpage)—Jun 13**; sellers 7:30 AM; buyers 9 AM. *Spr:* Long Island Mobile ARC. Briarcliff College, 1055 Stewart Ave; LIE to Exit 44S (Seaford-Oyster Bay Expressway-Rte 135), go S to Exit 9 (Broadway, Bethpage), turn right onto Broadway, bear right onto Cherry Ave, go past Bethpage High School, turn right at light onto Stewart Ave, go past flashing light, College on left. Hamfair and Electronics Show, equipment dealers, computers, ARRL info, tailgate spaces ($10, bring your own table, chair, umbrella), VHF tune-up clinic, free parking, refreshments. *TI:* 146.85 (136.5 Hz). *Adm:* $6, nonham sweethearts and under 12 accompanied by a paying adult free. Brian Gelber, WB2YMC, Box 392, Levittown, NY 11756; 631-286-7562; **hamfest@limarc.org**; **www.limarc.org**.

†**New York (Cortland)—Jun 12**, 7 AM to 2 PM. *Spr:* Skyline ARC. Cortland County Fairgrounds, Fairgrounds Dr; I-81 to Exit 12, turn left onto Rte 281 S; turn left on Fisher Ave, turn right onto Fairgrounds Dr. Indoor and outdoor flea market, vendors, VE sessions. *TI:* 147.18. *Adm:* advance $4, door $5. Tables: $2, $5, and $10. Paul Osinski, KC2DWW, Box 383, McGraw, NY 13101; 607-836-8745; **kc2dww@hotmail.com**; **www.skylineradioclub.org**.

†**New York (Rensselaer)—May 22**, 8 AM to 1 PM. *Spr:* East Greenbush ARA. East Greenbush FD Park Station, Phillips Rd, just off NYS Thruway Exit 23; take I-787 N to Rensselaer/East Greenbush Exit, follow US Rtes 9 and 20 E/S to East Greenbush, once in EGB contact talk-in; from I-90, take Exit 9, contact talk-in. Tailgating ($5 per space). *TI:* 147.33, 146.52. *Adm:* Free. Tables: $10. Chris Linck, N2NEH, 6 Park Ave, E Greenbush, NY 12061; 518-477-6915; **n2neh@arrl.net**; **www.com-tech.org/EGARA.html**.

New York (Rochester/Henrietta)—Jun 4-6, Atlantic Division Convention. See "Coming Conventions."

†**North Carolina (Salisbury)—Jul 3**, 8 AM to 2 PM. *Spr:* Rowan ARS. Salisbury Civic Center, 315 S Boundary St; exit I-85 at Exit 76-B, turn right on E Innes St, go 3 blocks and turn left on S Boundary, go 3 blocks to Civic Center on left. Tailgating (free with admission), auction (1 PM), VE sessions. *TI:* 146.73 (94.8 Hz), 146.52. *Adm:* advance $4, door $5. Tables: $10. Ralph Brown, WB4AQK, 1621 Emerald St, Salisbury, NC 28144; 704-636-5902; **rbrown@salisbury.net**; **www.qsl.net/w4exu**.

†**Ohio (Milford)—Jun 19**, 8 AM to 2 PM. *Spr:* Milford ARC. Live Oaks Career Development Campus, Buckwheat Rd; I-275 to Rte 28, right on Buckwheat Rd. Commercial vendors, tailgating, foxhunt, VE sessions, refreshments. *TI:* 147.345. *Adm:* $5. Tables: $5. Chris Reinfelder, KB8SNH, 3782 Grovedale Pl, Cincinnati, OH 45208; 513-351-2776; **kb8snh@cs.com**.

†**Ohio (Wauseon)—Jun 13**, 8 AM to 1 PM. *Spr:* Fulton County ARC. Fulton County Sportsmen Club, County Rd 14, between County Rd H and US Rte 2; just 1.5 miles SE of the OH Turnpike Exit 34 (formerly Exit 3). Flea market; vendors; new and used AR equipment, computers, software and supplies; trunk sales ($5 per space); VE sessions; overnight camping available (Saturday night); free parking. *TI:* 147.195 (103.5 Hz). *Adm:* advance $4, door $5 (under 11 free with paying adult). Tables: $10 (1 free ticket included with 1st indoor table reservation). Angela Infante, KB2AVN, Box 521, Wauseon, OH 43567; 419-822-4382; **fcarc@hotmail.com**; **www.fcarc. 8m.com**.

Oregon (Seaside)—Jun 19-20, Northwestern Division Convention. See "Coming Conventions."

†**Pennsylvania (Bressler/Harrisburg)—Jul 4**; set up Saturday 6-9 PM, Sunday 6-8 AM; public 8 AM. *Spr:* Harrisburg RAC. Emerick Cibort Park; from PA Turnpike take Exit 19 (Harrisburg E), go N on I-283 for 2 miles, exit at Swatera/PA-441, make left turn and go to traffic light just W of exit, turn left onto Eisenhower Blvd, stay in right hand lane, turn right onto PA-441, follow this to fork in road, bear left onto Main St, turn left onto Center St, turn right onto Penn St to hamfest entrance. Flea market, commercial dealers, tailgating ($5 per space), overnight camping, refreshments. *TI:* 146.76. *Adm:* $5 (nonham spouses and children free); or bring a carload of people for $10. Tables: $12 each (before Jun 1), $15 each (on or after Jun 1). Pete deVolpi, K3PD, 408 Hillside Ave, New Cumberland, PA 17070; 717-938-8249; **w3uu@aol.com**; **hrac.tripod.com/July4.htm**.

†**Pennsylvania (Erie)—Jul 10**, 8 AM. *Sprs:* Wattsburg Wireless Assn and Union City Wireless Assn. Greene Township Municipal Bldg, 9333 Tate Rd; I-90 to Parade St Exit (27), go S on Rte 8 for 2 miles, turn right on Tate Rd, across from Hammett Motors, ¼ mile on left. Emergency Preparedness Theme; tailgating ($7, plus admission); vendors; VE sessions; CE EMCOMM 1, 2, and 3 Exams; off-street parking; refreshments. *TI:* 147.3, 146.7. *Adm:* $4. Tables: $10 (first table), $5 each additional. Floyd Titus, WA3LCO, Box 11071, Erie, PA 16514; 814-825-8599; **wwa@wattsburg-wireless.us**; **www.wattsburg-wireless.us**.

†**Tennessee (Cookeville)—Jun 19**, 8 AM. *Spr:*Upper Cumberland ARA. Putnam County Fairgrounds, 155 Fairground Ln; I-40, Exit 287 (Jefferson Ave/Hwy 136), go N 0.6 mile, Fairgrounds entrance on left just past Taco Bell. Weather Spotters Class, VE sessions, refreshments. *TI:* 145.27 (123 Hz), 147.135 (123 Hz), 146.52. *Adm:* Free. Tables: Free. Wilson Cowan, KG4REA, 991 Lebanon Hwy, Lebanon, TN 37087; 615-449-0287; **wpcowan@bellsouth.net** or **hamfest@ucara.org**; **www.ucara.org**.

Tennessee (Knoxville)—Jun 11-12, Tennessee Section Convention. See "Coming Conventions."

Tennessee (Nashville)—Jun 17-20, YLISSB Convention. See "Coming Conventions."

Texas (Arlington)—Jun 18-19, West Gulf Division Convention. See "Coming Conventions."

†**Texas (Lubbock)—Jun 5**, 8 AM to 4 PM. *Spr:* Lubbock Amateur Contest Club. Noble Stidham Memorial LACC Clubhouse, 1110 98th St; from I-27/TX Hwy 87 take 98th St Exit, go W on 98th, Clubhouse is approximately ¼ mile from hwy, on same lot as Eagle Self Storage. VE sessions. *TI:* 444.625 (118.8 Hz). *Adm:* Free. Tables: $5. Daniel Holwerda, KD5QMN, 1605 77th St, Lubbock, TX 79423; 806-745-2408; **dholwerda@unitedtexas.com**.

†**Texas (Texas City)—Jul 10**; set up 5 AM (commercial vendors), 7 AM (flea market tables); public 8 AM to 2 PM. *Spr:* Tidelands ARS. Doyle Convention Center, 2100 5th Ave N at 21st St N; from I-45 take Exit 16 E onto FM 1764 (also called E.F. Lowery Expressway), go E 8 miles, turn right (S) onto 21st St at "Jack in the Box," hamfest is in large brick building about ¼ mile down on left at next stop sign. Swap tables, major vendors, contest, VE sessions, ARRL table, nearby free parking, refreshments. *TI:* 147.14, 442.025 (103.5 Hz). *Adm:* advance $4, door $5. Tables: $6 (non-vendor flea market; plus admission), $15 (vendor/commercial; no admission fee required); power available but not guaranteed, bring your own extension cords and duct tape. Joe Wileman, AA5OP, Box 73, Texas City, TX 77592; 409-945-6794; **aa5op@arrl.net**; **www.tidelands.org**.

Virginia (Franklin)—Jun 12. Stewart Tyler, WA4JUO, 757-934-2115.

†**Wisconsin (Oak Creek)—Jul 10**, 6 AM to 2:30 PM. *Spr:* South Milwaukee ARC. American Legion Post No 434 Grounds, 9327 S Shepard Ave; take I-94 to Ryan Rd Exit, go E on Ryan Rd to Shepard Ave, then go N ¼ mile to Legion Post Grounds. Outdoor first-come, first-served buyers and sellers event; limited overnight camping; breakfast and lunch. *TI:* 146.52. *Adm:* $5. Tables: Bring your own. Robert Kastelic, WB9TIK, 7410 S Clement Ave, Oak Creek, WI 53154; 414-764-3871; **kastelic@execpc.com**; or Vern Teske, W9RYA, 414-762-3235; **ryatex@aol.com**.

Attention All Hamfest Committees!

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VHF/UHF CENTURY CLUB AWARDS

Compiled by Eileen Sapko
Awards Manager

The ARRL VUCC numbered certificate is awarded to amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs are the assigned award numbers, issued in order of date received. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from February 7 to April 6, 2004.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/awards/vucc**. An SASE to ARRL is required if you cannot download these forms. If you have questions relating to VUCC, send an e-mail to **vucc@arrl.org**.

50 MHz
100

1358	KC5YCH
1359	K8XF
1360	NB5R
1361	WD9IOK
1362	N2BX
1363	W5LUA
1364	V31MD
1365	W6TE
1366	W3SO
1367	AB0SD
1368	K4DAM
1369	KG4QMI
XE2ED	250
NØXLR	200
K2JF	275
K2CS	325
W2JLK	125
W4UDH	775
NG4C	550
N4CH	775
K5GJR	225
W5ZN	500
WA5KBH	300
W5OZI	1025
WB5AFY	300
KB6NAN	650
NH7RO	400
NL7AU	250
KC8KSK	150
KF8UN	225
WB9DRB	275

144 MHz
100

628	AA9MY
629	K6PF
630	AG2A
W4WTA	175

222 MHz
50

120	K8EB
W5ZN	80
WB5AFY	70

432 MHz
50

307	K8EB
W5ZN	150
WB5AFY	160

902 MHz
25

W5ZN	40

1296 MHz
25

139	K8EB
WB5AFY	55
W5ZN	50

2.3 GHz
10

W5ZN	30
W5LUA	100

3.4 GHz
5

W5ZN	20

5.7 GHz
5

W5ZN	25

10 GHz
5

149	N1EUX
150	KT8O
W5ZN	20

241 GHz
5

1	W2SZ

Satellite
100

135	N4QWF

St Lucia 2004

By Don Dubon, N6JRL/J68DD

Although I have been on many DXpeditions and contests, they are always on my mind. When I saw an ad in *Worldradio* that Scott, N9AG, was looking for an extra operator for the ARRL CW DX Contest, I couldn't wait to contact him and offer my services. I had been on several contest expeditions with Scott and enjoyed the last time we were in St Lucia, when he set a new world record on 10 meters for the WPX contest. He is, of course, a world class competitor and a ferocious contester. I have known Scott since moving to the Dayton area when I retired from the military seven years ago. We see each other once in awhile at SWODXA meetings and of course annually at the Hamvention.

The dates for this year's contest were February 21-22, and most of the gang were going to be in St Lucia from the 11th-25th. I couldn't get the full two weeks with such short notice, so I opted to arrive on the island on the 19th and depart on the 25th along with a few others in the group. I knew Scott would save a few antennas for me to assemble and put up, as I would be there for the entire tear-down process.

Finally, the day of departure arrived and it was like any other day. My son was going to drive me to the Dayton airport but lost his car keys and the spare. I called my wife at work and she had to leave and drive home to get me and drive me to the airport. I arrived at the airport just two hours before departure and still had to get a boarding pass as I just had an E-ticket. 8:30 in the morning on a Thursday is definitely the time to fly out of Dayton. I walked right up to the counter, checked my bag, got my boarding passes and was through security within 10 minutes. I was prepared for the security people to disassemble my entire luggage and ask with amazement what all these contraptions were, especially the Bencher paddles and the memory keyer. Instead I was whisked through and standing at the Boston Stoker getting a gourmet coffee before my wife had even made it to the Interstate.

My good luck and good fortune seemed to continue as the plane, a regional jet, was boarded and left a little early. I know this is going to be hard to believe, but we arrived in Chicago 20 minutes early. After a Chicago-style hot dog (I didn't know it was legal to put all that stuff on a hot dog) for lunch, I sat at the gate for my next flight to San Juan.

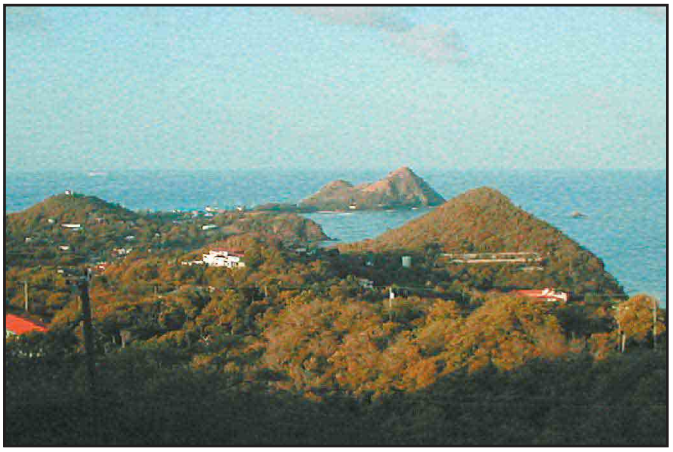


Figure 1—View to the NW Pidgeon Island.

The flight to Puerto Rico took about 4 1/2 hours. Not much to do but sleep, have something to eat and maybe enjoy a few drinks through a boring movie. Upon landing in Puerto Rico, it was late in the evening and only about 45 minutes to make the next flight. The terminal was not crowded and it is not real big. I made it to the gate just as the flight was preparing to board. Onto a bus and a ride of about 300 yards to an awaiting twin prop ATR that held 64 passengers. To my delight and surprise, only 16 people boarded the flight to St Lucia, which took 1 1/2 hours. We landed right on time at the small George F. Charles airport in the northern part of the island near the capital city of Castries.

Once on the tarmac we were able to walk the 300 yards into the very small terminal. Entering the doors, we proceeded to the immigration desk for passport stamping. After the officer observed many previous entries in my passport to St Lucia, he said, "welcome back." The customs officer asked how long I would be in St Lucia and if I had anything to declare. I explained I had nothing to declare and that I would be on the island for 6 days. He bid me a good evening; then with luggage in tow I exited to the terminal area outside where it was a balmy 80°. After I waited for about 15 minutes and turned down many offers of a cab ride, a small Suzuki vehicle pulled up with someone waving and shouting greetings. I could see it was my old friend Ernest, J69AZ, who is a citizen of the country, and Al, WA1T, whom I had never met but now know as a friend and fellow ham and contester. We loaded my luggage into the car and off we went to the Villa Kinnoul, a 15 minute drive from the airport.

Al and I dropped Ernest off at his home on the way and continued the drive, arriving at the contest site at about 12:30 AM local time. As we entered, just about everyone was still up and some were tak-

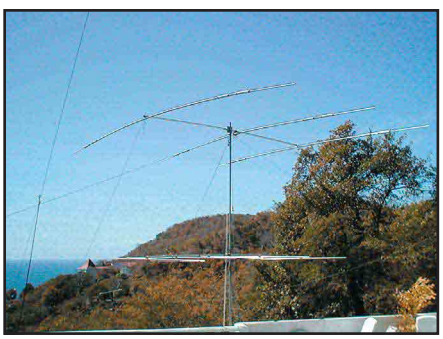


Figure 2—Triband antenna and 6 meter beam near the pool.

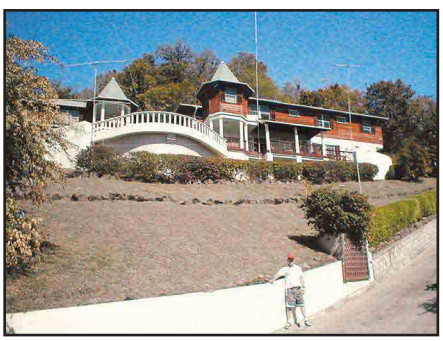


Figure 3—Don, N6JRL/J68DD standing in front of the Villa (Kinnoul).

Bernie McClenny, W3UR ♦ 3025 Hobbs Rd, Glenwood, MD 21738-9728 ♦ w3ur@arrl.org

ing advantage of late night propagation. Scott, N9AG, had gone to sleep but I greeted old friends, some of whom I hadn't seen in six years: Kirk, W8QID; Gary, KI6T; Jack, K9JE, and Pete, NØFW. We sat on the patio outside in the nice balmy weather, had a few cold ones, reminisced and talked about the contest, antennas and DX already worked during the previous week when everyone else had arrived and began building the contest stations and antennas.

The next morning, Scott was up early as usual and we talked and put some coffee on and made some contest logistical plans while we waited for everyone else to get up. After everyone got up and we settled all of the finances and had some breakfast, we teamed up outside and raised a few more antennas for the contest. Our antenna farm consisted of a tribander for 10/15/20, monoband Yagis for 10 and 15, a 40, 80 and 160 meter vertical, as well as dipoles for 40 and 12, 17 and 30 meters. After antenna construction was complete, four of us went to buy some groceries and beverages for the contest. After we returned with supplies late in the afternoon, the swimming pool was so inviting that several of us took advantage and made our amphibious assault.

By early evening on Friday we had already worked the bugs out of all the antennas and had the rigs and computers ready to go. The start of the contest came ever nearer. I sat down with Gary and plugged in my headphones to an adapter and observed him the first two hours just to get myself in the rhythm of the scoring software and watch the master at work. Gary was knocking them out at about 200 an hour. I was impressed, as I think the best rate I got was 125-130. Although my CW skills are very good, people like Gary, Scott and Kirk all have an exceptional ability to run the rates that are at the level of outstanding CW operators. In my 40-plus years in ham radio I have never seen better operators than these guys.

I jumped in after about the first two hours and took over for Gary on 20. After about the first 10-15 Qs I was into it and actually enjoying the process. We never did have a regular schedule, but everyone had many turns in each of the operating positions through the next 48 hours of the contest.

Taking a few hours to sleep and eat seemed to be the order of the day for the rest of the contest. It seemed never-ending but everyone took their turn at any operating position available at any given time. By Sunday morning, the end of the contest was still many hours away, at 8 PM local time. The amount of time now was shorter at any operating position, and the dupes were becoming evident. At times it seemed we had worked everyone on every band, but still the new contacts kept trickling in. Sundown came at about 6, and I sat down to give 20 meters my last effort. To my surprise, the stations started to really roll in and after an hour my rate was up over 100 and I was thinking of someone to relieve me; then I just kept going...1 hour to go, 45 minutes to go, 30 minutes then 15, 10, 5 and the last 2 minutes I pulled the headphones. Al videotaped the sights and sounds of everything in the last 2 minutes of the contest. Finally it was over and cheers and high fives went up, beers were opened and Gary had his calculator out and was figuring the preliminary score. After 48 hours, roughly 7000 contacts and enough multipliers to make our score approximately 7 million points, we rested.

Figure 4—The author operating the contest.

Figure 5—Al, WA1T (left), and Jack, K9JE, working 20 and 15.

Figure 6—The J6DX team. Left to right: Pete, NØFW; Jack, K9JE; Don, N6JRL; Scott, N9AG; Kirk, W8QID, and Gary, KI6T.

Now that the contest was over, everyone relaxed and tabulated scores, but wait—Scott and Gary are on the radio on SSB giving out a new country to many stations in the US. It seems that the bands are still open, and although it is 8 PM local, it is still 7 PM on the East Coast and 4 PM on the West Coast. After a few hours, everyone shuts down the radios and retires for a good night's sleep.

The day after the contest we once again awoke to a beautiful morning, and the sun shining over the Caribbean Sea. It was Monday and some of the antennas came down in preparation for everyone leaving the island on Wednesday. We were fortunate that most of our antennas, guy ropes, masts and poles remain on St Lucia with our longtime friend Givan, J69AC. He stores our supplies until the next contest trip down to the island.

Tuesday evening the families of Givan and Ernest, J69AZ, come to the Villa and we have the traditional going-away barbecue dinner and a few beers and make plans for trips to the airport early the next morning. E-mail addresses are exchanged, QSL cards are traded and the farewells are shared. With another contest expedition complete, we are all ready to return home to our families—and to the mostly cold lousy weather.

The only alarm clock we had was on Al's cell phone so I set it for 3:30 AM. Al and I loaded my luggage in the car and he drove me to the airport. The small airport was open—it has no doors or windows, just a roof, ticket counters and some chairs to sit in until the security and boarding areas open. After having my carry-on bag, passport and ticket checked, I got a cup of coffee and sat down to await my boarding call. At 6:15 the boarding call was made. With only 15 passengers it didn't take long to load the plane and take off. I walked the 300 feet to the plane (no jetways here) and got comfortable in my seat.

After landing in Puerto Rico, we got into a bus for the short drive to the door to customs and immigration. The officer asks me if I have anything to declare, and I say only two bottles of rum. He quickly passes me through.

