QST

Official Journal of ARRL — The national association for AMATEUR RADIO

Devoted entirely to **Amateur Radio**

www.arrl.org

December 2008

NEW Membership Benefit See page 45 for details!

QST reviews:

Microtelecom Perseus Software Defined Receiver

Inside:

The Magic of Olivia

Low Noise Receiving Loop

"Pounding Brass" in the 21st Century

A Joyous Holiday Season to All!

$4.99 US $6.99 can.

12

19260

0 843655 9

Visit the *ARRLWeb* at www.arrl.org

Mistletoe can take on many forms.

Icom HF. Mistletoe for real hams.

Radios shown from top to bottom: 718, 7000, 756PROIII, 7700, 7800. Icom HF radios not shown: 703 Plus, 706MKIIG, 746PRO, 7200.

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Connect for the holidays!

IC-R9500 Icom's Ultimate Wide Band Receiver

We've raised the bar with our super performance, multiple function wide band "measuring" receiver. The IC-R9500 has normal and wide spectrum scope functions. With five roofing filters before the first amp, two independent 32 bit floating point DSP processors, and 7-inch wide color TFT LCD, this is something to get excited about!

NEW IC-RX7

Stylish Scanner with Smart Interface

- 0.150 - 1300.000 MHz*
- AM, FM, WFM
- 1650 Alphanumeric Memory Channels
- High Speed Scan and Search
- Computer Programmable (Optional CS-RX7)
- Water Resistance Equivalent to IPX4

IC-R1500

IC-R2500

Mobile or PC Controlled Wide Band Receivers

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, USB, LSB, CW
- Fast Scan
- Optional DSP
- 1000 Alphanumeric Memory Channels
- PCR Upgradeable

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, SSB, CW (Main)
- AM, FM, and WFM (Sub)
- 1000 Alphanumeric Memory Channels
- D-STAR Compatible (Option UT-118)
- P25 (Option UT-122)

IC-R75

WIDE BAND RECEIVER

- 0.03 - 60.0 MHz*
- Triple Conversion
- Twin Passband Tuning
- Digital Signal Processing (DSP)

Happy holidays!

IC-R20

Advanced Wide Band Receiver

- 0.150 - 3304.00 MHz*
- AM, FM, WFM, SSB, CW
- 1000 Alphanumeric Memory Channels
- Dual Watch Receiver
- 4-hour Digital Recorder

IC-R5 SPORT

Grab-n-Go AA Alkaline Convenience

- 0.5 - 1300.00 MHz*
- AM, FM, WFM
- 1250 Alphanumeric Memory Channels
- CTCSS/DTCS Decode
- Weather Alert

Select Icom receivers are now on sale for the holidays. Visit your authorized Icom dealer today!

For the love of DC to Daylight.

*Frequency coverage may vary. Refer to owner's manual for exact frequency specs.

ICOM®

hy-gain® ROTATORS

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

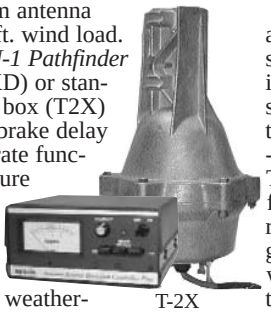
HAM-IV

HAM-IV
$649.95

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
$799.95

T-2XD
$1229.95
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
$449.95

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
$1099.95
with DCU-1

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

AR-40

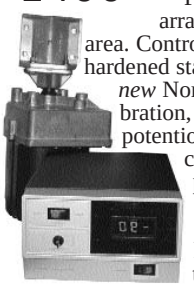
AR-40
$349.95

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
$1499.95



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.**

ROTATOR OPTIONS

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

Digital Automatic Controller

DCU-1
$749.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° 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
$89.95

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

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

NEW! Automatic Rotator Brake Delay

RBD-5
$29.95

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.

hy-gain®

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308 Industrial Park Road,Starkville, MS 39759, USA

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MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT ON THE DOOR EDGE.

All the mounts attach to van doors, truck side doors, SUV doors, etc... and require no holes. Includes 16' 6" deluxe cable assy w/18" mini RG-1888A/U type coax for weather seal entry.

Choose a mount depending on the antenna size and vehicle mounting location space.

For Small Antennas & Limited Space

MODEL / ANT CONN / COAX CONN

Maldol **EM-5M** SO-239 / PL-259
Footprint: 1.1"x .75"
Max Antenna: 40"

For Medium Size Antennas

MODEL / ANT CONN / COAX CONN

COMET **CP-5M** SO-239 / PL-259
COMET **CP-5NMO** NMO / PL-259
Footprint: 3.4" x 1.25"
Max Antenna: 60"

For Tall or Multi-band HF Antennas

MODEL / ANT CONN / COAX CONN

COMET **HD-5M** SO-239 / PL-259
COMET **HD- 5 3/8-24** 3/8-24 / PL-259
Footprint: 3.75" x 1.1 "
Max antenna: 80"

COMET **BNC-24** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: BNC Super flexible featherweight whip

COMET **SMA-24** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: SMA Super flexible featherweight whip

COMET **SMA-503** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Length: 8.75" • Conn: SMA

Maldol **MH-209** *(BNC Conn)* **MH-209SMA** *(SMA Conn)* **2M/70CM DUAL-BAND HT ANTENNAS**
3" length, soft rubber cover. Good performance in a small package!

COMET **NEW! CSB750A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 1/2 wave, 70cm 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max Pwr: 150W

COMET **NEW! CSB770A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 5/8 wave center load, 70cm 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

COMET **NEW! CSB790A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 7/8 wave center load, 70cm 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

Maldol **AX-50** **DUAL-BAND 2M/440MHz**
Wavelength: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

Maldol **AX-75** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

Maldol **AX-95** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

COMET **B-10 / B-10NMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/4 wave • 446MHz 1/2 wave • Length: 12"
• Conn: B-10 PL-259 , B-10NMO - NMO style • Max Pwr: 50W

COMET **SBB-2 / SBB-2NMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/4 wave • 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18"
• Conn: SBB-2 PL-259 • SBB-2NMO NMO style • Max Pwr: 60W

Maldol **EX-107RB / EX-107RBNMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length:29"
• Conn: EX-107RB PL-259 • Ex-107RBNMO NMO style • Max Pwr: 100W

COMET **SBB-5 / SBB-5NMO** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39"
• Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

COMET **SBB-7 / SBB-7NMO** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58"
• Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

COMET and Maldol Mobile

For a complete catalog, call or visit your local dealer.
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This Month in QST

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Technical

News and Features

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To compensate for additional postage for mailing outside the US, the following rates apply:

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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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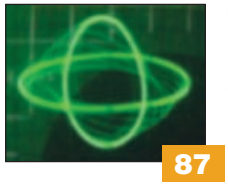
QST Workbench



Radiosport

Our Cover
May the wonder of this holiday season bring joy and peace to you and your loved ones, both near and far. On our cover, the first place winning photograph by Bob Johnson, W7LRD, of Renton, Washington, in our Third Annual Photo Contest illustrates the magic and marvel of all that winter brings (front snowglobe). From our family to yours, we here at ARRL HQ wish you the most delightful of holiday seasons. A more personalized greeting appears on page 37.

Departments

A radio For Every Need - Yaesu VHF/UHF Mobiles and Handhelds

Imagine the Future of the Mobile Radio ...
It's Now All Yours ! ... YAESU FTM-10SR

IP57 Submersible 3 feet for 30 min Body/Front panel

DUAL BAND DUAL RECEIVE

10 W 2 m/70 cm*
Dual Band FM Mobile
FTM-10SR *70 cm 7 W

Great New Features to Support Outdoor Motor Sports Activities
Mobile Transceiver... Great Appearance ... Easy to Operate

IP57 Submersible 3 feet for 30 min Front panel

DUAL BAND DUAL RECEIVE

50 W 2 m/70 cm*
Dual Band FM Mobile
FTM-10R *70 cm 40 W

YAESU PRESENTS THE THIRD GENERATION ULTRA-COMPACT HAND-HELD FM TRANSCEIVER THE VX-3R !

2 m / 70 cm Dual Band

1.5 W Ultra Compact
2 m/70 cm Dual Band FM Hand held
VX-3R

50 W 2 m Ultra Rugged VHF FM Mobile
FT-1802M 2 m Band

65 W 2 m Rugged FM Mobile
FT-2800M 2 m Band

QUAD BAND DUAL RECEIVE

50 W 10 m/6 m/2 m/70 cm*
Quad Band FM Mobile
FT-8900R *70 cm 35 W

DUAL BAND DUAL RECEIVE

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-8800R *70 cm 35 W

DUAL BAND

50 W 2 m/70 cm*
Dual Band FM Mobile
FT-7800R *70 cm 35 W

IPX7 Submersible 3 feet (1m) for 30 min.

5 W Ultra-Rugged, Submersible
6 m/2 m/70 cm Tri-Band FM Hand held
6 m / 2 m / 70 cm Tri-Band
VX-7R/VX-7RB

IPX7 Submersible 3 feet (1m) for 30 min.

5 W Heavy Duty Submersible
2 m/70 cm Dual Band FM Hand held
VX-6R

2 m / 70 cm Dual Band

5 W Heavy Duty
2 m/70 cm Dual Band FM Hand held
FT-60R

IPX7 Submersible 3 feet (1m) for 30 min.

2 m Mono Band

70 cm Mono Band

(8 key)

(16 key)

5 W Heavy Duty Submersible
2 m FM Mono Band Hand Helds
VX-120 (8 key Version) **VX-170** (16 key Version)

70 cm FM Mono Band Hand Helds
VX-127 (8 key Version) **VX-177** (16 key Version)

Ultra-Rugged 5 W Full Featured
2 m FM Hand helds
VX-150/VX-110 2 m Mono Band

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FT-897D

TCXO DSP 60 m Band

HF/50/144/430 MHz
100 W All Mode Transceiver
(144 MHz 50 W/430 MHz 20 W)

HF/VHF/UHF Multimode Mobile Transceiver, now Including Built-in DSP

FT-857D

DSP 60 m Band

HF/50/144/430 MHz
100 W All Mode Transceiver
(144 MHz 50 W/430 MHz 20 W)

Automatic Matching for FT-897/857 Series Transceivers

FC-40

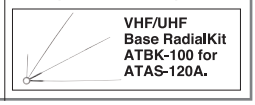
Automatic-Matching 200-Memory Antenna Tuner
(160 m ~ 6 m Band)

WATERPROOF

Mobile Auto-Resonating 7~430 MHz for FT-897/857 Series Transceivers

ATAS-120A

Active Tuning Antenna System
(no separate tuner required)



VHF/UHF Base RadialKit ATBK-100 for ATAS-120A.

REAL PERFORMANCE, REALLY PORTABLE

FT-817ND

HF/50/144/430 MHz
5 W All Mode Transceiver
(AM 1.5 W)

60 m Band

ATAS-25
Manually-Tuned Portable Antenna

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Loaded with Leading-edge Performance Capabilities. . .
The First Triumph in the 2nd Generation of the FT DX 9000 Lineage:
The Powerful FT-2000!

HF/50 MHz Transceiver
FT-2000
100 W Version (Internal Power Supply)

DMU-2000
Data Management Unit

Photograph shows 100-Watt version. Computer display and keyboard are after-market items, not supplied with the FT-2000.

HF/50 MHz Transceiver
FT-2000D
200 W Version
(External Power Supply)

Options

SP-2000
External Speaker with Audio filters

RF μ-Tune Kits

160m Band	80/40m Band	30/20m Band
RF μ-Tune Kits A	RF μ-Tune Kits B	RF μ-Tune Kits C

- Up to three μ-Tune Kits may be connected.
- μ-Tune Kit is included in purchase price of μ-Tune Unit.

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

Specifications subject to change without notice. Some accessories and/or options may be standard in some areas. Frequency coverage may differ in some countries. Check with your local Yaesu dealer for specific details.

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"It Seems to Us"

Our Next Spectrum Challenges

"Defending and enhancing amateurs' access to the radio spectrum: That is the most important mission of the ARRL. Members support this mission through their membership dues, but another essential source of support is the Fund for the Defense of Amateur Radio Frequencies, often called the Spectrum Defense Fund for short. Without the voluntary contributions to this fund, we could not do what we do."

Our spectrum defense and enhancement efforts have enjoyed many successes over the years. Despite exponential growth in the variety and number of radio frequency devices in the hands of consumers and businesses, we have managed to protect our bands and to add several new ones. Even our most disappointing defeat — the loss of the bottom 40% of the 220-MHz band some two decades ago — gave us upgraded status, from shared to exclusive, in the remaining 60% of the band.

Next March 29 we will celebrate the full implementation of one of our greatest victories: the removal of high-powered international broadcasting stations from the heart of the 40-meter band. We are working with the broadcasters to make sure the change takes place as agreed at the 2003 World Radiocommunication Conference (WRC). While it's probably too much to expect 100% instant compliance, we know that the responsible broadcasters are preparing to move out of the 7100-7200 kHz segment — doubling the size of the worldwide 40-meter band and making this popular band more useful than it's been in 70 years!

Just as we were planning this celebration came word of a new threat to the 40-meter band in the form of an experimental license grant by the FCC. Under the WE2XRH license issued to Digital Aurora Radio Technologies (DART), transmitters in Alaska radiating up to 660 kilowatts of digital emission, with 20-kHz bandwidth, would be permitted to operate in the 7.1-7.3 MHz band! Of course the ARRL has filed a strong protest. The only possible explanation is that the license grant was made in error; the only reasonable step for the FCC to take is to correct its error immediately, either by cancelling the license or by amending the frequency ranges to delete 7.1-7.3 MHz. Error or not, this should serve to remind us that we can take nothing for granted and must be constantly vigilant to protect our spectrum access.

At the WRC in 2007 the Amateur Radio Service earned its first low-frequency (LF) allocation, 135.7-137.8 kHz. However, here in the United States we will *not* gain access to this new band automatically when the Final Acts of the conference take effect on January 1, 2009. We must petition the FCC to implement the allocation, and we know the petition will not be granted without an argument — because we've been down this road before. Twice in the past, the ARRL has sought an LF allocation. Both times our request was opposed by the Utilities Telecom Council (UTC) — the same organization that has opposed our efforts to protect radio services from Broadband over Power Lines (BPL) interference.

Speaking of BPL interference, our battle to give this problem the attention it deserves has been going on for six years. Last year, in the wake of Federal Communications Commission decisions that did not adequately protect licensed radiocommunication services from interference from BPL systems, the ARRL even went to court to challenge the FCC. As you may have heard, we won! On April 25 the United States Court of Appeals for the District of Columbia Circuit confirmed what the ARRL has been saying for years about how the FCC was handling the BPL interference issue: FCC prejudice tainted the rulemaking process.

On July 9 the Court went one step further, ordering the FCC to pay the ARRL more than $6,000 toward our costs in pursuing the appeal (the check arrived in September). While this is a tiny fraction of our total investment, the award affirmed that — contrary to the "spin" the FCC had been trying to give to the Court's decision — the ARRL substantially prevailed in its appeal.

The Court's decision was a tremendous victory for radio amateurs and other licensed users of the radio spectrum — indeed, for anyone who cares about the federal administrative process. Yet, the remand does not guarantee that the FCC will correct its errors. We face another round of technical arguments. No doubt the FCC's technical staff, many of whom want to do the right thing, will remain under heavy pressure to ignore the laws of physics and give preference to wishful thinking once again. When the FCC reopens the BPL proceeding as the Court has ordered, we must leave no room for these technical issues to be settled on anything other than technical grounds. There's more work to do!

Another challenge lies ahead in 2011, when another WRC is scheduled. Preparations are already underway. The key WRC-11 issues for Amateur Radio are:

- A possible allocation near 500 kHz. This would provide our first access to the lower part of the medium frequency (MF) band. A "600 meter" band offers exciting possibilities for reliable groundwave communication through the application of digital signal processing techniques to a portion of the spectrum that is as old as radio itself!
- Defense against a push to allocate spectrum between 3 and 50 MHz for oceanographic radar applications.
- Support of an initiative to provide better protection for radio services against interference from short-range radio devices.
- Consideration of regulatory measures for software-defined radio and cognitive radio systems, which offer both opportunities and threats to existing radio services.
- Selection of agenda items for the WRC to follow, tentatively planned for 2015.

ARRL staff and volunteers are hard at work on your behalf, teaming up with International Amateur Radio Union (IARU) volunteers from around the globe to build the strongest possible case for Amateur Radio at WRC-11.

Your financial support of the Spectrum Defense Fund is vital to our continued success. If you have not done so already, please consider making a generous contribution. Visit **www.arrl.org/defense** for more details, or call our Development Office at 860-594-0397.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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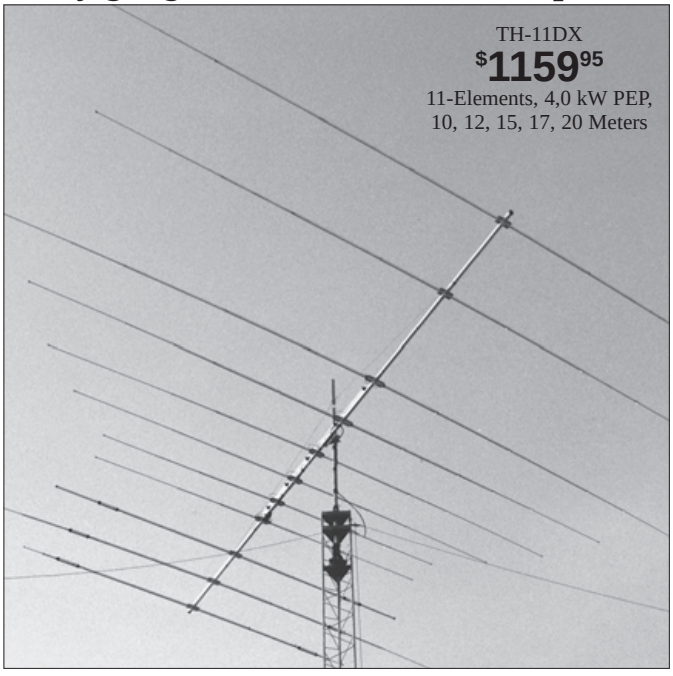

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10, 12, 15, 17, 20 Meters

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

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

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

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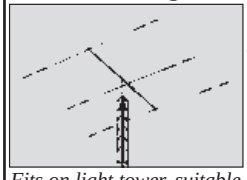

Fits on light tower, suitable guyed TV pole, roof tri-pod

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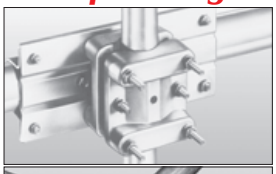
Model No.	No. of elements	avg gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	boom feet	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Sugg. Retail
TH-11DX	11	*For Gain and F/B ratio--See…*		4000	10,12,15,17,20	12.5	100	24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

Tooled Manufacturing . . . Highest Quality Materials

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



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

3. Thick-wall *swaged* aluminum tubing

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

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- Optional Data Management Unit (DMU-2000) permits display of various operating conditions, transceiver status and station logging.
- Optional RF μ -Tune Units for 160 m, 80/40 m and 30/20 m Bands

Optional, YAESU Exclusive, Fully-Automatic μ -Tuning Preselector System!

Fully automatic, Ultra-sharp, External μ -Tuning Preselector (optional) features a 1.1" (28 mm) Coil for High Q

On the lower Amateur bands, strong signal voltages impinge on a receiver and create noise and intermod that can cover up the weak signals you're trying to pull through. YAESU engineers developed the μ (Mu) Tuning system for the FT DX 9000/FT-2000, and it is now available as an option for the FT-950. Three modules are available (MTU-160, MTU-80/40, MTU-30/20); these may be connected externally with no internal modification required! When μ -Tuning is engaged, the VRF system is bypassed, but the fixed Bandpass Filters are still in the received signal path.

Optional External Data Management Unit (DMU-2000) Provides Many Display Capabilities

Enjoy the ultimate in operating ease by adding the DMU-2000! Enjoy the same displays available with the FT DX 9000 and FT-2000: Band Scope, Audio Scope, X-Y Oscilloscope, World Clock, Rotator Control, Extensive Transceiver Status Displays, and Station Logging Capability. These extensive functions are displayed on your user-supplied computer monitor.

Shown with after-market keyer paddle, keyboard, and monitor (not supplied).

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- Richard Garriott, W5KWQ, provided hams around the world with contacts from the International Space Station (ISS) after becoming the sixth private citizen to fly with the Russian Federal Space Agency (RKA).
- The Manassas, Virginia City Council has voted 4-2 to assume control of the Broadband over Power Lines (BPL) service from the private company that serves approximately 675 residents.
- Well-known contester, DXer, and *QST* and *NCJ* author Paolo Cortese, I2UIY, passed away from a brain aneurysm the weekend of October 11 at age 48.
- The third annual ARRL On-Line Auction ran from October 23 through October 31.
- The winner of the *QST* Cover Plaque Award for September is Jim Weit, KI8BV, for his article, "An All Band HF Dipole Antenna."
- Scouts around the world took part in the annual Jamboree-on-the-Air (JOTA) October 18-19.
- Governor Ed Rendell has signed into law a bill that guarantees Pennsylvania radio amateurs the right to erect antenna support structures up to 65 feet without the need for a Special Use Permit.
- The US Fish and Wildlife Service (FWS) has selected a group of hams led by veteran DXpeditioners Bob Allphin, K4UEE, and Glenn Johnson, WØGJ, to lead a DXpedition to Desecheo Island, KP5 (IOTA NA-095), in early 2009.
- The 2009 *ARRL Handbook for Radio Communications* and the 2009 ARRL Amateur Radio Calendar are available from dealers or the ARRL Bookstore.
- Texas Governor Rick Perry has appointed ARRL West Gulf Vice Director Dr David Woolweaver, K5RAV, of Harlingen, to the Council of the Department of State Health Services (DSHS).
- A 67 page booklet, "Ethics and Operating Procedures for the Radio Amateur," by John Devoldere, ON4UN, and Mark Demeuleneere, ON4WW, is available for free download from the ARRL Web site.
- The Korean Amateur Radio League hosted the Amateur Radio Direction Finding World Championships in September.
- These ARRL online course sessions are to begin November 21: Amateur Radio Emergency Communications Level 2 (EC-002); Antenna Modeling (EC-004); HF Digital Communications (EC-005); VHF/UHF — Life Beyond the Repeater (EC-008), and Radio Frequency Propagation (EC-011).
- The ARRL International EME Competition was October 18-19.

Media Hits

Allen Pitts, W1AGP

Gustav, Hannah and Ike may be fading memories to many of us, but not to the people who were there. Although this time the commercial communications systems fared much better in the storms, the assurance of Amateur Radio's presence as a backup was noted in media.

- *The Daily Reveille* (Baton Rouge, LA) noted Bill Gabour's use of an old tour bus he converted to make a rolling command post in Katrina and Gustav. Meanwhile, *The Eagle* (Bryan, TX) headlined "Ham operators gave valuable help" and reported on the use of Amateur Radio by WC5AAH and WX5HGX during Ike.
- An unusual outlet and outcome for Amateur Radio in media was the October 9 *Florida Baptist Witness* (Graceville, FL) article about ham operator Brent Gay. Describing his experiences providing communications for the Florida Baptist Disaster Relief activities in Ike, Brent promoted Amateur Radio well. His story was also picked up in the *Foster Folly News* (Washington County, FL). Curiously, he seems to have gotten the call sign of everyone involved into the article — except for his own! It's KF4JZY.
- As the focus of destruction centered on Galveston, the inability of people to get into the devastated areas slowed both recovery operations and information. But Galveston residents KE5CDE and KE5CFF, Kevin and Sharon Briscoe, rose to the occasion as reported in the *Galveston Daily News*. Working out of his truck and using phone patches, they passed H&W traffic for neighbors, reports on the situation there and later worked with a POD unit. The *Houston Community Newspapers* group also noted "Amateur radio operators assist in Ike recovery." Chuck Sprick, KE5RAD, had an excellent quote in those articles in which he said, "Amateur Radio is a hobby, but ARES is a commitment."
- An interesting pair of events was reported in the news out of the Northwest. The *Herald* (Everett, WA) published a story that was picked up by the Associated Press about Glenn Russell Ruby Jr, W7AU, using a QRP rig and CW after he broke his leg in the wilds of the Casades in western Washington. 600 miles away, Bob Williams, N7ODM, heard the signal and brought rescue. Preventing situations like this, often with far worse outcomes, was the goal of two new ham repeaters in the Sawtooth National Forest. KTVB-TV in Boise, ID extensively documented that in an area known by locals as "communications hell," the repeaters are the only reliable means of communications in the rugged region. Reporter Joni Shriver did excellent work covering the important technology involved without confusing the viewers.
- Stories explaining Amateur Radio's technology for general audiences are not easy to write, but the *Clarkson University News* (Potsdam, NY) also did an excellent job of this on October 9 reporting a $15,000 donation by Qualcomm to the university to demonstrate the effectiveness of a new digital voice and data communications system of "cutting-edge technology." Presented to the Community Radio Team, the new system will "set the standards for next-generation radio communications." We hams know the system as D-Star.
- Finally, *JNCI* — the Journal of the National Cancer Institute — opened with Dr Francis Moore saying, "Great advances…tend to come from creative people whom no one has heard of before, working in obscurity… Enter John Kanzius, a retired TV engineer and ham radio operator…" Their July 16 issue is a good summary of the ongoing research at that time.

Hams Amid the "Glitterati"

PHILIP GREENBERG

A recent gala event in New York City offered a rare "eyeball QSO" opportunity. From the left: Brian Wruble, W3BW, chairman of The Jackson Laboratory Board of Trustees, his wife, Kathleen Bratton, K2KWB, the Honorable John Baldacci, KB1NXP, Governor of the State of Maine, and 1993 Physics Nobel Laureate Dr Joseph Taylor, K1JT.

On the evening of September 18, a glittering event was held at the Pierre Hotel in New York City. How glittering? For starters, there were six Nobel laureates in attendance, including 1993 Physics laureate Dr Joseph Taylor, K1JT. The Jackson Laboratory, a large and vital genetics research center based in Maine, held the gala to bestow a Lifetime Achievement Award on Dr David Baltimore, another Nobel laureate (Physiology or Medicine) and a Laboratory Trustee. The event was hosted by actress Glenn Close and featured a musical performance by James Taylor. — *tnx Brian Wruble, W3BW*

JOEL KLEINMAN, N1BKE

At the table: **At September's ARRL Washington State Convention in Spokane Valley, those meeting and greeting ARRL members included (from the left) Northwestern Division Director Jim Fenstermaker, K9JF; Shirley Fenstermaker, KE7CBH; Vicki Sawders, K7VKI, and Northwestern Division Vice Director Bill Sawders, K7ZM.**

Five-Ham Family Down Under

Walt Davidson, KC7OMZ

We have an IRLP Radio Net here in the Phoenix Area and some check-ins from farther north. The Las Vegas reflector has been kind enough to let us use that channel every morning from 0415 until 0530 Mountain Time. There are usually some six or eight hams in the Sydney area that also connect to the reflector, and we have a great time talking and comparing notes.

Ali Simpson, VK2FALI, provides her Fourth Grade class with a demo, including an IRLP contact with ham friends in the Phoenix, Arizona area. Ali's parent and two sisters are all licensed.

Among the hams from Down Under are the Simpsons. The Simpsons are both schoolteachers who live in New South Wales, and their three daughters are also now licensed. This past spring, Alicia, VK2FALI, now 9, gave a ham radio demo to her Fourth Grade class, including a contact here to the Phoenix area. Shortly after the last member of the family got her call sign we had the entire Simpson family check in on the Phoenix Down Under Net (**www.phoenixdownunder.net**).

Inside HQ

ARRL.org Improvements

About 30,000 users visit our Web site daily and they view about 385,000 pages of Web content each day. This results in about 10 million page views a month. **www.arrl.org** is a busy Web site!

Our Web site contains lots of information about Amateur Radio and the ARRL. It's difficult to determine exactly how many pages of content the Web site contains because many of the pages are created on-the-fly based on specific user requests, such as the location VE sessions or hamfests. We estimate that the Web site has over 30,000 pages of content. The content is both wide and deep. This amount of material is challenging to manage and organize.

While many individual areas of the Web site have been improved and updated over the years, the overall Web site has not been updated since September 2000, almost nine years ago. Since then our Web traffic and activity level have increased substantially. Our members increasingly rely on our Web site to find information and to interact with us. An increasing percentage of our members use the Web site to renew their membership, purchase ARRL books, and complete other transactions with us.

Because of these factors, we have begun a major Web site rebuilding effort that will take us about a year to complete. We have hired an outside firm to help us and we will, essentially, be rebuilding the Web site ground up. We plan the transition to the new version of arrl.org around the beginning of 2010. The goals for the new site include an updated look and feel, improved search capability, a more streamlined navigation scheme and a more logical organization structure. We also plan to make the new site friendlier to our users by making it customizable to individual users' needs. Similar to other Web sites, members will be able select their own areas of interest that will be displayed on their customized home page when they log in.

Although the completed new site will not debut for a year from now, you are already seeing some of the preliminary upgrade work in our current site. As we continue to improve the functionality and organization of specific content areas, we will incorporate them into our current site. We started this process with the redesign of our new membership pages a few months ago. In addition, we have just added the members-only *QST* Archive and Search feature where members can access *QST* online and print their favorite articles. Another example, and a bit of a preview of how we believe our new site might look, can be found at **www.wedothat-radio.org/wedothat/**.

This is an exciting project and an important upgrade for our members and for us here at HQ. If you have any comments or suggestions, please let me know.

73,

Harold Kramer, WJ1B
ARRL Chief Operating Officer
wj1b@arrl.org

Guide to ARRL Member Services

ARRL, 225 Main Street ♦ Newington, Connecticut 06111-1494, USA

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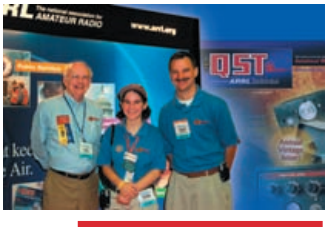

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The American Radio Relay League, Inc. is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

ARRL is an incorporated association without capital stock chartered under the laws of the State of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," the ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A *bona fide* interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

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From QST Magazine, March, 2005

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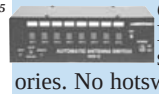

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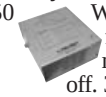

Whisper quiet fan, 2.5kW/1 minute on, ten off. 300W continuous. SWR< 1.25 to 30 MHz.<1.4 to 60 MHz.

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Up Front in QST

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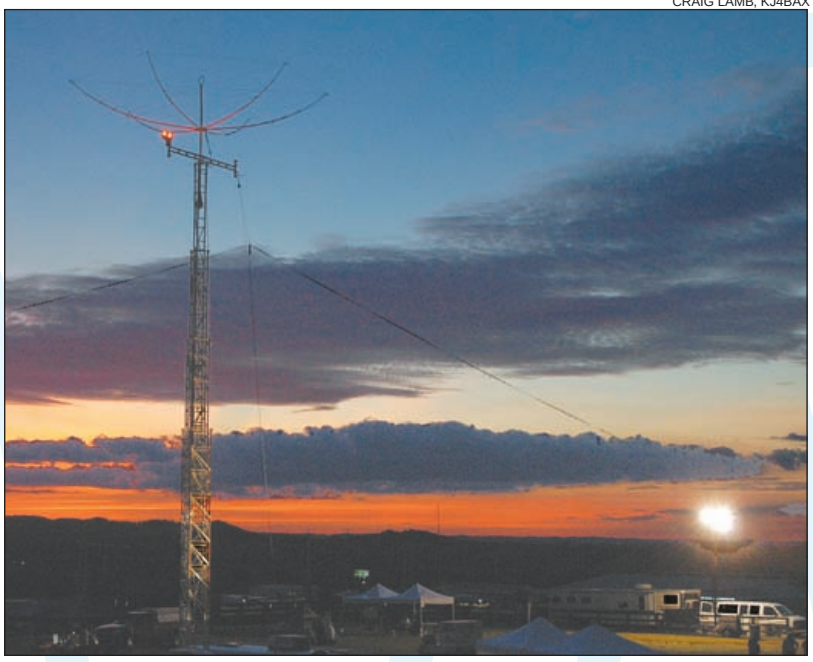
Field Day Fun!

As they have done since 1933, hams braved the elements (and this year's dearth of sunspots) over Field Day weekend June 28-29 to set up stations in some pretty unusual locations (and some traditional ones as well). The complete results are in this issue, starting on page 69, and on the ARRLWeb at **www.arrl.org/contests/**.

CRAIG LAMB, KJ4BAX



Sunset over the Field Day: **It's getting dark at the FD site of the Williamson County (TN) Amateur Radio Emergency Service. The tower in the foreground is a 100 foot Aluma Tower, deployed to 45 feet, with a hex beam antenna built by the club for the occasion. The tower and related equipment were provided by the County Emergency Communications department.**

CPT JEFFREY HAMMER, N9NIC/YI9NIC

Two sergeants do FD from Iraq: **Sgts Nathan Cummings and Owen Fuller explore PSK31 with *DigiPan* software.**

The Bands are a Zoo — Literally!

Tad Burik, K3QC

If you are an animal lover like I am, you should have joined us for Field Day at the Octagon Wildlife Sanctuary in Punta Gorda, Florida. Image hearing lions and tigers roar in the background as the CW contacts pile up. There is no way to filter out the loud macaw screeches. The bears pace only yards away and look at us as if we are strange.

Lauri Caron, director of the OWS, assisted me in starting a ham radio club at the zoo, and we have the distinguished call W8OWS.

Stella Gurka, WB2FAU; Don Kilpatrick, W9LBY; Dave Penezic, WA4GUK, and myself, all friends from the QCWA, had our hands full putting up two inverted Vs, a trap dipole and a vertical in places where we would not bother the animals or zoo visitors. Another friend, Phil Jansen, AF4VE, helped us set up and operate on Saturday.

The Octagon has invited us back next year. In the meantime you can look for W8OWS on weekends throughout the year. If you happen to be in southwest Florida please visit the sanctuary and get on the air from our club station. The animals will thank you!

TAD BURIK, K3QC

TAD BURIK, K3QC

The lady and the tiger: **Stella Gurka, WB2FAU, seems to be enjoying FD '08 at the Octagon Wildlife Sanctuary, and Tony looks pleased to have her (and the other W8OWS ops) share his space.**

2008

Homebrew Transceiver

Alex Mendelsohn, AI2Q, of Kennebunk, Maine with his all-homebrew transceiver, which he calls the STAR (Software Transmitter And Receiver). It is a G3XJP-reference design originally published in a series of articles in the RSGB's *RadCom* magazine. The STAR runs three PIC microcontrollers and an Analog Devices DSP, and covers 160M through 10M SSB and QSK CW. It includes a high-performance H-mode mixer and a 14 bit direct digital synthesizer (DDS) VFO.

"Just after getting the rig operational," Alex writes, "a nifty thing happened. 5B4AGN happened to arise at 3 AM on Cyprus to get a glass of water and, as he passed his shack, he flipped on his receiver. The first station he heard was me, so we closed the loop with a STAR-to-STAR QSO."

ALEX MENDELSOHN, AI2Q

XCVR HR HB: **Alex Mendelsohn, AI2Q, with his homebrew transceiver. It was a 16 month project involving acquiring parts, etching boards, drilling holes, soldering and testing.**

Diablo Bravo 08

Deputy Secretary of Defense Gordon England, ex-W3AWO, visited the federal emergency exercise called Diablo Bravo 08, which simulated a terrorist attack on a nuclear weapon being transported through Kitsap County, Washington. Hundreds of federal personnel were involved in this exercise. Kitsap County hosted the exercise and provided support.

That support included Amateur Radio. The exercise was never intended to be a communications exercise; we were there to let everyone know that we are prepared for a real emergency.

On the third day of the four day exercise, Secretary England observed the exercise in progress. He was given a VIP tour of the event site (where the simulated weapon was attacked) and the Emergency Operations Center where we were located. When he came into the EOC, he saw the 6 foot "Amateur Radio" banner and he started walking straight toward us. He told us how he built Heathkits when he was young and about some of the things he did when we was licensed.

Several federal personnel who visited our Comm Vehicle were fascinated with our tunable radios. It seems that they had only been familiar with channelized radios and they were impressed with our ability to manually tune frequencies. — *Dave Gutierrez, WA6PMX*

DAVE GUTIERREZ, WA6PMX

Kitsap County EC/RO Lester Crawford, AB7Y, and Kitsap County Emergency Management Department Program Coordinator Mike Gordon, KE7HHP, at Diablo Bravo 08.

Deputy Defense Secretary Gordon England, ex-W3AWO, visited with us at our operating position at the EOC during Diablo Bravo 08.

Bedford ARC Helps Out Santa

The Santa USA program (**www.santa-usa.org**) began in northeast Tarrant County, Texas about 30 years ago. The program's intent was and is to bring Christmas cheer to children, the infirm and elderly. What started out as one individual using one vehicle has evolved into an organization with over 100 volunteers using multiple motor vehicles and two helicopters to visit area hospitals, nursing homes and schools.

The helicopters are used to transport Santa and his helpers to multiple locations quickly and efficiently, and that's where the Bedford ARC provided critical support. The Santa USA program visited 27 area schools over a three day period last year. In order to keep the operation both safe and on schedule, timely communications were critical. Last year, a total of 15 operators provided net control (operated out of the City of Bedford's EOC), landing zone and individual school support. Two separate local UHF repeaters were used, one for landing zone operations and the other for school operations support. To ensure timely communications, a radio operator was assigned to each school principal to keep him or her abreast of Santa's progress so that the children could be brought outside just prior to Santa's arrival in the helicopters.

This is yet another example of how Amateur Radio operators can help the public in non-emergency communications. — *Frank Knox, KS5F*

RICK NASH, W5AWQ

Net control operator Frank Knox, KS5F, assisted by Darren Wallerstedt, W5DLW, coordinates support for the Santa USA helicopter operations. Last year, Santa visited a total of 27 schools in three days.

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CORRESPONDENCE

MAKING ROOM FOR EVERYONE

♦ Gil McElroy, VE3PKD, makes a good point — there does seem to be a CW contest almost every weekend ["CQ Contest! A History of Radiosport," October 2008, pages 54-56]. It might be a worldwide event or QSO party. Check the "Contest Corral" in *QST*; I think you'll agree.

Since 1996, I have run a CW Net above 14050 kHz on Saturday mornings. I believe that contest activity has increased many fold since then. It seems that almost every one of our Nets is in competition with a contest. The endless and constant CQ TEST that we hear is amazing. You can run the band from 14000-14050 or above and hear nothing but CQ TEST.

I was amused by one of the recent hints suggested by ARRL Contest Branch Manager Sean Kutzko, KX9X, in his monthly *QST* column. He suggested that contesters be courteous and use QRL? before transmitting. Having been a ham since the 1960s, I think I could probably count on one hand how many times I've heard a contester sending QRL?.

With the exceptions of the worldwide contests or Field Day, wouldn't it make sense to at least strongly encourage contesters to use a small portion of the band rather than the entire CW or SSB spectrum? I certainly don't have all of the answers for what I see as a problem. But I do believe it's something that needs to be seriously addressed, rather than the finger pointing and eventually ignoring or sweeping the problem under the rug. Maybe another idea might be to outlaw all automation during contests — just good old fashioned manual sending and receiving as illustrated by the picture on October's *QST* cover. Let's see who the real operators are.

FRED GOODWIN, K7LF
Port Angeles, Washington

MEMBERSHIP HAS ITS PRIVILEGES

♦ The letter from Brian Cieslak, K9WIS ["Correspondence," November 2008, page 24], really got my attention! I had no idea that the ARRL had all issues of *QST* through December 2004 available for members on their Web site. I immediately checked this out by bringing up the October 1956 issue, went to the "How's DX?" column and found calls like 4S7YL who I used to talk to when stationed in Bavaria. I also found DL4SD, a friend who was also stationed at the same Kaserne (barracks). I was immediately hooked! I spent the next hour reading an article written by the legendary author Lew McCoy, W1ICP, and other articles of that time. Suddenly, 50-plus years had melted away and I was the new, young ham once again. I can see where this is going to be an enjoyable winter, prowling through past issues of *QST*. This is without a doubt one of the greatest benefits of ARRL membership, for old and young alike.

ALLEN POLAND, K8AXW
Keyser, West Virginia

JOYS OF JOTA

♦ This year, our Cub Scout Pack picked Sunday, October 19, to participate in Jamboree on the Air (JOTA). This is consistently a great event for the young Cub Scouts. As I tuned up the radio in preparation for the Scouts' arrival, I noticed that there was a QSO Party on the band. I was worried that we would not be able to make any JOTA contacts with the contest going on. I called a few of the contesters and they were all willing to take a break from the contest and talk with the boys. The Scouts had a great time talking with the hams. Dean Holste, KC9EOQ, said I could him back when the Scouts arrived. Special thanks also goes to David Johnson, KC9MAV, who took extra time and related his experience as a young ham to the Scouts. I was impressed with the willingness of the contesters to take time out for this non-contest activity. This speaks well of the hobby when we can take time out of our normal activities to motivate a young person. Thank you.

JAY JABOUR, W8WJJ
Beavercreek, Ohio

ANTENNA ACTION

♦ What a bargain I made 40 years ago when I decided to become a Life Member of ARRL. I know that I am not the only lucky ham to make this decision. My membership and thousands of others combined make the ARRL a powerful lobby. I think that the ARRL should use as much pressure as possible to take on the issue of CC&Rs (covenants, conditions and restrictions) as they relate to our wonderful hobby.

With the pressure of the terrorists posing a threat to the USA, now is the time to change the attitude of Washington toward covenants that prevent us from erecting much-needed towers and outside antennas to provide communications should a disaster occur and Amateur Radio is left as the sole means of communications. I know that attic antennas will work, and that is my means of being active. In my little community, a young person or a newcomer to the hobby would be crippled and discouraged when it comes to erecting antennas on their property. Hidden antennas are always compromises. Action and pressure by the ARRL is needed now, and in my humble opinion, this is the most opportune time to accomplish the possibility of overcoming this restriction directed toward the amateur community.

JOHN GREENE, KE8U, ARRL Life Member
Johnstown, Ohio

♦ *ARRL Regulatory Information Manager Dan Henderson, N1ND, replies*: ARRL has been on the forefront of lobbying on behalf of Amateur Radio since at least the days following World War I when Hiram Percy Maxim, W1AW, went to Washington to get Amateur Radio back on the air; we continue that mission today. We encourage today's hams to lobby their Members of Congress on matters concerning Amateur Radio. In 2006, the League set up a Legislative Action Committee (LAC). Contact your Division Director (all Directors are listed on page 15 of any issue of *QST*) to find out how you can get involved with this process. You can also check out the February 2007 and July 2008 issues of *QST* for more information on the LAC.

HONOR AMONG HAMS

♦ I enjoy immensely the human interest items published in *QST*, but "Collage Honors Family's Hams" ["Up Front in *QST*," October 2008, page 20] about the Deppe family is the greatest. I was very touched by Paul Deppe's, N4NEH, efforts to commemorate the hams in his family tree. Keep up the great work!

CHRIS WALTER, KI4CBF
Pembroke, Virginia

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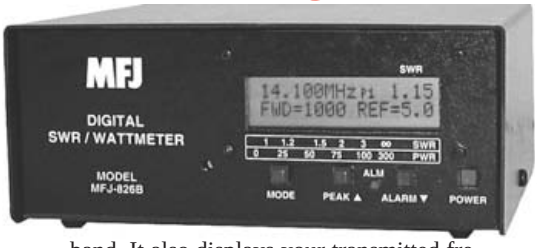

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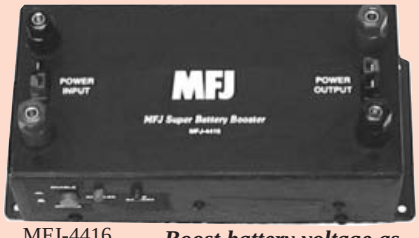

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RTTY 500W (5 minutes)
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Circuit:
Class AB parallel push-pull
Cooling Method:
Forced Air Cooling
Multi-Meter:
Output Pf 1kW, Reflected Power 100W, Drain Voltage Vd 60V, Drain Current Id 50A
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Exciting Power (RF Drive):
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A Different Way to "Pound Brass"

Bring CW into the modern age by using your PC sound card.

Barry Feierman, K3EUI

One of the simplest means of communicating by radio is to turn your RF carrier wave on and off by a keying circuit of some type. There are three states: off (no RF), on for a short time (dit), and on for a longer time (dah). Put the dits and dahs together into a kind of alphabet (the Morse code) and you have a means of communicating by radio. Thus, the mode we call *continuous wave* (CW) was born. CW is simple technically, takes up very limited RF spectrum space or bandwidth, and is easy to demodulate (recover the sound) at the receiver. CW is also a simple mode because the transmitter needs no audio circuitry.

Your receiver needs to translate this on and off CW signal into an audio tone so that the listener can hear the Morse dits and dahs. Such is the function of the BFO (beat frequency oscillator), detector and speaker in the receiver. You can't *hear* the audio tones of a CW signal with your receiver in the AM or FM position (BFO off). Well — it just goes *thump, thump, thump* as the automatic gain control responds to the presence of a carrier. Not a pleasant signal to copy.

My first CW rig was a simple homebrew four tube transmitter using a crystal oscillator (6AU6 tube), a rectifier and voltage regulator, and a final RF amplifier (6146). I built this transmitter mostly out of junk TV parts. It put out about 50 W and I could work 80, 40, or 15 meters (the Novice bands back then) with a few crystals. The year was 1958, the sunspot cycle was at its peak, and I could work the world with a dipole antenna. What a wonderful introduction to the hobby for me as a new Novice — KN3EUI. Back then all of the Novice class licenses had that characteristic *N* in the call.

CW always fascinated me, both as a youngster and now, as an adult 50 years later. But the technology has come a long way since those simple crystal controlled transmitters. I began to wonder how I might incorporate some of the new technology of computers and sound cards to enjoy the CW mode from a different perspective.

Note that for most operators, sending CW using a telegraph key and receiving with our ears is still the best, and often the most accurate way to operate. Still, using computer keyboards and displays may be the only choice for some people and can also serve as an aid to the learning process, especially if you listen as you go.

In the following sections, we'll discuss a few ways to accomplish this starting with a discussion of the synergy between CW and the other *digital* transmission modes.

Enter — Sound Cards

One of the technologies that has been available to ham radio operators for some time is the computer and sound card. Sounds (audio frequencies) created by the sound card can be used to *modulate* the radio wave in an SSB transmitter to create the various digital modes now known as RTTY, PSK31, SSTV and, of course, CW. *ARRL's HF Digital Handbook* explains what you need and how to set it up.[1]

How it Works— Receiving Digital Modes

All you need to receive the digital HF modes is a shielded cable to connect between your speaker jack (use a Y splitter if you also want to hear with your speaker) and the INPUT jack of the sound card.[2] You may need to adjust the volume of the audio from your radio, as well as the input sensitivity of your sound card to prevent getting too much audio signal into your sound card. Double click the speaker icon on the bottom of your *Windows* screen and up comes a sound control panel. Your RECORDING panel should have a number of input choices. Select the proper input (LINE or MIC) and adjust the input sensitivity to get just enough signal into the sound card. You need no special interface device to receive and decode digital signals with your sound card equipped PC.

Software

There are plenty of choices of free or shareware software these days. My preferences are the following: for RTTY (*MMTTY*), PSK31 (*Digipan, Win PSKse*), Slow Scan TV (*MMSSTV*), and CW (*CW GET* and *CW Type*). Some programs (*MixW, Hamscope, MultiPSK and Stream*) can even support multiple modes.

You can purchase a CD with these and more programs for $10 from West Mountain Radio at **www.westmountainradio.com**. Alternately, just use your favorite Internet search engine to find and download the programs from the Internet or see the links below to obtain software.[3]

Transmitting Digital Modes

To transmit the digital modes, you have to accomplish two tasks: turn your transmitter on, and feed the proper level of audio into the microphone circuit of your SSB radio. Turning your transmitter on can be accomplished by your software and involves a circuit called *push-to-talk* (PTT). Most software sends a control signal over one of the serial port lines (DTR or RTS) to key the transmitter, just like pushing the talk switch on your microphone. You don't want your microphone to be "live" while operating on the digital modes with a sound card, however, so you need to either unplug your mic or have the hardware do it for you by disconnecting the microphone line from the transmitter.

Interface Hardware

There are devices manufactured today

[1]Notes appear on page 32.

that take care of all the problems typically found in getting on the digital modes. I use a device called a *RIGblaster Plus*, manufactured by West Mountain Radio, but there are others on the market, such as those from MFJ, MicroHAM and Tigertronics. The output of my sound card (LINE out or HEADPHONE out) connects via a three-conductor stereo shielded cable to my RIGblaster. The RIGblaster conditions the wave, isolates the ground, and provides for the adjustment of the signal level. On most RIGblasters, you can also plug in your microphone to the RIGblaster box. When you push the PTT switch on your mic, the RIGblaster disconnects your sound card. What a nice feature — no cables to change to go from data to voice mode. A major problem to avoid is RF feedback — getting unwanted signals from your radio back into your additional audio lines and then into your radio.

I have used this combination of sound card, RIGblaster and radio to make numerous contacts on the digital modes. RTTY is one of the oldest digital modes, and you can still find a lot of activity around 14.080 to 14.090 MHz. RTTY is accomplished by alternating between two tones called a *mark* and a *space*. The two tones, which differ by 170 Hz, are alternated in a specific pattern, called a Baudot or Murray code, with typical speeds of 60 wpm.

PSK31 came along around 10 years ago as a result of the hard work of Peter Martinez, G3PLX. PSK31 has the advantage of taking up very little bandwidth (about 30 Hz) and works well under weak signal conditions. You can work PSK31 on 20 meters (often 14.070 to 14.073) and work the world with 10 W and a simple dipole or vertical antenna.

Newer modes such as MFSK16, Domino and Olivia are starting to be heard on the 20 meter band now using a variety of schemes to send characters. Many modes also provide error detection, and some even error correction, advantages in noisy or fading channels.

What about Sending CW with Your PC?

Some programs, particularly many of the contest oriented logging programs, only send CW from a computer keyboard or memory locations via special use of contact closures of computer serial or parallel port control leads. Many other programs have this as the default connection mode. These leads, generally with a simple relay or transistor interface, can be used as if they were regular key contacts. For many who aren't set up that way, the sound card connections provided for other digital modes can be used for CW as well.

Sending CW with a Keyed Audio Tone in SSB Mode

Typical carrier on and off CW signals have a spectrum of up to 100 Hz even from a well designed transmitter. The bandwidth of a CW signal is related to the keying waveshape of the RF envelope and the keying speed. Faster rise time (typically around 5 ms) and faster keying speeds result in a wider bandwidth. This is all discussed in any recent *ARRL Handbook*.

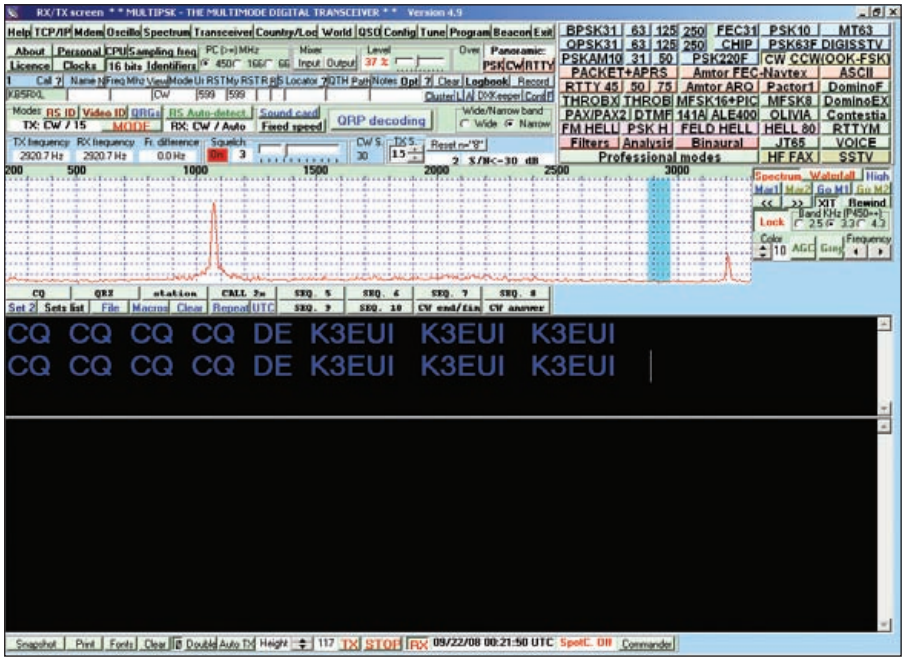


Figure 1 — Example of PC software for CW use. This is *MultiPSK* in CW mode.

Keying the Audio Line of an SSB Radio

Now, what happens when you *key* the audio wave going into the MIC jack of your SSB rig? The output of the radio is now a keyed RF wave of constant amplitude and frequency in whatever band you are set for. The frequency of the RF wave is a combination of my dial frequency (suppressed carrier frequency in SSB mode) plus or minus the audio frequency (depending on whether my rig is set for USB or LSB). Let's say that my dial reads 7.100 MHz on my radio and my audio sound card is set for 1000 Hz (1 kHz). If I am in USB, just add the two frequencies to get 7.101 MHz to get the RF frequency going to the antenna. If I am in LSB mode, then subtract the audio frequency from the (removed) carrier frequency to get 7.099 MHz. An RF frequency meter attached to my coax line shows me this is true.

How Does it Play

Not surprisingly, the output of a properly adjusted SSB transmitter with a pure single tone is virtually identical to the output of a CW transmitter with the key down. This is shown graphically in Figure 3 that shows the spectrum for each case as taken in the ARRL Lab on a typical Product Review SSB transceiver. In Figure 3A, the CW signal is on the carrier frequency, while in 3B, it is offset by the tone frequency. It should be clear that the spectrum width resulting from each generation method is comparable.

Keep in mind that it is the responsibility of each amateur to transmit a clean signal. With

Figure 2 — Another example of PC software. This is *CW GET* receiving code practice from W1AW.

a CW transmitter, control of the waveshape and frequency stability are key to a good signal. By using a tone to send any data mode, including CW, other variables are added to those. It is critical to avoid tone generators that have significant harmonic content as well as to avoid driving the audio stages into distortion. In either CW generation method, there are more ways to generate an obnoxious signal than to generate a good one!

The vintage Collins KWM series of transceivers actually sends CW by injecting an audio tone into the early audio stages of their SSB transmitters, as described in a recent *QST* article.[4] Note that the KWM adjusted their tone frequency higher than desired to avoid harmonics of the audio tone passing through the SSB filter. Fortunately, PC sound cards exhibit less harmonic distortion than did the old KWM tone generator.

Why Operate CW in the SSB Mode?

Just because we can transmit CW from our computer sound card doesn't necessarily mean we should. My computer software such as *CW Type*, allows me to type on my keyboard. The sound card creates the sound at whatever audio frequency I select. It enters my rig via the MIC jack. This avoids the need for a special interface, using exactly the same interconnections as the other sound card modes.

So now I have two means to send CW using my computer and rig. During many CW contacts on 20 meters, I have asked the other ops to listen as I switched the method of sending CW: from keying the CW jack (rig in CW mode) to keying the audio coming from my sound card (rig in USB mode). The result — no one could detect any difference. Keying an audio line going into a properly working SSB is true CW. It's just that my radio switch is in the SSB mode while I am making CW contacts.

So How's it Work?

CW GET is the receiving program I usually use. It translates well-sent Morse into letters on my screen and can copy from very slow speeds to speeds greater than 30 wpm. Perhaps no computer software is as good as the human ear, but this one comes close. Erratic spacing of the dots and dashes or noise between the code elements is always a problem with computer programs.

Most CW receiving software works very well with machine sent code, such as that from W1AW code practice or bulletins as shown in Figures 1 and 2. The speed and spacing is uniform throughout the transmission, so once the software gets its timing synched up it can copy very well. On the other hand, a human operator sending with fits and starts can result in many decoding errors. If you listen carefully as the characters appear on the screen, you may find that your receiving code speed and comprehension actually improve as "human operator beats machine."

One of the features of many digital programs is to work in *panoramic* mode, whereby all the audio tones passing through to the speaker can be decoded by the sound card at the same time. In other words, I can listen in on more than one CW conversation at a glance of my video screen. I can see perhaps 10 CW conversations at a glance, and look for that rare station calling CQ. Try doing that in your head!

CW Type is the transmitting program I use. You can set the audio frequency and level leaving your sound card with your mouse to any frequency in your transmitter passband. You can also adjust the rise and decay time of your audio wave, the dot and dash spacing, and the space between letters in menu settings. It's very versatile.

In Summary

I've always enjoyed CW the old-fashioned way and still copy CW in my head and send with a straight key, but now there is another way I can enjoy the mode. For beginners, CW via computer sound card can be like training wheels, allowing you to copy along in your head as well as see the characters appear on your screen. The goal of Amateur Radio communication is to enjoy the mode, make new friends and sharpen your communications skills. Although CW may be considered an "old-fashioned" mode, it is one many of us still enjoy.

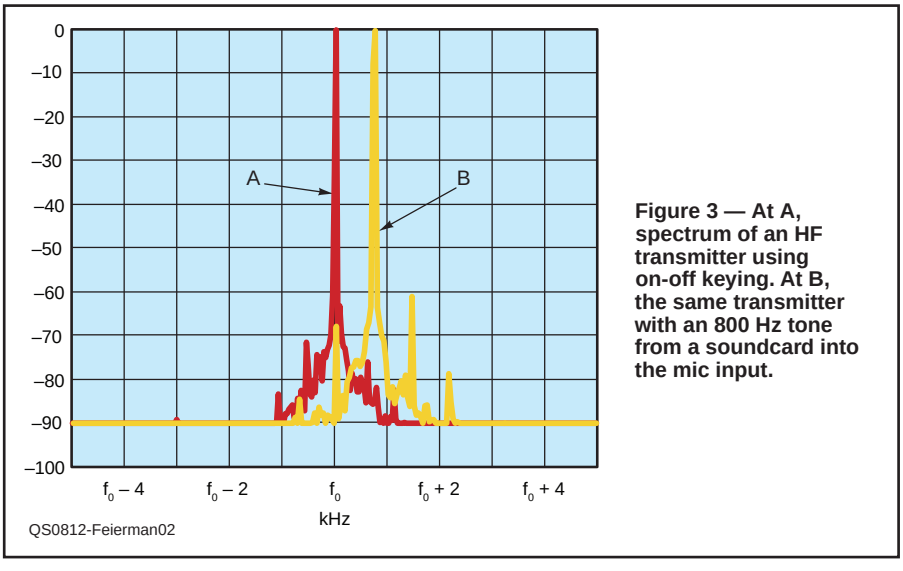


Figure 3 — At A, spectrum of an HF transmitter using on-off keying. At B, the same transmitter with an 800 Hz tone from a soundcard into the mic input.

Notes

[1]S. Ford, WB8IMY, *ARRL's HF Digital Handbook*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1034. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2]If your transceiver has a LINE output, it will work even better as an interface to the sound card. The line output level remains constant if the volume is changed, and the speaker can stay connected as usual.

[3]URLs for some popular Soundcard CW software include: *CW ONLY* (all *Windows* only): *CW Decoder* by Grant Connell, WD6CNF; **www.amqrp.org/projects/cwdecod/decoder.htm**, *CWGet* and *CWType*; **www.dxsoft.com**, *MRP40*; **www.polar-electric.com/Morse**, *CWLab04* by WN2A; **www.qsl.net/wn2a/**, Multimode including CW; *Fldigi* (*Windows*, *Linux* or *OS X*); **www.w1hkj.com/Fldigi.html**, *MixW* (*Windows*); **www.mixw.net**, MultiPSK (Windows); **f6cte.free.fr/index_anglais.htm**, multimode (*OS X*); **www.blackcatsystems.com/software/multimode.html**, *Cocoamodem* (*OS X*); **homepage.mac.com/chen/w7ay/cocoaModem/**.

[4]R. Bitzer, WB2ZKW, "Modifying the Collins KWM-2 for Serious CW Operation," *QST*, Jan 2008, pp 30-34.

Barry Feierman was first licensed in 1958 at age 13 as KN3EUI. He was inspired to get his ham radio license after visiting the Franklin Institute Science Museum's ham radio exhibit, W3AA (formerly W3TKQ), in Philadelphia. He took code practice sessions with W3DYP (SK) at the museum and learned to copy code at 20 wpm in his head, listening for words rather than individual letters as his instructor taught him. He earned the Amateur Extra class license after college and continues to enjoy CW as well as the other digital modes. Barry is an ARRL member.

His interest in ham radio led him into the world of physics and electronics resulting in a career as a high school physics teacher for 36 years at Westtown School near Philadelphia. He continues to help aspiring young hams in his classes. He was part of a school group that contacted the Shuttle Discovery *in April 1993 from the Franklin Institute's station. He is an active member of both the Phil-Mont Mobile Radio Club and the Chester County ARES/RACES group.*

You can reach Barry at 105 Broadway Ave, West Chester, PA 19382 or via e-mail at **k3eui@aol.com**. QST

A Modular Receiver for Exploring the LF/VLF Bands

Part 2 — Add a software defined radio to your LF/VLF converter from Part 1.

Larry Coyle, K1QW

Part 1, last month, presented the front end pieces of a high performance LF/VLF receiver.[4] They also could be used to make a stand-alone converter to use with your 80 meter amateur receiver or transceiver. Last month's article also provided a sidebar *What's Down There?* to provide a brief overview of the interesting listening to be found in that region of the spectrum. This month we will complete the project by making our own LF/VLF software defined radio (SDR) receiver.[5]

A Brief Look at the Design

The three modules making up the receiver are shown in Figure 6 and in block diagram form in Figure 7. Details of the converter and antenna possibilities appear in Part 1. Following the converter in Figure 7 is the I-Q detector. This is the real heart of the receiver and its name stems from the fact that its function is to extract both an in-phase *I* component of the signal as well as a 90° out-of-phase *Q*, or quadrature, component. This is the approach followed in most modern radio designs.

The reason I-Q detection is such a favored technique among receiver design engineers is that once you have both the I and Q components as a function of time, you know, literally, everything there is to know about that signal. If the I and Q signals are digitized, by feeding them into a computer sound card, for instance, the wide world of digital signal processing opens up. With the appropriate software, all modulation modes — AM, FM, CW, SSB, PSK and any others — can be detected.

The other module shown in Figure 7 is the local oscillator (LO) that feeds the I-Q detector. It's simply a tunable frequency generator running at a frequency four times the received frequency plus 4000 kHz.

Now for a Few Details

The I-Q Detector

The heart of the receiver is shown in Figure 8. It's a very clever and elegant circuit known as a *Quad Sampling Detector* (QSD) that separates the in-phase and quadrature phase components of the incoming signal. It's also referred to as a *Tayloe* detector.[6] Basically, it consists of an array of four fast analog switches (U1) that endlessly and sequentially sample the incoming signal at a rate four times the desired IF frequency. Think of any one of the switch outputs as being the 0° phase reference, then the next one in sequence samples at the 90° point, the next switch samples at 180° and the next, at 270°. This sequence repeats ad infinitum.

The sample voltage levels of the four phases are stored in capacitors C1, C5, C10 and C13. When the 180° sample is inverted and combined with the 0° sample and appropriately filtered, the result is the in-phase, or I, component of the signal at one-quarter of the sample rate. C1 and C5 store the samples and provide the filtering for the I channel, while op amp U2A does the inverting and combining. U3A gives a gain boost and additional filtering. Similarly, the 90 and 270° samples are

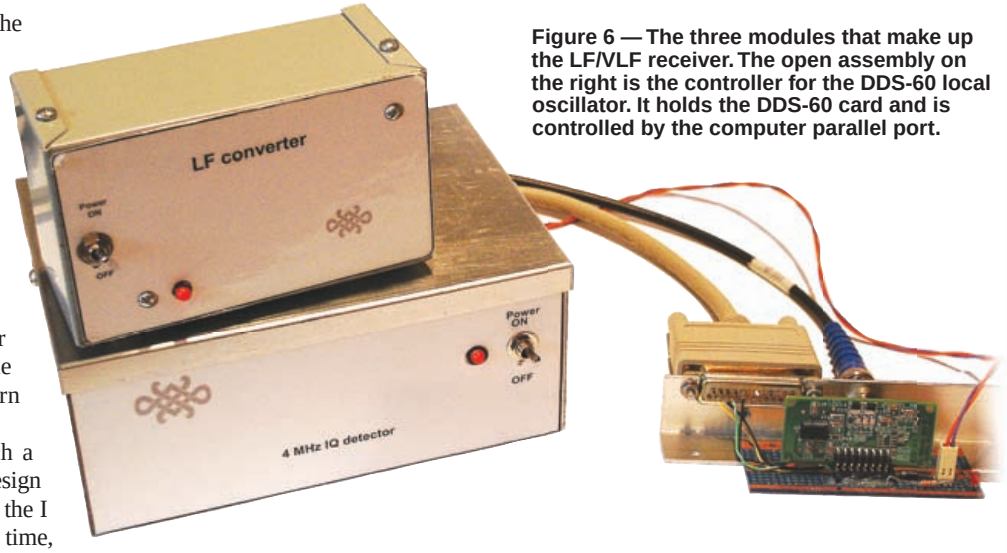


Figure 6 — The three modules that make up the LF/VLF receiver. The open assembly on the right is the controller for the DDS-60 local oscillator. It holds the DDS-60 card and is controlled by the computer parallel port.

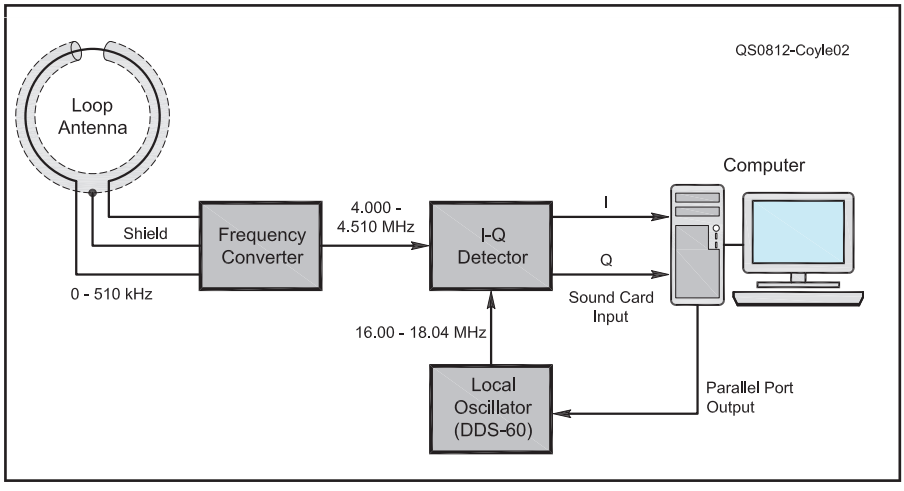


Figure 7 — Receiver block diagram. The computer runs the *WINRAD* program for the display and the DDS VFO program for DDS-60 local oscillator control. Alternatively, the LO may be any external signal generator that can supply 16 to 18.04 MHz at a level of 500 mV peak to peak or greater.

[4]Notes appear on page 37.