We take off on time to Chicago, and then it's on to Dayton. I quickly made my way to the baggage claim area, and my wife, Sandy, N3TQU, is there to pick me up. It was 30° and I was in shorts and a short sleeve shirt, but we grab my luggage and get to the car. We stop for dinner on the way home. I was so glad to be home, but I'm also ready for the next trip. I enjoyed the camaraderie of all of the contest team members and friends who were a part of this trip, and I thank them all once again for a great time.

Photos by the author. QST

The Wireless Boys

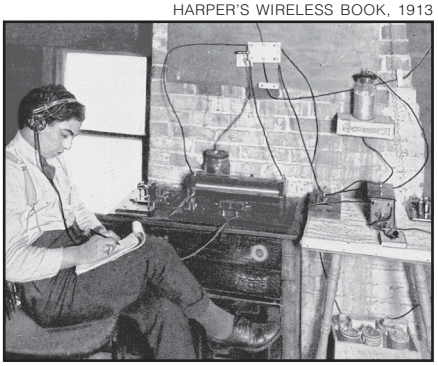
I've received e-mails asking to see some early stations. One question that I'm always asked is "What was it like to be a ham during the early years?" My fast answer usually is "Exciting!" But really it was much more than that.

The hard part is finding good examples to talk about. Most, if not all, of the operators from around 1910 are now Silent Keys. Their stations and most of their documentation are long gone, as families moved on with their lives. So we must search the early magazines and books to get a good look into those times; those times where we find:

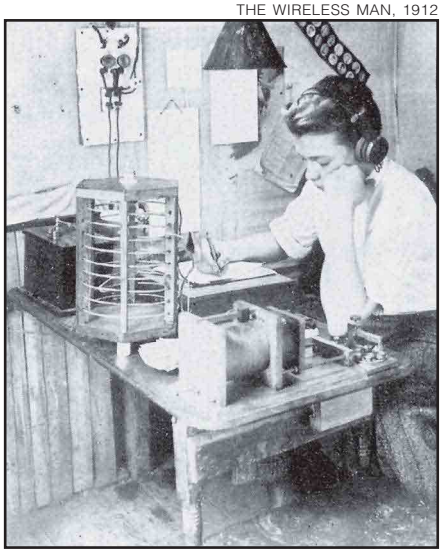
Boys in the Attic

Many early stations were located in bedrooms and in attics. In the 1913 technical book, *Harper's Wireless Book*, by A. H. Verrill, there is a great photo of a 1910 attic ham shack. It clearly shows a teenage boy sitting at his radio, copying code. The photo also details the interconnection of all of the station's components.

HARPER'S WIRELESS BOOK, 1913



THE WIRELESS MAN, 1912



In that book, a young Eric Thompson Bradley wrote chapter 10, *A Boy's Experience with Wireless Telegraphy*. It is his experience learning about radio, and building his own station. Later, he joined a Wireless Club made up of boys from a neighboring town. I will reprint this interesting chapter on my Web page, **www.eht.com/oldradio/arrl/index.html**.

Another great book is, *The Wireless Man, His Work & Adventures on Land & Sea*, by Francis A. Collins, 1912. This book is loaded with wonderful short stories about radio operators. One chapter, *The Wireless Boy*, talks about clubs, [that] "are open to members of twelve years, and it is common for a club to limit its membership to boys between say fourteen and eighteen years of age." (See this chapter on my Web page.)

Attic Radio

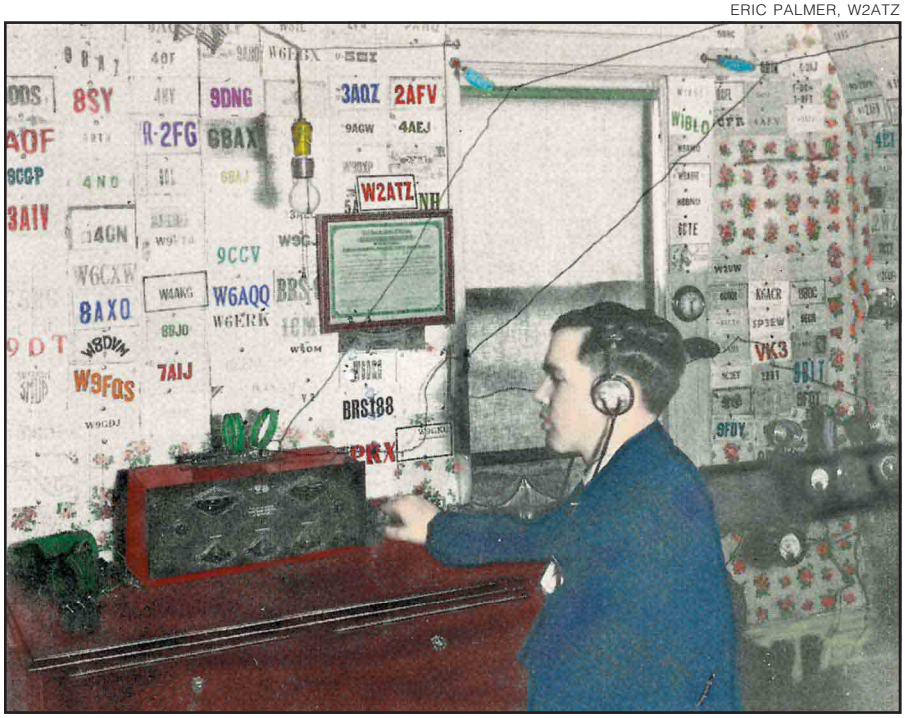
One of my favorite books is *Riding the Air Waves with Eric Palmer Jr*, 1930. Eric's family had enough money for him to have a very good ham radio station during the 1920s. He was also able to get a tremendous amount of publicity for himself, and for ham radio, due to some unusual happenings. His book is about his many adventures, both ordinary and not so ordinary. In reading his story, you get a glimpse into how exciting radio was to a young person back then.

Writing the book in 1929, he starts off in his first chapter, "Attic Radio," by saying:

> We've got to what my dad calls the parlor stage of radio. What he means is that radio has gone ritzy. With fancy cabinets, to roost in the drawing room along with the curio cabinet and grandpa's picture. The idea is that radio has ascended from the attic era, or descended, rather, from the top floor corner to a position of state for the visitors to gape at.

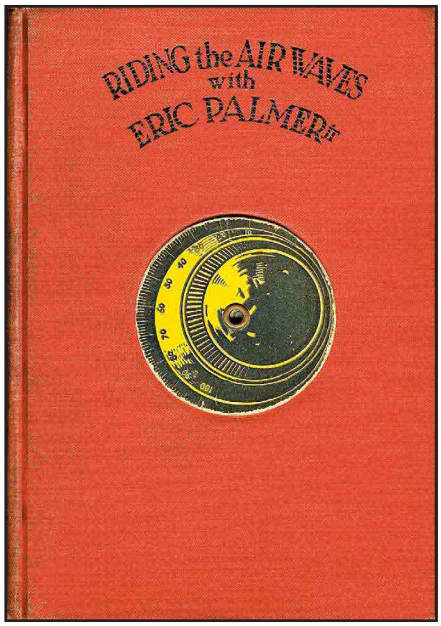
He continues, "But I'm still up in the attic. There are thousands like me, all over the world." And later he said, "Hams started the attic epoch in radio. That's where it really began."

ERIC PALMER, W2ATZ



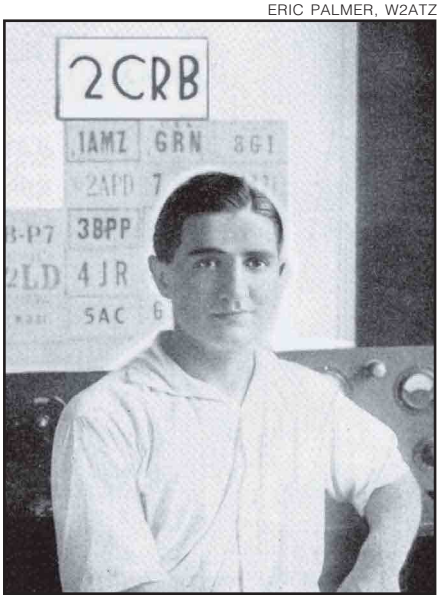
Eric Palmer, W2ATZ, using his 1926 Grebe CR-18 receiver in his attic station. His homebrew transmitter is at the far right.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org



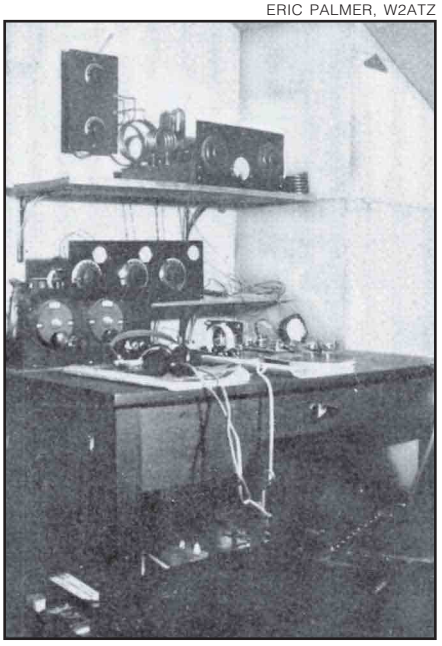
The book is easy to identify with its paper radio dial riveted to the front cover.

ERIC PALMER, W2ATZ



Eric's good friend Joseph Goldstein, W2CRB, who helped him get started in radio.

ERIC PALMER, W2ATZ



W8CFR, the station of Robert Lloyd from Emsworth, Pennsylvania. Eric talked daily with him from Rio de Janeiro, and kept in constant contact with his parents in Brooklyn.

W2ATZ Makes the Newspapers

Eric tells the story where his parents were worried that he spent too much time on his radio and not enough time eating, going to school, sleeping, etc. It got so bad that one night his father removed all the tubes from his radio and forced Eric to go to bed at a reasonable hour.

He said this about his father, "But he was busy, I found where the tubes were hidden, and the next night I was chinning with a chap on a boat in Shanghai."

Eric continued operating too many hours on his radio, and after switching schools, then being suspended, his parents threatened to take the radio away from him.

He said, "About two months before he [his dad] had threatened to write to the Radio Commission and ask for a suspension of the license, but he felt that this would be rather foolish. Now he got so darn mad he sat before a typewriter and addressed a letter to the commission. He rushed right out and mailed it."

Someone in Washington leaked his father's letter. Three days later the Associated Press sent out a long story about it. The story had also gone out via the United Press, the International News, and a story was even printed on the front page of *The New York Times* by Orrin Dunlap Jr, the radio editor.

Now famous, Eric received copies of newspapers with his story from around the world, with headlines like:

Radio Killing Son, Father Seeks License Suspension

Dad Invokes U.S. Aid to Cure Boy of Radio Mania; Asks License Ban

Devotion to Radio Saps Vitality of Brooklyn Youth

Thus began the next phase of Eric's radio adventures. When a noted explorer wanted to search the jungles of Brazil for treasures in lost cities, and needed a radio operator, Eric was asked. Of course his mother said no, but his dad came through and allowed him to go. So at 17, Eric was off to Rio de Janeiro and the beginning of a great two-year adventure.

Throughout the trip, Eric kept regular contact with his family via ham radio with Robert M. Lloyd, W8CFR. I've included several photos from his book, including one of W8CFR's station.

Finding this Book

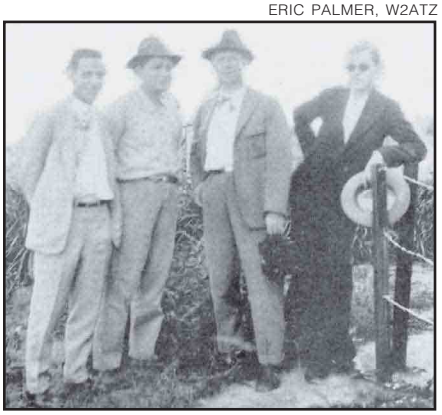
You'll have to find a copy of this book if you want to read it. I've included a photo of its unique cover to help you spot it. Copies are around, but they're not common. There are also articles about Eric in some of the old magazines, like *Radio News*.

If anyone knows what happened to Eric Palmer Jr, W2ATZ, in his later life, please let me know. If I find out anything, I'll update everyone in a later column.

Girls and Ham Radio

Eric enclosed two photos of girl hams in his book. We must remember it was a so-called man's world back then and girls were left out of many things. Ham radio had some great YLs, but most of them didn't get a lot of publicity. I'll cover some of them soon. In the meantime, you can reread my September 2002 column, "The First 'YL,'" for an interesting story about a remarkable YL. Please visit my Web page, **www.eht.com/oldradio/arrl/index.html**.—*K2TQN*

ERIC PALMER, W2ATZ



Visiting the Brazilian High Power Station in Santa Cruz. W2ATZ is at the right, wearing smoked glasses as a protection from the dazzling South American sun. At the left is Alvaro Friere, one of South America's foremost amateurs.

Get Ready for BPL

By Gregory D. Lapin, PhD, PE, N9GL

The BPL industry has argued that their signals do not interfere with HF signals. They claim that they have not received interference complaints from HF users. As we all know, it is not easy to locate interference sources, particularly when a technology emits noise from the entire length of a power line. Combine that with the few trials of BPL so far, and it is not surprising that few complaints exist.

The FCC has affirmed its desire to make BPL a reality in the United States, although they acknowledge the need to prevent interference to licensed users of the HF spectrum. In case you've been out of touch for the past year, BPL stands for Broadband over Power Line technology and is realized by encoding digital signals on carriers that range from 1.7-80 MHz. The signals are injected into the medium voltage power lines that run through our neighborhoods. As anyone with experience using long wire antennas can imagine, these carriers that span the HF bands are likely to radiate from the power lines and produce substantial interference to users of those frequencies.

Part 15 of the FCC Rules allows BPL to be implemented as long as it radiates below given levels and, more importantly, *as long as it does not interfere with licensed users of the spectrum.* BPL installations are being planned for many communities across the country and some have already been installed.

What should you do if BPL comes to your community? According to the current FCC regulations, the BPL installation would have to stop operating if there are complaints from licensed users of *harmful* interference. In its recent Notice of Proposed Rule Making (NPRM, ET Docket No. 04-37), the Commission proposes making it even easier than usual for interference complaints to be registered. The BPL companies would have to make databases of their sites available to the public, and anyone who experiences interference would be able to complain directly to those companies, which would have to respond by adapting their modulation scheme to avoid the frequencies on which the interference was reported. It remains to be seen if this concept will actually work to alleviate interference.

There are two hurdles that we may have to overcome to have the interfering source removed. First, we may be asked to prove that the interference we experience is *harmful*. This is a subjective term and, as such, just stating that the noise source is bothering us may not be enough. Rather, we would have to demonstrate that communications we were able to make before are no longer possible in the presence of the new noise source.

We may also have to prove that the source of our interference is truly from the BPL. We all know the HF bands can be noisy. We hear atmospheric noise and noise from other natural sources. We also hear noise from a myriad of manmade sources, including automobile engines, electric motors and electronic instruments. The noise sources vary throughout the day and over the course of the year. How do we recognize a new noise source as coming from BPL? Short of shutting down the BPL system and comparing the noise in the HF bands before and after, we would need some sort of evidence that indicates the levels of noise on the bands before BPL came to town, and measurements of the levels following the introduction of BPL. There are characteristics of BPL noise that we could recognize, but that can be subjective and it is likely that BPL purveyors would deny that the noise was from them. Without further evidence, the situation could turn into a he-said-they-said scenario.

I recommend that every ham start keeping a simple log of the characteristics of the HF bands at his or her QTH—today. We should start by writing down the details of our stations, particularly with descriptions of our antennas and radios. We should note at different times of day and in different seasons what the background noise levels on the bands are and the characteristics of the noise. Noise characteristics should include whether the noise is uniform across the band and if it appears to be from signals or is more like background static. We should also note the typical signal strengths on each band to indicate the propagation characteristics. If BPL comes to our areas and the noise on the bands increases, we will have a record of typical noise levels on the bands to show that the introduction of BPL caused an increase in the noise.

We should also keep track of the S-meter readings of the stations that we communicate with. If we have to make a case that the noise from BPL is harmful, we will be able to show that prior to BPL we regularly made contacts with stations whose signals were weaker than the levels of noise that BPL has introduced.

With any luck, you will not find yourself in a position where you have to use this type of evidence to prove that BPL has caused harmful interference to your Amateur Radio activities. But, in case you are one of the unlucky ones plagued with this new source of noise, you will be in a good position to make a viable complaint to try to get it stopped.

Without objective proof that BPL causes interference to HF stations, the FCC will have no choice but to conclude that it is not an interference source, just as its makers claim. In light of that conclusion, the Commission may be willing to increase allowable power levels for BPL transmissions. It is up to the Amateur Radio community to provide the proof that BPL causes harmful interference to HF users, even at the Part 15 power levels. If we fail to act, we will have no one but ourselves to blame.

The author, who is Chair, ARRL Amateur Radio Interference Assessment Project and Member, FCC Technological Advisory Council, can be reached at **n9gl@comcast.net**.

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.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

*W1CQN, Allyn H. Fisher, Walpole, MA
WA1HSZ, Robert W. Greenfield, St Petersburg, FL
K1LBU, Malcolm L. Hilton, Bolton, CT
WA1LHW, Carl Beckenbach, Greenwood Lake, NY
WA1UGB, B. J. Bailey, Salisbury Center, NY
KP2BL, Joseph P. Feehan, St Thomas, VI
WA2DUG, Richard Krasnitski, Hazlet, NJ
WA2HQB, Edward F. Maher, Hudson, FL
W2LG, Meyer Gerstein, Phoenix, AZ
KS2L, Alfred Fontana, Watkins Glen, NY
W2LTY, Robert F. Cassidy, Schenectady, NY
W2NEH, John E. Dombroski, Middlesex, NJ
KB2NXA, Richard E. DiFiore, Red Bank, NJ
K2QFL, Harry A. Hamlen, Stewartsville, NJ
W2QHW, Milla K. Garretson, Turin, NY
WA2RRK, George F. Clay, Garrison, NY
N2XIM, Judith A. Haingray, Fairport, NY
WB2YGA, Vincent J. Banville Sr, Waymart, PA
KD3AK, Louis A. Cattley, Pittsburgh, PA
K3BDO, John R. Flynn, West Mifflin, PA
N3CWP, T. K. Morrow, Greensburg, PA
W3EOD, Vernon A. Bell, Lancaster, PA
W3FCM, Fred C. Magnuson Jr, Blandon, PA
K3FOU, Joseph Zeidman, Atlanta, GA
W3GHV, Alvin J. Gutt, Harleysville, PA
W3HVE, Thomas C. Freedom, Bedford, VA
K3NBD, Robert R. DeVaughn, Pittsburgh, PA
W3OKI, Kenneth C. Rhody, Wyomissing, PA
*W3PA, David W. Jefferies, Bedford, PA
WA3ZRU, David L. Ickes, Altoona, PA
K4AHI, Clayton M. Fendley, La Grange, KY
W4AN, Bill Fisher, Alpharetta, GA
W4BBU, M. Larry Miller, Prospect, KY
KG4CLG, Richard D. Gannon, Owego, NY
K4DCM, Martin M. Greenstein, Altamonte Springs, FL
WD4DHI, Henry L. Baggett, Ashland, AL
WA4DLL, Clark J. Evans Sr, Tampa, FL
NB4DN, James H. Allen, La Quinta, CA
K4EAJ, Roaul E. Wright, Oak Ridge, TN
WB4FJU, Edward Ward, Jackson, TN
KB4GF, Hugo A. Bondy, Decatur, GA
N4HF, Hugh W. Fallis, Troy, VA
AA4IB, Harry E. Stewart, Bradenton, FL
WD4LCN, Niles H. Hollenbaugh, Richmond, VA
W4LWU, James C. Peacock Jr, Goldsboro, NC
*W4MLA, Jerry E. King, Melbourne, FL
K4ML, James W. Tucker, Falls Church, VA
AA4QO, Charles L. Cargile, Prattville, AL
N4TUN, Herman P. Gardner, Cullman, AL
W4TVL, Kenneth L. Strickler, Gallatin, TN
K4UNE, Arthur L. Calhoun, Somerset, KY
KE4VAA, Jack N. Mitchell, Panama City, FL
N4VHZ, Harold L. Miller, Sturgis, MI
N4WJZ, Michael White, Supply, NC
KA5DGD, Elmer R. Hopkins, Lago Vista, TX
W5DJO, Glenn E. Milner, Arlington, TX
K5IKB, Joseph L. Haughton, Amory, MS
W5LLU, John P. Stewart, Houston, TX
ex-KG5MO, Brandon T. Babjack, Houston, TX
KC5SO, John F. Stone, Stillwater, OK
KD5SZN, Earvis J. Courvelle, Cankton, LA
K5UPN, Josiah B. Brown, Longview, TX
W5VUY, Gerald C. Chaisson, Breaux Bridge, LA
W5VWC, William D. Hafer, Clarkridge, AR
*W5YSM, Frank L. Jamison Jr, Baton Rouge, LA
N6ALB, Jo Ann L. Grover, Chatsworth, CA
WD6ASB, Arlene M. Ellis, Kingman, AZ
W6EA, Arthur V. Enockson, Buena Park, CA
W6FOB, James K. Palmer, San Luis Obispo, CA
N6GPA, Claude A. Burkholder Jr, Fresno, CA
W6GV, Richard I. Wilson, Clovis, CA
KD6HPS, Leonard E. Hoff, Fresno, CA
N6KGX, Frances V. Stansifer, San Diego, CA
W6LWD, Forrest W. Balliet, El Cerrito, CA
*W6MR, Joe Clement, Orange, CA
K6OO, John E. Morris, Coronado, CA
W6PNW, Maurice R. Reynolds, Pipestone, MN
K6PXT, Leland W. Kiff Jr, San Leandro, CA
*N6SR, Wilbur C. Schroeder, Camarillo, CA
KD6TY, David Haimbach, Fresno, CA
W6UK, Alvino Rey, Sandy, UT
W6UVW, Harold M. Rowlette, North Highlands, CA
KB6UX, Betty L. Hollidge, Walnut Creek, CA
K6WXO, Robert Szatkowski, Concord, CA
WT6X, Thomas W. Uhlmeyer, Porterville, CA
KB6ZT, Charles N. McKenna, Coronado, CA
WA6ZTW, Evelyn R. Brightman, Long Beach, CA
N7AUF, Ted L. Buhler, Seabeck, WA
K7BQ, Clifford E. Fay, Peoria, AZ
K7DX, Lee E. Warren, Sun City, AZ
N7GAH, John J. Gahms, Spanaway, WA
W7GRQ, John R. Padden, Tacoma, WA
W7HQB, D. Duane Lind, Columbia Falls, MT
W7HVJ, Robert E. Shafer, Port Angeles, WA
K7JMN, David S. Marshall, Gardnerville, NV
W7KRW, James E. Groll, Avilla, IN
KW7M, Jerry C. Jewell, Silverton, OR
K7OPX, Joe Wong, Tucson, AZ
N7PRF, Ruth S. Pfeiffer, Carson City, NV
N7RIC, Jay G. Davies II, Olympia, WA
N7VOF, George A. Staples, Bellevue, WA
N7VWJ, Richard A. Berndt, Seattle, WA
WD8AAK, Ronald W. Folkert, Benton Harbor, MI
WA8CWD, Larry I. Reitz, Perrysburg, OH
NZ8D, Edward Wojcik, Ashtabula, OH
W8IZZ, Don F. McKechnie, Dayton, OH
N8ORW, Dennis Galleck, St Helen, MI
W8UJE, James Watt, Farmington Hills, MI
KA8ZZI, James M. Brown, South Point, OH
WA9BZZ, Charles E. Reith, Huntington, IN
KG9EX, James T. Wittke, Huntington, IN
N9GEU, Alan G. Pugh, Huntington, IN
W9HE, William C. Littlewood, Brookfield, WI
W9HXO, A. L. Flassig Jr, Portage, IN
KB9JDD, Granville L. Foster, Richmond, IN
N9NNA, James W. Raasch, Grafton, WI
WB9YEY, Robert C. Greer, Wabash, IN
KØARA, Fred Davidson, Fort Dodge, IA
WØAXC, Ross C. Stanbery, Clarion, IA
WØBZT, Jack S. Linton, Joplin, MO
WØEIQ, Forrest P. Eye, Appleton City, MO
KAØFXJ, Robert A. Johnson, Grand Island, NE
KØHXB, John E. Erickson, Brainerd, MN
KØLIK, Ralph S. Chezum, Fairfield, IA
KØLV, Stanley W. McKean Jr, Leavenworth, KS
WØRTY, E. Riley Morawitz, Center, MO
*NUØT, Donald C. Blenden, Columbia, MO
KØUSY, Jack C. Buffington, Frontenac, KS
WØVNA, Bill L. Dunbar Sr, Omaha, NE
*G3IDG, F. A. Herridge, Hampshire, Great Britain
G6XN, Leslie A. Moxon, Surrey, Great Britain
*HB9CHV, Markus Vest, Bottmingen, Switzerland
VK3ZC, John K. Tutton, Camberwell, Vic, Australia