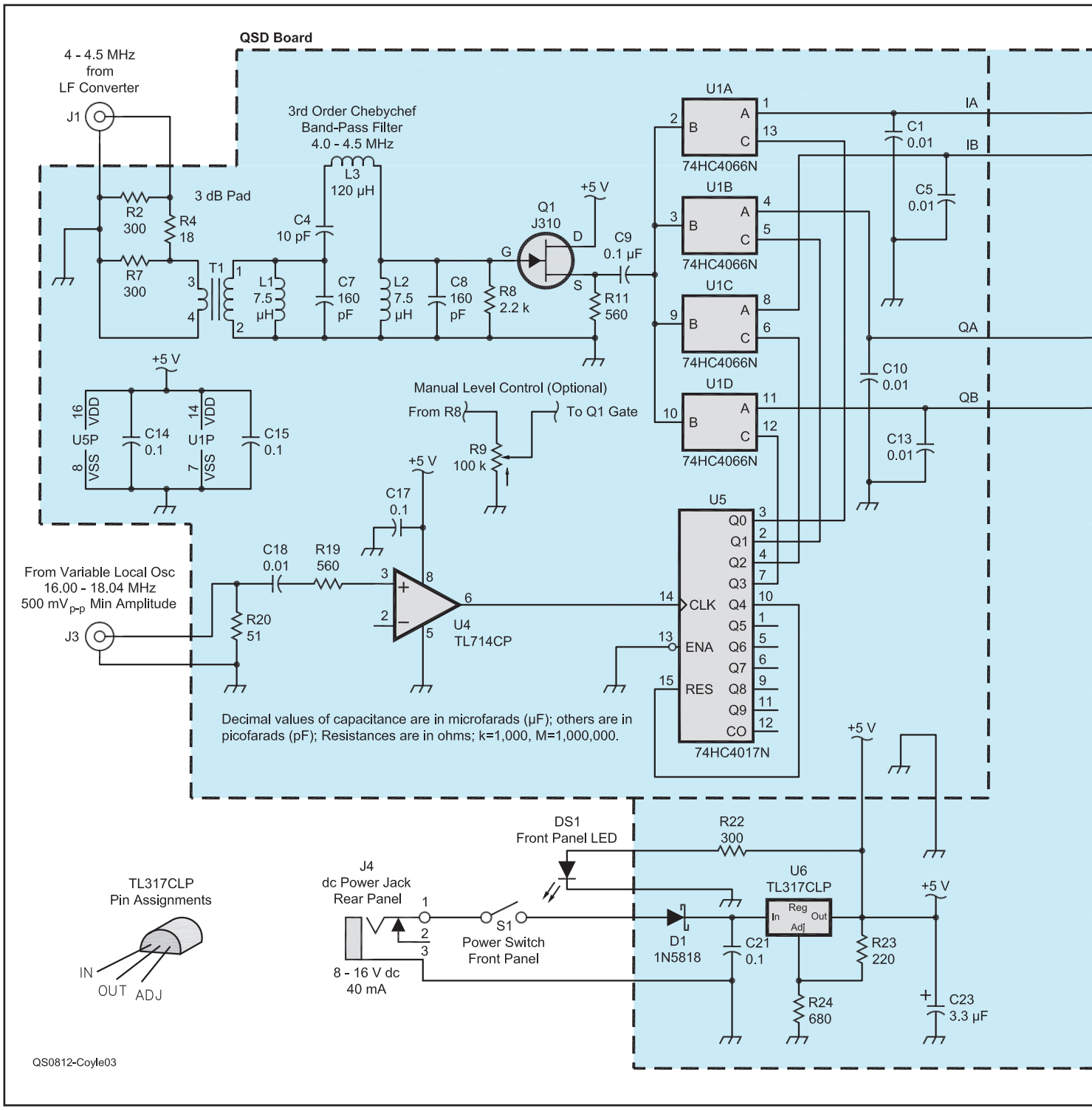
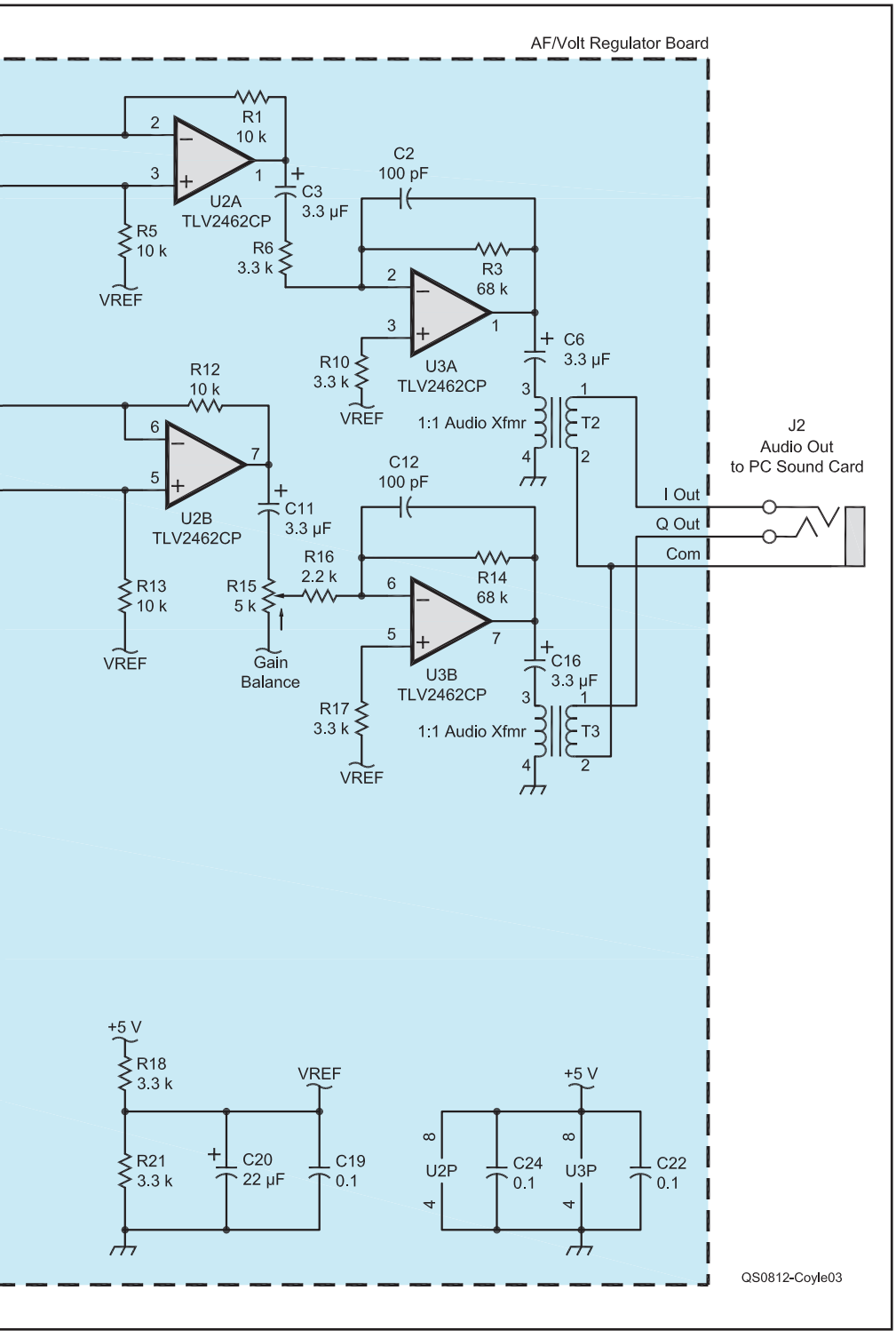


Figure 8 — Schematic diagram and parts list of the I-Q detector module. For convenience, the front-end band-pass filter and the quad sampling detector are built on one board, while the op amps that combine and filter the QSD outputs are on a separate board along with the 5 V dc regulator.

C1, C5, C10, C13, C18 — 0.01 µF ceramic capacitor.
C2, C12 — 100 pF ceramic capacitor.
C3, C6, C11, C16, C23 — 3.3 µF, 16 V electrolytic capacitor.
C4 — 10 pF ceramic capacitor.
C7, C8 — 160 pF ceramic capacitor.
C9, C14, C15, C17, C19, C21, C22, C24 — 0.1 µF ceramic capacitor.
C20 — 22 µF, 16 V electrolytic capacitor.
D1 — 1N5818 Schottky diode.
DS1 — Light-emitting diode, red.
J1, J3 — BNC connector.
J2 — 3.5 mm stereo audio jack connector.
J4 — Connector, dc power coax jack.
L1, L2 — 7.5 µH inductor, 12 turns 22 gauge wire on FT37-61 toroid core.
L3 — 120 µH inductor, 17 turns 24 gauge wire on FT37-43 toroid core.
Q1 — J310 N-channel JFET.
R1, R5, R12, R13 — 10 kΩ, ¼ W, 5% resistor.
R2, R7, R22 — 300 Ω, ¼ W, 5% resistor.
R3, R14 — 68 kΩ, ¼ W, 5% resistor.
R4 — 18 Ω, ¼ W, 5% resistor.
R6, R10, R17, R18, R21 — 3.3 kΩ, ¼ W, 5% resistor.
R8, R16 — 2.2 kΩ, ¼ W, 5% resistor.
R9 — 100 kΩ variable resistor.



R11, R19 — 560 Ω, ¼ W, 5% resistor.
R15 — 5 k Ω variable trimmer resistor.
R20 — 51 Ω, ¼ W, 5% resistor.
R23 — 220 Ω, ¼ W, 5% resistor.
R24 — 680 Ω, ¼ W, 5% resistor.
S1 — SPST toggle switch.
T1 — Transformer, step-up. Primary, 4 turns, secondary, 26 turns of 22 gauge wire on FT50A-77 toroid core.
T2, T3 — 1:1 audio transformer, RadioShack # 273-1374.
U1 — 74HC4066N quad analog switch integrated circuit.
U2, U3 — TLV2462CP dual op amp.
U4 — TL714CP voltage comparator.
U5 — 74HC4017N Johnson counter.
U6 — TL317CLP adjustable voltage regulator.

stored in C10 and C13 and combined in U2B followed by U3B to generate the quadrature, or Q, component.

Trimmer resistor R15 is used to adjust the gain of the Q channel to match that of the I channel — a necessary condition for complete suppression of unwanted sidebands.

U5 is set up as a four state Johnson counter to generate the four sequential pulses that drive the four switches in U1 in the correct order. U5 in turn is clocked from a voltage comparator, U4, which squares up the 16 to 18.04 MHz signal from the external local oscillator coming in at J3.

At the input to the analog switch array, a 4.0 to 4.5 MHz band-pass filter helps to reject spurious signals. The filter is preceded by a toroid transformer to match the filter input to 50 Ω and by a 50 Ω, 3 dB resistive pad. Adding the pad improved the impedance match to the converter and resulted in a small improvement in spurious signal rejection, especially at the VLF end of the spectrum. Signal levels are reasonably high at this point in the signal chain, so the loss of 3 dB is not bothersome.

Audio output transformers T2 and T3 eliminate any ground currents between the VLF receiver and the computer sound card that it feeds. The output connector for the I and Q baseband signals is a standard 3.5 mm stereo audio connector, making it easy to mate with almost any computer sound card using an off-the-shelf stereo audio patch cable. In addition, the signal level here is high enough to drive a set of 32 Ω headphones. With the I channel in one ear and the Q channel in the other, you can savor the unique experience of binaural listening in which signals seem to exist in a wide-open space, moving through your field of hearing as you tune up and down the band.[7] The optional manual level control, R9, is a good idea if you do much binaural listening.

For more in-depth information on the QSD and I-Q signals in general, a series of articles that appeared in *QEX* magazine is well worth reading.[8]

The Local Oscillator

The LO can be any sinusoidal signal source that covers 16,000 to 18,040 kHz (remember that the I-Q demodulator samples at four times the actual frequency we are trying to detect, plus 4000 kHz) and can supply at least 500 mV_{pp} into a 50 Ω load. I chose the DDS-60, a nifty little signal source supplied in kit form by the folks at AMQRP.[9] This device is a plug-in 1 × 2 inch circuit board that puts out a clean digitally synthesized sine wave from below 1 to 60 MHz, with output level adjustable up to 4 V_{pp}. The DDS-60 requires an external controller to set the frequency, and the easiest approach is to use the parallel port of a computer, the circuit shown in Figure 9 and run the freeware program *DDS VFO*, created by WA6UFQ.[10,11] Incidentally, the

DDS-60 all by itself makes a nice wide-range RF signal generator for use around the shack or workbench.

Software

While dealing with I and Q components of a signal, a computer stereo sound card followed by specialized software is the most convenient approach. Stereo sound inputs are nearly ubiquitous in the personal computer field, and there are several very good, and free, software packages available. I've had good results with *WINRAD*, an outstanding *Windows* based program developed specifically for Amateur Radio use and regularly updated by Alberto di Bene, I2PHD, and Jeffrey Pawlan, WA6KBL. It's available for downloading at **www.weaksignals.com**. *WINRAD* features spectrum and waterfall displays, and offers a number of methods of combining the I and Q channels. Figure 10 is a screen shot that shows the *WINRAD* program in action.

The performance of any of these programs, particularly in the area of unwanted sideband suppression, depends greatly on the quality of the sound card. The cheaper ones with rock-bottom prices leave a lot to be desired in the crucial areas of crosstalk between channels and dynamic range, as do the sound chip sets that are integrated onto the computer mainboard.[12]

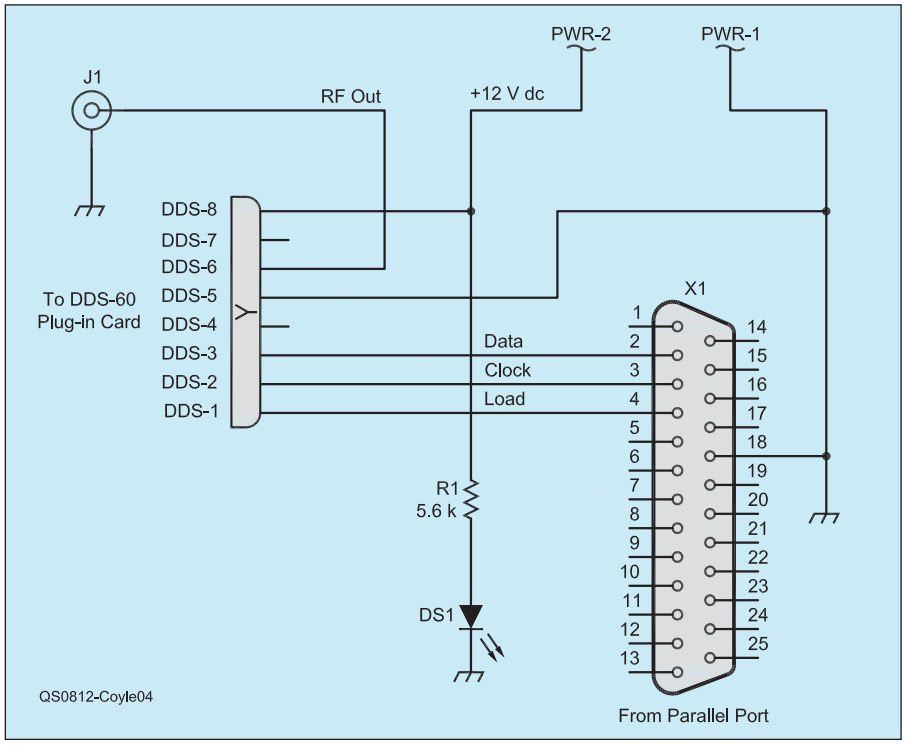


Figure 9 — DDS-60 controller. This simple interface holds the DDS-60 oscillator board along with a 25-pin D connector for the cable to the computer parallel port. The computer runs the DDS VFO program that sets the control bits on the DDS-60 to the correct configuration for the frequency selected. The RF is brought out through a BNC connector and is fed to the LO input connector on the I-Q detector module.

Performance

A spectrum display such as *WINRAD*'s makes performance measurements much easier than using conventional methods. For example, the minimum detectable signal (MDS) and single-tone compression levels can be read right off the display. The ratio of these two levels gives the single tone dynamic range of the receiver. Similarly, by feeding the receiver two signals spaced a few kHz apart (using a hybrid combiner), the third order intercept (IP3) level is also easily found.[13] I was able to measure the performance parameters shown in Table 1. No doubt these figures could be improved considerably with a more sophisticated front-end mixer.

Construction

I used ordinary perforated board to construct these modules. Figure 11 shows the two circuit boards that make up the I-Q detector preamplifier circuitry. At low frequencies such as these, the problems of stray capacitance and inductance are not major considerations. But there is quite a bit of gain from antenna input to the I and Q outputs, and there is always the possibility of sneaky and subtle feedback paths. Building the receiver in separate mod-

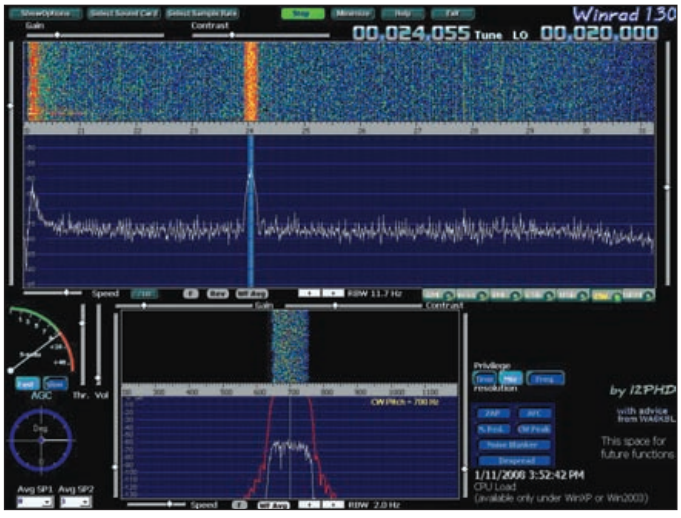


Figure 10 — This is a typical display presented by the *WINRAD* program. In this screen shot, the receiver was tuned to a base frequency of 20 kHz (the DDS-60 frequency was set to 4020 × 4, or 16080 kHz). The large peak at 24 kHz standing 18 dB above the noise floor is NAA, a US Navy 1 MW station in Cutler, Maine.

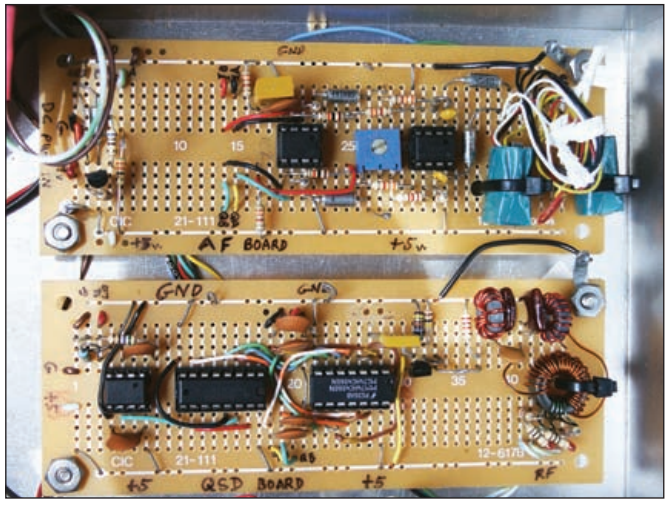


Figure 11 — The two circuit boards that make up the I-Q detector module.

Table 1

Measured Receiver Performance

Parameter	*Measured Value*
Single-tone dynamic range	80 dB
IP3 Dynamic range	76 dB
Noise Figure	12.7 dB

ules helps to eliminate potential problems in this regard.

Final Remarks

This project doesn't provide the ultimate in VLF radio performance, nor was it intended to. I designed it with an eye on simplicity of construction with easily obtainable parts and free software while still achieving enough functionality to dig into the basics of I-Q decoding.

I unashamedly admit that most of this material is not new. I have borrowed and built on ideas from many different sources and added a few of my own. I have no doubt that every module described here could be improved upon and used as a springboard for bigger and better things. I'd be happy to hear from anyone who has done so. After all, the reward is in the journey, as well as in reaching the goal.

If you just have a yen to listen in on an interesting region of the radio spectrum where few hams have gone before, you can simply and inexpensively build up the front end (converter section) and enjoy exploring. On the other hand, if you're interested in getting your feet wet in the details of modern receiver design, this project can provide a worthwhile introductory learning experience to a truly fascinating and wide-ranging field. Besides, the creative satisfaction is hard to beat.

Finally, I wish to give credit to Dan Brown, W1DAN, for his thoughtful criticism and advice during the writing of this article. Thanks, Dan!

Notes

[4]L. Coyle, K1QW, "A Modular Receiver for Exploring the LF/VLF Bands — *Part 1*," *QST*, Nov 2008, pp 36-39.

[5]J. Hallas, W1ZR, "Getting on the Air—How About a Software Defined Radio," *QST*, Sep 2008, pp 68-69.

[6]D. Tayloe, "A Low-noise, High-performance Zero IF Quadrature Detector/Preamplifier," *RF Design*, May 1, 2003. This article is a very readable discussion of the Quad Sampling Detector and can be found on the Internet at **rfdesign.com/mag/radio_lownoise_high-performance_zero/**.

[7]R. Campbell, KK7B, "A Binaural I-Q Receiver," *QST*, Mar 1999, pp 44-48. This article gives an informative and entertaining description of the I-Q binaural listening experience.

[8]G. Youngblood, AC5OG, "A Software-Defined Radio for the Masses — *Part 1," QEX*, Jul/Aug 2002, pp 13-21, *Part 2, QEX*, Sep/Oct 2002, pp 10-18, *Part 3, QEX*, Nov/Dec 2002, pp 27-36 and *Part 4*, *QEX,* Mar/Apr 2003, pp 20-31.

[9]The American QRP Club (AMQRP) provides information, kits and discussion forums for radio amateurs interested in low-power operation. The DDS-60 numerically controlled oscillator kit can be purchased via their very active Web site at **www.amqrp.org**.

[10]The DDS controller program by WA6UFQ can be downloaded from **home.austin.rr.com/wa6ufq//ddscontroller.html**.

[11]A schematic diagram of a simple parallel port interface to control the DDS-6 can be found at **www.njqrp.org/dds/waystouse.html**.

[12]J. Taylor, K1RFD, "Product Review — Computer Sound Cards for Amateur Radio," *QST*, May, 2007, pp 63-70. This provides a real eye opener about sound interface performance. A wide variety of sound cards was evaluated in the ARRL Lab and the results tabulated. The best card tested outperformed the worst by 47 dB in the dynamic range tests and by 46 dB in crosstalk — two important performance parameters in this application.

[13]*The ARRL Handbook for Radio Communications,* 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**. An excellent explanation of the concept of receiver intercept points and their measurement can be found in pages 11-18 through 11-21.

Larry Coyle, K1QW, was first licensed in the 1950s when he was in high school. His interest in Amateur Radio never waned, and he is now the holder of an Amateur Extra class ticket and an ARRL member. You can reach him at 100 Rolling Ln, Needham, MA 02492 or at **lmcoyle1@verizon.net**

A Low Noise Loop That Works — Plus a Bonus 2 Meter Beam

Get an HF band receive antenna and a VHF log periodic, all on one boom.

Rick Darwicki, N6PE

After subscribing to our local TV channels via direct broadcast satellite, I no longer had any use for my old TV antenna. I decided that rather than discard it, in typical Amateur Radio fashion, I would make it into a ham antenna project. I was more successful than I had hoped.

This is not meant to be a typical construction article. The antenna described is basically a 2 meter beam made from an old TV antenna and a rotatable receiving loop that is similar to one half of a K9AY array (see Figure 1) mounted above ground. It performs well on 2 meter FM and is very effective as a low noise receiving antenna. The cost is next to nothing and the whole thing has a fairly low profile.

Figure 1 — Overall view of the completed 2 meter Yagi and rotatable receiving loop.

Start with What's at Hand

My TV antenna was a large RadioShack unit with VHF/UHF elements with a second support boom below the main boom. There were nine elements bent inward in typical TV antenna fashion. Other TV antennas could be modified and different mechanical arrangements could be devised to create a similar combination.

Using the log periodic design program from the 19th edition of *The ARRL Antenna Book*, the TV antenna boom length and number of elements were input as a starting point.[1] The program found the element lengths needed for a 144 to 148 MHz log periodic with an 111 inch long boom. The elements were trimmed to length (see Table 1) with an extra inch on each side for margin. I used an MFJ-259B antenna analyzer to plot the impedance of the antenna. I compared the measurements to the program results and found it was right on, so I trimmed off the extra inches.

The design program indicated a spacing for the target 2 meter antenna of about 15.7 inches between the two rear elements and 12.2 inches between the two front elements. Moving the TV antenna elements would be time consuming so I left the spacing as it was. The TV antenna generally has approximately 12.5 inches between elements 1 through 5, 17 inches between elements 5 and 6, 17 inches between elements 6 and 7 and 12.5 inches between elements 7 through 9.

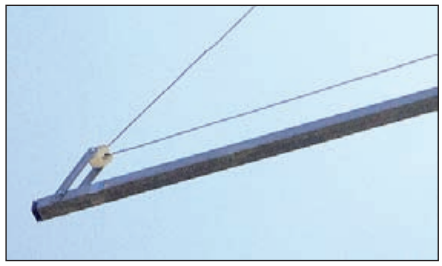


Figure 2 — Detailed view of loop end insulator.

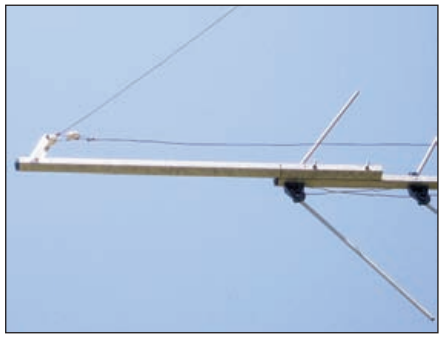


Figure 3 — Loop resistor and strain relief insulator at rear corner (see Figure 4).

The UHF elements and reflector screen were removed from the main boom, along with the lower support boom. The elements were turned to the vertical position for FM repeater use. There is no reason you could not leave the elements horizontal for 2 meter SSB and CW work. The front driven element of the 2 meter section is fed directly with 50 Ω RG-213 coaxial cable. No matching circuit is used and the coax is taped along the boom and back to the mast.

Table 1

Results of *The ARRL Antenna Book* LPDA Design Program.

All dimensions in inches.

Element	*Length*	*Spacing*	*Cumulative Spacing*
1	40.180	0	0
2	38.751	15.696	15.696
3	37.372	15.138	30.834
4	36.043	14.599	45.433
5	34.761	14.080	59.513
6	33.524	13.579	73.093
7	32.332	13.096	86.189
8	31.182	12.630	98.819
9	30.072	12.181	111.000

Adding the Loop Supports

The old lower support boom was cut in unequal parts and attached to the sides of the main boom so that there is about 87 inches from mast to tip on each side of the boom and about 86 inches for the bottom legs of the loop. The old support straps were turned up and an egg insulator was placed inside each support. See Figures 2 and 3. Mounting the extension

[1]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/sales/**; **pubsales@arrl.org**.

pieces on the side of the boom allowed for greater clearance of the receiving loop wires from the 2 meter elements.

Ten feet of ¾ inch PVC was driven two feet into the support mast to act as a vertical support for the receiving loop. A 6 foot piece of ½ inch electrical conduit was inserted to about half way down the PCV to keep it from flexing as shown in Figure 4. Just above the boom and on the mast, a small piece of clear polycarbonate is bolted through the mast to act as a center insulator. See Figure 5. The bolts also secure the mast, PVC and conduit together. Binding posts are used to secure the wires.

Installing the Loop

A piece of 10 gauge wire runs from the polycarbonate insulator on the mast, along the boom, through the boom support insulator, up through a hole in the end of the PVC, down to the other boom support insulator and back to the insulator. The wire is tensioned slightly to help support the boom.

The center of the loop base wire is fed with quad shield TV coax that was on hand, as shown in Figure 4. The best results were obtained with a 910 Ω resistor at the back corner near the 2 meter "reflector" end. The resultant pattern is nicely unidirectional, pointed the same direction as the 2 meter beam. The first configuration had the loop floating, without the coax shield grounded at the boom. With the coax grounded to the boom there was a slight improvement in the depth of the nulls and front to back ratio.

This loop is untuned and thus works on all bands without a matching transformer or tuning capacitors to foul or age. There was only a slight change in the 2 meter beam tuning after the loop was added.

Pulling it All Together

The TV antenna had a 5 foot long mast that was placed in a lightweight TV rotator mounted on a 10 foot pipe on the side of the house. It is only about 20 feet away from the Create 40 meter vertical, used as a 40, 80 and 160 meter inverted L ground plane.

The loop is just over a λ/4 wave on 40 meters. Using the receive antenna connection on my ICOM IC-756 PRO III with an Ameritron AL-80B, too much RF gets into the RX ANTENNA port on 40 meters and fouls the break-in circuit. A pair of signal diodes back to back across the RX antenna coax plug cured the problem.

2 Meter Performance

The ARRL antenna program gave an approximate gain of 8.35 dBd and front to back ratio of approximately 27 to 33 dB for a nine element log periodic on an 111 inch boom. Because of the TV antenna construction, no attempt was made to change the element spacing. The actual gain is likely lower as the element spacing is 2 to 3 inches different in some sections than the program calculated. A test with a station about 20 miles away showed at least 25 dB difference as the beam was rotated 180°. No attempt was made to measure the 2 meter gain; however, several repeaters could be accessed with the beam that could not be accessed with a two stack ⅝ λ vertical at the same height. The measured SWR is about 1.2 to 1.4:1 at the band edges. Although it may not have optimal gain or F/B ratio, it is, in essence, a free 2 meter beam.

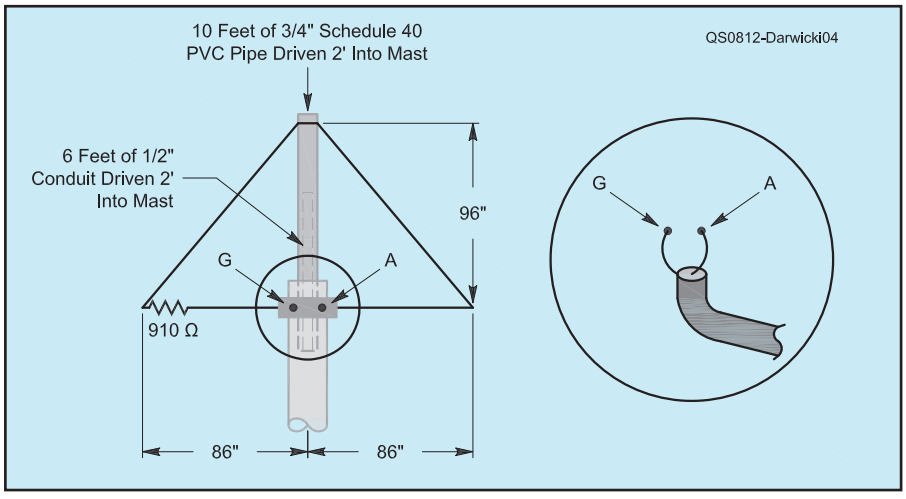


Figure 4 — Construction details of receiving loop. The resistor is adjacent to the corner insulator.

Figure 5 — Loop center insulator mounted on mast as described in text.

Loop Performance

There is about a 4 S unit improvement in S/N on 160 meters at this location and very noticeable directivity on local noise. The ICOM IC-756PROIII preamp is usually not needed. A small KD9SV preamp is kicked in at times on 160 meters if necessary.

The 2.5 MHz WWV signal is 4-5 S units down broadside to the loop and off the back. Noise is about 3 S units less than the ground plane. The 5 MHz WWV signal shows only about 1 S unit of directivity/null. With the same received strength, noise on the loop barely moves the meter and is S 4 on the main ground plane for 160/80/40.

There were several strange noise sources that were louder on the loop than on the ground plane, but the general ambient noise just off the noise source was louder on the ground plane. The noise source could be nulled out with the loop and overall noise is much lower.

The loop is an experimenter's dream. Using *EZNEC* antenna software, the loop pattern was shown to vary from endfire to broadside depending on the resistance value. The gain drops with added resistance, so you have to play with the value depending on how high it is mounted, frequency and other factors.

Conclusions

Generally, the loop appears to have good directivity and nulling capability on local noise and shows diminishing directivity on skywave signals as the frequency is increased. The 2 meter section has very usable gain and good front to back over the entire 2 meter band.

During the recent 9XØR operation there was an astonishing difference in signal to noise on 40 meters. The 9XØR SSB signal was barely readable on the main 40 meter ground plane, yet they were solid copy on the loop.

Rick Darwicki, N6PE, an ARRL Life Member, was first licensed in 1959 and holds an Amateur Extra class license. Rick is a Registered Mechanical Engineer. He spent most of his early career as a chief engineer designing heating, ventilating and air conditioning systems. He now specializes in due diligence for high rise buildings including fire protection, elevators and plumbing systems.

He currently combines his woodworking and electronics hobbies by restoring old wooden AM radios and breadboard style regenerative receivers. You can reach Rick at 17775 Elmhurst Cir, Yorba Linda, CA 92886 or at **n6pe@yahoo.com**.

PRODUCT REVIEW

Microtelecom Perseus Software Defined Receiver

Reviewed by Steve Ford, WB8IMY
QST *Editor*

As depicted in ancient Greek dramas, Perseus was a hero who used a clever ruse to slay the hideous Medusa (she of the reptilian coiffure and statuesque stare) and went on to save his beloved Andromeda from a sea monster. The 21st century Italian-made Perseus is a receiver that is striving to create its own legend by taking an innovative approach to software defined radio (SDR). Whether or not the gods smile on this Perseus — only time will tell.

To set the stage for this "drama," some explanation is in order. Most amateurs think of a software defined receiver as a device that starts with conventional front-end hardware — a filter and/or preselector, followed by an RF preamplifier and finally a stage that converts the RF signal to in-phase (I) and quadrature (Q) signals at audio frequencies. These *baseband* signals are subsequently fed to a computer sound card that samples and digitizes them, making the resulting data available for sophisticated massaging by software. As Gerald Youngblood, K5SDR, stated in his 2002 *QEX* article, "Give me I and Q and I can demodulate anything."[1]

The Perseus receiver uses a somewhat different method. It digitizes the RF the moment it exits the front end filters and preamplifier. A high-speed analog-to-digital converter (ADC) converts the RF to data by taking 80 million samples of the signal each second. Next, the Perseus uses a field programmable gate array (FPGA) to create I and Q information that is streamed to the PC via a USB cable for processing. In other words, the signal becomes data before it even reaches the computer.

This approach to SDR has several benefits that are apparent right away…

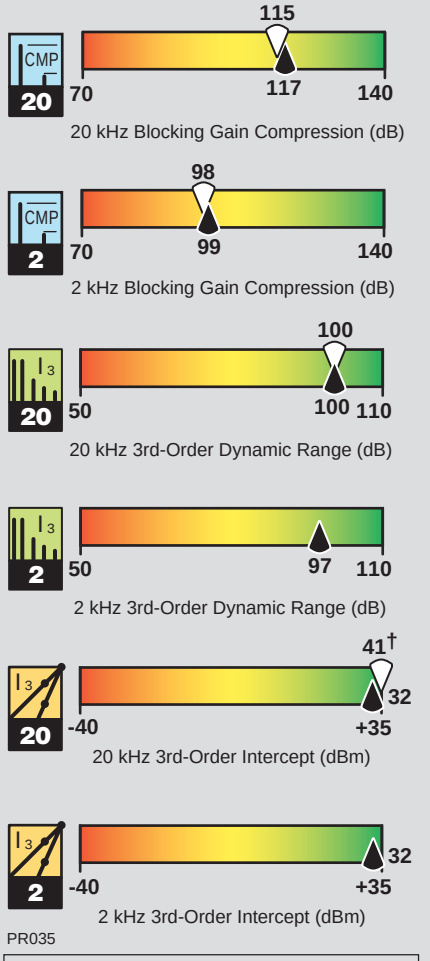
- Fewer parts housed in a compact enclosure. The Perseus hardware enclosure only measures 4.3 × 1.4 × 7.3 inches. Figure 1 is a look inside the box.
- Fewer cables. No sound card audio cables required — just a single USB cable to your computer.
- And saving one of the best benefits for last, the performance of the Perseus does *not* depend on the quality of your computer sound card. With a conventional SDR your sound card acts as the analog-to-digital converter, so a mediocre sound card will give a mediocre result. With the Perseus, the analog-to-digital conversion is handled by high-performance hardware within the radio itself. The sound card in your computer is only there to drive your speakers, so any sound card will do.

Setting Up the Perseus

The Perseus arrives in a small, unpretentious package with very little inside. There is the radio itself, a 5 V wall-wart power supply with interchangeable US or European plugs, a USB cable and a CD-ROM with the

[1]G. Youngblood, AC5OG, "A Software-Defined Radio for the Masses — Part 1," *QEX*, Jul/Aug 2002.

Key Measurements Summary



PR035

Key:
† Off Scale
80 M
20 M

Dynamic range and intercept values with preamp off.
Intercept values determined using -97 dBm reference.

Bottom Line

The Perseus SDR uses cutting edge receiver technology to offer excellent performance and a wide range of features. It covers 10 kHz to 30 MHz and can receive all popular analog and digital modes with appropriate software.

Mark J. Wilson, K1RO ♦ Product Review Editor ♦ k1ro@arrl.org

Perseus software, USB drivers and instruction manual.

Microtelecom recommends a minimum 2 GHz PC running *Windows XP* or *Vista*. If you want to push the Perseus to its performance limit, they recommend a 2.5 GHz dual-core system. (Our ARRL Lab tests shown in Table 1 were performed using a 1.86 GHz dual-core PC.) The minimum requirements shown in Table 2 are easily met with any recent computer.

For my tests, I used a 2 GHz Toshiba Satellite laptop computer with 1 GB of memory and *Windows Vista Home Basic*. This is typical for what now passes as a "budget" consumer laptop.

It is worth noting that the Perseus is not confined to a *Windows* environment. Any SDR application can be used as long as it can "talk" to the Perseus hardware. If *Linux* is your pleasure, Microtelecom encourages you to try the popular *Linrad* application at **www.sm5bsz.com/linuxdsp/linroot.htm**.

Once you have the Perseus applications loaded to the computer, simply plug in the USB cable on the rear panel (Figure 2). With the Perseus hardware attached, fire up the application of your choice (the main Perseus software or the spectrum analyzer) and the radio comes to life.

At first I tried receiving with just a 30 foot wire plugged directly into the radio's BNC RF INPUT port. This didn't work well because the antenna was too close to my RF-noisy laptop, resulting in a continuous S7 level noise floor. I tried using a 15 foot USB extension cable to put some distance between the laptop and the antenna. This reduced the noise substantially. When I connected the Perseus to my outdoor inverted V antenna, the laptop interference was finally inaudible.

The World at Your Fingertips

Hams who've read my product reviews know that one of my favorite yardsticks is the *no-manual test*. Yes, we should all read the manuals before we apply power to any equipment. In theory, however, a well designed piece of hardware or software should be sufficiently user friendly that it works right out of the box with as little study as possible.

The Perseus software passed the no-manual test admirably. Once you figure out how to click your mouse on the arrow keys at the lower edges of the spectrum display, you're in business. There is a digital frequency readout as well. If you double-click within the readout window, a direct frequency entry keypad appears. Just enter your desired frequency in kilohertz and click OK or turn your mouse wheel. There are a total of 10 ways to tune the radio by clicking and dragging

Table 1
Microtelecom Perseus, serial number 00501

Manufacturer's Specifications	*Measured in the ARRL Lab*
Frequency coverage: 0.01-30 MHz.	0.01-40 MHz.
Power requirement: +5 V dc, 700 mA.	As specified.
Modes of operation: SSB, CW, AM, FM.	As specified.
Receiver	***Receiver Dynamic Testing***
SSB/CW sensitivity, 2.4 kHz bandwidth, 10 dB (S+N)/N: 0.39 μV (SSB)	Noise Floor (MDS), 500 Hz filter: *Preamp off* / *Preamp on* 1.0 MHz –126 dBm / –129 dBm 3.5 MHz –127 dBm / –129 dBm 14 MHz –126 dBm / –127 dBm
AM sensitivity: Not specified.	10 dB (S+N)/N, 1-kHz, 30% modulation: *Preamp off* / *Preamp on* 1.0 MHz 3.4 μV / 3.1 μV 3.8 MHz 2.7 μV / 2.3 μV
FM sensitivity: Not specified.	For 12 dB SINAD: *Preamp off* / *Preamp on* 29 MHz 4.5 μV / 3.9 μV
Blocking gain compression: Not specified.	Gain compression, 500 Hz bandwidth: *20 kHz offset Preamp off/on* / *5/2 kHz offset Preamp off* 3.5 MHz 115/115 dB / 104/98 dB 14 MHz 117/112 dB / 105/99 dB
Maximum notch depth: Not specified.	>70 dB.

ARRL Lab Two-Tone IMD Testing

Band/Preamp	*Spacing*	*Input level*	*Measured IMD level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–27 dBm	–127 dBm	100 dB	+23 dBm
		–5 dBm	–97 dBm		+41 dBm
14 MHz/Off	20 kHz	–26 dBm	–126 dBm	100 dB	+24 dBm
		–11 dBm	–97dBm		+32 dBm
		0 dBm	–88 dBm		+44 dBm
14 MHz/On	20 kHz	–28 dBm	–127 dBm	99 dB	+22 dBm
		–11 dBm	–97 dBm		+32 dBm
14 MHz/Off	5 kHz	–29 dBm	–126 dBm	97 dB	+20 dBm
		–11 dBm	–97 dBm		+32 dBm
		0 dBm	–89 dBm		+44 dBm
14 MHz/Off	2 kHz	–29 dBm	–126 dBm	97 dB	+20 dBm
		–11 dBm	–97 dBm		+32 dBm
		0 dBm	–88 dBm		+44 dBm

Second-order intercept: Not specified.	Preamp off/on, +85/+89 dBm.
Image rejection: 90 dB	97 dB
FM adjacent channel rejection: Not specified.	20 kHz offset, 29 MHz, preamp on: 79 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, 29 MHz, preamp on: 80 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off or on, 56.2 μV.*
IF/audio response: Not specified.	Range at –6 dB points (bandwidth):** CW: 348-850 Hz (502 Hz) Equivalent Rectangular BW: 496 Hz; USB: 113-2845 Hz (2732 Hz); LSB: 112-2865 Hz (2753 Hz); AM: 73-3090 Hz (3017 Hz).

Size (height, width, depth): 1.4 × 4.3 × 7.3 inches; weight, 13.4 oz.

Price: $1299.

*S-meter reading not affected by preamp or attenuators.
**Variable filters, set to 449.7 Hz, 2.73 kHz and 5.98 kHz (CW, SSB, AM)

Table 2

Minimum System Requirements

- 2 GHz Pentium IV CPU with 512 MB RAM.
- USB 2.0 port.
- 16 bit AC-97 compatible audio board.
- 1024 x 768 minimum resolution video board and monitor.
- Two button mouse with wheel.
- 10 GB or more internal hard-disk.

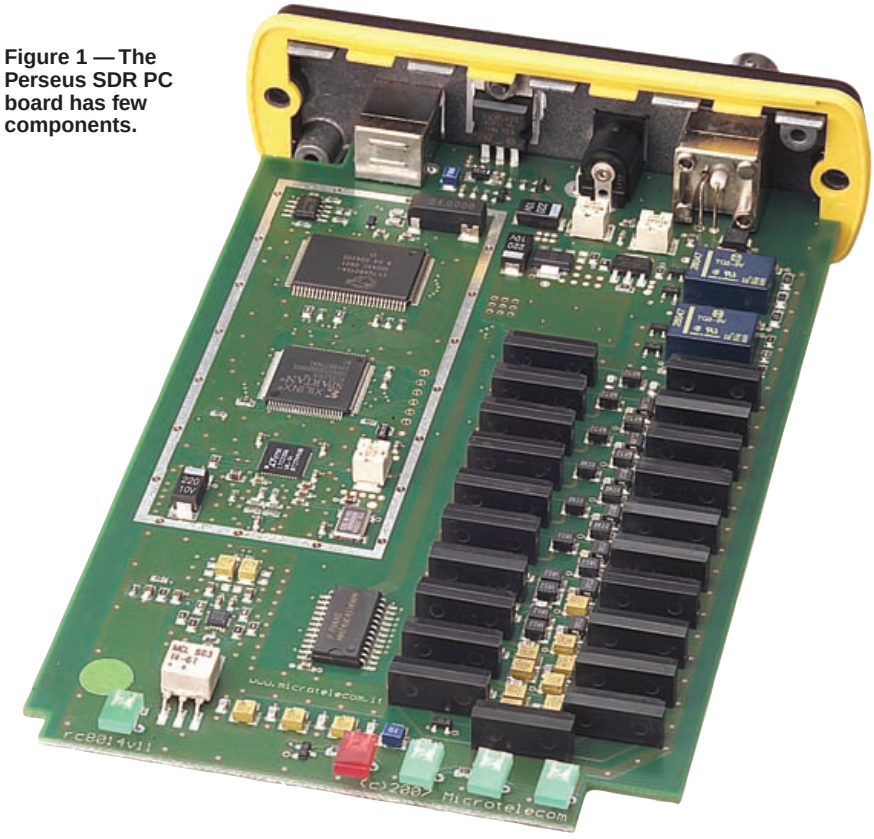


Figure 1 — The Perseus SDR PC board has few components.

Figure 2 — The receiver's rear panel has just three jacks for connecting power, your computer and an antenna.

various parts of the display. If you prefer a more tactile tuning experience, the Perseus will also work with the Griffin Technology PowerMate USB controller acting as a traditional knob ($45 at **www.griffintechnology.com/products/powermate**).

The Perseus software creates an attractive "virtual radio" on your computer screen, as you can see in the accompanying illustrations. All functions are clearly labeled and the operation of the software overall is very intuitive. During my first 30 minutes of exploration, I only had to resort to the manual when I wanted to learn the finer points of a particular function.

The Perseus has an effective receive range of 10 kHz to more than 30 MHz. Within the spectrum display window you can monitor up to 800 kHz at a time.[2] For most of my applications, however, I reduced the display bandwidth considerably to make it easier to tune narrow signals such as CW or digital.

There are eight receive modes available at the click of a software button: CW, Upper Sideband, Lower Sideband, AM, Synchronous AM, RTTY, FM and DRM (more about DRM in a moment). The Perseus also provides a USER mode that makes the raw I and Q data available for user-designed applications.

The turbocharged performance of the Perseus became evident when I used it to dig weak CW signals out of the noise one evening on 40 meters. Some of the signals that I could hear clearly with the Perseus were mere whispers when I switched to my conventional transceiver using the same antenna. Best of all, I could create ultra-narrow filters by simply clicking my mouse cursor in the Perseus bandwidth window and dragging the right and left-hand bars that represent the filter skirts. It was fascinating to tune into a crowded band, then narrow the filters slowly, listening as the nearby signals vanished. You can also "drag" the filter through the bands, hearing signals pop in and out of the filter window.

If you've never listened to shortwave broadcasts using synchronous AM (SAM), you don't know what you've been missing. When you tune in an AM signal and toggle the SAM mode button, the Perseus creates a stable reference carrier to effectively replace the one sent by the transmitting station. This greatly reduces the effects of fading, making the signal a pleasure to hear. Even music, which often suffers worst of all, is enhanced with SAM.

I used the Perseus in the RTTY mode to receive digital signals, but the software does not have a built-in RTTY decoder. To use the Perseus with a digital decoding application such as *DigiPan*, you have to find a way to share the receiver's audio output signal. You can do this with a clever piece of *Windows* software known as *Virtual Audio Cable* (*VAC*). *VAC* is available at **software.muzychenko.net/eng/vac.html** for $30. There is a free trial version, but it injects a nagging voice into the audio stream saying "Trial!" every 10 seconds or so. With *VAC* running in the background, I was able to eavesdrop on PSK31 conversations using *DigiPan*, as you can see in Figure 3.

With the Perseus you can get a taste of digital shortwave broadcasts that use the DRM (Digital Radio Mondiale) format. You've probably heard the wide, buzzing DRM signals from time to time on the HF bands. These broadcasts offer FM quality audio, text streams and more, but the Perseus cannot decode DRM directly. You must download the general-purpose DRM decoder at **www.winradio.com/home/download-drm.htm** and purchase a license key for

[2]The manufacturer reports that the latest software supports 1600 kHz at a time.

Figure 3 —Using *DigiPan* PSK31 software with the Perseus.

Figure 4 — Listening to a Vatican Radio DRM broadcast with commercial DRM decoding software running alongside the Perseus application.

Figure 5 — The Perseus in waterfall display mode.

Figure 6 — Close-up view of the Perseus memory display. In this example, the software automatically identified five stations from the EIBI database that could be occupying the frequency at that time.

$49.95 at **www.robogroup.com/winradio/drmkey.htm**. Alternatively, you can try your hand at installing the source code for the free *DREAM* software at **www.nschall.de**. I chose the commercial DRM decoder and had to use the *VAC* application to port the audio to it. After some tweaking and experimentation, I finally achieved success as shown in Figure 4. It is an astonishing thing to hear such high-fidelity stereo audio on shortwave frequencies!

Enhanced Features

The Perseus software provides signal processing control through a number of enhanced features. AGC levels are selectable, or the AGC can be disabled entirely. The noise reduction function can be switched on and the level varied accordingly. Unlike some DSP noise reduction applications that tend to create a hollow, ringing sound, the Perseus version is pleasant to the ears — even at high noise reduction levels. Speaking of noise, the Perseus also offers an impressive variable noise blanker. This worked quite well, although it tended to introduce distortion into SSB signals when set to high blanking levels. Since it is eliminating or reducing signal spikes that represent impulse noise, it's understandable that the Perseus blanker would have this effect on a rapidly changing SSB signal.

You can select from 10, 20 and 30 dB attenuation levels, which is useful when you're tuning particularly strong signals. You can also activate a front end preselector, as well as a receive preamplifier. The preamp only has about 2 dB gain, so its contribution isn't very noticeable.

You certainly hear the effects of the attenuators as you switch them in and out, but you don't see the effects reflected in the S meter, which displays the actual received signal level regardless of attenuator or preamplifier selection. The receiver can also be set to display the received signal level in dBm, and readings were within 1 dB of the ARRL Lab's calibrated signal generator.

I used the spectral signal display during most of my tests. However, a colorful waterfall display is also available (Figure 5). While tuning through a wide swath of signals with either display, it was handy to use the software "marker" function to label the amplitudes and frequencies of interesting signals I discovered along the way.

What's that Signal?

The Perseus puts signal databases to work in a novel way. As you tune through the frequencies, the software continuously checks station information stored in one of three databases: HFCC, EIBI or USER. HFCC stands for the database available from the High Frequency Coordination Committee (**www.hfcc.org/**) and EIBI denotes the popular database maintained by Eike Bierwirth (**www.susi-und-strolch.de/eibi/**). Recent versions of both the HFCC and EIBI databases are included with the Perseus software. Obviously, USER is a database you create yourself.

Whenever the Perseus tunes within 500 Hz of a station frequency listed in the selected database, it quickly determines whether the station should be on the air according to the current date and time. If all the

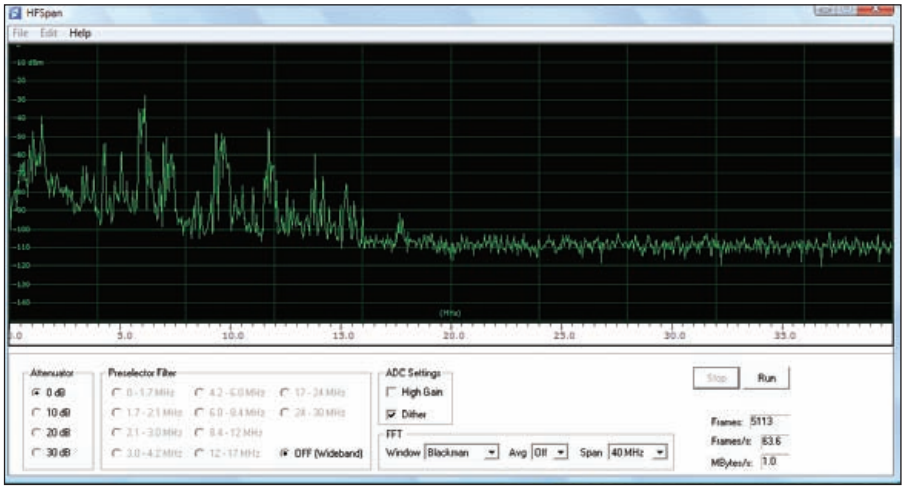


Figure 7 — The Perseus *HF Scan* spectrum analyzer displaying the full 10 kHz to 40 MHz range with the radio attached to an outside antenna.

data points match, it displays the information in the MEM (memory) window (Figure 6).

For example, I tuned across a broadcast at 7.185 MHz at 2230 UTC on a Friday evening while the HFCC database was selected in the memory window. At that instant, the Perseus software found a match in the HFCC database and informed me that the signal I had just received was most likely Radio Romania.

As helpful as this function is, it has two problems from my point of view. First, you cannot add new discoveries to the USER database without going through the clumsy effort of opening the database as a text file and manually typing in the information. (And the Perseus manual only offers sketchy instructions about how to do this.) Unlike most amateur transceivers and conventional shortwave receivers, the Perseus doesn't offer the equivalent of a convenient MEMORY WRITE button.

Second, you cannot scroll through a database, select a station frequency and command the Perseus to switch to that frequency. In fact, you can't scroll through the databases within the Perseus software at all. Again, this is a function usually present in amateur transceivers and receivers.

Recording Magic

In addition to its phenomenal performance, the Perseus does something that seems almost magical. Depending on which sampling rate pushbutton you click on the Perseus panel — 125, 250, 500, or 1000 kS/s — you can record a spectrum "window" up to 800 kHz wide.[3] The software saves the recordings as contiguous 10 minute long WAV files containing the I/Q signal information. When you play these files back through the Perseus software, the entire spectrum is available to you as though the radio was still receiving on those frequencies. During playback, any of the tuning methods can be used.

For instance, let's say that you recorded 10 minutes worth of the 400 kHz between 7.000 and 7.400 MHz. At any later time you can switch on the Perseus, load the file and tune through the frequencies, listening to one signal after another, just as though you were doing it in real time. This could have serious applications for Amateur Radio contest analysis or spectrum usage studies. The only catch is that the I/Q WAV files can be quite large. Recording just 10 minutes at a 400 kHz bandwidth creates a 1.75 GB file. To record an entire 24 hour contest you'd need a dedicated 250 GB hard drive.

These I/Q WAV files are not the ordinary audio WAV files you'd play with an application such as *Windows Media Player*. They will only play back through the Perseus software.

The Perseus software does not have the ability to record conventional WAV audio files, which is an unfortunate handicap, especially when you want to record a specific signal and share it with others who don't own a Perseus. One way you can do this is, again, by using the *Virtual Audio Cable* application to share the audio output with *Windows Sound Recorder* or another sound recording application of your choice.

Spectrum Analyzer

I'd be remiss if I failed to mention the handy *HF Scan* spectrum analyzer. This *Windows* application comes with the Perseus software, although it is separate and cannot operate at the same time.

HF Scan uses the high-performance Perseus hardware to create a real-time RF spectrum analyzer covering 10 kHz to 40 MHz. This is an extremely useful function for many different applications including transmitter or amplifier testing, interference hunting and more. In Figure 7 you'll see *HF Scan* displaying the full 10 kHz to 40 MHz range while the Perseus was attached to my outside antenna. Notice how all the activity is going on below 20 MHz — a typical afternoon of poor propagation!

My Perseus Wish List

Everyone has a wish list for their favorite radio, a list of everything they wish the radio could do (within reason). The problem with wish lists is that even if the manufacturers agree, change doesn't come easily to conventional hardware-based radios. The results of consumer feedback can take years to show up in finished products.

Not so with software defined radios. The power of SDR is in its extraordinary flexibility. Since nearly all the heavy lifting is done in malleable software, change can come with astonishing speed. Only the hardware remains the same.

So, with that in mind, here is my wish list for future incarnations of the Perseus:

- Make it possible to use the Perseus software without the radio attached. As small as it is, I shouldn't have to lug the box around just to listen to prerecorded spectrum files.[4]
- Add the ability to easily record conventional WAV audio files.
- Add the ability to write to the USER memory database with a single mouse click and include the ability to scroll through all databases from within the Perseus software and select individual stations.
- Add direct DRM decoding without making the user resort to third-party software.
- Add built-in decoders for RTTY, PSK31 and other digital modes.

The Perseus's $1299 price tag may seem a bit breathtaking for a receiver, but keep in mind that you're investing in a radio with professional-grade characteristics. Also, you're paying for the benefits of cutting edge SDR performance with software that can adapt to changing needs. The Perseus you purchase today may become a very different radio a year from now with more features and improved performance. You won't have to reach for your credit card to upgrade to the latest model, though. Just go to your nearest Internet connection.

Manufacturer: Microtelecom, Pavia di Udine, Italy; **www.microtelecom.it/perseus**. Distributed in the United States by SSB Electronic USA, 124 Cherrywood Dr Mountaintop, PA 18707; tel 570-868-5643; **www.ssbusa.com**.

[3]See Note 2.

[4]The manufacturer reports that our wish has been granted in current software versions. QST

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QST 12/2008

Ghost QSOs — Olivia Returns from the Noise

Olivia — the magic mode.

Gary L. Robinson, WB8ROL

It was a chilly foreboding fall evening when I fired up the Yaesu FT-100D, started my DM780 software (part of the *Ham Radio Deluxe* suite) and parked my dial frequency on 1.808 MHz. The waterfall was as empty and devoid of signals as a sunspot starved ionosphere. After listening for almost half an hour without hearing any signals, I decided to set the program up to call CQ automatically once a minute.

I set my mode as Olivia 500/16 (500 Hz wide using 16 tones format) — a digital mode I had recently "discovered" and was intrigued with — and double checked the frequency to make sure it was not in use. I engaged the auto-CQ and reached for my low G Irish whistle — another favorite endeavor of mine — and commenced playing a short lively jig. I routinely play tunes when sending auto-CQs and keep the receiver audio at a low level. With one ear on the receiver, one eye on the waterfall and both hands on the whistle I multitasked merrily.

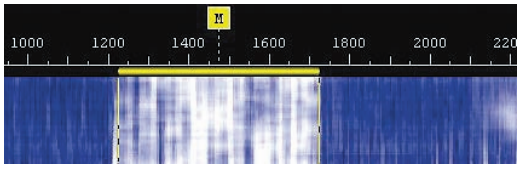
I had not heard all that much Olivia digital mode in use on 160 meters (or on the other bands) so I often found that calling CQ in that mode was more effective than just listening for activity. As I was slogging my way through O'Carolan's Concerto for the second time, whistling like a piper on fire, the auto-CQ already had finished five calls. So far I had not heard the cacophony of tones signifying an Olivia signal or noticed anything at all in the waterfall window. It was at this moment that I entered the world of the paranormal.

I chanced to glance at the text box that displayed received (decoded) text and I saw characters appearing. My call letters appeared as if a ghostly presence was typing them and answering my CQ. I screeched to a halt on my whistling, immediately disabled the auto-CQ and turned up the receiver volume. With the volume all the way up, all I could discern was the usual S8 hiss and static typical of nights on 160 meters. The waterfall still did not show any signal at all — but the characters kept appearing! What was going on here? Was it time to shut the rig off and consider bed rest and rehabilitation? Was it a bad piece of meat or an uncooked portion of potato I had for dinner that was causing hallucination? Or should I attempt to answer the ghostly call?

There's No 0 for Signal Strength

Well, I am a ham first and foremost so I cautiously clicked on the transmit button and began to tap out my reply — only hesitating when I had to consider just what I should give as a signal report. I finally banged out a 519 RST (Readability, Signal Strength, Tone) report (only because there is no zero for signal strength) and sent it back to my ghostly friend to see what would happen next.

Well, we went back and forth for several transmissions as we exchanged all the usual information and then we ended the QSO passing friendly 73 to each other. My ghostly friend appeared to be a real ham in Texas and checked out okay on the Internet Web site **QRZ.com**. My sanity was preserved and apparently intact (my wife doesn't totally agree on this point), though I was still slightly confused and filled with wonderment by what had just transpired!



Close-up of an Olivia 500/16 *average* format transmission shown on the DM780 waterfall display.

Since that day I have had several more of what I refer to as "Ghost" QSOs using the Olivia mode and have done a little online research to reassure myself that this is not all that uncommon. For the previous three and a half years I had mostly operated on PSK31 (a digital mode using phase shift keying at 31.25 bits/sec) and a little MFSK16 (Multiple Phase Shift Keying; a digital mode using 16 tones) and yet I had never experienced this type of ghostly phenomenon with either of these excellent digital modes. Apparently Olivia is one of the few modes that can actually decode signals that are at or below the noise level. That is why I *never* use the squelch with this mode because it could cut off signals below the noise floor that would otherwise be decoded.

The Internet resource Wikipedia.org says, "Olivia MFSK is an Amateur Radio teletype protocol developed by Pawel Jalocha, SP9VRC, in late 2003 to work in difficult (low signal-to-noise ratio plus multipath propagation) conditions on shortwave bands. A signal can still be properly copied when it is buried 10 dB below the noise floor (ie when the amplitude of the noise is slightly over three times that of the signal)." The Wikipedia entry includes several paragraphs describing the technical details of the mode.[1]

Now, I am neither a technical whiz nor an expert in any field but I found myself smitten. I don't have a giant tower with humongous beams, run high power or even live at a great ham location, but Olivia in particular has made it possible for me to chase DX and have quality ragchews like no other mode I have ever used. It has really ignited my activity level and fun factor to heights that rival my early Novice days and later DX chasing when I did have a big tower and massive antennas.

Let Me Introduce You

Olivia mode can be set to various formats that are labeled using the particular format's bandwidth and number of tones. Bandwidths of 125, 250, 500, 1000 and 2000 Hz are typical. The number of tones can be set anywhere from 4 to 256 depending upon the propagation conditions. Different combinations of tones and bandwidths provide for slower or faster transmission rates. Commonly used formats are 125/4 (125 Hz bandwidth using 4 tones), 250/8, 500/16, 500/8, 1000/32. The 500/8 format seems most popular at this moment, though I have had several QSOs on the 125/4 and 250/8. The 1000/32 format seems to be popular on 20 meters.

Each of the Olivia formats has advantages and disadvantages. Obviously, the bandwidth differences make the more narrow formats attractive because they will fit in available open spectrum space more easily. They also

[1]Notes appear on page 47.

Olivia QSO Formats

Format Bandwidth/Tones	Audio Center Marker (Hz)	Baud	Decode S/N Ratio (dB)	Speed WPM
500/16*	750	31.25	−13	19.5
1000/32*	1000	31.25	−12	24.4
500/8	750	62.5	−11	29.3
1000/16	1000	62.5	−10	39.1
500/4	750	125	−10	39.1
250/8	625	31.25	−14	14.6

*The most common Olivia formats in use at this time.

will likely get through slightly better since all the power of the transmitted signal is concentrated in a smaller bandwidth — much the way CW gets through better than wide phone signals.

The speed of Olivia is an issue also. Olivia is generally not as fast as PSK31 or MFSK16. Olivia 500/16 sends text at approximately 20 wpm. The 500/8 format speeds that up to nearly 30 wpm. Fewer tones results in more speed while less bandwidth results in slower speed. Olivia 1000/8 and 2000/8 are often used by Military Affiliate Radio System (MARS) traffic nets because these formats are fairly fast, accurate and get through when the MT63 mode (a digital mode using 64 tones phase shift keyed in a 1 kHz bandwidth) fails. Most of this information and more pertaining to Olivia are available at the HFLink and DXZone Web sites. [2, 3]

Many hams find Olivia slower than they like and prefer to use other modes, while many others find the accuracy and ability to get through an acceptable trade off. Also, many of us, including myself, are not fast typists and actually find "slower" to be a positive attribute and allows for more comfortable overall operation.

Another advantage to the mode is that it's not quite as critical for it to be tuned exactly on frequency as it is with PSK, MFSK and many other modes. If you click on the waterfall with your mouse and the indicator doesn't get exactly on the signal it may still decode properly. Most implementations of Olivia are set to search for signals to either side of your center frequency by a fixed percentage of your signal's width.

Pioneers Wanted

The activity level of Olivia can be described as somewhat sparse, especially compared to PSK and CW. That is partly explained by the fact that only a few programs support Olivia at this time and that Olivia has not been around quite as long as other established modes. *MixW* (newer versions), *MultiPSK*, *Ham Radio Deluxe's DM780* (latest Beta versions)[4] and *OliviaMFSK* support Olivia operation and are available for *Windows* based computers, while the *FLDigi* (v3) program is available for *Linux* and *Windows XP/Vista*. All of these, except *MixW*, are available for free.

There are a few other things worth mentioning about Olivia. Since it does incorporate some error correcting, it is not totally a 'real time' mode. It is essentially a real time mode in the sense that you do not 'connect' to a station and it is not duplex or bulletin board (BBS) type operation.

Like PSK, you go back and forth in a typical ham QSO fashion. The difference is when you click on the waterfall of a PSK signal it starts decoding very quickly. When you do the same on an Olivia signal it may take 3 to 6 seconds before it starts decoding. The opposite happens at the end of a transmission. When the station you are listening to stops transmitting — your Olivia software program will continue to decode for 3 to 6 seconds. Typically that will result in a 6 to 12 second gap when passing transmissions back and forth.

This varies depending on the format and the software implementation in the program you are using. I see less of a gap using *FLDigi* than with *DM780* for instance. What this means is that when you click on a signal if you don't see anything right away — be patient! It takes a few seconds. When you send it back to the other station — again, be patient. It may be a few seconds before you start to see his printout or even hear him.

The QSO is on the Calling Frequency

Another aspect of Olivia operation that is slightly different from most other digital modes is a loose voluntary channelization of the frequencies used by many operators. Since it is possible to copy signals that you cannot hear or that you might not see on the waterfall, it makes sense to use specific designated frequencies for calling and meeting other stations. Otherwise, if you just tuned all over the place looking or listening for an Olivia signal you could miss a lot of stations.

A few of the popular frequencies are 14.107.50 MHz (20 meter calling frequency 1000/32 format generally), 7072.50 MHz (40 meter calling frequency 500/250/125 Hz bandwidth formats generally) and 10.133.65 MHz (30 meter calling frequency 500/250/125 Hz bandwidth formats generally). These frequencies are *dial* settings — meaning the frequency that your transceiver would display on *upper* sideband. For the 500/250/125 Hz bandwidth formats the waterfall position (center marker) should be set for 750 Hz. On the 1000 Hz bandwidth format the waterfall position should be set at 1000 Hz, and with the 2000 Hz bandwidth format it would be set at 1500 Hz.

These "channels" and settings are not cast in stone and are certainly not mandatory or used by all Olivia stations but they are useful especially to help facilitate weak signal QSOs. For a much more complete set of voluntary frequencies see the charts at the HFLink Web site.

Better Than CW?

After a full year of operating Olivia I have had 650 QSOs with 45 states and 21 countries and have found it to be more reliable and more fun than any other mode that I have ever used on ham radio — including CW. It gets through noise (QRM), static (QRN) and fading (QSB) better than most and is excellent for DXing, rag chewing and even VHF weak signal QSOs. The faster Olivia formats are very useful for handling message traffic. The only place where it fails to shine as brightly is during contests. With many of the Olivia formats being slower and with the "not quite 100%" real time quality (4 to 6 second delay) it is probably not well suited for contesting.

So in the end, it turns out that a really great communications mode and not ghosts were responsible for my extremely weak and spooky QSOs. I will put away my ghost busting tools, discard the books about Area 51 and fire up the rig to see if I can scare up some more Olivia activity! Give it a try and discover the magic and mystique of Olivia!

Notes

[1]**http://en.wikipedia.org/wiki/Olivia_MFSK**
[2]**http://hflink.com/olivia**
[3]**www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=12012**
[4]**http://hrd.ham-radio.ch**

Gary L. Robinson, WB8ROL, was first licensed in 1963 as WN8GIG at the age of 13 and obtained his Extra class license in the mid 1980s. He is semi-retired and living in a small town in rural Ohio with his spouse Nancy. During his active work years he wore many hats — including Corrections Officer for 14 years, computer technician and C, C++ and C# programmer. Currently he focuses on his five loves — ham radio (digital, especially Olivia, DominoEX FEC and THOR modes), computers and programming (primarily but not exclusively on Linux), playing Irish whistles, five cats and his wife. An ARRL member, Gary can be contacted at **wb8rol@arrl.net** *or look for him lurking in the digital subbands of 160 meters through 70 cm.* QST

Make that List and Check it Twice!

Now that you're getting your station spruced up, and who isn't, all your friends and relatives want to know what you'd like for the holidays.

Joel R. Hallas, W1ZR

Figure 1 — A selection of current mid-range HF transceivers (not to scale). From left to right: Elecraft K3, FlexRadio 5000, ICOM IC-756ProIII, Kenwood TS-2000, Ten-Tec Omni VII and Yaesu FT-2000. All feature digital signal processing and a wide range of features and options.

Everyone enjoys their favorite holidays, and many involve exchanging presents. Now that you are putting your ham station together, and trust me no matter how long you've been a ham you are still *putting your station together*, your interest in presents may shift from getting a new scarf to getting something for the shack.

Unfortunately, while Aunt Millie may have great taste in scarves, she is likely to have no clue about what you most need or want for the shack.

How to Decide What You Want

Sure, we all would love to have that fancy new $15,000 HF transceiver, or $10,000 linear, but it is likely not all those you exchange presents with have that much allocated for your present this year. Besides, the last thing you want is to get three of them! Fortunately, there are purchases that could be useful for the amateur station at all price levels. For almost all categories of radio equipment and umn is the place to start. Fortunately column is the place to start. Fortunately, all reviews from January 1980 on are available to ARRL members at **www.arrl.org/members-only/prodrev**.

At the High End

We've all heard someone on the air say: "My wife got me my new transceiver for the holidays," so it does occasionally happen and it can't hurt to have one in mind. We wrote an article earlier this year on how to select an HF transceiver.[1] As noted there, prices for new HF transceivers range from around $550 to $15,000 — a dynamic range of more than 14 dB! Fortunately, most of the material in that article is still current. If there is a new transceiver, determine its specs and costs and see where it fits in the tables in that article. Lay the requirements of your operating style against the features as tempered by the cost and see where you end up. Figure 1 shows a selection of current mid-price HF transceivers.

In addition to transceivers, there are a number of other items that could be in the *major* present category. I would include amplifiers, many antenna systems, some major transceiver accessories and even a new computer for the shack or an ARRL Life Membership!

To help find items, check the *QST* advertisers in this issue and look at their Web sites for complete lists, usually shown either by product category or manufacturer.

The Middle Ground

This covers the area that could be the high end for most of us mere mortals — perhaps $100 to a few hundred. There's a lot of potential opportunity here. Some items that come to mind:

[1] J. Hallas, W1ZR, "Getting on the Air — Selecting Your First HF Transceiver," *QST*, May 2008, pp 71-72.

Figure 2 — Representative sample of computer interface devices to make operating digital modes, including keyboard, data, digital voice and video manageable from your PC. From left to right, units from MFJ, microHAM, SignaLink and West Mountain Radio.

Figure 3 — VHF and UHF FM mobile and handheld radios represent a real bargain in performance and features for the price. Here are representative units from Alinco, ICOM, Kenwood and Yaesu.

✔ Explore those digital modes with a *computer interface device* that facilitates connecting your radio to your PC. Try worldwide PC keyboard to keyboard communication with low power using PSK31, traditional radioteleype (RTTY) or even slow scan TV, all using your PC and the same interface. Representative units are shown in Figure 2.

✔ Move up to VHF and UHF FM with a new handheld, base or mobile transceiver. There are a wide variety available that can help with your local EmComm activity, or just provide more fun in your travels. See Figure 3.

✔ There are many antenna choices available in this price range — from mobile VHF to HF verticals and wire antenna systems. No ham can have too many antennas!

✔ Enhance your voice operation with a professional quality microphone. There are many choices available, both from radio manufacturers and independent audio specialists.

✔ Improve your CW sending with a new straight key, bug or electronic keyer paddles.

✔ A wide-range antenna tuner will allow multiband operation with your current antennas.

✔ There are all manner of test instruments available in this range. If you don't have an antenna analyzer yet or frequency counter, this is where they fit.

✔ Move your receive capability up a notch by adding an optional selectivity bandpass filter, roofing filter or DSP noise reduction system. Check your owners' manual or the equipment Product Review for internal options, advertisers for outboard ones.

✔ Replace that old transmission line with new lower loss coax or window line. You can help reduce global warming by not dissipating so much of your transmitter power as heat from that old lossy transmission line.

✔ Get serious with grounding and lightning protection using proper arrestors, bonding and terminating devices.

✔ Upgrade to an ARRL Life Membership through quarterly payments.

Moving Toward Stocking Stuffers

Don't despair if we haven't gotten to Millie's price range yet. There are even more items available in the $10 to $100 range! Consider:

✔ *Basic test equipment.* There are many surprisingly accurate and versatile digital voltmeters (DVM) available in this range. If you don't have one this would be a great time to rectify that. A calibrated signal generator, or receiver calibrator is very handy for calibrating your receiver S-meter, or checking the functionality of radios at flea markets.

✔ *Add to your technical library*. Check the ARRL Bookstore at **www.arrl.org/shop/** or your radio dealer for titles on most aspects of Amateur Radio. New this season just in time for the holidays are *Basic Antennas — Understanding Practical Antennas and Design* by yours truly and *The ARRL Satellite Handbook* by Steve Ford, WB8IMY. (See Figure 4.) It's never too late to learn something new and whole new interests might spring forth. Need a new *ARRL Log Book* or *ARRL Repeater Directory*? This is a great time to get up-to-date.

Figure 4 — Newly available from the ARRL Book Store: *Basic Antennas — Understanding Practical Antennas and Design*, by yours truly and *The ARRL Satellite Handbook* by Steve Ford, WB8IMY.