*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 the 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

QEX INCLUDING: COMMUNICATIONS QUARTERLY

In the May/June Issue:

• Dick Lichtel, KD4JP, shows us how to build, program and operate a USB 1.1 interface. USB is one up-to-date way to make connections to your software radios, test equipment and other computer-controlled projects. Glen Gardner Jr, AA8C, brings us his receiver preamplifier based on the MiniCircuits MAR-6. It is a reasonably easy construction project that performs.

• Paolo Antoniazzi, IW2ACD, and Marco Arecco, IK2WAQ, return with their measurements of 2.4-GHz helical antennas. They include information about building a slotted-line coupler, allowing you to make return-loss measurements. Pavel Zanek, OK1DNZ, is back with another two-band diplexer. This one is for 2 m and 1.5 m.

• Bill Rynone writes about ground planes made of composite materials such as metal-mesh and carbon-fiber cloth. Bob Zavrel, W7SX, takes a look at the relations among antenna aperture, gain and directivity. Bob focuses on equations that reveal what happens between two antennas.

• Sergio Cartoceti, IK4AUY, describes a double-balanced "H-mode" mixer that uses a high-speed bus-switch IC. He gives its developmental history and his particular implementation. Andrew Roos, ZS1AN, adds to the international flavor of this issue with his reduced-height vertical array. Analysis and optimization accompany construction details. Chris Sieg, WA3LDI, rounds out our feature articles with his "Uncoder," a nifty accessory for those 2-m and other rigs that don't have CTCSS, also known as PL or "private line." Neat features include automatic detection and setting of PL frequencies.

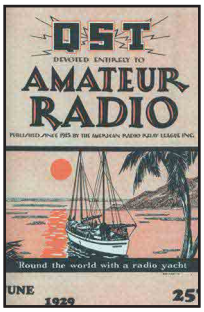
• In *RF*, Contributing Editor Zack Lau, W1VT, tells how to stack 2-m Yagis for good performance.

QEX is edited by Doug Smith, KF6DX (**dsmith@arrl.org**) and is published bimonthly. The subscription rate (6 issues) for ARRL members in the US is $24. For First Class US delivery, it's $37; elsewhere by surface mail (4-8 week delivery) it's $31. In Canada by airmail it's $40. Elsewhere by airmail it's $59. Nonmembers add $12 to these rates.

Would you like to write for *QEX*? It pays $50/printed page. Get more information and an *Author's Guide* at: **www.arrl.org/writing.html**. If you prefer postal mail, send an SASE (6×9 inches, minimum) with 1 unit of postage to Maty Weinberg, ARRL, 225 Main St, Newington, CT 06111-1494, and request an *Author's Guide*.

75, 50 AND 25 YEARS AGO

June 1929



♦ The cover drawing shows the *Nomad* at anchor in a tropical setting, with the caption, "Around the world with a radio yacht." The editorial discusses the modern practice used by military nets of all stations operating on the same frequency (rather than each station being on a different frequency), and suggests that this would be a good example for amateurs to follow.

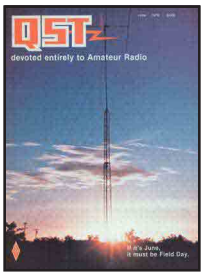
Stephens Miranda tells about "WHDC—Aboard the *Nomad* on a World Cruise." Thornton Dewhirst discusses "Photo-Electric Cells and Methods of Coupling to Vacuum Tubes." In "The President's Corner," Hiram Percy Maxim speaks of the "Self-Control" that amateurs have admirably exhibited, using the phrase, "…it almost seems as though amateur radio were a child of destiny." A ham writing as "Uncle Jimmy" tells the story of "The Pied Piper of Hamelin—A '1929' Edition of an Old Story"; Gil, W1CJD, illustrates the tale with cartoons. D. J. Angus, W9CYQ, discusses "Indicating Instruments for Amateur Transmitters." The second entry in the League's Station Description Contest is W8BQ of Hazleton, Pa.

June 1954

♦ Forward-looking cartoonist Gil, W1CJD, shows the Podunk Hollow gang getting ready to operate Field Day from the Moon. The editorial urges volunteer examiners to meet their new responsibilities well as they begin giving more amateur exams, following the recent changes to FCC rules.

"New Record on 10,000 Mc." reports on the work Len Garrett, W7JIP, and Ralph Harris, W7OVK (plus supporters W7OAY, W7JSK, and W7HAE) did in setting the new 47.4-mile record for that band. By Goodman, W1DX, presents Part II of "Some Principles of Radiotelephony," this time with plain talk about A.M. fundamentals. Robert Resconsin, W1TRF, tells how he built "A Bandswitching 813 Rig with Pi-Section Output." F. E. Ladd, W1IDZ, discusses "50-Mc. TVI—Its Causes and Cures." Robert Webster, W4IMM, describes the advantages of "Mobile Loop Antennas." Edward Hayward, W1PH, tells how to build "A Receiver for Flat Purses," a T.R.F. regenerative set. In "YL News and Views" Eleanor Wilson, W1QON, introduces us to a new crop of YL hams—who range in age from 12 to 17.

June 1979



♦ The cover photo shows a beautiful sunset behind a tower, with the caption, "If it's June, it must be Field Day." The editorial discusses the diversity of the interest groups that live under the umbrella of Amateur Radio, urging the reader to try something new in ham radio.

Albert Helfrick, K2BLA, tells about "A Medium-Power Solid-State Transmitter" that provides 50 watts on HF CW or RTTY. Doug DeMaw, W1FB, tells the reader how to "Build Your Own $^{5}/_{8}$-Wave Antenna for 146 MHz." Jim Bartlett, K1TX, discusses "An Accurate, Low-Cost Antenna Elevation System." Steve Phillabaum, K7NR, looks at "Installation Techniques for Medium and Large Yagis." "Measuring Transmission-Line Velocity Factor," by George Downs, W1CT, tells the reader how to determine the speed of radio waves traveling down his transmission line. Doug DeMaw, W1FB, teaches us about "The Practical Side of Toroids." Robert Wilson, K9RBW, suggests an interesting weekend project, "The Wee-Keyer," a simple electronic keyer made from only nine parts. George Hart, W1NJM, asks, "High-Speed CW, Anyone?" and tells about his homebrew program to give hams practice at speeds of 20 to 65 WPM. 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

New General Class Question Pool to Take Effect July 1; QPC Invites Input for Extra QP Revision

Effective July 1, 2004, a new Element 3 General class question pool will take effect for examinations. VECs and VEs will have new test designs available for use in exam rooms effective that date. All question pools can be found at **www.arrl.org/arrlvec/pools.html**.

The new General pool released by the Question Pool Committee (QPC) in December 2003 contains 432 questions, up from 385 in the existing pool. While all sub-elements grew slightly, the greatest increase in questions this time around is in the Operating Procedures and Amateur Radio Practices subelements. The General class question pool does not contain any diagrams or symbols.

Extra Class Question Pool is Next

The Question Pool Committee now is turning its attention to developing an outline for an updated Amateur Extra class (Element 4) question pool, which will be revised over the next two years. Assuming there's no change in direction due to ongoing license restructuring discussions, the revised Extra pool will go into effect July 1, 2006.

Public input is invited and requested now on our future Extra exam questions. Consistent with the pool syllabus (found at **www.arrl.org/arrlvec/pools.html**), interested parties can submit input on questions, answers or distractors to the entire QPC via e-mail to **qpc@arrl.org**, or to the individual committee members: Chairman, Scotty Neustadter, W4WW (**w4ww@arrl.net**); Fred Maia, W5YI (**w5yi@w5yi.org**); John Johnston, W3BE (**johnston.john1@worldnet.att.net**), and to me Bart Jahnke, W9JJ (**w9jj@arrl.org**).

When you submit new question material, or suggest changes to existing questions, please limit question length to 210 characters, and answer or distractor lengths to 140 characters. (For new or existing questions being modified, please indicate the sub-element reference number and topic—and existing question number if any—with your submission; for example, "**E3A**, RADIO WAVE PROPAGATION").

To locate a VE Team or VEC in your area, see **www.arrl.org/arrlvec/examsearch.phtml** or **wireless.fcc.gov/services/amateur/licensing/vecs.html**.

A HELPING HAND—VEs TESTING PERSONS WITH DISABILITIES

Throughout the history of the Amateur Service, taking a license test has been a great challenge for many of us who are able to see, hear, write and/or speak. Yet for those with physical or other disabilities, the examination process presents a formidable challenge, at times a process seeming nearly impossible.

Over the decades, FCC themselves afforded the disabled a limited set of accommodations, including tests administered by a volunteer at the person's home and/or bedside, or reading or writing for those who could not do so themselves; or with the Morse exam, increasing or decreasing the volume or tone frequency, or using flashing light or vibrating surface to convey the test message. When the FCC turned exams over to the VEC system in the early '80s, these accommodative techniques were passed on as guidance for volunteers in the new system.

In the early '90s, FCC expanded on this list affording greater code test accommodations, including "where warranted" pausing the message after sentences/phrases, between words or even character-by-character. FCC also indicated that, as an accommodation, where warranted, a sending test might be administered in place of a receiving test where the particular disability might preclude using a receiving test.

These accommodative procedures are described on the back of NCVEC Form 605 (**www.arrl.org/arrlvec/ncvec605-3.pdf**), the current application form used by VEs at testing sessions.

Question Pools

The current question pools and their four-year validation periods are as follows:
***Current General class Element 3:** Expires at midnight 6/30/04
New General class Element 3: 7/01/04 through 6/30/08
***Current Extra class Element 4:** Expires at midnight 6/30/06
***Current Technician class Element 2:** Effective 7/01/03 through 6/30/07

*No update release is scheduled for July 2005.

Exam Days

The next ARRL Fall National Exam Days weekend is Saturday and Sunday, September 25-26, 2004.

The Handi-Hams

Let us also not forget our friends at the Handi-Ham Courage System (a membership organization themselves) who have for more than 35 years assisted those persons requiring a helping hand in learning about Amateur Radio, preparing for or taking examinations and assembling their stations. For more information on the resources of Handi-Hams, or to join see **www. handiham.org** or call 763-520-0512 weekdays 6:30 AM to 3 PM Central Time.

Consider Accommodations

Those who request an accommodation must be afforded appropriate considerations by the VE team. Per FCC Rules Section 97.509(k), "VEs must accommodate an examinee whose physical disabilities require a special examination procedure." The FCC also says that "The administering VEs may require a physician's certification indicating the nature of the disability before determining which, if any, special procedures must be used." These words are not a suggestion—FCC requires VEs to offer a helping hand to those in need.

The VE team is expected to acknowledge what particular difficulties are identified by an examinee, and to consider what, if any, accommodations must be used. A VE team cannot simply reply: "we don't do that," "we aren't able to assist you," "come back in 6 months" or the like as the FCC Rules do not support such a response. A VE team can certainly defer a test using special procedures to a time/date or place most conducive to administering the accommodative examination. The VE team can expect reasonable notice from an examinee prior to a test session where an accommodation is sought. In addition, per FCC Rules, the VE team can require a person seeking accommodations to supply the VE team (in advance) with a Physician's Certification (a statement or letter from a medical professional) that explains the nature of the disability in order that the examiners can determine which, if any, accommodation must be used. While the Physician's letter may offer sufficient information that the VEs can make a clear determination on what accommodation is appropriate, all too often the letter is vague and sometimes not legible. Either way, it is the VEs who must determine the appropriateness of any accommodation and the VEs who sign the application certifying to FCC that the procedure chosen by the VE team was in their view most appropriate for that examinee. ARRL VEs are encouraged to review Chapter 7 of the 8th Edition *ARRL VE Manual* (also on-line at **www.arrl.org/arrlvec/vemanual/**) or contact the ARRL VEC should they have procedural questions.

Any two VEs, or VE teams, even after careful considerations, may indeed have differing opinions! Determining the appropriateness of any particular accommodation may vary from volunteer to volunteer, and from VE team to team. As FCC provides broad guidance, it's possible that one VE team may conclude that a particular accommodation may be warranted where a different team may conclude that no accommodation is necessary. Both VE teams, after giving due consideration, can be correct in their judgments. That said, most VE teams approach such challenges with all of the compassion and understanding they can muster, and accommodations or not are often prompt to offer their helping hand, whether it be a special examination procedure or simply moral support. QST

Bart Jahnke, W9JJ ♦ ARRL VEC Manager ♦ bjahnke@arrl.org

CONTEST CORRAL

W1AW Qualifying Runs are 10 PM EDT Friday, June 4 (0200Z June 5), and 7 PM EDT Wednesday, June 16 (2300Z June 16). The K6YR West Coast Qualifying Run will be at 9 PM PDT Wednesday, June 9 (0400Z June 10) (40-10 WPM). Check the W1AW Schedule elsewhere in this issue for details.

Abbreviations

SO—Single-Op; M2—Multiop—2 Transmitters; MO—Multi-Op; 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.

June 4-7

QRP TAC Contest—CW, SSB and PSK31—sponsored by EPA QRP Club from 1800 to 2359Z Jun 5. Frequencies: 80-10 meters. Categories: QRP (<5 W), QRPp (<1 W), Tactical (portable with temporary antennas), Homebrew, Classic (pre-1985 radios). Exchange: RST, name and telephone area code (TAC), DX send area code or prefix. PA stations send×after the area code. For more information: **www.n3epa.org**. Logs due Jul 12 to **tac@n3epa.org** or EPA QRP Club c/o Ron Polityka, 1155 Robeson St, 2nd Fl, Reading, PA 19604-2151.

World Wide Major Six Club Contest—CW/SSB—sponsored by the Six Meter World Wide DX Club, from 2300Z Jun 4-0300Z Jun 7. Frequencies: 50 MHz only. Categories: SO only. Exchange: Grid Square. QSO points: own country—1 pt, diff country (incl KH6 and KL7)—2 pts. Score: QSO points × grid squares (counted only once). For more information: **6mt.com/contest.htm**. Logs due 30 days after the contest to **w4wrl@aol.com** or to Wayne Lewis Sr, Six Club Contest Director, 3338 S. Cashua Dr, Florence, SC 29501-6306.

IARU Region 1 Field Day-CW—sponsored by IARU Societies from 1500Z, Jun 5 to 1459Z, Jun 6 (SSB-Sep 4-5). Frequencies: 160-10 meters. Categories: SOAB (LP, QRP), MS (HP, LP). Exchange: RST and serial number. QSO points: non-EU to EU—3 pts, with portable EU stations—4 pts. Score: QSO points × DXCC and WAE entities counted once/band. See IARU Region 1 society Web sites for more information. Send logs to the appropriate national societies (NA hams to RAC or ARRL).

June 12-14

ANARTS WW RTTY / Digital Contest—sponsored by Australian National Amateur Radio Teleprinter Society (ANARTS) from 0000Z Jun 12-2400Z Jun 13. Frequencies: 80-10 meters. Categories: SO, MS, and SWL, SO and SWL only operate 30 hours. Exchange RST, CQ zone and Time (UTC). QSO points are determined by an exchange table available from ANARTS. Score is QSO points × DXCC entities + VK, JA, VE and W call districts + continents (counted only once). For more information: **www.users.bigpond.com/ctdavies**. Logs due Sep 1 to **ctdavies@bigpond.net.au** or Contest Manager, VK2BQS, Jim Swan, PO Box 93, Toongabbie, NSW 2146, Australia.

Asia-Pacific Sprint—SSB—1100Z to 1300Z Jun 12. Frequencies: 20 and 15 meters only (see Feb *QST*, p 103, or **jsfc.org/apsprint/aprule.txt**).

ARRL June VHF QSO Party—1800Z Jun 12-0300Z Jun 14 (see May *QST*, p 107, or **www.arrl.org/contests/rules/2004/june-vhf.html**).

Portugal Day Contest—SSB—sponsored by Rede dos Emissores Portugueses (REP) from 0000Z-2400Z Jun 12. Frequencies: 80-10 meters. Categories: SOAB only. Exchange: RS + serial number or CT district abbreviation. QSO points: different country—3 pts, CT stations—6 pts. Score: QSO points × CT districts counted once per band. For more information: **www.rep.pt/dia_de_portugal.htm**. Logs due Sep 1 to REP-Rede dos Emissores Portugueses, Award/Contest Manager, PO Box 2483, 1112 Lisboa Codex, Portugal.

WW South America CW Contest—sponsored by the Confederacao Brasileira de Radioamadorismo (LABRE) from 0000Z Jun 12-1600Z Jun 13. Frequencies: 80-10 meters. Categories: SOAB, SOSB, MOAB. Exchange: RST and continent. QSO points: South America entrants: own country—1 pt, different country—3 pts, diff continent—10 pts; non-SA entrants: own country—1 pt, diff country—3 pts, diff cont—5 pts, SA—10 pts. Score is QSO points × prefixes (WPX rules). For more information: **www.labre.org**. Logs due Jul 31 to **labre@labre.org** or LABRE—WWSA Contest Committee, PO Box 0000470359-970, 70359-970 Brasilia DF, Brazil.

June 19-20

Kid's Day Operating Event—from 1800 to 2400Z Jun 19 (see **www.arrl.org/FandES/ead/kd-rules.html**).

West Virginia QSO Party—CW/SSB—sponsored by the West Virginia State Amateur Radio Council from 1600Z Jun 19-0200Z Jun 20. Frequencies: 80-10 meters, CW—35 kHz from band edge, Phone—35 kHz from General Class band edge and Novice/Tech 10-meter segment. Categories: SO, MM and Mobile, all categories may be HP, LP (<100 W), QRP (<5 W), Phone, CW, or mixed mode. Work stations once per band/mode and WV stations from each county (WV mobiles keep separate log for each county). Exchange: RS(T) and WV county or S/P/C. QSO points: Fixed stations: CW—2 pts, SSB—1 pt; Mobiles: CW—3 pts, SSB—2 pts; Bonus—100 pts for QSOs with W8WVA once per band/mode, WV mobiles add 100 points per county activated with minimum of 1 QSO. Score: QSO points × WV counties (+ S/P/C for WV stations), add bonus to final score, multipliers count only once. For more information: **www.qsl.net/wvarrl**. Logs due Jul 19 to **WA8WV@aol.com** or Dave Ellis, WA8WV, 610 Hillsdale Dr, Charleston, WV 25302.