✔ *Every ham needs a complete set of quality hand tools*. If you've got the basics, how about specialized tools such as crimpers for those ubiquitous Powerpole connectors. Others are handy such as special coax cable strippers and tools for assembling those modular connectors that are showing up on mics and elsewhere.

✔ Speaking of cables and connectors, how about some coax between-series adapters such as from UHF to BNC or Type N. Patch cables always seem to be in short supply as well.

Don't be Bashful

Now is not the time to be the strong silent type. If you want something aside from another scarf with your call letters, you'd better let folk know what your *druthers* are. Not only is it likely that you and only you know what you want, even if you told someone what it's called you might not end up with what you had in mind. Best to say: "I'd really love an XYZ and you can get it from ABC Radio online or by phone and here's how much it should cost."

In our family someone is the custodian of each person's want list and all get in touch to find out what's on it. By having a wide range of items at different price points you will maximize getting what you really want.

Whatever you do, have a happy holiday with friends and family. No matter what's on your list, remember the real meaning of your holiday and the most important gifts of all — they may not even be in your shack!

Joel R. Hallas, W1ZR, is ARRL Technical Editor. He can be reached at **jhallas@arrl.org**. QST

New Products

CRYSTAL CALIBRATOR KIT FROM GRANDAD'S ELECTRONICS

◊The XTAL1 from Grandad's Electronics (part of Novatech Instruments) is a 100 kHz crystal calibrator kit using a crystal controlled Pierce oscillator said to be rich in harmonics past 30 MHz. The PC board also includes a Hartley modulation oscillator that can be switched on to produce tones for AM-only receivers. Price: $17.95. For more information, or to order, visit **www.novatech-instr.com/grandadselectronics.html**.

THE OLD TIMER BY JIM SMITH, VK9NS

◊*The Old Timer: 60 Years in the Hobby of Amateur Radio* is the memoir of James B. (Jim) Smith, VK9NS, of Norfolk Island. A well-known, life-long DXer, Smith has traveled extensively and participated in many DXpeditions. Smith has also been an avid equipment builder and has taken an interest in the administration of Amateur Radio. This book runs 583 pages and covers the Amateur Radio activities of VK9NS from 1947 through 2007. Price: $40 (CD version $20). For more information, or to order, visit **www.jimkirsti.com**.

ELECRAFT TRANSCEIVER CARRYING CASES FROM N7HKW

◊Carrying cases for the Elecraft K2 and K3 transceivers are available from Rose Kopp, N7HKW. The outer layer of fabric is a heavy 100% cotton duck. The inside

lining is a soft polar fleece, and there's a layer of polyester batting between the layers as protective padding. The sides and bottom have a continuous 1 inch wide nylon web strap that acts as a support for the radio and there are D-rings for attaching the carrying strap. There is a small inside pocket for power cables or accessories, and the K3 case has an additional pocket under the cover flap that will hold the radio's manual or a logbook. There are two padded flaps that close over the front of the radio for additional protection and the cover flap has a heavy hook-and-loop closure. The front of the case can be personalized with an embroidered name and call sign at no additional cost. Covers for Elecraft radios are available as well. Price: $85 for the K3 case; $75 for the K2. For more information and ordering details, e-mail Rose Kopp at **ElecraftCovers@rfwave.net**.

SCS MODEM FIRMWARE V. 3.9

◊ Special Communications Systems (SCS) has released version 3.9 firmware for use with PTC modems produced since 1995. Enhancements allow greater data throughput for PACTOR III digital communications and direct support for control of Yaesu FT-450, FT-950, FT-2000 and FTDX-9000 series transceivers. The new version offers other improvements and bug fixes as well. The version 3.9 update is available online from **www.scs-ptc.com/software.html**. Users will also need *SCSupdate*, a utility for updating PTC modems, from **scs-ptc.com/download/SCSupdate.exe**. SCS products are distributed in the US by Farallon Electronics, **www.farallon.us**.

PACTERM AND PKTERM SOFTWARE UPDATE

◊Creative Services Software (CSS) has released new versions of *PacTerm* (for Timewave/AEA TNCs) and *PKTerm* (for Kantronics TNCs). The new versions add support for Yaesu FT-450, FT-950, FT-2000 and FTDX-9000 series transceivers, as well as the ICOM IC-7700. In addition, *PKTerm* now supports the new Timewave DSP-232+ TNC. Other improvements include better multitasking support, an updated wizard for soundcard and TNC setup and better file transfer. For more information on ordering or upgrading CSS products, visit **www.cssincorp.com**.

CAT-MATE ELECTRONIC "Y" SPLITTER FROM BHI LTD

◊The bhi CAT-MATE is an electronic "Y" splitter that enables more than one accessory to be used via the CAT port on Yaesu FT-817, FT-857 and FT-897 radios. Primarily designed to be used with the bhi Radio Mate compact keypad, it can also be used as a standalone product. The CAT-MATE is able to receive commands from either of its two CAT input

ports and connect to a single radio. The appropriate reply from the radio will then be directed to the port from which the command was issued. The CAT-MATE has a built-in RS-232-to-CAT interface that allows operation with PC control software programs such as the *FT-817 Commander*, *Ham Radio Deluxe* and others. The unit operates from power provided by the transceiver and distributes this power to the other two CAT ports. The CAT-MATE is manufactured in the UK by bhi Ltd and is distributed in the US by W4RT Electronics. Price: $89. For more information, or to order, visit **www.w4rt.com**.

City of Manassas Takes Over BPL System from Private Company

In late September, the Manassas, Virginia City Council voted 4-2 to assume control of the Broadband over Power Lines (BPL) service from the private company that serves approximately 675 residents. As a result of the vote, the City of Manassas will now have to use monies from an enterprise fund — around $110,000, in addition to the approximately $640,000 the city has already spent on BPL infrastructure — to fund the service and recoup the cost from the subscribers; monies in an enterprise fund come from the utility's ratepayers. BPL technology uses the electricity grid in a city and the wiring in individual homes to provide direct "plug in" broadband access through electricity sockets, rather than over phone or cable TV lines. Because BPL wiring is physically large, often overhead and extends across entire communities, these systems pose a significant interference potential to over-the-air radio services, including Amateur Radio.

According to *BPL Today*, "Manassas was the first city in the world to have BPL deployed to all its residents and has been a demonstration center for utilities, integrators/operators and government entities from around the globe." It was in Manassas that then-FCC Chairman Michael Powell and then-Federal Energy Regulatory Commission (FERC) Chairman Pat Wood announced completion of the FCC's BPL rules and FERC's support for FCC jurisdiction over BPL before the October 2004 meeting at which the BPL rules were finally adopted, prompting an ARRL complaint. *BPL Today* is a weekly journal for the BPL industry.

10 Year Franchise

The City of Manassas — located 30 miles southwest of Washington, DC — launched a field trial to test out BPL technology in July 2002; 15 months later, they awarded a 10 year franchise to Prospect Street Broadband. This company agreed to expand the field trial and offer high speed Internet service to the entire Manassas community via power lines. In April 2004, the city terminated its contract with Prospect Street and put the contract out for rebidding. At this point, the City of Manassas had spent $140,000 on BPL equipment to serve 200 accounts.

In March of 2005, Manassas reported that it had signed up more than 200 customers for BPL services, with another 1300 on a waiting list. Manassas officials said they "expect[ed] to spend [another] $500,000 enhancing its telecommunications and electrical infrastructure by the time COMTek completes the installation [later that month]."

In October 2005, COMTek, based in Chantilly, Virginia, announced the first city-wide BPL service in Manassas. According to COMTek, the City of Manassas had the potential for more than 12,000 residential and 2500 commercial subscribers. In May 2006, Philadelphia-based GridPlex announced it would acquire Manassas' BPL program from COMTek.

In May 2006, *BPL Today* reported that GridPlex had the goal of "growing the deployment into a state-of-the-art smart grid including a wide range of municipal applications such as electricity demand response, energy and water conservation, security monitoring and many more." GridPlex also announced plans to upgrade and modernize the network in Manassas, including the provision of smart meters.

In July 2008, the Manassas City Council held a public hearing concerning GridPlex's takeover of the BPL system. The Director of the City of Manassas Utility Department, Mike Moon, told the council that the cost for BPL services — currently $28.95 per month — could be lowered and said GridPlex had plans to improve connection speeds. Moon did not give a timetable for when the change would take place, but said subscribers would be notified when it was to occur. No one at the hearing spoke in favor or against the provider change.

Moon said that if GridPlex acquired the system from COMTek, this would permit city residents to utilize GridPlex's smart grid technology, allowing them to tap into "cost effective, conservation encouraging technology." Residents could keep track and control their consumption of water and electricity on a daily basis. "We are in discussions with [GridPlex] on using those services, but we're not to the point of making that final decision," he said. "That's a $4-5 million project for us, so we have to make sure it's the right company, the right business plan for the city."

At the Council meeting in September, Moon explained that GridPlex's takeover of Manassas' BPL system — scheduled for early August 2008 and postponed many times — would not occur. According to the meeting minutes, "The inability of GridPlex to take over the COMTek franchise has made it necessary for [Manassas] to assume the operation of the BPL system and the current customer base, which consists of approximately 675 residents. The City must now purchase all assets owned by COMTek and will then exercise a short-term service agreement to service existing accounts." Speaking for Moon, Manassas' Utilities Deputy Director (Electric) Gary Paulson told the ARRL that the cost of the assets totaled approximately $110,000. "This includes all the hardware, software and licenses needed to operate the BPL system," Paulson said.

City Steps In

Four members of the six member Council voted to take over the BPL service. According to Kipp Hanley, a reporter for the *News and Messenger* in Manassas, this means the city will have to use a small percentage of its electric department reserve fund to pay for the service for the next six months. After

S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

six months, Hanley told the ARRL, it will be up to the Council if they want to include it in the city budget.

One reason to keep the BPL technology, he said, is Advanced Metering Infrastructure (AMI) via the smart grid, something that the Manassas utility department has advocated. Moon said that his office is also looking at other ways to carry AMI, such as wireless. This was put out to bid in September 2008.

Manassas Vice Mayor Andy Harrover was one of the four who voted to take over the service from COMTek. Harrover told the *News and Messenger* he voted in the affirmative as a "common courtesy for those who use the service and for the future of the AMI system," but said he has a "fundamental problem" with the city providing Internet services. "The philosophical question is should the city be in the Internet business and the answer is no."

Councilman Jonathan Way was one of two members who voted against taking over COMTek's services. "If we really feel compelled to compete, we should do so with modern, fast and reliable technology," he told the *News and Messenger*. "The current operator of the BPL system cannot make a go of it and wants out. There should be a lesson hiding somewhere in that fact."

PENNSYLVANIA BECOMES 27TH STATE WITH PRB-1 LAW

On October 8, Pennsylvania Governor Edward G. Rendell (D) signed into law a bill that guarantees radio amateurs the right to erect antenna support structures up to 65 feet without the need for a Special Use Permit. The bill passed in the House with a vote of 196-1; it passed in the Senate with a vote of 49-1. The new law is scheduled to go into effect December 8.

Senate Bill 884 (now Act 88), *An Act Amending Title 53 (Municipalities Generally) of the Pennsylvania Consolidated Statutes, Restricting Municipalities from Regulating Amateur Radio Service Communications*, was first introduced on June 1, 2007 by Pennsylvania Senator Stewart J. Greenleaf (R), after a request from George Brechmann, N3HBT. The bill requires local municipalities to "reasonably accommodate amateur radio service communications, and [to] impose only the minimum regulations necessary to accomplish the legitimate purpose of the municipality" and says that "[n]o ordinance, regulation, plan or any other action shall restrict amateur radio antenna height to less than 65 feet above ground level. A municipality may impose necessary regulations to ensure the safety of amateur radio antenna structures, but must reasonably accommodate amateur service communications."

FOURTEEN NEW SECTION MANAGERS VISIT ARRL HQ

The 16th annual New Section Manager Workshop on October 10-12 afforded 14 new SMs a chance not only to visit ARRL Headquarters and gain some perspective on their new leadership positions. During the weekend gathering, participants not only got to meet many HQ staffers but learned some of the ins and outs of how to become effective section leaders and administrators.

The workshop also provided an opportunity for those taking part to chat among themselves or within the group, sharing their own views on various issues and exchanging ideas. Through training and orientation sessions conducted by ARRL staff members and by meeting with other Section Managers, participants were able to explore what works as well as what does not and to bring home some fresh ideas, plus some encouragement.

Field Organization Supervisor Steve Ewald, WV1X, led the Section Managers on a tour of Headquarters where they met staff and visited W1AW, the Hiram Percy Maxim Memorial Station. The visiting Section Managers enjoyed the chance to operate from W1AW in their spare time during the weekend.

ARRL Membership and Volunteer Services Department hosted the event. Several HQ staff members led training sessions during the weekend workshop, giving the new Section Managers an opportunity to learn more about the League's Field Organization, as well as discuss the variety of ARRL programs and support available from Headquarters with staff experts.

Western Washington Section Manager Jim Pace, K7CEX, said he has attended many conferences throughout his career and found that "some are not so good, some are sort of good and some are just a waste of time; however, the Section Manager Workshop was beyond what I thought it was going to be. The information, quality of presenters and the ability to converse, argue and resolve issues with other Section Managers made it a great event."

Louisiana Section Manager Gary Stratton, K5GLS, agreed: "I had a great time in Newington, as well! It was a pleasure to

S. KHRYSTYNE KEANE, K1SFA

Fourteen newly elected or appointed Section Managers attended the 16th Annual ARRL Section Manager Workshop in October,

FCC News

♦**FCC Assigns Contested Vanity Call Sign to Wisconsin Club**: In an Order on Reconsideration and Order Proposing Modification released on September 24, the FCC decided that Falls Amateur Radio Club (FARC) was the rightful recipient of call sign W9CQ. FARC and the QRQ CW and Contest Group (QRQ) had both claimed they were entitled to use the call. Both clubs applied for the call sign after the holder, Robert C. Moldenhauer, W9IS, had released it. Moldenhauer had applied for and received the vanity call sign in April 2007 on the grounds that he was related by marriage to its former holder, Paul Kent, but said he later discovered he was related to a different Paul Kent. More information can be found on the ARRL Web site (**www.arrl.org/news/stories/2008/09/25/10351/**).

meet all of the other Section Managers and interact with them during the meetings. I think that Steve and the rest of the Headquarters staff did a great job organizing the sessions."

Workshop attendees were Jay Isbell, KA4KUN, Alabama; Jim Larsen, AL7FS, Alaska; Jim Latham, AF6AQ, East Bay; Ed Stuckey, AI7H, Idaho; Gary Stratton, K5GLS, Louisiana; Don Wood, W5FHA, New Mexico; Joe Giraudo, N7JEH, Nevada; Lynn Nelson, WØCQ, North Dakota; Paul Eakin, KJ4G, Northern Florida; Rich Krohn, N2SMV, Northern New Jersey; Steve Early, AD6VI, San Diego; Glen Clayton, W4BDB, Tennessee; Jim Pace, K7CEX, Western Washington, and LeeAnne Allen, WY7DTW, Wyoming.

WAC AND 5BWAC CERTIFICATES GET NEW LOOK

In September, the ARRL Awards Branch unveiled a new design for two IARU award certificates: the Worked All Continents Award (WAC) and the 5 Band Worked All Continents Award (5BWAC). WAC is awarded to amateurs who have confirmed contacts on any band with Africa, Asia, Europe, South America, North America and Oceania, while 5BWAC recognizes hams who have made confirmed contacts with those continents on 10, 15, 20, 40 and 80 meters.

The WAC/5BWAC rules state that all contacts must be made from the same country or separate territory within the same continental area of the world. Contacts made on 10/18/24 MHz or via satellites are void for the 5 band certificate and 6 band endorsement. All contacts for the QRP endorsement must be made on or after January 1, 1985 while running a maximum power of 5 W output or 10 W input. US amateurs must be ARRL members to receive these awards; foreign amateurs must be members of their IARU Member-Society and should apply through their Member-Society.

According to ARRL DXCC Manager Bill Moore, NC1L, the WAC award — originally announced in the April 1926 issue of *QST* — continues to be popular around the world with more than 6000 participants. "Besides the certificate design change, the WAC certificate will also display the award holder's name alongside their call sign. We do this already on the 5BWAC certificate."

Moore said there are a couple of ways that hams interested in applying for WAC or 5BWAC can do so. "They can download the form from the WAC Web site (**www.iaru.org/wac/wac.pdf**) and send it via regular mail (along with QSL cards and payment) to ARRL, or DXCC recipients can send an e-mail to **wac@arrl.org**, referring to their DXCC award. We can look into your account to verify the contacts; just include your payment information in your message," he said. WAC is currently not supported in ARRL's Logbook of The World (LoTW), but Moore said that an upgrade to do so is currently in the planning stages.

MONTANA HAM ASSISTS IN RESCUE OF FELLOW AMATEUR 600 MILES AWAY

On Sunday, September 21, Bob Williams, N7ODM, of Bozeman, Montana, was just tuning around on 40 meters, giving his rig a test just before a scheduled QSO with his brother Rich, K7URU, in Spokane, when he heard a faint CW signal around 1 PM (MDT): Glenn Russell Ruby Jr, W7AU, of Corvallis, Oregon had broken his leg and was using a portable radio and Morse code to send out a call for help. Williams said he was able to understand the injured man's code even when his signal became very weak.

"He called me. He must have heard me testing out the radio. When I finished, I signed off with my call, and then I heard, 'N7ODM, this is W7AU/7,' so I answered," Williams told the ARRL. "I told him to go ahead, I had solid copy. He told me that he was a hiker that had fallen and broken his leg. He identified himself as Russ, provided information as to his GPS coordinates, the shelter, food and water on hand, as well as his detailed physical condition. He told me exactly who I needed to contact for assistance."

"Had His Act Together"

According to Williams, Ruby had slipped on a wet rock and broken his leg while out hiking in the Buck Creek Pass area of the high Cascades in Western Washington, 600 miles away from Williams. "Russ really had his act together," Williams said. "He had his tent set up before he even called for help. It was raining when he fell, so he climbed into his tent and got into some warm clothes and had a snack of sunflower seeds and dried apricots."

Ruby told the ARRL that after he fell, a group of hikers, one of whom happened to be a doctor, passed by. The doctor confirmed Ruby had indeed broken his leg; the doctor helped Ruby with his leg and the group helped set up his tent and string his antenna. "They said they would pass on my conditions and whereabouts to the rangers, but figured they were about three days out from seeing anyone," he said. So Ruby fired up his Elecraft KX1 and started calling on the radio. Williams said that Ruby told him he had a "couple of weeks worth of battery power" for the radio.

Ruby asked Williams to notify the Snohomish County Search and Rescue in Washington State. "I didn't have their number, so I called my local 911 dispatcher. All they had was the info for King County in Washington, so I called them and they gave me the number for Snohomish. When I got a hold of Snohomish County Search and Rescue, they asked me to obtain additional info from Russ, such as the color of his tent and if he was in a clear or wooded area, and remain in contact with him as long as possible," Williams said.

"Russ and I were able to maintain contact until about 8 PM on Sunday, during which time I was able to pass additional traffic between Russ and Search and Rescue, but then his signal got so weak where I couldn't copy it anymore. Before he faded, we had agreed to try and make contact in the morning. I tried, starting around 6:30, but he never heard me. I finally heard him calling me around 9 on 7.051 MHz. We kept in contact until he was evacuated from the site by Search and Rescue at about 10:35 AM," Williams told the ARRL.

To Safety on Horseback

On Sunday, rescue crews reached Ruby, who had set up camp on Buck Creek Pass, at about 6000 feet just west of the Chelan County line. He was taken to safety Monday on horseback. Williams said that bad weather Sunday prevented a helicopter rescue.

"I just happened to be at the same frequency," Williams said. "It's just a stroke of luck that turned out great. It was quite an experience. I'm just glad that he was a ham radio operator and that I was able to talk to him. It made the difference for him. What I did was not anything special. I'd like to think that any ham in Montana would've done the same thing."

In Brief

- **West Gulf Vice Director Appointed to State Agency**: Texas Governor Rick Perry has appointed ARRL West Gulf Vice Director Dr David Woolweaver, K5RAV, of Harlingen, to the Council of the Department of State Health Services (DSHS) formerly known as the Texas Department of Health. The nine member council makes recommendations regarding management, operation, policies and rules for public health, mental health and substance abuse. DSHS has workforce of 12,000 and has an annual budget of $2.7 billion.

David Woolweaver, K5RAV

- **Contester/DXer Paolo Cortese, I2UIY (SK)**: Well-known contester, DXer, and *QST* and *NCJ* author Paolo Cortese, I2UIY, passed away from a brain aneurysm the weekend of October 11. He was 48. According to fellow contester Doug Grant, K1DG, Cortese was the "most popular competitor" at the first WRTC in Seattle in 1990. "His big laugh and constant kidding around really made everyone smile," remembered Grant. "Everyone will tell you that he was a big man with a big heart, a big appetite for life (both literally and figuratively) and one of the biggest and most enthusiastic cheerleaders for ham radio in general — and contesting specifically — anywhere in the world." Cortese served as log-checker for many contests, including the European Sprints, CQ WPX RTTY and CQWW RTTY, and was an active DX advisor to the CQ World Wide Contest Committee, translating the rules into Italian. Grant said that as manager of the Associazione Radioamatori Italiani (ARI, the IARU Member-Society in Italy) QSL bureau, "every QSL card into or out of Italy via the bureau passed through Paolo's hands." Cortese was inducted into the CQ Contest Hall of Fame in 2008. "Paolo has been a tremendous contributor behind the scenes to contesting and ham radio," said fellow inductee Randy Thompson, K5ZD. "It was an honor to be inducted into the CQ Contest Hall of Fame with him this year." Cortese's article, "A DXpedition to Niger" appeared in the May 2002 issue of *QST*.

BOB NAUMANN, W5OV

Paolo Cortese, I2UIY (SK)

RICHARD GARRIOTT, W5KWQ, JOURNEYS TO ISS

Richard Garriott, W5KWQ, took off for the International Space Station (ISS) on October 12, becoming the sixth private citizen to fly to the ISS. Not two hours after he arrived on the ISS on October 14, Garriott

ANDREW YATES

Owen, W5LFL, and Richard Garriott, W5KWQ

was making ham radio contacts, just as his father, Owen Garriott, W5LFL — the first ham to make QSOs from space — did in 1983. Richard was scheduled to return to Earth on Thursday, October 23.

Amateur Radio on the International Space Station (ARISS) International Chairman Frank Bauer, KA3HDO, said that not only did Richard start making QSOs almost immediately after docking to the ISS, he also started SSTV operations. Bauer explained that Richard's flight on the ISS is "a part of history. Some have asked why Richard is using his call sign for some QSOs and SSTV contacts, instead of the ISS station call signs. There is a long and proud history that is attached to the Garriotts. This includes ham radio in space and their personal call signs. Twenty-five years ago, Richard's father, Owen Garriott, W5LFL, initiated the first ham radio contacts from space on the STS-9 SAREX mission. Richard, W5KWQ, is following in his father's footsteps, using the ARISS ham radio system extensively on his first flight. Richard's call sign is actually his grandfather's original call sign. So you can see that this mission touches three generations of ham radio and two generations of ham radio in space!"

"Richard is great!" said ARRL ARISS Program Manager Rosalie White, K1STO. "First he wanted to do a QSO with the mayor of his hometown — Austin, Texas — then he asked us to sponsor an Austin school QSO. He got the mayor to bring kids into the mayor's office for the QSO! Last I heard, several busloads of kids were being brought to the mayor's office. And right after that QSO, he thrills hams with more QSOs. We've gotten several notes from hams who talked to Richard saying they had talked to his dad years ago, too. Pretty cool!" QST

SKYWARN Recognition Day Celebrates 10 Years!

David Floyd, N5DBZ
Warning Coordination Meteorologist,
National Weather Service
david.l.floyd@noaa.gov

The 10th annual SKYWARN Recognition Day (SRD) special event will take place Saturday, December 6, 2008. SRD is co-sponsored by the National Weather Service (NWS) and the American Radio Relay League. SKYWARN Recognition Day is a way to recognize the commitment made by Amateur Radio operators in helping keep their communities safe. During the 24 hour special event, Amateur Radio operators visit their local National Weather Service office and work as a team to contact other hams across the world.

The original SRD concept took shape in the summer of 1999. Scott Mentzer, NØQE, Meteorologist-In-Charge of the NWS office in Goodland, Kansas was trying to think of a way to let storm spotters know how valuable their reports were to the NWS (See Figure 1). Since many of those storm spotters were also hams, it seemed like a natural fit for the recognition to be centered on Amateur Radio.

With the approval of NWS headquarters and a commitment to participate from many local NWS offices, the first "National Weather Service Special Event" took place on November 27, 1999. At the end of the event, an amazing 15,888 QSOs were logged, with contacts made to all 50 states and 63 countries. The Des Moines forecast office took the honor of making the most contacts of any office that first year with 761 QSOs (and went on to lead the pack through 2003 by logging between 1300 and 1500 contacts each year).

Feedback from the first event was overwhelmingly positive from both the NWS staff and the local ham clubs. Suddenly there was incentive for more NWS staffers to either obtain a license or upgrade so that more people could work ham radio during severe events. In addition, many club members had never visited an NWS office and they learned the value of their reports and how they were used in conjunction with existing technology.

And so began an annual tradition. In 2004, 85 of the 122 NWS offices participated in the event, making nearly 24,000 QSOs. Perhaps the most unusual contact occurred in 2000 with an airliner 39,000 feet above Utah. The pilot ended the QSO with a request for a "spot weather forecast" for his arrival at Salt Lake City airport.

In 2001, the name of the event was changed to SKYWARN Recognition Day, which seemed to better relate what the day was all about. Each year since the inception of SRD the number of NWS offices and local ham clubs participating has increased; now more than 100 offices sign up each year to take part. The most contacts made during any SRD by an office occurred in 2006 when staff and local hams in the Grand Junction area logged 1640 QSOs!

Station call signs have also changed over the years. Some offices and clubs apply for a special event call sign such as W3B in Brownsville or NØY in Aberdeen, South Dakota. Other call signs hint at office location, including WX9GRB in Green Bay and WX4NHC at the National Hurricane Center. Still others represent more of the big picture, as in KCØSKY in Pleasant Hill, Missouri.

Another change in recent years has been a greater use of digital communications in addition to CW, RTTY and packet radio. Each year more and more contacts are being made using EchoLink, Winlink and reflectors.

The 2008 SKYWARN Recognition Day will be held from 0000 UTC to 2400 UTC December 6. In 2007 contacts were made in all 50 states and 40 countries during the 24 hour event. If you haven't joined in the fun, 2008 is your year! To learn more, check out our Web site: **http://hamradio.noaa.gov**.

CHRIS FOLTZ, KCØTYY

Figure 1 — Scott Mentzer, NØQE, organizer of the event, works a station during the 2007 SRD.

BAKER TO VEGAS

Eugene D. Humpherys, KG6SLC

Springtime for hundreds of Amateur Radio operators means it is "Baker To Vegas" time! Seven-hundred fifty of volunteer Amateur Radio operators and others gather each year to provide support for the "Baker To Vegas" event — an arduous 120 mile relay race. As for ham operators, many of us travel up to hundreds of miles; use our own radio(s), antennas, equipment and supplies to provide our unique service for a variety of functions. Each segment of the race involves hams that provide communication to runner teams, race coordinators, as well as other hams involved in additional duties. Many Amateur Radio operators perform background functions and are not visible to participants or the general public.

Since 1984, this event begins close to Baker, California, heads northbound on Highway 127 through Shosone, turns onto Highway 178, travels to Pahrump and then proceeds eastbound on the 160 freeway finally ending in Las Vegas, Nevada. It is a grueling

120 mile relay race specifically for law enforcement agencies and virtually all aspects of law enforcement across the board are represented. In the words of "Baker To Vegas" Communications Director Joy Matlack, KD6FJV, it has been described as "The longest foot pursuit in the history of law enforcement."

This year the race began with 243 teams and well over 5000 runners. The course crosses the desert and runners typically encounter sweltering heat during the day and almost certainly freezing cold during the night. Temperature and weather vary from stage to stage and are not always consistent year to year and in some cases hour to hour. Many runners run the risk of heat exhaustion as running in the blistering heat of the desert sun can feel like one is running inside a furnace. Early morning runners will feel the bite of extreme cold as they make their way through the higher elevations that will sometimes have snow and blizzard conditions. These men and women are focused, determined and persistent. They each give their all to this endeavor as evidenced by having to life-flight runners to hospitals every year.

The Web site **www.b2v.org** provides a brief history of the event. "The Challenge Cup/Baker to Vegas Relay (road race) was the vision of Officer Chuck Foote, then General Manager of the Los Angeles Police Revolver and Athletic Club, Inc (LAPRAAC) and Officer Larry Moore, then LAPD Athletic Director. Its predecessor, the LAPD Metro Division's Death Valley Relay, established the format still in use today."

Comms Challenges

Successful communications over such wide area and terrain conditions does not come without its share of challenges. Joy relates that there are locations having mineral deposits that seem to absorb RF like a sponge. This region has also been known to occasionally shift the polarization of a signal as it wends its way across the desert. Propagation also varies with humidity and other atmospheric and weather conditions. Of particular interest is a somewhat unusual phenomenon. There is one specific area where cell phone coverage cannot be received for some distance except when standing very close to a particular bush. Anyone in this vicinity wishing to make or receive a telephone call must be located adjacent to this bush. Over time this bush has come to be known as "The Magic RF bush."

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Figure 2 — One of the Early Warning and PA announcer crews at the stage location. From left: Chris Aberle, KB7IAY; Dan Sherwood, WA6PZK, and Carol Humpherys, KI6DWE.

Our crew was assigned to stage 15. Stage locations are places where runners begin and end their relay leg. Here we would see family, friends and fellow department and support personnel gather to provide runners with encouragement, nourishment, cheers, medical assistance and other support as needed. Stage locations are also the place where a good number of volunteers are positioned.

The most noticeable service that Amateur Radio provides directly to participating teams and supporters alike is provided by the Early Warning team stationed 1 mile from the end of each stage. One of our Early Warning teams was a father and son team. The father is a seasoned ham. The son was ecstatic that he received his license just in time to participate last year.

Early Warning hams will radio the running team number to the stage location of every runner as they pass their position (Figure 2). At the stage location a ham receives this information and another volunteer (usually a ham) writes the number of the runner and the time they passed the 1 mile early warning mark on a white board.

A Helpful Service

Seeing expressions of excitement on the faces of family and support crew as they hear the update of their runner being announced on the stage public address system or seeing them hover around the whiteboard for the latest update can be very rewarding. This service provides support personnel an accurate window in which to ready themselves to greet their runner who is just completing the stage. It also assists them to warm up and otherwise prepare their next runner for her/his contribution to the team event in a timely manner.

Three stages of this year's event were coordinated and staffed by ARES® (Amateur Radio Emergency Service) members from the Los Angeles area: Scott Hanley, WA9STI, coordinated stage 8, the author, Eugene D. Humpherys, KG6SLC, coordinated stage 15 and James Curio, KI6FGV, coordinated stage 17.

The race began Saturday morning near Baker approximately 100 miles from our location. That gave us time to relax and socialize throughout the day before the race activity reached our stage. In the evening we were able to enjoy the full moon rise upward from the desert floor glowing brightly as it began its journey across the glimmering sky. The first activity at our stage occurred at around 10 PM when the first runner passed the 1 mile Early Warning position. Following the first runner all subsequent runners passed through our stage intermittently throughout the night. The last runner completed our stage just before dawn the next morning (Sunday). It had been a sleepless night.

Stage 15 communications have been pretty straightforward. We had modified our stage layout and approach slightly from last year. In 2007, to communicate with the Early Warning hams we used the well-proven method that has probably been tried by every ham at least once — a magnetic mount antenna attached to a cookie sheet at the stage location. At the Early Warning location, we used a mobile unit mounted inside a vehicle. This arrangement worked quite well but limited the mobility of the Early Warning hams.

2008 Stage 15 Participants

Aberle, Chris	KB7IAY	Early Warning (at stage location)
Albright, Jim	NB6V	Chip Timer/Hand-off Chute
Bianchi, Larry	AF6GF	Chip Timer/Hand-off Chute
Hoffman, Margie	KG6TBR	Chip Timer/Hand-off Chute
Hoyt, Keith	K6GXO	Stage 15 Communicator
Humpherys, Carol	KI6DWE	Announcer / PA system
Humpherys, Eugene	KG6SLC	Ham Lead / Floater
Jackson, Don	K6GET	Chip Timer/Hand-off Chute
Rowlan, Dan	KG6PQA	Early Warning (1 mile out)
Rowlan, Mike	KI6IYE	Early Warning (1 mile out)
Sherwood, Adrienne	WA6YEO	Whiteboard (at stage location)
Sherwood, Dan	WA6PZK	Early Warning (at stage location)

In 2008 we used a more efficient antenna system at the stage location. As a result, the Early Warning hams were able to easily use a handheld throughout the entire operation. Soon into the race we discovered that being able to "hear" better did not mean that it was a better situation overall. At the stage location we were now receiving another group that shared the same frequency with us. Since the race was already well underway and with a careful ear we could easily distinguish our crew from the other radio chatter, we elected to tolerate this minor inconvenience. Another factor in our decision was that it appeared our transmissions were not affecting the other stage.

In 2009 we will most likely incorporate tones to resolve this issue although a number of other solutions could also have been implemented that would still keep us in compliance with the overall communications plan. As one would expect, the communications plan is a comprehensive one that coordinates FRS, GMRS, Citizens Band, Business Band and Amateur Radio in addition to various government and police frequencies used by participating agencies and their support groups.

The chill of the cold early morning air was felt on our faces, fingers and even our toes as we worked our positions. Fortunately, we came prepared and had dressed in layers and other warm clothing. At times the cold wind would prompt us to add more layers. Hot coffee and chocolate was shuttled by Carol, KI6DWE, from the RV to the chip timing table. It felt like we were freezing and all of us made frequent trips to the RV to thaw out as we rotated responsibilities. The warm RV gave us temporary relief but our sense of duty bid us to return to our posts. While it was cold, we were glad there wasn't sleet like we encountered in 2007.

I spent part of the early morning hours at the chip timing table. Here I had a close-up view of its operation. As runners completed their assigned stage they traveled through a "chute" of sorts that would guide their path directly alongside an RF sensitive mat. The runner would tap the baton (containing an RFID chip) onto the RF sensitive mat to signal the end of her or his leg (Figure 3). He or she would then hand off the baton to the next runner.

These actions were recorded using both the internal logging capabilities of the equipment as well as manual logs kept by volunteers. Maintaining accurate timing logs are critical as time is the primary basis for race results and placement. At this position we used a large atomic clock that also proudly displayed the current temperature, a frequent reminder of why we were dressed like Eskimos. As the night progressed, the thermometer dropped from mid 40s to mid 30s by early morning.

The chip timer and baton trade-off areas do not require the use of an Amateur Radio license but hams usually staff these positions as well. In fact, at this position we cannot use a radio at all because the mat and recording equipment are sensitive to RF signals in general and there is a no-transmit zone of 12 feet immediately around the chute operation. This no-transmit zone includes cell phones, radios, RFID badges, keys equipped for wireless entry and any other device that would emit an RF signal.

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Figure 3 — A runner passes his baton over the RF mat as he completes his stage.

Behind the Scenes

Events such as these provide positive exposure of ham radio to the public. What the public does not see are behind the scenes support activities of additional Amateur Radio operators and others without which this event would not be possible. These include hams that provide repeater operations, APRS tracking, Net Control, monitoring of cross-band repeat operations, relay stations and general coordination of the communications effort. Many of these hams are located miles from where the event actually takes place. As is the case with most hams we enjoyed providing our skills and talents in the service of others.

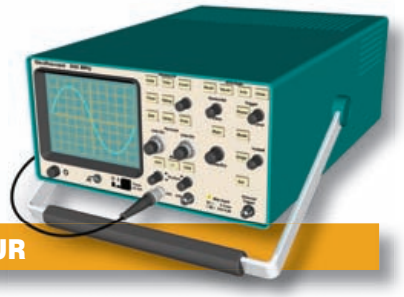
Let's face it. Many of us get our license. Then over time find ourselves in a daily routine. We forget even how to program our radios. Others of us may never have learned that skill in the first place.

As we become involved in these types of events, we lessen that risk. That is one reason activities such as this are extremely valuable to ARES members and for Amateur Radio operators in general. It provides an opportunity for newer hams to learn from more experienced Amateur Radio operators in a mentoring side-by-side working environment. It helps us hone our skills in numerous areas such as logging information that we hear on the radio, programming our radios for frequencies and PL tones, setting up our gear, basic communicating, working with others in an active communication environment and knowing that our equipment actually works and is not just in a go-bag somewhere waiting for a disaster to happen. After all, every ham does have a go-bag…right?

This article has focused primarily on the Amateur Radio perspective of this race. It is a team effort of many groups that have volunteered their time and equipment to make this event the success that it has become over the years.

The cold and whatever weather we encountered will become less significant in our memory as time marches forward. What we will recall is the social interaction between volunteers and feeling good within ourselves as we unselfishly give of our time and energy in service to others. At stage 15 it has become a tradition to have a group BBQ/potluck on the Friday evening prior to the race. Here we enjoy the company of other good people with whom we share a common interest and build memories to be cherished for years to come. In fact we are already looking forward to next year! "Baker To Vegas" is a venue that allows us to provide a service to the community and interact with others while practicing our communication skills. After all, isn't that at least part of the reason that we became Amateur Radio operators in the first place? QST

The Doctor is IN



PROJECTS AND INFORMATION FOR THE ACTIVE AMATEUR

Q Tom, NØSS, asks: Ferrite beads come in all sizes from very tiny to pretty large, such as the ones salvaged from the video cables of CRT monitors. In the past, when I've applied ferrite beads to conductors in an attempt to create an RF choke, I've tried to use a bead with an inside diameter (ID) that is just slightly larger than the wire or wires I'm passing through the center of the bead.

I wonder how much effect the ID of a bead has on the effectiveness of the bead if the ID is significantly larger than the wire being passed through the bead. For instance, using a CRT monitor bead as an example, the ID of a sample bead is 0.5 inches, and a single 20 gauge wire (0.032 inch OD) is being passed through it. Then, the #20 wire is replaced with a length of RG-8X cable (0.25 inch OD). Will the impedance of the bead on the two different wires be significantly different, and is there a rule of thumb regarding the size of wire to be used with a ferrite bead of a given ID? While I realize that one turn is one turn, it would seem that, at some point, the distance of the bead from the wire itself will start to have a significant effect upon the benefit of the bead.

A Tom, the impedance of a wire through a bead is proportional to the log of the ratio of the two diameters. Thus, the larger diameter might actually work better. A larger diameter has two additional potential benefits, although sometimes you need to choose between them:

- Often a cable can fit through without having to remove a connector.
- It is possible to have more than a single turn (a wire passing straight through the center of the core counts as one turn). The inductance goes up in direct proportion to the number of turns, although the effectiveness can be reduced by the capacitance between turns.

Q John, KJ4GER, asks: I am reading the *ARRL General Class License Manual*. In a few places, it mentions the 75 meter band. On my ARRL provided "US Amateur Radio Bands" chart, it shows an 80 meter band and a 60 meter band, but no 75 meter band. What is the 75 meter band, and why does it not show up on the official band chart?

A John, 75 meters is the designation for the 3.6 to 4.0 MHz phone subband, a portion of the 3.5 to 4.0 MHz 80 meter allocation. If you convert 4.0 MHz to wavelength (300/4) you will find that the top end of the band has a wavelength of 75 meters. The FCC, in Part 97, Subpart D, Section 97.301. Technical Standards, refers to 80 and 75 meters as separate entities.

Historically, 75 meters refers to the voice portion of what is generally called the 80 meter band. The term 80 meters is often used to refer to the entire band. Most HF radios have a bandswitch position for 80 meters that covers the entire band, not a separate one for 75 meters. Unlike any other band, you will rarely hear anyone refer to "80 meter phone."

Q Dave, AB9RD, asks: I have often wondered about the usefulness of older 2 meter FM transceivers that do not include CTCSS tone access capability.[1] Can a tone board be added, or can an external tone be used for repeater access?

A There are accessory tone boards available, from at least two companies, Communications Specialists (**www.comspec.com**) and Transcendient (**www.transcendient.com**). I have successfully used them in a number of radios over the years. The boards designed for internal mounting run around $30. One limitation of the internal boards that I've found is that they must be set to a single tone frequency. This can make your older radio useful for access to your local repeater, but is not easily adapted to multiple repeater use. There are outboard mounted switchable units for somewhat more, but they add considerably to the size of the arrangement, especially for mobile use.

For either type, the audio connection has to be made right to the phase modulator itself since the usual speech amplifier won't pass the lower frequency CTCSS tones. If your radio had provision for an accessory tone generator, it is often straightforward to use the existing connector and space within the radio.

With current handheld and mobile 2 meter radios, complete with many additional modern functions, available for not much over $100, it is often easier to transition the old set to another application. They can be dedicated to packet data use, as NOAA weather channel monitor or to listen for activity on your local repeater. Also check with your club. My local repeater disables tone access requirements during scheduled nets or emergencies.

Q Tommy, KH8T, asks: Some equipment that has a speaker does not also have a phone jack. What is the best way to install a phone jack so that the speaker is disconnected when the phones are plugged in, like late at night?

A Most amateur HF equipment of my experience includes a headphone jack that disconnects the speaker when the phones are plugged in. If so, you should be good to go with one possible issue.

Headphone jacks (and plugs) can be found either as "two circuit" (stereo) or "single circuit" (mono). If you plug a pair of stereo phones into a mono jack, you will hear sound only in one ear. If you plug a mono phone into a stereo jack, you will short out one audio channel. In many radios that will only result in reduced volume, although there are some that warn against possible damage. To be safe, if you don't require actual stereo operation (as with dual receivers), use phones wired for mono (two sides in parallel) using a stereo plug. (See Figure 1.) Hook both sides to the *tip* connection and both common wires to the *sleeve* and leave the intermediate or *ring* unconnected.

If, as is the case with many V/UHF transceivers, there is a jack for an external speaker that shuts off the internal speaker,

Figure 1 — Two-circuit or stereo phone plug. The connections are referred to as *sleeve, ring and tip* from left to right.

[1] J. Hallas, W1ZR, "Getting to Know Your Radio — VHF Squelch Modes" *QST*, Aug 2005, pp 46-47.

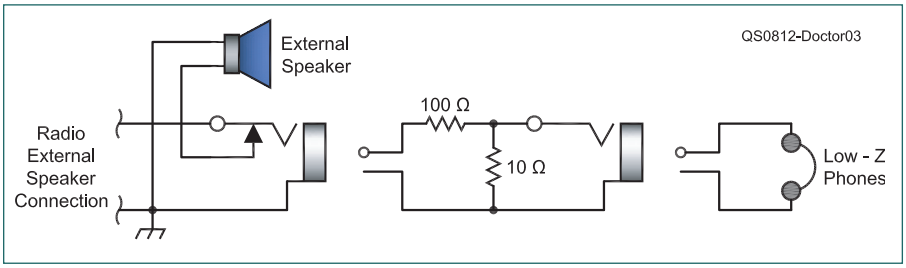


Figure 2 — Single-circuit closed circuit jack with attenuator pad. When the phones are plugged in, they are live and the speaker is disconnected.

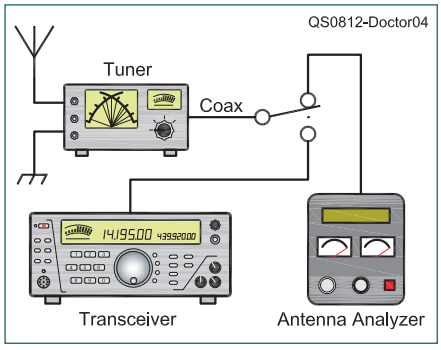


Figure 3 — Connection arrangement for adjusting an antenna tuner using an antenna analyzer.

you can use it with headphones. To preserve the phones (and your hearing) a simple attenuator pad should be between them. I would suggest a series resistor of around 100 Ω into about 10 Ω across the phone side. That should look like a low impedance to the typical 50 Ω headphones, so the frequency response should be uniform.

If you don't have a jack, but your radio has an external speaker (and no internal speaker), you can use a "closed circuit" jack connected between the speaker connections and the headphones, wired so that the speaker is opened when the phones are plugged in. These are available both for one and two circuit phone connectors. Use one or two of the above attenuator pads going to the headphones, depending on whether you wire for mono or stereo phones. Figure 2 shows the single circuit connection arrangement.

Q A different headphone question from Bob, VE6RI: Vintage regenerative and crystal receivers make use of high impedance headphones in the range of 2000 Ω. How can I determine the impedance of my headphones to ensure I have the proper type?

A Well, one good thing is, I'm not aware of any headphones or vintage radios that will be damaged by an impedance mismatch, so one way is to try them. If the audio output is very low, they are likely modern ones.

The best way to tell for sure is to use an audio impedance meter, set to a frequency of around 1000 Hz. Equivalently, if you apply a tone of 1000 Hz and measure the voltage and current (perhaps measuring the current by measuring the voltage across a small resistance) with an oscilloscope, you can use Ohm's law to determine the impedance.

The dc resistance, as measured with a VOM can give you a clue. I measured some modern stereo phones and found each transducer was around 70 Ω, or 35 Ω, if wired in parallel for mono. That is typical, in my experience. A pair of WWII vintage high impedance phones measured 200 Ω at dc. I would expect their impedance at 1000 Hz to be about 10 times as high.

If you don't have the right kind, try an old vacuum tube type audio transformer typically designed to transform a load of 4000 Ω to 4 Ω from the radio output into your modern phones. It will likely provide close to the performance of the older phones.

Q Jim, N9JO, asks: What is the correct mounting spacing from metal objects for twin lead, open wire or window line?

A Unlike properly terminated coaxial cable, in which the fields are between the inner and outer conductors, the various forms of unshielded balanced line have fields that extend beyond the space between the conductors. It is important for lowest loss and predictable results that lossy or conducting material be kept out of the fields.

The rule of thumb I have always used is to space the line at least four times the distance between the conductors. More may be even better, but any distance beyond four times becomes a case of diminishing returns. If you remember the TV type twinlead standoffs, they were about 2 inches long when screwed in and the line was spaced around ½ inch, so my rule reflects longstanding practice.

Q Marty, N3MOW, asks: What is the proper way to tune an antenna tuner? I have a 100 W HF transceiver, manual antenna tuner and a commercial ground mounted multiband ¼ λ vertical antenna. I've been told to key the transmitter on CW and then adjust the tuner for minimum SWR. I do not have a key. Could the TRANSMIT/RECEIVE switch be used instead of a key? Should I identify before tuning?

A First, I should mention that if your antenna is properly adjusted, you should not need a tuner, except perhaps at the edges of some bands. You may save a lot of effort by tuning the antenna instead of the tuner.

The most desirable method to tune a tuner is to first use the receiver and tune for maximum signal strength, or maximum band noise on the receiver. Watch your receiver S-meter, since the receiver automatic gain control (AGC) tends to make the sound change less than you would expect. Often, tuning on receive will get you very close.

The best way to tune for minimum SWR is to use an antenna analyzer at the radio side of the tuner — a coax switch can be used to make this easy as shown in Figure 3. By using the antenna analyzer, you minimize the signal that you put out on the air, and avoid stressing your radio or your tuner. Once you have the SWR close to 1:1 on the analyzer, switch the tuner to the radio and you should be good to go.

If you don't have an antenna analyzer, first find a clear channel, then transmit at low power until you have the tuner set. Use just enough power to get an indication on your SWR meter. A telegraph key is often the best way to make a very short transmission for tuning, and I recommend one on general principles; however, some radios have a way of keying the radio with a TUNE or TRANSMIT switch. Note that switching to transmit, or pushing the PTT button in SSB won't result in any output until you speak. Using the mic PTT button in AM or FM mode, however, should put out a steady carrier. For a 100 W SSB transmitter, switching to AM mode usually will put out a maximum carrier of 25 W, while FM will put out the full 100 W, so AM is much better for this application if your radio has it. Reducing the power to 5 W or less is often enough to be able to avoid stressing the radio, and minimizes interference. If using AM or FM, keep the background noise low to avoid unintended modulation, and only do this in the phone part of the band.

You are required to identify yourself, and best to do so after you have completed a short tuning cycle, to avoid overstressing your transmitter. Besides, people will hear you better.

I find it very helpful to make a chart of tuning settings for each frequency range, every 100 kHz or so, on every antenna. It gets you into the ballpark very quickly the next time you change bands.

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

The Arrow II 146-4BP Antenna

Mike Gruber, W1MG
ARRL Laboratory Engineer
mgruber@arrl.org

I'd long considered a portable 2 meter collapsible antenna — many times and for a multiplicity of purposes. The ideal candidate would combine light weight, compact design and functionality in a single package. I wanted something that would easily fit in a backpack or airline luggage, feature quick easy assembly without tools and provide useful performance for a variety of applications.

I seriously began to consider my options after several discussions with ARRL Laboratory test engineer Bob Allison, WB1GCM. I was planning a summer vacation in Cape Cod, Massachusetts and Bob suggested that I attempt a 2 meter SSB contact with him at his home station in Coventry, Connecticut. Although Bob seemed confident in some level of success, it was a long haul for low power and low elevation — about 120 miles as the crow flies. The more Bob and I talked about it, however, the more intrigued I became with the idea. Although time was short, I was confident the upcoming Dayton Hamvention® would provide some interesting antenna options. The Arrow II 146-4BP Yagi antenna was one of them.

The Arrow 146-4BP Yagi perched on the author's balcony at Cape Cod, Massachusetts.

A quick look at Arrow's Web site indicated they would not be at the upcoming Hamvention, but my disappointment was short-lived. Through an e-mail inquiry to Al Lowe, NØIMW, at Arrow, I learned that their distributor, VIS Electronics, would be at the show. An e-mail to VIS confirmed they would be selling the 146-4BP at their booth. I returned home from Dayton with a new 146-4BP antenna ($55) and two related accessories: an Arrow M/B II mounting bracket ($9) and an Arrow 30 inch nylon bag ($24).

My Dayton Acquisitions

A quick look at the antenna suggested the origin of the "Arrow" moniker. Although the boom is ¾ inch rectangular aluminum, each of the elements is made from aluminum arrow shafts — minus the point and feathers, of course. I opted for the four-element Yagi design with a three-section collapsible boom. (A three element antenna and a single section boom are also available.) Individual element lengths range from 17⅛ to 20¼ inches. The 48 inch boom breaks down into three 16 inch sections.

The manual is primarily a double sided sheet with diagrams showing element and gamma match dimensions. I only needed two minutes to assemble the antenna once the mounting bracket was installed. The boom sections are keyed to prevent incorrect assembly. When assembly is complete, four threaded rods through the boom hold everything together — both the boom sections and elements. Only the reflector elements are uniquely marked, but identifying them by length is easy.

The gamma match comes preset from the factory. The manual doesn't describe how to adjust it, but I found the SWR to be acceptable for my purposes. (It was a maximum of 1.6:1 at the bottom of the band and 1.1:1 at the upper end.) I suppose adjustments could be made to tweak the antenna for a particular frequency range, but I didn't try it. *EZNEC+* antenna modeling software predicts the forward gain to be 9.38 dBi at 144.20 MHz. The antenna feed point is equipped with a female BNC connector, so you'll need to invest in an adapter for other types of connectors.

The Acid Test

A quick trip to the local hardware store provided a very inexpensive mast — a 5 foot section of ½ inch plastic pipe. I mounted the 146-4BP on the pipe and propped the mast vertically on my balcony using a plastic outdoor chair (see photo). I gave a few quick calls and heard WB1GCM right on schedule. Signals peaked around S7 after a little direction tweaking and I was having some serious fun! A second attempt two nights later provided similar results. Bob and I maintained a full one-hour QSO with 100% copy for the duration despite some fading.

The ARRL June VHF QSO Party provided my next opportunity to assess the Arrow's performance. I worked stations from Long Island to Vermont using a similar mounting scheme on my backyard deck in Connecticut.

An unknown source of 2 meter radio interference proved to be an opportunity to assess the Arrow's use in a direction-finding application. Most commercial power-line-noise-locating antennas operate at frequencies higher than 2 meters. Lower frequencies, however, can provide longer range when necessary, possibly an advantage when the source is some distance away. In this case, the interference was *only* on 2 meters, probably a Part 15 consumer device located in a nearby home. Using a professional noise locating receiver and the Arrow antenna, I was quickly able to pinpoint the source. A 1 foot section of plastic pipe served as a convenient handle during the hunt. The antenna was a bit larger than convenient for my sedan, so some disassembly was required for transport.

Some Final Thoughts

The entire Arrow II 146-4BP Antenna with mount weighs less than 23 ounces. Small and light, this antenna gives me a plenty of take-anywhere performance for vacations, hiking in the hills with my handheld transceiver, foxhunting or as a backup during a power line noise hunt. Given a little time, I'm sure you'll also be able to come up with some ideas of your own for this antenna.

Manufacturer: Arrow Antennas, 911 E Fox Farm Rd #2, Cheyenne, WY 82007, tel 307-638-2369; **www.arrowantennas.com**. *Note: Arrow doesn't accept credit cards over the phone or ship outside the US.* QST

Time to Tune Up that Straight Key!

Straight Key Night is fast approaching. Setting up and using your key properly will make it more fun for you — and for the op at the other end!

Joel R. Hallas, W1ZR

Before the advent of amateur exams without a code requirement, all hams became familiar with the use of a straight key. Now many new hams are discovering the joy of sending and receiving Morse code on the air. ARRL Straight Key Night, each New Year's Eve, provides an opportunity for all to return to our common roots by mastering and enjoying the skill of using a telegraph key.

A Key's a Key — So What's to Learn?

While there have been some more complicated ones, most telegraph keys are pretty simple electrically. In essence they are a single pole, single throw, momentary contact switch — equivalent to a doorbell push button. Some also add a circuit closing switch that can keep the contacts closed, but that doesn't change much.

What makes a good key a thing of beauty is the precision with which it's constructed and the balance and feel of its operation. All of this can make a key that is a pleasure to use for hours on end but only if it is properly adjusted and used. We will cover the basics here, but just like getting to Carnegie Hall, it takes practice and more practice to become comfortable with one.

Getting Down to Essentials

The typical telegrapher's *straight* key (as opposed to a mechanical *semiautomatic* or *electronic* key) consists of a lever supported by bearings with an attached knob, contacts, return spring and a travel stop all mounted on a base. Figure 1 shows a WWII vintage military J-38 key, typical of most straight key designs.

Figure 2 shows the J-38 disassembled. I have removed the circuit closing switch, since it will not be found on all keys and is not essential to the discussion. You will encounter some variations in bearing or suspension details on some keys, and not all will provide for all adjustments, but the differences should be obvious from a quick inspection.

Setting it Up

The first step is to inspect the key and, unless its design prohibits it, disassemble and clean the pieces. If it is old and of brass or nickel, some metal polish can turn it into something beautiful. Check the contacts for smoothness and lack of oxidation. Most are silver, so be very gentle. Often a matchbook cover provides just the right amount of abrasion to clean them. Don't overdo it.

Figure 1 — The venerable J-38 military telegraph key.

Bearings

Start by replacing the lever in its bearings. Leave the springs and stop adjustment for later so you can tell what the bearings are doing. By adjusting the bearings from side to side, you should be able to position the moving contact directly above the fixed one. Now tighten the bearings equally until there is no wobble, but not to the point that the lever drags in them. When you have them adjusted correctly, tighten the lock nuts and recheck. You want no drag on the lever as it goes up and down.

Spring and Stop

Install the return spring and put in its adjustment screw until it just keeps it centered. Install the stop screw and adjust it until there is a gap of about 0.15 inch (about five thicknesses of pad paper) between the contacts. Tighten the contact adjustment lock nut without changing the spacing.

With no spring tension, the contacts should be resting against each other. Increase the spring tension until the lever lifts off the contacts and just reliably returns to the upward position. Too much tension in the spring will result in muscle tension and tremors. Some folk think a lot of tension and a very small gap makes for faster sending. In my experience it just makes for choppy sending and arm tremors — don't try it.

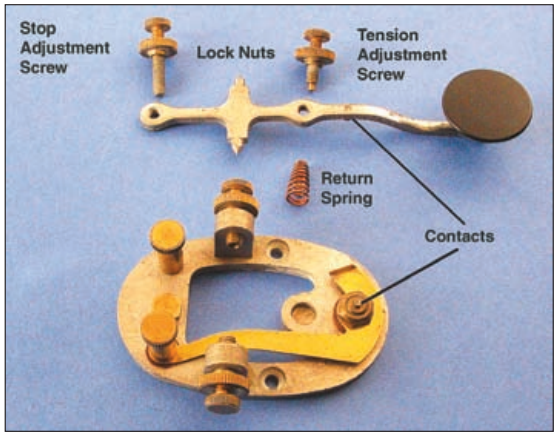


Figure 2 — J-38 disassembled to major subassemblies.

Mounting the Key

There are very few keys with a heavy enough base that they can be used just sitting on a table. The best position is with a key screwed down on the operating table in a location that permits your arm up to your elbow to rest on the table while sending. This is not recommended for family heirloom antique desks — but there's an easy solution. Just mount the key on a thin piece of wood as long as your forearm. Use countersunk screws so you won't scratch that desk. A piece of felt will make it even safer.

Practice Makes Perfect

Send with your arm straight, pivoting at the elbow, not the wrist. Use a smooth motion to make clear characters. Hook up a code practice oscillator, or even your radio with no power output and connected to a dummy load. Begin at a relaxed speed that you also can receive comfortably with. Start by sending dots until you can send 30 in a row with the dot and space of equal length, then move to combinations of dots and dashes keeping the same spacing, but making the dashes three times the length of a dot.

When you have the "fingering exercises" well under control, start sending text from a book. Make sure you can send for long periods without getting tired or cramped. If you have the capability, record your code and listen to it with a critical ear. You may want to ask an experienced CW operator for her opinion as well. When you're satisfied, hook up the antenna, turn up the power and look for W1ZR on Straight Key Night! QST

NØAX

HANDS-ON RADIO

Experiment #71 — Circuit Layout

Success with radio electronics has a lot to do with knowing how to construct a circuit. As frequency increases, this sort of "radio know-how" becomes increasingly important. This month's experiment will present an example of the effects of circuit layout on its performance at different frequencies. (This experiment is based on a column by Dave Kelley, ND3K, professor of Electrical Engineering at Bucknell University and a frequent reader of Hands-On Radio.)[1]

The Basic Filter

The circuit we're going to build — in three different ways — is a low-pass filter with a cutoff frequency of around 28 MHz. The schematic is shown in Figure 1. The filter is designed to be used with a 50 Ω source and load.

Figure 1 also shows (in red) the *parasitic reactances* associated with each of the *ideal* components. For example, the *interturn capacitance* of L1 creates C_{w1}, typically a few pF for an airwound coil of the size you'll wind. The *lead inductance* of C1 appears as L_{s1} and is about 12 nH/inch for 20 gauge wire. More parasitic capacitance appears as C_{io}, the capacitance between the input and output connections. The size and placement of the components affects each of these parasitic values.

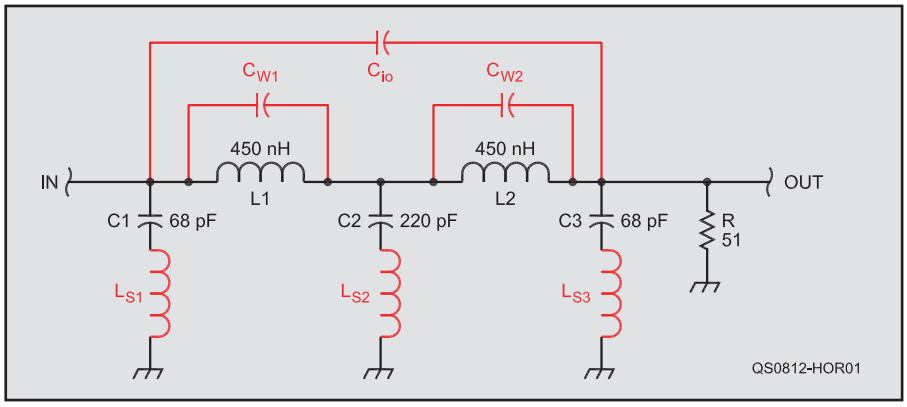


Figure 1 — Performance of the two-section low-pass filter is affected by parasitic reactances (shown in red).

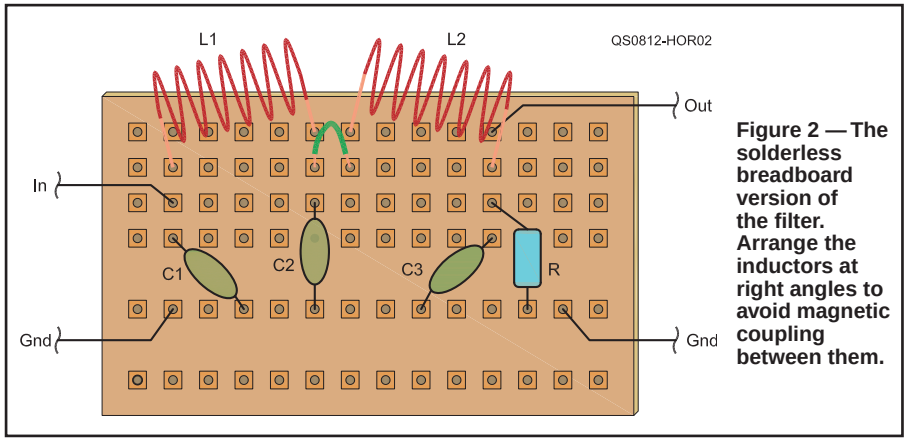


Figure 2 — The solderless breadboard version of the filter. Arrange the inductors at right angles to avoid magnetic coupling between them.

Sans Solder

The first version of the circuit is built on a solderless breadboard, as seen in Figure 2. To wind the inductors, start with 16 inches of solid 20 gauge wire. (Scrape the enamel coating off the ends of the wire with a knife or file.) On a ½ inch form (such as a drill bit or dowel), wind nine turns over a length of about ⅞ inch. Leave about ¾ inch of wire on each end to make leads.

Plug the inductors into the breadboard at an angle to each other. If the inductors are placed end-to-end in a straight line, their magnetic fields will *couple* and upset circuit performance quite a bit. Connect the capacitors from the inductors to the breadboard's ground rail. It's not necessary to minimize lead length or arrangement — yet.

Now comes the fun part — measuring how the circuit responds at different frequencies. As a signal source, you'll need a signal generator or an SWR analyzer, such as an MFJ-259. Any stable source that can output more than a few hundred millivolts at frequencies up to 50 MHz or higher will do. You'll also need an oscilloscope with a bandwidth of at least 20 MHz. To connect the signal source to the circuit, find a 2 to 3 foot piece of coaxial cable with a connector on one end. Attach a pair of alligator clips to the end without the connector, or just solder the braid and center conductor to short pieces of wire that can be plugged into the breadboard.

Set the source to about 1 MHz and connect it to the filter. Use the 'scope to measure the filter input and output signals in V_{P-P}. Increase the source frequency until the output voltage, $V_{OUT} = 0.707\ V_{IN}$. This is the filter's *cutoff frequency*, f_0, and it should be somewhere above 20 MHz and less than 35 MHz. If you have a 'scope with a bandwidth of 20 MHz or less, you can still use it if it can provide an indication, because we are taking *relative* measurements between input and output.

Now sweep the source from 1 MHz to 100 MHz or as high as the source will go. Watch the output signal amplitude. Is it steady through the *passband* below f_0 or does it vary? Does the filter's *amplitude response* (the ratio of output to input) de-

[1]D. Kelley, "The Good, the Bad, and the Ugly: Demonstrating Basic Circuit Layout and Measurement Concepts," *IEEE Antennas and Propagation Magazine*; Vol 49, No 6, Dec 2007, p 153.

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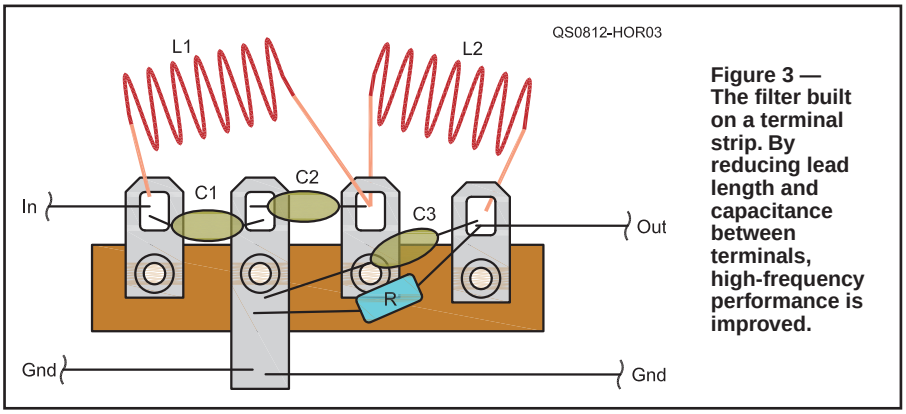

Figure 3 — The filter built on a terminal strip. By reducing lead length and capacitance between terminals, high-frequency performance is improved.

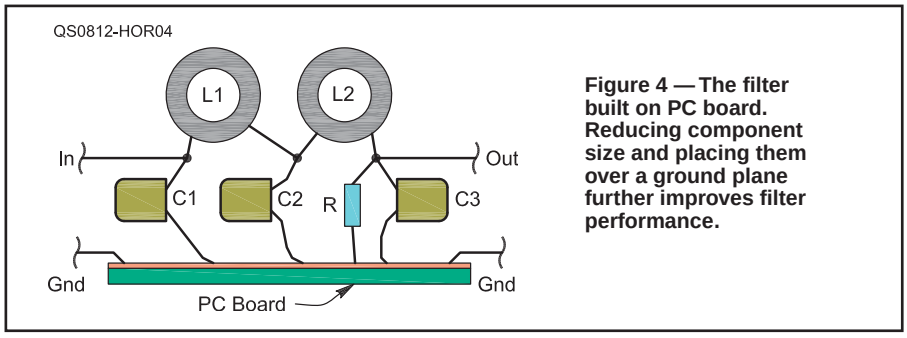

Figure 4 — The filter built on PC board. Reducing component size and placing them over a ground plane further improves filter performance.

crease smoothly (*roll-off*) up to 3 × f_0 or are there peaks and notches and abrupt or erratic changes? Increase the frequency still further and see if the filter's attenuation levels off or even begins to decrease. Graph the filter's frequency response in dB by downloading the spreadsheet available on the Hands-On Radio Web site under Experiment #18.[2]

You'll probably see a pretty uneven response at and above f_0 due to the effects of the parasitic reactances. These effects are quite undesirable and hard to predict. Rearrange the components to see changes in the frequency response.

The parasitic capacitance present between the connector strips of the breadboard affect filter performance above a few MHz, as well. All in all, it's easy to see why this construction technique is not recommended for radio frequency projects.

Terminal Strip

The parasitics inherent to the breadboard are avoided in a style of construction popular before printed-circuit boards became the norm. The *terminal strip* is a good way to connect simple circuits, particularly for parts with wire leads.

Rebuild the filter on a terminal strip as shown in Figure 3. The terminal strip can be screwed to a scrap of wood, or soldered to a piece of printed circuit board scrap. Any solid mounting method will work.

Reattach the source by soldering the coax center conductor and shield directly to the input terminals. Use the spreadsheet to graph the circuit's frequency response. Compared to the frequency response of the breadboard filter, the terminal strip version will show a much smoother frequency response with higher attenuation at high frequencies. This is because the component leads are shorter (less inductance) and there is less capacitance between adjacent contacts. Additionally, all the grounds are connected at a single point, minimizing inductance in ground connections.

Now replace the air-wound inductors with toroid inductors: 13 turns of 20 gauge wire spaced evenly around a T-30-10 powdered-iron core. (*The ARRL Handbook* shows how to wind a toroid inductor.)[3] About 1 foot of enameled wire will do the job. (Don't forget to remove the enamel from each end of the winding!)

Repeat the frequency response measurements of the filter and note any changes in the response. With the toroids, you'll probably see even smoother pass-band and roll-off characteristics. The *ultimate attenuation* at higher frequencies will likely be higher since there is less input-to-output parasitic capacitance.

PC Mount

Finally, obtain a scrap of printed-circuit board a couple of inches square. Clean the surface with steel wool or a scrubbing pad and build the filter as shown in Figure 4, using the toroid inductors. Reattach the source by soldering the coax braid to the circuit board and the center conductor directly to the filter input. Repeat your frequency response measurements.

Compare the sets of measurements you've made with all three types of construction and the two types of inductors. As the effects of circuit construction and component parasitics are reduced, the response of the filter becomes closer to the ideal of a flat passband, smooth roll-off, and even attenuation at high frequencies. When you build your next RF project, remember the effects of construction!

Parts List

- Terminal strip (3 terminals plus ground terminal).
- Capacitors. Two each 68 pF and one 220 pF silver mica.
- Powdered iron toroid cores; two type T-30-10.
- Resistor, 51 Ω, carbon composition or film.
- Enameled wire, 6 feet of 20 gauge.
- PC board scrap.

If you have been wondering where to get parts for the experiments in the Hands-On Radio columns, the ARRL (**www. arrl. org/shop**) and Kanga US (**www.kangaus.com**) have teamed up to provide a kit with all of the electronic parts for experiments #1 through #61. For columns #62 and later, check the parts list spreadsheet on the Hands-On Radio Web site.

Recommended Reading

For more information on how components behave at high frequencies, *The ARRL Handbook* is a good place to start. Chapters 5 and 6 provide good information on the types of components and their RF characteristics. *Experimental Methods in RF Design* provides lots of examples of how to build RF circuits properly.[4]

Next Month

While most hams are familiar with the idea of standing wave ratio (SWR), not many delve into how it is calculated and fewer are familiar with the measurement preferred by professional RF designers — return loss. Next month, we'll reflect on those and other concepts.

[2]All Hands-On Radio experiments and an extensive FAQ are available at **www. arrl. org/tis/info/HTML/Hands-On-Radio**.

[3]*The ARRL Handbook for Radio Communications,* 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261 (Hardcover 0292). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[4]W. Hayward, W7ZOI, R. Campbell, KK7B, and B. Larkin, W7PUA, *Experimental Methods in RF Design*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8799. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**. QST

HINTS & KINKS

PORTABLE LIGHTWEIGHT ANTENNA SUPPORT

◊ Having recently participated in several bike tours as a communicator, I realized that my heavy tree-pruning tool was not the optimum antenna support. I noticed that one ARES®/RACES ham used an aluminum 15 foot pool-cleaning pole as his antenna support. This pole collapses down to about 6 feet, so it easily fits in a car. I was able to purchase the Kem-Tek pool-cleaning pole at Orchard Supply Hardware (OSH) for $25 recently, but since it was designed to be handheld, it would not stand up by itself. At one event I found a parking sign and attached the pole with bungee cords. While that made a secure antenna mount, how would I set up operations without the benefit of parking signs? I needed an inexpensive, lightweight, collapsible tripod that could mount anywhere.

While at OSH recently, I noticed a sale flyer that advertised a Craftsman 500 W work light (#73826) with tripod stand for $10 (Figure 1). The normal price is $20. I had seen this on an earlier trip to OSH, but

RICH STIEBEL, W6APZ

Figure 1 — The worklight tripod before the addition of the PVC leg extensions.

RICH STIEBEL, W6APZ

Figure 2 — The worklight tripod with the PVC legs attached.

did not want to pay $20 just to get the tripod. The price was now right, so I purchased the light just to get the tripod for my 15 foot pool-cleaning pole.

When I unpacked the tripod, I became concerned about the diameter of the tripod's base. Was it large enough to keep the pole from falling over when the pole was extended to its full 15 foot height? Setting up the tripod, I noticed the quick-release pin at the top of the tripod post. I was able to unscrew and remove this with a crescent wrench to permit the bottom of the pool pole to fit over the top of this tripod post. Upon extending the pole to its full 15 feet in my back yard, I immediately realized that the tripod base diameter was not sufficiently large to support the fully extended pole with antenna *if* there were much of a wind.

I needed to increase the tripod diameter somehow. Each foot of the tripod had a plastic cap on the end to prevent the metal tube from digging into a floor. Those plastic caps pry out very easily. The inside diameter of the legs is just big enough to accept a piece of one half inch schedule 40 PVC pipe. I happened to have several 18 inch lengths of this pipe available, so I put a length of PVC pipe into each leg (Figure 2). This more than doubled the tripod diameter and greatly increased the stability of the tripod, even with the 15 foot pool-cleaning pole at its maximum length. One could use longer pieces of PVC pipe to provide even more stability if needed, or one could place weights over the ends of the PVC pipe to anchor the tripod in a windy environment. Another alternative, if the tripod has been set up on earth, would be to use a tent stake driven into the ground near each foot of the tripod and secured to the PVC pipe.

This tripod is an inexpensive way to mount an antenna for emergency work or when helping out at a public service event. One could also use this support system to hold a Buddipole or a dipole antenna made with two Hamsticks when working HF. This tripod is very lightweight, so it is easy to carry. I look forward to using this setup at future public service events and RACES drills. — *73, Rich Stiebel, W6APZ, 840 Talisman Dr, Palo Alto, CA 94303-4435,* **w6apz@sbcglobal.net**

CORRODED CONNECTIONS MAKE MOBILES MALFUNCTION

◊ Not long ago my HF mobile station developed some strange symptoms. After a couple of months of inactivity, when I turned on the radio all functions would operate normally until I keyed-up the microphone, at which time the display would go haywire, blink once or twice and the rig would turn itself off.

Like any good do-it-yourself ham, I thought "bad connection." I proceeded to check the remote cable and the power and ground connections for the radio. I then made a quick voltage check at the rig end of the power cable, which showed the expected 12.6 V.

To my disappointment, it wasn't anything simple like a bad ground connection, so I turned my attention to the battery terminals under the hood. They looked clean and tight, and a voltage check showed the same 12.6 V. To be sure, I decided to clean them too, disconnecting the negative terminal first[1] and then the positive terminal; I cleaned both using a battery terminal brush available from most auto supply stores. When I reassembled the connections, I did it safely, putting the

Steve Sant Andrea, WB2GYK ♦ Assistant Editor ♦ h&k@arrl.org

positive terminal on first and then the negative terminal.

To my disappointment the radio displayed the same symptoms as before — when I keyed-up the microphone, it still turned itself off! Then, I noticed the positive battery cable going into a power distribution block on the side of the engine compartment. When I removed the plastic cover it was clear that the point where the positive battery cable connected to the power distribution block (Figure 3) could loosen or corrode.

ANDY VAVRA, KD3RF/VE2DXY

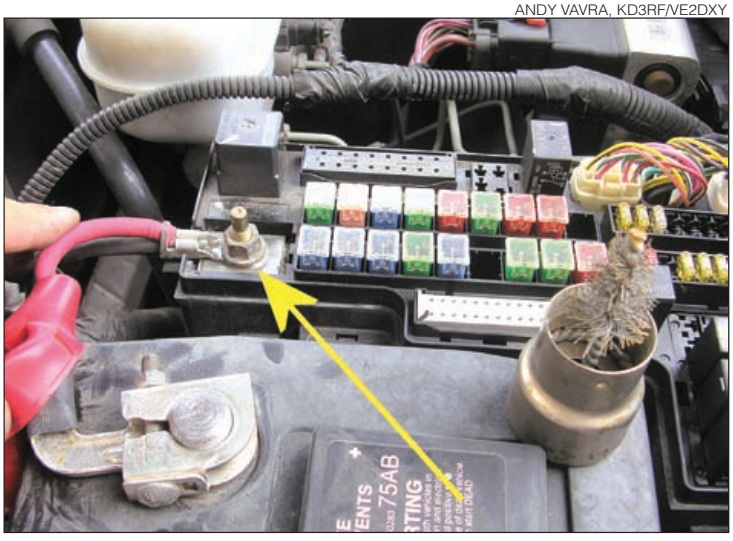

Figure 3 — The power distribution block with an arrow indicating the location of the corrosion.

Cleaning both sides of the crimped-on lug, along with the copper stud, eliminated a high resistance connection that was introducing just enough of a voltage drop to cause my HF radio to shutdown. For extra insurance I applied a light coating of an antioxidant product that is available commercially from several different manufacturers to both battery terminals, the crimped-on lug and the copper stud, and then retightened the connection securely. My HF mobile now works perfectly; no blinking and no shutting down unexpectedly. Happy DXing! — *73, Andy Vavra, KD3RF/VE2DXY, 11 Collins Ln, Schwenksville, PA 19473,* **kd3rf@arrl.net**

RADIO DISPLAY PROTECTOR

♢ The plastic displays on radios can be scratched easily. PDA screen protectors will prevent accidental scratches to these plastic faces. Once they are scratched, there's little chance of removing the scratch, and forget about a replacement screen.

Use a scissors to cut and fit a protective sheet to the radio's display face. Also, Duke found that his Kenwood D-700 display is slightly curved requiring two sheets and a bit more care in cutting and trimming. Patience with the trimming and subsequent installation makes a very acceptable job and the vertical line on the D-700 face, where the two sheets join, is barely perceptible. Fingerprints are pretty hard to avoid on the adhesive surface but don't seem to show up once the protector is pressured in place. Above all, use clean hands (I used an alcohol pad on mine) and don't use rubber gloves. Most rubber gloves come lightly powdered and that powder will definitely show up on the adhesive surface! If the protector is "rolled" on, air bubbles are minimized and they can be worked to the side with the applicator card. For the bubble that just won't be moved, use a fine needle and puncture it (very gently) and it will disappear with a little pressure. — *73, Duke Knief, W4DK, P O Box 1000, Etowah, NC 28729,* **w4dk@arrl.net** and *Milton Garb, W6QE, 1426 Delamere Dr, Rowland Heights, CA 91748-2429,* **w6qe@scsxc.org**

[1]For safety's sake, when working with lead-acid storage batteries always wear proper safety gear including glasses, goggles or a face shield and appropriate clothing to protect your face, hands and body. Do not lay tools or other conductive objects on top of the battery, which may cause short circuits between terminals or from positive to ground. Batteries generate hydrogen gas, so keep all sources of ignition away from the battery.

SOUND CARD CAVEAT

♢ When I went to buy a new laptop, a Dell Inspiron 1501, I insisted that it had to have a stereo input sound card and port. I was assured that the 1501 did have such a card. When the computer arrived and I had finished setting up all the necessities, I started testing the sound card with a free audio program called *Audacity*. I soon found no way to record in stereo.

After a week on the phone to Dell support I found out that the card as supplied was a stereo card with a stereo input port but the software *drivers* supplied were only mono. Once the stereo *drivers* were installed and *Audacity* set to record in stereo it was able to record either microphone or line input in stereo.

So, for all those authors such as Rich, W3OSS ("Hendricks QRP Kits FireFly Transceiver," Sep 2007, p 65) who have laptops and can't get it to use stereo input, all they may have to do is find the correct *driver*(s) for the sound card in the laptop. I'd contact the manufacturer to find out for sure if the sound card is stereo, but if you can at least get the make and model of sound card used (Most manufacturers do not make their own sound cards. They use some brand and simply "plug" it into their motherboards.) then you stand a chance of finding out if the card is stereo or not. Then the manufacturer's Web site should have the stereo *drivers*. Good luck — *73, Phil Karras, KE3FL, 3305 Hampton Ct, Mount Airy, MD 21771-7201,* **ke3fl@comcast.net**

TEXTURED PAINT FINISH FOR RADIO CABINETS

♢ A way to generate a textured finish for a radio cabinet is to apply a coat of an automobile rocker panel coating (eg, 3M Rocker Panel Spray, 05910) after the cabinet is primed but before the color coat is sprayed. This technique avoids spouse ire that can occur when you heat the cabinet in the family oven before painting to make the paint wrinkle. Even better, make friends with the folks at a local auto body repair shop and let them paint the cabinet for you between other jobs. — *73, Michael Davis, KB1JEY, 533 Tennis Ave, Ambler, PA 19002-6016,* **michael.davis@alumni.duke.edu**

WINDOWS SOUNDS ON DIGITAL FREQUENCIES

♢ As you listen on the various digital frequencies you will hear the familiar *Windows* startup and shutdown chimes. I just happened to find the following tip in AA5AU's "Getting Started on RTTY" Web page (**aa5au.com/gettingstarted/rtty_start5.htm**) that may be a useful reminder to *Windows* users on how to ditch the *Windows* sounds. One way to keep *Windows* sounds from keying your radio is to turn *Windows* sounds off. You do this by going to the *Windows* Control Panel and then to Sounds. Under Schemes, choose "No Sounds." This does not totally eliminate sounds generated by your computer. For instance, the beep sound used in many programs will still be generated. — *73, Dick Kriss, AA5VU, 904 Dartmoor Dr, Austin, TX 78746-5163,* **aa5vu@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

AMATEUR RADIO WORLD

Growing (and Going) for Gold

Ellam, Garpestad Accept Nominations for IARU Leadership

The IARU Constitution states that the ARRL, as International Secretariat, is responsible for initiating discussions with the IARU Administrative Council to identify candidates for President and Vice President. The nominations are made by the International Secretariat, but not until agreement has been reached that the candidates are suitably qualified.

Current IARU President Larry Price, W4RA, confirmed to the IARU Administrative Council (AC) last year that he would not be available to serve another term in that office. Subsequently, the International Secretariat, following consultation with the AC, nominated current IARU Vice President Tim Ellam, VE6SH, of Alberta, Canada, for President and Ole Garpestad, LA2RR, of Vestby, Norway, for Vice President. These names have been submitted to the IARU Member-Societies for consideration. Ballots must be received by the International Secretariat no later than February 10, 2009. Terms begin on May 9, 2009 and are for five years.

Two Amateur Radio Societies Petition to Join IARU

The International Secretariat has informed the Member-Societies that it has received two applications for IARU membership: The Emirates Amateur Radio Society and the Kazakhstan Federation of Radiosports and Radioamateur.

The Emirates Amateur Radio Society (EARS), based in Sharjah, submitted their application via IARU Region 1 to the AC. EARS has 28 licensed members; there are 72 hams in the United Arab Emirates.

The Kazakhstan Federation of Radiosports and Radioamateur (KFRR), also submitted their application to the AC via IARU Region 1. There are 617 licensed amateurs in Kazakhstan and 452 KFRR members.

According to the International Secretariat, IARU Region 1 has examined the applications of EARS and KFRR and found them to be in order, and recommends that the two societies be elected to IARU membership. IARU Member-Societies have until February 10, 2009 to return their ballots.

The IARU Constitution provides that a proposal is adopted "upon the casting of affirmative votes by a simple majority of the Member-Societies who have submitted, within the specified time, a vote or abstention, either on that proposal or in response to one of the three preceding issues of the *Calendar* which contained proposals for consideration by the Member-Societies." Past issues of the Calendar can be found on the IARU Web site (**www.iaru.org/calendars.html**).

IARU-Endorsed Booklet Promoting Ethics, Operating Issues, Now Available

A 67-page booklet, "Ethics and Operating Procedures for the Radio Amateur" by John Devoldere, ON4UN, and Mark Demeuleneere, ON4WW, is now available. The booklet is an "Americanized" version of the booklet that the authors wrote for an international audience. At its June 2008 meeting, the IARU Administrative Council endorsed and recommended the principles set out in the booklet as a means of encouraging all radio amateurs "to operate to the highest levels of proficiency, with proper consideration for others using the amateur radio bands" and as a tool "to teach newcomers and others correct operating behavior." The booklet mainly addresses HF operating issues, but the principles are also applicable to VHF and higher bands.

IARU Secretary and ARRL Chief Executive Officer David Sumner, K1ZZ, expressed appreciation for Devoldere's and Demeuleneere's efforts: "The authors are well known, experienced HF operators who are concerned about on-the-air operating standards and who decided that 'It's better to light a candle than curse the darkness.' Anyone who reads their booklet will learn something, no matter how experienced they may be." The booklet may be downloaded at no cost from the ARRL Web site (**www.arrl.org/awards/dxcc/Eth-operating-ENarrl-SITE-1jul2008.pdf**). The international version is at **www.iaru.org/Eth-operating-EN-iaru-SITE-1July2008.pdf**.

IARU Seeks Input on QSL Bureaus

At its meeting in June, the Administrative Council discussed the problems faced by member-societies in operating the worldwide QSL Bureau system. The existing IARU policy concerning QSL bureaus, Administrative Council Resolution 85-9, was adopted 23 years ago. Much has changed since that time. Postage and other expenses are increasing, while there is a growing trend toward electronic confirmation of radio contacts for awards purposes. After discussion, the Administrative Council agreed that the IARU President will invite the regions to nominate individuals to conduct a study of the future of the QSL bureau system. IARU Member-Societies were requested to complete and return a questionnaire concerning their outgoing QSL Bureau.

Going for ARDF Gold in Korea

The Korean Amateur Radio League hosted the Amateur Radio Direction Finding (ARDF) World Championships in September, and for the sixth time, Team USA made the trip.

VADIM AFONKIN

Members of Team USA ranged in age from 23 to 66 and represented seven states.

According to ARRL ARDF Coordinator Joe Moell, KØOV, this was Team USA's best performance ever. "We had four Top 10 finishes in the two days of fox-finding competition, first with 2 meter AM signals, and then with 80 meter CW signals," he said. "ARRL's team faced more than 300 of the planet's best ARDFers that represented 24 other national Amateur Radio societies."

George Neal, KF6YKN, of Maspeth, New York, led the American team by capturing a bronze medal in the category for men between ages 50 and 59 in the 2 meter foxhunt. He found all four required transmitters and got to the finish line in 1:23:42, less than six minutes behind gold medalist Igor Kekin of Russia. The other Top 10 finishers — all in the 80-meter event — were Vadim Afonkin of Boston, who was 5th in M40 category; Bob Cooley KF6VSE, of Pleasanton, California, who was 7th in M60, and Nadia Scharlau of Cary, North Carolina, who was 9th in W35. QST

S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

This Month in Contesting

Sean Kutzko, KX9X
ARRL Contest Branch Manager, kx9x@arrl.org

HOLIDAY POTPOURRI

The Holidays are always a time of reflection. It's natural to view the end of the year as a measuring tool, and taking stock of the friends and family we have in our lives is important.

Many of the best friends I have today are a direct result of Amateur Radio contesting. There has always been a bond among those who are licensed, but there seems to be something unique among contesters. The best of the best operators are generally unselfish, willing to be an Elmer to the newcomer, and generous with their time and expertise. Many of us had an Elmer when we first got into Amateur Radio; after being licensed for 26 years, the most rewarding aspect of the hobby to me is being able to give back to the community at large and to be an Elmer myself. Giving back what we have learned over the years is not only a good thing to do, it's critical to our survival.

In case you're at a loss for what you can do to Elmer a budding contester, here are just a few suggestions:

- Open your station to those who don't have one.
- Host a multi-operator entry in a contest. Use it as a teaching forum.
- Donate unused gear to somebody who doesn't have any.
- Give a presentation on contesting at your local club.
- Be a GOTA coach at your club's Field Day effort.
- Help with antenna construction for your fellow club members.
- Teach a license class through your local club.
- Sponsor a plaque.
- Assist with the running of a local or regional contest.

While the opportunity to give back is highlighted during this time of the year, the need exists year-round. With a little effort, you could help create more skilled operators who enjoy this aspect of Amateur Radio.

By the time you read this, the ARRL November Sweepstakes will be history. 2008 was the 75th edition of the longest-running domestic contest, and we wanted to make this year special. Thanks to everybody who participated. I'd also like to give a special thank-you to Ray Novak, N9JA, and ICOM America for their continued support of November Sweepstakes. As the Principal Awards Sponsor, ICOM America funds the awards plaques and certificates in the November Sweepstakes that are not covered by clubs or individual sponsors. Without their assistance, many awards would have to be purchased by the winners themselves; that is a significant amount of money to many amateurs. Thanks, ICOM America!

I just got back from the Pacific Northwest VHF Society Conference, held in Moses Lake, Washington. It was a real treat to meet over 100 hams from throughout this propagationally challenged area of the country. Their dedication to VHF+ operating and VHF+ contesting is quite an inspiration. Here is an entire region that simply doesn't benefit from the great propagation the Southeast or the Northeast regions experience, yet they're still hitting it as hard as they can, whether roving, operating from home, or operating from a hilltop somewhere (and there are *plenty* of hilltops in Washington state!).

Some would ask, "If you can't win, why bother contesting?" It's not about the winning, it's about the *doing*. Many people enter other events as diverse as 10k runs to bowling tournaments with no expectations of being Top Dog. Why is contesting held to a different standard? Like any other event, some take it more seriously than others, but the primary motivator should be the Fun Factor. Contesting is still *fun* to me, regardless of the mode, frequencies or output power. December features two great ARRL events: The 10 Meter Contest and the 160 Meter Contest. Check out the rules at **www.arrl.org/contests**, load up the antenna, and focus your time on a single band for the first two weeks of December. If you have any questions, drop me a line; I'll do my best to imbue you with the Fun Factor!

Happy Holidays to all.

December 2008 QUALIFYING RUNS

♦ W1AW Qualifying Runs are 10 PM Friday, December 5 EST (0300Z December 6) (10-40 WPM) and 9 AM (1400Z) Tuesday, December 16. The West Coast Qualifying Run will be transmitted on 3.5815, 7.0475, 14.0475 and 21.0675 kHz by station K6KPH at 2 PM PST (2200Z) Saturday, December 13. Unless otherwise indicated, code speeds are from 10-35 WPM.

In the November/December "Contesting 101"

Kirk Pickering, K4RO, gets philosophical on discovering the competitive streak in all of us, understanding the playing field, location and "fairness," and what that all means in the end. "Contesting 101" can be found in the *National Contest Journal,* published six times per year. For subscription information, visit **www.arrl.org/ncj**.

Operating Tip of the Month

Good Things Come To Those Who Wait. *If you're having trouble working through the pileups of loud stations on Saturday, take a calculated risk and wait until Sunday. The Big Stations will still be there, and the pileups will be smaller on the second day. Don't try this with the rare African or Asian multipliers, though!*

CONTEST CORRAL

in association with the *National Contest Journal*

DECEMBER 2008

Start & Finish	HF	VHF+	Contest Title	SSB	CW	Dig	Exchange	Sponsor's Web Site
4 Dec 0000Z - 4 Dec 0600Z	1.8		Top Band Sprint		✘		RST, S/P/C, ARCI number or Power	qrparci.org/contests
5 Dec 2200Z - 7 Dec 1559Z	1.8		ARRL 160 Meter Contest		✘		RST and ARRL/RAC section if US/VE	www.arrl.org/contest
6 Dec 0000Z - 6 Dec 2400Z	1.8-28		TARA RTTY Mêlée			✘	RST and State/Province or serial	www.n2ty.org/seasons/tara_melee_rules.html
6 Dec 1600Z - 7 Dec 1800Z	3.5		Top Operators Activity Contest		✘		RST, serial, and TOPS/PRO number	www.procwclub.yo6ex.ro
11 Dec 0000Z - 15 Dec 0700Z		50-432	North American Meteor Scatter			✘	Both calls, grid square, and acknowledge	www.sportscliche.com/wb2fko
13 Dec 0000Z - 14 Dec 2359Z	28		ARRL 10 Meter Contest	✘	✘		RS(T), and State/Province or serial	www.arrl.org/contest
13 Dec 0000Z - 14 Dec 2400Z	28		28 MHz SWL Contest	✘	✘		Log ARRL 10 Meter Contest QSOs	hamradio.nikhef.nl/cie/nl/
13 Dec 0000Z - 14 Dec 2400Z	3.5-28	50	PSK Death Match			✘	Name and S/P/C	www.mdxa1.org/deathmatch.html
13 Dec 0000Z - 13 Dec 0200Z	1.8		Russian 160 Meter Contest	✘	✘		RS(T), serial, square ID (see Web site)	www.radio.ru/cq/contest/rule-results/
13 Dec 1400Z - 14 Dec 1400Z	1.8-28		Croatian CW Contest		✘		RST and serial	www.hamradio.hr
14 Dec 2100Z - 14 Dec 2259Z	14		Great Colorado Snowshoe Run		✘		RST, S/P/C, class, CQC number or power	www.cqc.org/contests/snow2008.htm
20 Dec 0000Z - 20 Dec 2400Z	3.5-28		OK DX RTTY Contest			✘	RST and CQ Zone	www.crk.cz/ENG/DXCONTE.HTM
20 Dec 0001Z - 4 Jan 2359Z	1.8-28	50,144	Lighthouse Christmas Lights QSO Party	✘	✘		Serial or ARLHS number	arlhs.com
21 Dec 2000Z - 21 Dec 2400Z	1.8-28		Holiday Spirits Homebrew Sprint		✘		RST, S/P/C, ARCI number or Power	qrparci.org/contests
26 Dec 0830Z - 26 Dec 1100Z	3.5-7		DARC Christmas Contest	✘	✘		RS(T) and DOK or special station code	www.darc.de/referate/dx/fedcx.htm
27 Dec 0000Z - 27 Dec 2359Z	1.8-28	50,144	RAC Winter Contest	✘	✘		RS(T) and province or serial	www.rac.ca
27 Dec 0200Z - 27 Dec 0959Z	3.5-28		RAEM Contest		✘		Serial and lat/long in degrees	www.srr.ru/CONTEST/cup_raem_engl_07.php
27 Dec 1500Z - 28 Dec 1500Z	1.8		Stew Perry Top Band Distance Challenge		✘		Grid square	jzap.com/k7rat/stew.rules.txt
28 Dec 0000Z - 28 Dec 2400Z	14		070 Club QRP DX Scramble			✘	Call sign, first name, DXCC entity	www.podxs070.com

All dates refer to UTC and may be different than calendar date in North America. No contest activity occurs on 30, 17, 12 meters.

Refer to the contest Web sites for full rules, scoring information, operating periods or time limits, and log submission information.

Serial — Sequential number of the contact. S/P/C — State, Province, DXCC Entity

Publication deadline for Contest Corral listings is the first of the second month prior to publication.

Check for updates, additional contests and a downloadable PDF version online at www.arrl.org/contests

Sean's Picks

- **State QSO Parties this month:** None.

ARRL 160M Contest (Dec 5-7): Top Band is a great place to be, especially at the bottom of the sunspot cycle. Take whatever wire you can and load it up; you *will* make QSOs!

- **ARRL 10M Contest (Dec 13-14):** There will be lots of action in this one. Technician-class licensees can work SSB from 28.3 MHz-28.5 MHz; jump on in and get your hands on some winter Sporadic-E.
- **North American High-Speed Meteor Scatter Contest (Dec 11-15):** Bounce a VHF+ signal off an incoming meteor and you can work stations over 1000 miles away. Use voice, CW or the digital mode FSK441 with free *WSJT* software. This one is a *lot* of fun!
- **PSK31 Death Match (Dec 13-14):** An entire weekend of Digital fun. A great event run by the Michigan DX Association. Everybody works everybody! First place gets a sword!
- **OK RTTY DX Contest (Dec 20):** The Czechs come out in full force in this fine RTTY event. Try your hands at the QRP category for an added challenge!
- **RAC Winter Contest (Dec 27):** The Canadians know how to throw a party. See how many of the Canadian provinces you can get in your log.
- **Stew Perry Top Band Distance Challenge (Dec 27-28):** Sponsored by the Boring (OR) ARC, this unique event features distance-based scoring. You'll need to know your Maidenhead Grid Square for this one, which is the common data exchanged among VHFers.

www.arrl.org/contests

"Just the Facts" — ARRL Field Day 2008

With a tip of the hat to Jack Webb, we investigate this annual phenomenon that looks suspiciously like a whole lot of fun.

Dan Henderson, N1ND
Field Day "Detective"

When the sunny days of June come, some people will spend countless hours throwing baited hooks into waterways hoping to snare the largest fish ever. Others will swing wildly at small, dimpled balls on green pastures known as courses trying to make pars and avoid bogeys. You will find others who will walk with a purpose, mow grass or find many other ways to amuse and entertain themselves.

But for some when the fourth full weekend of June arrives, they will eschew all other forms of recreation and entertainment to spend their time frantically throwing ropes through trees, pulling up wires and spending hours speaking into electrical devices. Perhaps some are pounding pieces of brass to make electrical impulses promulgate through the atmosphere or typing into a computer making messages that will then transmit through the ether. Tens of thousands of these perpetrators gather to partake in this annual ritual… And when that happens, I become involved…My name is Hiram…I carry a call sign.

The story you are about to read is true… No call signs have been changed because none of the participants are innocent…

Top 10 Claimed Scores

Call Sign	Score	Class
W3AO	33,664	23 A
W4IY	21,108	9 A
K2AA	19,434	6 A
W2RDX	17,978	3 A
W9CA	17,552	3 A
W6YX	17,108	4 F
K1R	15,980	5 A
W2EN	15,088	3 F
K4LRG	15,060	5 A
W1NVT	14,754	2 A

It was Friday evening June 27. I was working the weekend watch out of the Maxim Memorial Station on Main Street in Newington when we received the first notice that something might be up. It seemed that W1AW was sending out a transmission known as a "Field Day bulletin." I had heard this before and for some reason this activity always signaled the start of the rampant raucous radio reverberations associated with this "Field Day" activity. After consulting with our chief, "The Old Man" himself, my partner Percy and I decided we had better pay close attention over the next hours, as we were never sure what to expect when this episode began.

Things remained quiet for the next few hours, but based on past years we knew that it was during this quiet time after the first bulletins that the "perps" were finalizing their plans for the assault that began for most groups on Saturday morning. And it was shaping up to be huge — in fact, we ended up with reports of a record number of perps, uh, participants — more than 35,000 were apparently involved. This was going to take a lot more work than usual to handle.

We had gotten the word from our snitch, Joey C (who was known to hang around W1AW), that at precisely 1800 UTC on Saturday June 28 the frenetic firing of electrons would begin. And so they did…Over the rest of this "Field Day" over 1.2 million contacts, known as QSOs, were completed. This was an amazing number of contacts, considering that some clown known as Ol' Sol had apparently stolen all of a rare resource known as "sunspots," which made QSOs hard to come by on many bands. My partner Percy commented he hadn't seen such a caper since Claude Cooper, the kleptomaniac from Cleveland, copped the clean copper clappers from the Acme School Bell Company — the famous Sgt Joe Friday case from *Dragnet*. A curious clue came from this data — the number of digital QSOs continued their climb, representing over 2% of the total contacts completed for the first time ever. They were coming in faster than a Chicago typewriter.

"The Old Man" had reminded Percy and me that we needed "only the facts," but gathering them was turning into a titanic task. As we started deciphering the exchanged messages for clues, we realized that they seemed to be coming from all over. It turned out that participants from every US state, territory and ARRL section except the Virgin Islands, and all Canadian provinces and territories acknowledged their activities by submitting an entry report. Most were received via the **www.b4h.net\cabforms** Web site, which garnered them an immediate acknowledgment of their activities as well as bonus points. Ohio and Michigan led the way with reported activities — this was truly a continent-wide escapade.

Joey C (our snitch) reminded us that it might be hard to track down all of the perpetrators because in the past the majority of them "went on the lam" and operated from places other than their normal comforts of their homes. Again, Joey C was right — as it turned out, 1694 of the entries claimed to

Field Day Entries by Class

1A	166	1B1	169	1E	203
2A	487	1B2	62	2E	27
3A	338	2B2	21	3E	18
4A	122	3B2	1	4E	3
5A	82			5E	3
6A	35	1C	53	9E	1
7A	15	2C	1		
8A	12	4C	1	1F	23
9A	7			2F	75
10A	2	1D	373	3F	43
12A	2	2D	15	4F	16
15A	1	3D	12	5F	9
18A	1	4D	4	6F	2
23A	1	7D	1	8F	2

General Field Day Stats

	2008	2007	2006	2005	2004
CW QSOs	506,139	511,580	518,799	503,205	517,738
Digital QSOs	27,869	22,112	21,459	21,766	20,940
Phone QSOs	702,847	679,240	696,567	692,722	787,444
Total QSOs	1,236,855	1,212,932	1,236,825	1,217,693	1,326,122
Total Entries	2409	2331	2199	2212	2241
Novice/GOTA	447	467	432	396	436
Participants	35,798	34,833	32,506	33,078	33,002

Entries by ARRL Section

Section	Entries
AB	10
AK	8
AL	29
AR	21
AZ	44
BC	29
CO	46
CT	32
DE	6
EB	18
EMA	31
ENY	29
EPA	62
EWA	13
GA	60
IA	28
ID	11
IL	80
IN	51
KS	32

Section	Entries
KY	32
LA	18
LAX	37
MAR	10
MB	3
MDC	47
ME	20
MI	92
MN	46
MO	55
MS	17
MT	20
NC	73
ND	9
NE	14
NFL	38
NH	22
NL	5
NLI	27
NM	23

Section	Entries
NNJ	39
NNY	8
NTX	53
NV	8
NWT	2
OH	115
OK	27
ON	68
OR	44
ORG	44
PAC	9
PR	5
QC	24
RI	14
SB	13
SC	23
SCV	38
SD	9
SDG	23
SF	14

Section	Entries
SFL	24
SJV	26
SK	1
SNJ	24
STX	55
SV	25
TN	55
UT	18
VA	76
VT	13
WCF	23
WI	46
WMA	13
WNY	38
WPA	45
WTX	12
WV	16
WWA	62
WY	11

be operating as either class A, B or F, which would put them out in the field. Hmm…In the field for Field Day…This could be a significant clue. As it turned out, there was a Web site where perps could post details about their operating locations, making it easier to draw accomplices into the action. Joey C reminded us that this Web site (**www.arrl.org/contests/announcements/fd/locator.php**) was a new feature — and used by over 1500 participants. This thing had spread like wildfire.

At 2100 UTC on Sunday, June 28, the activities on the air stopped as suddenly as they had begun. As we combed the rules for clues we discovered that this was a once a year event and most stations were limited to 24 hours of operating time. So all Percy and I could do at HQ was to accumulate the several thousand incoming reports and see what sense we could make of this activity.

Things quickly came into focus as we worked on our report for the record. Apparently this "Field Day" thing was intended to test Amateur Radio operators and their ability to get on the air in less than ideal circumstances. It has been taking place for over 70 years and there doesn't appear to be an end in sight. Over 170 of these groups openly shared details of their activities with others on the ARRL Contest Soapbox, which we found online at **www.arrl.org/contests/soapbox/**. Seems people are prone to "brag" about their activities during Field Day — something that can be understood after you read their comments and see the pictures in the Soapbox.

So the best Percy and I can do is surmise that this Field Day takes place every year on the fourth full weekend in June — that means that we will be busy June 27-28, 2009. And based on the results and reports we received, I think we can advise that this is the most popular 24 hour Amateur Radio activity in the world. Our best bet…join in the fun — after all, if you can't beat them, join them!

Scores

Class A stations are clubs or groups operating with more than two operators. Score listings are grouped according to the number of transmitters in simultaneous operation. The listings show club or group name, call sign(s) used, total number of QSOs, number indicating power output used (5 is less than 5 W, 2 is less than 150 W; 1 is more than 150 W), number of participants and total score including bonus points and ARRL section. Scores are listed from highest to lowest in each class. Class B stations are portables manned by one or two operators. When there are two operators, the other operator's call is listed in parentheses, if it is known. Class C stations are mobiles. Class D stations are home stations using commercial power. Class E stations are home stations using emergency power. Class F stations are EOC stations.

1A

San Diego DX/Pt Loma ARC
W6PT 2457 2 7 8,596 SDG
South Heartland Contest Society
WØICT 1651 2 7 6,862 KS
Bonfield Area Radio Fraternity
K9TP 1480 2 3 6,688 IL
Union City Wireless Assn
W3CG 1702 2 11 5,866 WPA
Army Research Lab ARC
W3ARL 1318 2 7 5,722 MDC
N4OL 1199 2 13 5,560 NC
Tucson Tracon ARC
WA7NB 2079 2 3 5,390 AZ
Robert F Heytow Memorial RC
K9YA 1130 2 6 5,270 IL
Case ARC
W8EDU 1311 2 4 5,058 OH
Mobile Em Com Club
W3USA 1540 2 4 4,944 OH
Bozo and the Lids
W9TG 977 2 6 4,748 IL
Greer ARC
W4IT 1327 2 12 4,744 SC
Friends and Alumni of LT
K1LT 1071 2 8 4,624 OH
Buckeye DX Club
W8OS 1041 2 4 4,614 OH
KY IN DX Assn
NW4T 1015 2 4 4,582 KY
Metro DX Club
W9TY 1441 2 10 4,520 IL
Dr. Loomis Memorial Junior Mechanics League
W3KDR 1478 2 13 4,506 MDC
Gunnison Valley ARC & Pitkin ARC
WØFD 1344 2 14 4,474 CO
Wildcat Creek Contestors
W9PC 1114 2 5 4,400 IN
Koolau ARC & Emergency ARC
KH6J 1191 2 50 4,146 PAC
West Island ARC
VE2CWI 861 2 27 4,066 QC
Associated Radio Amateurs of So New England
W1AQ 1293 2 22 3,826 RI
Acadiana ARA
W5DDL 760 2 42 3,780 LA
Big Hill ARC
KØHP 768 2 3 3,616 SD
Gila ARS
K5GAR 1045 2 10 3,590 NM
South Georgian Bay ARC
VE3SGB 1276 2 8 3,502 ON
Loop Group
K4QXX 1010 2 16 3,414 WCF
Alberta Clippers
VE6EX 735 2 5 3,244 AB
Scorpion Ranch Hands
WS4Y 891 2 4 3,060 KS
IOOK
KN8J 490 2 12 2,836 WV
Garden State ARA
K2USA 653 2 22 2,686 NNJ
VE2CRB 819 2 13 2,666 QC
Greater Lansing DX Group
N8VYS 493 2 10 2,622 MI
Newton ARA
WØWML 462 2 15 2,474 IA
Oklahoma DX Assn
K5YAC 1450 1 3 2,470 OK
Southwest Mississippi ARC
W5WQ 695 2 19 2,452 MS
First State ARC
K3QBD 572 2 16 2,336 DE
WPPS RC
W7POE 404 2 3 2,266 MT
Gallatin Ham RC
W7ED 701 2 15 2,232 MT
Jasper RC
K4BEH 389 2 15 2,202 GA
Central WI Radio Amateurs @ UWSP
K9UW 732 2 11 2,174 WI
Lanark North Leeds ARES Group
VE3LCA 296 2 11 2,096 ON
Loudon Co. ARES
W4FLO 436 2 22 2,096 TN
Valley Baptist Comm Group
KD4HXT 706 2 3 2,032 SJV
Morris RC
W2YD 440 2 13 1,990 NNJ
Monroe ARC
WZ4V 747 2 12 1,944 TN
Athens Co ARA
W8MHV 300 2 8 1,942 OH
Reno Co Kansas ARA
WØWR 302 2 17 1,920 KS
Benton ARS
K5NE 444 2 11 1,892 AR
SHARK
N5AF 371 2 35 1,882 STX
Union Metropolitaine des Sans-filistes de Montreal
VE2UMS 342 2 60 1,856 QC
Covey Hill ARC
VE2CYH 521 2 23 1,788 QC
Stanly Co ARC
K4OGB 592 2 18 1,784 NC
Dixie Radio Pirates
N4ARR 598 2 12 1,766 NC
KB7TG 837 1 9 1,724 MT
Hattiesburg ARC
K5PN (+W5CJR)
518 2 30 1,720 MS
Harrison ARS
W5JJ 435 2 5 1,656 AR
USS Jurassic
K8SSJ 150 2 9 1,642 OH
North Country ARC
W2LCA 234 2 9 1,492 NNY
Halton ARC
VE3OD 296 2 13 1,464 ON
The Wind Blown Lightning Rods
WY7FD 333 2 3 1,460 WY
Bonanza Lightning Dodgers
WT7B 633 2 6 1,436 ID
Bawating Amateur Group
VE3LSC 307 2 3 1,434 ON
Sandia National Laboratories ARC
W5MPZ 476 2 8 1,412 NM
Maui ARC
KH6RS 1062 1 5 1,412 PAC
Maui ARC
KH7RS 1062 1 5 1,412 PAC
VE7LGY 202 2 13 1,384 BC
Chicago FM Club
WA9ORC 759 1 41 1,349 IL
Benson Co ARC
NØBG 227 2 7 1,306 ND
W4UX 302 2 3 1,272 TN
KA8PIZ 359 2 3 1,260 MI
Marshall Co ARC
WØGCJ 220 2 14 1,252 KS
North Augusta-Belvedere RC
K4NAB 221 2 46 1,216 SC
EM-TE-EMRS
W6SRS 292 2 3 1,126 SCV

Southern Plains Amateur Radio Klub
NØRZ 239 2 22 1,124 KS
Caroll Co. ARC
KD8AMX 237 2 10 1,084 OH
Coastal ARA
W4BWZ 293 2 8 1,076 SC
Tidelands ARS
K5BS 135 2 20 1,062 STX
West Park Junior Ops
W8AJF 260 2 4 1,056 OH
Satellite ARC
W6AB 240 2 5 1,030 SB
Lake Of the Woods ARS
VE3JJF 215 2 8 1,026 ON
VA3BRC 158 2 10 1,024 ON
World Radio Staff ARC
WR6WR 356 2 3 1,012 SV
W7GVE 452 1 3 1,004 AZ
Granite Bay Montessori School
K6GBM 140 2 9 952 SV
TERAC
K7AUO 392 2 3 952 WWA
Parma RC
W8PRC 253 2 10 950 OH
WNØG 251 2 3 938 IA
VFW Post 3115 ARC
KFØTG 314 2 6 878 CO
BSA Venturing Crew 80
W3BSA 200 2 5 870 VA
ARC of Augusta
W4DV 131 2 14 858 GA
Montgomery Auxiliary Comm Service
KN3U 253 2 3 846 MDC
Iola ARC
KDØEAX 140 2 8 840 KS
Owensboro ARC
K4HY 131 2 6 826 KY
Niagara Co ARES
K2ZT 663 1 3 813 WNY
Gateway Technical College ARC
N9GTC 116 2 14 798 WI
Calvert ARA
K3CAL 75 2 8 786 MDC
Ogdensburg ARC
K2RUK 136 2 21 782 NNY
Western Mass ARG
W1WMA 184 2 8 768 WMA
Williston Basin ARC
KØWSN 315 1 8 765 ND
Mine Canyon Contest Club
W6E 252 2 4 754 SCV
WD8MQN 144 2 10 740 VA
Smoky Mountain AR Team
N4GSM 216 2 3 732 NC
SKATS
W4L 182 2 18 714 KY
Wheat State Wireless Assn
NØAG 220 2 6 714 KS
Piqua ARC
W8SWS 117 2 30 708 OH
Gorge East AR
KE7EEM 74 2 13 694 OR
Jacks Peak ARA FD Group
K5CAB 171 2 3 692 NM
Hickory Corners Engineering Society
W8JGC 240 2 5 680 MI
Tasis Comm Group
KC2NYS 51 2 22 652 WNY
W8LBZ 250 2 8 650 OH
AC7FT 120 2 3 638 OR
N7WS 189 2 4 628 AZ
Silver Circle
W6JA 256 2 4 612 SJV
Manistee Radio Amateur Em Service
WZ8N 71 2 4 592 MI
Cypress Chapter
KI4ZCB 148 2 12 590 NFL
NØWP 143 2 4 576 VA
Wellesley ARS
W1TKZ 75 2 25 564 EMA
MITRE Bedford ARC
W1ON 58 2 15 518 EMA
Rowlett RACES
KM5VZ 30 2 19 510 NTX
Team Heise
NØFOI 153 2 14 496 NTX
Club de Radio Amateur du Madawaska
VE9CRM 112 2 6 474 MAR
Country Cabin RC
WØAXT 50 2 6 470 IA
KD5PTM 61 2 3 412 WTX
CT ARL of Youth
K3KID 115 2 11 400 CT
Westside ARC
WA6RC 67 2 10 384 LAX
Foothills ARC
W3LWW 42 2 13 380 WPA
WA4UQC 27 2 6 358 NC
SEMARC
K7HWK 77 2 5 354 MT
NKDXE
WA4ZKO 71 2 3 342 KY
KØLVS 95 2 3 340 VA
Ellicott ARC
KDØCPA 91 2 4 332 CO
KD5PTL 6 2 3 302 WTX
Watertown ARC
N9HR 54 2 26 288 WI
NØJHX 71 2 10 242 MO
Sweetwater ARC
WY7U 65 2 10 230 WY
Mayerthorpe Flying Tigers
VE6FT 19 1 12 219 AB
KC7QMF 4 2 3 198 WTX
K5NLX 27 2 3 154 AR
So IL Univ ARC
W9UIH 46 2 6 142 IL

1A Battery

N4BP 873 5 3 9,445 SFL
Chew's Ridge Gang
K6MI 519 5 6 6,110 SCV
Los Chupacabraderos
N5JO 283 5 9 3,450 STX
Marconi ARC of Newfoundland
VO1MRC 166 5 4 2,430 NL
Rochester ARC-QRP
WØSAA 136 5 18 2,310 MN
Hiawatha / Falls City ARC
WEØC 213 5 28 2,125 KS
Minnesota QRP Soc
WQØRP 150 5 3 1,930 MN
Bear Mountain QRP Group
K5LWN 157 5 7 1,815 NM
Solder Monkeys
W7FC 85 5 5 1,200 OR
Yarmouth RC
W1YAR 51 5 3 1,105 ME
Green Mountain Boys
WA1QGC 79 5 3 955 VT
Terrace ARC
VE7NWZ 40 5 8 725 BC
Club Radioamateur St. Hyacinthe
VE2CAM 34 5 4 390 QC
Southwest Gallia Contest Group
NC8CC 35 5 3 345 OK

1A Commercial

VE2CRL 502 2 10 1,354 QC
Dairyland Xpeditionary Keyers
WE9L 392 2 3 1,016 WI
Callaway ARL
KSØB 347 2 8 944 MO
Mobile Ohm Volunteers
N9OQT 123 2 9 848 IL
Clinton ARC
WØCS 165 2 31 680 IA
Huntingdon Co ARC
W3VI 104 2 12 620 WPA
Englewood ARA
W2RJ/2 114 2 8 600 NNJ
Franklin ARC
WF4RC 184 2 9 472 VA
CRA Sorel Tracy
VE2CBS 123 2 12 454 QC
Atchison Co. AR Service
KØHK 60 2 10 436 KS
Pathfinders ARC
VA4PAR 71 2 10 332 MB
VA3PRC 99 1 10 99 ON

2A

Radio Amateurs of Northern Vermont
W1NVT (+W1PU)
4779 2 29 14,754 VT
Buckhead CC
W4KJ (+W4TE)
3753 2 8 12,774 GA
Central Virginia Contest Club
W4ML (+WK4Y)
3110 2 44 11,840 VA
The Udder Club
W1MOO (+W1ARF)
3624 2 17 11,574 VT
Falmouth ARA
K1RK (+W1HQH)
3449 2 70 11,532 EMA
Batesville ARC
NG5M (+KD5J)
3484 2 20 11,134 AR
Raytown ARC
KØGQ (+WØHV)
2795 2 79 10,792 MO
Eastern MI ARC & Thumb Area CC
K8EPV (+K8FGL)
2188 2 18 9,780 MI
Hoosier DX & CC
KJ9D (+N9NS)
2597 2 14 9,662 IN
McMinn Co ARC
NA4K (+NA4IT)
2231 2 39 9,442 TN
Halifax ARC
VE1FO (+VE1TRI)
2785 2 37 9,420 MAR
Randallstown ARC
N3IC (+K3AN)
2494 2 17 9,022 MDC
Billerica ARS
W1HH (+N1HY)
2308 2 27 8,998 EMA
Providence RA
W1OP 2934 2 18 8,938 RI
The Sakonnet 49'ers
W1LY (+K1DA)
2744 2 23 8,866 RI
Valley and Massanutten ARA
W4XD (+K4MRA)
2651 2 70 8,810 VA
Saratoga ARA
K6SA (+K6NN)
2403 2 35 8,512 SCV
Big Bend ARC
K5FD (+W5ATO)
2303 2 15 8,308 WTX
CARS
K4M (+W4PQ)
2364 2 22 8,306 NC
Hudson Valley Contesters and DXers
W2MU 2566 2 14 8,026 ENY
Marin ARS & REDXA
W6SG (+W6XU)
2330 2 50 7,996 SF
Pikes Peak DX Group
WØGG (+KFØW)
1934 2 15 7,910 CO
Fond Du Lac ARC
W9EBV (+N9NE)
2126 2 38 7,892 WI
Williamson Co ARC
W5C (+WC5T)
1954 2 25 7,754 STX
Mother Lode DX and Contesting Club
K6NV (+KI6ESK)
1917 2 10 7,618 SV
Escondido ARS
N6SD (+N6WB)
2251 2 37 7,562 SDG
Tilson Contest Group
K5WA (+KB5GTB)
1717 2 9 7,530 STX
Santa Barbara ARC
K6TZ 1883 2 30 7,360 SB
Motor City RC
W8MRM (+W8GTZ)
1743 2 77 7,220 MI
Stones River ARC
N4SDM (+K4CM)
1731 2 45 6,826 TN
Wayne ARC
W8AV (+N8IW)
1850 2 18 6,768 OH
Cape Fear ARC
K4MN 1940 2 26 6,710 NC
Texas DX Society
K5DX (+N5UR)
1869 2 60 6,630 STX
Hagg Lake FD Group
K7ZS (+KØRNE)
2191 2 9 6,502 OR
Texas AR Rescue Group
K5LFD (+W5LYS)
1945 2 24 6,388 NTX
Minden ARA
N5RD (+N5SEG)
1774 2 26 6,272 LA
Reelfoot ARC
K4RFT (+N4MJ)
1440 2 25 6,224 TN
Indianapolis RC
W9JP (+W9RCA)
2010 2 40 6,192 IN
Oregon High Desert CC
K7AW 1554 2 3 6,112 OR
PARC & PRA
W1HP (+K1KKM)
1489 2 16 6,098 EMA
Lake Co ARC
W9LJ (+W9EMA)
1648 2 18 6,096 IN
Meriden ARC
W1NRG (+W1XPW)
1601 2 30 6,092 CT
W/K ARC of Greater Milwaukee
N9AW 1618 2 8 6,088 WI
Northern Ohio DX Assn
W8DXA (+NO8DX)
2017 2 25 6,074 OH
Smith Chart ARS
K4OO 1620 2 15 6,052 VA
Fidelity ARC
W1MB (+K1NQG)
1658 2 29 6,010 RI
Pacific Co ARC
W7RDR (+K7KID)
1394 2 30 5,914 WWA
Madera Coy ARC
W6A (+K6MXZ)
1546 2 32 5,868 SJV
Boulder ARC
WØDK (+WMØG)
1545 2 31 5,792 CO
Williamsburg Area ARC
K4RC (+NR4C)
1572 2 41 5,690 VA
Lynchburg ARC
K4CQ (+K4ALE)
1529 2 25 5,644 VA
Big Island ARC
KH6EJ 1248 2 51 5,530 PAC
Northwest ARS
W5NC (+N5NXS)
1248 2 72 5,404 STX
Monroe Co Radio Comm Assn
W8PI (+W8DWL)
1596 2 8 5,376 MI
Candlewood ARA
W1QI 1638 2 30 5,350 CT
Fresno ARC
W6TO 1338 2 22 5,328 SJV
LARC-FARL
K8UNS (+K8UTT)
1423 2 40 5,328 MI
West Allis RAC
W9FK 1485 2 14 5,300 WI
Nashoba Valley ARC
N1NC (+K1NNJ)
1461 2 23 5,280 EMA
Mountaineer ARA
W8SP 1469 2 24 5,242 WV
Schaumburg ARC
N9RJV (+WA9UBR)
1214 2 46 5,160 IL
KØLIR 1422 2 23 5,150 MO
North Shore ARC
VE7NSR (+VE7CTV)
1217 2 27 5,148 BC
MARC
KK5I (+W5EJK)
1550 2 20 5,046 OK
MARCA
W7MOT (+WB7SCK)
1431 2 20 4,994 AZ
Waltham ARA & Clay Center ARC
W1MHL (+W1CLA)
1375 2 15 4,956 EMA
Ski Country ARC
KØRV (+WWØAL)
1346 2 33 4,948 CO
Stu Rockafellow ARS
W8NJH (+AA8RK)
1392 2 18 4,796 MI
Mifflin Co ARC
WU3U 1166 2 4 4,780 WPA
Montrose ARC
KØIIT (+KIØKY)
1236 2 36 4,768 CO
Mid-MO ARC
NØSS (+KØETY)
1066 2 30 4,728 MO
Kent Co ARC
W3HZW (+AA3ZH)
1054 2 40 4,724 DE
Montgomery ARC
KV3B (+W3EXP)
1496 2 29 4,706 MDC
Arrowhead RAC
WØGKP (+NØGSC)
1088 2 38 4,692 MN
Oakville ARC
VE3HB (+VE3OGP)
1157 2 20 4,680 ON
New Providence ARC
N2XJ (+K2UI)
1258 2 33 4,678 NNJ
Anderson RC
N4AW (+N5CSA)
1199 2 10 4,610 SC
NorthEast RC
NW2C 1253 2 27 4,596 NLI
Utah ARC
W7SP (+K7LO)
1033 2 45 4,572 UT
Green River Valley ARS
K9WM 1277 2 24 4,564 IL
Hancock ARC
W9ATG (+N9TT)
1181 2 44 4,554 IN
Massillon ARC
W8NP (+KC8IDJ)
1104 2 25 4,530 OH
Thomas Edison Memorial RC
NI8G 1039 2 3 4,496 OH
Tampa ARC
N4TP (+K4NQ)
1114 2 25 4,460 WCF
Tennessee Valley DX Assn
W4PL 1242 2 30 4,222 TN
K2PUT (+K2PC)
1153 2 46 4,218 ENY
Central Oregon DX Club
N7LE (+W7CTA)
1052 2 15 4,210 OR
W8AL (+NX8J)
1046 2 31 4,190 OH
San Mateo RC
W6UQ 1285 2 18 4,180 SCV
OH-KY-IN ARS
K8SCH (+N8YC)
1216 2 24 4,166 OH
Palos Verdes ARC
K6PV 1048 2 22 4,160 LAX
MIT Radio Society
W1MX (+W1GSL)
1072 2 17 4,156 EMA
Tallahassee ARS
K4TLH 1124 2 43 4,152 NFL
WØBU 995 2 54 4,118 MN
Lakes Region Repeater Assn
W1UR (+W1BST)
1391 2 7 4,086 NH
Eastern Panhandle ARC
K8EP (+N3JDR)
1077 2 20 3,974 WV
North East Tarrant ARC
N5EOC (+NI9U)
811 2 15 3,968 NTX
Tipton ARS
KE4ZBI 945 2 14 3,900 TN
Goshen ARC
K9WJU 860 2 30 3,862 IN
Harrisburg RAC
W3W 848 2 20 3,820 EPA
Hilltop Transmitting Assn & Keystone VHF Club
W3ZGD (+AD3PA)
1175 2 14 3,814 EPA
ARC Emer Comm Svc
WB2QBP (+K2ARC)
1279 2 23 3,806 NLI

Johnson Co RAC
WØERH (+KCØYDZ)
914 2 60 3,720 KS
Delaware Valley RA
W2ZQ (+KB2SYB)
970 2 22 3,716 SNJ
Yonkers ARC
W2YRC (+KF2FK)
809 2 31 3,700 ENY
3 Amigos
W2MF 1224 2 3 3,656 SNJ
Souris Valley ARC
KØAJW 792 2 15 3,648 ND
Montgomery ARC
W4AP (+KV4AC)
823 2 57 3,582 AL
Peterborough ARC
VE3RB (+VE3KRG)
857 2 22 3,578 ON
Tippecanoe ARA
W9REG (+K9FOH)
735 2 15 3,576 IN
Richmond ARC
VE7RAR (+VE7QRM)
630 2 27 3,572 BC
Oswego Cty RACES/Fulton ARC
W2OSC 1067 2 20 3,504 WNY
Ottawa ARC
VE3RC 897 2 40 3,464 ON
Peekskill / Cortlandt ARA
W2NYW 1109 2 10 3,460 ENY
Fox Cities ARC
W9ZL 792 2 49 3,442 WI
NC Contest Group
K4KQ 947 2 35 3,422 NC
Heartland DX Assn
NIØDX 880 2 15 3,392 NE
Harris Intersil ARC
K4HRS (+WA4AQV)
670 2 13 3,370 SFL
Cedar Valley ARC
WØGQ (+KØECW)
837 2 26 3,338 IA
Central Michigan ARC
W8MAA (+KC8QZB)
730 2 20 3,318 MI
South Baldwin ARC
K4A 864 2 31 3,308 AL
K9GXU 838 2 21 3,284 IL
East Greenbush ARA
W2EGB (+K2CK)
1120 2 35 3,266 ENY
Horned Toad Acres Wireless Assn / Explorer Post 599
WA2DFI (+N7KQ)
826 2 28 3,202 AZ
Jupiter Tequesta Repeater Group
WY5I (+N4T)
884 2 198 3,166 SFL
Catalina Amateur Repeater Assn
AD6HK 1249 2 12 3,148 LAX
Sierra Blanca ARC
KR5NM (+WB5LYJ)
541 2 31 3,134 NM
South Bay ARC
W6SBA 680 2 29 3,126 LAX
Randolph Co ERC
K4RAN (+KI4WIQ)
1195 2 12 3,122 AL
KD8SQ 1425 2 8 3,120 OH
Charlestown Ham Radio Team
KA1RI 641 2 16 3,100 RI
K9IU//K9DIY/K9SOU Clubs
K9DIY (+K9SOU)
615 2 50 3,092 IN
Ascension ARC
K5ARC 735 2 25 3,090 LA
Santa Clara Co ARA
W6UW (+W6UU)
762 2 20 3,076 SCV
N6ER (+W6KOS)
729 2 40 3,070 ORG
Fists Along the Mohawk ARC
W2FAM 569 2 3 3,026 WNY
Crawford ARA
W3MIE 710 2 30 3,014 WPA
Six Meter Club of Chicago
K9ONA 799 2 18 2,998 IL
Vashon Maury Island RC
W7VMI 570 2 29 2,984 WWA
Long Island Mobile ARC
W2VL (+W2UFT)
721 2 61 2,980 NLI
Blackstone Valley ARC
W1DDD (+W1JMZ)
877 2 31 2,930 RI
Fort Madison ARC
WFØRT (+WØFUN)
481 2 15 2,902 IA
FCARC
WE4A 804 2 22 2,880 NC
Radio Operafores Del Ests
KP3RE 505 2 32 2,878 PR
Schuylkill ARA
W3SC 878 2 9 2,878 EPA
Blossomland ARA
W8MAI (+W8KIT)
695 2 53 2,876 MI
Ellsworth AWA
W1TU (+W1TA)
711 2 14 2,876 ME
Mecklenburg ARS
W4BFB (+NC4DP)
607 2 50 2,838 NC
Central Missouri RA
KØSI 604 2 30 2,826 MO
West Nodaway Rockets
WØWNR (+NØUB)
695 2 12 2,824 MO
Temple ARC
W5LM (+W5T)
643 2 39 2,786 NTX
Los Alamos ARC
W5PDO (+WD5JRO)
738 2 20 2,766 NM
Lowell ARC
W8LRC (+KC8REH)
1044 2 17 2,766 MI
Paso Robles ARC
W6R (+N6KKS)
1427 1 20 2,762 SB
Algoma ARC
VE3SOO 746 2 8 2,750 ON
Mills Co ARC
K5TRO (+N5QBU)
519 2 10 2,734 NTX
Austin ARC
W5KA (+K5LBJ)
551 2 57 2,710 STX
Hendricks Co ARS
N9HC 566 2 24 2,692 IN
Middle Peninsula ARC
W4HZL 516 2 29 2,682 VA
St. Louis and Suburban RC
WØSRC (+WØDCW)
613 2 85 2,680 MO
Penn-Mar RC
W3MUM 850 2 22 2,630 EPA
Valencia Co ARA
K5OUR 442 2 120 2,620 NM
Irvine Disaster Em Comm
N6IPD (+K6NL)
811 2 40 2,616 ORG
Northville ARA
NA1RA (+WJ1D)
936 2 15 2,612 CT
Kingsport/Bays Mountain ARC
W4TRC 974 2 20 2,598 TN
Goddard ARC
WA3NAN (+KB3PEE)
844 2 12 2,584 MDC
Club Radio Amateur de Quebec
VE2CQ 595 2 25 2,560 QC
Colorado Mountain Moguls
WØDZ 562 2 9 2,550 CO
Sonoma Co Radio Amateurs
W6SON (+W6LFJ)
544 2 36 2,536 SF
South Lyon Area ARC
N8SL 665 2 16 2,496 MI
Table Mtn Group
WA7NCL 560 2 3 2,470 EWA
Boulder ARC Jr
ACØGW 576 2 67 2,470 CO
EPCOM
VE7PCE 694 2 19 2,468 BC
Rockingham Co ARC
N4IV 558 2 18 2,424 NC
LeFrog
W9VBQ 559 2 8 2,376 WI
Kamloops ARC
VE7UT 397 2 34 2,372 BC
Olive Branch ARC
W5OBM (+W5KDM)
574 2 20 2,356 MS
Southtowns ARS
WB2ELW (+KB2ESM)
484 2 30 2,336 WNY
Eastern Shore ARC
K4BW 526 2 17 2,314 VA
HF Radio Group
W2US 423 2 3 2,310 NNY
Neptue ARC
W2NRC 451 2 65 2,294 NNJ
Englewood ARS
N4FA 547 2 22 2,264 WCF
Quinte ARC / Prince Edward RC
VE3RL 514 2 20 2,262 ON
Parkersburg ARK
N8NBL 646 2 25 2,260 WV
Coshocton Co ARA
W8CCA (+WN8RGW)
409 2 30 2,258 OH
Fluvanna Co ARES Group
WO4R 811 2 15 2,246 VA
Palms West ARC
W4SS 595 2 15 2,240 SFL
Northwest Ohio ARC
W8EQ 524 2 10 2,238 OH
Trident ARC
N4EE (+W4ANK)
460 2 14 2,218 SC
Prescott-Russell ARES Group
VE3PRV 526 2 20 2,198 ON
ARES LAX NW/SW
N6HD 685 2 25 2,184 LAX
HAM Assoc of Mesquite
WJ5J (+K5ADC)
369 2 45 2,182 NTX
Florida Atlantic University ARC & Boca Raton ARA
K4FAU (+N4KK)
513 2 29 2,176 SFL
Em Comm Assn of SCC
WØECA 502 2 12 2,160 MO
Benzie Amateur Radio Friends
W8BNZ 599 2 36 2,154 MI
Elko ARC
W7V (+W7LKO)
585 2 30 2,144 NV
Santa Fe Trail Amateur Trail RC
KSØKS (+KCØSKR)
399 2 43 2,122 KS
Franktown FD Group
WØCBH 723 2 10 2,120 CO
Lafayette Cou ARES
KBØNHW (+NVØU)
284 2 40 2,088 MO
Larkfield ARC
W2LRC (+KC2NRB)
534 2 20 2,086 NLI
Fort Pierce ARC
W4AKH 394 2 37 2,082 SFL
BEARS Seattle
K7NWS (+N7XTL)
394 2 13 2,072 WWA
Franklin Co ARC
AC1L (+N1AW)
334 2 25 2,066 WMA
Southwest Louisiana Amateur Repeater Club
W5BII (+KE5TFG)
395 2 35 2,060 LA
Twin City Ham Club
W5EA (+AD5XM)
482 2 20 2,052 LA
Milford ARC
W8YDK 350 2 10 2,052 MI
Laredo Hams ARC
W5LRD 487 2 20 2,044 STX
Shelby ARC & ARES of Cleveland Co
N4C (+KM4C)
592 2 20 2,040 NC
Virginia ARES District 6
N4MI 521 2 30 2,038 VA
Runestone ARC
WØALX (+WØBTS)
292 2 16 2,034 MN
W8ZZV (+KD8BUF)
380 2 29 2,030 OH
Irving ARC
N5BB (+WA5CKF)
270 2 74 2,020 NTX
K7UXO 564 2 5 2,020 MT
Stockton Delta ARC
W6SF 698 2 20 2,012 SJV
The Villages ARC
K4VRC 336 2 35 2,010 NFL
Mid-Atlantic ARC
W3NWA 452 2 25 1,990 EPA
Pine State ARC
N1ME 345 2 37 1,988 ME
Hambuds
KA5E 528 2 13 1,986 STX
Sturdy Memorial Hospiptal ARC
W1SMH 479 2 14 1,982 EMA
Cherryville Repeater Assn II
W2CRA (+KC2TKI)
431 2 25 1,962 NNJ
Shuswap AR - North Oranagan AR
VE7RAW (+VE7TYO)
341 2 28 1,962 BC
HMB ARES
WR6HMB 545 2 20 1,954 SCV
Elliot Lake ARC
VA3TOP 345 2 22 1,944 ON
Winona ARC
WØNE 389 2 17 1,934 MN
Seattle Auxiliary Comm Service
W7ACS (+N7LYE)
317 2 90 1,918 WWA
Stillwater ARA
WØJH (+KBØSCE)
360 2 22 1,912 WI
Green Valley ARC
WE7GV 353 2 45 1,908 AZ
Clark Co ARC
W9WWI (+N9UGP)
440 2 42 1,898 IN
Humboldt ARC
KD6LM 294 2 30 1,896 SF
Whitley Coy ARC
WC9AR (+W9NNH)
510 2 35 1,896 IN
21 Repeater Group / Kendallville Contesters
N9VI 415 2 19 1,880 IN
Shack Hoppers AR Communicators
WS3S 237 2 14 1,874 EPA
Northwest AR & Electronics Assn
WØKE 566 2 9 1,872 MO
Tyler ARC
K5TYR (+W5ETX)
426 2 56 1,846 NTX
Durham FM Assn
NC4FD 547 2 8 1,846 NC
Wattsburg Wireless Assn
K3WWA 546 2 25 1,844 WPA
San Jose RACES
W6SJC (+KI6QXO)
247 2 33 1,842 SCV
Sachse Em Services Group
W5S 384 2 30 1,826 NTX
W3BD 471 2 5 1,812 EPA
W6JW (+N7TN)
384 2 10 1,804 LAX
Maple Valley ARC
KC7KEY (+N9JA)
384 2 31 1,804 WWA
Garland ARC
K5QHD 368 2 38 1,802 NTX
West Virginia AR
WV8AR 419 2 25 1,802 WV
Coastside ARC
WA6TOW 520 2 20 1,790 SCV
Headrick ARC
W7ROU (+KD7LBP)
456 2 15 1,790 OR
Androscoggin Valley RC
K1AVR 277 2 10 1,788 NH
North Kitsap ARC
KC7Z (+KE7RPR)
297 2 21 1,780 WWA
Zero Beaters ARC
WAØFYA 501 2 30 1,772 MO
Saint Clair Co. ARES
K4SCC 643 2 25 1,766 AL
Cape Ann ARA
W1GLO (+KB1PGH)
380 2 30 1,762 EMA
Magnolia ARC
AA5MT (+KE5EXK)
481 2 8 1,760 MS
The Outlaws
AC9X 477 2 8 1,758 IN
Moosehorn ARC
AL7LE 378 2 31 1,754 AK
Albuquerque DX Assn
W5UR 438 2 5 1,740 NM
Midwest ARS
W9MAR 281 2 7 1,724 IN
K7LYY 338 2 16 1,722 MT
KA9R 412 2 3 1,710 IL
Tuscoarc
W8ZX 358 2 38 1,702 OH
Mt Baker ARC
K7ZC 255 2 40 1,696 WWA
Ocean State ARG
K1OS 497 2 8 1,684 RI
North Okaloosa ARC
W4AAZ (+KI5FR)
343 2 18 1,680 NFL
Greenwood ARS
W4GWD (+K4GBH)
272 2 21 1,672 SC
K5PLD 305 2 48 1,670 STX
Flint Hills ARC
KBØVAC 261 2 6 1,668 KS
West Tennessee ARC
WF4Q (+KI4LMZ)
243 2 10 1,654 TN
Aeronautical Center ARC
W5PAA 257 2 32 1,652 OK
Enterprise ARS
WD4ROJ 273 2 17 1,644 AL
Louisville Amateur Transmitting Soc
W4CN 460 2 17 1,644 KY
Red Ryder Group
KB8TI 571 2 10 1,642 MI
Tri-County ARA
K6AGF 400 2 20 1,638 LAX
Lincoln Co ARS
W4BV (+KA4WOG)
273 2 14 1,638 TN
Richmond Amateur Telecom Soc
W4RAT 501 2 33 1,628 VA
Convair/220 ARC
W6UUS 378 2 25 1,616 SDG
Holiday City ARC
W2HC (+KC2QMZ)
232 2 23 1,606 SNJ
Iowa City ARC
WØJV 347 2 14 1,604 IA
Amateur RC of Amite Co
W5CCW 288 2 4 1,600 MS
The Fly Spotter Swatters
KØNLE (+WØW)
157 2 31 1,600 SD
South Kitsap ARC
N7IG 399 2 13 1,598 WWA
Los Angeles ARC
W6QET 409 2 8 1,594 LAX
Plantz CW Society
KGØGY 337 2 3 1,594 NE
Reading RC, Inc.
W3BN 356 2 44 1,580 EPA
Anchorage ARC
KL7AA (+KL7G)
539 1 45 1,579 AK
Indian Hills RC
W8DDD 249 2 4 1,564 OH
Mt. Magazine ARC
W5MAG 538 2 12 1,546 AR
Huntington Co. ARS
K9HC 522 2 19 1,544 IN
Knob Hill Krew
N5WLA 325 2 6 1,526 NTX
Metuchen RC
K2YNT 369 2 10 1,518 NNJ
Central Ohio Operators Club Extra Novice
W8TNX 416 2 12 1,516 OH
Plattsmouth ARC
KBØSMX 231 2 16 1,516 NE
JC ARC Port Townsend
N7BXU 225 2 9 1,512 WWA
Cedar Creek ARS
KD9J 421 2 15 1,512 IL

Issaquah ARC
W7BI 235 2 14 1,510 WWA
SARES
K6SNY 199 2 60 1,508 SCV
Thick Mountain Group
KB3GDG 467 2 5 1,506 WPA
Hiawatha Valley ARC
NØDH 401 2 42 1,506 MN
Platte Co ARG
KØKEX 265 2 43 1,500 MO
Okaw Valley ARC
KK9N (+W9KXQ)
351 2 11 1,498 IL
Renfrew Co ARC
VA3NRR 273 2 35 1,494 ON
Newington ARL
W1N 410 2 28 1,490 CT
Lake of the Ozarks ARC
NØZS 359 2 10 1,478 MO
Ogden ARC
W7SU 443 2 32 1,456 UT
N7PI 246 2 16 1,440 ID
California Co Expeditioners
KI6VC 378 2 3 1,434 SJV
Lincoln Co Volunteer Comm
NC4LC 250 2 17 1,430 NC
Coos Co. RC
K7CCH 307 2 50 1,426 OR
Huron ARA
WØNOZ 289 2 14 1,418 SD
Western Illinois ARC
W9AWE 318 2 12 1,416 IL
Phillips Co. ARC
WØZXN (+KDØCJF)
295 2 15 1,410 KS
Wild Horse Desert Hams ARC
K5WHD 138 2 82 1,404 STX
SPARC / HBO ARC
WB2HBO 269 2 21 1,392 NLI
DLARC
W3OK 464 2 11 1,386 EPA
Rockwall ARC & Trinity Valley RC
K5RKW (+KB5RP)
265 2 27 1,384 NTX
W4ATC 452 2 13 1,370 NC
Hidden Valleys ARC & UW-Platteville ARC
KC9KQ 203 2 12 1,362 WI
Thompson River ARC
VA7TRS 103 2 20 1,358 BC
Skywatchers & Communicators
KC2UFO 227 2 6 1,352 NNJ
Dog Hollow Contest Group
AK9D 478 2 5 1,352 KS
River's Bend ARC, Inc.
KØRBR 414 2 15 1,348 MO
Lunenburg Co. ARC
VE1LUN 469 2 5 1,338 MAR
Alhambra High School ARC
K6R 201 2 6 1,330 ORG
Tri-States ARC & Rambler RC
W4GTA 265 2 10 1,322 GA
Ak-Sar-Ben ARC
KØUSA (+WØEQU)
322 2 15 1,314 NE
Outer Banks Repeater Assn
W4PCN 328 2 11 1,306 NC
Laguna Beach Em Comm Team
N6L (+KE6GFF)
187 2 70 1,294 ORG
Winnipeg ARC
VE4BB 225 2 59 1,292 MB
Delaware ARA
W9DUK 252 2 21 1,288 IN
WD3E 329 2 7 1,278 MDC
Wright Co ARS
WØWCR (+KCØIOG)
254 2 20 1,258 MN
Yellowknife ARC
VE8RAC 54 2 19 1,246 NWT
Theodore Roosevelt ARC
KØND 238 2 19 1,246 ND
ARA of Bloomington
WCØAAA 257 2 20 1,244 MN
Faulkner Co ARC
W5AUU (+KD4TA)
204 2 32 1,242 AR
ICARC
W9RWX 89 2 12 1,242 IL
NHRC ARS
W1CUM 326 2 8 1,234 NH
DCS-22 Lost Hills / Malibu Group
K6DCS 295 2 75 1,232 LAX
Matanuska ARA
KL7JFU (+KL2HU)
328 1 30 1,231 AK
Gateway ARC
W4KP 98 2 15 1,230 KY
CVRC/GEARS
AD6IZ 269 2 40 1,226 LAX
PRARL
KP4ES 157 2 11 1,226 PR
Central Kansas ARC
WØCY 236 2 16 1,224 KS
Pine Ridge ARC
WØFLO 235 2 14 1,214 NE
Martin Co ARES/RACES
N4A 145 2 27 1,212 SFL
Madison Co ARC
KE8RV 162 2 15 1,210 OH
TARA
K3TAR (+KB3PSN)
438 2 10 1,206 EPA
South Bay ARS
K6QM 146 2 15 1,202 SDG
ARC of Parker Co
W5PC 85 2 22 1,200 NTX
Woodford Co ARC
KY4WC 214 2 20 1,198 KY
Bryan ARC
W5BCS 316 2 32 1,182 STX
VE7NA 223 2 25 1,180 BC
Moore Co ARS
NC4ML 113 2 28 1,178 NC
Tulare Co ARC
WA6BAI 255 2 7 1,168 SJV
Yavapao ARC/ARES/RACES/ Verde Valley ARA
W7YRC 242 2 25 1,168 AZ
Moreno Valley ARA
AB6MV (+KC6FJC)
216 2 13 1,164 ORG
Hobble Creek Stake
W7UAR 257 2 25 1,158 UT
Atlanta IBM ARC
W4IBM 293 2 10 1,158 GA
Eastern New Mexico ARC
KA5B 414 2 10 1,156 NM
Sooland ARA
KØTFT 177 2 31 1,136 IA
Tech ARA/Socorro ARA
KC5ORO 180 2 10 1,134 NM
KRNH Aviators
W9DKB 256 2 3 1,126 WI
Inland Empire ARC
W6IER 124 2 20 1,122 ORG
KC3AM 408 2 9 1,116 DE
Radops of El Jebel Shrine
KØFEZ (+KIØID)
253 2 14 1,116 CO
Black Diamond Radio Group
KX9M 282 2 17 1,104 WI
Casper ARC
W7VNJ 298 2 9 1,096 WY
K7SAM 293 2 5 1,094 MT
VE3OSC 318 2 58 1,090 ON
Royal Gorge ARC
NCØA 183 2 4 1,082 CO
Heart of Texas Ham Operators Group
WA5HOT 147 2 9 1,044 STX
STARS
W9SRC (+AB9JW)
116 2 10 1,028 IL
Lenoir ARC / Caldwell ARES
KF4WØD 228 2 8 1,026 NC
Brunswick Shores ARC
N4GM 243 2 22 1,018 NC
KB3IRR 324 2 3 998 EPA
Palatine ARES
KG9IL (+KB9SW)
137 2 23 994 IL
Limestone ARES
N4SEV 132 2 20 992 AL
Somerset Co ARC
K3SMT 260 2 15 990 WPA
Arlington ARC
K5SLD (+W5JCK)
40 2 15 970 NTX
ARA of Bremerton
W7VE 142 2 4 948 WWA
Land of Lakes ARC
K9HD 298 2 7 946 IN
Akron Simplez Group
AB8SX 280 2 4 940 OH
Bluewater AR Operators
VA3WR 324 2 3 932 ON
Calgary ARA
VE6NQ (+VE6DKC)
141 2 12 932 AB
Presque Isle Co ARC
WB8TQZ 186 2 11 922 MI
SC4 ARC
W6SCF 236 2 20 922 SCV
Murray State University ARC
K4MSU (+W4GZ)
169 2 20 898 KY
KCØWJB 190 2 7 880 NE
Clinton Co. ARC
W9AH 195 2 11 878 IN
West Georgia ARS
W4FWD 79 2 13 868 GA
Top of Michigan ARC
WD8DX 204 2 8 858 MI
Manhattan Area ARS
ACØCY (+KSØMAN)
225 2 12 850 KS
ARC at UCF
K4UCF (+KI4ORG)
46 2 14 848 NFL
Garden City ARC
K8GC 93 2 20 846 MI
Lockport ARA
W2RUI 152 2 14 842 WNY
Laurel ARS
AE4QL 166 2 25 822 KY
Benton Co ARES
K7CVO 17 2 13 814 OR
Free State ARC
K3IVO 231 2 8 812 MDC
Huber Heights ARC
NO8I 115 2 6 806 OH
VECTOR
VE7VCT 62 2 40 804 BC
Clarksville ARTS
KF4L 102 2 12 800 TN
Grant ARC
W8STX 300 2 21 800 OH
Pike Co. ARC
W9UL 134 2 24 796 IN
Southern Piedmont ARC
WD4NHW 178 2 5 794 GA
WC4M 117 2 20 784 AL
Mountain ARC
NXØG 105 2 15 776 CO
Titusville ARC
K4KSC 52 2 31 754 SFL
Association des Radioamateurs Independants
VE2REG 350 2 10 750 QC
K2MS 100 2 14 750 NH
The Wrecking Crew
W4RFJ 313 2 3 740 NC
Cass Co Area Amateurs
NØUMP 112 2 6 730 MO
K6VRS 156 2 3 714 SDG
McKean Co ARC
W3VV (+KB3POF)
68 2 4 706 WPA
Interstate Repeater Soc
K1IRS 38 2 5 702 NH
VE6CJ 449 1 3 699 AB
Rasnick Group
K6VBC 132 2 4 696 SB
Oak Forest ARC
KE5TRB 37 2 5 694 STX
Bi-State ARC
KNØBS 111 2 10 672 IA
Wedixie ARC
WB4MZO 49 2 4 672 GA
Lake Wales Repeater Assn
K4LKW 8 2 39 666 WCF
Nantucket ARA
N1NBQ 96 2 9 660 EMA
Shore Points ARC
K2B 62 2 25 658 SNJ
Dalton ARC
W4DRC 63 2 24 646 GA
Ottawa Valley Mobiile RC, Inc.
VE3RAM 187 2 12 634 ON
Lincoln Co ARC
N7OY 86 2 4 622 OR
Sky Valley ARC
W7SKY 11 2 8 622 WWA
Idaho Society of Radio Amateurs
K7BSE 118 2 8 616 ID
PCARA
N9XH 64 2 9 612 WI
Radio Amateurs of the Gorge
W7RAG 42 2 12 604 OR
Seaway Valley ARC
VE3VSW 116 2 7 582 ON
JVARC
K3DNA 96 2 9 576 WPA
Waldo Co. ARA
N1TN 169 2 8 538 ME
Boyer Valley ARC
KØBVC 116 2 9 522 IA
Carteret Co. ARS
W4YMI 57 2 15 514 NC
NS7F 119 2 4 490 AZ
Montmorency Em Radio Services
KD8AEM 72 2 9 474 MI
KC9HUS 46 2 13 442 IN
W1YU 32 2 3 418 CT
University ARC
N7UW 107 2 11 414 WY
Northern Chautauqua ARC, Inc.
W2SB 51 2 6 370 WNY
Radio Amateur Educational Society
VE6CWM 24 2 5 348 AB
Borderline ARC
W7BAR 71 2 25 212 UT
Nebraska ARC
NEØRC 57 2 3 180 NE
Palestine/Anderson Co ARC
K5PAL 43 2 31 136 NTX

2A Battery

WØCQC (+KØFEI)
1354 5 4 13,785 CO
K2ZR 1177 5 8 12,505 WNY
Motorola ARC
K9MOT (+N9EP)
1020 5 17 10,005 IL
QCWA Ch.17
W3GS 750 5 9 6,810 EPA
Reno QRP Group
W7FST (+NU7T)
368 5 14 4,660 NV
Tommy Atkerson Memorial FD Club
W4RRW 439 5 6 4,640 GA
Western KY DX Assoc
K4CMS 503 5 3 4,590 TN
Walton RA
W2LZ (+W2CD)
334 5 8 3,600 WNY
Androscoggin ARC
W1NPP (+KE6PIJ)
253 5 26 3,275 ME
Peninsula ARC
W4MT 344 5 12 3,195 VA
Paulding ARC
W4TIY (+KI4HVN)
251 5 38 3,060 GA
Prairie Contesters
NØUD 202 5 5 2,590 ND

J M MAHONEY, KI4GAP

Milt Coleman, K4OSO (foreground) and Walt Komienko, K2WK, operate the 2A stations for the Central Virginia Contest Club during Field Day 2008 activities. Looking on is Mike Baker, N4LSP. The club operated with generator power from a park near Richmond, Virginia.