All-Asian DX Contest—CW—sponsored by the Japan Amateur Radio League from 0000Z Jun 19 to 2400Z Jun 20. (SSB—Sep 4-5). Frequencies: 160-10 meters (160 is CW only), incl 10-min. band change rule. Categories: SOAB, SOSB, MO, Low Power (Asian stations only), Junior (JA stations <20 years), Senior (JA stations >70 years). Exchange: RS(T) and a two digit number denoting the operator's age. YL stations may send 00. QSO points for non-Asian stations: 40-15 meters—1 pt, 80 and 10 meters—2 pts, 160 meters—3 pts. Score: QSO pts × Asian prefixes (WPX rules). For more information and Asian station QSO points—**www.jarl.or.jp/English/4_Library/A-4-3_Contests/2004AA_Rule.htm**. Logs due Jul 31 (Oct 31 for phone) to **aacw@jarl.or.jp** (SSB logs to **aaph@jarl.or.jp**) or JARL, All Asian DX Contest, 170-8073, Japan.

SMIRK QSO Party—sponsored by the Six Meter International Radio Klub, 0000Z Jun 19-2400Z Jun 20. Frequencies: phone QSOs within the lower 48 states and Canada above 50.150 MHz; only DX QSOs between 50.100 and 50.150 MHz. SO category only. No repeater QSOs. Exchange: SMIRK number and grid square. QSO points: SMIRK member—2 pts, nonmember—1 pt. Score: QSO points × grid squares. For more information: **www.smirk.org**. Logs due Aug 1 to **contest@smirk.org** or Dale Richardson AA5XE , 214 Palo Verde Dr, Kerrville, TX 78028.

Quebec QSO Party—CW/Digital/Voice—sponsored by the Radio Amateurs du Quebec from 1700Z Jun 19-0300Z Jun 20. Frequencies: 80-2 meters, no repeater contacts. Categories: SOAB (150 W max), MO, QRP, VHF (QRP and VHF are VE2 and NA stations only). Exchange: RS(T) and Quebec region or S/P/C, /MM send ITU zone. QSO points: Voice—1 pt, CW/Digital—2 pts, VE2RIO—10 pts. Score: QSO points × VE2 regions and ITU Zones counted once per band and mode. For more information: **www.raqi.ca/qqp**. Logs due Aug 24 to **qso-log@raqi.ca** or Radio Amateur du Quebec (QQP), 4545 Av Pierre-de-Coubertin, CP 1000, Succursale M, Montreal QC, Canada H1V 3R2.

June 26-27

ARRL Field Day—1800Z Jun 26 to 2100Z Jun 27 (see May *QST*, p 107 or **www.arrl.org/contests/rules/2004/rules-fd-2004.html**).

His Majesty King of Spain Contest-SSB—1800Z Jun 26-1800Z Jun 27 (see May *QST*, p 99).

QRP ARCI Milliwatt Field Day—1800Z Jun 26-2100Z Jun 27. Follows ARRL Field Day rules, see **2hams.net/ARCI/mwfd.htm** for more information.

Marconi Memorial HF Contest-CW—sponsored by ARI from 1400Z Jun 26-1400Z Jun 27. Frequencies: 160-10 meters, according to IARU band plan. Categories: SO -LP (<100 W) and -QRP (<5 W), and MO. Exchange: RST + serial number. QSO points: 1 pt/QSO. Score: QSO points × DXCC entities counted once per band. For more information: **www.qsl.net/ik6ptj/marconi.htm**. Logs due 30 days after the contest to **ik6ptj@qsl.net** or ARI sez. di Fano, PO Box 35, I-61032 FANO (PS), Italy.

UK DX Contest—SSB, sponsored by the Scottish-Russian ARS from 1200Z Jun 26-1200Z Jun 27. Frequencies: 160-10-meters. Categories: SOAB and SOSB (HP, LP <100 W, QRP < 10 W), MS, MM. Exchange: RST and serial number, UK stations send UK region code. QSO points: Own DXCC entity—1 pt, same continent—2 pts, different cont—3 pts, UK stations—5 pts. Score: QSO points × UK regions + DXCC entities on each band. For more information: **www.srars.org/ukdxcruleseng.pdf**. Logs due 30 days after the contest to **ukdxssb@srars.org** or Scottish-Russian ARS, PO Box 7469, Glasgow, G42 ØYD, Scotland, UK.

STRAYS

QST congratulates...

◊ ARRL Atlantic Division Director Bernie Fuller, N3EFN, who was honored recently by the French Creek Council of the Boy Scouts of America with the award of the Silver Beaver. It is the highest award that can be awarded to a registered Scouter by a Boy Scout Council.

◊ The Rocking Chair Net, a 2 meter FM simplex net in the Detroit area, which celebrated 20 years of operation in March. You can find it on 145.630 MHz every night Monday though Saturday at 8 PM Eastern Time.—*Richard Sudney, KB8TVB*

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

SPECIAL EVENTS

Fort Wayne, IN: Allen County Amateur Radio Technical Society and Fort Wayne Radio Club, KB1IBW. 1500Z-2400Z **May 29**. Amateur Radio Military Appreciation Day. General bands; PSK 31; IRLP nodes 9205 8380; Echolink Nodes 16686 106819. QSL. Emery McClendon, WB1IBW, 6116 Graymoor Ln, Ft Wayne, IN 46835-2313. **www.fortwayneradioclub.org**.

Sainte Marie du Mont, France: Reseau des Emetteurs Francais, TM6JUN. **May 31-Jun 13**. 60th anniversary of Allied disembarkment at Utah Beach. SSB and CW 80, 40, 20, 17, 15, 12 and 10 meter bands. QSL. Denis Villemion, F5RJM, Le Flaquet, 50470 Tollevast, France.

Ponca City, OK: Kay County Amateur Radio Club, K5P. 2100Z **Jun 4**-2000Z **Jun 5**. Ponca City Oklahoma's Annual Jumpin in June celebration. 28.360 21.360 14.260 7.260. QSL or certificate. Joseph Widner, 3644 Ashbury Rd, Ponca City, OK 74604.

Boston Harbor area, MA: USS *LST*-325 Amateur Radio Club, W2T. **Jun 4-Jun 14**. USS *LST*-325 46-day, 4119 mile trip up the east coast of the United States. All amateur bands. QSL. Robert Wilder, AF2HD, 6032 Idlemoore Ct, Theodore, AL 36582-4036. Trip begins May 24; WW2LST/MM will also be used.

Badin, NC: Montgomery Amateur Radio Society, NC4MC. 1400Z-2100Z **Jun 5**. 60th Anniversary US Navy B-25 lost in Badin Lake, NC. 28.480 21.360 14.260 7.235. Certificate. Jim Aderholt, KI4DH, 128 Northwood Ln, Robbins, NC 27325.

Cobb Island, MD: Charles County Amateur Radio Club, K3SMD. 1200Z-2100Z **Jun 5**. Celebration of Cobb Island Day 2004. 28.345 21.345 14.245 7.245. QSL. CCARC, PO Box 73, Accokeek, MD 20607.

Tylertown, MS: Southwest Mississippi Amateur Radio Club, KD5QNC. 1500Z-2200Z **Jun 5**. Walthall County Dairy Festival. 14.270 7.270. QSL. Southwest Mississippi ARC/KD5QNC, 1545 Friendship Ln NW, Brookhaven, MS 39601. **www.swmarc.cjb.net/**.

Union, IL: Illinois Railway Museum, W9T. 1400Z-2100Z **Jun 5**. 51st Anniversary of the Museum. 145.390 28.350 21.350 14.250. Certificate. Larry Zacharias, 1031 Pershing Dr, Wauconda, IL 60084.

Camden, NJ: Battleship *New Jersey* Amateur Radio Station, NJ2BB. 1200Z **Jun 5**-2359Z **Jun 6**. 50th anniversary of the four Iowa Class battleships sailing together. 14.250 14.050 7.250 7.050. Certificate. Margaret Burgess, KB2BRR, 150 Schooner Ave, Barnegat, NJ 08055.

Green River, WY: Sweetwater Amateur Radio Club, WY7U. 1800Z **Jun 5**-1800Z **Jun 6**. Butch Cassidy and the Wild Bunch UPRR train robberies. 21.365 14.265 7.265 3.915. QSL. Sweetwater Amateur Radio Club, 1000 South Dakota, Green River, WY 82935. **www.qsl.net/wy7u—** special certificate for working both Jun and Aug events.

Linthicum, MD: Historical Electronics Museum ARC, W3HEM. 1300Z **Jun 5**-2200Z **Jun 6**. The contributions of electronics to D-Day invasion. 14.244 7.244 14.044 7.044. Certificate. HEMARC, PO Box 746 MS4015, Baltimore, MD 21203. **www.qsl.net/w3gr**.

Streetsville, ON: Mississauga Amateur Radio Club, VE3MIS. 1400-2000Z daily **Jun 5** and **Jun 6**. Annual Streetsville Bread & Honey Festival. 28.480 21.315 14.240 7.227. Certificate. MARC, c/o Michael Brickell, 2801 Bucklepost Cres, Mississauga, ON, Canada L5L 1M6. Include $1 US, 2 IRCs or 2 green stamps for postage. **www.marc.on.ca**.

Windsor, Ontario: Amherstburg Radio Club, VE3TMG. 1600Z **Jun 5**-2359Z **Jun 6**. Commemorating CKLW radio station on the air since 1932. 28.460 14.260 7.260. Certificate. Terry Greenwood, 2210 Janette Ave, Windsor, ON, Canada N8X 1Z8. Include $1 US for postage.

Birmingham, AL: D&G Amateur Radio Association, W4V. 1500Z **Jun 5**-2400Z **Jun 13**. Celebrating the restoration of the Vulcan statue. 14.260. QSL. W4DAI, PO Box 51, Alton, AL 35015-0051. **www.valcanpark.org**.

Atkinson, NH: Atkinson Amateur Radio Club, K1D. 0401Z **Jun 5**-0400Z **Jun 20**. Celebrating Kid's Day and Amateur Radio Awareness. 28.370 21.370 14.270 7.230. Certificate. Peter Schipelliti, 7 Dearborn Ridge Rd, Atkinson, NH 03811.

New Orleans, LA: Jefferson Amateur Radio Club, W5D. 1400Z-2200Z **Jun 6**. 60th anniversary of D-Day from New Orleans. 14.250. Certificate. W5GAD, PO Box 73665, Metairie, LA 70033. **www.qsl.net/w5gad/**.

West Chester (Cincinnati area), OH: West Chester Amateur Radio Association, WC8VOA. 1200Z **Jun 6**-0500Z **Jun 7**. 60th Anniversary of the Normandy Invasion. 28.305 21.305 14.275 7.275 CW up 35 kHz 10 15 20 40 m. QSL. WC8VOA, PO Box 913, West Chester, OH 45071. **www.wc8voa.org**.

Various, England, Royal Signals Amateur Radio Society, GB6OL. 0700Z **Jun 6**-2359Z **July 3**. 60th Anniversary of Operation Overlord 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**.

Fond du Lac, WI: Fond du Lac Amateur Radio Club, Inc, W9W. 1800Z **Jun 11**-1800Z **Jun 13**. Walleye Weekend Festival. 28.350 21.350 14.250 7.250. QSL. Dave Witt, WD9W, 1160 S Park Ave, Fond du Lac, WI 54935.

Clearfield, PA: Quad County Amateur Radio Club, N3QC. 1400Z-2000Z **Jun 12**. Clearfield County Bicentennial. 444.625 146.865 14.230 7.225. Certificate. QCARA, Jeffrey Rowles, 3319 Allport Cutoff, Morrisdale, PA 16858. **www.qcarc.com**.

Weatherly, PA: Anthracite Repeater Association, KB3AGZ. 1300Z-2000Z **Jun 12**. Weatherly Hill Climb. 7.280. Certificate. Jack Provizzi, PO Box 356, Beaver Meadows, PA 18216.

Maple Valley, WA: Maple Valley Amateur Radio Club, KC7KEY. 1600Z **Jun 12**-0400Z **Jun 13**. Tenth Anniversary of Maple Valley club founding. 28.455 21.347 14.267 3.965. Certificate. Tom Patterson, PO Box 488, Maple Valley, WA 98038. **www.kc7key.org**.

Warsaw, IN: Hoosier Lakes Radio Club, W9W. 1500Z-2300Z **Jun 19**. Celebrating the Sesquicentennial of Warsaw, IN. 14.240 14.040 7.240 7.040. Certificate. Joe Sanburn, WA9PSV, 1095 W 200 S, Warsaw, IN 46580. **www.maplenet.net/~lmelton/**.

Lake Angelus, MI: McMath Hulbert Solar Observatory, K8MHO. 1600Z **Jun 19**-2000Z **Jun 20**. 70th anniversary of the first movies of surface of the sun. 21.350 14.250 7.250 3.850. Certificate. McMath Hulbert Astronomical Society, 895 N Lake Angelus Rd, Lake Angelus, MI 48326. **www.mcmathhulbert.org**.

Fayetteville, AR: Amateur Radio Klub of the Arkansas Northwest, W5F. 1400-0000 **Jun 19-20** and 1400-000 **Jun 20-21**. Airfest 2004. Bottom portion of General band 20m 15 m SSB. QSL. ARKAN, PO Box 9701, Fayetteville, AR 72702. **www.arkan.us**.

Rock Island, IL: Green River Valley Amateur Radio Society, K9G. 1800Z **Jun 23**-1800Z **Jul 4**. Grand Excursion 2004—150th anniversary of America's first railroad connection to the Mississippi River. 14.270 21.305 7.260. QSL. Peter Beedlow, NN9K, 741 Greenway Ave, Colona, IL 61241. **www.grandexcursion.com**.

Boston Harbor area, MA: USS *LST*-325 Amateur Radio Club, W2T. **Jun 26-Jul 1**. USS *LST*-325 46-day, 4119 mile trip up the east coast of the United States. All amateur bands. QSL. Robert Wilder, AF2HD, 6032 Idlemoore Ct, Theodore, AL 36582-4036. Trip begins May 24; WW2LST/MM will also be used.

Landrus, PA: Nessmuk Amateur Radio Association, W3BGK. 1500Z-2100Z **Jun 26**. 1890 coal mine ghost town of Landrus, first electric coal mine in area. 14.240 7.240. Certificate. Nessmuk ARA, W3BGK, PO Box 101, Wellsboro, PA 16901.

Los Alamos, NM: Los Alamos Amateur Radio Club, W5PDO. 1500Z-1800Z **Jun 26**. Earthwatch Institute's Student Challenge Awards Program from Fenton Hill Observatory. 28.450 21.350 14.250. Certificate. Don Casperson, AA5PA, 984 Nambe Loop, Los Alamos, NM 87544. **laastro.lanl.gov/earthwatch**.

Rocky Mount, NC: Castalia Island DX Association, K4UP. 1800Z **Jun 26**-1800Z **Jun 27**. Annual emergency communications readiness demonstration. 14.225. QSL. K4UP, PO Box 3, Castalia, NC 27816. **www.qsl.net/w4rmt/fieldday.shtml**.

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 **Aug** *QST* would have to be received by Jun **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...

◊ The Bellevue Amateur Radio Club, which has been named 2003 Volunteer Group of the Year by the Nebraska Chapter of the National Multiple Sclerosis Society. The club has provided Amateur Radio communications for the annual Celebrate Cycling and MS-150 Ultimate Bike Tours for many years. *—Doug Eubanks, KAØO*

By **Ford Peterson, NØFP**

Results, 2003 ARRL 160 Meter Contest

One machine can do the work of fifty ordinary men. No machine can do the work of one extraordinary man.—Elbert Hubbard

As every avid contester knows, each HF band has a personality. Depending on the time of day, one band is better suited than another for any one of a number of reasons. "Topband" (aka 160 meters) has a reputation, too—a reputation rooted in tradition, folklore and pure science. Old timers call it the gentleman's band—and for good reason. It takes a plantation sized estate to support a world class antenna. It is also very fragile. Since the whole continent is open to propagation, participants must cooperate in a gentlemanly fashion and deal with interference and noise from just about everywhere. Learning Topband traditions takes time and practice. You may likely be called a LID a time or two until you figure it all out (an Elmer really helps). Doing well in the 160 band requires skill, finesse, and yes, lots of big hardware.

Those who have come to love Topband wouldn't miss the ARRL 160 Meter Contest. The folklore that says you need a 160 acre estate to "compete" is simply not factual. This year, 58 new "Section Records" were set. In the Regional competition, 8 new records summarily forced old records kicking and screaming into the archives. Some of these new records were set by people using considerably less than "world class" systems.

What counts is not necessarily the size of the dog in the fight—it's the size of the fight in the dog.—Dwight D. Eisenhower

Although the 857 logs submitted indicates a decline from 2002's record shattering year with 919 logs, the trend is still up (2001 had 777 logs). K9DX landed the highest Q count of 1498, which is down from 2002's maximum of 1592 by VY2ZM. With the sunspot doldrums lurking around the corner, you can expect a large increase in 2004's running of the 160 Meter Contest. Higher top score records requires more Qs from more participants. As the sunspot minimum approaches, 160 meter propagation should be at a peak. Let's hope the contest community responds to this 11 year anomaly by having more people show up to compete for top honors. With summer here, I encourage everyone, especially the clubs, to start Elmering new ops by helping them get their 160 meter station running.

This year's summary tables include a new twist. (s) appears next to the call sign of the op that challenged and retired a "Section" record during this year's contest. (r) appears if the score represents a new "Region" record. The analysis goes back to and includes 1997. I am excited about this new feature. For the first time, ops in every section can examine the top scores of record for their Section or Region and challenge the previous "bests." If you "own" a Section or Region record that is older than 1997 that tops these, let me offer my apologies. Notify the contest desk at the ARRL and your achievement will be duly noted in future presentations of this table and on the Web. The Web contains updated information on the individual Sections and Regions. You can look at your 2003 performance and compare it to the top scores of prior years. I encourage holders of older records to examine the history for your Section and claim what is rightfully yours. Just reference the appropriate *QST* date and page in your claim.

Top Ten

Single Operator, QRP

N8VW (r)(s)	72,864
N7IR (r)(s)	52,114
N2CU (r)(s)	49,225
W8VK	47,488
W4TMR	46,726
AA1ZT (s)	44,820
W3TS	42,771
KG9X	39,216
N9NE	32,500
W1BYH (s)	30,345

Single Operator, Low Power

K2BA (r)(s)	176,874
K1HTV (s)	164,736
K1PX	160,905
K7CA	155,817
N4ZI (s)	149,760
WB9CIF (s)	130,086
WO4O	127,374
K4CNW	127,160
K8FH (s)	126,768
N9CO (s)	117,840

Single Operator, High Power

AA1K (s)	410,688
K9DX (r)(s)	372,960
VY2ZM	293,962
N4PN (s)	273,171
K5NA	235,200
W8MJ	219,114
KT3Y	216,216
WE3C	216,000
K4OAQ	215,328
K4ZW	211,038

Multioperator

W2GD (s)	369,138
NO2R (s)	351,747
K8XXX (r)(s)	317,130
AK9F	288,503
K3WW (s)	251,572
KE9I (s)	242,844
NØNI (r)(s)	238,572
K1LT	230,860
WØAIH	210,028
WØUCE (s)	203,504

(t)=top ten record; (r)=region record; (s)=section record

Top Ten

While there were no Top Ten records broken in 2003, there were several spectacular performances, given this year's somewhat unsettled propagation conditions. N8VW tops the Single Op QRP

Expanded Reports Available

For expanded results, participant soapbox and the complete scores in a user-searchable database, please visit **www.arrl.org/contests/results**. ARRL Members without Internet access may obtain a printout of the complete line scores by sending a self-addressed, stamped envelope to ARRL Contest Results, 225 Main St, Newington CT 06111. Please be sure to include the contest name and year.

How many ops does it take to run a world class 160 multiop station? At W2GD, it takes three. From the left: K2SG operates the "multiplier" position while W2NO and K2TW pilot the "run" position.

Scores by Region

(t)=top ten record; (r)=region record; (s)=section record

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)				
N2CU (r)(s)	49,225	447	55	A	W4TMR	46,726	377	61	A	N8VW (r)(s)	72,864	522	69	A	W7FB	28,840	258	56	A	N7IR (r)(s)	52,114	359	71	A
AA1ZT (s)	44,820	413	54	A	K4ORD	23,641	250	47	A	W8VK	47,488	429	56	A	WA8ZBT	20,102	218	46	A	N6WG	10,976	174	32	A
W3TS (s)	42,771	399	53	A	N4ROA	22,656	233	48	A	KG9X	39,216	342	57	A	WU0L	14,592	154	48	A	K6EI	10,585	184	29	A
W1BYH (s)	30,345	296	51	A	KW4JS (s)	14,805	162	47	A	N9NE	32,500	328	50	A	KI0II	12,600	158	42	A	W6YJ	10,428	117	44	A
KB2EBL (s)	17,184	189	48	A	WA4PGM	12,870	140	45	A	VE3MGY	25,300	281	46	A	W7DRA	11,704	161	38	A	WX7G	10,045	142	35	A
K1HTV (s)	164,736	893	88	B	N4ZI (s)	149,760	959	78	B	WB9CIF (s)	130,086	798	81	B	K2BA (r)(s)	176,874	1076	82	B	KJ7WY (s)	77,610	500	78	B
K1PX	160,905	916	85	B	WO4O	127,374	818	78	B	K8FH (s)	126,768	825	76	B	K7CA	155,817	869	87	B	NT6K (s)	76,822	541	71	B
WA1Z	99,718	650	73	B	K4CNW	127,160	695	88	B	K9WJU	108,450	716	75	B	N9CO (s)	117,840	735	80	B	N6RK	55,074	394	67	B
N1RL	69,240	577	60	B	W4NZ	101,400	671	75	B	(W9CG,op)					N0PB (s)	117,424	713	82	B	AC7A	37,118	271	67	B
W3EF	54,932	433	62	B	WJ9B	96,480	669	72	B	K9OT	108,416	702	77	B	K7RE (s)	115,038	752	77	B	WS6X	36,351	290	63	B
										VE3CSK	101,409	648	77	B									
AA1K (s)	410,688	1384	124	C	N4PN (s)	273,171	1159	111	C	K9DX (r)(s)	372,960	1498	112	C	K5NA	235,200	1161	98	C	N6SS (r)(s)	194,670	1016	90	C
VY2ZM	293,962	1036	103	C	KT3Y	216,216	890	104	C	W8MJ	219,114	1118	94	C	N5OT (s)	197,118	1014	94	C	N6RO	135,536	715	86	C
WE3C	216,000	989	100	C	K4OAQ	215,328	1067	96	C	W8QID (s)	208,288	1105	92	C	K8FC	171,864	968	88	C	W0YK (s)	106,018	622	79	C
W2FU	180,500	754	100	C	K4ZW	211,038	911	102	C	K9AY (s)	176,088	930	92	C	N0TT	165,968	1002	82	C	AC6DD (s)	88,640	526	80	C
W1SJ	168,980	974	85	C	WD5R	207,552	1085	92	C	VE3PN	154,616	817	88	C	K0IR (s)	163,590	989	82	C	K7OX	86,424	542	78	C
W2GD (s)	369,138	1213	119	D	W0UCE	203,504	1059	92	D	K8XXX (r)(s)	317,130	1331	110	D	N0NI (r)(s)	238,572	1241	94	D	N7GP (r)(s)	194,490	1007	90	D
NO2R (s)	351,747	1194	121	D	N4DW	110,565	577	91	D	AK9F	288,503	1335	103	D	N5TW	179,602	994	89	D	W6AW (s)	59,563	447	67	D
K3WW (s)	251,572	1010	109	D	K3KO	103,976	629	82	D	KE9I (s)	242,844	1209	98	D	K5PTC	179,080	1009	88	D	W6YX (s)	44,416	344	64	D
W1QA (s)	186,337	870	97	D	AA4V	81,732	467	84	D	K1LT	230,860	1160	97	D	K0LIR (s)	173,430	953	90	D	W9NGA	38,881	289	59	D
VE2OJ (s)	148,185	807	89	D	AD4TJ	42,978	372	58	D	W0AIH	210,028	1144	91	D	W0GG	172,956	982	87	D	K8IA	27,648	211	64	D

category, leaving five record breaking scores from 1997 and 1998 intact. K2BA missed landing the all-time high score in the Single Op Low Power category, leaving W3GH's 2001 effort as the high score on record. AA1K took a commanding lead over K9DX for the #1 spot in Single Op High Power category, but left K1ZM's spectacular performances from VY2ZM in both 2001 and 2002 untarnished. And finally, W2GD took top honors in the Multiop category, leaving KC1XX's 2002 score the current top Multi score on record. It is interesting to note that two High Power Single Ops, AA1K and K9DX, both managed to edge out all the Multiop stations this year.

Regional Competition

It is safe to conclude that the Northeast and the Central regions have slightly better propagation to population centers and DX multipliers than the rest. The Southeast and Midwest regions are roughly comparable in this regard. The West Coast is clearly handicapped. The Regional Scores table serves to illustrate the effects of regional differences by summarizing each region's five best ops for each category for seven years.

As mentioned earlier, eight Regional records were retired this year: Central and West Coast Regions had three new records, with Midwest changing two more.

Among the QRP contestants, N7IR managed to retire his old West Coast record(s) by quite a margin. N8VW retires N9JF's 1997 QRP record in the Midwest Region. The only Low Power Op to land a Regional record was K2BA in the Midwest competition, effectively ending K7CA's three consecutive year rally. K9DX was able to significantly improve on his 2002 SOHP top score in the Midwest Region. The Multioperators were able to land new records in several regions. K8XXX placed a tombstone on WB9Z's 1997 Multiop record in Central. NØNI improved their now five out of seven year top score in the Midwest. N7GP has a West Coast record score for the second year running.

Affiliated Club Competition

Unlimited Category	Score	Entries
Society of Midwest Contesters	3,179,861	52
Minnesota Wireless Assn	1,563,654	52
Medium Category		
Potomac Valley Radio Club	3,201,523	47
Frankford Radio Club	2,503,867	21
Mad River Radio Club	1,392,480	15
Yankee Clipper Contest Club	1,362,008	32
Tennessee Contest Group	1,208,762	21
Contest Club Ontario	854,644	18
South East Contest Club	831,965	14
Northern California Contest	770,709	27
Central Texas DX and Contest	590,321	9
Grand Mesa Contesters of CO	356,353	8
Kansas City DX Club	353,636	5
Rochester (NY) DX Assn	301,214	6
Hudson Valley Contesters and DXers	281,413	11
Southwest Ohio DX Assn	276,164	3
Central Arizona DX Assn	274,432	3
North Coast Contesters	263,032	6
Florida Contest Group	224,411	12
Carolina DX Assn	161,848	4
North Texas Contest Club	157,594	3
Kentucky Contest Group	150,167	6
Northern Arizona DX Assn	120,244	5
Southern California Contest	94,916	7
Green River Valley ARS	86,424	3
West Park Radiops	41,296	4
Western Washington DX Club	25,888	5
Bergen ARA	24,774	3
Willamette Valley DX Club	21,172	3
Mother Lode DX/Contest Club	16,300	3
Local Category		
Medina 2 Meter Group	205,997	3
Spokane DX Association	160,422	4
CT RI Contest Group	86,235	6

Regional Scores

Region	Sum of Scores	% of Total
Northeast	20,448,599	25.2%
Southeast	16,960,644	20.9%
Central	19,907,347	24.5%
Midwest	15,777,295	19.4%
West Coast	8,115,539	10.0%
Total	81,209,424	100.0%

Club Competition

Almost half of this year's participants submitted a score crediting their local club. Although the 421 logs submitted by club members dropped slightly from 2002's record breaking 464, the competition for top scores was fierce. Moving to the Unlimited Category for the first time is the Minnesota Wireless Association. A three year long campaign to get people into the 160 Meter Contest appears to be working. The MWA reported 24 logs in 2001, 47 logs in 2002 and 52 logs for 2003, a steady increase. In contrast, SMC reported 77 logs for 2001, 67 logs in 2002 and 52 logs in 2003, a steady decrease. Let's hope SMC can reverse the trend.

2004 Contest

The "gloves" are coming off this year! A Topband *death match!* I can't wait. While the lack of speckles on the Sun is wreaking havoc on the higher bands, conditions are moving toward the peak of 160 meter propagation (sunspot minimum). The companion Web article has lots of good information about contest records. In particular, the new "Section" and "Region" history will enable participants to check their performance on the local level for the first time. I'm sure there are many stations eager to place their call high enough on the list to survive several sunspot cycles! See you the first weekend in December. QST

By Kelly Taylor, VE4XT

Results, 2003 ARRL November Phone Sweepstakes

If you think contests aren't fun until you have multiple towers and more aluminum than Alcoa, you haven't tried the ARRL Phone Sweepstakes. This contest is the great equalizer among North American-run contests, where operating skill is rewarded more than investment in hardware.

"SS phone is the greatest. It is the true measure of an operator," says Mitch, W1SJ, op at WB1GQR, which placed No. 8 in Unlimited and No. 2 in the Northeast division. "With a tribander and dipoles at 50 feet, I compete head to head with guys running stacked Yagis at two to three times that height and I can do well against them. That will not happen in a DX contest."

Ty, K3MM, agrees. "I prefer domestic contests because they accentuate good operating skills over dominant hardware," he writes in an e-mail. "I love operating from the W3LPL multi-multi or one of the Caribbean hot spots in the big DX contests, but my station with relatively modest antennas works better for domestic contests and I can stay home and sleep (at least a little) in my own bed!"

For the rest of North America, this is all a delicious bit of comeuppance for the Northeast, since northeast stations dominate DX contests but haven't seen one of their own win Phone SS since the 1970s. Even stations in propagationally challenged North Dakota and Manitoba break into the Top 10, or win the thing altogether. The breakdown of categories, high-power, barefoot, QRP, multiop, school and unlimited, gives many stations a shot at making Top 10. But the beauty of SS is that regional battles, Northeast vs Northeast, Midwest vs Midwest, provide the basis for competition, even for operators who can't or won't come out on top.

"Since it is impossible to win High Power from the East (last time done was in the '70s) regional battles are the only way to keep sane in the SS," said Mitch, W1SJ. The last time a W1 has won SS Phone was 1978, when K1GZL took the multioperator class. A W1 has never won in high-power or in QRP and the last low-power win was 1971 (K1EUF).

Mike, KH6ND, busy preparing the antennas for the contest at WP2Z.

High Power

Still, there are some advantages too great to overcome. Rich, KE3Q, continued his dominance operating from WA3FET's station WP3R at Arecibo, Puerto Rico. It's enough that there's been chatter on contesting e-mail reflectors urging Rich to let someone else run WP3R for a change. But he's got the station booked for ARRL SS, both weekends, for the foreseeable future. So it looks like the way to topple him is to go down there and do it the hard way—the right way, some would say—by actually beating him.

He's game for the challenge, and Mike, KH6ND, tried, accepting an invitation from K8MJZ to take over WP2Z on St Thomas, but the battle of the Caribbean never quite shaped up as Mike hoped. Murphy, and a quite low solar flux index, had other ideas.

"The SFI was predicted to be 140 for the SSB weekend, but turned out to be just barely over 100," Mike writes. "This was a disaster to the game plan we had in mind."

Propagation turned against him, and even though the hardware at WP3R isn't in superstation category, it's quite a bit better than at WP2Z. Plus, the op at WP3R has several years' experience with

Top Ten

PHONE

Single Operator, QRP

N7VY	80,660
K9ZO	67,640
N8IE	66,882
WA8ZBT	60,192
K5MJE	56,316
W7YAQ	49,284
K7MM	48,840
W6AQ	47,002
N8NM	46,920
WR6WR (N6WR)	44,988

Single Operator, Low Power

K5WA	227,520
K4WX	208,876
KØUK	187,680
KK9A	185,952
N8II	185,018
W5AJ	184,080
WØAH	183,912
N4RZ	182,248
W8MJ	178,640
N5TW (KC5YKX, op)	175,252

Single Operator, High Power

WP3R (KE3Q, op)	408,640
K4XS	347,840
K5TR	342,228
K5TA	317,600
W5WMU	287,360
W7WA	286,400
WP2Z (KH6ND, op)	285,636
K5GA	282,978
K3MM	280,160
K4PV	265,914

Single Operator, Unlimited

KP2A (KW8N, op)	351,392
K6LL	308,000
K7RL	256,800
W4NF	244,800
KD4D	232,892
N2BJ	225,280
W7RN (WX5S, op)	223,412
WB1GQR (W1SJ)	221,052
WE9V	219,360
K6YT (WØYK, op)	206,560

Multioperator

K9NS	298,880
NJ4M	277,120
N5DO	257,920
N4FCG	256,152
KØDU	253,280
K8CC	244,584
KTØR	243,794
N8HR	233,220
K4JNY	231,360
W6XK	230,560

School Club

K5UTD	172,852
K7UAZ	104,258
W6PRB	85,644
W2CXM	83,622
W9NAA	64,526
WØEEE	60,882
W7UQ	48,604
WF4DD (KG4CZU, op)	31,200
W2SZ	30,056
W1YK	18,270

propagation from the Caribbean.

"We got hammered brutally by Mr. Murphy, but his presence was a distant second place compared to the damage done to our plan by the poor conditions," Mike continues. "Ten meters died after the first hour, and 20 died shortly after dark. Not what we needed with the antenna disadvantage that we knew we were facing." WP2Z finished seventh overall.

Bob, KW8N, went to KP2A and took second place overall, but chose to operate in Unlimited class so didn't really pose a threat to Rich's B-class supremacy.

Instead, the nearest rival to WP3R was Bill, K4XS, who last year was the No. 1 op in the continental US east of the Mississippi, but this year beat out all lower-48 stations to take No. 2 in high-power and No. 3 overall. George, K5TR, was third. Both George and Bill agreed that it was 40 meters that made the difference for K4XS. "Twenty dropped out by 0000 so there I was on 40, which actually turned out to be a good thing. Forty really turned out to be one of the two money bands for me," Bill writes.

For his part, George said 40 and 80 are keys to guys like Bill, who can work many nearby stations on Saturday night, and he expects 40 will become more important to him as sunspots wane. "He did great—he has a huge station on 40 and 20 meters," George writes of Bill, adding, "I need to work on my 40 meter antennas."

A photo of Single Operator Low Power champion Bob, K5WA's, station after the battle was over.

Unlimited

If location defines the B category, it's shaping up as the defining factor in U, as well. KP2A, piloted by KW8N, mounted the most serious challenge yet to B-class supremacy, taking Unlimited honors and placing No. 2 overall behind WP3R. Dave, K6LL, came in second.

Mitch, W1SJ, op at WB1GQR, explains the attraction of U this way: "I operated in 'B' for 25+ years. I moved to 'U' to get a shot at the title," he writes. "I have a couple of 2nd place national finishes in this category, but I'm sure the competition will start to realize this and spread out. This year, I was happy to settle for 10th or 11th in 'U' with the lousy conditions. Operating in 'U' leaves a little room for the other guys in Vermont to battle it out for 'B.'"

And now that the Caribbean has discovered the relatively new Unlimited class, what had been a refuge for stations who were either geographically disadvantaged or up against much bigger stations is slowly losing that appeal.

Low Power

Bob, K5WA, would be in tough competition as a Texan in high-power, what with No. 3 K5TR a short drive away. So, instead, he's happy to slip in under the bedlam and walk away with the low-power title. "Most of the extremely competitive guys around here are B stations, so I don't mind letting them clear the ether while I slip in behind them," he said.

For Bob, it's part strategy, part TVI: "I can't really run an amp on 80 through 10 the whole weekend without upsetting the neighbors."

The Phone weekend was marked by really lousy conditions north of, say, St Louis, a point even K5TR noticed. Summed up nicely by Kirk, NØKK: "Yep, El Stinko!"

So, many a log arrived without a sweep and many complained of missing VE4, not to mention VY1. Conspicuous by his absence was Rob, VE4GV, and a repeat winner of this category. Like the author,

Sponsored Plaque Winners

Plaque Category	*Winner*	*Sponsor*
Overall Single Operator High Power	WP3R (KE3Q, op)	Carl Cook, AI6V
Overall Single Operator Low Power	K5WA	Ken Adams, K5KA
Overall Single Operator QRP	N7VY	QRP Amateur Radio Club International
Overall School Club College Division	K5UTD	Mark Smith KD4JLC Memorial
Overall Multioperator	K9NS	Central Texas DX & Contest Club
Atlantic Single Operator High Power	K3MM	North Coast Contesters
Atlantic Single Operator Low Power	K1HTV	Potomac Valley Radio Club
Atlantic Multioperator	N3OC	Mark Sickmeyer, KB3GJ Memorial
Central Single Operator High Power	WB9Z	Society of Midwest Contesters
Central Single Operator Low Power	KK9A	Society of Midwest Contesters
Central Single Operator QRP	K9ZO	Don Haney, W9WW
Central Single Operator Unlimited	N2BJ	Society of Midwest Contesters
Central Multioperator	K9NS	Don Haney, W9WW
Dakota Single Operator High Power Phone	WØSD (WDØT, op)	Minnesota Wireless Association
Dakota Single Operator Low Power Phone	ACØW	Minnesota Wireless Association
Dakota Single Operator QRP Phone	WAØVBW	Minnesota Wireless Association
Dakota Single Operator Unlimited Phone	KØHW	Minnesota Wireless Association
Dakota Multioperator Phone	KTØR	In Memory of Jim Dokmo, KØFVF, Minnesota Wireless Association
Great Lakes Single Operator High Power	K1OU	North Coast Contesters
Great Lakes Single Operator Low Power	N4RZ	Mad River Radio Club
Great Lakes Single Operator QRP	N8IE	Mad River Radio Club
Midwest Single Operator High Power	KWØA (KAØGGI, op)	Kirk Pengelly, NØKK
Midwest Single Operator Low Power	NØAC	Society of Midwest Contesters
New England Single Operator Low Power	K1EP	Ed Parish, K1EP
New England Single Operator QRP	N1SW	QRP Club of New England
Roanoke Single Operator High Power	K4JA (N4GG, op)	Potomac Valley Radio Club
Roanoke Single Operator Low Power	N8II	Raleigh Amateur Radio Society - W4DW
Roanoke Single Operator QRP	N4ZAK	No Va QRP Group
Rocky Mountain Single Operator Low Power	KØUK	Grand Mesa Contesters of Colorado
Southwestern Single Operator QRP	N7VY	Ray and Donna Day, N6HE and N6HTH
West Gulf Single Operator High Power	K5TR	Ken Adams, K5KA
West Gulf Single Operator Low Power	K5WA	Ralph "Gator" Bowen, N5RZ
Canada Single Operator QRP	VE6EX	Frank Merceret, NA4CW

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Northern California Contest Club	21,943,202	299
Society of Midwest Contesters	16,397,484	294
Potomac Valley Radio Club	10,684,780	145
Yankee Clipper Contest Club	5,296,026	80
Minnesota Wireless Assn	5,198,134	99
Florida Contest Group	4,227,042	52
Medium Category		
Mad River Radio Club	3,961,860	45
Southern California Contest Club	3,478,684	33
Tennessee Contest Group	3,344,164	49
North Texas Contest Club	2,214,650	20
Central Texas DX and Contest Club	1,979,344	20
Frankford Radio Club	1,970,266	27
South East Contest Club	1,933,932	25
Grand Mesa Contesters of Colorado	1,719,404	19
Hudson Valley Contesters and DXers	1,348,758	20
Contest Club Ontario	1,216,390	22
Kansas City DX Club	1,195,226	12
Western Washington DX Club	1,149,498	15
Motor City Radio Club	953,746	32
Kentucky Contest Group	880,670	19
Spokane DX Association	772,088	11
Willamette Valley DX Club	727,918	10
Oklahoma DX Assn	716,674	7
Radio Amateurs of Northern VT	710,412	4
New Mexico Big River Contesters	687,740	3
Central Arizona DX Assn	649,308	6
Texas DX Society	644,178	6
North Coast Contesters	630,734	10
Magnolia DX Assn	399,282	4
Rochester (NY) DX Assn	356,816	6
Florida Contest Group - Panhandle	340,112	3
Loudoun ARG	339,674	11
Eastern Iowa DX Assn	338,182	6
BC DX Club	300,234	4
Ozark Contest Club	288,320	3
Order of Boiled Owls of New York	282,062	8
West Park Radiops	259,876	13
Carolina DX Assn	217,892	4
Western New York DX Assn	207,004	4
South Jersey Radio Assn	205,148	9
Rip Van Winkle ARS	191,504	3
Northern Arizona DX Assn	188,932	6
Southwest Ohio DX Assn	184,476	4
Bergen ARA	124,282	6
Franklin County ARC	121,816	4
Woodbridge Wireless	90,522	7
Central Michigan ARC	64,468	4
Wyoming DX Contest Club	28,770	3
Local Category		
CT RI Contest Group	627,982	10
Northern Rockies DX Association	292,136	4
Alberta Clippers	242,346	3
Medina 2 Meter Group	208,230	6
Sussex County ARC	159,762	3
Hollywood Hills QRP Contest Club	135,680	6
Northern New York Contest Club	123,968	9
Sterling Park ARC	99,558	5
Dominion DX Group	95,288	8
Empire Contest Club	72,956	3
10-70 Repeater Assn	66,456	4
Heartland DX Association	56,846	3
Redmond Top Key Contest Club	55,720	4
Meriden ARC	45,732	3
Wireless Association of South Hills	45,622	3

Regional Listings

Tables list call sign, score and class (Q = QRP, A = Low Power, B = High Power, M = Multioperator, U = Unlimited)

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

K3MM	280,160	B
W1VE	236,210	B
K3CR	221,208	B
(LZ4AX, op)		
K2PLF	214,968	B
K1XX	207,636	B
K1HTV	134,560	A
K1EP	97,050	A
K2UF	90,132	A
W3LL	87,400	A
W2ENY	81,472	A
N3UR	31,098	Q
AA2VK	26,928	Q
W2CE	26,664	Q
N1SW	24,924	Q
KR2Q	21,090	Q
KD4D	232,892	U
KD4D	232,892	U
WB1GQR	221,052	U
(W1SJ, op)		
K3DNE	156,156	U
KI1G	124,820	U
WE2F	122,460	U
N3OC	228,942	M
NA2NA	176,480	M
KE2DX	148,456	M
W1QK	137,748	M
N1FOJ	127,140	M

Southeast Region (Delta, Roanoke and Southeastern Divisions)

WP3R	408,640	B
(KE3Q, op)		
K4XS	347,840	B
W5WMU	287,360	B
WP2Z	285,636	B
(KH6ND, op)		
K4PV	265,914	B
K4WX	208,876	A
N8II	185,018	A
N4LR	170,640	A
W4ATL	164,794	A
W4IX	156,618	A
W5JAY	32,208	Q
KN4QS	28,470	Q
WB6BWZ	20,520	Q
N4ZAK	14,664	Q
KT0P	12,960	Q
KP2A	351,392	U
(KW8N, op)		
W4NF	244,800	U
WD4K	120,536	U
(K0EJ, op)		
N6ZO	92,708	U
KE5K	45,892	U
NJ4M	277,120	M
N4FCG	256,152	M
K4JNY	231,360	M
KA1ARB	221,832	M
N4DD	199,360	M

Central Region (Central and Great Lakes Divisions; Ontario Section)

WB9Z	254,880	B
K9BGL	204,926	B
K1OU	169,554	B
K9NW	161,950	B
N9RV	160,992	B
KK9A	185,952	A
N4RZ	182,248	A
W8MJ	178,640	A
N0FW	171,200	A
AJ9C	154,208	A
K9ZO	67,640	Q
N8IE	66,882	Q
N8NM	46,920	Q
K8IR	41,344	Q
W9DZ	30,366	Q
N2BJ	225,280	U
WE9V	219,360	U
NA9D	192,320	U
W9IU	156,624	U
KI9A	147,888	U
K9NS	298,880	M
K8CC	244,584	M
N8HR	233,220	M
VE3RM	175,538	M
W0AIH	175,520	M

Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

K5TR	342,228	B
K5TA	317,600	B
K5GA	282,978	B
W5WW	260,320	B
W0SD	255,840	B
(WD0T, op)		
K5WA	227,520	A
K0UK	187,680	A
W5AJ	184,080	A
W0AH	183,912	A
N5TW	175,252	A
(KC5YKX, op)		
WA8ZBT	60,192	Q
K5MJE	56,316	Q
WA0VBW	40,736	Q
N0UR	37,422	Q
KJ5RM	34,584	Q
AA5NT	181,600	U
W5GN	179,646	U
W7UT	169,060	U
K8FC	136,752	U
K5NZ	132,000	U
N5DO	257,920	M
K0DU	253,280	M
KT0R	243,794	M
W0NO	225,624	M
W5LCC	173,920	M

West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

W7WA	286,400	B
N6BV	254,240	B
(@ N6RO)		
K6LA	245,690	B
K7XZ	223,680	B
(K1MY, op)		
K7ZSD	223,236	B
K6AM	159,900	A
AA6PW	153,892	A
WN6K	129,792	A
WA0KDS	114,550	A
N6HC	86,550	A
N7VY	80,660	Q
W7YAQ	49,284	Q
K7MM	48,840	Q
W6AQ	47,002	Q
WR6WR	44,988	Q
(N6WR, op)		
K6LL	308,000	U
K7RL	256,800	U
W7RN	223,412	U
(WX5S, op)		
K6YT	206,560	U
(W0YK, op)		
W1SRD	200,960	U
W6XK	230,560	M
W6OAT	181,440	M
N6KI	179,804	M
W6YX	177,118	M
K0BEE	173,958	M

VE4GV shouted at the radio for an hour before calling it quits. Many times, we'd call loud stations on clear frequencies with no pileups and get no response.