Barstow ARC
WA6TST (+KI6KNA)
227 5 24 2,520 ORG
Bolingbrook Area Radio Contesters
N9GH 220 5 4 2,470 IL
Macoupin Co ARC
K9MCE (+KC9LIC)
342 5 19 2,465 IL
WJ4N 145 5 3 2,085 SFL
Silver Comet ARS
W4RSC (+WB3ILX)
141 5 12 1,975 GA
QCWA Chapter 162
K9AKG 110 5 9 1,575 WI
Head Lake Group
VE3LM 174 5 4 1,505 ON
Portland Amateur Wireless Assn
W1KVI 159 5 10 1,315 ME
ARC of Alameda
K6QLF 73 5 20 1,130 EB
KB8YBS 4 5 3 470 OH
Capital City ARS
WB3KIC 18 5 8 365 MDC

2A Commercial

Radio Central ARC & Order of Boiled Owls Contest Club
W2RC (+KW2O)
1838 2 36 5,970 NLI
North Franklin ARS
N2NNY 1345 2 12 5,370 NNY
Ottumwa ARC
WAØDX 1137 2 9 3,688 IA
Pottstown ARC
K3ZMC 1065 2 13 3,240 EPA
Hesston College & Newton ARCs
KØHC (+NØNK)
630 2 18 2,972 KS
Club Radio Amateur de l'Estrie Inc.
VA2UT 661 2 27 2,244 QC
Trojan ARC
WØWOB 381 2 11 2,150 KS
WØP (+KCØYNE)
415 2 6 2,076 MO
Columbia Co. ARC
K4KNS (+K4UUG)
367 2 8 1,502 GA
Noble Co Repeater Group
NC5RG 342 2 13 1,390 OK
Heart of Dixie ARS
W4HOD (+K4ANU)
231 2 9 1,362 AL
Nassau Co Police ARC
NC2PD 319 2 9 1,088 NLI
Delta Co ARS
K8ZAS 335 2 13 1,020 MI
Cumberland ARC
K3IEC (+AF3I)
258 2 16 990 EPA
Scott Co ARES
NØBHC 135 2 18 986 MN
Scioto Co. AERS
WW8O 480 2 3 980 OH
Wantagh ARC
W2VA 124 2 12 894 NLI
Macon Co. ARC
NØPR 306 2 12 812 MO
Fairfield ARA
WB1CQO 234 2 9 726 NH
Mayes Co ARC
AE5DQ 118 2 8 626 OK
LEARC
W9COP 180 2 8 610 IL

Opequon RS
W8ORS (+KD8PUG)
9 1 6 509 WV
Lewes ARS
W3LRS 86 2 10 472 DE
Cleveland Co AR Services
NA4CC (+KI4ZJI)
28 2 5 406 NC

3A

Rochester DX Assn
W2RDX (+W2AN)
5092 2 40 17,978 WNY
CorTek RA
W9CA (+K9RN)
4786 2 20 17,552 IL
Utah DX Assn
K7UM (+K7XV)
3893 2 42 12,638 UT
Greater Norwalk RC
N1EV (+W1NLK)
3207 2 50 10,050 CT
Midland ARC
W5QGG (+WJ5DX)
2886 2 30 9,884 WTX
Oakland Co ARS
W8TNO (+K8IY)
3208 2 22 9,812 MI
Old Barney A.R.C.
W2C (+N2OB)
2950 2 40 9,614 SNJ
Minnesota Wireless Assn
WØAA 2151 2 14 9,316 MN
North Shore RC
K9OR (+K9RST)
2402 2 75 9,246 IL
NC Contesters Club
N4PY 2319 2 7 8,804 NC
Magnolia DX Assn
K5MDX (+W5NO)
2313 2 70 8,786 MS
Kishwaukee ARC
WA9CJN (+N9RFR)
2064 2 14 8,474 IL
North Fulton ARL
NF4GA (+K4BB)
2272 2 194 7,688 GA
Sussex Co. ARC
W2LV 2275 2 17 7,658 NNJ
Lafayette DX Assn
W9LDX 2199 2 10 7,238 IN
Lake Amateur Radio Assn / ARES
K4FC (+N4FBC)
1856 2 36 7,202 NFL
East Bay ARC
W6CUS (+AA6XZ)
1830 2 30 7,160 EB
Peoria Area ARC
W9PIA (+K9PEO)
2012 2 50 7,116 IL
Sterling Park ARC
K4NVA (+W4KSN)
1922 2 25 7,000 VA
Edmond ARS
K5EOK 2080 2 59 6,900 OK
Nassau ARC
K2VN (+K2RRM)
1698 2 25 6,320 NLI
St Paul RC & Mining RC
WØMR (+KØAGF)
2085 2 40 6,290 MN
Jefferson Co ARC
W7JCR (+N7PL)
1390 2 49 6,274 WWA
Davis Co ARC
K7DAV (+N7CN)
1632 2 50 6,096 UT
Paducah ARA
W4NJA 1656 2 50 5,976 KY
Twin City FM Club
WØEF 1406 2 50 5,912 MN
Arkansas River Valley AR Foundation
K5PXP (+N2WV)
1431 2 25 5,738 AR
Hazel Park ARC
W8HP (+W8JXU)
1710 2 25 5,676 MI
Albany ARA
K2CT (+KM2O)
1534 2 51 5,654 ENY
NEKSUN / KVARC
KØHAM (+WØCET)
1330 2 107 5,554 KS
Dial ARC/ Butler Co VHF
K8PI (+W8BLV)
1526 2 58 5,506 OH
Red River Radio Amateurs
WØILO 1234 2 16 5,282 ND
Southern Vermont ARC
K1SV (+N1OI)
1758 2 10 5,242 VT
Milford ARC
W8MRC 1420 2 41 5,228 OH
South Orange ARA
K6SOA (+K6WO)
1188 2 62 5,214 ORG
SMARS
W8DF 1460 2 10 5,212 MI
Historical Electronics Museum ARC
W3HEM (+W3GR)
1208 2 15 5,190 MDC
Kennehoochee ARC
W4BTI 1447 2 74 5,182 GA
CARC & NADXA
W7TB (+AA7DK)
1183 2 30 5,048 AZ
Blue Ridge ARS
W4KA 1205 2 53 5,044 SC
Tristate ARS
W9OG (+N9OL)
1285 2 39 5,000 IN
Roanoke Valley ARC
W4CA (+AB4A)
1701 2 61 4,966 VA
Mich-A-Con ARC
KC8VC (+W8JWN)
1359 2 15 4,962 MI
Michiana ARC
W9AB 1111 2 26 4,932 IN
Lighthouse AR Alliance
K4L (+W4J)
1132 2 67 4,914 SFL
Shreveport ARA
K5SL (+KE5DLM)
1050 2 50 4,884 LA
Amateur Radio for Youth
KØH (+WØYH)
1560 2 10 4,748 CO
AR for Youth
KØG (+WØYH)
1560 2 10 4,748 CO
Medina 2 Meter Group
W8EOC (+W8MFU)
1262 2 17 4,724 OH
Hamsters RC
W9A (+W9AA)
1375 2 26 4,646 IL
Bristol ARC
W4UD 1375 2 40 4,590 TN
Foothills ARS
K6YA (+K6RJN)
1294 2 25 4,578 SCV
QSY Society
K2QS (+AA2OI)
1189 2 91 4,568 ENY
Heart O' Texas ARC
W5ZDN (+W5TSA)
1072 2 27 4,530 NTX
Florence ARC
W4ULH (+K4UA)
902 2 29 4,502 SC
McKinney ARC
W5MRC (+K5EEN)
944 2 61 4,498 NTX
Radio Farm
NØMA 1182 2 18 4,426 IA
Kankakee Area RS
W9AZ (+N9OE)
1176 2 26 4,422 IL
White Mountain ARC
W1MWV (+KB1EZJ)
1020 2 38 4,418 NH
Howell Co. ARC
WØHCA 1053 2 17 4,402 MO
Eau Claire ARC
KB9S 1061 2 30 4,370 WI
Xerox ARC
W2XRX 1049 2 10 4,354 WNY
K6EMI 936 2 5 4,350 ORG
San Andreas Faultline Survivors
W6SW (+KE6DAX)
1388 2 10 4,344 SJV
W8VP (+N8XAY)
1050 2 34 4,340 OH
Regina ARA
VE5NN 1224 2 12 4,254 SK
M. Vernon ARC
K8EEN 1223 2 17 4,226 OH
Lincoln ARC
KØKKV (+KBØDMP)
1243 2 75 4,200 NE
Peconic ARC
W2AMC 1313 2 43 4,152 NLI
Troy ARA
N2TY 1094 2 84 4,036 ENY
Hannibal ARC
WØKEM (+WØMTL)
928 2 33 4,008 MO
Blue Ridge ARC
W4YK 798 2 42 4,006 NC
Morrow Co ARG
N8KU 985 2 10 3,928 OH
South Canadian ARS & OU ARC
W5NOR 826 2 61 3,914 OK
No BARC
N1WM 997 2 27 3,882 WMA
Monessen ARC
W3CSL (+W3EMV)
1026 2 34 3,862 WPA
NØGF 957 2 15 3,834 ND
Antelope Valley ARC
K6OX (+AF6GF)
978 2 78 3,828 LAX
Coquitlam/ Burnaby/ New-Westminster ARCs
VE7SCC 987 2 30 3,826 BC
W7OTV 789 2 86 3,810 OR
W4EXU 914 2 18 3,782 NC
MNARC/DCARA/MobileSixers
K3TU 949 2 31 3,766 EPA
Delta ARC / Mid-South ARA / Tri-State Repeater Assn
W4BS (+WA4KHN)
928 2 100 3,754 TN
Wilderness Road ARC
W4CDA (+WQ4Z)
769 2 36 3,742 KY
North East Wyoming ARA
NE7WY (+N7XKT)
786 2 49 3,714 WY
Bristol Co Repeater Assn
W1ACT (+N1JOY)
850 2 10 3,674 EMA
Milwaukee Repeater Club
WI9MRC (+K9VS)
906 2 101 3,636 WI
Saratoga Co RACES Assn
WA2UMX (+N2MBX)
1138 2 15 3,622 ENY
Naval Postgraduate School ARC
K6LY (+K6NPS)
943 2 30 3,610 SCV
Aero ARC/BRATS
W3PGA 785 2 15 3,602 MDC
Washington Amateur Comm
WA3COM (+KC3HW)
926 2 41 3,550 WPA
Ashe Co ARC
W4FD (+W4YSB)
768 2 41 3,546 NC
Owatonna Steele Co ARC
NØUW 959 2 13 3,508 MN
Club de Radioamateur de la valle du Richelieu
VE2CVR 943 2 26 3,484 QC
Guilford ARES
NA4GC (+AJ4DV)
859 2 30 3,452 NC
San Fernando Valley ARC
W6SD (+NN6RK)
807 2 40 3,410 LAX
Lake Area Radio Klub
WØWTN 723 2 25 3,342 SD
Alliance ARC
W8LKY 914 2 15 3,340 OH
Eastern Connecticut ARA
KZ1M (+K1MUJ)
1004 2 26 3,322 CT
Orange Co ARC
W2HO 945 2 65 3,300 ENY
Orange Park ARC
K4BT 872 2 53 3,238 NFL
Alcorn Co ARES
W4TX 631 2 40 3,236 MS
Nixa AR
NØA 731 2 28 3,210 MO
Southeast LA Em Comm
W5RU (+W5GAD)
542 2 114 3,154 LA
Genesee Co RC
W8ACW (+WA8MY)
834 2 10 3,098 MI
Stanwood Camano ARC
KC7MAP 899 2 65 3,090 WWA
GARC
N6FR 792 2 20 3,064 SV
Gaston Co ARS
N4GAS 656 2 26 3,052 NC
Granite State ARA
N1QC 903 2 20 3,030 NH
Ole Virginia Hams ARC
W4OVH (+W4PVA)
541 2 29 2,974 VA
Stamford ARA
W1EE (+K1FC)
726 2 32 2,958 CT
Lakeland ARC
K4LKL 560 2 25 2,922 WCF
Jayhawk ARS
WØLB (+KDØBKH)
669 2 25 2,906 KS
CORE GROUP
W4MAC (+W4JTA)
535 2 21 2,898 WCF
Vero Beach ARC
W4OT (+K4JC)
514 2 25 2,888 SFL
Columbus ARC & Russell Co. RC
W4CVY (+WX4RUS)
527 2 33 2,888 GA
Keowee Toxoway ARC
K4WD 827 2 24 2,860 SC
Grand Rapids ARA
W8DC (+W8GVU)
784 2 50 2,798 MI
Univ of Mississippi ARC
W5UMS 623 2 20 2,756 MS
Hernando Co ARA
K4BKV 368 2 12 2,752 NFL
Lockheed Martin Recreation Assn RC
W5IU 617 2 25 2,744 NTX
Hampton Public-Service Team
W4HPT (+W4QR)
740 2 62 2,744 VA
Snohomish Co Hams Club
WA7LAW (+WA7ETH)
443 2 93 2,726 WWA
Surrey ARC
VE7SAR 533 2 20 2,724 BC
Corona PD CSV Team
W6CPD 677 2 13 2,698 ORG
W8USA 723 2 16 2,692 MI
Xenia Weather AR Netwrok
W8XRN 611 2 55 2,690 OH
Spring Hill ARC
N4WO 490 2 51 2,654 NFL
St Charles ARC
KOØA (+WBØHSI)
625 2 47 2,640 MO
Eastern Pennsylvania ARA & PARK
N3IS 589 2 30 2,638 EPA
BARS & STARCRC
K4TN (+W4HSO)
469 2 43 2,608 WCF
Dixie ARC
W7DRC (+K7DLX)
758 2 32 2,608 UT
Twin State RC
W1FN 984 2 10 2,604 NH
CRES ARC
W8ZPF 541 2 38 2,592 OH
Riverland ARC
W9UP 512 2 39 2,572 WI
Oakland Radio Comm Assn
WW6OR (+N6ORC)
573 2 50 2,570 EB
Southern Maryland AR Technical Group
N3PX (+KB3NDS)
587 2 4 2,540 MDC
Central Mississippi RA
WM5A (+KE5LIO)
344 2 20 2,538 MS
Kings Co RC
W2RAK 718 2 8 2,524 NLI
TARC
W9TAZ 883 2 10 2,512 IL
Warrensburg Area ARC
WØAU 414 2 34 2,506 MO
Central Ohio ARES
K8DDG 796 2 33 2,498 OH
Grumman ARC
WA2LQO 670 2 15 2,466 NLI
Jackson ARC
W5PFC 389 2 46 2,462 MS
HP Boise ARC
AB7HP (+WV7I)
565 2 22 2,436 ID
WØEA 621 2 3 2,416 IA
The FPL Group
K8ESQ (+K8QBR)
533 2 5 2,406 MI
Barrie ARC
VE3GCB (+VE3ORC)
475 2 36 2,380 ON
Hamilton ARC
VE3DC (+VE3DF)
940 2 40 2,380 ON
CTARC
WD5IYF (+KE5OMZ)
628 2 12 2,372 OK
Wyandot Area Ham Operators Organization
KD8BNV (+KE8PX)
381 2 34 2,336 OH
San Joaquin Valley ARS
WA6SJV (+WA6WTF)
509 2 30 2,336 SJV
Chicago Suburban Radio Assn
N9BAT 499 2 36 2,304 IL
Joplin ARC
WØIN 404 2 12 2,300 MO
Nashville ARC
K4CPO 473 2 12 2,292 TN
NWHC & Waller Co ARES
KC8EO (+KD5HW)
494 2 30 2,284 STX
Riverside Radio Amateur's
KC8YXF 821 2 8 2,272 MI
North Ottawa ARC
W8CSO (+N8RXC)
423 2 40 2,266 MI
Springhill ARC
N5II 560 2 5 2,228 LA
Charles CO ARC
K3SMD (+AA3WS)
466 2 12 2,228 MDC
Burlington Co RC
K2TD 458 2 19 2,206 SNJ
West River RC
W1RRC 436 2 36 2,188 VT
Soc of Newfoundland RA
VO1AA 294 2 25 2,152 NL
Valley of the Moon ARC
W6AJF 415 2 10 2,140 SF
Alamo Area Radio Org
AA5RO 283 2 45 2,128 STX
N3SBF 541 2 4 2,122 WPA
Rappannock ARA
K4YM 535 2 20 2,120 VA
Kokomo ARC
W9GO 412 2 20 2,114 IN
Muscatine ARC
NØLAG 619 2 20 2,052 IA
Aroostook ARA
K1FS 632 2 18 2,042 ME
Southern Berkshire ARC
W1BAA/2 (+K1LEE/2)
299 2 30 2,026 ENY
Montachusett AMA
W1GZ (+N1UZ)
337 2 8 1,980 WMA
Thunderbird ARC
WK7B 401 2 18 1,978 AZ
Pasadena RC
W6KA 547 2 38 1,974 LAX
Valdosta ARC
W4VLD 457 2 12 1,942 GA
Schenectady Museum ARA
W2IR 456 2 16 1,914 ENY

San Angelo ARC
W5QX (+KD5SBE) 297 2 39 1,908 WTX
West Central Ohio ARA
WC8OH 552 2 22 1,902 OH
Sportsman's Paradise ARC
K4WAK 402 2 14 1,892 NFL
Madison-Oneida ARC
W2MO 452 2 23 1,888 WNY
Northwest Illinois ARC
W9F (+N9WN) 342 2 12 1,880 IL
W4NPS 422 2 8 1,876 VA
Estes Valley ARC
WØRP (+KCØKNU) 332 2 41 1,872 CO
WA4USN (+WA4GPS) 201 2 70 1,864 SC
Big Rapids Area ARC
N8OE 331 2 18 1,846 MI
Northern Kentucky ARC
K4CO 413 2 23 1,838 KY
Holmesburg ARC
K3FI 436 2 16 1,836 EPA
WBØPTD 581 2 6 1,832 KS
Starke Co ARC
W9JOZ (+WB9L) 344 2 34 1,818 IN
Olympia ARS
NT7H 382 2 27 1,816 WWA
Skyview RS
WX3SKY (+KB3NUQ) 436 2 30 1,814 WPA
Michigan City/ LaPorte/Porter County
W9LY 430 2 53 1,812 IN
Stonewall Jackson ARA
K8DF (+K8TPH) 348 2 20 1,810 WV
Bellbrook ARC
W8DGN 474 2 43 1,798 OH
New Bern ARC
W4EWN (+K4DJW) 251 2 12 1,764 NC
Jones Co ARC
WØCWP 452 2 10 1,754 IA
Ellijhay ARS
NB8N 296 2 40 1,746 GA
ARC of Savannah
W4HBB 405 2 27 1,744 GA
PJ' s Group / WAFAR
W9FT 441 2 18 1,732 IL
Skyline Tower ARC
W7DTV 663 2 15 1,692 OR
Cape May Co. ARC
N2CMC (+W2CMC) 194 2 18 1,686 SNJ
Buffalo AR Repeater Assn
W2EUP 463 2 27 1,666 WNY
M&M ARC
W8PIF 682 1 44 1,660 MI
New River Valley ARC
N4NRV 291 2 18 1,632 VA
Golden Triangle ARC
W6GTR (+W6ODF) 302 2 38 1,624 ORG
Austin and Albert Lea, MN ARC
NXØC 400 2 30 1,620 MN
Fredericton ARC
VE9ND 215 2 9 1,614 MAR
Chattanooga ARC
W4AM 380 2 21 1,610 TN
Long Island AR Simplex Club
W2LIS 563 2 21 1,602 NLI
Insurance City Repeater Club
K1DFS (+K1WMS) 303 2 8 1,586 CT
Camden Co ARS
K4B 258 2 15 1,586 GA
Toronto ARC
VE3TNC 478 2 25 1,574 ON
Fallbrook ARC
N6FQ 355 2 44 1,566 SDG
ADR Woods Buster's Radio Group
KØQL 364 2 3 1,546 MN
Bloomfield ARC
W1CWA 333 2 9 1,536 CT
Dubois Co ARC
N9NAU 448 2 17 1,526 IN
Warren ARA
W8VTD 289 2 31 1,508 OH
Gloucester City ARC
NJ2GC 224 2 8 1,498 SNJ
Lawton Fort Sill ARC / Lawton Independent Repeater Alliance
K5USA (+KO5OK) 199 2 90 1,496 OK
285 Techconnect RC
NAØTC 211 2 17 1,494 CO
North Hills AR Contest Soc
W3WPA (+K3W) 235 2 8 1,480 WPA
Dugger ARC
KC9AK 369 2 12 1,478 IN
Bluegrass ARS
K4KJQ 327 2 31 1,476 KY
South Texas ARC
N5CRP 247 2 25 1,468 STX
North Hills ARC
W3EXW 132 2 40 1,450 WPA
WØWCL 345 2 11 1,448 MN
Naval Research Lab ARC
W3NKF 307 2 9 1,446 MDC
Cleveland ARC
W4GZX 248 2 32 1,442 TN
Old Timers
K8CJQ 540 2 5 1,442 MI
Hayward RC
K6EAG (+N6MQQ) 160 2 33 1,438 EB
Central Arkansas UHF Group
N5AT (+N5CG) 273 2 20 1,430 AR
Randolph ARC
NC4ZO (+AE4SI) 188 2 47 1,426 NC
Razorback RC
WU5PIG 310 2 10 1,424 AR
VE7VCC 231 2 20 1,420 BC
Ellis Co ARC
WD5DDH (+K5ASU) 367 2 42 1,414 NTX
San Gorgonio Pass ARC
KF6GDX 187 2 17 1,406 ORG
Garlic Valley ARC
W6GGF 337 2 5 1,406 SCV
Chatham-Kent ARC
VE3CRC 275 2 15 1,404 ON
Sun City Senter ARC
KE4ZIP (+N1OV) 209 2 38 1,398 WCF
Cumberland Valley ARC
W3ACH (+W3SML) 250 2 53 1,396 WPA
Lake Washington Ham Club
K7LWH 267 2 80 1,370 WWA
CCAFMA
K2HE 310 2 38 1,360 WNY
Navarro ARC
N5VO 117 2 41 1,358 NTX
Northern Michigan ARES
NM8ES 168 2 30 1,356 MI
Broken Arrow ARC
W5BBS (+KD5RHF) 199 2 46 1,348 OK
Rolla Regional ARS
WØGS 331 2 24 1,348 MO
Mile High RC
K6GUN 139 2 10 1,328 ORG
Old Post ARS
W9EOC 286 2 12 1,316 IN
RIT ARC
K2GXT 382 2 4 1,312 VT
Stubblefield Repeater Club
K4HJ 311 2 27 1,288 KY
Laguna Woods ARC
W6LY 183 2 14 1,284 ORG
AB9RB 384 2 8 1,274 IN
Sun Country ARS
W4CW 287 2 5 1,266 NFL
Branchburg OEM
N2B 250 2 6 1,250 NNJ
Mid Island RA
VE7MIR 147 2 10 1,242 BC
Susquehanna Valley ARC
W3VPJ 135 2 12 1,240 EPA
Rogue Valley ARC
W7OEK 149 2 14 1,226 OR
Electric City ARC
W7ECR 156 2 15 1,222 MT
K9HDH 292 2 8 1,220 IN
Metropolitan ARC
K8NOW 400 2 8 1,210 MI
Clearwater ARS
WE4TT 304 2 20 1,198 WCF
RA of Corry
W3YXE 209 2 12 1,194 WPA
SoCal Amateur Transmitting Soc
WB6LRU 412 1 12 1,182 LAX
Scott Co. ARES
NE4ST 193 2 8 1,158 KY
Madison Co DX Club
KKØG 152 2 4 1,150 IA
Dallas ARC / Dallas CO REACT
W5FC 110 2 33 1,108 NTX
Hualapai ARC
WB6RER 128 2 15 1,106 AZ
Macedonia ARC
N8OBJ 244 2 5 1,100 OH
USC ARC
W6YV 120 2 3 1,090 LAX
Tri-County ARC
VE9TCA 134 2 31 1,080 MAR
Independent RC
WA6IRC 208 2 40 1,072 SJV
Gas Line Groovies ARC
KI4LBK 305 2 6 1,068 VA
Atchafalaya Amateur DX Assn
WA5MC 197 2 6 1,064 LA
Ohio State University Amateur Radio Club
W8LT 243 2 8 1,054 OH
Cumberland Co RACES
WX2Y (+KC2STS) 138 2 14 1,046 SNJ
Morongo Basin ARC
W6BA 118 2 20 986 ORG
South West Iowa ARC
KØSWI 255 2 15 980 IA
Great Bay Radio Assn
W1FZ (+W1WRH) 166 2 12 922 NH
Wichita ARS
N5WF 65 2 32 910 NTX
Baccalieu Amateur Radio Klub
VO1BRK 92 2 12 904 NL
Federal Way ARC
WA7FW (+W7WAY) 91 2 16 898 WWA
Navarre CERT ARC
KC4ERT 57 2 15 884 NFL
Southern California Japanese Ham Club
K6JP 84 2 7 868 LAX
Easton ARS
K3EMD 202 2 11 848 MDC
Fulton Co ARC
K9ILS 145 2 13 840 IL
USS Hornet ARC
NB6GC 93 2 8 836 EB
Wexaukee ARC
K8CAD 121 2 12 810 MI
SW Missouri ARC
NØECA 67 2 15 784 MO
WWA Medical Services Em Comm Dist 5
AD7AW 62 2 5 774 WWA
Effingham High School ARC
KB9WRF 219 2 4 738 IL
Opp ARC
W4ORC 182 2 18 734 AL
Sacramento ARC
W6AK 79 2 10 734 SV
Delaware Valley OMIK
W3DVO 142 2 10 734 SNJ
NU7DE 74 2 3 732 AZ
Spencer Co ARC
KC9FTG 59 2 5 730 IN
Conneaut ARC
W8BHZ 105 2 17 716 OH
Northern CA Cactus Repeater Assn
K6SRA 75 2 6 696 SCV
Ogemaw Arenac ARS
K8OAR 173 2 6 646 MI
Grande Ronde Radio Amateurs Assn
W7GRA 14 2 6 628 OR
KA4KBX 46 2 5 602 AL
Altus Area ARA
AJ5Q 17 2 7 492 OK
Gateway ARC
NG4AR 32 2 25 464 GA
KI6QCY 75 2 19 450 SJV

3A Battery

Baton Rouge ARC
K5DF 727 5 38 7,765 LA
Scenic City ARS
W4SCA 519 5 13 4,855 TN
Anne Arundel RC
W3VPR 297 5 58 3,670 MDC
Dekalb Country ARC
W4GBR 209 5 14 2,655 AL
Ramona Outback ARS
NG6B 187 5 32 2,540 SDG
Colorado QRP Club
ABØCD 167 5 11 2,450 CO
C^5
KI7EL 77 5 3 1,035 WWA
VE3OB 12 5 3 620 ON

3A Commercial

Zamora Shrine Ham Radio Unit
W4ZHR (+KE4ID) 1284 2 28 5,038 AL
Splitrock ARA
K2RF (+KC2PRX) 1173 2 20 3,694 NNJ
Albemarle ARS
K4WO 1221 2 32 3,574 NC
Ashtabula Co ARC
K8CY (+KD8ILG) 1221 2 27 3,568 OH
New York City Transit ARC
K2IRT 1074 2 15 2,986 NLI
Canadian Lakes ARC
K8PAO 1167 2 14 2,684 MI
Hill Country ARC
N5HR (+KA5ONN) 648 2 60 2,078 STX
Gratiot Co. ARA
W8AWE 656 2 9 1,960 MI
Spartanburg ARC
K4II 547 2 31 1,728 SC
Bluff Country DX Assn
W9IDX 507 2 4 1,582 MN
Georgian Bay ARC
VE3OSR 544 2 20 1,314 ON
K5M Consortium
K5M 341 2 8 1,282 WTX
High Point ARC
W4UA 262 2 18 1,246 NC
K8HRC 272 2 15 1,188 MI
Tobacco Valley ARC
K7EUR 381 2 12 1,152 MT
Southeast Louisiana ARC
WM5T 527 2 16 1,112 LA
Tri-State ARG
W5OKT (+W5ROB) 98 2 38 952 OK
Coon Valley ARC
NØNAF 275 2 7 894 IA
Richmond ARC
W4ZA (+W4FJ) 117 2 53 868 VA
Cascade RC
W7EK 221 2 19 752 WWA
GREAT Club
KF1Y 320 2 4 730 GA
Plateau ARA
WV8E 207 2 10 680 WV
Champaign Co. ARES
WB8UCD 138 2 9 516 OH
Brookings Radio Research Club
WØBXO 71 2 20 342 SD
Northeast Missouri ARC
WØCBL 111 2 3 222 MO
Penticton ARC
VE7PRC 47 1 6 60 BC

4A

Delaware ARA
K8ES (+W8JK) 3992 2 57 14,202 OH
North Shore RA
NS1RA (+KB1PAL) 4048 2 75 12,980 EMA
Huntsville ARC
K4BFT 3443 2 34 12,076 AL
Contoocook Valley RC
K1BKE (+K1DFQ) 3583 2 21 10,964 NH
Palo Alto ARA
W6ARA 3276 2 53 10,738 SCV
Vienna Wireless Society
K4XY (+K4HTA) 2758 2 110 10,370 VA
ARROW/UMARC FD team
W8UM (+W8PGW) 2398 2 45 9,194 MI
Westchester Em Comm Assn
N2SF (+AB2WS) 2515 2 40 9,100 ENY
Murgas ARC
K3YTL 2879 2 27 8,746 EPA
Fauquier ARA
W4VA (+KW4VA) 1771 2 25 7,178 VA
BOARS ARC
NG5A (+AD5NR) 1712 2 18 7,158 NTX
Scranton Pocono AR Klub
K3CSG (+N3CQ) 2092 2 27 7,110 EPA
Portage Co AR Service
KD8CKP (+KB8VJL) 1942 2 65 5,944 OH
Carroll Co Contesters
WY3P 2419 2 10 5,742 MDC
Green Mountain Wireless Soc
N1VT (+AB1CH) 1468 2 34 5,716 VT
Pamlico ARS
N4PRS (+N4LV) 1652 2 53 5,688 NC
Southwest Dallas Co ARC
W5AUY (+N5UV) 1366 2 42 5,478 NTX
Cuyahoga Falls ARC
W8VPV 1656 2 19 5,426 OH
Cherryland ARC
W8TCM 2044 2 20 5,230 MI
KU6S (+W6GEM) 1216 2 42 5,200 EB
WØMA 1447 2 20 5,106 MO
Findlay RC
W8FT (+N8ET) 1233 2 65 5,048 OH
Penn Wireless Assn
W3SK 1059 2 16 4,844 EPA
RA of Erie
W3GV 1332 2 20 4,684 WPA
Smoky Mt ARC
W4OLB 1050 2 36 4,608 TN
Fort Smoth Area ARC
W5ANR 907 2 25 4,546 AR
Tuscaloosa ARC
W4XI 1226 2 70 4,472 AL
London ARC
VE3LON 1416 2 40 4,274 ON
Franklin Co. ARC
W4FCR (+W4BOT) 855 2 12 4,218 VA
Wireless Assn South Hills
N3SH 1194 2 25 4,134 WPA
Columbia-Montour ARC
WC3A (+KB3BJO) 896 2 19 4,022 EPA
Dixie AR Klub
W4DAK 1007 2 33 3,980 NFL
Chesapeake AR Service
W4CAR (+K5VIP) 1006 2 40 3,916 VA
Alford Memorial RC
W4BOC (+KJ4DCA) 785 2 68 3,748 GA
All ARC
W7PU 896 2 4 3,744 WWA
Kalamazoo ARC
W8VY 1196 2 45 3,712 MI
Bladen ARS
W4BLA 1076 2 35 3,650 NC
Capital Area AR Em Response Team
W9SPI 922 2 8 3,628 IL
Des Moines Radio Amateur Assn
WØAK 709 2 33 3,584 IA
Philmont Mobile RC
W3EM (+W3PSH) 795 2 20 3,476 EPA
Overlook Mountain ARC
N2LL (+N2VOT) 651 2 6 3,412 ENY

The Radio Society of Tuscon, K7RST, greeted over 150 visitors to their FD site with this information booth.

Beloit ARC
W9BJ 833 2 23 3,366 WI
West Chester ARA
WC8VOA 1827 1 30 3,342 OH
Middlesex ARS
W1EDH 739 2 20 3,226 CT
NWSOAR
N7UO (+KD7WDP)
530 2 32 3,122 WWA
Wide Area Amateur Radio Network
WA1ARN 866 2 18 3,062 ME
Brightleaf ARC
W4AMC (+NC4PC)
706 2 50 3,008 NC
Panhandle ARC
W5WX (+N5HPJ)
651 2 52 2,930 WTX
Yakima ARC
W7AQ (+KK7KI)
671 2 10 2,904 EWA
Greater Vancouver Radio Group
VE7VRG (+VA7OSO)
794 2 25 2,880 BC
Skyline ARC
K2IWR 828 2 35 2,774 WNY
Milton ARC
W4VIY 518 2 32 2,770 NFL
W8GVB 542 2 15 2,746 OH
Southern Pennsylvania Comm Group
K3AE 665 2 32 2,590 EPA
Triple A ARA
AC3J 760 2 32 2,580 WPA
Alexandria RC
W4HFH 573 2 15 2,498 VA
W2GLQ 663 2 10 2,424 NNJ
Lake Oswego ARES
WA7LO (+KD7ZDO)
436 2 46 2,410 OR
Wayne Co ARA & Goldsboro Amateur Repeater Club
W4GOL 539 2 32 2,368 NC
Toothless Talkers
N8IVE (+KA8YTS)
609 2 10 2,358 OH
Monongalia Wireless Assn
W8MWA 432 2 15 2,336 WV
Ft Herkimer ARA
W2FHA (+N2ZWO)
403 2 5 2,326 WNY
Bay-Tuscola Co. Michigan FD08
N8ZE 450 2 29 2,320 MI
Arlington Public Service RC
W4AVA (+NV8U)
631 2 15 2,272 VA
Hot Springs ARC
KØHS 387 2 41 2,268 SD
Fort Venango Mike and Key Club
W3ZIC 356 2 25 2,250 WPA
KZ9B 542 2 12 2,202 WI
Clark Co ARC
W7AIA (+K7JAO)
314 2 130 2,190 WWA
Ozark Mtn ARC
AAØIU 353 2 32 2,156 MO
MTARS
W4UOT 405 2 38 2,114 TN
Saint Croix Valley ARC
WW1IE (+K1BSA)
387 2 30 2,076 ME
North Richland Hills ARC
K5NRH (+K5GD)
248 2 106 2,052 NTX
Rip Van Winkle ARS
WD2K 401 2 25 2,040 ENY
Radio Amateurs of Greater Syracuse
W2AE 529 2 65 2,038 WNY
Antietam Radio Assn, Inc.
W3CWC (+W3F)
411 2 17 2,020 MDC
Thumb ARC
W8AX 497 2 36 1,986 MI
RAC of Knoxville
W4BBB 423 2 40 1,968 TN
Maury ARC
W4GGM 301 2 47 1,964 TN
Southboro Rod & Gun Club ARC
W1SRG (+KB1JFG)
513 2 6 1,920 WMA
Eva ARC
KI4FDU 288 2 45 1,896 AL
Grayson Co ARC
K5GCC 311 2 20 1,832 NTX
Tri-County CW ARC
W3TCW 311 2 18 1,728 WPA
Portsmouth ARC & PARES
W4POX 328 2 35 1,726 VA
Peace River RA
W4DUX 214 2 30 1,714 WCF
Pilgrim ARC
N1FI 356 2 18 1,672 EMA
Bridgerland ARC
W7IVM 473 2 40 1,664 UT
High Sierra FD Group
W6PS 945 1 8 1,617 SV
T-CEP Disaster Radio Team
K6TI 250 2 10 1,608 LAX
USCG AuxiliaryDivision 10/ District 11SR
K1EHO 156 2 29 1,560 AZ
Silvercreek ARA
W8WKY 414 2 6 1,478 OH
Lakeway ARC
W2IQ 306 2 37 1,466 TN
RECWA
WW2FD 305 2 5 1,460 ENY
Hoosier Hills Ham Club
W9QYQ 178 2 12 1,344 IN
Crawford Co Hams
KC9IND 239 2 24 1,328 IN
Cascade ARS
W8JXN 332 2 15 1,318 MI
Vinton Co ARC
AB8XG 204 2 8 1,238 OH
Shasta Cascade ARS/ARC of Anderson
NC6I 285 2 3 1,226 SV
Radio Operators Assn of Dallas
W7ORE 201 2 24 1,146 OR
Pioneer ARC
KØJFN 188 2 15 1,142 NE
Quarry Top Hams
N8ZV 74 2 51 1,132 OH
Lanier Land ARC
W4B 78 2 12 1,128 GA
Barry ARA
K8BMI 64 2 30 1,114 MI
Border ARS
K5P 267 2 15 1,106 STX
Need-A-Hat Group
K9UJH 206 2 8 1,100 WI
Houston Co. ARC
WA5EC (+KE5PJO)
43 2 19 986 STX
Jefferson Co. ARC
KD8DMI 65 2 12 970 WV
Delaware Valley Ragchew Club
N2HQX 32 2 8 864 SNJ
W8GDW 206 2 16 862 MI
Capital City ARC
W7TCK 46 2 8 492 MT

4A Battery

Portland ARC
W7LT 445 5 21 4,905 OR
St. Louis QRP Soc
NØWM 262 5 19 3,620 MO
Friends of the 045 Repeater
W6V (+WU5SHU)
375 5 6 3,510 EB
Northern VA QRP Group
WA4MM 244 5 8 3,155 VA
Snake River ARC
K7SI 68 5 20 1,465 ID

4A Commercial

Anthracite Repeater Assn
W3SJI 782 2 15 2,212 EPA
North Bay ARC
NØBRC (+KI6OCL)
807 2 12 2,002 SF
RA of Western NY
W2PE 476 2 25 1,866 WNY
Black River ARC
K8BRC 426 2 20 1,302 MI
Flagler Palm Coast ARC
W4FPC 172 2 22 1,200 NFL
Jersey Shore ARS
NJ2AR 208 2 10 774 SNJ
NØK 127 2 14 704 NE
KØQBI 18 2 12 486 MN

5A

Port City ARC
K1R (+W1WQM)
4951 2 35 15,980 NH
Loudoun ARG
K4LRG (+AJ4EY)
4299 2 55 15,060 VA
Oazukee RC
W9LO (+AA9W)
3985 2 35 12,816 WI
Virginia Beach ARC & VADXCC Club
W4UG (+K4IX)
3047 2 67 10,682 VA
N4N FD Group
N4N (+KE4UW)
2016 2 25 7,868 GA
Santa Cruz Co ARCs
K6WC (+N1WC)
1855 2 65 7,628 SCV
Schenectady ARA
K2AE (+W2CSN)
1735 2 34 7,456 ENY
St Petersburg ARC
W4TA 1615 2 28 6,940 WCF
Rochester ARC
WØSA 2894 1 59 5,718 MN
Brazos Valley ARC
KK5W 1316 2 40 5,388 STX
Fort Wayne RC
W9TE 1166 2 52 4,894 IN
Twin City ARC
K9CU 1581 2 40 4,816 IL
RF Hill ARC
W3AI 1359 2 20 4,484 EPA
Redmond ARES/MicroHAMs/RTKCC
K7R (+N7OS)
947 2 45 4,382 WWA
Fort Myers ARC
W4LX 998 2 30 4,382 SFL
Holland ARC
K8DAA 1137 2 25 4,244 MI
Starved Rock RC
W9MKS (+K9ZQ)
914 2 63 4,144 IL
Butler Co. ARA
W3UDX (+AA3YW)
1104 2 12 4,068 WPA
NE GA ARC & Athens ARC
N4G (+KD4QHB)
963 2 37 3,954 GA
Wheaton Community Radio Amateurs
W9CCU 813 2 25 3,848 IL
Manotick ARG
VE3AIR 1249 2 175 3,800 ON
Oxford Co ARES
W1OCA (+N1YIS)
777 2 41 3,750 ME
River City AR Comm Soc
N6NA (+W6FT)
749 2 41 3,526 SV
Hoodview
W7Q (+N7QR)
746 2 34 3,458 OR
Central NH ARC
W1JY (+W1CNH)
710 2 25 3,456 NH
Highlands Co ARC
K4W 651 2 30 3,442 WCF
VE3SWA 679 2 5 3,304 ON
L'Anse Creuse ARC
N8LC 822 2 24 3,286 MI
York Region ARC
VE3YRA 685 2 30 3,274 ON
AARC Jr
KI3DS 730 2 50 3,090 MDC
South East Metro ARC
WØCGM 583 2 10 3,050 MN
Montcalm Area ARC
N8MA 709 2 24 3,024 MI
Lancaster ARC Inc
W2SO 790 2 6 3,010 WNY
AREA
W9YPC 690 2 15 2,962 IL
Mount Diablo ARC
W6CX 831 2 75 2,932 EB
10-70 Repeater Assn
N2SE (+W2INS)
585 2 28 2,908 NNJ
Associated Radio Amateurs of Long Beach
W6RO (+AE6VZ)
590 2 82 2,798 LAX
Iredell Co ARS
W4SNC 608 2 20 2,796 NC
Kitchener Waterloo ARC
VE3IC 1038 2 14 2,780 ON
CORE Group
K4ORE 668 2 8 2,642 TN
Las Vegas RAC
N7F (+K7UGE)
739 2 120 2,632 NV
Island Co ARC
W7AVM 438 2 27 2,596 WWA
Sangamon Valley RC
W9DUA 628 2 30 2,566 IL
Callam Co. ARC
W7FEL (+KE7XX)
458 2 24 2,450 WWA
W2IMU 495 2 5 2,440 SNJ
Honeywell-Glendale ARC
K7HON 646 2 8 2,402 AZ
Wood Co Em Comm
WC8EC 493 2 19 2,378 WV
The Northern Ohio ARS
K8KRG 541 2 23 2,340 OH
Panoramaland ARC
K7JAR 459 2 17 2,256 EWA
Denver RC
WØTX 533 2 21 2,078 CO
Kendall ARS
KB5TX 493 2 11 2,034 STX
Mt Vernon ARC
K4US 427 2 15 1,988 VA
Toledo Mobile RA
W8HHF (+NN1I)
375 2 55 1,970 OH
Copperas Cove Fire/CERT/Tri-City ARC
AC5IO (+WR5CRA)
349 2 32 1,810 NTX
Kent ARS
K3ARS (+N3WGC)
298 2 10 1,740 MDC
Wisconsin Valley RA
W9NA (+W9HDG)
238 2 11 1,702 WI
Fulton Co ARC
K8BXQ 304 2 15 1,658 OH
Superstation / Scottsdale ARC
NK7T 432 2 11 1,628 AZ
Elk Co. ARA
N3NIA 329 2 17 1,558 WPA
Jonestown Mountain Repeater Assn
N3CSE 326 2 8 1,548 EPA
NW Georgia ARC
W4VO 200 2 7 1,516 GA
Northwoods ARES
NS9Q 98 2 15 1,416 WI
Sunset Empire ARC
W7BU (+WA7TEM)
107 2 30 1,364 OR
WØUJ 188 2 24 1,270 MN
K4WOC 180 2 12 1,250 GA
TCARES
K6TUO 295 2 9 1,240 SJV
W6O 59 2 5 1,130 ORG
W5ZU 102 2 12 1,082 NM
Kings Co Repeater Assn
KC2RA 234 2 22 558 NLI

5A Battery

Durham Region QRP Club
VE3QDR 934 5 6 9,755 ON
Zuni Loop Mtn Expeditionary Force
N6GA 795 5 9 7,725 LAX
Forsyth ARC
W4NC (+W4WS)
461 5 46 5,035 NC
North Coast ARC
N8NC 280 5 32 2,740 OH

5A Commercial

Milledgeville ARC
W4M 1163 2 27 4,324 GA
ARA of SW Florida
W4F (+K2ZEL)
1103 2 24 2,526 SFL
Wisconsin ARC
K9RHH (+W9IQ)
547 2 12 2,210 WI
LaGrange ARC
AB4GA 522 2 50 1,706 GA
West Central Louisiana ARC
W5LPJ (+W5LSV)
273 2 60 1,586 LA
Sarasota Em RC
N4SER (+NJ4M)
390 2 28 1,582 WCF
Coastal ARS
W4LHS 373 2 30 1,562 GA
Bootheel ARC
KBØUFL 222 2 21 1,104 MO
Suffolk Co RC
W2DQ 188 2 20 826 NLI

6A

South Jersey Radio Assn
K2AA (+W2EA)
5754 2 45 19,434 SNJ
Mike & Key ARC
K7LED (+K7OV)
3848 2 70 12,906 WWA
Lake Co ARA
N8BC 2206 2 26 8,796 OH
United Radio Amateur Club
K6AA 2355 2 22 7,232 LAX
Central Kentucky RS
AA4NJ 1708 2 13 6,304 KY
Big Bear ARC
K6BB 1514 2 32 6,020 ORG
DuPage ARC
W9DUP (+KC9LEZ)
1590 2 67 5,656 IL
Two Rivers ARC
W3OC 1287 2 45 5,468 WPA
Lake Monroe ARS
N4EH (+AJ4HP)
1524 2 64 5,424 NFL

Sun Parlour Retirees ARC
VE3OW 1721 2 30 5,020 ON
Orlando ARC
W1SE 980 2 24 4,698 NFL
Tipp City AR
K8ZC 853 2 25 4,226 OH
Fountain Valley Amateur Comm Team
WA6FV 996 2 20 4,162 ORG
Niagara Peninsula ARC
VE3VM (+VA3ROW)
1361 2 35 4,042 ON
Bellevue ARC
WØWYV (+WBØCAP)
1033 2 16 3,978 NE
WR4MG (+KJ4O)
1041 2 32 3,640 GA
Salem ARC
W7SAA 765 2 82 3,460 OR
Andrew Johnson ARC
W4WC 768 2 15 3,436 TN
Crawford Co ARC
W8BAE 1138 2 33 3,236 OH
VE3BA 1196 2 10 3,196 ON
ARC of El Cajon
WA6BGS 745 2 73 3,164 SDG
Saginaw Valley ARA
K8DAC (+N8XPS)
761 2 31 2,948 MI
Short Mountain Repeater Club
W4YXA (+K4RH)
472 2 56 2,688 TN
Butler Co. Amateur Radio Public Service Group
K3PSG 674 2 30 2,684 WPA
Johnston ARC
K4SWR 545 2 65 2,614 NC
Waterville Area Wireless Assn
WA1WA 440 2 25 2,496 ME
Whitman ARC, Inc.
WA1NPO 519 2 46 2,402 EMA
East River ARC
W8MOP 372 2 15 2,030 VA
Parrottsville Crackers
AG4OA 300 2 30 1,922 TN
Chelsea ARC
WD8IEL 325 2 20 1,868 MI
Keuka Lake ARA
KV2W 302 2 33 1,856 WNY
Stanislaus ARA
W6ERE 311 2 26 1,654 SJV
Whitby ARC
VE3WOM 326 2 8 1,402 ON

6A Commercial
Milwaukee RA Club
W9RH (+AB9FH)
789 2 26 3,098 WI
Tishomingo Co ARC
W5TCR 513 2 16 1,926 MS

7A
Hampden Co RA
W1NY (+WB1Z)
3457 2 45 11,602 WMA
Raleigh ARS
W4DW (+W4RNC)
3382 2 41 9,732 NC
RC of Tacoma
W7DK (+W7OS)
2204 2 126 8,434 WWA
Gloucester Co. ARC
W2MMD 1679 2 24 6,990 SNJ
Gwinnett ARS
W4GR (+WA4HCE)
1805 2 85 5,796 GA
Warminster ARC
K3DN 1280 2 24 5,038 EPA
Greater Wichita Field Day
NØW (+KCØMTM)
1047 2 75 4,394 KS
Muskegon Area AR Council
W8ZHO 910 2 17 3,770 MI
Silverado ARS
W6CO (+KO6FR)
737 2 25 3,526 EB
Midland ARC
W8KEA 543 2 20 2,850 MI
Calaveras ARS
N6FRG (+WS6P)
394 2 21 2,638 SJV
Wilson ARC
WC4AR 621 2 12 2,614 TN
Kern Co Central Valley ARC
W6LIE 481 2 33 2,200 SJV
Scarborough ARC
VE3WE 367 2 12 1,484 ON

7A Battery
David Sarnoff ARC
N2RE 292 5 58 3,860 SNJ

8A
Rappahannock Valley ARC
K4TS (+AK1E)
3030 2 38 10,782 VA
Cuyahoga ARS
W8BM 2628 2 50 10,048 OH
Mississauga ARC
VE3MIS 2377 2 19 8,282 ON
Fox River Radio League
W9NE (+W9CEQ)
1954 2 75 7,828 IL
W9UUU 1879 2 58 6,824 IN
Radio Society of Tucson
K7RST (+KD7SPY)
1574 2 29 5,294 AZ
Bears of Manachester
W1BRS 1092 2 28 4,184 CT
Mahoning Valley ARA
W8QLY 1009 2 31 4,048 OH
Western Carolina ARS
W4MOE (+W4IYS)
385 2 10 2,480 NC
South Shore Simplexers
K1M 404 2 15 2,106 EMA

8A Battery
West Valley ARA
N6N (+AD6RE)
1190 5 30 11,650 SCV
Orange Co Radio Amateurs
W4EZ (+KI4LLL)
1067 5 36 10,530 NC

9A
Woodbridge Wireless
W4IY (+N2PJ)
6592 2 42 21,108 VA
Nashua ARC
N1FD 3635 2 30 11,362 NH
Orange Co ARC
W6ZE (+N1AB)
3265 2 83 11,316 ORG
Delta ARS
VE7SUN 1281 2 35 5,018 BC
Four Lakes ARC
W9JZ (+NQ9A)
804 2 15 3,620 WI
K8TKA 611 2 11 2,846 OH

9A Battery
Conejo Valley ARC
AA6CV 526 5 45 6,020 SB

10A
El Dorado Co. ARC
AG6AU 1085 2 33 4,044 SV
Silver Springs RC
K4GSO 671 2 13 3,594 NFL

12A
VCARS/ VCARC/Simi Settlers ARC
N6R 783 2 25 3,796 SB
Signal Hill Amateurs
NØEV 695 2 20 1,476 CO

15A Battery
Utica Shelby Em Comm Assn
K8UO (+KG4JTC)
1317 5 116 13,085 MI

18A
Genesis ARS
N1ZIZ (+KB1FVR)
403 2 25 3,500 EMA

23A
Potomac Valley RC/Columbia ARA
W3AO (+KE3Q)
10709 2 60 33,664 MDC

1B-1 Op Battery
AB4I 796 5 1 8,260 VA
K3WW 774 5 1 7,875 EPA
K4Y 740 5 1 7,550 KY
W3TS 649 5 1 6,940 EPA
NØUR 662 5 1 6,870 MN
K7IA 633 5 1 6,680 NM
N8BB 531 5 1 5,460 MI
K5WNH 393 5 1 4,280 NTX
VE3RER 355 5 1 3,900 ON
W3CB 301 5 1 3,760 MDC
VA3DF 380 5 1 3,745 ON
KXØR 326 5 1 3,510 WY
K8AB 338 5 1 3,350 OH
KEØG 255 5 1 2,650 MN
WS8H 252 5 1 2,640 MI
N8TD 249 5 1 2,595 OH
W7QC 224 5 1 2,590 ID
WA8REI 210 5 1 2,300 MI
W8PBO 217 5 1 2,270 WV
VE3LC 200 5 1 2,150 ON
K5SI 191 5 1 2,010 STX
N7XJ 162 5 1 1,970 UT
KD2JC 185 5 1 1,900 NNJ
N3AB 164 5 1 1,740 EPA
VE2GB 153 5 1 1,730 QC
W6UR 154 5 1 1,690 SJV
K1PDY 125 5 1 1,600 NH
AD7L 131 5 1 1,560 OR
W5ODS 120 5 1 1,550 OK
W9NJY 120 5 1 1,530 WI
N3ZP 152 5 1 1,520 WV
AC3V 123 5 1 1,480 SNJ
NGØR 119 5 1 1,440 MN
WØRSP 138 5 1 1,430 SD
K4CHE 113 5 1 1,330 DE
VE3CG 97 5 1 1,320 ON
AB4EL 126 5 1 1,310 NC
K3TW 80 5 1 1,250 MDC
WD6DX 132 5 1 1,205 SCV
AK7V 117 5 1 1,165 ORG
WG5F 80 5 1 1,080 OK
W7CD 55 5 1 1,075 WWA
K5ICW 100 5 1 1,050 STX
KA1FFO 79 5 1 1,040 MDC
KU4A 118 5 1 1,000 KY
KC9ZO 77 5 1 920 IL
WD8DSB 84 5 1 890 IN
AB9IO 89 5 1 810 WI
NØBN 47 5 1 805 CO
W5BOB 61 5 1 765 STX
K9SIU 61 5 1 760 IL
W9YO 60 5 1 750 IL
W2HLI 64 5 1 740 NLI
K1EME 56 5 1 710 NH
N2JFS 44 5 1 690 VT
KA1HSP 50 5 1 650 WMA
KIØG 33 5 1 645 CO
KC5LN 28 5 1 640 OR
K6BBQ 62 5 1 620 SF
N2JPR 60 5 1 620 ENY
W7VN 48 5 1 580 OR
N8XA 83 5 1 555 OH
ACØGP 46 5 1 550 MO
W5TB 29 5 1 540 NTX
WUØL 29 5 1 540 IA
KE3HG 36 5 1 530 EPA
AB1HL 47 5 1 520 EMA
WB1GCM 36 5 1 510 CT
VE6ZC 40 5 1 480 AB
AB4VF 27 5 1 470 NFL
WB3CEG/5 22 5 1 470 STX
KD2MX 42 5 1 470 NNJ
W7AU 31 5 1 460 OR
KE2OI 61 5 1 455 SNJ
K9WIS 10 5 1 450 WI
W6CT 10 5 1 450 SCV
KE4KE 51 5 1 430 TN
KB9UIY 33 5 1 415 OH
KB7LJP 14 5 1 390 WWA
KI6FEN 22 5 1 370 SV
K1ULF 12 5 1 370 CT
KA5GIS 27 5 1 370 AR
K3SFP 25 5 1 350 VA
KD5RYZ 49 5 1 345 NM
W4CLQ 29 5 1 330 OH
KL2/W7GKF 15 5 1 300 AK
WB9SFM 18 5 1 290 IL
AC7CJ 5 5 1 275 EWA
WD9EWK 3 5 1 265 AZ
K1YPP 21 5 1 260 EPA
NØNBD 15 5 1 250 KS
W7JAZ 18 5 1 240 OR
KB5DRJ 28 5 1 240 NTX
WA5ZTD 4 5 1 190 OR
N1EMF 7 5 1 185 VT
KDØAWW 2 5 1 160 CO
KKØD 11 5 1 160 CO
K2EIR 3 5 1 115 ENY
KD2MU 9 5 1 95 NLI

1B-1 Op
K2EK 1252 2 1 4,236 NFL
WB9COY 1056 2 1 4,018 SDG
K8RYU 886 2 1 2,902 OH
WB8JUI 500 2 1 2,250 OH
KE7NO 749 2 1 2,100 MT
N5JB 436 2 1 2,082 NTX
WØAAA 496 2 1 2,006 MN
KV2X 454 2 1 1,966 NNY
KM5VI 815 2 1 1,880 MI
W9ZRX 486 2 1 1,872 NC
N4UF 429 2 1 1,854 NFL
WA2S 308 2 1 1,476 NNJ
AA1PL 411 2 1 1,364 RI
KB8O 464 2 1 1,088 NLI
KC3Q 220 2 1 980 EPA
AD7LL 105 2 1 922 ID
KA1SG 146 2 1 780 ME
W9KHH 120 2 1 780 WI
W6EFB 102 2 1 754 SJV
WM5Z 93 2 1 746 NM
N6GEO 150 2 1 744 SV
KC7O 205 2 1 682 SDG
KE6JZS 104 2 1 658 ORG
K6CU 108 2 1 632 ORG
KC9MAV 239 2 1 628 IL
VA2NU 114 2 1 578 QC
KI6CDF 128 2 1 510 ORG
K6PDQ 120 2 1 490 SB
K6JRA 96 2 1 442 EB
K7AGE 88 2 1 434 SV
VE2SMW 40 2 1 430 QC
KØCWW 122 2 1 394 NE
WB8BZK 62 2 1 378 IL
N8PR 66 2 1 370 OH
NØTRQ 151 2 1 352 WI
W5JAK 44 2 1 338 CO
WA5OYU 114 2 1 328 MS
KA9VHG 36 2 1 326 WI
KØMPH 64 2 1 306 ND
KI5JF 89 1 1 298 STX
VA4CQD 22 2 1 294 MB
VE6PKR 63 2 1 276 AB
WAØNVT 82 2 1 264 MO
WB5LRP 77 2 1 254 STX
N7CFO 23 2 1 246 EWA
N3FP 68 2 1 236 GA
KA7BHK 10 2 1 220 AZ
KBØVSN 25 2 1 200 MN
WA7TPB 10 2 1 170 WWA
N2IYR 55 2 1 160 SNJ
N5YM 23 2 1 146 NTX
KC7AQZ 20 2 1 90 AZ
KA9IVY 9 2 1 68 IA

1B-1 Op Commercial
K7DR 939 2 1 3,548 MI
K3ZT 201 2 1 552 EPA
WC4V 92 2 1 410 KY
KI4RUG 95 2 1 360 VA
AF1SH 82 2 1 314 OH
WB5A 129 2 1 308 NM
N1LDT 150 2 1 300 VT
W8EKG 52 2 1 254 OH
KG4CDI 90 2 1 230 NC
KD5BBR 102 2 1 204 OK
KN6BN 15 2 1 182 SDG
KE8E 52 2 1 154 OH
KB9WWM/1 25 2 1 144 RI
NØOMC 19 2 1 138 KS
WB8VQU/8 41 2 1 132 MI
KE6EKC 27 2 1 104 EB
N9DVT 30 1 1 30 MN

1B-2 Op Battery
W5YA 783 5 2 8,305 NM
K9OM 364 5 2 3,890 WI
VA3YV 404 5 2 3,725 ON
N4RE 330 5 2 3,550 NC
K4RDU 327 5 2 3,470 VA
WØUFO 281 5 2 3,260 MN
WB9CIF 307 5 2 3,060 IN
W7RIN 233 5 2 2,505 AZ
K2WNY 231 5 2 2,390 WNY
N1YWB 216 5 2 1,930 SDG
NØEVH (+KØWEW)
145 5 2 1,650 MO
W5ON 148 5 2 1,530 AR
W3WT 119 5 2 1,490 EPA
W6LPW 171 5 2 1,455 SCV
WØAZ 100 5 2 1,250 CO
AK2S (+WB2PKG)
114 5 2 1,240 SNJ
KD7T (+K7POS)
101 5 2 940 WWA
K2QR 19 5 2 840 WNY
WA5ZNU 22 5 2 760 OR
W3BIG 100 5 2 750 EPA
AJØW 15 5 2 670 MO
KO6TD 57 5 2 635 LAX
VE7GDS 45 5 2 570 BC
K4RET 38 5 2 455 VA
AE6JB/6 29 5 2 350 SF
WA7THF (+KI6RRK)
19 5 2 290 SCV

1B-2 Op
W2RA 1774 2 2 7,446 WNY
N4DD 1312 2 2 5,498 VA
KK9J 900 2 2 3,838 WI
KA1VHF 769 2 2 3,226 OH
WK6O 909 2 2 2,998 ORG
VE3II 711 2 2 2,994 ON
N9EZ 676 2 2 2,854 MI
K7GGG 900 2 2 2,826 AZ
VE6KC 583 2 2 2,582 AB
W3SW 872 2 2 2,094 WNY
N6JF 312 2 2 1,388 LAX
N5LBJ 457 2 2 1,364 MDC
W7Y 500 2 2 1,284 WY
KL2AX 286 2 2 1,256 AK
WA4OF 219 2 2 1,188 NC
VA7MM 201 2 2 1,090 BC
NØJDC 100 2 2 858 CO
W5JMW 144 2 2 798 WTX
N5PJ (+WDØGTY)
136 2 2 736 OK
NX4N 213 2 2 698 NFL
VA3TQX 121 2 2 612 ON
VO1PY 185 2 2 520 NL
K6CF (+N6VHF)
126 2 2 476 ORG
N8FGB 153 2 2 456 MI
N8PJ (+N8RMZ)
111 2 2 422 OH
N8HC 106 2 2 362 MI
W3RP (+K8ARY)
127 2 2 354 WPA
KI6DSW 47 2 2 344 SCV
NJ9B 78 2 2 326 IN
N1DIQ (+KA1ZPI)
111 2 2 322 VT
AE6UP 32 2 2 314 SF
W6OFM 30 2 2 260 SF
K3ZYK 13 2 2 196 WPA

1B-2 Op Commercial
NE7D 364 2 2 1,506 OR
KAØZPP 205 2 2 660 ND
WØNBP 125 2 2 550 IA

2B-2 Op Battery
K3ZZ 1264 5 2 9,930 MDC
AA4W 361 5 2 3,960 NFL
N8EFO 384 5 2 3,545 OH
KGØRD 121 5 2 1,560 IA
VA3OVQ 55 5 2 1,180 ON
N6MBY (+K6RHB)
117 5 2 1,085 SB
K6ORI 8 5 2 390 EB

2B-2 Op
K3WGR 1347 2 2 5,620 EPA
NA5Q 490 2 2 1,754 LA
KC5JFO (+K5PAR)
410 2 2 1,528 NTX
AI4SK 351 2 2 1,394 MDC

W7SST	296	2	2	1,168	OR
K2OAK	337	2	2	1,030	NNJ
WA9STI	314	2	2	984	SB
WO9K	135	2	2	958	IL
K9PLX	230	2	2	924	WI
AE6FD	181	2	2	712	SJV
AF6AV	66	2	2	602	SDG
KØMHP (+KCØLKG)	302	1	2	402	MO
VE6RI/VE8	33	2	2	334	NWT
KT5QQ	15	2	2	280	NM

3B-2 Op

KW8N	2978	2	2	10,008	OH

Mobile Stations

1C

N6VW	459	5	3	4,680	LAX
W5JBV/M	411	5	1	4,050	NFL
AA6DP	830	2	4	3,448	LAX
NJ4X	556	2	1	2,324	MO
K4MUT	180	5	1	2,150	MDC
W9XS	220	2	1	1,128	IL
WO8L	143	2	1	792	NC
N7DLV	208	2	1	766	WWA
WA7ZZB	93	2	1	636	WWA
NM2L	108	2	1	582	GA
K8TL	117	2	2	554	OH
K7CN	36	5	1	510	OR
NB7O	85	2	1	420	OR
K1UR	94	2	2	348	EMA
KH6/K4IQJ	47	2	1	338	PAC
ABØYM	33	2	1	316	CO
NØCQI	80	2	1	310	NE
W7CGA	15	2	1	310	EWA
AB8XX	25	2	1	300	OH
W4ZPR	24	2	1	296	VA
N4LS	66	2	1	286	AZ
WA2CRQ	33	2	1	274	SCV
W4SHG	111	2	2	272	TN
K5VHH	83	2	1	266	STX
K1UQE	39	2	1	256	CT
N1KR	53	2	1	256	SCV
WS9C	40	2	1	232	SD
KØMAF	40	2	1	230	OK
KEØL	89	2	1	228	MN
WH6C	38	2	1	226	PAC
KBØG	19	2	2	208	VA
N2BZP	25	2	1	200	ENY
N9THK	25	2	1	200	NC
WA4JA	25	2	1	200	TN
KE3FL	9	2	1	186	MDC
K2HVN/M	28	2	1	184	NH
K8YC	57	2	1	180	MI
KA1KNW	40	2	1	180	CT
WX5ARK	14	2	1	178	MI
KCØOTR	14	2	1	178	VA
WBØNRE	26	1	1	176	ORG
W9MMZ	36	2	1	172	OH
N1KFC	2	2	1	154	NC
AD6AF	23	2	1	146	LAX
KA3KSP	22	2	1	144	WPA
KA5FQA	21	2	1	142	OR
ACØHD	36	2	1	122	MO
NX2PX	31	1	1	112	OH
N7QMT	11	1	1	111	WWA
KG4BXN	13	2	1	76	GA
N3AWS	5	5	1	75	MS
KI4CVU	12	2	1	74	TN
VE7CX	1	2	1	52	BC

2C

W8AG	274	2	7	898	MI

4C

WI3N	50	2	2	352	MDC

Home Stations Commercial Power

1D

K5KG	1168	2	1	3,848	WCF
WT7TT	759	2	1	3,086	CO
W9HB	574	2	2	2,446	WI
K9WZB	890	2	1	2,108	AZ
K9AVE	510	2	1	2,090	IL
W9LHG	515	2	1	2,066	WI
KØAXU	686	2	1	2,036	MO
K9UQN	427	2	1	1,858	IL
K4GA	829	2	2	1,734	GA
KØOB	616	2	1	1,730	MN
W6UB	429	2	1	1,704	TN
VA7ST	413	2	1	1,702	BC
N3KR	370	2	1	1,530	EPA
K7ZZ	1040	1	1	1,513	OR
KL2R	255	2	5	1,466	AK
VE7NH	333	2	1	1,382	BC
WA8UXP	368	2	4	1,366	OH
WØEAN	422	2	2	1,288	IA
KØPK	307	2	1	1,278	MN
W4ARM	318	2	1	1,248	SFL
W2LHL	266	2	1	1,114	NNJ
VE3EY	261	2	1	1,094	ON
AE5PW	261	2	1	1,086	AR
N7RVD	237	2	1	1,058	WWA
VE3XD	248	2	1	1,042	ON
KG4W	256	2	1	1,024	VA
AI7H	215	2	1	1,010	ID
WWØJD	241	2	4	988	IA
VE3MPT	360	2	3	986	ON
W8WZZ	313	2	5	976	OH
KO7X	550	1	2	959	WY
VE3MGY	442	2	1	934	ON
W8IQ	231	2	1	920	OH
N4CPA	217	2	1	912	TN
WAØKAQ	322	2	1	906	CO
KJ5ZT	423	2	7	896	AR
KI4VB	213	2	1	876	VA
K5BG	412	1	1	869	NTX
N8CPA	212	2	1	848	OH
W7QN	230	2	1	840	WWA
WF4W	210	2	1	840	GA
K4AQ	195	2	1	828	GA
KB9YGD	320	2	1	814	IN
KA2OUO	235	2	1	812	NC
N3CZ	226	2	1	802	NC
WA3AAN	183	2	1	782	EPA
WØRAA	176	2	1	754	CO
W1WIU	305	2	1	742	RI
KC8WGA	189	2	1	732	MI
K2MK	340	1	1	730	SNJ
N1WQ	160	2	1	690	MN
KF8GE	194	2	1	678	STX
VE3FJ	155	2	1	670	ON
N2XI	154	2	1	666	ENY
KØLWV	153	2	1	662	MO
KB4AMA	303	2	1	656	KY
K5HDU	150	2	1	650	STX
VE2FFE	121	2	1	634	QC
KD5MFY	289	2	1	628	OK
W6AFA	563	1	1	613	LAX
W5TT	136	2	1	586	AR
KA2L	268	2	1	586	NLI
VE3IAE	170	2	1	580	ON
KI4YAH	522	1	1	572	VA
VE1ZAC	146	2	3	570	MAR
KØLC	113	2	1	552	KS
N7UJJ	250	2	1	550	AZ
W6RFF	124	2	1	546	SV
W2GHD	99	2	1	546	WNY
WØQQG	120	2	1	530	VA
K6CSL	141	2	1	528	SJV
KI4JQB	119	2	2	528	VA
KT4PD	128	2	1	522	SFL
N6KW	200	1	1	522	WWA
W3KS	234	2	1	518	DE
W5THT	141	2	1	510	MS
W8ICN	221	1	1	492	MI
W5GAI	139	2	1	492	STX
KA2FHN	119	2	1	486	WNY
W3TUA	112	2	1	482	EPA
N1NN	108	2	1	482	EMA
W4NTI	108	2	1	482	AL
N5PA	208	2	1	480	MS
KF3CV	107	2	1	478	MDC
N3BM	106	2	1	474	VA
K9AHH	105	2	1	470	IL
YO7ARY/W1	117	2	1	468	CT
KA6NGR	117	2	1	468	SV
N2QJN	208	2	1	466	NNJ
AL1G	348	1	1	457	AK
WB2KLD	226	2	1	452	NNY
W7UG	239	1	1	452	OR
W1CDX	100	2	1	450	NH
KO4D	100	2	1	450	VA
N7FDU	110	2	1	442	WWA
NX7F	110	2	1	436	NV
K6III	230	1	1	427	SV
NS4DX	140	2	1	422	VA
K6GFJ	104	2	1	416	SCV
VE3EJ	91	2	1	414	ON
AA3II	103	2	1	412	WPA
W8TWA	103	2	1	412	MI
W3DP	90	2	1	410	EPA
VE3VV	100	2	1	400	ON
W9SE	190	2	1	400	IL
NE8J	174	1	1	398	NFL
N7HZB	8	2	1	396	UT
NA4O	172	2	1	394	GA
NY7P	105	2	1	390	MDC
N3ALN	168	2	1	386	MDC
NP2I	385	1	1	385	WI
W7CH	159	2	1	368	EWA
KG4WNA	67	2	1	368	KY
K8BZ	195	1	1	368	MI
WS7R	179	2	1	358	AZ
ABØTA	228	1	1	350	MO
K6WSC	87	2	3	350	SDG
W4NRV	150	2	8	350	VA
VE3TAZ	141	1	1	348	ON
K3GW	147	1	1	344	WPA
KN8DMK	48	2	1	342	OH
KB6A	178	1	1	341	ORG
W6VM	146	2	1	336	SB
VA3HUN	84	2	1	336	ON
WD4MKU	116	2	1	332	NC
N4SHY	139	2	1	328	SC
AC7JW	76	2	1	328	UT
W3GQJ	30	2	1	320	NFL
NØVPL	80	2	1	320	NTX
K3VED	160	2	1	320	WPA
VE2CLM	65	2	9	318	QC
K2DSL	134	2	1	318	NNJ
WB9ICL	79	2	1	316	IN
W7SM	156	2	10	312	OR
KR4GT	127	2	1	304	KY
KO6OP	127	2	1	304	SJV
AAØA	300	1	1	300	MO
KI3O	76	2	1	298	VA
K6OGO	74	2	1	296	ORG
N1MHV	101	2	1	290	CT
KO9A	104	2	1	284	IL
VA3QWW	142	2	1	284	ON
WS2N	52	2	1	284	NLI
WP4AOH	58	2	1	282	PR
K1LOG	65	2	1	282	ME
N4NC	70	2	1	280	NC
WU7R	71	2	1	280	MT
WO2N	115	1	1	280	NLI
K6TTD	66	2	1	280	SV
WA7YNU	95	2	1	272	MT
W7DML	47	2	1	272	UT
WB9RFV	135	2	2	270	IN
KO4Y	110	2	1	270	TN
WD4BMG	65	2	1	268	NC
NX9T	215	1	1	265	NC
AB1BW	58	2	1	262	CT
VO1HE	56	1	1	259	NL
W8TK	64	2	1	256	OH
KD7GUS	102	2	2	254	EWA
N9WVM	101	2	1	252	IN
KC4TVZ	199	1	1	250	GA
KV5WS	50	2	1	250	STX
K7EIQ	50	2	1	250	EWA
N2QGV	53	2	1	248	NFL
KB1MNN	39	2	1	248	WMA
K7DAC	99	2	1	248	UT
WB9GHD	49	2	1	246	SDG
AD7MQ	80	2	1	246	MT
KC9AOP	77	2	4	244	IL
N6QZS	61	2	1	244	SV
KB3P	172	1	1	241	EPA
KO8S	90	2	1	240	MI
N3TG	60	2	1	236	VA
WD8KRV	21	2	1	232	AZ
N3GGT	45	2	1	230	EPA
W7LN	57	2	1	228	MO
KM4LS	88	2	1	226	GA
WA6GFR	44	2	1	226	ORG
VE2DWE	37	2	1	224	QC
N6EM	68	2	2	224	SCV
N4JDB	214	1	1	222	AL
WB9WHG	43	2	1	222	MN
ND2E	43	2	1	222	TN
W1GQN	33	2	1	216	EMA
KB3MIS	83	2	1	216	EPA
N4DLR	82	2	1	214	OH
AI4WW	81	1	1	212	SFL
WD8DIN	53	2	1	212	NC
AB3S	40	2	1	210	SFL
KD5RSS	52	2	1	208	OK
N4TCP	79	2	1	208	NC
KCØRRS	77	2	1	204	KS
N2YHQ	43	2	1	204	WNY
KD7SWL	57	2	4	204	UT
NC4MI	203	1	1	203	NC
AE6YB	76	2	1	202	SF
KD5MEB	76	2	1	202	AR
AG4SO	201	1	1	201	VA
WB9LRK	75	2	1	200	IN
W7MPK	50	1	1	200	MT
KB9GEG	75	2	1	200	IL
AB8S	57	2	1	198	WV
KA6GDT	40	2	1	196	SJV
VE9JT	72	2	1	194	MAR
WA9AFM/5	36	2	1	194	OK
K5KWR	71	2	1	192	STX
KF4ZNL	94	2	1	188	GA
N5KJ	90	2	1	186	STX
K2FEO	68	2	1	186	WNY
KD7IIC	68	2	1	186	MT
AB8AG	92	2	1	184	OH
K5WBM	67	2	1	184	MS
N1IVY	36	2	1	184	ME
N3UA	47	2	1	184	VA
KA1RWY	66	2	1	182	CT
K6GEP	48	2	1	182	ORG
W2PWS	91	2	1	182	SDG
N8ERV	65	2	1	180	MI
WA1MA	32	2	1	178	EMA
KA3UBG	8	2	3	178	EPA
KI3G	64	2	1	178	EPA
WA3SWJ	32	2	1	178	MDC
VE3RCN	47	2	1	174	ON
K7MY	121	1	1	171	AZ
WB5EXI	5	2	1	170	STX
KL7GLL	48	2	1	168	VA
KH6GMP	29	2	1	166	PAC
NØDET	29	2	1	166	CO
W6RBA	76	1	1	163	SCV
WQ1Z	113	1	1	163	EMA
WA6VIU	56	2	1	162	SV
AA1AR	28	2	1	162	WMA
K6MJB	80	2	1	162	LAX
WB7ONJ	55	2	1	160	AZ
W4DDR	54	2	1	158	TN
KB8RWQ	53	2	1	156	ENY
W1CRP	62	1	2	156	ENY
WB8ZKI	52	2	1	154	OH
VA3RJ	26	2	1	154	ON
KE7QXW	153	1	1	153	OR
K4IJK	51	2	1	152	RI
VE2WNF	50	2	1	150	QC
K4RST	30	2	1	150	TN
AF6IF	25	2	1	150	SCV
WB1HGL	64	2	1	148	WMA
KC5YWN	49	2	1	148	AR
AB8A	23	2	1	142	OH
WD4KTF	46	2	1	142	KY
AB8XA	23	2	1	142	OH
KR6BG	46	2	1	142	SDG
N8XMS	23	2	1	142	MI
KD5ZEZ	44	2	1	138	STX
KD4LEM	43	2	1	136	VA
AB8RX	43	2	1	136	MI
AI4CJ	43	2	1	136	SFL
K8HUG	134	1	1	135	OH
K9JU	33	2	1	132	IL
WAØOTO	33	2	1	132	MN
KB8M	66	2	1	132	MI
W3WOT/4	66	2	1	132	NC
W9NFL	65	2	1	130	WI
KCØHUJ	40	2	1	130	KS
AC5DI	54	2	2	128	NTX
KF7VG	23	2	2	128	WWA
K4SQ	38	2	1	126	NC
NG2T	19	2	1	126	NNY
W2BVH	36	2	1	126	NNJ
K2ZC	61	2	1	122	NNJ
N9HM	6	2	6	122	IN
K4XD	60	1	1	120	NC
WA3YMM	35	2	1	120	WPA
AE6IC	45	2	1	118	SDG
VE7GIF	20	2	1	118	BC
KF6ROE	34	2	1	118	SDG
N1SWK	32	2	1	114	MO
N4OWG	63	1	1	113	NE
K4ECP	56	2	1	112	VA
AG1H	25	2	1	110	KY
KA1BNO	55	2	1	110	RI
KE5VDR	8	2	4	106	STX
KI4WAF	14	2	1	106	NC
KI4WKT	27	2	1	104	VA
KZ2G	51	2	1	102	NLI
W8LEV	26	2	1	102	WPA
WB4DHI	26	2	1	102	NFL
W6YQQ	51	1	2	101	SV
N2SQW	100	1	1	100	ENY
W6VNQ	98	1	1	98	SV
KØBHN	18	2	1	98	KS
KF6VYH	23	2	1	96	SV
K2SI	14	2	1	96	WNY
KA1GYB	20	2	1	92	CT
W1DVF	46	2	1	92	ME
W7ZMD	23	2	1	92	AZ
KG6YPH	21	2	2	92	SCV
K6ZCL	13	2	1	92	LAX
WB2KXC	21	2	1	92	SB
NR4J	40	1	1	90	SC
KD5WJS	19	2	1	88	NTX
AB3EO	19	2	1	88	EPA
W1SRB	43	2	1	86	EMA
KN6N	41	2	1	84	ORG
KB3PPY	17	2	1	84	MDC
WA2ART	13	2	1	82	NLI
KAØECB	16	2	1	82	CO
K7RQN	40	2	1	80	AZ
KGØAL	15	2	1	80	MT
KAØLL	40	1	1	80	MN
KJ4AED	15	2	1	80	GA
NØICV	15	2	1	80	IL
WB9MII	20	2	1	80	IL
KØCOP/4	14	1	1	78	SC
WW3N	14	2	1	78	MDC
KF4DVF	14	2	1	78	NFL
AI4UN	14	2	1	78	GA
KD7OED	7	2	1	78	AZ
VE3LXL	20	2	1	78	ON
N6SJC	8	2	1	76	SCV
KD7HCU	38	2	2	76	EWA
W7JAM	25	1	1	75	WWA
KI6ORO	12	2	1	74	SF
KB1MEK	12	2	1	74	CT
K7EMJ	11	2	1	72	SC
WA8RUM	11	2	1	72	OH
WA2EAJ	11	2	1	72	EPA
K8BAX	9	2	1	70	OH
K4YRK	70	1	1	70	TN
K4GOP	33	2	1	70	NFL
W6BT	34	2	1	68	LAX
W6TPQ	17	2	1	68	LAX
W4ZRX	9	2	1	68	GA
KE6SMG	9	2	1	68	SJV
AA6GZ	34	2	1	68	SJV
W2GD	8	2	1	66	ME
W8KNO	8	2	1	66	OH
N9YSQ	7	2	1	64	KY
NØKBA	6	2	1	62	MO
KEØCU	3	2	1	62	CO
KB9JLF	6	2	1	62	IN
K5GZR	61	1	5	61	STX
AA6AC	15	2	1	60	SB
W5VDM	15	2	1	60	STX
VE3MVM	10	1	1	60	ON
N3WDZ	10	1	1	60	WPA
N9VN	3	2	1	58	IL
KD8CHN	4	2	1	58	MI
KG4IVD	3	2	1	56	NC
K9FH	2	2	1	54	IL
AC8Q	24	2	1	54	SDG
N9NUZ	2	2	1	54	WI
N8QE	1	2	1	52	OH
W9FL	25	2	1	50	WI
N4KTM	40	1	1	40	GA
VA3RNJ	34	1	1	34	ON
KF6FIX	15	2	1	32	LAX
KJ4EGY	15	2	1	30	VA
KK7CG	15	2	1	30	OR
WK8A	13	2	1	26	MI
N8VQG	11	2	1	22	KY
N6AJR	10	2	1	20	EB
NP3CW	6	2	1	20	PR
WB7CLF	9	2	1	18	WWA
KA6FBB	8	2	1	16	ORG
KS4JB	8	2	1	16	VA
K1NPT	7	2	1	14	RI
W7KSO	7	2	1	14	AZ
KH6HME	6	2	1	12	PAC
W6NF	6	2	1	12	NV
K9NCC	6	2	1	12	EPA
N5UVQ	4	2	1	8	NM

K2HVE	8	1	1	8	NNJ
W6GB	1	2	1	4	GA
KB6NN	1	2	1	4	SF
NM4LS	2	1	1	2	WCF

2D

VE2CWT	1149	2	2	4,646	QC
K7SDX	1065	2	6	4,050	EWA
WA7LNW	1098	2	2	3,404	UT
W2LI	429	2	23	1,258	NNJ
W5AC	382	2	12	948	STX
VE6AO	750	1	2	800	AB
VE2CSP	182	2	23	706	QC
W4BPH	181	2	11	604	WCF
N5BL	262	2	24	538	NM
W7JQ	200	2	8	450	WWA
K2VK	70	2	4	430	NNJ
W5SLA	44	2	20	428	LA
KY5G	135	2	3	320	WWA
K9AIH	58	2	1	194	WI
KØXI	44	2	6	174	MO

3D

W4W	1637	2	10	3,324	AL
VE3URF	1324	2	4	3,054	ON
W5SSV	523	2	9	1,482	STX
K1HRO	260	2	3	1,008	NH
W8OWS	160	2	5	758	WCF
W5STR	241	2	13	642	AR
W8BAP	232	2	12	608	OH
W1ORS	268	2	10	592	CT
WA4GDN	172	2	34	590	WCF
N7TAR	120	2	30	440	AZ
W2JST	68	2	7	376	ENY
N1YKH	62	2	10	204	CT

4D

W6DA	525	1	8	1,142	ORG
WB1GOF	251	2	31	1,102	EMA
KSØLV	147	2	7	678	KS
KBØPKL	27	2	1	104	KS

7D

K1TTT	2625	2	3	5,386	WMA

Home Stations Emergency Power

1E

AA3B	1842	2	1	7,618	EPA
W6JTI	689	5	1	7,140	SF
N4PN	1881	2	1	5,318	GA
W2BC	1241	2	1	5,314	WNY
K9ES	1047	2	3	4,634	SFL
W8TM	437	5	1	4,620	OH
K1EEE	532	5	3	4,560	NH
K3ATO	1009	2	3	4,146	EPA
W9TS	359	5	1	3,840	IL
WA2EQF	802	2	5	3,372	NNJ
K4KSR	273	5	1	3,080	VA
WØQL	280	5	1	3,050	CO
KH7B	2161	1	6	3,033	PAC
AA1O	292	5	1	3,020	EMA
W3HGT	1111	2	7	2,914	NC
K7QD	272	5	2	2,870	ID
KA4NWS	753	2	1	2,834	SC
VE3GSI	610	2	1	2,690	ON
K3PH	232	5	1	2,670	EPA
WA8KAN	260	5	1	2,650	WV
KE7VM	1202	2	1	2,604	WWA
N3EF	567	2	1	2,518	MDC
W1FM	264	5	1	2,510	EMA
W3AG	207	5	1	2,290	WPA
K4WW	600	2	1	2,250	KY
NQ7R	198	5	1	2,185	AZ
KØHW	628	2	1	2,144	SD
WA1VKO	744	2	1	2,138	NH
W3LL	1040	2	1	2,130	MDC
N5ESE	185	5	1	2,100	STX
W4YCC	730	2	4	2,062	SC
K4WOP	394	2	2	1,826	VA
KQ2F	500	2	1	1,742	NLI
KØRW	151	5	1	1,730	IL
WØNTA	572	2	2	1,724	CO
KØCEA	154	5	1	1,670	MO
N8AJN	414	2	2	1,670	CO
VE9CEH	659	2	1	1,668	MAR
KB3FJJ	140	5	1	1,650	EPA
W5USJ	147	5	1	1,620	NTX
W6PRI	327	2	1	1,618	SCV
KE1AF	636	2	1	1,604	RI
W7NNN	393	2	3	1,470	WWA
N6ZFO	326	2	1	1,454	SF
K5QQ	300	2	1	1,450	MO
WR2I	308	2	1	1,402	ENY
VE2Ø08VQ	391	2	1	1,400	QC
N7MAL	125	5	1	1,400	AZ
WA5RML	129	5	1	1,390	NTX
KD4YDC	575	2	1	1,336	GA
WØVHV	288	2	1	1,302	MO
AI2T	110	5	2	1,300	WNY
W4FZA	297	2	1	1,288	ORG
KX1E	102	5	1	1,270	ME
NI7R	115	5	1	1,250	AZ
NØXT	567	2	1	1,234	MN
W5ORM	113	5	1	1,230	OK
VA2PZ	486	2	1	1,196	QC
WA4FOM	82	5	1	1,170	NNJ
KØRFD	273	2	1	1,138	CO
N7NB	87	5	1	1,120	WWA
KG9JP	382	2	1	1,118	AZ
N7UVH	291	2	1	1,064	ID
VE3SHL	184	2	2	1,062	ON
K7NAL	405	2	1	1,060	UT
K4CX	302	2	1	1,054	TN
K8DV	357	2	3	1,040	OH
N9GG	89	5	1	1,040	EPA
NQ2W	89	5	1	1,040	ENY
N5KEV	100	5	1	990	NM
K4YJ	218	2	1	972	GA
KEØRR	227	2	2	934	MN
KU4WD	415	2	1	930	TN
WA3QCV	371	2	2	892	NFL
N6KIA	132	5	1	810	ORG
KD7MSC	250	2	1	806	OR
WI9X	172	2	2	788	IL
N4NSS	133	2	1	782	WCF
W3DQT	156	2	1	774	MDC
VE7KDK	96	2	3	772	BC
K6YLG	42	5	1	770	STX
KE7DX	145	2	1	762	AZ
AA3SB	102	2	1	758	MDC
K7VGF	123	2	1	742	WWA
W4ZE	201	1	1	736	SFL
WK7P	228	2	2	726	OR
AC6TK	110	2	1	718	ORG
K9UT	56	5	1	710	IN
AL9A	216	2	1	704	AK
VE3OZ	225	2	1	702	ON
N4DXI	106	2	1	674	NFL
ACØLP	51	5	1	660	MO
NN9X	163	2	2	658	IN
AG4V	656	1	1	656	TN
AC4YD	250	2	1	650	KY
KE3D	145	2	1	642	STX
N7VF	187	2	1	624	AZ
AK4K	355	1	1	616	WCF
W6GMT	93	2	1	610	MN
KC8MMU	115	2	1	608	MI
W5UGD	170	2	2	590	SC
VE2FXL	87	5	1	590	QC
N7BK	214	2	1	578	WWA
NAØBR	107	2	1	578	CO
N7ICK	100	2	1	576	OR
AE1P	104	2	1	566	NH
K2XC	108	2	1	566	NNY
KG6S	156	2	2	562	SV
W66GMT	93	2	1	560	MN
K3IZ	134	2	1	556	VA
WA8UMT	65	2	4	554	MI
N6PA	188	2	1	546	SB
KF4VXJ	55	2	1	540	NC
K6TY	8	5	4	530	LAX
VA3TPS	109	2	1	526	ON
K4QET	124	2	2	516	VA
N4US	119	2	1	510	NFL
AI4LY	117	2	1	502	TN
K5RHR	49	5	1	500	NM
N4MUH	153	2	1	488	NFL
WØYZZ	136	2	1	488	MO
N2MTG	217	2	1	484	ENY
KA8SMA	41	5	2	475	MI
AB5JR	109	2	1	468	NM
WB6MRQ	106	2	1	462	SCV
N5MUJ	108	2	2	454	NTX
KG6MXO	25	5	1	450	LAX
K6LMN	73	2	1	446	LAX
K6OTT	25	2	2	440	SCV
W5EPW	46	2	1	434	SFL
K5DCM	45	5	1	425	AR
KC4YAU	41	2	1	414	AL
KE5CQJ	61	2	1	408	STX
WD8PNL	116	2	2	406	WPA
W7DPB	108	2	1	402	WY
WO3X	76	2	1	402	OH
KE5FDZ	125	2	1	400	MO
W1WRA	118	2	1	386	EMA
K5RWP	110	2	2	382	NTX
KB9OOK	18	5	3	375	IL
W9DO	100	2	1	370	IL
W1AFV	160	2	1	370	MN
KC9HIY	76	2	1	368	IN
K4RY	53	2	2	360	AL
KM6I	50	2	1	350	SCV
KAØEIC	50	2	1	348	KS
KT4OO	112	2	2	346	SC
VE3VO	30	5	1	340	ON
KØLMD	115	2	1	340	CO
N1NRA	119	2	10	338	VT
KF7HB	8	5	1	330	OR
N5IAC	113	2	1	326	NM
K7FSI	91	2	2	318	AZ
NYØO	16	5	1	310	IA
KG4BYN	14	5	1	290	TN
AE4EC	66	2	1	290	NC
KC9DNN	5	2	3	290	IL
KG4USN	97	2	1	286	GA
VE2GLA	44	2	1	276	QC
NP2F	44	2	1	276	MI
N3YDF	23	5	1	265	WPA
KG4SFB	32	5	1	260	TN
K6DY	55	2	1	260	ORG
KK6TV	54	2	2	258	SDG
KC8JJT	3	2	1	256	MI
N2SDB	74	2	1	248	NNJ
AD5VJ	88	1	1	235	NTX
K4JWM	17	5	1	235	AL
KI6LCF	42	2	2	234	EB
N9BT	8	5	1	230	IL
KD7ZVI	7	5	1	220	OR
WB7QBO	58	2	1	218	NV
KS6M	32	2	1	214	EB
KE7KDD	30	2	1	210	EWA
N3XRV	16	5	1	210	EPA
N3JON	54	2	1	208	MDC
KM4KB	53	2	1	206	GA
W7MEW	28	2	1	206	WY

JEFF HATTRICK PHOTOGRAPHY

Eight Boy Scouts from Troops 69, 2000 and 3000 joined North Fulton Amateur Radio League for Field Day and went for their Radio Merit badge at the site. After helping put up antennas during setup, the scouts got down to business to pass their merit badge requirements under the direction of Wes, W3WL, at the rig. Here, the scouts are getting ready to make their first FD contacts under the eye of US Senator Johnny Isakson (red shirt).

WE5T	27	2	1	204	NTX
ABØUO	16	2	1	202	KS
WBØIWG	76	2	1	202	WPA
WB4QNG	22	2	1	194	KY
KA2BXH	19	2	1	188	SNJ
KC4MYV	19	2	1	188	NFL
WI6ZRD	15	2	1	180	ORG
KA5J	14	2	1	178	OK
KBØMPY	37	2	1	174	CO
K7II	14	5	1	170	WWA
KD5DYJ	9	2	1	168	OK
WD4NIT	9	2	1	168	GA
KC2OBN/AE	34	2	1	168	NLI
N6NFB	23	2	1	146	WWA
KB7UM	23	2	1	146	IL
KA2IBN	20	2	1	140	ENY
AC6N	41	2	1	132	NV
KK5CT	15	2	3	130	NTX
KC7PVD	13	2	1	126	UT
KCØUUT	25	1	1	125	MN
N5BF	26	2	1	102	LAX
KD7DCR	44	1	1	94	MT
K3DI	28	1	1	84	MDC
AB3HJ	3	5	1	65	MDC

2E

W8VM	520	5	12	5,750	OH
K5ER	1608	2	6	4,824	LA
K1VA	1276	2	3	4,816	AZ
W4RKC	790	2	15	3,450	VA
AE5T	1207	2	2	2,528	LA
VE7UF	521	2	3	2,308	BC
W5ROK	429	2	11	1,964	NTX
K4YTZ	845	2	8	1,890	SC
WA7PRC	452	2	2	1,884	WWA
N7PR	1304	1	2	1,657	SV
K2HIG	445	2	2	1,656	STX
NV8N	665	2	4	1,614	MI
W5ES	428	2	32	1,524	WTX
VE6FI	1298	1	4	1,498	AB
K7SEL	312	2	5	1,238	ID
KC9FQD	208	2	4	766	WI
WB5LVI	184	2	10	688	STX
N7TCO	304	2	2	658	EWA
WD8LQT	133	2	2	652	GA
KB2URI	54	2	1	648	WNY
KB6TR	201	2	1	616	SV
KC7QYR	56	2	2	462	WWA
K7EMS	92	2	2	434	WY
N5HMH	83	2	1	366	LA
N9QID	30	2	2	310	IN
N2UTV	8	2	1	280	WNY
W1XM	40	2	1	130	EMA

3E

N2BJ	2360	2	4	7,566	IL
Skyview RS					
K3MJW	1841	2	40	6,788	WPA
K2FA	484	5	2	5,045	WNY
N2MO	817	2	20	3,658	NNJ
N3DUE	1129	2	4	3,646	MDC
W6VIO	904	2	15	3,604	LAX
W3KWH	841	2	19	3,400	WPA
W3YA	2632	1	6	3,182	WPA
NR3K	776	2	6	3,018	EPA
W7FLY	611	2	7	2,746	WWA
KC8UAV	1106	2	5	2,562	MI
NN6MI	559	2	25	2,548	EB
W8DYY	1047	1	18	1,747	OH
AA6SD	411	2	8	1,498	ORG
AB2DE	554	2	6	1,340	NNJ
WB5EKW	419	2	8	1,232	WTX
KC9CCQ	1122	1	3	1,172	MN
K3TI	298	2	10	646	EPA

4E

K5HLA	2170	2	15	7,818	STX
K5WPH	1108	2	37	3,260	WTX
N4QLX	257	2	8	1,064	NC

5E

W4DXA	3774	2	20	13,950	NC
K6LRG	2011	2	13	5,788	EB
WA4FD	1668	1	20	2,168	AL

9E

WØNT	2360	2	36	9,800	CO

EOC Stations

1F

West Essex ARC					
W2EF	781	2	13	3,682	NNJ
New Providence ARC					
WK2I	750	2	15	3,422	NNJ
Sarasota Co Em Management					
WC4EM	642	2	6	2,358	WCF
Fayette ARA					
K8FAY	507	2	7	1,904	OH
Will Co Em Mang Amateurs					
W9WIL	191	2	10	1,774	IL
SCVRA					
KØCD	280	2	20	1,628	WI
Thibodaux ARC					
W5YL	581	2	9	1,626	LA
Charlotte ARC					
W4CQ	334	2	12	1,446	NC
Baltimore City RACES					
AB3CA	309	2	10	1,322	MDC
Loveland Colorado EOC					
WØFT	270	2	7	1,290	CO
OC ARS-RACES					
W4EEE	210	2	6	1,210	GA
Washington State Net					
N7EIE	54	2	8	1,092	WWA
Westcumb ARC					
VE1WRC	174	2	16	998	MAR
Tracy ARC					
N6TCY	18	2	22	826	SJV
Galveston Co Em Comm Group					
WR5GC	51	2	2	758	STX
Seal Beach/Los Alamitos RACES					
K6ZT	132	2	10	650	ORG
Metro ARC					
W9FO	220	2	18	510	IL
Butte ARC					
W7FO	509	1	6	509	MT
Tulsa Health Department ARC					
K5THD	57	2	2	464	OK
Central Florida CAP RA					
W4AFV	15	2	18	380	WCF
KD5DLZ	53	2	3	206	OK
Peninsula AR Em Team					
KA7EOC	54	2	3	158	WWA
Roseland ARC					
K2GQ	34	1	8	34	NNJ

2F

Alamance ARC Inc					
K4EG (+W4VGZ)					
	1850	2	28	7,102	NC
Lake Co RACES/ARES					
K9IQP (+W9QL)					
	1905	2	30	6,568	IL

Montgomery Co RACES
AA3E (+W3CF)
2121 2 13 5,642 EPA
Bullitt ARS
KY4KY (+W4KBR)
1282 2 40 5,304 KY
Houston ECHO Soc & Houston Red Cross
W5ECO (+AG5T)
1497 2 15 5,296 STX
Story Co ARC and Cyclone ARC
WØYL (+WØISU)
996 2 25 4,486 IA
Battle Creek EOC
AB8I 1216 2 9 3,918 MI
Merrymeeting ARA
KS1R (+N1TRC)
636 2 27 3,650 ME
Piscataquis ARC
K1PQ (+KB1NJO)
613 2 3 3,220 ME
Anderson RC
K4TG (+KY4LAW)
803 2 10 3,182 KY
Heart of America RC / Red Cross HQ EOC
WØRR (+KAØFSP)
785 2 11 3,142 MO
York Radio Club
W9PCS (+NN9L)
970 2 17 3,132 IL
Platinum Coast ARS
W4MLB (+AF4Z)
565 2 43 3,028 SFL
North Wildwood OEM
AI2I 768 2 6 2,864 SNJ
Cass Co ARC
W9VMW (+N9PMW)
701 2 42 2,760 IN
Prince William Co ARES
W4PWC (+KG4GIY)
731 2 23 2,622 VA
Great Falls Area ARC
W7ECA 846 2 18 2,600 MT
Geauga Co ARA
W8DES 860 2 15 2,562 OH
Thomasville ARC
W4UCJ (+KI4RGD)
454 2 34 2,484 GA
Benicia ARC
KR6BEN 803 2 33 2,476 EB
Turkey Heaven Mountain Repeater Assn
N4THM (+W4CET)
572 2 23 2,470 AL
Lehigh Valley ARC
W3OI (+KW3K)
328 2 26 2,300 EPA
South Mountain Repeater Assn
N3TWT 660 2 11 2,252 EPA
Hays/ Caldwell ARC
KE5LOT (+AE5GT)
339 2 14 2,234 STX
Daytona Beach CERT ARC
KI4LBF (+KI4VWP)
396 2 26 2,164 NFL
Tennessee Signal Group
KJ4ELF 400 2 6 1,976 TN
Johnson AR Service
WA5JRS (+KD5TIZ)
393 2 9 1,922 NTX
Oakland Co ARPSC
W8OAK 527 2 8 1,838 MI
East Paslo ARS
K4EX 307 2 27 1,740 WCF
Arizona ARC
W7IO 368 2 14 1,668 AZ
Waterbury ARC
W1LAS 537 2 10 1,624 CT
Western Tidewater Radio Assn
WT4RA 375 2 9 1,620 VA
Corona Norco ARC
W6PWT 558 2 10 1,586 ORG
Cowichan Valley ARS
VE7CVA 596 2 12 1,550 BC
KB5MAR 267 2 28 1,540 NTX
Washington Co ARES
WN1EOC 213 2 9 1,532 ME
Westminister RACES
W6JNU 165 2 14 1,484 ORG
Picorams
K9IYP 200 2 17 1,480 IL
Cupertino ARES
K6KP 90 2 44 1,440 SCV
Massasoit ARA
W1MV 187 2 22 1,424 EMA
Quad Co ARC
N3QC 143 2 8 1,368 WPA
Burlington ARC
W1KOO 246 2 15 1,346 VT
Imperial Co ARES/RACES
W6ICR 397 2 5 1,318 SDG
Manteca ARC
K6MAN (+K6EMS)
139 2 33 1,308 SJV
Anoka Co ARES/RACES & ACRC
WØANA 217 2 22 1,302 MN
Fair Lawn ARC
W2NPT 253 2 17 1,276 NNJ
Carousel RC
K2OQ 245 2 6 1,256 WNY
CCARCT
NC4CC (+AE4AA)
187 2 18 1,234 NC
Cocoa ARS
N4LEM 340 2 7 1,230 SFL
Puerto Rico ARS
KP4MQ 212 2 9 1,226 PR
SW Alabama ARES Group
KI4YJQ 369 2 2 1,194 AL
Shoreline ARC
W1BCG 220 2 17 1,190 CT
Tippah ARA
K5DGL 255 2 12 1,180 MS
Decatur ARC
W4ATD 237 2 9 1,140 AL
Central Iowa RAS
KØMIW 272 2 8 1,120 IA
Orchard City ARC
VE7OGO 219 2 25 1,088 BC
Marshall Co ARA
KI4HUS 157 2 8 1,064 KY
ARA of the Southern Tier
W2ZJ 216 2 24 1,052 WNY
Glynn AR Group
WX4BWK 301 2 9 1,052 GA
Branch Co ARC
WD8KAF 266 2 22 1,042 MI
Raritan Bay Radio Amateurs/ Manalapan RACES
K3GNZ (+K2DLS)
134 2 18 1,038 NNJ
KB7EOC (+KE7UDJ)
45 2 17 1,020 OR
Oakville Karon RA
W5LOC 158 2 6 972 STX
TriCity ARA
W7GDY 205 2 6 960 AZ
Brownwood ARC
K5BWD (+KE5NYB)
128 2 25 940 NTX
South. Nye Co ARES
W7NYE 150 2 24 860 NV
Eastside AR
K7BEL 121 2 12 808 WWA
Loyalist City ARC
VE9OEC 228 2 15 706 MAR
Hennepin Co Mobile AR Corps
WØPZT 78 2 12 706 MN
Red River Valley ARC
WB5RDD 169 2 12 700 NTX
FDCAR
KØRGT 50 2 14 670 MO
Mountain View ARES
K6MTV 50 2 22 614 SCV
Campbell River AR
VE7CRC 111 2 10 572 BC
Delaware Rural Fire Dept
KK5WA 166 2 6 502 AR
KØEFD (+KCØUAQ)
83 2 4 446 CO

3F

West Jersey DX Group
W2EN (+W2KN)
4360 2 35 15,088 NNJ
Williamson Co ARES
N4FR (+W4SQD)
1724 2 140 6,930 TN
East Alabama ARC
W4LEE 1315 2 56 4,788 AL
McHenry Co RACES/ARES
K9ESV 950 2 15 4,442 IL
Oak Ridge ARC
K4PJ 936 2 35 4,154 TN
Southern Counties ARA
K2BR 892 2 25 3,748 SNJ
WC4DC (+AF4YL)
843 2 14 3,506 TN
Coffee CO ARES
WM4CC 782 2 17 3,056 TN
Nacogdoches ARC
W5NAC 855 2 20 3,042 NTX
ARC Hohenwald
K4TTC 571 2 50 2,974 TN
WØS 829 2 8 2,832 MO
Southington ARA
W1ECV 996 2 25 2,764 CT
Southwick EOC
WC1SW 763 2 20 2,744 WMA
Central Illinois RC
W9AML 605 2 15 2,504 IL
WT4C 521 2 7 2,218 SC
PPRAA & Tri-Lakes Fire District
AFØS (+WØTLM)
394 2 35 2,120 CO
Sierra ARC
WA6YBN 118 5 10 2,045 SJV
Golden Spike ARC
K7UB 446 2 28 2,024 UT
East Ohio ARC - Northern Panhandle ARC
W8TPY 284 2 19 1,910 OH
Racine Megacycle Club & Racine Co ARES
W9UDU (+WI9RAC)
128 2 45 1,894 WI
Coastline ARA
N1EG 575 2 45 1,880 CT
Cherokee ARS/Cherokee ARES
AI4GL 429 2 20 1,872 GA
Grand Strand ARC
W4GS (+AF4UZ)
327 2 21 1,856 SC
K6UCI ARC
K6UCI 339 2 8 1,808 ORG
Weakley Co AR Operators
W4UTM 256 2 18 1,746 TN
Drake State Technical College ARC
N4DTC 585 2 4 1,620 AL
Adams Co ARS
W3KGN 298 2 9 1,504 EPA
Headwater ARC
N3PC 402 2 12 1,494 WPA
Maxim Memorial Station
W1AW 1079 1 9 1,486 CT
Citrus Co. ARC
AA2JZ 180 2 10 1,484 NFL
Medical Univ of SC
N4SJW 126 2 5 1,436 SC
VMARC
W4COV 403 2 5 1,432 VA
Squaw Island ARC
W2ONT (+K2BWK)
366 2 14 1,412 WNY
CCARA
W4VS (+KØTIS)
305 2 43 1,404 TN
Blount Co ARC
W4BLT (+AE4TX)
299 2 27 1,398 AL
Raritan Bay RA / South Rive RACES
K2GE 151 2 25 1,352 NNJ
Algonquin ARC
N1EM 300 2 13 1,052 EMA
KF6NNM 169 2 4 844 SV
Indian River ARC
W4NLX 217 2 12 786 SFL
Coyote ARC
KE5NWT (+KE5RYJ)
18 2 15 736 STX
Burbank Emergency Amateur Radio Service
N6CDJ 53 2 40 606 LAX
Scotland Co. ARES
WA4UFS 46 2 7 592 NC
City of Mission ARC
VE7MIS 94 2 6 488 BC

4F

Stanford ARC
W6YX (+K6SU)
4895 2 40 17,108 SCV
Bergen ARA
K2BAR (+KC2SKL)
2389 2 42 7,544 NNJ
Van Wert ARC
W8FY 1724 2 14 5,478 OH
Carroll Co ARC
K3PZN 1535 2 16 5,180 MDC
Cochise AR Assn
K7RDG 1109 2 25 5,108 AZ
Tri-Town RAC
W9VT (+N9DWG)
1037 2 24 4,102 IL
Middle East TN Em Radio Service
KG4NLF (+WR4MS)
556 2 30 2,694 TN
Shelby Co ARC
W4SHL 723 2 30 2,516 AL
Greater Bridgeport ARC
WA1RJI (+W1TXL)
661 2 20 2,412 CT
Metroplex ARC
W2MPX 399 2 25 2,266 NNJ
K1BCI 533 2 22 2,178 CT
Coppell ARC
KD5OEW 253 2 10 2,016 NTX
Valley Camp
K7S 416 2 10 1,944 WWA
ARA Tonawandas
W2SEX 385 2 21 1,918 WNY
National Trail ARC
K9UXZ 329 2 12 1,348 IL
DMAT OK-1 ARC
ND5MS 184 2 5 1,112 OK

5F

Palomar ARC
W6NWG 2461 2 56 8,996 SDG
Forsyth Co ARES
N4AC 2498 2 82 8,308 GA
Worc EmComm Team
WE1CT (+W1YK)
1084 2 59 4,458 WMA
Tri-State ARA
W8VA 834 2 37 3,786 WV
Flagler Em Comm Assn
AF2C 379 2 30 2,626 NFL
Metro Detroit SATERN
N8SE 458 2 20 2,166 MI
Sammamish ARES/RACES Groups
W7S 346 2 15 1,872 WWA
Cross Co. ARC
WA5CC 185 2 44 1,600 AR
Sabine Valley ARA
K5GVL 120 2 25 790 NTX

6F

Queen City Emergency Net
W8VND 1756 2 16 4,444 OH
SATERN San Bernardino & Riverside Co's
W1SAT 75 5 13 2,030 ORG

8F

W2GSB 673 2 58 3,926 NLI
Arlington ARC
W4WVP 334 2 20 2,632 VA

QST

VHF/UHF Century Club Awards

Compiled by Sharon Taratula
Administrative Manager

The ARRL VUCC numbered certificate is earned by 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 indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from July 18, 2008 to September 15, 2008.

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. Send questions relating to VUCC to **vucc@arrl.org.**

50 MHz
100

1639 KD4QMY
1640 KBØLYL
1641 WA7AJ
1642 WD4JHD
1643 N4QWZ
1644 K6PSP
1645 WA3YGQ
1646 K3JT
1647 KS4V
1648 W3OU
1649 K4EQH
1650 VA3PZ
1651 W4AS
AA4S 150
AJ4W 150
KE4P 175
VA3TTX 175
W9VS 175
N6ORB 175
K6RG 225
N6HC 225
K7HSJ 250
K8VFV 250
W4KXY 250
N4JRY 300
W8WG 325
N4UFP 400
WBØULX 400
W5WVO 475
K6QG 500
KE7SW 500
KR7O 500
K4LVV 525
N6JV 650
KB6NAN 725
AA7A 750
K8SIX 750
N4MM 925
WD5K 1125

144 MHz
100

686 WA2ODO
687 KI4TZ
N4HN 150
WA3BZT 175
AA7A 600

222 MHz
50

AA4ZZ 90

432 MHz
50

AA4ZZ 90

5.7 GHz
5

58 KBØPE

10 GHz
5

184 KØVXM

Satellite
100

168 WA4NVM
169 N4NAB

QST

Wet and Wild — 2008 June VHF QSO Party Results

Were you prepared?

Rick Rosen, K1DS
rick1ds@hotmail.com

What more fun can a few thousand VHF+ operators have than a weekend with plenty of other stations to work and with propagation enhanced by sporadic-E or "E-skip" (E_s) on 50 and 144 MHz? The June 2008 VHF QSO Party was thoroughly enjoyed by almost all participants thanks to the substantial hours of open bands from E_s, plus the use of CW and digital modes, including FSK441 for meteor scatter and JT65 for EME.

Preparation

Preparation included checking all the gear for functionality prior to the contest, checking the rover schedules of those who post a route on the various VHF and contesting reflectors, and then having a back-up plan for managing anything that needs repair or replacement during the action.

Getting enough sleep prior to the contest is also useful preparation, as one unnamed operator manning the four stations of a limited multi-operator station in the wee hours of the morning was found asleep at 5:30 AM with all four voice keyers on a continuous loop calling CQ!

The Bands

"What bands do I need to be active on for this event?" The answer is you must have 6 m capability. That's where everyone will be if that band is open. And since the band was open for a long time on both days of the weekend, there was the post-contest complaint on the various reflectors that scores were down on the higher bands. While it has been suggested that we should have an event without 6 m, the Midwesterners responded that without 6 m, there would be no significant activity. We have the August UHF QSO Party, on 222 MHz and up, for that type of a contest.

For many in the right places, the action was fantastic on 2 m, as E_s was prevalent throughout the Southeast, Central and Southwestern parts of the country. Grid totals higher than 50 were achieved by 10 stations across a wide geography and included a station in each of the single- and multi-op classes.

NØKE

Peanut, Rooster and Steve, NØTU, the "old goat" on the trail up to Mt Herman (CO) with a battery-powered FT817 transceiver, homebrew 6 m dipole, and 5 element 2 m beam.

The Logs

There were 1075 logs received and according to the log of W5PR from STX, operating only 6 m, there were at least 1630 participants as each of them were in his log! (See Figure 1.)

The breakdown of entries included 659 (61%) in the Single-Operator Low-Power category, 200 (19%) in the Single-Operator High-Power category, 51 (5%) in the Limited Multi-Operator category, 33 (3%) in the Unlimited Multi-Operator category, 35 (3%) in the QRP Portable category, and 96 (9%) in the three new Rover categories.

Conditions

Almost everyone was happy and excited to have some 6 m E_s, and as reported by the stations in the Texas and surrounding Midwest areas, the band was open the entire contest. There was also an excellent enhancement on 2 m Sunday morning and some aurora facilitated QSOs during the weekend.

Northeast and West Coast contesters were not as fortunate as those in more southern and central US locations, as the 6 m E_s QSOs were less available. As a gauge of the different conditions, we can compare the 6 m results of multi-operator station K5QE, operating from EM13 in Texas, to the multi-operator W2SZ group in western Massachusetts in FN32. The Texas group had 1345 6 m QSOs in 245 grids,

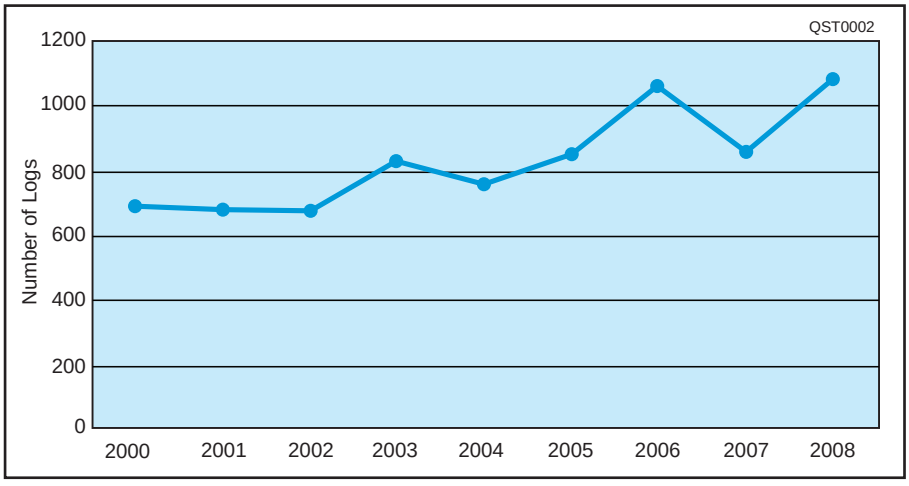

Figure 1 — The trend is good for the June VHF QSO Party, as log submissions were the highest since the year 2000.

Single Operator, Low Power

K2DRH	328,338
K5RQ	202,384
K3FM	193,817
WB1GQR (W1SJ, op)	191,952
N4BP	165,870
K4LY	144,826
AF1T	143,550
AA4W	135,740
K4EPS	135,026
KB9TLV	113,960

Single Operator, High Power

K1TEO	657,815
W5PR	443,360
K1RZ	440,622
KC4PX	392,040
WD5K	365,044
K9MK	305,109
KMØT	304,007
K4SN	261,711
WB9Z	248,940
WA2FGK (K2LNS, op)	242,536

Single Operator Portable

KA1LMR	78,078
K9AKS	36,120
K6VCR	35,588
N7IR	35,242
K1ZE	23,534
N8XA	11,658
N3LL	5,850
N3AWS	5,432
KQ6UP	5,088
WA4A	4,600

Limited Multioperator

K5TR	577,638
AA4ZZ	458,136
W3SO	358,154
W4IY	355,100
W4NH	307,515
AE5T	218,400
AB5GU	208,848
WA7JTM	189,750
WØLSD	186,534
W1QK	181,536

Multioperator

W2SZ	1,907,504
K8GP	1,434,157
K5QE	1,122,051
W3CCX	887,415
K3YTL	454,210
WØEEA	396,644
KBØHH	289,250
KØDI	217,404
N2NK	174,167
WØKVA	155,672

Rover

N6NB/R	281,436
AE5P/R	160,398
N5AIU/R	154,364
AH8M/R (KD4VRY, op)	136,136
VE3NPB/R	111,166
W1RT/R	109,070
WDØACD/R	97,760
K2TER/R	94,677
K2QO/R	74,936
KC3WD/R	67,200

Limited Rover

KG6TOA/R	97,328
W3DHJ/R	36,585
K4GUN/R	24,462
K6EU/R	22,876
AG4V/R	22,134
KK6MC/R	14,016
K6JRA/R	13,824
AF6AV/R	12,172
N4JDB/R	11,502
KR1ST/R	11,480

Unlimited Rover

W6TE/R	385,336
N6MU/R	280,875
N5AC/R	65,230
KRØVER/R	22,035
KR5J/R	20,992
N1MU/R	16,030
W3BC/R	9,760
N3UW/R	5,920

while the Mt Greylock gang logged 889 QSOs in 153 grids on 6 m. The top 24 grid gatherers on 6 m with 199 through 280 grids were mostly in a band of states from Florida through New Mexico, plus others from Colorado, Iowa and South Dakota.

Two meters provided some nice long-haul openings for the central part of the country on Sunday. Noted on June 15 was a report of two long-haul 222 MHz contacts between W5UWB in EL17, Texas, and NØVZJ in EN35, Minnesota, and between AA4ZZ from EM96, North Carolina, and W5DDR in DM84, New Mexico.

Digital modes were again popular for stations that either made schedules in advance of the contest for some DX grids, or for those who planned to use EME. Even without the ability to have elevation, there were QRO stations workable in random mode at moonrise and moonset using CW or WSJT modes.

Record Setting and Breaking

Many operators, recognizing the unique opportunity on 6 m took full advantage of running it long and hard. The stations with favorable 6 m conditions, well aware of the chances they had to top previous records, stayed in their seats to milk the last drops of propagation. Eight division and 26 section and DX records were set. See Table 1.

A new record was set for the highest number of 6 m QSOs in a June QSO Party Single-Op High-Power category: W5PR, with 1630 contacts. The previous record of 1212 was set by N5HHS 10 years ago. This previous high-water mark was also topped this year by WD5K with 1388 QSOs, and by KC4PX with 1281 QSOs. The Unlimited Multi-op K5QE team also set a QSO record for their category this year with 1345 contacts, besting the 2006 W2SZ result of 1168.

Looking at the Single-Op High-Power grid-multiplier records, KC4PX topped his previous 6 m record of 263 grids from 2003 with an extraordinary catch of 280 grids this time. W5PR with 272 grids also topped the old record and WD5K tied it with 263 grids. The Single-Op Low-Power record set in 2006 by Wisconsin's K9MU 1094 QSOs in 229 grids still stands.

Table 1

Section and Division Records Set in 2008

Call	Cat	Sec	Score	QSOs	Mults	Division
K5RQ	SO-LP	WCF	202384	973	208	Southeast
K3FM	SO-LP	MS	193817	877	221	Delta
K4LY	SO-LP	SC	144826	544	227	Roanoke
AA4W	SO-LP	NFL	135740	609	220	
W6ZI	SO-LP	OK	99424	433	208	
N4QWZ	SO-LP	TN	95545	380	197	
W9ZRX	SO-LP	NC	89880	535	168	
CO2OJ	SO-LP	CO2	59792	404	148	
WA3EOQ	SO-LP	MDC	55977	272	141	
W3PAW	SO-LP	WPA	54002	273	134	
W4PJP	SO-LP	GA	49968	342	144	
XE3N	SO-LP	XE	38413	359	107	
W5PR	SO-HP	STX	443360	1630	272	West Gulf
K1RZ	SO-HP	MDC	440622	919	273	
KC4PX	SO-HP	SFL	392040	1306	297	Southeast
W4WA	SO-HP	GA	196605	626	257	
XE2WWW	SO-HP	XE	121218	681	178	Int'l
AE5T	LIM-MO	LA	218400	975	224	Delta
KH7Y	LIM-MO	PAC	270	18	15	
K5QE	UN-MO	STX	1122051	1943	449	West Gulf
KØDI	UN-MO	LAX	217404	726	198	
K9AKS	SO-QRP	NE	36120	240	140	
K6VCR	SO-QRP	SDG	35588	290	82	
N3LL	SO-QRP	WCF	5850	90	65	
N3AWS	SO-QRP	MS	5432	97	56	
WC4V	SO-QRP	KY	1287	37	33	

Single-Operator

There are three single operators who have maintained their top spots in their respective categories for several years in a row. Setting the pace in the low-power category, Bob, K2DRH in Illinois led with a score of 328k, using eight bands through 3 GHz and scoring 120k more than his nearest competitor. In somewhat of an operating contrast, K5RQ operating from West Central Florida came in second place using only 6 m and scoring 202k, with a hefty QSO count of 973 and 208 grid multipliers. K3FM was 3rd in the low-power category with 198k points, operating from Mississippi with 6 m and 2 m. Our 4th place station, WB1GQR (W1SJ, op) from Vermont scored 191k in a 7-band effort, while in 5th place, N4BP amassed 166k from south Florida, as a single-band 6 m op.

In the high-power group, Jeff, K1TEO managed to accumulate almost 658k points from his Connecticut QTH to stay in the top spot for yet another year. With pinpoint 6-digit grid aim, he is able to "run the bands" with microwave-capable stations. He added 228 QSOs on 903 MHz through 10 GHz and in the process scored an additional 124 multipliers. Taking second honors from South Texas, Charles, W5PR took advantage of the 6 m propagation and scored a whopping 443k points using a single band, the greatest number of QSOs made by any single-op in the contest. In third place, Dave, K1RZ operating out of Maryland was only 3k points behind, with a total of 440k points. Fourth place was won by KC4PX from South Florida, who also had a magnificent 6 m total of 1281 QSOs in 280 grids and garnished that with additional 25 contacts on bands B, C, D, and E. Our fifth place winner was WD5K

Affiliated Club Competition

	Entities	*Score*
Unlimited Club		
Society of Midwest Contesters	71	1,827,380
Medium Club		
Potomac Valley Radio Club	35	2,766,272
North East Weak Signal Group	20	1,407,723
Mt Airy VHF Radio Club	16	1,198,399
Grand Mesa Contesters of Colorado	12	930,086
Florida Contest Group	11	869,515
Florida Weak Signal Society	11	841,428
Northern Lights Radio Society	17	777,331
Carolina DX Assn	6	649,520
North Texas Microwave Society	11	576,503
Yankee Clipper Contest Club	15	455,157
Roadrunners Microwave Group	6	407,505
Contest Club Ontario	18	396,625
Northern California Contest Club	21	337,173
Rochester VHF Group	6	326,630
Pacific Northwest VHF Society	23	307,952
South East Contest Club	6	265,685
Alabama Contest Group	5	134,096
Central Arizona DX Assn	7	86,860
Mad River Radio Club	6	67,408
Frankford Radio Club	4	51,588
Central Texas DX and Contest Club	4	47,474
Oklahoma DX Assn	3	41,885
Raritan Bay Radio Amateurs	10	33,449
Tennessee Contest Group	9	30,125
Bergen ARA	7	23,798
Contest Club Du Quebec	4	20,496
Kentucky Contest Group	4	14,827
North Coast Contesters	3	12,362
Local Club		
Nacogdoches ARC	5	1,452,607
Murgas ARC	5	759,705
Eastern Connecticut ARA	8	218,447
Chippewa Valley VHF Contesters	7	198,055
Badger Contesters	7	123,485
Low Country Contest Club	7	84,911
10-70 Repeater Assn	3	57,051
Portage County Amateur Radio Service	4	12,672
Maritime Contest Club	4	6,595
Steel City ARC	3	64,255
Downey ARC	4	12,868
Meriden ARC	4	10,831
Ashe County ARC	3	2,559

Northeast Region
(New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

WB1GQR (W1SJ, op)	191,952	A
AF1T	143,550	A
NN1D	77,616	A
WB2SIH	72,092	A
K1KG	61,632	A
K1TEO	657,815	B
K1RZ	440,622	B
WA2FGK (K2LNS, op)	242,536	B
K1TOL	148,410	B
N2GHR	104,622	B
KA1LMR	78,078	Q
K1ZE	23,534	Q
WB2AMU	1,872	Q
K2KWK	513	Q
K1ZK	1	Q
W3SO	358,154	L
W1QK	181,536	L
KB1DFB	100,980	L
KA2LIM	98,334	L
KE1LI	60,600	L
W2SZ	1,907,504	M
W3CCX	887,415	M
K3YTL	454,210	M
N2NK	174,167	M
KV1J	147,630	M
W1RT/R	109,070	R
K2TER/R	94,677	R
K2QO/R	74,936	R
K3LFO/R	57,245	R
W1AUV/R	45,276	R
K3IUV/R	80	RL
W3BC/R	9,760	RU
N3UW/R	5,920	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

K5RQ	202,384	A
K3FM	193,817	A
N4BP	165,870	A
K4LY	144,826	A
AA4W	135,740	A
KC4PX	392,040	B
K4SN	261,711	B
WJ9B	238,750	B
W4WA	196,605	B
W4ZRZ	188,496	B
N3LL	5,850	Q
N3AWS	5,432	Q
WA4A	4,600	Q
WA5ZEK	216	Q
KC8KSK	110	Q
AA4ZZ	458,136	L
W4IY	355,100	L
W4NH	307,515	L
AE5T	218,400	L
N4LR	62,088	L
K8GP	1,434,157	M
W4OZK	37,973	M
W4YCC	26,334	M
AH8M/R (KD4VRY, op)	136,136	R
KC3WD/R	67,200	R
AF4OD/R	14,170	R
KE5GAQ/R	13,736	R
N9KS/R	5,187	R
K4GUN/R	24,462	RL
AG4V/R	22,134	RL
N4JDB/R	11,502	RL
KR1ST/R	11,480	RL
WA4JA/R	1,998	RL

Central Region
(Central and Great Lakes Divisions; Ontario Section)

K2DRH	328,338	A
KB9TLV	113,960	A
W9GKA	64,148	A
KO9A	57,023	A
K8MR	50,553	A
WB9Z	248,940	B
K9CT	235,036	B
K8EB	142,096	B
K9EA	112,312	B
K8TQK	109,720	B
N8XA	11,658	Q
WC4V	1,287	Q
VE3/KC8QVO	990	Q
NF8M	36	Q
N8ZM	82,654	L
KC8QAE	27,707	L
N9TF	14,016	L
NG9R	7,326	L
K2KW	5,424	L
N9UHF	85,824	M
K9SG	84,216	M
VE3WCC	80,620	M
N8KOL	66,015	M
W8PGW	22,950	M
VE3NPB/R	111,166	R
VE3SMA/R	55,814	R
WB8BZK/R	54,184	R
K9ILT/R	22,230	R
KF8QL/R	21,528	R
K9ZF/R	10,224	RL
K8DOG/R	9,792	RL
K9JK/R	9,776	RL
VE3RKS/R	1,056	RL
VE3AP/R	45	RL
N1MU/VE3/R	16,030	RU

Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

WA5LFD	106,505	A
W6ZI	99,424	A
WB5ZDP	98,264	A
NØPOH	71,360	A
KØMHC	56,511	A
W5PR	443,360	B
WD5K	365,044	B
K9MK	305,109	B
KMØT	304,007	B
K5AM	237,072	B
K9AKS	36,120	Q
KIØG	150	Q
NØGSZ	24	Q
W5/JH7IPR	-3	Q
K5TR	577,638	L
AB5GU	208,848	L
WØLSD	186,534	L
WDØT	180,525	L
WØVB	43,134	L
K5QE	1,122,051	M
WØEEA	396,644	M
KBØHH	289,250	M
WØKVA	155,672	M
WQØP	102,985	M
AE5P/R	160,398	R
N5AIU/R	154,364	R
WDØACD/R	97,760	R
KCØIYT/R	30,720	R
WRØI/R	11,607	R
W3DHJ/R	36,585	RL
KK6MC/R	14,016	RL
AC5TS/R	4,400	RL
N5AC/R	65,230	RU
KRØVER/R	22,035	RU
KR5J/R	20,992	RU

West Coast Region
(Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

NU6S	77,248	A
WJØF	43,146	A
VA6AN	32,004	A
WE6T	29,484	A
K6XN	28,260	A
K7AED	72,581	B
K6KLY	66,885	B
N6KN	65,130	B
WB6AAG	55,115	B
KI7JA	53,640	B
K6VCR	35,588	Q
N7IR	35,242	Q
KQ6UP	5,088	Q
VE7IHL	4,025	Q
N6FD	3,648	Q
WA7JTM	189,750	L
W7JLC	31,374	L
WB6BFG	7,812	L
K4TRT	6,292	L
K7TM	3,128	L
KØDI	217,404	M
K6LRG	77,520	M
K7RST	50,061	M
W6YX	25,353	M
KI6MPQ	24,375	M
N6NB/R	281,436	R
KE6QR/R	18,528	R
KI6CG/R	8,772	R
KB8VAO/R	4,563	R
NW7O	2,944	R
KG6TOA/R	97,328	RL
K6EU/R	22,876	RL
K6JRA/R	13,824	RL
AF6AV/R	12,172	RL
AL1VE/R	11,067	RL
W6TE/R	385,336	RU
N6MU/R	280,875	RU

with another one-band wonder-score on 6 m from North Texas, putting 1388 calls from 263 grids in his log.

QRP portable participants are a hardy group. They adhere to a special set of station requirements, and better results are often achieved from being in a high spot in a densely populated area and using several bands. Topping the score list again in this class, KA1LMR from New Hampshire doubled the score of his nearest competitor with an 8-band 78k result. Even with QRP power, he logged 217 QSOs and 82 grids on 6 m and 92 QSOs on 2 m with 19 grids. In second place with 36k points, K9AKS operated from the Nebraska plains near a small airport, which provided a good horizon in all directions. Here was another adventure that capitalized on the great 6 m conditions with 203 QSOs and 111 grids, supplemented by a few additional contacts on bands B, C, D and E.

Following in third place with 35.5k points, K6VCR in San Diego used a 10-band set-up and had multiple contacts on the microwave bands to boost his score. From Arizona, N7IR managed to capture the 6 m magic and most of his 35.2k score is accounted for by his 228 6 m QSOs in 119 grids for fourth place. On the East Coast, in Connecticut K1ZE scored 23k with a 7-band effort securing fifth position.

Multi-operator

Battling it out in the top two Unlimited Multi-operator spots as they have for many years, W2SZ, the Mount Greylock Expeditionary Group, bested K8GP, the Grid Pirates, by having more QSOs, especially the higher point variety from the microwave bands. Despite the advantage of K8GP on 6 m and 2 m, the larger W2SZ group and their rovers were able to add the enormous number of QSOs and multiplier grids on the microwaves, even though their 10 GHz gear was visited by Murphy part way through the fray. Entering the national top-three circle was the multi-op team from K5QE. For the past several years this South Texas group's activity had posted previous section records and scored in the 500-600k range. With the efforts to make this a fixed contesting superstation, the judicious tracking of rovers, and the addition of excellent 6 m and 2 m propagation, they broke the 1 million-point barrier. The fourth place Mt Airy VHF Packrats, W3CCX, redesigning many of their stations this year, were in a contest rebuilding mode, yet had a respectable 887k total. The K3YTL team continues to grow in band capability and scooted home with 5th place.

In the Limited Multi-Operator category, stations submit a four-band entry. Operation on additional bands is allowed, but those QSOs are treated as in a check-log. Using the great advantage of the 6 m conditions to take first place in this category, again, are the K5TR multi-ops from South Texas with 577k points and a huge total of 1344 6 m QSOs in 264 grids. The AA4ZZ team in North Carolina challenged, but was in second place in this grouping with 458k points, building a solid number of QSOs and grid multipliers across all four lower bands. The W3SO operation netted third place scoring 358k from their mountaintop perch in Western PA. Just behind in fourth place were the W4IY multi-ops with 355k. The difference between these two groups was the number of QSOs made by the W3SO group on the higher-point bands of 222 and 432 MHz. The W4NH 4-band operation, also from NC, earned 5th place with 307k.

Rovers — In Three Categories

This is the first June QSO Party with the three categories of rovers; Classic, with 1-2 operators and all gear and antennas carried in the vehicle; Limited, with the number of operating bands limited to four; and Unlimited, where the number of participants, bands and rover tactics have little restriction. Ninety-five rovers submitted logs for this event. The overall number of rover entries is similar to previous years (98 rover entries in '07 and 96 rover entries in '06). A special

"Thank You" goes out to Toyota, who as graciously sponsored all available Rover plaques this year.

A majority of the stations entering the Classic Rover category used six bands or more, with many having 8-10 bands in use. Eight of the top 10 scorers in this category had a two-operator entry. Apparently gas prices were not a serious challenge as the number of grids covered by the rover bunch did not seem to change much from previous years. One wily rover group found a way to maximize their scores simultaneously in all three categories. The Classic Rover category had 61 entries, and N6NB/R was top scorer with 281k points, covering 15 grids with a group of similarly-equipped rovers who operated in a fashion to enhance their scores and also garner top spots in the Limited and Unlimited Rover categories. There are further details of this group's activity on the Soapbox Web page under "N6NB/R", and also on the N6NB home page (**commfaculty.fullerton.edu/woverbeck/n6nb.htm**).

There were 25 entries into the premier event of the Limited Rover category — stations who were using four bands of their choosing with the same power limits as for Single-Op Low-Power. The intention of developing this category was to allow stations who were somewhat limited in their gear, or newcomers to roving with rigs which included 1-4 VHF bands, to compete with each other and not with those stations equipped with a whole array of VHF-UHF and microwave bands. Finding a unique opportunity within this new category, using the four bands from 2.3 GHz through 10 GHz, and moving with the team of other rovers, KG6TOA/R topped this category with a score of 97k, traversing 15 grids.

In second place with 36k, W3DHJ/R took advantage of the great 50 MHz openings in the Midwest and using only two bands and roving through only four grids, had a 135-grid multiplier. K4GUN/R with partner K4LIG copped third with a 10-grid band-ABCD activity and a 24k score. In 4th place K6EU/R had 22.8k points and a mere few hundred points behind, AG4V/R, who maximized his score focusing on 6 m multiplier grids. The average score in this group was 13k.

The new Unlimited Rover category allowed stations to use almost any type of configuration, operator contingent and any number of QSOs with other rovers, including tandem roving or grid-circling. A total of eight entries were received in this class, and these averaged 101k points, with a top score of 385k by W6TE/R traveling with partner K6MI. Second place was N6MU/R with 280k. Each of them carried 10 bands and roved through 15 grids, apparently tracking with the other top entries from the Classic and Limited rover classes. In 3rd was N5AC/R, who, with W5RSH and KE5BUZ covered five grids in the NTX area with nine active bands.

These new categories of contest rovers will hopefully satisfy many participants. In time we are sure to see more feedback on the effects of the new classes; how the competition can still be managed and scores maximized in each group with specialized roving tactics — proudly promoted by some, and decried by others.

VE3WCC

Grid expedition to FN04xa by members of the West Carleton ARC of Ottawa. Operators included Ken, VA3KA; Doug, VE3XK; Andy, VE3NVK; Barney, VA3BGB; Dean, VA3CDD; Al, VO1NO and Jeremy.

Complete Results are on the ARRLWeb

For the complete 2008 June VHF Contest Results, including scores for all entries, see **www.arrl.org/contests/.** Soapbox comments are at **www.arrl.org/contests/soapbox/.**

Club Competition

The group of VHF aficionados in the Midwest grew, as demonstrated by the Society of Midwest Contesters entry: 71 logs submitted for an aggregate score of 1.8M points. This is 16 logs and 700k points greater than their 2007 submission and has them as the only entry and top spot in the Unlimited Club category. Will it be long before we find additional Midwesterners capturing more top categories and besting some of the scores from stations on the coasts?