But that opened the door for K4WX, KØUK and a host of others to join the Top 10, albeit with reduced scores, thanks in no small part to conditions. Indeed, of all the stations entered, only 76 scored Sweeps, compared to 448 in 2002.

Multioperator

Club station K9NS in Illinois took multioperator honors, ahead of stations in areas more favored geographically, beating West Central Florida's NJ4M and West Texas's N5DO. Not surprisingly, given their location—too central to capitalize on high-band openings (and, this year, too far north, perhaps) 40 meters was the money band with 931 QSOs, compared to 373 on 20 and less than 60 on 15 and 10 combined.

For many multioperator stations, this class is about giving beginners a leg up into contesting. For others, it's about the camaraderie of coming together as a team.

At KSØP, the Boulder (Colorado) Amateur Radio Club, it's about the future of contesting. All operators were between 12 and 16 years of age and competed under the watchful eye of Elmers—Mike, KCØEFR, and Dan, NØHF. "KSØP, KØDE and KCØINX are BARC Jr Elmers who helped teach the younger operators the ropes of contesting...copying all exchange information correctly, watching out for the band edges and holding a run frequency," writes Dan, NØHF. "The kids operated 2 hour shifts with one operating, one log-

ging. All had prior contesting experience with the exception of two new kids who watched and learned Saturday and then operated on Sunday."

Dave, N5DO, commenting on the regional battle in the Midwest region and multioperator, pointed out how greatly band selection strategy varied among Midwest multioperator stations; Midwest stretches from Manitoba and Saskatchewan down the North American Trade Corridor to Texas. "One interesting result from the Multi-operator section in the Midwest Region is the pattern of contacts as a function of latitude," he writes.

Stations in the north found their money bands to be 40 and 80, while in Texas high bands were the breadwinners. N5DO had almost 38 per cent of contacts on 15 while WØNO, No. 4 multioperator in the Midwest region, only had 1.2% of its contacts on 15.

It's an observation that applies to all categories, and gives a strong indication of how poor conditions were in the north-central area of the continent and, no doubt, explains the paucity of sweeps.

QRP

Lousy band conditions took their greatest toll in this class, with the winner, N7VY, more than 50,000 points off the previous winning score, but this category continues to attract those operators who don't think phone SS alone is hard enough.

"QRP generally requires some stubbornness and lots of magazines to read during the contest," understates No. 2 QRP entrant Ralph, K9ZO, who operates QRP when some part of his normally high-power station is out of action. With 445 QSOs and 76 sections, Ralph admits: "Obviously there was a lot broken for the last SS."

But it's a tight race all the same. In behind K9ZO was N8IE, who logged more QSOs (471) but fewer mults to come up less than a thousand points behind Ralph. In normal years, when more people sweep, 1000 points are less than a seven-QSO gap. That's tight.

With little ability to run for long stretches at a time, the search-and-pounce technique is a great way to practice. N7VY finished with 545 QSOs and 74 sections.

Gordon, N7VY, says he started QRP at his old QTH owing to neighbors' complaints about RFI. It just kinda stuck with him when he moved. "Yes, I have caught the QRP bug, at least as far as contesting is concerned. For me it is the only way to be competitive with the big boys," he writes.

He said this year was exceptionally tough. "You could really hear that the bands are changing." He missed many close-in stations but credits non-QRP operators for having the patience to work him. "These guys work really hard to copy me. Thanks."

As Ralph, K9ZO, dryly points out: "QRP is not an efficient way to turn alternating current into RF. You generally need hundreds of watts of ac to generate 5 W output," he writes, pointing to room lighting, computing power, coffeepot and refrigerator and rotators.

School

Still the smallest category, School is drawing an enthusiastic following among repeat entrants. K5UTD won again, posting a respectable 172,852 points, which once again would have been just out of Top 10 in A class. Like most stations, K5UTD's score was kicked down by bad conditions. They won in 2002 with just more than 200,000 points and a sweep. This year, they missed one section.

Trevor, KCØOJH (left) and Zoe, KCØPEK, operating the Boulder Amateur Radio Club Jr, of Boulder, Colorado station—KSØP.

As Multioperator is to many stations, School is often a great training ground for young, enthusiastic contesters-to-be. Even when Murphy strikes. (If you have to learn about Murphy, it might as well be in School, right?) Just ask Ken, KC9UMR, one of the ops at No. 6 WØEEE: "Our 847 died 2 hours into the contest, and my IC-706 did not have an amplifier cable (until 7 AM Sunday morning when I finally got around to building it!). And bad propagation—we had a really rough time. We missed Manitoba and Northwest Territories for sure. I think Montana was another one that eluded us."

"Everyone who participated had a lot of fun, though, which is our main goal in operating the contests!"

Affiliated Club Competition

Affiliated Club Competition is a great way to generate activity in a popular contest like SS, particularly if your club has a good rivalry with another. It evokes that competitive spirit that urges members to fire up their radios, even if for only a short time. If your club members seem to be missing their daily-recommended allowance of RF, this is one way to get things going. And if it seems like the way to win is to get the most people on the air, well, that's kind of the whole point.

After a three-year reign, Society of Midwest Contesters gave up the Unlimited gavel to the Northern California Contest Club. Though both clubs had similar numbers of logs (299 for NCCC and 294 for SMC), Sunshine State north pulled ahead by more than five million points. SMC is threatening to be back with a vengeance this year, so we'll see.

Potomac Valley Radio Club was third with 145 logs and 10.6 million points, followed by Yankee Clipper Contest Club, Minnesota Wireless Association and Florida Contest Group (rest in peace, OJ).

In the Medium Category, Mad River Radio Club moved from Unlimited, where they finished last in 2002, to take the Medium title. Southern California Contest Club came in a close second despite having 12 fewer logs, followed by Tennessee Contest Group, which had the most logs. With 40 clubs, Medium is the most popular category.

Local title goes to CT RI Contest Group, with the Northern Rockies DX Association taking second place.

The swing from the high to low bands will continue as we race toward the end of the current sunspot cycle. Get ready for the challenge of the 2004 ARRL November Phone Sweepstakes set for November 20-22. QST

NEW PRODUCTS

ECHOMAC V1.13 FROM DOGPARK SOFTWARE

◊ Dog Park Software has announced the release of version 1.13 of N9YTY's *EchoMac* for Macintosh computers. It can now be downloaded from **www.dogparksoftware.com/EchoMac.html**. See their Web site for details and the complete features list. *EchoMac* is a program written for MacOS X, based on the *echoLinux* (**www.cqinet.sf.net**) program by Jeff Pierce, WD4NMQ, that gives licensed Amateur Radio operators the ability to access the Echolink system (**www.echolink.org**). New features of V1.13 include additional bug fixes related to the Portaudio library and system volume settings. For more information, contact Steve Palm, N9YTY, at **n9yty@n9yty.com**.

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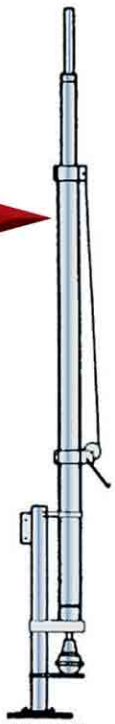

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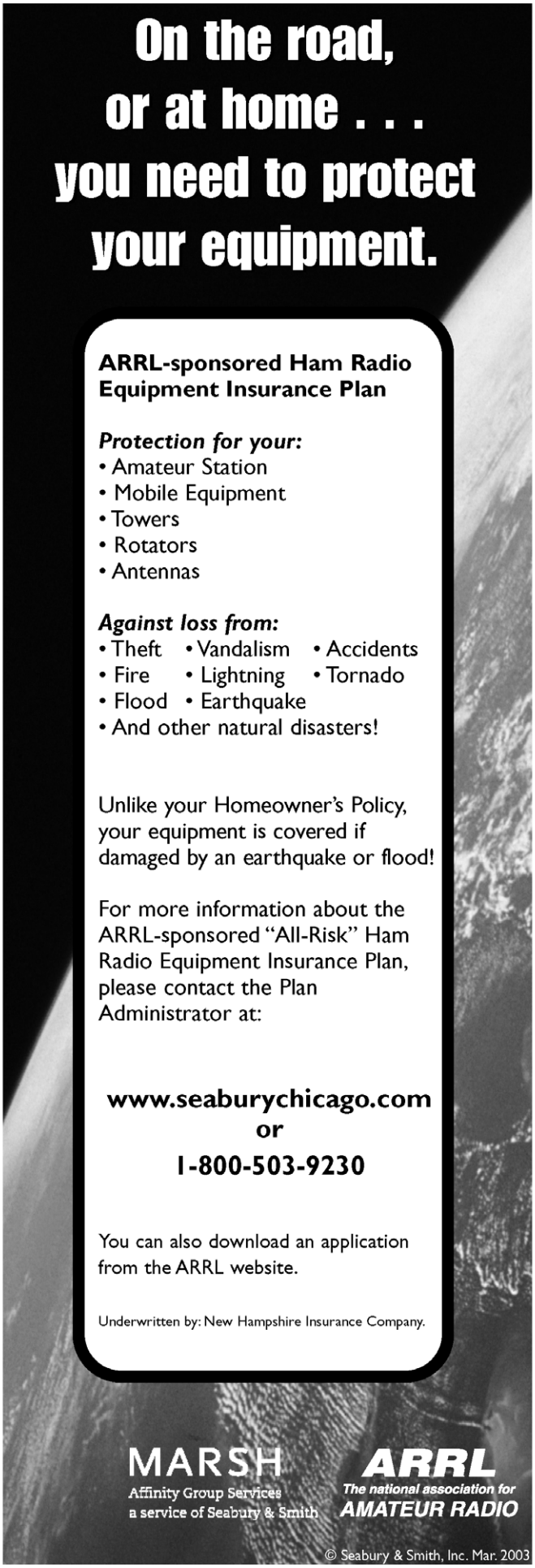

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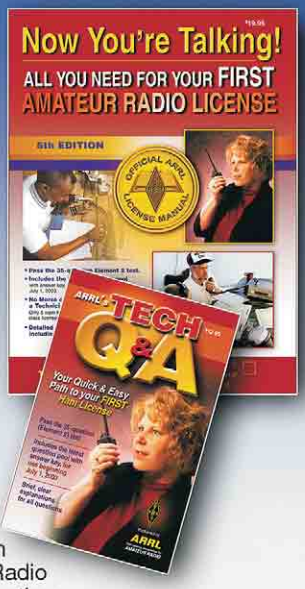

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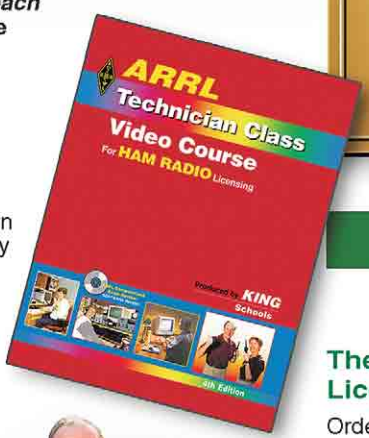

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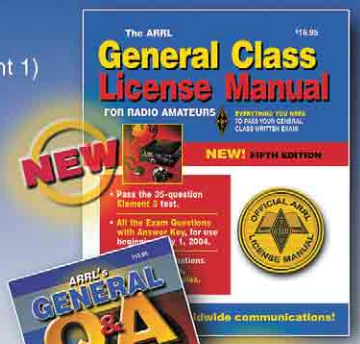

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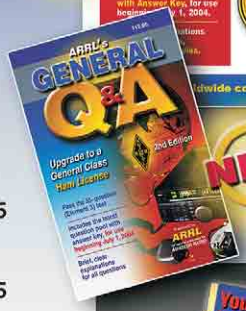

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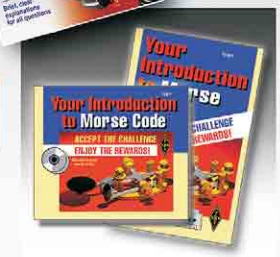

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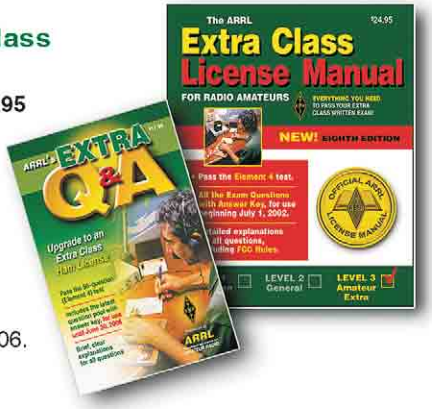

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IC-2GXAT/HP Simple use, maximum output. (left) This 144MHz FM transceiver is built for durability, splash-resistance, and 7W of maximum output. The 2GXAT offers 40 memories, 5 DTMF memories and redial, memory scan/skip, tone scan, and monitor function. 2.2"w x 4.9"h x 1.4"d, 12.9 oz ..... Closeout **$249.99**

IC-T2H SPORT More than enough power. (middle) The 6W Sport meets MIL SPEC for shock and vibration and is more than enough for long distances. The 2M HT boasts tone squelch, customizable keys, DTMF encode, 40 memories, 10 weather channels and cloning. 2.3"w x 5.5"h x 1.3"d, 14.8 oz **$99.99**

IC-T22A High performance, easy fit. (right) The 2M T22A provides 3W of communication power. It's packed with 40 memories (expandable to 80), memory back up, alphanumeric pager, CTCSS tone encoder, and mic remote control. 2.25"w x 4.81"h x 1.12"d, 10.9 oz **$199.99**

IC-V8 Quality, simplicity, anywhere. (left) This polycarbonate and die-cast aluminum 144MHz FM transceiver is constructed for durability. 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 **$124.99**

IC-T7H Powerful output and ample receive audio. (middle) A 6W amp circuit provides superior transmit on VHF/UHF when 13.5 V DC is supplied. In addition, 500mW of AF is output from the speaker – easy to copy when noisy. Separate CTCSS tone encoder and enc/decoder standard. This 2M/440 MHz meets MIL SPEC. 2.25"w x 4.34"h x 1.06"d, 10 oz **$179.99**

IC-W32A User-friendly, independent band controls. (right) The full-function, 5W, 2M/440 W32A meets demands of both novice and experienced operators: simple use and advanced features. Separate tune/volume controls per band, simultaneous receive, 200 memories, and tone en/decode. 2.25"w x 5.41"h x 1.31"d, 1 lb **$259.99**

IC-V8000 75W of "base" power. The V8000 also offers 25/10/5W. With the operator-facing speaker, audio is clear even when mobile. The 2M V8000 also features CTCSS and DTCS, standard DTMF encoder, 207 memories, FM narrow, and remote mic. 5.9"w x 1.97"h x 5.9"d, 2.22 lbs **$189.99**

IC-2720H Twice the versatility, twice the fun! The 2M/440MHz, 50/35W 2720H offers simultaneous receive capability, independent controls for each band, and Dynamic Memeory Scan 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. 5.5"w x 1.56"h x 7.38"d, 3 lbs (main) **$369.99**

IC-208H High power, wideband. This 2M/70cm mobile provides 55/50W, plus reduced power for local. The 208H covers 118-173, 230-549 and 810-999MHz (cell blocked) rx as standard. With improved DMS, detachable front, and 500 memories. 5.56"w x 1.56"h x 7.31"d, 2.65 lbs..... **$299.99**

IC-910H 100/75W stable output. This 2M/440MHz base provides a high performance receiver, 9600bps, satellite support. 99 memories, simultaneous rx. 9.5"w x 3.69"h x 9.4"d, 9.9 lbs **$1099.99**

IC-2100H-25N Durable 2M rig with superior RX IMD, performance. The 2100H25N offers 50W on transmit, extending its range. It also features CTCSS tone enc/decode, tone scan and 100 alphanumeric memories. It can be remote controlled using the new backlit mic. 5.5"w x 1.56"h x 7.09"d, 2 lbs, 10 oz **$169.99**

IC-2200H 65W and new digital features. With a familiar 2100H interface, the 2M 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..... **$229.99**

IC-706MKIIG Base features, mobile size. The 160-10M + 6M, 2M, 70cm Mark II G is constructed for stable, quality output with low IMD and spurious emissions. Tone squelch, DSP, auto repeater and 107 memories. 6.56"w x 2.28"h x 7.88"d, 5 lbs, 6 oz..... FREE RMK706 **$769.99**

IC-718 Origin of HF. With performance found in the HF all-band 718, such as wide dynamic range, high S/N ratio, and full duty operation, making distant contacts is easy. Experience the latest RF and digital technology. 9.44"w x 3.75"h x 9.41"d, 8 lbs, 6 oz..... FREE UT106 **$569.99**

IC-703 For QRP enthusiasts. The 160-10M 703 is capable of 5/10W and focuses on QRP performance. A portable HF unit, it features a relay-type antenna tuner, low current consumption, DSP, memory keyer and 105 memories. Ideal long distance communications. 6.56"w x 2.28"h x 4.88"d, 4.4 lbs ..... © **$619.99**

IC-703PLUS The 703, plus 6M..... © **$649.99**

IC-746PRO 32-bit DSP takes you higher. 100W, 102 memories, and a multi-function LCD command the HF/50/144 MHz 746PRO. 24-bit AD/DA converter and digital noise reduction. 11.3"w x 4.7"h x 12.5"d, 19 lbs, 13 oz.. FREE PS-125 © **$1379.99**

IC-756PROII Digital leap. All-mode, HF, 50MHz rig adding customer suggestions. The PROII offers 32-bit floating DSP, 24-bit AD/DA converter, selectable IF shape, and adjustable noise blanker. 13.38"w x 4.38"h x 11.2"d, 21 lbs, 1 oz.... FREE PS-125 © **$2299.99**

IC-7800 The big honcho! Icom launches the hottest rig with the most bells and whistles. The 200W, HF/50MHz 7800 is a fusion of 40 years of analog RF design expertise with cutting-edge digital technology. Built-in supply and auto antenna tuner, four 32-bit floating DSPs, TWO identical receivers…the kitchen sink! Be one of the first to own this incredible rig. 16.6"w x 5.9"h x 17.1"d, 55 lbs.... **$10599.99**

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TH-K2AT A triumph of advanced engineering and design. (middle) This 2M 5W HT is equipped with internal VOX, weather alert/RX, auto simplex checker, auto repeater offset and multiple scans. The K2AT also offers built-in CTCSS, DCS and 1750Hz tone burst. The K2AT charges up to 3X faster than others and meets MIL-STD-810 for resistance to rain, vibration, shock and humidity. 2.44"w x 4.38"h x 1.13"d, 12.5 oz **$159.99**

TH-G71A The brighter side of handy communications. (right) This FM, 144/440MHz boasts illuminated keypad and LCD, high-performance antenna, and ergonomic design. The 5W G71A also offers convenience with menu mode, PC compatible and 200 memories. 2.31"w x 4.44"h x 1.44"d, 11.6 oz..... **$229.99**

TH-F6A Head-scratching, unique features. (left) The FM 144/220/440MHz F6A offers dual-channel RX capability, 16-key pad, multi-scroll key, 5W, and 435 memories. Other attractive features include built-in ferrite bar antenna for AM, backlit LCD, lithium-ion battery, and a MIL-STD design. 2.3"w x 3.44"h x 1.18"d, 8.8 oz..... **$329.99**

TH-D7A(G) Explore APRS opportunities with an HT built for the future. (left) This 5W FM dualband (2M, 440MHz) is equipped with a TNC and provides the radio enthusiast with a 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, who can pinpoint the location. 4.75"h x 2.25"w x 1.5"d, 12 oz **$359.99**

TH-22ATH Tailored for utmost efficiency, Palm-Sized! (right) The 144MHz, 5W, FM 22AT is so small and slim, it easily slips into a shirt pocket. Yet, it delivers impressive performance and does not compromise on sound quality with its large speaker, ensuring loud and clear audio. Features include luminescent DTMF keypad, 40 memories plus 1 call, multiple scan functions, DTSS and page. 2.19"w x 4.63"h x 1"d, 10.2 oz..... Closeout **$199.99**

TM-271A All-terrain performance. On or off road, the 144MHz, 60W 271A delivers powerful mobile performance and other features such as multiple scan functions, 200 memories, NOAA weather, and CTCSS/DCS. This MIL-STD transceiver also provides high quality audio, illuminated keys and large LCD **$189.99**