In the Medium Club category there were 28 entries. Topping the list with 35 logs and 2.7M points, the Potomac Valley Radio Club, led by the K8GP contribution takes top honors again. In second place, moving up one place from last year with 20 logs and 1.4M points, we had the North East Weak Signal Group. Third honors go to the Mt Airy VHF RC with 16 logs and 1.2M points. Advancing several rungs up the club competition ladder, the Grand Mesa Contesters of Colorado submitted a score of 930k in 12 logs, while the Florida Contest Group was close behind in fifth place with 869k from 11 logs.

Led by the contribution of multi-op K5QE's 1.1M, the Local Club competition was won by the Nacogdoches ARC (TX) with only five entries but a huge score of 1.4M points.. In the second spot was the Murgas ARC (PA) with 759k. The Eastern Connecticut ARA placed third with 218k.

The club competition encourages participation. Of the 1074 log entries, 435 or 40% entered as a club-affiliated station. Much of the growth we get in VHF activity is supported by various club activities, rover development, building projects, club sponsored conferences, tune-up clinics and antenna range testing. If you are not already affiliated with a VHF-active club, go through the list of clubs on the competition list and find one that interests you and join in to share the VHF experience.

VHF-DX

It's always exciting to have a call in your log from a DX entity. Thanks to the participation of many stations in Canada, Mexico, the Caribbean and even those across the Atlantic Ocean, DX appeared in the logs and contest submissions. With a single-band 6 m entry, CO2OJ had a 60k score, setting a record for entries from Cuba. EA8BPX had 27 6 m QSOs in 21 grids in his log entry. Canada was well represented with 43 logs from seven provinces in all operating categories. There were 11 entries from Mexico, with 10 of them submitting single-band logs, having enjoyed the 6 m enhancements. Tim, NU6S added this comment, "Never heard so many XE's on six." Notably, Jorge, XE2WWW as a Single-Band high-power single-op scored 121k with 681 QSOs on 6 m in 178 grids. With this score, he set a new high-score record for stations from Mexico and the international participants. Zalo, XE3N another single-op in the low-power category, set a record for Mexico with 38k points, all on 6 m!

Preparing for the Future

It is not too early to prepare for the next VHF contest and other on-the-air VHF activities. The next ARRL VHF QSO Party will be held on June 13-14, 2009, and like the Boy Scouts, make sure you're prepared! QST

It's Coming — The 2009 ARRL International DX Contest

H7/K9GY

- W/VE stations send signal report and ARRL/RAC section
- DX Stations send signal report and transmit power
- E-mail Cabrillo-formatted logs to **dxcw@arrl.org** or **dxphone@arrl.org**
- CW submission deadline: 0000 UTC Tuesday, March 24, 2009
- Phone submission deadline: 0000 UTC Tuesday, April 7, 2009
- With sunspots still at a minimum, the low bands are going to be full of DX. This is one of the great HF DX contests. Don't miss out! Complete rules may be found at **www.arrl.org/contests**.

CW: 0000 UTC Saturday, February 21 – 2359 UTC Sunday, February 22

Phone: 0000 UTC Saturday, March 7 – 2359 UTC Sunday, March 8

K4RMC

Kids Day 2009 is Coming!

Saturday, January 3, 2009, 1800 UTC – 2359 UTC

K2JV

www/arrl.org/contests/kidsday

- **Sponsored by the Boring (OR) ARC, Kids 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. Stations exchange first names, age, location and favorite color.**
- **Suggested frequencies: 3.740 and 3.940 MHz, 7.270 MHz, 14.290 MHz, 18.140 MHz, 21.360 MHz, 24.960 MHz, 28.390 MHz and 2 meter repeater frequencies (with permission from your area repeater sponsor). Observe third party traffic restrictions when making DX contacts.**
- **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.**
- **Find out more about Kids Day by visiting www.arrl.org/FandES/ead/kd-rules.html. Don't forget to check out the certificate at www.arrl.org/FandES/ead/kids-day-survey.html. We are always looking for pictures of the kids operating your station so we can share them with others, so send them to kidsday@arrl.org.**

Dust Off that Straight Key:
It's Time for ARRL Straight Key Night

0000 UTC – 2359 UTC January 1, 2009

HAROLD KRAMER, WJ1B

Ring in the New Year by pounding brass, just like your parents or grandparents did! This on-air event has plenty of nostalgia with straight keys, bugs, vintage gear and more! Join us on the air and have some fun!

E-mail your summary of stations worked, along with your stories, high-resolution photos and your vote for "Best Fist" and "Most Memorable QSO" to **straightkey@arrl.org**, or send in your paper logs to Straight Key Night, ARRL, 225 Main St, Newington, CT 06111.

All entries must be received by 0000 UTC Saturday, January 31, 2009.

www.arrl.org/contests

Get Out the Brooms — 2009 January VHF Sweepstakes

"As the frozen gears turn and the meteors fly
Borealis fills the northern sky
Cold winds howl, bones are chilled
Grids are exchanged and logs are filled"

W8MIL

- ✔ **Contest exchange:** All stations send their 4 digit grid square; no signal report is necessary
- ✔ Submit Cabrillo-formatted logs electronically to **januaryvhf@arrl.org**
- ✔ All logs must be received at HQ no later than 0400 UTC Wednesday, February 18, 2009
- ✔ Complete rules can be found at **www.arrl.org/contests**

1900 UTC Saturday, January 17 – 0369 UTC Monday, January 19

DIGITIZE IN '09:
THE 2009 ARRL RTTY ROUNDUP

- ✘Ring in the New Year with the ARRL's digital-only contest! RTTY, PSK31, AMTOR, CLOVER and more!
- ✘US/Canadian stations send signal report and State or Province.
- ✘DX stations (including Alaska and Hawaii) send signal report and sequential serial number, starting with 001.
- ✘E-mail Cabrillo-formatted logs to **rttyru@arrl.org** or via regular mail to: ARRL RTTY Roundup, 225 Main St, Newington, CT 06111.
- ✘All entries must be postmarked by 0000 UTC Tuesday, February 3, 2009.
- ✘For complete rules, visit **www.arrl.org/contests**.

1800 UTC Saturday, January 3 – 2359 UTC Sunday, January 4, 2009


M3PHP

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Nov 1-Nov 15, 0000Z-2359Z, Paris, France. ARP Radio-Club de Paris, TM2DR. 110th anniversary of first Eiffel Tower CW link by Eugene Ducretet. 14.020 10.120 7.020 3.520. QSL. ARP, 66 avenue de la Republique, Paris 75011, France. **arp75@free.fr**

Nov 8-Nov 22, 0000Z-2359Z, Paris, France. ARP Radio-Club de Paris, TM3ST. 60th anniversary of the transfer of Paul Langevin F3ST to Pantheon. 14.020 10.120 7.020 3.520. QSL. ARP, 66 avenue de la Republique, Paris 75011, France. **arp75@free.fr**

Nov 16-Nov 30, 0000Z-2359Z, Paris, France. ARP Radio-Club de Paris, TM2PCI. Special ESPCI Paul Langevin event. 14.020 10.120 7.020 3.520. QSL. ARP, 66 avenue de la Republique, Paris 75011, France. **arp75@free.fr**

Nov 22-Dec 6, 0000Z-2359Z, Paris, France. ARP Radio-Club de Paris, TM8ARP. Special DVP award activity. 14.020 10.120 7.020 3.520. QSL. ARP, 66 avenue de la Republique, Paris 75011, France. **arp75@free.fr**

Dec 5-Dec 8, 0600Z-0559Z, San Angelo, TX. Donald Goff, AB5BG. Remembering Pearl Harbor. 28.400 21.300 14.265 7.235. Certificate. Donald Goff, 1210 Ardmore, San Angelo, TX 76905. **ab5bg@wcc.net**

Dec 6, 1700Z-2359Z, San Diego, CA. USS *Midway* CV-41 Museum Radio Room, NI6IW. Pearl Harbor Remembrance Day. SSB 14.325 7.250 CW 14.060 7.040 BPSK 7.070-7.080 MT63 14.109 7.037 RTTY 14.080 7.080. QSL. USS *Midway* CV-41 Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **af6ha@yahoo.com**

Dec 7, 1500Z-2245Z, Baton Rouge, LA. Baton Rouge and USS *Kidd* Amateur Radio Clubs, W5KID. Pearl Harbor Day. 15 20 40 m Gen bands. QSL. USS *Kidd* Special Event, 305 S River Rd, Baton Rouge, LA 70802. **www.lsu.edu/brarc/uss_kidd.htm**

Dec 7, 1600Z-2100Z, Wichita, KS. Wichita Memorial VFW Post 3115, WØVFW. Pearl Harbor, Radio Silence at 1855, time of first bomb. 14.283. Certificate. Marc Hammann, Wichita Memorial VFW Post 3115, 4801 W Douglas Ave, Wichita, KS 67209. **www.vfw3115.org**

Dec 13-Dec 14, 1400Z-2200Z, Royal Palm Beach, FL. Major Edwin H. Armstrong Memorial Radio Club, W2XMN. 75th Anniversary of the invention of FM radio. SSB 14.270 7.270 FM 52.525 29.600. QSL. Major EH Armstrong FM Association, PO Box 1584, Loxahatchee, FL 33470. **www.freewebs.com/mafma**

Dec 13-Dec 14, 1600Z-0400Z, Coos Bay, OR. Coos County Radio Club, K7CCH. 22nd Annual Holiday Lights at Shore Acres State Park. 14.260 14.250 14.270 3.980. QSL. Coos County Radio Club, PO Box 698, Coos Bay, OR 97420. **carl-3@charter.net**

Dec 13-Dec 15, 1400Z-0200Z daily, Nazareth-Bethlehem, PA. Christmas City and Delaware-Lehigh Amateur Radio Clubs, WX3MAS. Annual Christmas greetings from the Twin Christmas Cities. 28.465 21.365 14.265 7.270 3.970. Certificate. CCARC/DLARC WX3MAS, Greystone Building, Gracedale Complex, RR 8, Nazareth, PA 18064. **www.dlarc.org**

Dec 18-Dec 23, 2300Z-0200Z, Belen, NM. Valencia County Amateur Radio Club, KC5OUR. Celebrating Christmas from Bethlehem (Belen) New Mexico. 21.368 14.268 7.268. QSL. VCARA, PO Box 268, Peralta, NM 87042. **www.qsl.net/kc5our**

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.

***Note:** Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

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, at **www.arrl.org/contests/spevform.html**, or if you prefer, forms are available via the 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). Off-line completed forms may be mailed, faxed or e-mailed to ARRL, Attn: Special Events. 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 **Feb** *QST* would have to be received by **Dec 1**. In addition to being listed in *QST*, your event will be listed on the ARRLWeb Special Event page. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

W3UR

HOW'S DX?

The 100 "Most Needed" DXCC Entities

DXCC (DX Century Club) is a registered trademark of the ARRL and is the premier operating award.

Shortly after the beginning of the ARRL DXCC program, DXers from around the world created most wanted or needed lists of DXCC Entities (countries). These are lists of DXCC Entities that rank the most needed or wanted. DXpeditioners have used these lists to focus their attention for future DXpeditions. Over the years these lists have come and gone including the ARRL's list, which has not been published since the *DXCC Yearbook 2000*. Most wanted/needed lists have been published both in print media and on the World Wide Web. Some of these lists have been for all time mixed mode, some for individual modes, some for bands and others for specific regions of the world.

The ARRL's first 100 "Most Needed" list was published in the September 1993 "How's DX" column (page 95). There-after, the list was published in the *DXCC Yearbooks*, until 2000. Since then the list has not been published because of some anomalies. These variances have not been worked out yet; however, we hope to be able to do so in the future. The results come directly from the DXCC database. It uses the data of DXCC members from their confirmations accredited at the ARRL DXCC Desk. So it takes into account the actual confirmations that have been submitted (QSLs and LoTW credits) and counted for DXCC credit.

Some of the discrepancies involve the data from when DXCC was first computerized. This early information includes submissions dating back to 1991. Some DXers may not have submitted a DXCC application in recent years for several reasons (SK, no longer participating in the program, etc). For some of the newer DXCC Entities, like FJ — St Barthelemy, many DXers have worked it but not yet submitted it for DXCC credit. These countries will eventually go down in rank as QSL cards and LoTW credits are submitted. In the future we will need to limit the data to say, submissions made in the last 3 or 4 years only and, for the purposes of the survey, remove data from Silent Keys. This will make the "Most Needed" list more accurate for those who are continuing in the DXCC program.

FROM FEBRUARY 2002 *QST*

Ed Giorgadze, P5/4L4FN, at his shack in his home in Pyongyang, North Korea. He was working for the UN World Food Program.

Top 10 Most Needed Notes

The following are the top 10 most needed entities from the database along with your editor's candid comments. Please remember this "Most Needed" list is based on those DXers who have worked it, confirmed it and most importantly submitted it to the DXCC Desk for credit.

1 FJ — ST BARTHELEMY

This one was added to the ARRL DXCC list in December 2007. There have been several FJ operations since the addition. There will no doubt be more operations since it is easy to get to, though a little more expensive than your average Caribbean location. Obviously this should not be the most wanted country. It will go down in rank as DXers submit it for DXCC credit over the next year.

2 KH8/S — SWAINS ISLAND

Swains Island was added to the list in July 2006. It is clearly not the second most wanted, especially after the second DXpedition, N8S, and their 117,205 QSOs! This one will definitely go down in ranking over the next few years as DXers send in their cards to Newington.

3 P5 — NORTH KOREA

P5 is absolutely the most wanted DXCC country. Just over 16,000 QSOs have been made, of which just over 12,000 unique stations have this one confirmed. But nowhere near that many have it confirmed at the DXCC Desk! The outlook for seeing P5 back on the air is very questionable. Probably the only way P5 will return to the air is for some kind of major political change to take place.

4 4O — MONTENEGRO

Montenegro was put on the DXCC list in July 2006 and plenty of activity and QSLs followed. Definitely not number 4, much less the top 25. This too will go down in the poll in the future.

5 BS7H — SCARBOROUGH REEF

Scarborough Reef is one of the smallest and most difficult DXCC Entities. Despite the April 2007 DXpedition many DXers from the eastern half of North America were unable to work this one due mostly to such a short window of propagation. Getting a license and permission are not impossible. The most difficult part of putting this one on the air are the political tensions between China and the Philippines, as seen from past operations. Future DXpeditions should definitely continue to use the BS7H call sign, so most DXers will not rework them. Also, special attention will need to be made for openings to the East Coast of the US. This should be the number 2 most wanted.

6 7O — YEMEN

Probably the most dangerous DXCC Entity with a permanent population. Getting a license or better yet permission to operate from 7O has been next to impossible. There are several groups attempting to activate this one. Given the news from Yemen lately those groups need to seriously consider their personal security.

7 VP6/D — DUCIE ISLAND

There have been three DXpeditions to Ducie Island since it was put on the DXCC list in March 2002. The last operation, VP6DX, which took place in February 2008, made an amazing 183,686 QSOs. All direct QSLs have been mailed and this one could fall off the top 100 list after everyone submits to the DXCC Desk for credit.

8 FK/C — CHESTERFIELD ISLANDS

The Chesterfields were added to the DXCC list in March 2000 and the last operation was in October 2004. There have been four DXpeditions to this somewhat recent

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addition to the DXCC list. The Chesterfields are probably not really in the top 10, but rather in the top 20 and definitely a need here. I would not be surprised to see a future DXpedition to this one.

9 E4 —PALESTINE

E4 showed up on the DXCC list in February 1999. So there has been plenty of time for DXers to work Palestine and submit the QSL to the League. Since it was added to the list there have been several DXpeditions and even a few long term operations, especially

FROM MARCH 2000 *QST*

A QSL card from the February 1993 IOTA (OC-176) DXpedition to the Chesterfield Islands.

shortly after it was added. Over the past few years there has not been as much activity. The next operation to E4 should definitely pay attention to W5/W6/W7 and WØ.

10 4W — EAST TIMOR

In March 2000, 4W made it to the list. Up until 2003 there were plenty of DXpeditions and long term activity from this one. Then there was the Spanish June 2008 operation of 4W6R. There has been plenty of time for DXers to make a submission for this semi-rare one.

The 100 Most Needed DXCC Entities

Ranking	Prefix	Entity Name
1	FJ	Saint Barthelemy
2	KH8/S	Swains Island
3	P5	DPRK (North Korea)
4	4O	Montenegro
5	BS7H	Scarborough Reef
6	7O	Yemen
7	VP6/D	Ducie Island
8	FK/C	Chesterfield Is
9	E4	Palestine
10	4W	Timor — Leste
11	FO/M	Marquesas Island
12	FR/G	Glorioso Island
13	VU4	Andaman & Nicobar Island
14	BV9	Pratas Island
15	FO/A	Austral Island
16	H4Ø	Temotu Province
17	3Y/B	Bouvet Island
18	VU7	Lakshadweep Islands
19	VP8/S	South Sandwich Islands
20	ZS8	Prince Edward & Marion Islands
21	VKØ/H	Heard Island
22	FR/E	Europa & Juan de Nova
23	FT5W	Crozet Island
24	FR/T	Tromelin Island
25	SV/A	Mount Athos
26	VKØ/M	Macquarie Island
27	E3	Eritrea
28	VP8/G	South Georgia Island
29	HKØ/M	Malpelo Island
30	PYØ/S	Saint Peter and Paul Rocks
31	3CØ	Annobon
32	FT5Z	Amsterdam & St Paul Island
33	A5	Bhutan
34	3Y/P	Peter 1 Island
35	KP1	Navassa Island
36	ZL8	Kermadec Island
37	3D2/C	Conway Reef
38	ZL9	Auckland & Campbell Island
39	KH5/K	Kingman Reef
40	TN	Republic of the Congo
41	9U	Burundi
42	VK9W	Willis Island
43	VP8/O	South Orkney Islands
44	VK9/M	Mellish Reef
45	YA	Afghanistan
46	YVØ	Aves Island
47	FT5X	Kerguelen Island
48	XY	Myanmar
49	T31	Central Kiribati
50	KP5	Desecheo Island
51	CEØX	San Felix Island
52	PYØ/T	Trindade & Martim Vaz Islands
53	T33	Banaba Island
54	3B6/7	Agalega & St Brandon Islands
55	S2	Bangladesh
56	KH1	Baker Howland Island
57	KH5	Palmyra & Jarvis Islands
58	9M/DX	Spratly Islands
59	EP	Iran
60	1A	Sov Military Order Of Malta
61	6O	Somalia
62	ZD9	Tristan Da Cunha & Gough Is
63	3C	Equatorial Guinea
64	ZK3	Tokelau Islands
65	TT	Chad
66	XW	Laos
67	5A	Libya
68	FO/C	Clipperton Island
69	VK9	Christmas Island
70	TI9	Cocos Island
71	KH7K	Kure Island
72	JD1/M	Minami Torishima
73	KH9	Wake Island
74	VK9	Cocos (Keeling) Island
75	KH4	Midway Island
76	YK	Syria
77	SØ	Western Sahara
78	3D2/R	Rotuma
79	CEØZ	Juan Fernandez Island
80	CYØ	Sable Island
81	JX	Jan Mayen
82	R1MV	Malyj Vysotskij Island
83	TY	Benin
84	E5/N	North Cook Islands
85	ST	Sudan
86	YI	Iraq
87	XU	Cambodia
88	C2	Nauru
89	XF4	Revillagigedo
90	T2	Tuvalu
91	5R8	Madagascar
92	9X	Rwanda
93	9N	Nepal
94	VK9	Lord Howe Island
95	3B9	Rodriguez Island
96	ET	Ethiopia
97	D6	Comoros
98	3W	Viet Nam
99	CY9	Saint Paul Island
100	R1FJ	Franz Josef Land

QST

Strays

I would like to get in touch with...

◊ someone who can identify the expired call sign of my uncle, Philip Kendall Bodge. He was licensed in 1939 or so and lived on Elm Street, Goffstown, New Hampshire. A QSL may also have been addressed to Long Sands Road, York Beach, Maine. He went to Norwich University, graduated in 1947 and was drafted into the US Army in 1942. He went through Fort Monmouth, shipped out to India and later was assigned to China. He passed away several years ago and I would like to acquire his call sign if it is available. — *Stanley W. Wright Jr, W1SWW,* **w1sww@psouth.net**

QST congratulates...

◊ Tony McClenny, N3ME, who will serve as mayor of Bethany Beach, Delaware in 2009.

◊ Former *QEX* Editor Rudy Severns, N6LF, who was recently awarded a Lifetime Achievement Award from *Power Electronics* magazine. The magazine's editor noted that Rudy is "an innovator in power-supply design who anticipated the trend toward higher frequency switching, an illuminator of power-supply topologies, and one who introduced many engineers to the promise and perils of power MOSFETs." Rudy is also a participant in the ARRL 500 kHz Experiment. — *Fritz Raab, W1FR*

◊ Chayne Sparagowski, KI4WBN, of Crestview, Florida, who has reached the level of Eagle Scout. He project was building some high gain RDF antennas for the Crestview Fire Department and the Okaloosa County Emergency Services to use with their (just below 220 MHz) Project Lifesaver receivers. Project Lifesaver provides a small wrist band transmitter to Alzheimer's patients to aid in their rescue if they were to wander away from home or otherwise get lost. — *Cal Zethmayr, W4GMH*

W3ZZ

THE WORLD ABOVE 50 MHz

Maunder and Other Minima

In February, this column dealt with the approach of the sunspot minimum between Cycles 23 and 24. When that was written in November 2007, based on averages of spotless days in the recent past I expressed the hope that the actual minimum would occur sometime in 2008. Indeed the following month, December 2007, a spot appeared with reversed polarity from those in Cycle 23 and at high latitude typical of spots associated with Cycle 24. Another developed in January and since then nothing until the appearance of two additional high latitude ones with reversed polarity on September 21.

During 2008 there have been prolonged periods with a spotless sun and solar flux levels in the mid 60s not seen since the beginning of the 20th century. In fact on July 11, 2008 NASA published an interesting article at **science.nasa.gov/headlines/y2008/11jul_solarcycleupdate.htm** in which noted solar physicist David Hathaway concluded there is nothing unusual about this prolonged minimum. The article noted that the number of spotless days following Cycle 23 (420 updated to August 31, 2008 the latest figure available as of the writing of this column) is comparable to several known 20th century cycles including the minimum that preceded the largest recorded cycle, Cycle 19 (R_{max} in 1958) and substantially less than those occurring earlier in the 20th century (see Table 1).

Given the very slow start to Cycle 24, predictions for this next cycle have turned more pessimistic. Almost all prognosticators, including ones like Hathaway and Dikpati, who have previously predicted a large Cycle 24 with R_{max} exceeding 150, believe that the following cycle (#25) is likely to have a low R_{max} because the solar conveyor belt, which is central to sunspot formation, appears to be slowing down. What is in question is the immediate next cycle (#24). Will it be large or small or somewhere in-between? We have discussed this before in this space and the experts have not come to a consensus. Along with most amateurs I am hoping that those predicting a large cycle will be correct but as Cycle 24 continues to progress very slowly that hope may not come to fruition.

So what happens if Cycle 24 is the beginning of a series of "poor" sunspot maxima? We spoke briefly of that possibility in the February column. In this column I want to look at this possibility in more detail and try to convince my readers that it is not the end of the world. VHF radio will be affected but perhaps not as significantly as HF radio in many respects.

Table 1

Number of Spotless Days during Sunspot Minima, 20th/21st Century

Data from **http://science.nasa.gov/headlines/y2008/11jul_solarcycleupdate.htm?friend#spotlessdays.**

Cycle #	13	14	15	16	17	18	19	20	21	22	23
Spotless days following cycle	~931	~1019	534	568	269	446	227	272	273	309	?
Approx year	1902	1913	1923	1933	1944	1954	1964	1976	1986	1996	?

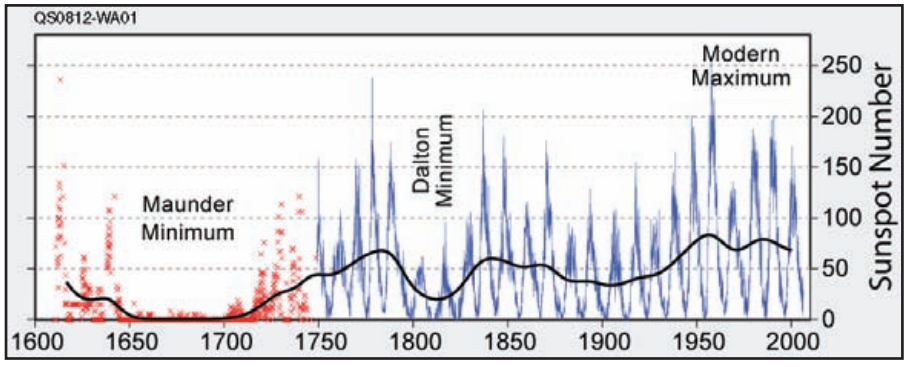

Figure 1 — This graph details the last 400 years of direct sunspot measurements using solid observational data since 1750. Less accurate numbers from the Maunder minima are also included. Sunspot graph is from Robert A. Rohde, *Global Warming Art* at http://upload.wikimedia.org/wikipedia/commons/2/28/Sunspot_Numbers.png.

Measurement of Solar Activity: Direct

The most obvious method of sunspot determination is direct visual observation. The numbers you see in tables were based on observations originally made at Zurich and its two branch stations but are now maintained by the Solar Influences Data Analysis Center (SIDC) at the Royal Observatory of Belgium. Accurate measurements go back to solar cycle #1 beginning in 1755. Actual observations began in 1610 following the application of the telescope to astronomy by Galileo and Thomas Harriot but because so few sunspots appeared during the Maunder Minimum (see below) from 1645-1715, more accurate numbers postdate this time.

Figure 1 represents a complete record of numbered sunspot cycles and a partial record back to 1610. For our later discussions please note that these spots appear in a cyclic but somewhat variable fashion with cycles (minimum to minimum) averaging between 9 and 13 years but the maxima exhibiting two distinct low periods — the Maunder and Dalton minima — and one distinct high period — the Modern Maximum. Historical details are indeed sketchy but it appears that the first direct sunspot observations date to the Chinese *Book of Changes* circa 800 BC but most observations date back only to the second century BC or later and approximately 150 sunspot events appear prior to 1500 AD. The quantitation of these examples

This Month

December 7	Good EME conditions*
December 11-15	North American HS Meteor Scatter Geminids Contest
December 13	Geminids meteor shower peaks at 2300Z

*Moon data from W5LUU

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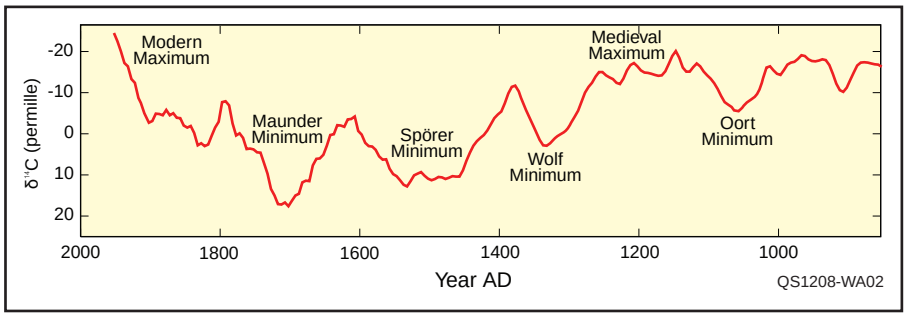


Figure 2 — A graph of Carbon 14 levels used as a proxy for sunspot activity over the last millennium. While not labeled, the Dalton Minimum would be the slight dip commencing just before 1800. After Leland McInnes in *Global Warming Art* at http://en.wikipedia.org/wiki/Image:Carbon14_with_activity_labels.svg.

is incomplete and thus sunspot cyclicity and Rmax cannot be inferred.

Measurement of Solar Activity: Proxies

While direct quantitative observation is the most accurate, it is possible to estimate sunspot number with a fair degree of precision by using proxies. These include the radioactive Carbon isotope, ^{14}C, in ice cores and tree rings, the radioactive Beryllium isotope ^{10}Be in ice cores and the occurrence of auroras and visual observations by the Chinese. For instance, the quantity of cosmic rays reaching Earth is inversely proportional to sunspot number. The amount of ^{14}C formed at any given time is importantly related to the density of cosmic rays. Thus, we can estimate the number of sunspots by measuring the amount of ^{14}C remaining in trees, deriving its age by counting tree rings, or by measuring the amount of ^{14}C trapped in air bubbles in ice cores. The resulting graph of ^{14}C concentration over that past millennium appears in Figure 2. Notice how well ^{14}C concentration follows low sunspot cycles of the two known minima and one known maximum sunspot periods over the last 400 years. Notice also how it follows two other minima known on the basis of climatology and other proxies and the well-known Medieval Maximum.

The Last Millennium

Our sun is a normal main sequence star. While its total irradiance and other properties are relatively constant, it does have variability. During the last 1000 years we have seen two periods of high sunspot (R_{max}) activity and five periods of reduced sunspot activity. We live in one of the former periods, the Modern Maximum (1945-present), which has included the highest recorded sunspot cycle (#19). The other maximum was during the Middle Ages (1100-1250), a time also known as the Medieval Warm Period because the climate in Europe was much warmer than normal. Of greater interest to this column should we be heading toward a period of prolonged dearth of sunspots were the five periods of low sunspot maxima: The Dalton (1790-1830), Maunder (1645-1715), Spörer (1420-1570), Wolf (1280-1340) and Oort (1010-1050) minima. A much more detailed description of the Maunder Minimum based on the classical Nature paper of Eddy was published in the July 1976 issue of *QST* by Joe Lynch, N6CL, present VHF Editor of *CQ* magazine. Thus, in the last millennium we have experienced 360 years of less than average sunspot cycles and 210 years of more than average cycles. On second thought perhaps our sun is not so steady after all.

Updated Predictions

Here in September 2008 as this is being written, Cycle 24 has been very slow to show much organized activity after the first few reversed polarity spots appeared in December 2007 and January 2008. Most recently was the appearance of a pair of spots with Cycle 24 characteristics on September 21, but of short duration. This has lead some observers to predict that a series of low sunspot maximum cycles would begin with #25, peaking in the 2020s. Most observers are in agreement that due to a slowdown in the sun's conveyor belt, it may actually commence with the current Cycle 24. These latter predictions are buttressed by the unusually low solar geomagnetic field observed in the past few years, the substantially decreased solar wind and the prolonged length of Cycle 23.

Thanks to a recent presentation by Jim Kennedy, KH6/K6MIO, we have some additional information. The past few cycles, and in particular Cycle 23, have had bimodal peaks associated with the fact that the sunspot cycle has not developed synchronously in the northern and southern solar hemispheres. Data from SIDC (Belgium) indicate that the prolonged minimum is due in great measure to a delayed decline in sunspots from the southern solar hemisphere and point to a double peak for the upcoming Cycle 24. Secondly, magnetic dipoles on the solar surface with the signature of Cycle 24 have recently been increasing in number along with a small but noticeable increase in solar flux (the latter noted by Fred, K3ZO).

One should also note that the sunspot minimum proceeding the largest cycle of all (#19) was marked by unusually low and prolonged inactivity unseen since early in the 20th century, but Cycle 19 had a single large peak. Given all this information I maintain there is still no way to make an accurate prediction at this time. I would venture to say that if there are no signs of a real resurgence of Cycle 24 by the summer solstice next year, those who favor a large Cycle 24 R_{max} are much more likely to be incorrect.

VHF Propagation in a Prolonged Minimum

We have discussed this briefly last February. But now let me try to convince you that even a Minimum-like stretch of sunspot cycles will not be the end of the world VHF-wise. Let's start with what we won't see. If the maxima are like the Dalton Minimum (maxima in the order of less than 50) we are not likely to see any F_2 propagation on 6 meters although transequatorial spread F will still be reasonably prevalent. Remember here that some TEP still existed during sunspot minimum. The second thing that will be severely reduced will be auroral propagation particularly on 2 meters and above. On the other hand there is no direct relationship between sunspot numbers and sporadic E (E_s). In fact sunspot maximum years often appear to have less vigorous E_s openings than years with few sunspots. If anything certain types of E_s-related propagation like the early openings from the eastern US to Japan may require relatively quiet geomagnetic conditions and should be enhanced by low sunspot maxima.

The major form of enhanced V/U/SHF propagation is tropospheric ducting of various kinds. Tropoducting requires stable air masses, especially slow moving high pressure systems. It has been my personal observation that tropoducting east of the Appalachian Mountains on the East Coast has been diminishing over the last 10-15 years compared with what it was in the 1980s. Even our most common enhancement along the Atlantic coast toward New England has been quite rare in recent years and openings southward toward Florida have been even rarer. Openings into the Midwest, while always infrequent, have virtually disappeared. I still get many reports of tropo in the Midwest extending to the Gulf Coast and the standard over-water tropo paths across the Gulf and CA/Hawaii appear to be alive and well. It is not clear whether the former are more or less frequent than they were at the beginning of the Modern Maximum.

As weather phenomena, tropo ducts will likely be affected by lower sunspot maxima but exactly how is unclear. To some extent

weather patterns are primarily affected by major air/ocean circulations like the El Nino Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO) but if previous conditions prevail, a prolonged series of lower sunspot maxima will lead to an increased amount of clouds, a higher albedo and ultimately lower temperatures and perhaps less precipitation. It is not clear whether these latter conditions will provide the stable high pressure air masses needed to enhance propagation.

Finally, it is an ill wind that does not blow someone some good. Low sunspot maxima will have a detrimental effect on HF propagation. Ten meters will resemble 6 meters and will see little or no worldwide propagation; 15 meters will become a sometimes band with erratic propagation. Yes, E_s offers the same opportunities on 10 and 15 meters that it does on 6 meters but HF operators can normally work all that DX on F_2 and often don't know how to take advantage of E_s openings as effectively as VHF operators. Twenty meters will exhibit a lot of crowding as the only straightforward daylight DX band. Forty-160 meters will be available for nighttime DX but antennas for those bands take up a lot a space. Thus, we may actually see an increase in the number of stations attracted to weak signal VHF particularly those with HF/VHF radios. What is sure is that regardless of whether Cycle 24 is large or small we will be in for interesting times.

ON THE BANDS

6 Meters. Not much magic in the Magic Band this month. The sole report is from Craig, KB3RHR (EN90) who worked ZF1EJ (EK99) while testing out his new 6M7JHV Yagi. Jon NØJK notes that KB4XK (FM06) also worked the ZF. The **dxworld.com** reflector indicates that KE4WBO (EL87) heard stations in the Caribbean on Sep 2, 12, 17, 24, 29 and 30.

Tropospheric Ducting. September is known for tropoducting and this month had some good examples. On Sep 6 Ron, K5LLL (EM10) worked EM25, 26, 27 and 29 on 2. The next day he worked into EM54 up to 1296 in the evening and the following morning K8TQK (EM89) on 2 and 222 and N8UM (EM85) (at 1377 km) all the way to 2304. Other 2 meter stations were worked into EM25, 32, 44, 55, 56, 65, 72 and 75 including K5SW (EM25) for a new 1296 state. On the 7th John, W5UWB (EL17) worked 10 grids on 2 meters (ODX EM85 984 mi); 4 grids on 222 (ODX EM66 at 877 mi); 5 grids on 432 (ODX EM66 at 877 mi); 2 grids on 1296 (ODX EM55 at 688 mi), and 1 grid, EM55, on 2304. The same day Ben, K4QF (EM64) worked KM5PO (EM12) and W5LUA (EM13) through 1296 on his loop antennas and heard both on 2304 but was unable to complete with his +15 dBm QRPP. Sep 22, Vic, WB4SLM (EM82) noted some coastal propagation on 2 meters working FM17 and hearing FN12. The **dxworld.com** reflector reports good tropo on Sep 5 TN, SC to New England and VE2; Sep 6 EN81 to EM13, 25, 26, 74; Sep 7 EM22-EM73, EM31-EM75, EM85-EL99. On Sep 21 New England and VE1 worked into southern VA, NC and SC.

Contests. A brief look at the September contests is in order. Many more details will be forthcoming shortly. The recent hurricanes offered some hope of extended tropo for the ARRL VHF QSO Party Sep 14-16 but that was not evident in any area. Conditions were generally mediocre particularly on 6 meters. No sign of E_s was evident as far as I can see. Scores reflected the realities and records will be scarce this year. The 2 meter fall Sprint Sep 21-22 featured enhanced conditions particularly from New England to the Midwest and up and down the East Coast. But there were electrical storms throughout the East for the 222 Sprint on Sep 30/Oct 1. Conditions were otherwise okay and if you could hear through the static crashes early in the contest, reasonable scores were possible.

HERE AND THERE

Geminids Meteor Shower. This active (ZHR up to 100/hr) display of rather slow (35 km/hr) meteors should peak at ~2300Z December 13. Bursts are short and ideal for FSK441.

North American High Speed Meteor Scatter 2008 Geminids Test. The NAHSMS coincides with the Geminids meteor shower and runs from 0000 UTC Dec 11 to 0200 UTC Dec 15, 2008. All contacts must be made by meteor scatter procedures of any kind. Self-spotting and schedules before and during the contest are allowed but no information may be passed during a contact by any means but MS. Further details are at **www.sportscliche.com/wb2fko/w08/rules_w08.html**.

AL7FH SK. Well known 6 meter operator Jan Fromm, AL7FH, recently became a Silent Key. Jan was one of the first US operators to earn Worked All JA on 50 MHz. She will be missed.

To my readers, the best of the Holiday Season, a Merry Christmas and a Happy New Year to you all and to all the best of VHF+ conditions in 2009.

50 MHz Standings by DXCC Entities Worked

Call Sign	State	States Worked	DXCC Entities Worked	Grids	DX† (km)
1					
W1JJ	RI	50	179	—	15,594
K1TOL	ME	50	173	1264	15,185
K1SIX *	NH	50	168	1013	15,549
K1SG *	MA	50	151	500	15,622
W3EP/1	CT	50	150	1121	15,750
K1AC	NH	50	145	—	14,535
K1MS	MA	50	139	—	14,498
W1AIM	VT	50	132	548	14,928
2					
K2ZD	NJ	50	156	468	15,610
K2MUB	NY	50	150	—	—
W2CNS	NY	50	127	639	15,120
K2OVS	NY	50	115	529	13,124
W2MPK	NY	50	115	—	—
K2PS	NJ	50	108	623	11,706
3					
W3VZ	MD	50	146	823	14,038
W3ZZ	MD	50	141	864	15,769
AE3T	PA	50	137	—	16,664
N3DB	MD	50	135	920	15,083
N3II	MD	50	134	793	15,876
W3TC	PA	50	133	790	15,221
W3CMP	PA	50	125	—	—
AK3E	MD	50	110	731	14,445
N3JPU	MD	50	90	493	—
4					
W4DR	VA	50	150	1043	10,245
K4MM	FL	50	150	—	16,326
N4MM	VA	50	140	923	—
W4UM	FL	50	134	298	—
WA4LOX	FL	50	134	—	15,664
W4TJ	VA	50	131	745	15,688
W4SO	FL	50	130	—	—
K4PI	GA	50	128	800	12,522
K4QI	NC	50	123	866	—
KE4WBO	FL	49	120	600	8,600
AA4H	TN	50	107	696	12,580
W4WA	GA	50	107	336	—
K3XA	VA	50	101	—	15,150
WA4CQG	AL	50	86	—	—
K4RF	GA	50	69	375	16,288
5					
W5OZI	TX	50	158	1086	15,131
WD5K	TX	50	146	1144	14,924
K5UR	AR	50	144	1125	—
K5SW	OK	50	143	—	16,746
K5AM	NM	50	138	851	17,861
W5HNK *	TX	50	115	606	14,815
WB5HJV	TX	50	115	—	15,106
AA5AM	TX	50	111	728	14,963
W4UDH	MS	50	109	907	13,903
W5LUA *	TX	50	102	—	—
WA5UFH	TX	50	100	551	—
W5UWB	TX	50	91	300	—
W3UUM	TX	50	89	618	15,933
W5ZN	AR	50	88	564	14,952
6					
K6QXY *	CA	50	148	—	15,555
KH6/ K6MIO	HI	50	101	471	19,360
KB6NAN	CA	50	85	744	16,638
KR7O *	CA	50	69	591	12,783
N6ZE	CA	47	70	330	—
7					
W7GJ *	MT	50	133	708	16,102
WA7JTM	AZ	50	112	800	18,138
W7KNT	MT	50	101	734	15,557
W7MEM *	ID	50	72	640	16,106
K7XC	NV	50	22	532	11,230
8					
K8MFO	OH	50	156	—	—
W8UV	OH	50	107	350	12,349
K8NXI	OH	50	103	—	12,107
W8TN	WV	50	102	489	12,436
WA8RJF	OH	50	84	583	15,365
N4DB	OH	50	84	390	11,037
9					
W9RPM	WI	50	132	722	14,092
K9LCR	IL	50	109	550	15,872
W9RM	IL	50	107	726	13,712
K9SM	IL	50	93	517	15,148
WA9PWP	WI	50	53	455	10,400
KB9TLV	WI	50	45	125	15,905
KA9UVY	IL	50	37	289	7,969
Ø					
KØFF	MO	50	125	740	16,246
NØLL	KS	50	123	852	14,901
KØGU	CO	50	110	819	17,142
KØCS	CO	50	84	533	13,409
NØPB	MO	50	75	503	13,246
KØAWU	MN	50	50	481	15,578
WØSD	SD	50	45	203	10,629
KØALL	ND	50	42	—	—
WØRT	KS	50	40	170	13,651
Canada					
VE2PEP	PQ	50	96	671	11,574
VE3TMG	ON	50	68	539	15,454
VE2PIJ	PQ	49	57	433	6,104
International					
NP3CW	PR	50	107	582	13,533
SM7FJE	INT	43	210	1034	15,912
GØJHC	INT	42	213	1148	15,951
IKØFTA	INT	38	233	1117	18,236
GW3HWR		31	95	472	10,970
W3CMP/VP9	36	39	—	—	

†Terrestrial
*Includes EME contacts
— Not given

WB8IMY

ECLECTIC TECHNOLOGY

Promoting Amateur Television on the Internet

Amateurs have been enjoying analog fast-scan TV over UHF and microwave for decades. In fact, after February 2009 amateurs may be among the few remaining practitioners of analog television in the United States.

Be that as it may, amateur TV (ATV) has always been a niche activity with a relatively small number of enthusiasts. Once upon a time, cost was a major barrier to entry. To see and speak with fellow ATVers over a reasonably wide area, you often had to invest in a high-gain antenna, usually perched atop a tower, and an RF power amplifier. The advent of ATV repeaters removed this hurdle in many areas of the country. Cameras sometimes carried hefty price tags. too, but now you can pick up miniature color TV cameras for less than $100—sometimes much less.

So what is the problem today? Why are ATVers still such a small segment of the ham community?

One answer may be *publicity*—specifically, the lack of it. Amateur Radio is so diverse it is difficult for the average ham to stay on top of everything that's going on. How many amateurs are even aware that ATV exists? How many know what ATVers are doing with their technology? (Not all are exchanging analog signals, by the way. There is digital ATV as well.)

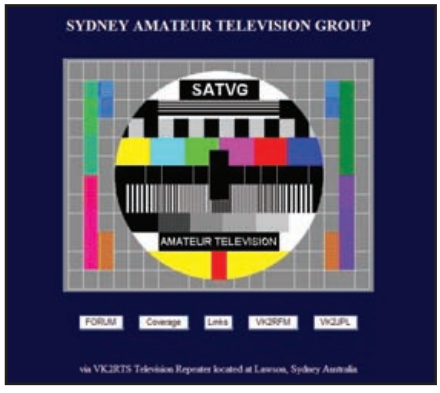
The good news is that a number of groups are now using the Internet as a means to expose the wider ham population to the fascination of ATV. They are streaming the outputs of ATV repeaters and individual stations over Web sites for all to enjoy. "Tune in" to these Web sites and you may see a random contact, a net in progress or even an on-air seminar.

Bryon Foster, N6IFU, publishes an e-letter called the *ATV Newsletter*. In it he has publicized many of these Internet ATV streaming sites. A partial list includes…

- ATCO ATV Net (every Tuesday at 6 PM PT/9 PM ET): **wb8lga.camstreams.com**
- W7TED Repeater Net Night (every Tuesday at 8 PM PT/11 PM ET): **w7ted.camstreams.com**
- CATS and BRATS ATV Nets: **kb3lnn.camstreams.com**
- ATV DXing from KA9UVY: **ka9uvy.camstreams.com**
- Severnside Television Group: (links to many international ATV streams on this page as well): **www.camsecure.co.uk/Camsecure_Radio_Amateurs.html**
- Sydney (Australia) Amateur Television Group: **www.satvg.org/**

The *ATV Newsletter* is free and you can subscribe by sending an e-mail to Bryon at **atv-newsletter@hotmail.com**.

SpaceWeather Phone is a subscription service that sends space weather alerts to your telephone.



The ATV streaming Web site of the Sydney (Australia) Amateur Television Group at www.satvg.org/.

Space Weather Alerts on your Telephone

If you're willing to part with $5 each month, you can subscribe to SpaceWeather Phone at **http://spaceweatherphone.com/**. Sure, you can always grab free information about solar flares and auroras at Web sites like **spaceweather.com**, but SpaceWeather Phone is for those times when you're not near a PC with an Internet connection.

The SpaceWeather Phone concept is simple. Whenever Old Sol becomes frisky and sends a blast our way, you receive a telephone call from Dr Tony Phillips with a recorded warning so that you can swing your antennas into position and make some VHF aurora-scatter contacts. (He doesn't actually say "Run to your radios!" but you get the idea.) If you spring for the $7 package, you'll receive "backyard astronomy" alerts, such as when the International Space Station is flying overhead, or when a meteor shower is at hand.

You can configure your subscription so that SpaceWeather Phone doesn't ring you in the wee hours. Too bad you can't set up warning priorities, though. Maybe I *would* like to hear from Dr Phillips in the middle of the night if an asteroid the size of Manhattan was descending on my town.

Or on second thought, perhaps not.

Let's Fly a Kite

Scientists from Technische Universieteit Delft in the Netherlands have demonstrated that a remote-controlled 10-square-meter kite can be used to generate 10 kW of electricity, enough to power several average homes.

How does it work? As the kite ascends, it pulls a light, high-strength cable attached to a flywheel reel on an electric generator. The rapidly unspooling cable spins the flywheel, cranking the generator and transforming mechanical energy into electricity. When the kite reaches its maximum altitude, it automatically descends and then rises again, repeating the process. Several high-flying kites tethered to generators could supply as much as 100 megawatts of electricity, according to the researchers. A multi-kite power station on such a scale is difficult to imagine unless you are, say, Mary Poppins.

This isn't just a blue-sky concept (pun intended). The philanthropic arm of Google Corporation recently invested $10 million in a US kite company called Makani to pursue a similar project. An Italian company called Kitegen has proposed a multi-kite scheme that they claim can generate *gigawatts* of power.

Hams have used kites as antenna supports since the earliest days of radio, but employing a kite as a power generator is a truly novel application. Imagine adding "kite power" as a Field Day alternative energy option! QST

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

K2TQN

OLD RADIO

Wireless North Pole Christmas

Imagine for a minute you are a young 21 year old ham living in Connecticut with your parents. You have recently completed your schooling and are thinking about a career in radio. Self-taught, you are able to build or troubleshoot any radio circuit; you have honed your Morse skills and are one of the top radio operators around, well known by your peers. So what are you going to do? It is early winter 1923.

You receive an invitation from Hiram Percy Maxim to apply for the position of radio operator on an expedition to the North Pole. It sounds exciting doesn't it? The only hitch is, you will be leaving in the spring and the trip will last for a full year. You will be spending most of your time on an 88 foot schooner and anywhere you can walk from there. You will be a working crew member but your primary duty is being responsible for keeping contact with the outside world on a ham radio set.

You will have primary responsibility duties but will share in the work associated with the trip. While under way you will be standing watch, cleaning the ship and helping in the galley. Once the final location has been selected you will help hunt, fish, find fresh water and bring it on board. You will help clean and prepare any fish or wild game for storage or for dinner. And when the Eskimo dogs arrive, you will help feed and take care of them.

That sure sounds like fun. How many of us would be willing to take this trip? Keep in mind that very little was known about the Arctic and the risk of being lost there was great. Historically, many explorers never came back and were never found.

For Don Mix, the answer was simple: yes! Don's father and brother Mit were both hams so you can imagine what advice they gave. He applied for the job.

Mix found out it was a 15 month expedition to the Arctic with an explorer named Donald MacMillan. He had wanted to take a ham radio operator with him and asked the ARRL to help him find a good one. MacMillan was very experienced in the Arctic, having first gone with Peary in 1909 when he discovered the North Pole. He insisted on a personal interview with Don Mix to insure he would fit in with the crew and the expedition. Mix did and was accepted immediately.

MIX FAMILY

The *Bowdoin* ice bound at Refuge Harbor. If you look closely you can see Don's water can.

Don's Diary

Lucky for us Mix kept a detailed diary of his daily activities. From his diary, and Captain MacMillan's journal, we can learn about his Christmas so far away from home. You will learn about him reading a letter from his mother. Keep in mind that his mother wrote several letters prior to him leaving Maine. She had them dated to open on special days, such as on his birthday. Likewise, the special food for the Christmas dinners, presents and letters were all stored on board prior to departure from Wiscasset, Maine.

We will jump ahead. The *Bowdoin* and crew have sailed to Greenland and onto their winter anchorage at Refuge Harbor. They have been frozen in place there since late September. In Don's diary we start reading on December 15, 1923, Don's 22nd birthday. His diary is quoted exactly as written. Selected dates follow:

"1923-12-15 Saturday 1901 - 22 Years Old - 1923 - N.D. [Nothing Doing] on raising anyone. QRN storms started about 3:45

1923 Christmas Dinner Menu

(From MacMillan's Journal)

• Efricure Fruit Cocktail • Assorted Hors d'Oeuvres • Filet deThorn Caviar Meli Melo • Macedoine au Vinaigre Queen Olives • Clear Green Turtle Soup • HTP Dinner Biscuit • Roast Stuffed Turkey – Brown Gravy (Presented by the Elmwood Farm) • Cranberry Sauce • Beach Plum Jelly • Haricots Verts Asparagus Tips Petits Pris • Corn on the Cob • Candied Sweet Potatoes • Squash • Chow Chow • Plum Pudding with Sauce • Nuts • Fresh California Dates • Malaga Raisins • Preserved Skinless Figs • Glace Stuffed Cumquats • Sugar Wafers • Water Crackers • Roquefort and Cheddar Cheese • Tea • Coffee • Romeo Julieta Perfectos Cigarettes.

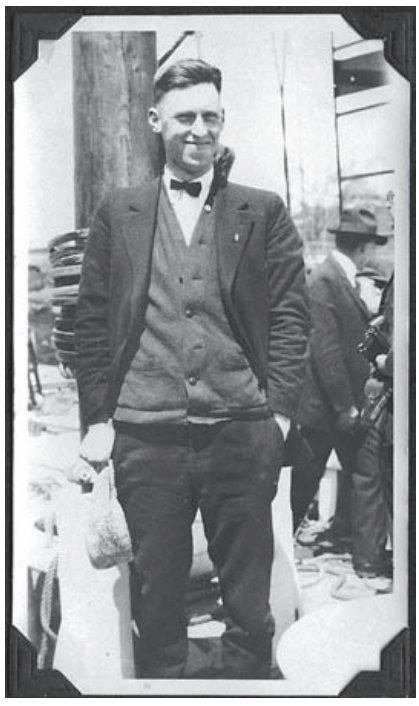
After dinner we sent for all the Eskimos to come in and get filled up, which they did. In the evening we gave out the presents and sat up until 2 o'clock to listen to a special concert given to us by WQAW of Omaha, NB. Unfortunately conditions were poor and we heard very little of it.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

MIX FAMILY

From left: Bill, Dick, Robbie, Don, Mac, Tom and John.

MIX FAMILY



Don Mix at the start of the expedition.

in earnest. Had been moderate until then but that time became so bad impossible copy anyone. Picked up parts of msg from McDonald [Zenith Radio President] being broadcasted by 9DKB regarding Bartlett's criticisms of Peary [controversy over North Pole Discovery]. Dick [crew] gave me a pound of raisins and a half pound of chocolate. Read mothers nice birthday note and re-read several letters received on first part of trip. Weather – unsettled with NE winds increasing air filled with frost temperature dropping. Received a card and book "The way of an Eagle" from the Sewall family. We had coffee for dinner and the Captain [MacMillan] gave me a pair of red plaid trousers.

"1923-12-16 Sunday - Raised Can. [Canadian], 4HH long enough to give him 9 msgs. Then QRM cut us off. Raised 9DKB few minutes later and took 4 from him and on finishing QSY'd to 250 [meters] and gave him 14. Using low power part of time. Listened for time signals from NSS and as there was no QRM copied press for first time without break.

"1923-12-17 Monday - Beautiful three quarter moon out early this am. Went up to lake and brought down can of water between 1 and 2 am. Temperature about 23° below with moderate NE winds. CQ'd and 6CEU came back but N.D. when I called him. Temperature dropped to lowest yet with 30 below. Robbie [crew] had all fo'c'sle hands out of their bunks the am as Abe's [crew] footsteps on deck were mistaken for a bear. Raised Can 4FN and 7SC but N.D. on traffic. Took one long one from 7CO but N.D. on getting any off.

"1923-12-24 Monday - N.D. on raising anyone, although 5GP came back on CQ. Tried Tuska set [donated by Clarence Tuska] but N.D. something wrong somewhere. Gales abated and QRN cleared up at 4am. About 3 or 4 feet of snow around ship on ice. Dick and Tom [crew] decorated fo'c'sle for Christmas. After press which consisted of but one section of German press with QST Merry Christmas to all. Went up to lake after can of water which I succeeded in carrying half way down. Had quite an exciting slide down lower part of hill. Robbie brought in some more decorations and lit the Bethel lite at 7. Dick and Tom dressed up and went into the igloo. Logged Dutch PA-9 code FUNOZ, British 6NI code GSYFY, British 2SZ code QLGGB and ?? code YGGOR. Southerly wind ceased entirely today and brisk nor'easter springing up tonight.

MIX FAMILY

Snow on the deck on the starboard side. Note the antenna lines.

"1923-12-25 Tuesday Christmas - Altho faint and distorted we succeeded in taking a few words from WJAZ. Captains nieces and sister spoke to us. All the Eskimos were out. Dick passed around Christmas cards for each one from someone in Washington and Captain opened cigars from Dr. Day. Kakotcheeah [Eskimo] gave Dick and John [crew] each a dog whip. Connected up with 6BCL and Can. 4HH for few mins each, taking one from Gov. Baxter [Maine] from 4HH but N.D. on clearing anything. Read mothers nice Christmas note. Certainly hope she will be there to meet me. Had wonderful Christmas Dinner. Turkey was spoiled so we had ducks instead. Eskimos came aboard again at 10 o'clock and we had a Christmas tree. Had a fine time. Someone gave 10 fine records. Received 2 boxes of candy, washrag and soap and 5 cigars. Evidently ate too much as I was taken sick late at night and paid a visit to the rail. Woke up OK in morning."

Conclusion

I'll have additional Wireless North Pole stories from Don Mix's diary in the future. Check my Web page, **www.k2tqn.com** for additional information in the meantime.

New Book for Old Radio Fans!

Those of us who really appreciate old radios will love the new addition to the ARRL Library: Joe Veras', K9OCO, *50 Years of Amateur Radio Innovation, Transmitters, Receivers and Transceivers: 1930-1980*. Joe is renowned for his radio photographs. You can order one from the ARRL at **www.arrl.org/shop** and get a free Boat Anchor calendar if you hurry. — *K2TQN*

COMING CONVENTIONS

SWOH DIGITAL AND TECHNICAL SYMPOSIUM

January 10, Middletown, OH

H S

The Southwest Ohio Digital and Technical Symposium (23rd Annual Symposium), sponsored by the Dial Radio Club and The Center for Chemistry Education of Miami University, will be held at Miami University, Thesken Hall, Middletown Campus, 4200 E University Blvd. Doors are open at 7:30 AM for registration and presentations start at 8 AM and continue to 4:30 PM. Features include digital and technical presentations, hands-on interactions between presenters and attendees and an ARRL forum. There will be no flea market — this is a technical conference/seminar only. Talk-in on 146.61. Admission is free. Contact Jay Slough, K4ZLE, 2554 Hamilton Rd, Lebanon, OH 45036; 513-934-0235; **k4zle@embarqmail.com**; **www.swohdigi.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 filled out online at **www.arrl.org/FandES/field/hamfests/regform.html**.

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.

November 15-16
Indiana State, Fort Wayne*

December 6-7
West Central Florida Section, Palmetto*

January 11
New York City/Long Island Section, Bethpage

January 17
Southern Florida Section, Fort Myers

February 7
South Carolina State, Ladson
Virginia State, Richmond

*See November *QST* for details.

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R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest 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 **December 1** to be listed in the **February** issue. Hamfest information is accurate as of our deadline; contact sponsor for possible late changes. For detailed directions to the event, see the event Web site or contact sponsor. For those who send in items for Hamfest Calendar and Coming Conventions: Postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Abbreviations: *Spr* = Sponsor, *TI* = Talk-in frequency, *Adm* = Admission.

Arizona (Glendale)—Jan 10

7 AM-2 PM. *Spr:* Thunderbird ARC. Thunderbird School of Global Management, 59th Ave and Greenway Rd. All indoor event. *TI:* 146.7 (162.2 Hz). *Adm:* $2. Tables: $5. Steve Grouse, W1ADW, 7523 W Ironwood Dr, Peoria, AZ 85345; 602-570-9214; **w1adw@cox.net**; **www.w7tbc.org**.

Florida (Ocala)—Dec 13 V

7 AM. *Spr:* Silver Springs RC. Green Clover Hall Field and Parking Lots, SE 25th Ave and Ft King St. *TI:* 146.61 (123 Hz). *Adm:* advance $4, door $5. Tables: $8. William Miller, N6WGM, 3381 SW 46th Ave, Ocala, FL 34474; 352-873-2017 (phone and fax); **n6wgm@cfl.rr.com**; **www.qsl.net/ssrc/hamfest/index.html**.

Georgia (Lawrenceville)—Jan 10 R S V

9 AM-2 PM. *Spr:* Gwinnett ARS. St Marguerite D'Youville Church, 85 Gloster Rd NW. 11th Annual Tech-Fest. *TI:* 147.075 (82.5 Hz). *Adm:* Free. Tables: Free. Norman Schklar, WA4ZXV, 480 N Peachtree St, Norcross, GA 30071; 770-840-9664; fax 770-755-5411; **norman@schklar.com**; **www.gars.org**.

Illinois (Carthage)—Dec 13 D R V

8 AM-1 PM. *Spr:* Big Bend ARC. 4-H Extension Center, 550 N Madison (Hwy 94 N). 5th Annual Hamfest and Electronics Show, VE sessions (9 AM, on site). *TI:* 147.105 (103.5 Hz), 146.52. *Adm:* $4. Tables: advance $10 (by Nov 30), door $15. Kathy Dougherty, KB9WBD, c/o BBARC, Box 278, Carthage, IL 62321; 217-357-6004 (phone and fax); **bbarc2004@yahoo.com**; **www.react2u.com/bbarc.htm**.

Mississippi (Poplarville)—Dec 13 D F V

8 AM-3 PM. *Spr:* Pearl River County ARC. Pearl River County Fairgrounds, Rodeo Dr (Hwy 26). Friendly Hamfest. *TI:* 145.21 (136.5 Hz), 146.52. *Adm:* $1. Tables: $12. Larry Wagoner, N5WLW, 40 Pinetucky Rd, Carriere, MS 39426; 601-590-0553; **n5wlw@arrl.net**; **www.prcarc.com**.

Missouri (Springfield)—Jan 10 D R V

8 AM-2 PM. *Spr:* Ozark Mountain AR Group. Faith Lutheran Church, 1517 E Valley Water Mill Rd. Project Room. *TI:* 146.52, 146.775. *Adm:* $5. Tables: Free. Connie Ballantyne, KBØZSG, Box 247, Walnut Grove, MO 65770-0247; 417-830-0336; **connielb05@aol.com**; **www.w0omd.org**.

New York (Marathon)—Jan 10 F R V

7 AM-1 PM. *Spr:* Skyline ARC. Marathon Civic Center, Peck Ave. Fun and fellowship. *TI:* 147.18. *Adm:* $3. Tables: $5. Patrick Dunn, KC2BQZ, 1302 Rams Gulch Rd, Jamesville, NY 13078; 315-488-3499; fax 315-696-6567; **kc2bqz@gmail.com**; **www.skylineradioclub.org**.

North Carolina (Winston-Salem)—Jan 10 F R

7 AM-noon. *Spr:* Forsyth ARC. Summit School Parking Lot, 2100 Reynolda Rd. "Winston-Salem FirstFest Swapfest." *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: Bring your own. Henry Heidtmann, W2DZO, c/o Forsyth ARC, Box 11361, Winston-Salem, NC 27116-1361; 336-245-5740; **firstfest09@w4nc.org**; **www.w4nc.com**.

Ohio (Middletown)—Jan 10, SWOH Digital and Technical Symposium. See "Coming Conventions."

South Carolina (Greenwood)—Jan 10 S V

9 AM-3 PM. *Spr:* Greenwood ARS. Greenwood Civic Center, 1610 Hwy 72/221 E. *TI:* 147.165. *Adm:* $6. Tables: $10. Darrell Manning, KI4BST, Box 2404, Greenwood, SC 29646; 864-418-8969; **dmanning@wctel.net**; **www.w4gwd.org**.

Tennessee (White Pine)—Jan 3 F H R V

8 AM-3 PM. *Spr:* Lakeway ARC. Smoky Mountains Expo Center, 1615 Pavilion Dr. 18th Annual Morristown Hamfest, free parking. *TI:* 147.03. *Adm:* $6. Tables: $15 (8-ft). June McClary, AI4SO, 2105 Tobes Creek Rd, Cosby, TN 37722; 423-487-0332; **ai4so@hughes.net**; **www.lakewayarc.org**.

Texas (Schertz/San Antonio)—Jan 10
D F T V
8 AM-2 PM. *Spr:* San Antonio RC. Schertz Knights of Columbus Hall, 509 Schertz Parkway. Amateur Radio Fiesta. *TI:* 146.94 (179.9 Hz). *Adm:* advance $4, door $5. Tables: advance $7, door $8. J C Smith, N5RXS, c/o San Antonio Radio Club, Box 34263, San Antonio, TX 78265-4263; 210-522-6167; **amateur-radio-fiesta@w5sc.org**; **w5sc.org/swapfest.htm**.

Wisconsin (Waukesha)—Jan 3 F H R V
8 AM-2 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum, 1000 Northview Rd (County Trunk FT). 37th Annual Midwinter Ham Radio, Computer, and Electronics Swapfest; VE sessions (9-11:15 AM, AMF Waukesha Lanes, across from Expo; bring your original license plus copy, CSCEs plus copy, photo ID, $5 fee); ham radio group meetings; free parking. *Adm:* advance $4, door $5. Tables: 8-ft, advance $19 each, door $20 (if available, plus admission); electrical outlet $20 (advance only). Send #10 business size SASE for advance reservation by Dec 30 to WARAC Swapfest, Box 1072, Milwaukee, WI 53201. Phil Gural, W9NAW, 414-425-3649; **janphil68@att.net**; **www.warac.org**.

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Attention All Hamfest Committees!

Get official ARRL sanction for your event and receive special benefits such as an announcement in these listings, donated ARRL publications, handouts, discounted rates for display advertising, and other support.

It's easy to become sanctioned. Contact the Convention and Hamfest Branch at ARRL Headquarters, 225 Main St, Newington, CT 06111, 860-594-0262, or send e-mail to **giannone@arrl.org**. The application form can be filled out online at **www.arrl.org/FandES/field/hamfests/regform.html**.

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Life Members Elected October 18, 2008

◊ Oscar S. Alonso, N6PAZ; Thomas A. Amoroso, N1TMK; James J. Aylward, KC8PD; Jeffrey M. Baer, WT4K; Thomas O. Bales, KE4SYS; Allen J. Bardwell, NS1O; Michael W. Bates, N7DQ; William A. Beech, NJ7P; Lee C. Benson, WA6FGK; Karl F. Bettinger, AF4EL; Richard P. Biby, N3UW; Andrew J. Bodnar, KA2VXA; J. Bruce Bossie, W7JBB; John S. Bremer, KB3RAO; Landon E. Brewer, KI6LO; Earl M. Brinson, K4BSK; Earl T. Brumfield, KD5EZQ; Derek Brumley, N2THR; David R. Burch, KC5PLT; Stephen M. Burney, K7SBE; Kellie A. Cahill, KC8TSX; William P. Cahill, AD8BC; Kevin Carey, WB2QMY; Lawrence E. Carter, N2MLH; Dewayne D. Carver, WDØHXX; Brian E. Cater, KC5YSM; Stephen B. Clark, N2YTD; Scott Clarke, W4COG; William S. Coe, KI4LVH; Harry Cook, W5HFQ; Randy Cornelison, K5UF; Dean A. Cuadra, WA6P; John J. Culliney, WH7MD; Clement R. Cwiklinski, KD8GRX; Dino Darling, K6RIX; Joseph A. Dawson, KBØLQR; David E. Deucher, KCØZVV; Robert D. Dittman, KB5UJM; David L. Dorrance, WA6YSO; Timothy J. Duffy, K3LR; Ken Edwards, WA4SQM; John B. Egger, K3GHH; Chris Emanuel, W6FTA; Douglas W. Fearn, K3KW; Robert L. Folgedalen, K7IOC; David Fowler, K4DLF; Michael E. Fox, N6MEF; Barbara L. Franklin, KI4BQT; J. Garman, KI6BVT; Elizabeth M. Garramone, KL1WD; Joan D. Gentry, NØUDY; John Gibson, W9LSR; Kevin J. Gilot, NZ1I; Paul A. Glatz, W2BP; Scott R. Gothard, W6SRG; Eric S. Gruff, NC6K; Robert Gryphon, KB7ZTP; David R. Heim, KA3SMF; Les Heitman, ACØHD; Benjamin C. Hofmann, K1NT; Scott Honaker, N7SS; Tristan Hube, KJ4BIW; Bruce W. Hunt, VK6XZ; John Jaloszynski, N7MLE; Robert A. Josuweit, WA3PZO; Michael J. Kellam, AA5JP; Max Kelly, K6MXD; Ken E. Kizzee, KF4EOM; Greg Kulin, VE6EO; Leonard Lauria, KG4NET; Randal A. Leval, AH6GR; Bradley D. Lietz, AA9EQ; Don L. Ling, WB5CKO; Robert Locher, W9KNI; Peter Lothberg, W4KEL; Robert J. Lovell, KCØEFC; Jim Lynch, K4GVO; George A. Mackus, ABØRX; Victor M. Madera, KP4PQ; Mark E. Madewell, W6MEM; George C. McElhoe, K5GCM; Robert F. McCoy, NBØB; Howard L. Miller, KI4ZGU; John A. Montalbano, W3SOF; Ken Moore, K7DOW; Albert F. Moreschi, AG4BV; Leonard T. Muscato, WX2X; Daniel D. Mutchler, KB1JAX; Calvin P. Myers, KØMW; Koichi Nakase, KN1J; Catherine P. Neff, KG4RJM; Grant T. Nicholls, KC2RCU; Eric J. Nordin, AD7BF; Jesse W. Ohlsson, KG7EQ; Joseph D. Orsak, W4WN; Peter J. Ossman, KD8IJC; Marcus L. Ovando, W8MLO; John P. Pacak, KC8WAN; Patricia D. Pack, KF6HNF; Domenic Padula, K1DP; Frank Palmer, AC8BF; David D. Palmrose, NY7C; Toby M. Papas, KLØSS; C. Eugene Pearson, AA8MI; Bob Pell, N8WFA; Bruce A. Pendleton, KD8DQ; Christophe L. Penningroth, KBØYOS; David E. Penrod, N3ISA; Anthony F. Petruccelli, KE3ED; Jack Quense, K6ZQ; John F. Quenzer, KC6VUN; S. Richard Ravich, K1SCJ; George P. Rebong, KE6TE; Johan K. Reinalda, WG7J; Rolfe O. Reinhart, KF6VMR; William A. Renaud, WR4MS; Coralee B. Riding, K7TNK; Peter J. Roberge, KE7OPJ; John S. Robertson, WJ4SR; Donn L. Robidoux, N1XFS; Howard S. Robins, W1HSR; George F. Rosemier, WA6SML; Philip R. Rossi, WA6ZLV; Robert Roszkowski, W5EVH; Stanford H. Rowe, K6VWE; Susan W. Sabin, KJ4DLP; Morton W. Sanford, K4VHO; Lara A. Schmoyer, KC2TEB; Philip D. Schoonover, KI4SIW; James H. Sherwood, N4UOZ; Michael Slonin; Michael W. Smith, N8GUZ; Glenn R. Snider, WØGRS; Michael L. Snuffer, W2MLS; Michael E. Sorton, WS2E; Peter N. Spotts, KC1JB; Fred H. Springall, KR4YK; Joseph J. Stanford, KØFCC; Oksana P. Stanford, KCØELV; Frederick W. Steiner, N6FS; William W. Stewart, W2BSA; Ricky D. Stoneking, W2RDS; L. Stubbs, KE5UNE; Stephen L. Susch, K2PLI; Erin M. Thomas, KD8AIW; Oscar L. Thomas, KB8FXG; Frederick S. Thompson, W4FST; Kevin A. Thornton, K5KVN; Stephen VanWambeck, N9VW; Marcus J. Wagner, KB9MW; Debora Walter, HB9EIW; Vincent B. Weal, K4JC; Mark E. Wise, NØGEH; Douglas G. Wittich, N3VEJ; Charles Wolf, KC2QPD; Dick Wolf, W1OLF; Thomas D. Woodard, KDØBRJ; Stephen J. Woods, K7SJW; James C. Wyant, W7AH; Christopher L. Wynn, N4XFA; Craig S. Young, KA5BOU; Gennaro A. Zaza, W4BFL; Arthur I. Zygielbaum, KØAIZ

ARRL Emergency Communications Course Honor Roll

We honor the following individuals who have passed all three ARRL Amateur Radio Emergency Communications courses (Levels 1, 2 and 3). This list also includes recertified individuals.