TM-G707A The essence of ease. From the extra-large panel to Kenwood's Easy Operation mode, the G707A is extraordinarily user-friendly. In addition to its regular profile, it can store four others for instant recall. This 50W/35W, FM dualband (144/440MHz) offers 180 multi-function memories with name function to identify each. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs **$269.99**

TM-V7A Cool Blue: The look of mobile communication. The V7A 144/440MHz FM transceiver marks a departure in ergonomic design with its easy-to-operate control panel and reversible LCD. The "5-in-1" programmable memory, 50/35W, DTSS and pager functions, and dual receive on one band make it a pace-setter. 5.5"w x 1.56"h x 7.44"d, 2.65 lbs **$399.99**

TM-461A Fully equiped, supremely user-friendly 440MHz mobile. 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 MIL-STD. 5.5"w x 1.5"h x 6.3"d, 2.2 lbs **$439.99**

TM-742AD Triple advantage in mobile communications. The 742AD 144/440MHz is a high performance FM multibander offering triple receive and display capabilities. With optional band units, it can even receive three bands simultaneously. The user can mount the controls and display separately (with optional kit) for unique 3-way convenience. The 50W (35W on 440) 742AD has built-in DTSS, 101 memories, flexible scan, tone alert, triple repeater functions and S meter squelch. 5.88"w x 1.94"h x 6.88"d, 3.3 lbs..... **$639.99**

TM-642AD 144/220MHz, 50W (25W on 220) version of the 742 above..... **$739.99**

TS-50S Compact milestone. The 50S 160-10M can be used mobile, taken on DXpedition, or installed as a base. Despite compact dimensions, it packs a 100W punch. DDS, AIP, and dual VFOs included. 7.06"w x 2.38"h x 9.19"d, 6.4 lbs .....Closeout **$649.99**

TS-570D(G) Affordable DSP. High-end technology doesn't mean high-end budget. With 16-bit DSP, untouchable filtering and central frequency control, the 570D(G) provides powerful 160-10M operation. 10.63"w x 3.75"h x 11"d, 15 lbs..... **$989.99**

TS-570S(G) Same as the 570D(G), with 6M **$1099.99**

TM-D700A Harnessing APRS®, GPS and SSTV. This FM 144/440MHz mobile features a built-in TNC offering options including simple packet. The brightest spot of the 50/35W D700A is its ability to enable APRS® without a PC. It also has 200 memories, dual receive, built-in CTCSS/DCS, and DX cluster monitoring. 5.5"w x 1.58"h x 7.68"d, 3 lbs.... **$519.99**

TM-541A Lightweight, perfect 1200 MHz mobile. The 10W 541A offers enhanced night time operation with illuminated keys, large LCD and backlit mic. It also features 20 multi-function memories, built-in CTCSS tone encoder and tone alert system. 5.5"w x 1.5"h x 6.3"d, 2.4 lbs... **$449.99**

TS-480SAT New compact all-mode. This 100W HF/50MHz can operate on DC 13.8V and offers two power terminals. The 480SAT also features AF DSP, RX dynamic range, separate LCD control panel with speaker, 100 memories and antenna tuner. Can be controlled from a PC, PSK31 compatible ... **$1169.99**

TS-480HX 200W, without tuner **$1279.99**

TS-870S DSP at the IF stage. The all-mode, HF 870S incorporates DSP with a full range of features including 100 memories, built-in keyer, interactive menu function, automatic antenna tuner and 100W power. 13"w x 4.75"h x 13.13"d, 25.35 lbs.... **$1999.99**

TS-2000 Distinctive, packed. The all-mode, HF, 2M, 6M, 70cm 2000's advanced digital technology converts analog into digital. 10.6"w x 3.8"h x 12.5"d **$1699.99**

TS-2000X Same as the 2000 with the addition of 1.2GHz..... **$2199.99**

TS-B2000 The 2000 with PC control software. 10.63"w x 3.75"h x 12.5"d **$1549.99**

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VX-150 Designed to perform under the most difficult conditions. (left) This 2M 5W HT provides exceptional receiver performance with clean, clear transmit. Built to withstand outdoor use, the 150 is also outfitted with commercial-grade speaker and Omni-Glow™ keypad. 4.3"h x 2.3"w x 1"d, 11.5 oz **$119.99**

FT-50RD/41B Commercial-grade, military spec. (middle) It's rugged, reasonably priced, and simple to operate. Boasting 5W, the 50RD covers 144 and 430MHz while also offering the "widest" band receive allowable. Perfect for outdoor activities. Built with 112 memories, DCS/CTCSS encode, and ARTS™. 2.2"w x 3.9"h x 1.2"d, 11.5 oz **$209.99**

VX-1R Power out of the pocket. (right) This 500mW dualband (144/430MHz) HT gives the user wide receiver coverage in a small package. The 1R offers 291 memories, ARTS™, internal speaker, SmartSearch™, and dual watch. Also provides one-touch emergency and built-in CTCSS/DCS while operating for more than 11 hours on a single charge. 1.9"w x 3.2"h x 1"d, 4 oz ..... Closeout **$129.99**

VX-2R Smallest HT dualband! (left) This 1.5/1W dualband (144/440MHz) handheld offers VHF, UHF, shortwave, marine and aircraft bands, or WIRES™ linking. The 2R's wide band receive includes the AM broadcast band, continuous HF shortwave, VHF/UHF up to 729MHz, plus 800-960MHz (cell blocked). It also includes over one thousand memories (20 groups), CTCSS/DCS encode/decode and auto repeater shift. 1.9"w x 3.2"h x 0.9"d..... **$179.99**

VX-5R/VX-5RS Setting water resistance standards. (middle) Offering 5W (4.5W on 430MHz), the 5R/5RS cover 50/144/430MHz while providing short to microwave reception. Great for outdoors with optional barometric pressure unit. Black or silver. 2.3"w x 3.4"h x 1.1"d, 8.9 oz..... **$219.99**

VX-7R/VX-7RB The first submersible amateur HTs. (right) Water protected, the 50/144/430MHz, 5W 7R/7RB are rated for 3', 30-minute submersions. Magnesium bodies make them ideal for outdoors. Include dual/wide-band rx, status strobe, and WIRES™ key. Silver or black. 2.4"w x 3.5"h x 1.1"d, 9.2 oz..... **$309.99**

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FT-7800R Get "back to basics." This FM, 144/430MHz mobile 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..... **$279.99**

FT-817ND Self-contained, battery-powered, multi-mode portable. The 5W 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 join you on your next hiking, camping, or search-and-rescue adventure. Includes 1400mAh NiMH battery and charger. 5.3"w x 1.5"h x 6.5"d, 2.6 lbs... **$629.99**

FT-2800M Cool and quiet 65W operation. The most rugged 2M transceiver ever provides 65/25/10/5W with an extensive 221 memories, alphanumerics and CTCSS/DCS. The 2800M also features NOAA with weather alert, WIRES™ access, SmartSearch™, and excellent receive performance. With a bullet-proof front end and direct keypad entry, it's a dream come true. 6.3"w x 2"h x 7.3"d, 4 lbs..... **$159.99**

FT-8900R Leading the way in FM mobile design. The 29/50/144/440MHz 8900R 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 configurations. The 8900R also provides 50W (35 on 440MHz), access to internet linking systems, over 800 memories, CTCSS/DCS, and built-in duplexer. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$419.99**

FT-8800R Easy operation, ultimate dualband. This 144/430MHz 50/35W mobile offers simultaneous monitoring of one band while operating the other. Besides extended receive, the 8800R provides 1000 memories, cross band repeat, versatile scan and CTCSS/DCS. Looks similar to the FT-8900R above. 5.5"w x 1.6"h x 6.6"d, 2.2 lbs..... **$369.99**

FT-897D All-in-one portable base. The all-mode, multi-band 897D features high output 100W (HF/6M), 50W (2M), 20W (70cm), rugged construction, 200 memories, TCXO and optional internal supply and external antenna tuner. 7.87"w x 3.15"h x 10.3"d, 8.6 lbs ... **$889.99**

FT-1000MP MK V Improving the 1000 series Elite-Class. Building on the success of the 1000 series, the Mark V offers five new developments. This HF all-mode adds 200W of output power and features Class-A PA operation, interlocked digital bandwidth tracking system, a variable RF front-end filter, and enhanced ergonomics. 16"w x 5.3"h x 13.7"d, 31 lbs..... **$2049.99**

MK V FIELD Reach the HF Summit! The Mark V Field brings the technology of the 1000D and Mark V to you in a 100W, self-contained design. This HF all-mode features Class-A (25W) PA operation, interlocked digital bandwidth tracking, a variable RF front-end filter and the ergonomics of the Mark V along with an auto antenna tuner and internal switching-regulator power supply. 16"w x 5.3"h x 13.7"d, 33 lbs..... **$1739.99**

FT-840 Performance forward. Blending high performance digital frequency techniques with operating convenience, the 840 is a base station that beginners and seasoned operators will appreciate. In addtion to 100W on 160-10M, it adds a choice of 2 optional remote auto antenna tuners. 9.4"w x 3.7"h x 9.6"d, 12 lbs..... **$579.99**

FT-847 A masterpiece of high-tech design and packaging! Ready for action on SSB, CW, HSCW, AM, FM, Packet, SSTV, and RTTY, the 847 expands your operating horizon beyond HF to 6M, 2M and 70cm, featuring DSP and full-duplex satellite. Advanced DSP enhances signal-to-noise ratio via sophisticated bandpass, noise reduction, and auto notch filters. 10.2"w x 3.4"h x 10.6"d, 14.4 lbs..... **$1569.99**

FT-857D The world's smallest HF/VHF/UHF multimode. The 100W (HF/6M), 50W (2M), 20W (70cm) 857D provides wide frequency coverage, outstanding receive, and convenient remote-head use (optional). Includes 200 memories, ease of access to features, advanced DX features, and CW operating flexibility. The 857D model now offers a built-in DSP. 6.1"w x 2"h x 9.2"d, 4.6 lbs..... **$779.99**

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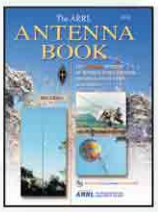

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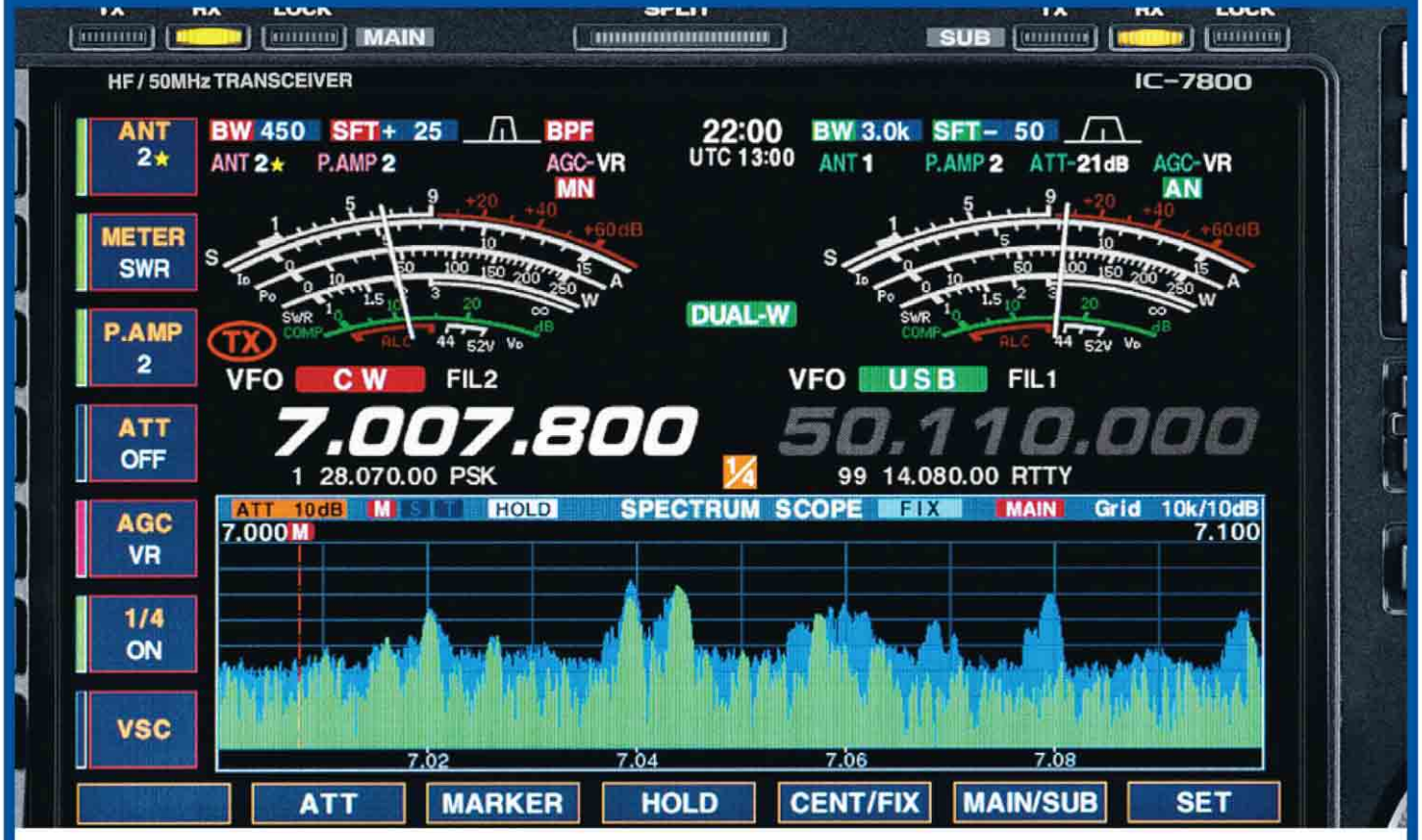

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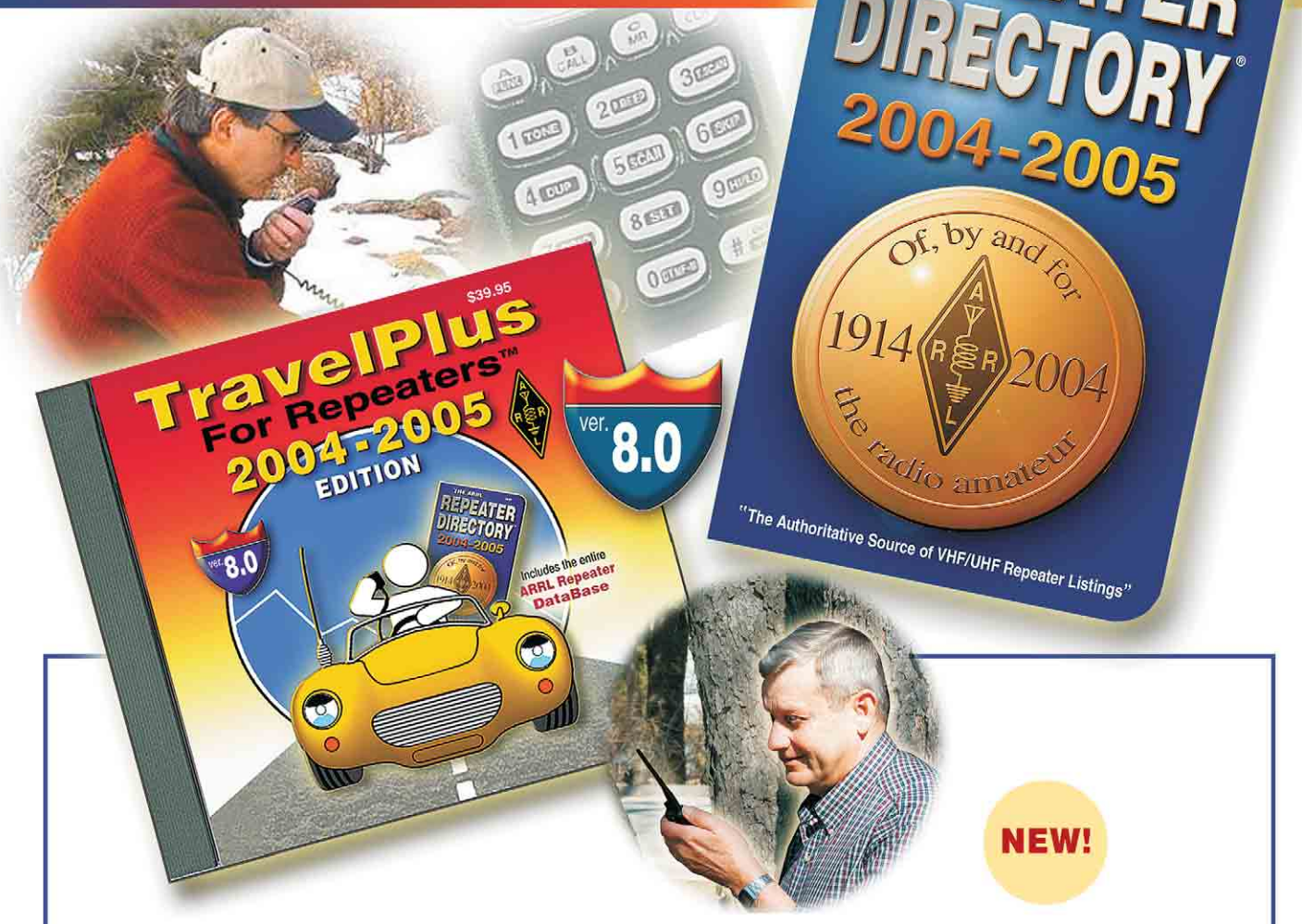

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MFJ-993

$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 tiny Travel Tuner

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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.

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$79.95 **New!**

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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.

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MFJ-915 *RF Isolator*

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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.

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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.

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For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

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Everything You Need

The MFJ-974H gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

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A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974H tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974H is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

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MFJ-974H **$199.95**

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

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Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter.* Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts with master fuse, ON/OFF switch, and "ON" LED provide 15 Amps for accessories. 12½x2¾x2½ in.

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12 outlets, each fused, 40 Amps total. Three high-current outlets for transceivers. Nine *switched* outlets for accessories. Mix and match in-cluded fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). *Built-in 0-25 VDC Voltmeter.* Includes *extra* 12 pairs of *PowerPole®* contacts and *extra* 10 fuses (2 each: 1, 5, 10, 25, 40A) -- *no extra cost.* 12Wx1¼Hx2¾D in.

MFJ-1126 **$79.95**

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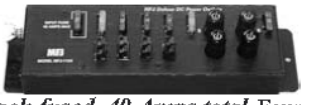
MFJ-1124 **$59.95**



6 outlets, each fused, 40 Amps total. Four *PowerPoles®* and two high-current 5-way binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes 4 pair *PowerPole®* contacts, and 5 fuses -- *no extra cost.*

•1 Year *No Matter What*™ warranty •30 day money back guarantee (less s/h) on orders direct from MFJ.

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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.

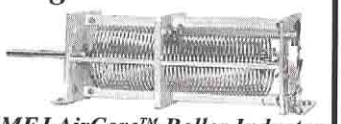
MFJ-989C **$359.95**

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.

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



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

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

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

MFJ *No Matter What*™ Warranty

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

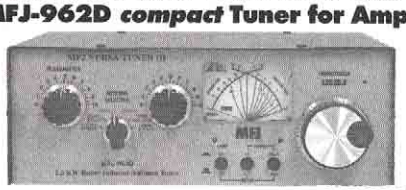
More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$329.95**

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

MFJ-962D *compact* Tuner for Amps



MFJ-962D **$269.95**

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

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$199.95**

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

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$149.95**

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. 3½Hx10⅞Wx7D inches. **MFJ-948, $129.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E **$119.95**

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

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

MFJ-945E **$109.95**

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

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$99.95**

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

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$79.95**

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

MFJ-16010 *random* wire Tuner

MFJ-16010 **$49.95**

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

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$79.95**

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

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 or MFJ-924 **$69.95**

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

MFJ-922 *144/440 MHz* Tuner

MFJ-922 **$79.95**

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

MFJ-931 *artificial* RF Ground

MFJ-931 **$89.95**

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

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1.8-170 MHz *plus* 415-470 MHz
MFJ HF/VHF/UHF Antenna Analyzer

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz

***Measures:** SWR…Return Loss…Reflection Coefficient…Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) . . . Coax cable loss(dB) . . . Coax cable length . . . Distance to short or open in coax … Inductance . . . Capacitance . . . Resonant Frequency . . . Bandwidth . . . Q . . . Velocity Factor . . . Attenuation . . . **Has:** LCD readout . . . frequency counter . . . side-by-side meters . . . Ni-MH/Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . One year No Matter What™ warranty . . .*

NEW MFJ-269 $359.95

You can instantly get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use handheld antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Inductance/Capacitance Meter

Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

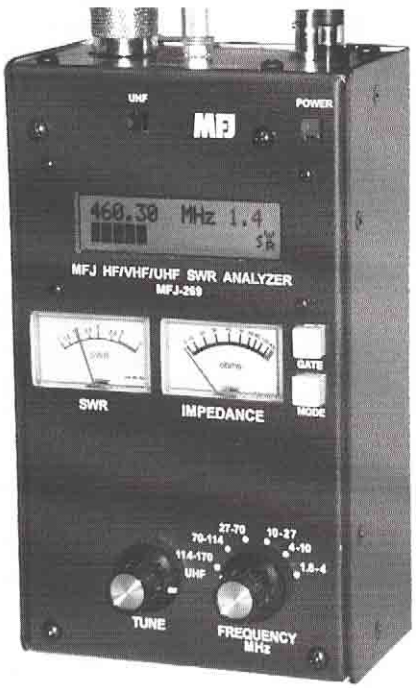
Digital and Analog displays

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.



You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1315, $14.95.

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.
Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends.

Has clear protective window for frequency display and cutouts for knobs and connectors -- use your MFJ *SWR Analyzer*™ without ever taking it out of your case. *Authentic MFJ leather logo distinguishes the real thing from imitators!*

MFJ-66, $19.95.
Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer*™.

MFJ-99C, $34.95.
SWR Analyzer Power Pack. 10 Pack MFJ *SuperCell*™ Ni-MH batteries, and MFJ-1315 Power supply for MFJ-269 SWR analyzers. ***Save $5!***

MFJ-98, $54.85.
MFJ-269 Accessory Pack. MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coil adapters, MFJ-1315 power supply for MFJ-269. ***Save $5!***

MFJ-98B, $77.85.
MFJ-269 Deluxe Accessory Pack. Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!***

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Family Member Name _____ Call Sign (if any) _____

❑ Sign up _____ family members @ $8 each = $ _____ .

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❑ Enclosed is $ _____ ($1.00 minimum) as a donation to the Legal Research and Resource Fund.

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MFJ *Switching* Power Supplies

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

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

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

MFJ's *MightyLites*™ are so light and small you can carry them in the palm of your hand! Take them with you anywhere.

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

MFJ's 25 Amp *MightyLite*™ weighs just 3.7 lbs. -- that's *5 times lighter* than an equivalent conventional power supply. MFJ's 45 Amp is even more dramatic -- *8 times lighter* and weighs just 5.5 pounds!

No RF hash!

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

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

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

Low Ripple . . . Highly Regulated

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

Fully Protected

You won't burn up our power supplies!

No RF Hash!

MFJ-4225MV
25 Amp
$149.95
plus s&h

MFJ-4245MV
45 Amp
$199.95
plus s&h

No RF Hash!

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

Worldwide Versatility

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

MightyLites™ . . . Mighty Features

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

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

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

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

Two models to choose from . . .

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

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

NEW! 25 Amp MightyLite™

Super light, super compact switching power supply delivers 25 Amps maximum/ 22 Amps continuous at 13.8 Volts DC. Low ripple, highly regulated. ***No RF Hash!*** Five-way binding posts for high current. Quick connects for accessories. Over voltage/current protection. 110 or 220 VAC operation. Meets FCC Class B regs. 3.5 lbs. 5½Wx2½Hx10¾D in.

MFJ-4125
25 Amp
$109.95
plus s&h

MFJ 35/30 Amp Adjustable Regulated DC Power Supply

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

MFJ-4035MV
$149.95
plus s&h

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

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

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

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

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

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

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

MFJ *High Current* Multiple DC Power Outlets

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

MFJ-1118
$74.95
plus s&h

MFJ-1116
$49.95
plus s&h

MFJ-1112
$34.95
plus s&h

New!
MFJ-1117
$54.95

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

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

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

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

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

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

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SUSSEX NJ HAMFEST New Jersey, (Augusta) Sunday, July 11, 2004. Sponsor: Sussex County ARC. Time: 8 am, Sussex County Fairgrounds, Plains Rd. off Rt 206. Free parking. Refreshments. Admission $6 (YLs and Harmonics free), Tailgate Space $16, Indoor $15 per table. Limited supply of tables available. Contact Dan Carter, N2ERH, 8 Carter Lane, Branchville, NJ 07826; Phone: 973-948-6999; Email: hamfest@scarcnj.org

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WILLIAMS, AZ. Amateur Radio Council of Arizona. (Formally Ft. Tuthill) Arizona's largest hamfest, JULY 2nd through 4th. I-40 exit 163. ARRL, Manufacturers, Dealers, Exhibits, Nationally Renowned Speakers, Seminars, HUGH SWAP AREA, Camping. SPONSORS: ARCA & City of Williams, AZ. ARCA, 16845 N 29th Ave #312, Phoenix, AZ 85053-3041. VM 602-881-2722, www.arca-az.org/arca.

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Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

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General

TECH TALK

IC-2720H - Expanding Your FM Mobile Horizons

Want to add new-found fun and excitement in your mobile pursuits? Check out Icom's new IC-2720H Dual Band FM mobile transceiver. It's loaded with today's hottest features, a joy to operate, and it will do crossband repeat. This unique transceiver is comprised of a small main unit, a remote-mount control head and an 11 foot interconnecting cable. It installs in a snap and produces a custom "built-in look" everyone will envy.

ROAD FRIENDLY, SURVIVAL READY! The IC-2720H features full duplex 2M/70CM operation, plus it simultaneously receives signals - the right side is a wide band receiver covering 118-174, 375-550, & 810-999.990 MHz*, while the left side covers the ham bands between 118-550 MHz. Each band has its own tuning, squelch and volume controls for easy operation, and all operating parameters are directly accessible from the supplied multifunction mic. This transceiver has it all!


IC-2720H

The IC-2720H delivers 50 watts output/2M, 35 watts/70CM and lower power selections of 15 and 5 watts per band. Additionally, it has 212 memories, 10 banks that can store up to 200 mix-and-match memories each, as desired. For weather watchers, the IC-2720H is preprogrammed with NOAA weather channels, and has a weather alert system that sounds an alarm when receiving a NOAA weather alert or bulletin.

Particularly attractive is the IC-2720H's inclusion of both CTCSS and DTCS encoders and decoders. Plus there's a tone-scan system that determines a repeater's required access tone and automatically loads it in CTCSS or DTCS memory. Either decoder can also be used to silently monitor a continuously-busy repeater and respond with alert beeps when receiving a specific tone or code. Further, the CTCSS decoding system is directly compatible with CTCSS encoders in all makes and models of FM transceivers (although other stations may wish they too had an IC-2720H for silent monitoring)!

CROSSBAND REPEAT TOO! Like high tech fun? The IC-2720H is capable of crossband repeat operation; It's like having a 50 watt rig right in your hand! Avoid unauthorized operation by activating either the CTCSS or DTCS for "Closed Repeater" operation. For information about acceptable crossband repeat operation, contact Icom's literature request hotline at 425-450-6088 and ask for our crossband repeat brochure. This document is downloadable from the web.

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TECH TALK

IC-703 - The Ultimate QRP!

I received the IC-703 just after it was introduced in 2003. I currently own an IC-706 and when I saw the form factor of the IC-703 I was delighted to see it was very similar to my IC-706. The radio ergonomics are critical to effective operation in the field or at home. If it's like the IC-706, I've got it made.

Using the separation cable, I mounted the front panel on my belt where I could have full access to the IC-703 controls. I installed a 12 volt 7 AH battery for power and a brand new mini screwdriver antenna from Super Antennas. The battery should provide a good 8 hours of talk-listen time, depending on how it is used.

Once the radio was connected to a 12 volt power source it was evident this rig was not a hobbled IC-706 but instead an all new QRP rig. It's already equipped for CW, SSB standard and rigged for digital modes. Once the antenna was connected, the receiver sounded hot and with the large tuning knob allowed me to tune the signals with great precision. This new all mode radio gives you big radio performance in a small package, standard. No tiny hard to see display here. The display is large, easy to read and shows all the information necessary for efficient operation. Buttons and knobs are large and well spaced. No small fingers required, thank goodness. The self-contained HF man pack gives me real freedom to be pedestrian mobile or set up some place and operate portable.

I jumped in with both feet and joined the County Hunter's contest working both 20 and 40 meter. The antenna I used for this was a 40 meter dipole thrown into a tree. The antenna tuner allowed me to tune 20 and 40 meters by pressing the tune button. It tunes very quickly as you hear the '703's relays set the C and L values. The optional CW filter worked very well and the installation was simple with the easy-to-follow manual.

All in all, this new little QRP rig gives me that big radio feel in a totally portable package. The new integrated Icom backpack makes the '703 feel great and work well.

When is the last time you took a hike and talked to DX? Now you can. What are you waiting for? The IC-703 is here, ready for action. Grab the key or microphone, battery and antenna and go have fun!

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TOWER for sale. 100' AB-105c w/heavy duty galvanizing. Dismantled, w/500' 5/16" Diameter New guy wire, 10" diameter screw anchors and new bolts, all in excellent condition. $1,200.00 Jim W9GLR, 5165 Island View Circle South, Polk City, FL 33868-8901 jimw9glr@juno.com 863-984-1317.

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WANTED: Early Microprocessors, eg: KIM's; SYM's; AIM's; SOL's; OSI's. Also: UNIMAT & Watchmaker Lathes & ATMOS Clocks. John Rawley, 1923 Susquehanna, Abington PA 19001; 215-884-9220; johnR750@aol.com

WANTED: Heathkit SB-110 6-meter transceiver, working or broken-down with HP-23 p.s. 937-675-3711 straley4272@msn.com

WANTED: Late Round Emblem Collins or Rockwell Collins S-Line. Jim, WA3CEX, 1-661-259-2011, jstitz@pacbell.net

WANTED: Tubes. Nobody pays more or faster than us! Mike Forman, 1472 MacArthur Blvd, Oakland, CA 94602, 510-530-8840, mftubes@webtv.net

WANTED: VACUUM TUBES - commercial, industrial, amateur. Radio Daze, LLC, 7620 Omnitech Place, Victor, New York 14564, Phone: (585) 742-2020, Fax: (800) 456-6494, email: info@radiodaze.com

WANTED: Yeasu FTDX560, BC-610, ART 13 and Accu-Memory II Keyer, KBØW, (916) 635-4994; fdellechaie@sbcglobal.net

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TELESCOPING ALUMINUM TUBING

DRAWN 6063-T832

.375	$.70/ft	1.375"	$1.75/ft
.500"	$.80/ft	1.500"	$1.95/ft
.625"	$.90/ft	1.625"	$2.25/ft
.750"	$1.00/ft	1.750"	$2.50/ft
.875"	$1.10/ft	1.875"	$2.75/ft
1.000"	$1.20/ft	2.000"	$3.00/ft
1.125"	$1.35/ft	2.125"	$3.50 /ft

In 6' or 12' lengths, 6' lengths ship UPS. Call for 3/16" & 1/4" rod, bar stock, and extruded tubing.

CUSHCRAFT ANTENNAS

13B2/A148-10S	$159/89
A270-6S/A270-10S	$79/99
A3S/A4S	$459/549
A50-3S/5S/6S	$99/169/269
A6270-13S	$199
AR2/ARX2B	$55/69
AR270/AR270B	$89/99
R6000/R8	$309/459
X7/X740	$649/269
XM240	$679

Please call for more Cushcraft items.

FORCE 12–MULTIBAND

C3	10/12/15/17/20m, 7 el	$599
C3E	10/12/15/17/20m, 8 el	$649
C3S	10/12/15/17/20m, 6 el	$539
C3SS	10/12/15/17/20m, 6 el	$559
C4	10/12/15/17/20/40m, 8 el	$759
C4S	10/12/15/17/20/40m, 7 el	$679
C4SXL	10/12/15/17/20/40m, 8 el	$979
C4XL	10/12/15/17/20/40m, 9 el	$1119
C19XR	10/15/20m, 11 el	$959
C31XR	10/15/20m, 14 el	$1299

Please call for more Force 12 items.

TRYLON "TITAN" TOWERS

SELF-SUPPORTING STEEL TOWERS

T200-64	64', 15 square feet	$1209
T200-72	72', 15 square feet	$1429
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T200-88	88', 15 square feet	$1949
T200-96	96', 15 square feet	$2249
T300-88	88', 22 square feet	$2189
T400-80	80', 34 square feet	$2089
T500-72	72', 45 square feet	$1979
T600-64	64', 60 square feet	$1869

Many more Trylon towers in stock!

BENCHER / BUTTERNUT

Skyhawk, Triband Beam	$1129
HF2V, 2 Band Vertical	$249
HF5B, 5 Band Minibeam	$359
HF6VX, 6 Band Vertical	$339
HF9VX, 9 Band Vertical	$369
A1712, 12/17m Kit	$54
CPK, Counterpoise Kit	$129
RMKII, Roof Mount Kit	$159
STRII, Roof Radial Kit	$125
TBR160S, 160m Kit	$139

More Bencher/Butternut–call

M2 VHF/UHF ANTENNAS

144–148 MHz

2M4/2M7/2M9	$95/109/129
2M12/2M5WL	$165/209
2M5-440XP, 2m/70cm	$179

420–450 MHz

440-470-5W/420-450-11	$139/95
432-9WL/432-13WLA	$179/239
440-18/440-21ATV	$129/149

Satellite Antennas

2MCP14/2MCP22	$169/239
436CP30/436CP42UG	$239/279

ROHN TOWER

25G/45G/55G	$89/189/239
25AG2/3/4	$109/109/119
45AG2/4	$209/225
AS25G/AS455G	$39/89
BPC25G/45G/55G	$75/99/110
BPL25G/45G/55G	$85/109/125
GA25GD/45/55	$68/89/115
GAR30/GAS604	$35/24
SB25G/45/55	$39/89/109
TB3/TB4	$85/99

Please call for more Rohn prices.

US TOWER

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TMM433SS/HD	$1349/1649
TMM541SS	$1789
TX438/TX455	$1279/1749
TX472/TX489MDPL	$2899/7299
HDX538/HDX555	$1499/2549
HDX572MDPL	$6669

Please call for help selecting a US Tower for your needs. Shipped factory direct to save you money!

COMET ANTENNAS

GP15, 6m/2m/70cm Vertical	$149
GP6, 2m/70cm Vertical	$139
GP9, 2m/70cm Vertical	$169
B10NMO, 2m/70cm Mobile	$36
SB14, 6m/2m/70cm Mobile	$59
SBB224NMO,2m/220/70cm	$69
SBB2NMO, 2m/70cm Mobile	$39
SBB5NMO, 2m/70cm Mobile	$49
SBB7NMO, 2m/70cm Mobile	$69
UHV4/UHV6	$109/135

Much more Comet in stock–call.

M2 ANTENNAS

50–54 MHz

6M5X/6M7JHV	$209/269
6M2WLC/6M9KHW	$459/499

10/12/15/17/20m HF

10M4DX, 4 Element 10m	$399
12M4DX, 4 Element 12m	$399
15M4DX, 4 Element 15m	$449
17M3DX, 3 Element 17m	$399
20M4DX, 4 Element 20m	$529

More M2 models in stock–please call.

GLEN MARTIN ENGINEERING

Hazer Elevators for 25G

H2, Aluminum Hazer, 12 sq ft.	$359
H3, Aluminum Hazer, 8 sq ft	$269
H4, HD Steel Hazer, 16 sq ft	$339

Aluminum Roof Towers

RT424, 4 Foot, 6 sq ft	$159
RT832, 8 Foot, 8 sq ft	$239
RT936, 9 Foot, 18 sq ft	$389
RT1832, 17 Foot, 12 sq ft	$519
RT2632, 26 Foot, 9 sq ft	$869

UNIVERSAL ALUMINUM TOWERS

4-40'/50'/60'	$539/769/1089
7-50'/60'/70'	$979/1429/1869
9-40'/50'/60'	$759/1089/1529
12-30'/40'	$579/899
15-40'/50'	$1019/1449
23-30'/40'	$899/1339
35-30'/40'	$1019/1569

Bold in part number shows wind-load capacity. Please call for more Universal models. All are shipped factory direct to save you money!

DIAMOND ANTENNAS

D130J/DPGH62	$79/139
F22A/F23A	$89/119
NR72BNMO/NR73BNMO	$39/54
NR770HBNMO/NR770RA	$55/49
X200A, 2m/70cm Vertical	$129
X500HNA/X700HNA	$229/369
X510MA/510NA	$189/189
X50A/V2000A	$99/149
CR627B/SG2000HD	$99/79
SG7500NMO/SG7900A	$75/112

More Diamond antennas in stock.

MFJ

259B	$219
269	$299
941E	$109
945E	$99
949E	$139
969	$169
986	$289
989C	$309
1798, 80–2m Vertical	$249
1796, 40/20/15/10/6/2m Vert.	$189

Big MFJ inventory–please call

COAX CABLE

RG-213/U, (#8267 Equiv.)	$.36/ft
RG-8X, Mini RG-8 Foam	$.19/ft
RG-213/U Jumpers	Please Call
RG-8X Jumpers	Ple ase Call

Please call for more coax/connectors.

TOWER HARDWARE

3/8"EE / EJ Turnbuckle	$11/12
1/2"x9"EE / EJ Turnbuckle	$16/17
1/2"x12"EE / EJ Turnbuckle	$18/19
3/16" / 1/4" Big Grips	$5/6

Please call for more hardware items.

TIMES MICROWAVE LMR® COAX

LMR-400	$.59/ft
LMR-400 Ultraflex	$.89/ft
LMR-600	$1.19/ft
LMR600 Ultraflex	$1.95/ft

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5 FT x .12" / 5 FT x .18"	$35/59
10 FT x .18" / 11 FT x .12"	$129/80
16 FT x .18" / 17 FT x .12"	$179/129
20 FT x .25" / 21 FT x .18"	$315/235
22 FT x .12" / 24 FT x .25"	$149/379

GAP ANTENNAS

Challenger DX	$289
Challenger Counterpoise	$29
Challenger Guy Kit	$19
Eagle DX	$299
Eagle Guy Kit	$29
Titan DX	$329
Titan Guy Kit	$29
Voyager DX	$409
Voyager Counterpoise	$49
Voyager Guy Kit	$45

Please Call for Delivery Information.

LAKEVIEW HAMSTICKS

9106	6m	9115	15m 9130 30m
9110	10m	9117	17m 9140 40m
9112	12m	9120	20m 9175 75m

All handle 600W, 7' approximate length, 2:1 typical VSWR...$24.95

HUSTLER ANTENNAS

4BTV/5BTV/6BTV	$129/169/199
G6-270R, 2m/70cm Vertical	$169
G6-144B/G7-144B	$109/179

Hustler Resonators in stock–call.

ANTENNA ROTATORS

M2 OR-2800P	$1249
Yaesu G-450A	$249
Yaesu G-800SA/DXA	$329/409
Yaesu G-1000DXA	$499
Yaesu G-2800SDX	$1089
Yaesu G-550/G-5500	$299/599

ROTATOR CABLE

R62 (#18)	$.32/ft.
R81/82	$.25/ft./.39/ft.
R84	$.85/ft

PHILLYSTRAN GUY CABLE

HPTG1200I	$.45/ft
HPTG2100I	$.59/ft
PLP2738 Big Grip (2100)	$6.00
HPTG4000I	$.89/ft
PLP2739 Big Grip (4000)	$8.50
HPTG6700I	$1.29/ft
PLP2755 Big Grip (6700)	$12.00
HPTG11200	$1.89/ft
PLP2758 Big Grip (11200)	$18.00

Please call for help selecting the Phillystran size for your application.

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IC-756PROII..... Icom Special!
The Icom IC-756PROII is an all mode HF and 6m transceiver featuring 32-bit digital signal processing, auto antenna tuner, 100 watts RF output, digital twin PBT, 5" multifunction color TFT LCD display with band scope function, built-in CW and SSB memory keyers, and more. Supplied with hand mic and DC power cord.

PW-1..... In Stock!
The Icom PW-1 is a 1000 watt solid state linear amplifier for HF and 6m operation, featuring a high power automatic antenna tuner, built-in power supply, and a removable front control panel, and more.

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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.

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All-mode 2m/70cm dual band transceiver, featuring dual data inputs, CTCSS encode/decode, CW keyer, satellite mode, scan, sweep display function, optional 23cm module, optional DSP, and more. Supplied with hand mic and DC power cord.

FT-1000MP-V..... Yaesu Special!
Competition class HF DSP transceiver with auto tuner, 200 Watts RF output, and more!

FT-1000MP-V Field .....Special!
Low power (100W) version of the FT-1000MP-V, with built-in power supply.

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All mode HF/6m XCVR featuring DSP, auto tuner, and more. With up/down hand microphone and DC power cord.

Quadra System ..... In Stock!

FT-897..... In Stock!
"Backpack" all-mode HF/6m/2m/70cm XCVR offering 100 watts of output power! The radio can be run from optional internal batteries with reduced output of 20 watts, or an optional internal power supply can be installed instead. An optional bolt-on external auto tuner is also available. The FT-897 is a truly self-contained portable!

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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.

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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.

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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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A truly tiny self-contained all mod e HF/6m/2m/70cm QRP XCVR featuring tone encode/decode, 200 memory channels, VOX, and more! With hand microphone.

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IC-W32A..... Now In Stock!
IC-T90A..... New, In Stock!

IC-208H..... Great Low Price!
A great 2m/70cm dual band mobile XCVR, featuring CTCSS tone encode/decode, 500 memories, removable control panel, and more. With a back-lit DTMF hand mic, mounting bracket, and a DC power cord.

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Rugged 2m mobile XCVR with CTCSS tone encode/decode/scan, DTMF paging/squelch, 113 memories, and more.

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Heavy duty antenna rotator handles 34 sq. ft. of antenna load, and features 450° rotation, preset and variable speed.

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All-Terrain Performance

On or off the road, Kenwood's new TM-271A delivers powerful mobile performance with 60W maximum output and other welcome features such as multiple scan functions and memory names. Yet this tough, MIL-STD compliant transceiver goes easy on you, providing high-quality audio, illuminated keys and a large LCD with adjustable green backlighting for simple operation, day or night.

144MHz FM TRANSCEIVER

TM-271A

▮ 200 memory channels (100 when used with memory names) ▮ Frequency stability better than ±2.5ppm (-20~+60°C) ▮ Wide/Narrow deviation with switchable receive filters ▮ DTMF microphone supplied ▮ NOAA Weather Band reception with warning alert tone ▮ CTCSS (42 subtone frequencies), DCS (104 codes) ▮ 1750Hz tone burst ▮ VFO scan, MHz scan, Program scan, Memory scan, Group scan, Call scan, Priority scan, Tone scan, CTCSS scan, DCS scan ▮ Memory channel lockout ▮ Scan resume (time-operated, carrier-operated, seek scan) ▮ Automatic repeater offset ▮ Automatic simplex checker ▮ Power-on message ▮ Key lock & key beep ▮ Automatic power off ▮ Compliant with MIL-STD 810 C/D/E/F standards for resistance to vibration and shock ▮ Memory Control Program (available free for downloading from the Kenwood Website: ***www.kenwood.net***)

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Amateur Radio Products Group

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