If you are interested in taking an Amateur Radio Emergency Communications course, or one of our other ARRL online courses, see **www.arrl.org/cep/.**

Constantinos Bouras, KB9ORA
Mark Cantrell, KD4IMA
Rick Colburn, NV8C
Mark Crosbie, N8MNI
Michael Crowe, AJ4GU
James Duncan, WB3HND
Harry Elwell, K2ATX
Joseph Fetterhoff, WY8C
Gerard Finnegan, KC5WLA
Howard Flint, KF7LN
Tom French, KI4ZKU
William Fults, KC8WSM
Adolph Galonski, KC1W
Denise Ganucheau, KJ5DG
Kenneth Gray, N0FRQ
James Hall, WB4YDL
Jeff Holstein, K8JMH
Douglas Jarmuth, N0DAJ
Marian Juskuv, AA1VU
Stephen Kalb, KE7EXX
William Kirkland, W9XH
James Lang, KD9GY
Robert Lewis, N8GU
Scott McAllister, W7OXZ
Jeffrey J. McCormack, KE5IAL
Michael McMillan, K6MCM
Bruce McPherson, AB3AC
Larry Minor, K4JOE
Ross Morris, KF7D
Johnny Nix, N5EEO
Lee Oliver, KC2WH
Debra Owen, KJ4AST
Daniel Page, K6DHP
James Perry, KB8LSR
Jaclyn Price, KA5LMZ
Gary Reed, N2QEE
Donald Robinson, WA4YYM
Thomas Seputis, KA9SNG
Carol Sjursen, KJ4AWB
Elbert Tanner, KB5SXC
Billie Taylor, AC8AA
Elisabeth Taylor, AC8ET
Robin Terrill, N4HHP
Michael Thomas, KI4KWC
Pamela Ware, AB3PW
William Watt, K4BLL
Gary West, KC9MBR
Donald Whitney, K9DRW
Joseph Widner, KC0UMZ
Debra Yingst, W4CKF
Victor Yingst, W4CKI

www.arrl.org/cep/

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

WA1DFM **Rogers**, Frederick F., Danville, NH
N1DZI **Cole**, James F. Sr, Gardiner, ME
W1KNW **Powell**, Elbert F., Sandwich, MA
KB1MJT **Mayhew**, I. Carl, Farmingdale, ME
W1OCU **York**, Malcolm E., Houlton, ME
W1OJA **Brill**, Donald T. Sr, Carlsbad, CA
K1QCF **Guyton**, James E., Gouldsboro, ME
KC1SE **Grandmaison**, James J., Fort Kent, ME
K1UDH **Montanese**, Charles M. Jr, St Pete Beach, FL
NK1U **Favaro**, David C., Williamsburg, MA
♦W1WPG **Fulton**, Luther G., Weymouth, MA
K2DUR **Adams**, Thomas C. Sr, Fulton, NY
WA2KOG **Snogles**, Earl R., North Syracuse, NY
KC2NVA **Higgins**, Brian J., Carlstadt, NJ
N2NWP **Ciborowski**, Raymond J., Maspeth, NY
KC2OJZ **Shields**, Lawrence F., Ocean, NJ
KA2TYU **Hughner**, Robert L., Canandaigua, NY
W3AOA **Faries**, James P., Media, PA
W3BVM **Kader**, Charles E., Massena, NY
K3FCA **Davison**, Francis S., Rock Hall, MD
W3IKR **Hibbs**, Nelson S., Roslyn, PA
WB3KBE **Stott**, Steve L., Charlestown, MD
K3MJQ **Hurwitz**, Melvin D., Greensboro, NC
W3MWY **Morgan**, George W. Jr, Baltimore, MD
W3PWE **Maser**, Robert C., Pittsburgh, PA
W3TLD **Visconage**, Charles Sr, San Antonio, TX
W3YPS **Bernd**, Richard F, York, PA
KD4BOE **Frey**, William M. Sr, Antioch, TN
WA4BUK **Murden**, Lemuel L., Chesapeake, VA
WB4BWX **Cushing**, Warren G., Winston Salem, NC
KA4EEG **Ulrich**, Lowell E., Dayton, VA
KA4EEH **Ulrich**, Marvin E., Dayton, VA
WD4EKN **Gilbert**, Steven W., Birmingham, AL
W4GIT **Gies**, Donald E., Melrose, FL
♦W4HGH **Kitchens**, Phillip H., Lanett, AL
K4HX **Smith**, David E., Charlotte, NC
KR4J **Breakstone**, Philmore, Springfield, VA
KF4KER **Stokes**, Ottie L., Pell City, AL
K4LI **Dobbins**, William E., Gardendale, AL
WA4MHA **Williamson**, Harold F., Pink Hill, NC
WA4QLB **Starr**, James, Oxford, AL
KG4SHA **Norloff**, Paul A., Vienna, VA
W4TRI **Bull**, William I., Arlington, VA
KB4TWB **Tate**, Roy E., Madisonville, KY
W4UNZ **Ray**, Bob, Nashville, TN
N4UZQ **Cleek**, William J., Hephzibah, GA
K4VCS **Knight**, John M., Beaver Dam, KY
♦W4VUO **Morris**, James H., Greer, SC
WA4WRO **Riley**, D. W., Madisonville, KY
KK4YD **Angelico**, S. J., Hanford, CA
ZR5AAD **Groom**, Ken, Holland, MI
KD5LQM **Kellner**, Fred L., Hot Springs Village, AR
KD5NXD **Mixon**, Walter A., Oxford, MS
N5OCF **Smith**, Leon, Richton, MS
N5YON **Whalen**, William M., Albuquerque, NM
WW6E **Buckner**, William L. Sr, Quapaw, OK
K6HLU **Johnson**, Eugene E., San Diego, CA
K6IJP **Sindeff**, Edward F., Long Beach, CA
KB6JBQ **Grambsch**, Frances L., San Jose, CA
KE6JSA **Gago**, C. A., Goleta, CA
KM6OW **Teitzel**, Richard, Great Falls, MT
KG6QHB **Scanlan**, Paul T., Carlsbad, CA
KO6WF **Benoy**, Harlan H., Oakhurst, CA
W7AFC **Grieve**, William O., Benson, AZ
W7AM **Robbins**, H. Allen, Portland, OR
W7BP **Hebert**, Will, Coeur D'Alene, ID
N7KBK **Koeberle**, Ward T., Coupeville, WA
K7QD **Schafer**, Lee, Boise, ID
W7QYA **Majerus**, Florence, Lewistown, MT
KC7QZB **Keefe**, Michael P., Prescott Valley, AZ
KF7SA **Smith**, Carol Lee, Darrington, WA
W8EGB **Niles**, Clyde S., Mancelona, MI
♦W8FSZ **Skutt**, Currin L., Lansing, MI
W8HUB **Mason**, William B., Waterford, OH
K8JIF **Matthews**, Edward Dr, Columbus, OH
ex WD8PPX **Arno**, Odas , Flushing, OH
WB8VZS **Mudge**, Leon E., Bellevue, MI
KD8XL **Dempsey**, F. E., Jackson, OH
W9BAR **Fallis**, Robert G., Eau Claire, WI
KC9ENS **Mohr**, Gary A., Richton Park, IL
KC9FNE **Phillips**, Arthur E., Evansville, WI
KK9KK **Brubaker**, Robert L., Dade City, FL
KA9MIT **Sorum**, Monty, Chippewa Falls, WI
N9QIT **Beider**, Bessie G., Milwaukee, WI
W9TBC **Ciezadlo**, John F., La Grange, IL
WA9TVJ **Pulliam**, Charles M., Belleville, IL
N9UGG **Benoit**, George R., Peshtigo, WI
W9VLM **Christensen**, Paul M., Hancock, MI
KD9YE **Ledbetter**, Thomas, La Center, KY
W9ZTY **Presley**, Thomas E., New Martinsville, WV
NØBET **Kreeger**, Jack J., Lees Summit, MO
WAØBQF **Stehr**, Kermit P., Lansing, IA
KØDWF **Novak**, Mike L., Kansas City, KS
♦KØGG **King**, Glenn G., Topeka, KS
♦WAØOHR **Elliott**, Robert K., Liberty, MO
NØWSA **Hollenbeck**, Fred H., Haysville, KS
♦WØXM **Eyman**, Duane, Ottawa, KS
KØZM **Rose**, Thomas M., Overland Park, KS
DJ4KF **Koeglmeier**, Gerhard, Feucht, Germany
F5PM **Manhes**, Pierre, Calurie, France

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Amy Hurtado, KB1NXO ♦ Silent Keys Administrator ♦ sk@arrl.org

Feedback

◊In "The Universal Keying Module" [Nov 2008, pp 43-45], Figure 1 has two errors. Pins 1 and 2 of U1 are reversed and Q1, a PNP transistor as indicated in the parts list, is incorrectly shown in the schematic with the symbol for an NPN transistor.

◊The *DXLab* Web site [Oct 2008, p 60] is **www.dxlabsuite.com**.

◊In "A Wireless PTT Switch for Mobile Operations" [Nov 2008, pp 73-75], the part number for the garage door receiver described in the text of the article is a Multicode 109950, instead of the GRD 1-channel Delta-3. Although they appear identical, the GRD 1-channel Delta-3 will not work with the specified transmitter.

◊*Clarification:* In "Product Review — GAP Hear It Speaker" [Nov 2008, p 50], Table 5 indicates that the audio output power was *not tested*. Our lab measurements are made from available access points on the equipment, and the GAP has no external speaker jack. Thus, we were unable to take that data without modifying the unit.

◊The Executive Committee of IARU Region 2 met in Panama City, Panama in late August. "In Brief" [Nov 2008, p 12] gave Lima, Peru, as the location. The 2009 meeting is scheduled for Lima.

Field Organization Reports

Public Service Honor Roll

September 2008

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this Web page: www.arrl.org/FandES/field/pshr/.

771 KT5SR
728 KK5NU
635 WB7WOW
608 N4HUB
575 WB8RCR
418 W2LTB
404 KC8NTE
399 W4CAC
398 KC8EO
386 KD5HW
376 W5QQ
329 AD5CQ
313 WC5M
310 KI4GWC
300 WA2WMJ
270 K2HJ
256 KB2VYZ
255 KI4GEM
250 W4DNA
246 K4DND
240 KI4JOO
219 W5PY
210 KB2RTZ
W5DY
W7JSW
205 KI4KWR
200 KE5HYW
WB5ZED
197 WA5DVO
189 KK7DEB
188 W7ELI
183 KE5DLZ
180 AC8AR
N5NVP
175 WA2BSS
174 K5SFM
172 KØIBS
168 WØSJS
NY3H
167 KA8ZGY
165 N7CM
164 K7BC
162 K8MFK
161 WD5TL
160 KB2BAA
W2KFV
KGØGG
159 W5XX
NC4VA
155 WD9FLJ
154 N5TCB
150 WB2FTX
WD8USA
149 N1CKM
WB4GHU
145 K7EAJ
140 K7BFL
WØLAW
N5MEL
W9ON
N1UMJ
138 N2GS
137 W2SFD
135 KC5OZT
WB2KNS
N2GJ
W3YVQ
133 KC2PNI
132 KB5PGY
130 WA4UJC
W4ZJY
W4FAL
K2YDD
128 AC6C
W2DWR
127 N4EJF
125 W7EKB
K9LGU
K2RRM
KI4HGO
N4LFJ
122 N7BEC
121 K8AMR
120 KA4FZI
KK5GY
K6JT
AG9G
K2UL
N3RB
KBØDTI
K4IWW
W8UL
WB5EXI
N1LKJ
W1GMF
KW1U
W7IJ
117 KS3Z
W3CB
N2RDB
115 N8IO
KD1LE
N4ABM
112 W3ZQN
KK1X
111 KJ7NO
110 W7QM
W7GB
KB5KKT
WB8OIF
W6DOB
W3TWV
WB9JSR
W2EAG
W2DSX
NØMEA
N1IQI
K2VX
N7XG
N7YSS
106 KC2IYC
KD8FNN
105 KE4CB
K2TV
N2VGA
104 N7EIE
K8AE
103 AD4BL
101 K6RAU
W1PLW
AC8AL
100 K4SCL
W7GHT
W9RTP
N1JX
WB6UZX
K4GK
KC4PZA
AA3SB
NX1Q
W4TTO
KB2KLH
N9MN
WB8SIQ
N8OD
N5OUJ
NIØI
NN7D
WB6OTS
KO4OL
99 KB8NDS
N7IE
K5MC
98 N2VC
97 N2EB
96 KB9KEG
95 WG8Z
K1LCQ
KF7GC
92 K1HEJ
KB1NMO
91 WV8RG
KC2SQI
W5ESE
90 KA8WNO
WD8DHC
NS7K
WB4BIK
N3ZOC
K3IN
KA1RMV
KA1GWE
KI4YV
WA2YBM
WB2HPI
K1JPG
NU8K
W8IM
N8DD
WD8Q
KE5LMB
89 W5CU
W8CPG
88 W2CC
K4BG
K4BEH
KM1N
87 WB2LEZ
86 AA4BN
K4DLF
KI4PRX
85 W9ILF
WA1JVV
K2BRG
KC2PSN
KE5BRD
83 NA7G
82 N8NMA
KI4JQB
81 KC2ANN
W7VSE
80 K7MQF
KE7DVV
KE5DKV
WDØGUF
N3SW
AB8SY
K8KV
W1SGC
W3GQJ
KA3NZR
79 WA2NDA
77 N2RLD
WF2T
76 K2GW
K2KYQ
KI4QAU
75 K8VFZ
74 AL7N
WD8JAW
KC2CHA
KK7TN
73 KC2SKI
W5GKH
72 W6SX
KM5VM
KA2EJD
WB2WAK
W4TY
70 KA5EXI
KB1NAL
WØADZ
NØDUW
NØDUX
NUØF
KAØFUI
NØMHJ
KØOR
KØRXC
NØUKO
WAØVKC
KD7ZUP
N3SW
NØUKO

The following stations qualified for PSHR in previous months but were not recognized in this column: (August) W2LTB 643, KC8NTE 316, WB8RCR 313, WD8USA 301, NC4VA 287, W5PY 216, KA1GWE 209, W2KFV 193, KD1SM 173, N4SCY 170, WA4UJC 170, K2HJ 166, AC8AR 160, K8MFK 156, K8AMR 145, W4DNA 145, AC8AL 145, K4GK 140, K8RDN 140, WB9JSR 130, NY3H 130, W4FAL 130, W1PLW 125, WD5TL 121, K1HEJ 120, W5HUD 120, K4IWW 120, N5MEL 120, N5NVP 115, NX1Q 110, W2EAG 110, KD8FNN 104, K4BEH 102, K5MC 100, N4MEH 100, W2EAG 100, KB2KLH 100, KB1NMO 100, K2TV 100, K8DD 100, W4TTO 100, WA2YBM 100, K8AE 96, WC5M 95, K2YYD 95, WD8JAW 94, KO4OL 93, W2DSX 91, K4BG 90, WB4BIK 90, KA1GWE 90, KA1RMV 90, N9DGK 90, KI4YV 90, NX1Q 88, K8KV 80, KM5VM 89, KØBXF 88, K2BRG 85, KBØDTI 84, AB8SY 75, KA1RMV 74, AE5V 72, KB1NAL 70. (July) K2TV 100. (June) K2TV 105. (Feb) K2TV 105.

Section Traffic Manager Reports

September 2008

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IL, KY, LA, MDC, MI, MN, MO, MS, NC, ND, NH, NLI, NNJ, NTX, OH, OK, OR, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WMA, WI, WV, WY. August STM reports that were received but not recognized in last month's column include: IL, MI.

Section Emergency Coordinator Reports

September 2008

The following ARRL Section Emergency Coordinators reported: EWA, GA, LA, IN, KY, MDC, ME, MI, MO, NC, NM, NTX, OH, OK, SD, SFL, SJV, SNJ, STX, SV, VA, WPA, WV, WTX. August SEC reports that were received but not recognized in last month's column include EWA, KY, MI, NC, SD, VA, WWA.

Brass Pounders League

September 2008

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format.

KK3F, 4239; WB5ZED, 2307; W4ZJY, 1382; KA9EKG, 1351; N1IQI, 1217; WB5NKD, 1091; W8UL, 955; WB9JSR, 891; WB5NKC, 824; W1GMF, 721; N1UMJ, 682; KW1U, 560; K4JGA 517.

The following station achieved BPL with originations plus deliveries: K8LJG 102, KK5GY 100.

The following stations achieved BPL in August, but were not recognized in this column last month: WB9JSR 693, K89LJG 113 (originations plus deliveries). QST

75, 50, AND 25 YEARS AGO

December 1933

- The artsy cover photo montage shows hams at work.
- The editorial remembers the exciting time 10 years ago, when the first transoceanic radio contact was made!
- James Lamb and Ed Handy provide practical information on "Pre-Selection and Image Rejection in Short-Wave Superhets."
- L. C. Waller, W2BRO, presents Part I of "An Efficient C.W. and 'Phone Transmitter Using the New Tubes and Circuits." His crystal-controlled multi-band rig uses a pair of type 800 tubes in the push-pull output stage.
- James Lamb writes about "The Overmodulation Racket," noting that over 90% of today's 'phone signals are horribly overmodulated, taking up excessive bandwidth.
- In "An Amplifier for the Universal Exciter Unit," George Grammer describes an amplifier that will provide 50 watts output, using a single RK-18 tube.
- *QST* Managing Editor Clark Rodiman tells how to "Convert 'Phone Monologues to Conversations," using a simple "push-to-talk" system. We're glad those long monologues will soon come to an end!
- Wallace Wiley, W9AZI, reports on "The World's Fair Radio Amateur Exhibit" — W9USA at the Chicago "Century of Progress" fair.

December 1958

- The cover photo shows the "SimpleX Super" receiver, described in this issue.
- The editorial refutes two widespread rumors: (1) that the 15-meter band will be taken away from hams, and (2) that Technician licensees will lose privileges on 50 Mc.
- By Goodman, W1DX, describes "The 'SimpleX Super Receiver," which covers 80 and 40 meters plus 5 Mc. (for WWV), and which sports a crystal filter.
- Lew McCoy, W1ICP, describes "The Novice 50 Watter," which uses a single 6146 in a crystal-oscillator rig!
- Dave Geiser, WA2ANU, tells how to use wire-wound resistors to make "Wide-Band Moderate-Power Dummy Loads."
- The "Two-Tube Mobile Transmitter" built by M. J. Westrem, WØHOB, uses only two tubes (a 12AT7 and a 6CL6) to provide a mobile rig for 80 and 40 meters.
- Joe Taylor, K2ITP, describes "Working Ionospheric Scatter on 50 Mc."
- Major Gilbert, K6LMW, sets new solar-powered terrestrial DX records with his "Ten-Meter Transistorized Phone Transmitter."
- Rev Daniel Lineham, W1HWK, tells about working "From Pole to Pole on 40 Watts," from McMurdo Sound, Antarctica, using the call sign KC4USC (one of the stations activated during the International Geophysical Year).

December 1983

- The cover photo shows experimentation with Yagi antennas, described in this issue.
- The editorial discusses the "Team Spirit" that ARRL brings to Amateur Radio.
- Dennis Lusis, W1LJ/DL, discusses "HF Propagation: The Basics," reminding us how radio signals get from here to there.
- Bob Shriner, WAØUZO, and Paul Pagel, N1FB, present a neat weekend project — an iambic keyer — in "CW on a Chip."
- In "Feeding Your Station," Doug DeMaw, W1FB, discusses the various kinds of antenna feed lines and helps the reader decide what's best for him.
- Scott Freeberg, WA9WFA, tells about "The Microcomputer Repeater Controller."
- "The Personal Computer," Part 2 (adapted from *Personal Computing* magazine), discusses useful computer peripherals such as disk drives and printers.
- Richard Fenwick, K5RR; Richard Fenwick, Jr, N5BXB, and Bobby Schroeder describe "The Extended-Element Beam," telling us how to get 6-element performance using only 3 elements.
- "Mark Barettella, KA2ORK — Grenada Story," by Carol Smith, AJ2I, tells how Mark gave on-the-air eyewitness accounts of the invasion of Grenada by United States military forces. Mark, a 22-year-old medical student at St George's University School of Medicine during the military action, was the only radio station on the air from Grenada (other than military radio stations).

Al Brogdon, W1AB ♦ Contributing Editor

W1AW Schedule

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US Time + 4 hours. For the rest of the year, UTC = Eastern US 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 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 also transmitted monthly. See "This Month in Contesting" in this issue for further details on the Qualifying Runs. 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 initial certificate is available for a $10 fee. Subsequent endorsement stickers are available for a $7.50 fee.

♦ **Digital transmissions:** Frequencies are 3.5975, 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.

♦ **Notes:** 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.

During 2008, Headquarters and W1AW are closed on New Year's Eve Day and New Year's Day (Dec 31 and Jan 1), Presidents Day (Feb 18), Good Friday (Mar 21), Memorial Day (May 26), Independence Day (Jul 4), Labor Day (Sep 1), Thanksgiving and the following day (Nov 27 and 28) and Christmas (Dec 25).

For more information, see **www.arrl.org/w1aw.html**.

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	DIGITAL 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	DIGITAL 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				

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners according to the total number of exam sessions they have participated in since their accreditations. Since each session requires an average time commitment of 2-4 hours or more, the thousands of hours these VEs have invested is extraordinary! Whether you are one of our VE Teams that test once a week, once a month or once a year, we want to express our warmest appreciation to all volunteers for their generous contributions to the ARRL VEC program.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/arrlvec/veparti.php**.

If you're not a VE, become one! See **www.arrl.org/arrlvec/become-a-ve.html**.

Examiner	*Sessions*	*Accreditation Date*
Sammy Neal, N5AF	474	20-Nov-1984
Royal Metzger, K6VIP	368	29-Apr-1985
Frank Glass, K6RQ	353	29-Apr-1985
Karen Schultz, KAØCDN	330	6-Sep-1984
Harry Nordman, ABØSX	329	9-Jan-2002
Glenn Schultz, WØIJR	320	28-Sep-1984
Paul Maytan, AC2T	293	6-Sep-1984
Franz Laugermann, K3FL	291	1-Dec-1991
David Laurel, KA6RHF	287	22-Apr-1985
Leonard Scarpelli, W6IO	285	1-Nov-1992
John Mackey, Jr, KSØF	280	1-Oct-1990
Victor Madera, KP4PQ	276	1-Mar-1992
Kevin Naumann, NØWDG	272	17-Nov-2002

Examiner	*Sessions*	*Accreditation Date*
John Moore, III, KK5NU	261	21-May-1995
Ralph Schutte, N6NAD	260	22-Aug-1997
John Hauner, KØIH	258	11-Jan-1985
Daniel Calabrese, AA2HX	258	1-Nov-1991
Scott Swanson, K6PYP	257	1-Dec-1992
Mary Lewis, W7QGP	255	12-Aug-1985
David Fanelli, KB5PGY	254	1-Oct-1991
Salvatore Teresi, W6EOA	252	21-Aug-1989
James Henderson, N8MPC	251	1-Nov-1991
Gerald Grant, WB5R	249	4-Jan-1985
Leslie Dale, NI5S	249	6-Sep-1984
Michael Faucheaux, N5KBW	248	15-Jul-1996

Strays

SAN DIEGO LIBRARY BRANCHES DISPLAY AMATEUR RADIO

◊ With only four days' notice, a group in the San Diego area put together a display, "What is Amateur Radio?" for the Serra Mesa-Kearny Branch Library. The display was so successful that the library has asked us to "take it on the road" to other library branches.

The initial display comprised several display cases. Once you passed the Library's A-Frame informing that Amateur Radio is on display, there was a triangular display case with a handheld transceiver and the ARRL License Manuals. The next display in the other triangular display case has a list of all of the local clubs and their Web sites, along with what you will need in case of an emergency and where you find a licensing class.

Further into the library, you came to the first large oak and glass display. In the center was an oscilloscope and the HF, VHF and UHF band plans. Along the sides were fact sheets about all the different modes and the way we use Amateur Radio, from transmitter hunts, moonbounce, talking to the Space Shuttle, ATV, DX contesting, amateur satellite, packet radio, and how we prepare for and communicate in a disaster.

In the last big display we had three sided hangers displaying movies and TV shows that have Amateur Radio in them. To support the three hangers are more fact sheets listing all the known movies and TV shows, including *Independence Day, Phenomenon, Frequency, The Munsters, Twilight Zone* and *M* A* S* H**. And then there is *Jericho*! To round out the display, we placed in the center a TS-520S transceiver with the cover off. We labeled some of the components and made fact sheets with pictures, electronic symbols and what they do.

You can find links to more information about movies and TV shows with a ham radio tie-in at **www.arprsd.org/ARD.html**. — *Paul Rios, KC6QLS*

COURTESY PAUL RIOS, KC6QLS

Library branch manager Rita Glick with part of the Amateur Radio display at the Serra Mesa-Kearney branch of the San Diego Public Library. The display has since been moved to other area library branches.

AMATEUR RADIO LOOKING UP IN THE UPPER PENINSULA

◊ Members of the Delta County (MI) Amateur Radio Club assisted with the design and construction of a new museum featuring Amateur Radio station equipment and telegraph memorabilia. In addition, club members activated a complete operating station of each. The 18 × 20 foot building is within the state fairgrounds at Escanaba and was completed before the Upper Peninsula State Fair in August 2007. The UP Telegraph building is surrounded by antique village buildings at the Steam and Gas Engine Village.

Several thousand visitors have since come through our Telegraph Museum. A fully operational station with an 85 foot tower and three-element beam is the mainstay of the club. Visiting hams can operate if they wish. Contact can be made through our Web site at **www.dcars.org**. Our doors are open year 'round. — *Les Elder, WA8LE*

LES ELDER, WA8LE

The UP Telegraph Museum houses a fully functional Amateur Radio station that's available to hams who visit Escanaba, in Michigan's Upper Peninsula.

HAMSPEAK

The following are brief descriptions of Amateur Radio related terms found in this month's issue of *QST*. More information on most can be found in *The ARRL Handbook*, or other specialized ARRL publications.[1] See also **www.arrl.org/qst/glossary.html**.

A Different Way to "Pound Brass"

BFO — Beat frequency oscillator. Circuit that generates a signal spaced appropriately from the intermediate frequency (IF) of a receiver to result in an audible beat note in the presence of a Morse code signal at the IF.

Crystal oscillator— Frequency generating circuit using a piezoelectric crystal as its frequency determining element. It is much more stable than circuits using a resonant indcutor-capacitor pair for the purpose. it is essectially a fixed frequency oscillator. See **www.arrl.org/tis/info/HTML/Hanod-On-Radio/**, Experiment #46 for more information.

CW — Continuous wave. Term that means radiotelegraph Morse code sent by turning a radio carrier signal on and off — on if a Morse character element, off in the space between them. See **www.arrl.org/FandES/ead/learncw/** for some tips on learning Morse code.

Final RF amplifier — The last stage in a radio transmitter. This stage provides the transmitter power output and a source impedance that can drive an antenna system.

Novice bands — The amateur band segments that were allocated to the previously offered Novice class Amateur Radio operators. These segments changed over time, but in the 1950s and '60s they were 3.7 to 3.75, 7.15 to 7.2, 21.1 to 21.25 and 145 to 147 MHz.

Novice class licenses — Beginner class FCC Amateur Radio license granted from 1951 until April 15, 2000.

PSK31 — Digital keyboard to terminal transmission mode using phase shift keying and characterized by a narrow occupied bandwidth of about 30 Hz. See **www.arrl.org/tis/info/psk31.html**.

Rectifier — Circuit that changes ac to pulsating dc. Often used as a part of a power supply, in which case it is generally followed by a filter that smoothes the pulsating dc to steady dc. The rectifier element is perhaps a vacuum tube, or more likely a solid state diode.

RF carrier wave — Steady narrowband signal that is often modulated by an information source to become a complex radio signal that is used for information transport.

RTTY — Radioteletype. Teletype is a keyboard and printer system that was designed to be carried over wireline transport. Keyboard characters are encoded into pulses that are of opposite polarity. In radio teletype, the two polarities are converted to two frequencies that are sent via a standard radio transmitter using frequency shift keying (FSK). . For more information, **see www.arrl.org/tis/info/digital.html**.

Shielded cable — Wire or wires that are enclosed in a usually braided shield to reduce coupling from other circuits. Coaxial cable is one form of shielded cable.

SSTV — Slow scan television, sometimes known as *freeze frame* TV. Kind of video communication that can be sent over a voice channel bandwidth. Amateur Radio versions make use of special encoding and decoding equipment, or more commonly a PC with sound card and special software. Also used for low bandwidth, telephone based, video conferencing. See **www.arrl.org/tis/info/sstv.html** for more information.

Voltage regulator — Circuit that maintains a relatively constant output voltage in the presence of variations in input voltage. This is useful as a supply subsystem for some circuitry, such as oscillators, that need to maintain a particular frequency over changes in other conditions.

Y splitter — Parallel circuit that provides two outputs from a signal source. The name comes from the appearance, as shown in the figure.

A Low Noise Loop That Works — Plus a Bonus 2 Meter Beam

Directivity — Ability of an antenna to transmit signals toward (and receive from) a specific direction.

***EZNEC* antenna software** — Family of computer programs that can be used to analyze the performance of an antenna system from an input of dimensional information. See **www.eznec.com** for more information, including a no-cost demo version.

Ground plane — Antenna in which a vertical monopole, typically λ/4 long, is fed against a small number, usually three or four, elevated λ/4 long horizontal or sloping radials.

Log periodic — Short for *log periodic dipole array* (LPDA). Wideband directional antenna in which the element spacing and length follow a logarithmic relationship from those of adjacent elements.

PVC — Polyvinyl chloride. Plastic material generally found as plumbing pipe and fittings at home supply stores. They are often used as insulating materials in amateur construction due to their low cost, ready availability and ease of fabrication. For typical product details see **www.spearsmfg.com**.

S unit — Unit of received signal strength found on the scale of receiver and transceiver S-meters. Intended to correspond to the *signal strength* parameter of the amateur *RST* signal reporting system. The standard value of the top of the scale, S-9 (very strong signal), is 50 µV in a 50 Ω system. Each S-unit below S-9 represents a 6 decibel (dB) or half voltage reduction. Many S-meters also show dB above S-9.

TV antenna — An antenna designed to receive television signals in the VHF or UHF bands, or both.

TV rotator — Light duty (and low cost) antenna rotator designed to turn a small TV antenna. Can also be used for similarly sized amateur VHF antenna systems.

WWV — Radio station system of the US National Institute of Standards and Technology, formerly the National Bureau of Standards located in Fort Collins, Colorado. WWV transmits time with voice announcements, frequency and other standard signals on 2.5, 5, 10, 15 and 20 MHz. Companion station WWVH in Kauai, Hawaii transmits on 2.5, 5, 10 and 15 MHz, while WWVB transmits coded signals on 60 kHz. See **tf.nist.gov/stations/wwv.html** for more information about available data and services.

A Modular Receiver for Exploring the LF/VLF Bands

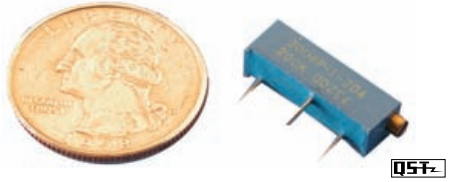
Band-pass filter — Circuit that passes only signals with frequencies between its upper and lower band limit frequencies. Other signals are attenuated. For more details, see **en.wikipedia.org/wiki/Band-pass_filter**.

Counter — Circuit that records the number of events received as pulses. If clocked over a time interval it can be used to measure the frequency of a pulsing signal or one that is converted to a pulse each cycle. For details about a simple example, see **www.allaboutcircuits.com/vol_6/chpt_7/8.html**.

I-Q detector — Device that recovers signal information in two components, one in-phase (the I component), and one with a 90° phase difference (the Q, or quadrature component). With these two components, any information content in the signal can be extracted.

Op-amp — Operational amplifier. Circuit that amplifies a wide bandwidth with a high gain. Components around the op-amp in feedback networks can be used to determine a specified bandwidth or gain as precise as the network components. Originally the basic element of an analog computer. To compare some typical product specifications, see **www.national.com/analog/amplifiers**.

Trimmer resistor — Variable resistor in which the adjustment is via a screwdriver driven mechanism rather than a knob. Used to adjust the final value of a critical component rather than for routine operator adjustment. The photo shows a miniature trimmer resistor designed for printed circuit mounting.



[1] *The ARRL Handbook for Radio Communications,* 2009 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0261. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

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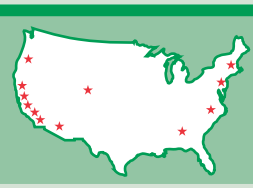

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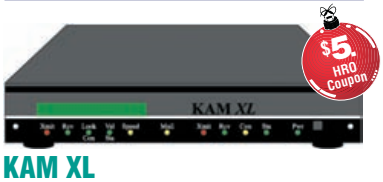

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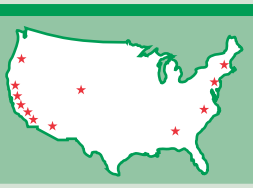

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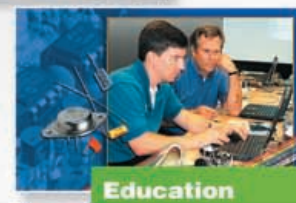

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DXE-RADP-1P	Radial Plate with 20 stainless bolt sets	$54.50
DXE-363-SST	Bulkhead Grounded Cable Connector	$6.95
DXE-BAL200-H10-AT	5kW/10kW SSB Balun	$119.95
DXE-VFCC-BRKT	Insulated Balun Mount	$14.95
DXE-CAVS-2P	V-Saddle Clamp for DXE-VFCC-BRKT	$10.95
DXE-GUY400-KIT	Optional Guying Kit	$47.95

SignaLink™ From Tigertronics

TIG-SL-USB **$86.95**

Then choose a cable for each radio!

Any Radio Interface Cable.....only **$12.95**
when purchased with SignaLink™ unit

YOUR TOTAL $99.90

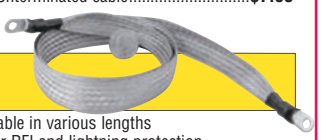
For your complete digital solution!

A Complete Digital Solution for Less

- Easiest installation and setup—Macintosh or PC
- Just plug in two cables
- Software CD ROM included
- Comprehensive & easy to follow instructions
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Uses Mic, Data, or Accy port
- Supports all sound card digital and voice modes
- Requires radio interface cable, sold separately below

Radio Interface Cables

TIG-SL-CAB4R	4-pin round mic connector	$14.95
TIG-SL-CAB8R	8-pin round mic connector	$14.95
TIG-SL-CABRJ1	RJ-11 mic connector	$14.95
TIG-SL-CABRJ4	RJ-45 mic connector	$14.95
TIG-SL-CAB5PD	5-pin DIN	$14.95
TIG-SL-CAB8PD	8-pin DIN	$14.95
TIG-SL-CAB13I	13-pin DIN Icom	$19.95
TIG-SL-CAB13K	13-pin DIN Kenwood	$19.95
TIG-SL-CAB6PM	6-pin mini-DIN	$14.95
TIG-SL-CABNC	Unterminated cable	$7.95



Ground Strap Assemblies

- Three widths available in various lengths
- Ground your rig for RFI and lightning protection
- Ideal for vehicle noise reduction with mobile systems, ground radial plate or balun to antenna
- Preassembled with lugs for both #10 and 1/4" bolt sizes
- Call to order custom cable/connector assemblies

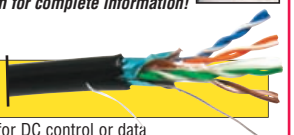
See DXEngineering.com for complete information!

Low Loss Coax Cable Assemblies

- All connectors are soldered, not crimped
- Connectors have silver plated body and barrel with center Teflon® dielectric
- Highest quality Belden coaxial cable is used
- All cable assemblies are high voltage tested to handle full rated power
- Watertight seal between connectors and coax
- Call to order custom cable/connector assemblies

See DXEngineering.com for complete information!

9-Conductor Control Cable



- Cat5e **shielded** cable for DC control or data
- Eight insulated #24 wires plus one ground wire
- Ideal for use with DXE Remote Switches

DXE-CW9-1K	1000 ft. reel	$214.00
DXE-CW9	Order by the foot	$0.29/ft.

BUILD YOUR OWN ANTENNAS!

New!

6063 Aluminum Tubing

- High strength Type 6063-T832 drawn aluminum tubing
- Sections with 0.058 inch wall thickness are perfect for telescoping antenna elements
- Most sizes are pre-slit on one end for element clamps
- Available in 3 and 6 foot lengths

Aluminum Tubing, 0.058" Wall, 3 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1240	0.375", no slit	$2.70	$0.90
DXE-AT1241	0.500", one end slit	$3.30	$1.10
DXE-AT1242	0.625", one end slit	$3.60	$1.20
DXE-AT1243	0.750", one end slit	$3.90	$1.30
DXE-AT1244	0.875", one end slit	$4.20	$1.40
DXE-AT1245	1.000", one end slit	$4.50	$1.50
DXE-AT1246	1.125", one end slit	$4.95	$1.65
DXE-AT1247	1.250", one end slit	$5.55	$1.85
DXE-AT1248	1.375", one end slit	$6.15	$2.05
DXE-AT1249	1.500", one end slit	$6.75	$2.25
DXE-AT1250	1.625", one end slit	$7.65	$2.55
DXE-AT1251	1.750", one end slit	$8.40	$2.80
DXE-AT1252	1.875", one end slit	$9.15	$3.05
DXE-AT1253	2.000", one end slit	$9.90	$3.30
DXE-AT1254	2.125", one end slit	$11.40	$3.80

Aluminum Tubing, 0.058" Wall, 6 Foot Length

Part Number	Diameter/End Type	Price	Cost/Foot
DXE-AT1189	0.375", no slit	$5.40	$0.90
DXE-AT1205	0.500", one end slit	$6.60	$1.10
DXE-AT1206	0.625", one end slit	$7.20	$1.20
DXE-AT1207	0.750", one end slit	$7.80	$1.30
DXE-AT1208	0.875", one end slit	$8.40	$1.40
DXE-AT1209	1.000", one end slit	$9.00	$1.50
DXE-AT1210	1.125", one end slit	$9.90	$1.65
DXE-AT1211	1.250", one end slit	$11.10	$1.85
DXE-AT1212	1.375", one end slit	$12.30	$2.05
DXE-AT1213	1.500", one end slit	$13.50	$2.25
DXE-AT1214	1.625", one end slit	$15.30	$2.55
DXE-AT1215	1.750", one end slit	$16.80	$2.80
DXE-AT1216	1.875", one end slit	$18.30	$3.05
DXE-AT1217	2.000", one end slit	$19.80	$3.30
DXE-AT1218	2.125", one end slit	$22.80	$3.80

Aluminum Tubing, 2.000" Diameter, 0.125" Heavy Wall

Part Number	Length/End Type	Price	Cost/Foot
DXE-AT1255	3', no slit	$14.85	$4.95
DXE-AT1204	6', no slit	$29.70	$4.95

All Stainless Steel Element Clamps

DXE-ECL-020	1/2" and smaller tubing	$1.90
DXE-ECL-040	5/8" tubing	$1.90
DXE-ECL-060	3/4" and 7/8" tubing	$1.90
DXE-ECL-10SS	1" and 1 1/8" tubing	$1.90
DXE-ECL-12SS	1 1/4" tubing	$1.90
DXE-ECL-16SS	1 3/8" and 1 1/2" tubing	$1.90
DXE-ECL-20SS	1 5/8" and 1 3/4" tubing	$1.90
DXE-ECL-24SS	1 7/8" and 2" tubing	$1.90
DXE-ECL-28SS	2 1/8" and 2 1/4" tubing	$1.90
DXE-ECL-32SS	2 3/8" and 2 1/2" tubing	$1.90
DXE-ECL-36SS	2 5/8" and 2 3/4" tubing	$1.90
DXE-ECL-40SS	2 7/8" and 3" tubing	$1.90
DXE-ECL-44SS	3 1/4" maximum tubing	$1.95

65 ft. Telescopic Aluminum Tubing Kit

- 65 ft. slow taper from HD 2" O.D. base to 7/8" O.D. top
- Build your own vertical antennas or arrays
- Use with DXE Insulated Base Assemblies

DXE-ATK65 ..... **$194.50**

Insulated Vertical Base Assemblies for 2" O.D. Antenna Masts

New!

Standard Base

- Tilt Base optional
- Two DXE-CAVS-1P mounting clamps required to attach base to mounting post

DXE-VE-BASE .....Only **$99.50**

DXE-CAVS-1P	V-Saddle Clamp	$8.95
DXE-TB-3P	Tilt Base Assembly	$62.50

Heavy Duty Base

- Tilt Base included
- Two DXE-CAVS-2P mounting clamps required to attach base to mounting post

DXE-VA-BASE		$149.50
DXE-CAVS-2P	V-Saddle Clamp	$10.95

Want the World's Biggest Ears?

Join the growing list of DXers and Contesters who know and use the best!

VP6DX DXPEDITION 2008 DUCIE ISLAND

Worked the Whole World Using DX Engineering Beverage Antennas!

FOUR-SQUARE RECEIVE CONTROLLER

Receive Four-Square Antenna Controller

- Switchable in four 90 degree spaced directions
- Reduced susceptibility to high angle signals compared to EWE, Flag, Pennant, and K9AY antennas
- Better signal-to-noise ratio
- Wideband time delay phasing
- Excellent directivity in a small space
- Usable over a very wide frequency range with optional DXE-ARAV2-4P Active Antenna
- Less physical space than a Beverage antenna
- Enhanced relay contact reliability

DXE-RFS-2P Receive Four-Square Antenna Controller & Switch Package **$359.95**

Complete Receive Four-Square Package with DXE-ARAV2-4P Active Antenna Kit

- 4 Active Vertical Antennas
- RFS-2 Four Square Switch
- CC-8 Controller
- 1,000 ft. of direct-bury F6, 75 Ω CATV Coax
- 25 Snap-N-Seal Coax Connectors
- Snap-N-Seal Connector Crimp Tool
- Coax Prep Tool

DXE-RFS-TS2P Complete Receive Four-Square Package **$1,525.00**

HAM-SWL

Active Receive Antenna

- Close spacing from transmit antennas
- Weak signal sensitivity rivaling full size antenna
- Operates from 100 kHz to 30 MHz
- Excellent strong signal handling with +30 dBm third order intercept
- Reduced Noise—quiet FET followers and exceptional feedline shield isolation
- Available in vertical or dipole configuration

DXE-ARAH2-1P Single horizontal antenna **$289.00**
DXE-ARAV2-1P Single vertical antenna **$259.00**

Receiving System Components

DXE-F6-1000 75 Ω, F6 style direct bury flooded cable, 1,000 ft. **$149.95**
DXE-F6-CTL 75 Ω F6 cable by the foot ..... **$0.19/ft.**
DXE-SNS6-25 Watertight F6 Connectors, 25 pack **$25.50**
DXE-SNS-CT1 F6 Connector Installation Tool **$52.00**

See Our Complete Selection of Components and Tools at DXEngineering.com

VERTICALS ON SALE

Best Antenna Value Anywhere!

DX Engineering now stocks replacement parts for all BTV antennas

Easiest assembly and tuning of any multi-band vertical!

4BTV (10, 15, 20, 40m) **$114.95**
5BTV (10, 15, 20, 40, & 75-80m) **$149.95**
6BTV (10, 15, 20, 30, 40, & 75-80m) **$174.95**
DXE-8X19-RT Coax Jumper Cable to BTV Base **$16.95**
DXE-A0K-DCF SO-239 Add-On Kit for BTV Base **$19.95**
DXE-CBC-8XU2 Jumper, Radial Plate to DCF **$18.99**

Hustler BTV Direct Coax Attachment All Stainless **$19.95**

MAXI-CORE™

Current Baluns and Feedline Current Chokes

- 5, 10 and 10 kW+ Baluns and Current Chokes
- High efficiency, low loss—W8JI design
- All standard ratios available

Feedline Current Chokes

- Reduce RFI and pattern distortion

Starting at just $69.95 for FCC050-H05-A

STAINLESS STEEL—WON'T DISSOLVE LIKE ALUMINUM!

Stainless Radial Plate with Coax Attachment

Makes radial attachment a snap!

- Fits 2" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

DXE-RADP-1P Complete with 20 stainless bolt sets **$54.50**
DXE-RADP-1HWK 20 sets of 1/4" stainless hardware ... **$7.50**
DXE-CAVS-2P Stainless Saddle Clamp for attachment to round tube 1.0" to 2.0" O.D. **$10.95**
DXE-363-SST Silver/Teflon® bulkhead connector ... **$6.95**
DXE-VFCC-H05-A Vertical Feedline Current Choke **$94.95**

NEW—Biodegradable Anchor Pins

DXE-RADW-500KBD Radial Wire Kit, 500 feet of wire, 20 lugs, 100 anchor pins **$61.90**
DXE-RADW-1000KBD Radial Wire Kit, 1000 feet of wire, 40 lugs, 200 anchor pins **$123.95**
DXE-STPL-100BD Biodegradable Radial Wire Anchor Pins, 100-pack **$16.00**

DXERS 1ST CHOICE!

Remote Antenna Switches

- Best SWR and port isolation on the market!
- Weatherproof, welded stainless steel housing for best RF shielding
- 8-position switch, controller included
- Better than 1.1:1 SWR below 30 MHz

5 kW Key-Down RF Switch

- Better than 70 dB of port-to-port isolation

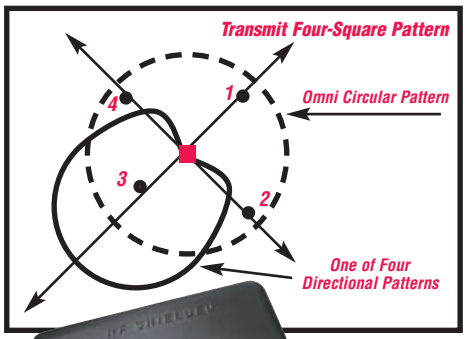
RR8-HP-P **$375.00**

10 kW Key-Down RF Switch

- Better than 60 dB of port-to-port isolation

RR8-SD-P **$495.00**

FOUR-SQUARE TRANSMIT CONTROLLER!



Transmit Four-Square Hybrid Controller—4 Directions plus Omni

- Four directions plus Omni—versatile
- Classic Hybrid design—easy to install
- 5 kW CW power rating—high reliability
- Hot switching lock-out—disables amplifier
- Drop-in replacement for Comtek—easy upgrade
- Proven DX Engineering RF relays—high performance
- RF Shielded weatherproof housing—unique protection

DXE-TFS4-160 160 Meter Four-Square Controller with Control Console **$419.90**
DXE-TFS4-80 80 Meter Four-Square Controller with Control Console **$409.90**
DXE-TFS4-40 40 Meter Four-Square Controller with Control Console **$399.90**

SWITCHING PROTECTION

Time Variable Sequencer Unit

- Protect receiver front end, preamplifiers, linear amplifiers, or other sensitive equipment from damage due to improper switching during the receive/transmit transition
- Five outputs tied to the CW keying or push-to-talk (PTT) lines each have adjustable delay from 0-30 ms in 2 ms increments
- Side-tone generator follows input of keyer, not transmitter
- Supports full CW break-in
- Ideal for protecting DXE-ARAV-2 or DXE-ARAH-2 Active Antennas from RF damage

DXE-TVSU-1 Time Variable Sequencer Unit **$159.95**

DXEngineering.com
1.800.777.0703

Order by 2:00 pm ET for Same-Day Shipping

8:30 am to 4:30 pm ET
1230 to 2030 UTC (March-October)
1330 to 2130 UTC (November-February)

Tech/International: **330.572.3200**

SOURCE CODE: 0812QS

Prices effective through January 15, 2009

LDG ELECTRONICS

The #1 Line of Autotuners

NEW! Z-817

The Z-817 is the ultimate autotuner for QRP radios including the Yaesu FT-817(D). The Z-817 interfaces to the CAT port (ACC) on the back of the FT-817 radio with the provided cable. Tuning could not be simpler; one button push on the tuner is all that is needed and the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters.

Of course, the Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. The Z-817 is powered by four AA internal Alkaline batteries (not included), so there are no additional cables required to use the Z-817. A coax jumper cable is also induced for fast hook up. Latching relays are used so that power consumption is Zero when not tuning allowing a set of batteries to last about one year. ***Suggest Price $129.99.***

SPECIFICATIONS

- *Up to 20 watts SSB, CW and digital modes.*
- *Latching relays for ultra low power consumption.*
- *Battery operated 4 x 1.5V Alkaline AA (not included).*
- *Built-in CAT port interface. CAT thru port for computer connection.*
- *2000 memories when used with FT-817 interface (200 memories for other radios).*
- *1.8 to 54 MHz coverage (continuous coverage for MARS)*
- *Tunes 6 to 600 ohms. (16 to 150 on 6M)*
- *SO-239 in and out connections for dipoles, verticals, beams, G5RV, OCF, Cobra, ect.*
- *Dimensions: 5.2"W, 4.6"D, 1.7"H. Weight: 13 ounces.*
- *Includes 1 foot CAT cable and 1 foot coax jumper.*

Z-11Pro

The original portable Z-11 was one of LDG's most popular tuners, accompanying adventurous hams to their backyards, or to the ends of the earth. Now meet the Z-11Pro, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. All cables included. ***Suggested Price $179***

Z-100

Designed from the ground up to provide 100 watt power handling in a small, lightweight package. Perfect for portable as well as sitting on your desk in your shack! The Z-100 will tune with 0.1 to 125 watts (50 watts on 6 meters), making it an excellent choice for almost any radio or operating style. Backpackers and QRP operators will appreciate the latching relays. Power can be removed from the tuner once you have tuned. Additionally, when it's not tuning, it draws nearly zero amps. ***Suggested Price $149***

FREE DIPOLE KIT WITH ANY AUTOTUNER PURCHASE!*

Purchase any LDG Electronics autotuner between September 15th 2008 and January 31st, 2009 and you will receive a free dipole kit buildable for 20, 17, 15,12, 10 or 6 meters (a $20 value) through the mail. Visit www.ldgelectronics.com for your rebate form or write to: 1445 Parran Rd. St. Leonard, MD 20685 USA. Limit one rebate per address.
*Free dipole kit applies to any new LDG autotuner $149 or higher in price.

Now with FREE Dipole Kit with any Autotuner Purchase*!

See AT-1000Pro Review in Nov. '08 CQ

AT-1000Pro

Building on the success of the AT-1000, LDG Electronics has refined and expanded its 1KW tuner. The AT-1000Pro has an Automode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Other features include: • Operates at any power level between 5 and 1,000 watts peak. RF Relay protection software prevents tuning at greater than 125 watts. • 2 Antenna connections • Tunes from 1.8 to 54.0 MHz (inc. 6 meters) • Tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. • 2000 memories.• All cables included. ***Suggested Price $599***

radio not included

AT-897 for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897 Autotuner mounts on the side of your FT-897 just like the original equipment. We even added the ability to mount the "feet" on the side of the tuner so when you're transporting your rig by the handle, you can safely set it down and not worry about scratching the case. The AT-897 takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price$199***

radio not included

AT-7000

The AT-7000 is the ideal tuner for IC-7000 & other Icom Radios: Covers all frequencies from 1.8–54 MHz (including 6 meters), and will automatically match your antenna. Requires just 0.1W for operation, but will handle up to 125W (100 W on 6 m), making it suitable for everything from QRP (IC- 703 Plus) to a typical 100 W Icom transceiver. All cables included.
Suggested Price $169

AT-200Pro

The AT-200 features LDG's new "3-D memory system" allowing up to eight antenna settings to be stored for each frequency. Handles up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz (including 6 meters). Rugged and easy-to-read LED bar graphs show power and SWR, and a function key on the front panel allows you to access data such as mode and status. All cables included. ***Suggested Price $249***

AT-100Pro

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch, allowing you to switch instantly between two antennas. The AT-100Pro requires just 1 watt for operation, but will handle up to 125 watts. All cables included. ***Suggested Price $219***

NEW! KT-100

The new KT-100 Autotuner fills a need for Kenwood transceiver owners after Kenwood discontinued the Kenwood AT-300 antenna tuner. The KT-100 is a flexible, low cost, easy to use unit just right for an AT-300 compatible Kenwood transceiver. Of course, most any LDG tuner will work just fine with a Kenwood transceiver, but wouldn't it be great if you could use that Tune button on the radio. The KT-100 allows you to do just that as LDG's first dedicated autotuner for Kenwood Amateur transceivers.

The LEDs on the front panel indicate tuning status, and will show a match in seconds, or even less of you've tuned on or near that frequency before. The KT-100 has 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies.

If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

Call or visit your favorite dealer today!

Visit www.ldgelectronics.com for a complete dealer list.

LDG Electronics, Inc.
1445 Parran Road
St. Leonard, MD 20685
Phone 410-586-2177
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HFSOC-HF4

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HF4-PP

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All Amps, Gauges & Colors in Stock!

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Order toll free 888-321-0073

The most Powerpole related products anywhere!

D-STAR: CONNECT ACROSS MILES INSTEAD OF METERS!

What is D-STAR?

D-STAR: an open protocol
D-STAR is an acronym for Digtal Smart Technology for Amateur (Ham) Radio. The D-STAR technology is an open protocol designed in Japan. The English version of the protocol is published on the ARRL website (www.ARRL.org). D-STAR is quickly growing in popularity with U.S. ham operators.

Emergency Relief Comms
While D-STAR's sole application is Amateur Radio, recent events have made Amateur Radio a primary focus for disaster relief communications by the International Telecommunications Union, or ITU. In its latest update, February 2, 2006, the ITU created recommendation ITU-D13, encouraging international government administrations "to take the necessary steps to allow amateur stations to prepare for and meet communication needs in support of disaster relief."

128k D-STAR is available on select Icom equipment. Backbone D-STAR repeaters are already in place in numerous states throughout the U.S. More and more are coming online!

D-STAR ready

IC-92AD & HM-175GPS

MILITARY RUGGED AND SUBMERSIBLE

- 5/2.5/.5/.1 Watt 2m/70cm
- RX: 0.495-999.990MHz*
- Shown with Optional GPS Speaker Mic (HM-175GPS)
- 1304 Alphanumeric Memory Channels
- IPX7 Submersible*

ALL HANDHELDS ARE ANALOG + DIGITAL
All in one!

IC-91A D-STAR optional
IC-91AD D-STAR ready

ADVANCED ANALOG & DIGITAL DUAL BANDER

5 Watt 2m/70cm • 1300 Alphanumeric Memory Channels • Digital Voice/Data Ready (91AD) or Upgradeable w/Optional UT-121 (91A) • 495kHz - 999.990MHz* • V/V, U/U or V/U • Weather Alert • Dual Watch • Li-ion Power

D-STAR optional

IC-V82 & IC-U82

D-STAR UPGRADEABLE FOR 2m OR 70cm

7 Watt VHF/5 Watt UHF • 200 Alphanumeric Memory Channels • Digital Voice & Data w/Optional UT-118 • Optional Callsign Squelch • CTCSS & DTCS Encode/Decode w/Tone Scan • Weather Alert

*Frequency specs may vary. Refer to owner's manual for exact frequency specs.

ID-RP2C
REPEATER CONTROLLER

The cornerstone of the D-STAR system. Handles up to four RF modules. Basic in-band or cross-band operation. Linking capabilities through the internet and future 10GHz backbone products.

ID-RP2D
1.2GHZ DATA MODULE

Access point with a data rate of up to 128kbps. Depending on the system setup, set up an email and/or file server for EmComm support. Perfect for web applications or support via internet connection.

ID-RP2V
1.2GHZ DIGITAL VOICE MODULE

ID-RP2000V
2M DIGITAL VOICE MODULE

ID-RP4000V
70CM DIGITAL VOICE MODULE

Finally, commercially available crossband systems! Together, with proper call sign programming in any D-STAR compatible mobile or portable, the Icom D-STAR system will automatically route your signal to any other RF module connected to a common RP2C. With simple system commands, you can direct your communications through any of the RF modules or across the world via the gateway.

D-STAR optional

DIGITAL

NEW IC-2820H
D-STAR UPGRADEABLE 2m/70cm

50/15/5 Watt • RX: 118-173.995, 375-549.995, 810-999.99MHz* • Analog/Digital Voice with GPS (Optional UT-123) • 500 Alpha-numeric Memories • Diversity Receive Capable

UT-123
DIGITAL VOICE/GPS MODULE AND ANTENNA

D-STAR ready

ID-1
GO DIGITAL ON 1.2GHz

10 Watt • High Speed Digital Data, Digital Voice, Analog Voice (FM) • Wireless Internet/Network Capable • PC Control via USB port • Digital Callsign & Digital Code Squelch

D-STAR ready

ID-800H
GO DIGITAL ON 2m/70cm

55 Watt VHF/50 Watt UHF Wide RX: 118-173, 230-549, 810-999MHz* • Analog/Digital Voice & Data • Callsign Squelch CTCSS & DTCS Encode/Decode w/Tone Scan

D-STAR optional

IC-2200H
D-STAR UPGRADEABLE FOR 2m

65 Watt • 207 Alphanumeric Memories • Digital Voice & Data w/Optional UT-118 • Optional Callsign Squelch • CTCSS & DTCS Encode/Decode w/Tone Scan • Weather Alert

*Frequency specs may vary. Refer to owner's manual for exact frequency specs.

ICOM®

VX-170 2M FM HT

- TX: 144-148 • RX: 136-174
- Power: 5/2/0.5W • Memories: 200
- Extra large LCD display & speaker

$129.99 after instant ©oupon

VX-8R Quad-band HT

- TX: 50-54, 144-148, 222-225, 430-450 MHz
- RX: 0.5-999 MHz (cell blkd) • Memories: 1200+
- Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
- Real Dual Ham Band Operation (V+V/U+U/V+U)
- Optional GPS/APRS & Bluetooth operation!

$399.99

FT-7800R 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 40/20/10/5W (440 MHz) • Memories: 1055

$264.99 YSK-7800 included!

FT-817ND HF/VHF/UHF Backpack Transceiver

- TX: HF/VHF/UHF • RX: 0.1-56, 76-154, 420-470 MHz • Power: 0.7-5W • Memories: 200
- Field operation with AA batteries or Ni-MH pack

$599.99

FT-857D HF/VHF/UHF Mobile

- TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200

$699.99 after instant ©oupon, YSK-857 included!

FT-897D 100W HF/VHF/UHF Portable/Base

- TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz
- Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz)
- Memories: 200

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FT-450 100W HF/6M Portable/Base

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 500 • IF DSP Technology • Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter & clarifier
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FT-450AT With Auto Antenna Tuner (ATU-450) installed

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FT-950 100W HF/6M Base

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner • 32-bit Floating Point DSP
- Requires 12VDC PS

$1479.99

FT-2000 100W HF/6M Base

- TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
- Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP
- Dual In-Band Receive • Internal Power Supply

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Dualband FM Mobile

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- Cross-band repeat • EchoLink® ready

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G5

WSF-21000

TM-D710A

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- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G5, Peet Bros Utimeter WX Station & EchoLink® ready

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AvMap G5

APRS Ready GPS Navigator

- Bright non-glare 5 inch color touchscreen
- Preloaded Tele Atlas street maps of N. America
- AV input; enjoy films, video games & pictures
- Import extra POI's with no extra costs
- Kenwood ready APRS cable included

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TH-F6A

TH-K2AT 2M FM HT

- TX: 144-148 • RX: 136-174 • Power: 5/1.5/0.5W • Memories: 100

$139.99

TH-F6A Triband FM HT

- TX: 144-148, 222-225, 438-450 MHz • RX: 0.1-1300 MHz (cell blkd)
- Power: 5/0.5/0.05W • Memories: 435 • Dual band RX

$329.99

TS-480HX 200W HF/6M Mobile/Base

- TX: HF/6M • RX: 0.5-60 MHz
- Power: 10-200W (with two optional 22A PS's) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band

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- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz
- Power: 10-100W (10-50W on 440 MHz) • Memories: 99
- HF/6M Auto Antenna Tuner
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Continued on page 152

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- Memories: 1650 • Scans 100 Channels per second

$299.99

IC-V8 Sport 2M FM HT

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- Power: 65/25/10/5W • Memories: 207
- D-Star upgradable with optional UT-118

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- TX: HF/6M/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 100W (HF/6M), 50W (2M), 35W (440 MHz)
- Memories: 503 • 41 band-widths with sharp or soft filter shape

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- TX: 144-148, 430-450 MHz
- RX: 118-173, 230-549, 810-999 MHz (cell blk)
- Power: 55/15/5W (2M), 50/15/5W (440 MHz)
- Memories: 512

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IC-7200 HF/6M Portable Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 201 • 32-bit IF-DSPs + 24-bit AD/DA Converters
- USB Port for CI-V Format PC Control and Audio In/Out

$1099.99

IC-2820H 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 118-549.95, 810-999.990 MHz (cell blkd) • Power: 50/15/5W
- Packet ready (9600 BPS – 6-pin DIN)
- Upgradable D-Star DV (digital voice) & GPS capabilities w/optional UT-123

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IC-746PRO Multimode HF/VHF Transceiver

- TX: HF/6M/2M • RX: 0.03-60, 108-174 MHz • Power: 5-100W
- Memories: 102 • 32-bit floating DSP & 24-bit AD/DA converter
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Saturday December 13, 2008
10AM – 4PM

Events:

Prizes
Talk to Manufacturers Representatives
Presentations
Special Pricing on most items
Refreshments
Extended Hours

Manufactures scheduled to attend this year:

Alinco, Ameritron, Comet, Daiwa, Heil, Hygain, Icom, Jetstream, Kenwood, Maldol, MFJ, Mirage, Vectronics and Yaesu.

Presentations:

11 am – Noon:
It All Starts At The Microphone
By Bob Heil
Noon – 1 pm:
D-Star
By Icom
1 pm – 2 pm:
DXing
By Dennis from Yaesu

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ALS600	*600 w amp*	1249.95
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VX7R VX6R FT60R VX3R

VX7R/B

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MH57A4B Speaker Mic 27.95
MH73A4B Waterproof Speaker/Mic....47.95

VX3R

ADMSVX3 Software/Cable 39.95
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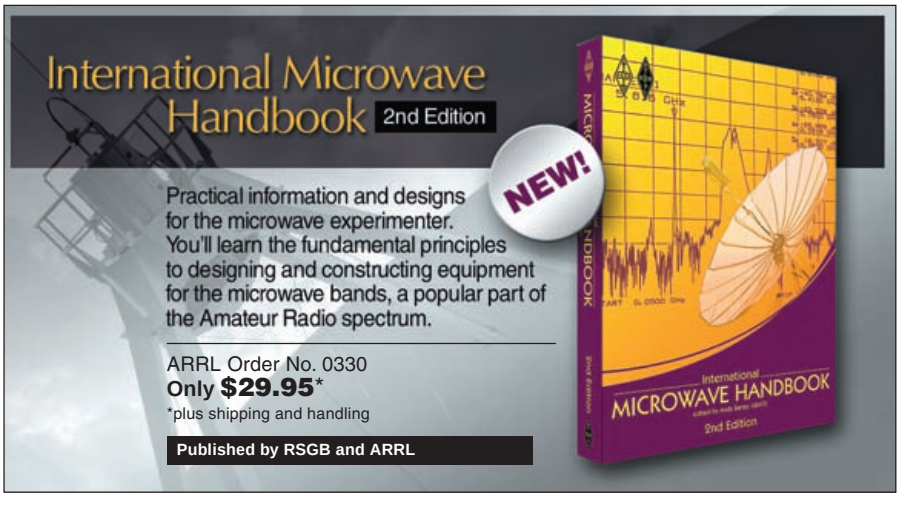

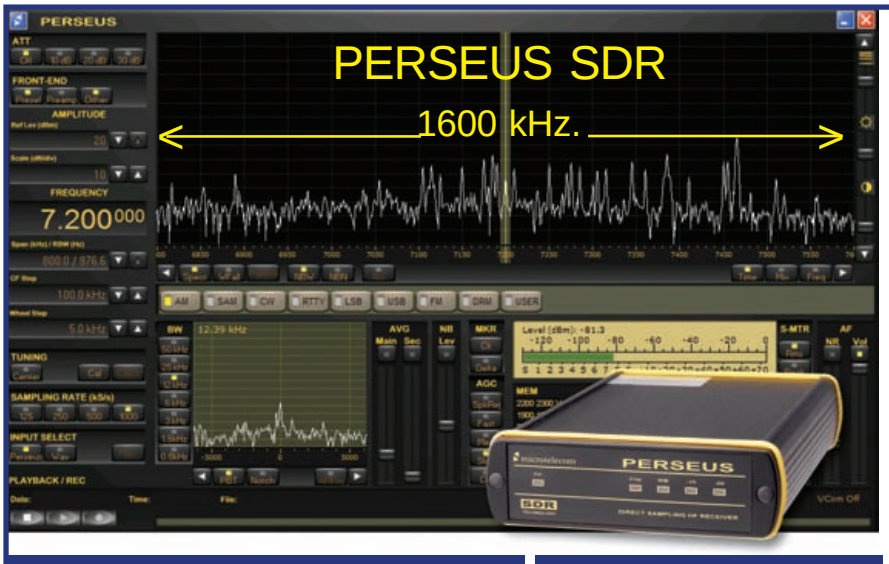

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SP-23	1296	<.9	20	100/10 W	480.00
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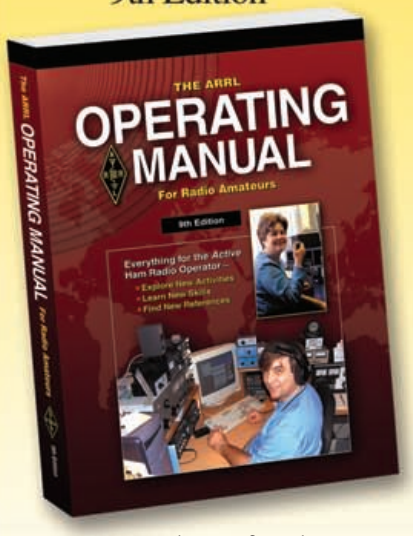

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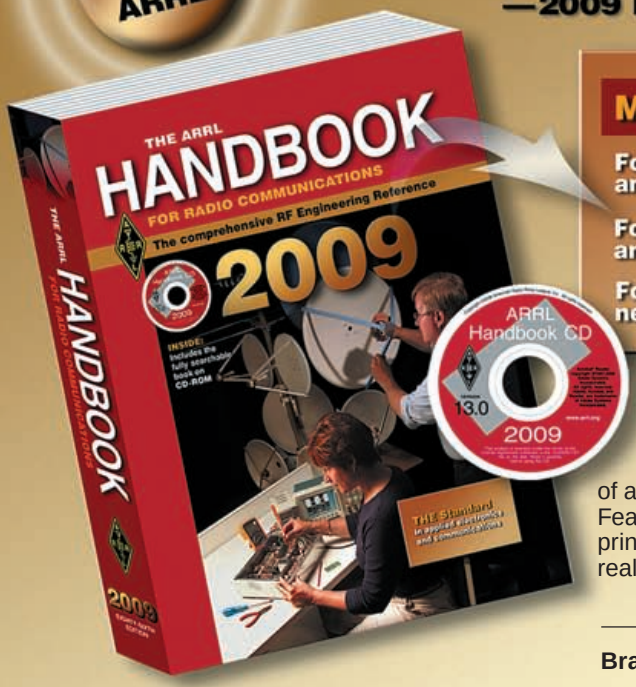

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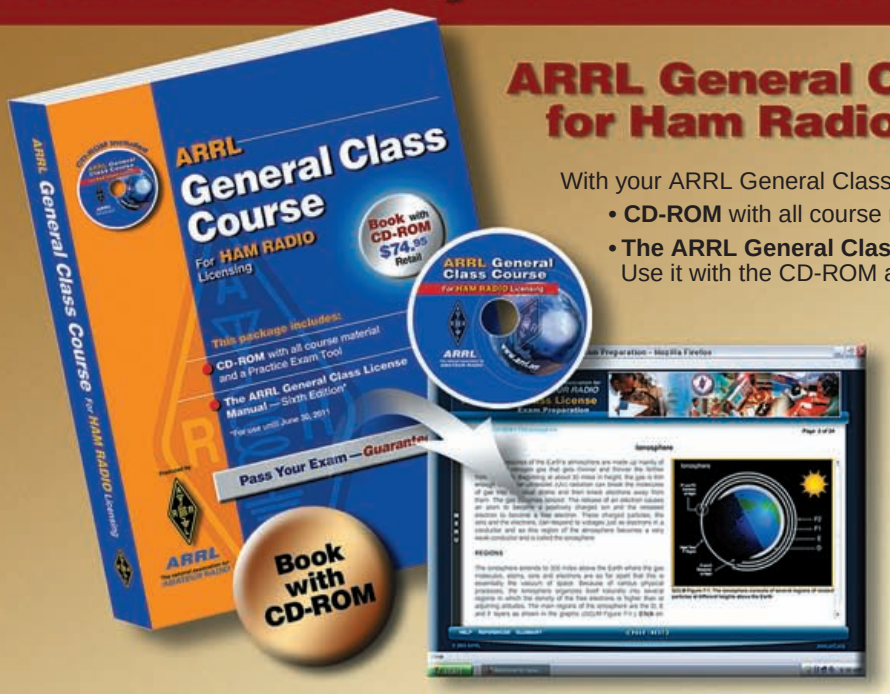

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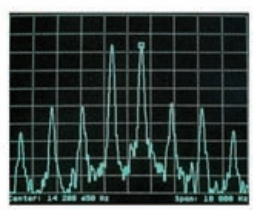

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VC-300M
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The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna, any HF transceiver and fits in the smallest car. It can also be used at home with any coax fed antennas -- dipoles, vees, verticals, beams or quads.

Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. 3.4 pounds.

SWR/Power Meters

PM-30
$89.95
PM-30UV
$99.95

PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.
144/220/440 MHz, 30/300 SWR/Wattmeters
PM-30UV, $99.95, SO-239 connectors.
PM-30UVN, $99.95, N connectors.
PM-30UVB, $99.95, BNC connectors.

1.5 kW *dry* Dummy Load

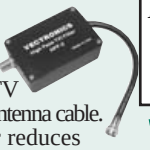
DL-650M, $79.95
100 Watts continuous 1500 W/10 seconds to 650 MHz. *Ceramic* resistor. SWR less than 1.3. SO-239s. **DL-650MN, $84.95** has N connectors.

Low Pass TVI Filter

LP-30, $89.95
Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. 1.5 kW.

High Pass TVI Filter

HPF-2, $34.95
Installs between VCR/TV and cable TV/antenna cable. Eliminates or reduces interference caused by nearby HF transmitters.



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MIRAGE. . .160 Watts on 2 Meters!

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

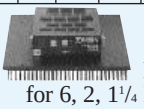
6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

Repeater Amps



11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base.* **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $299**, 60W out/2W in, for *handhelds.*

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount, $199.95*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Accurate SWR/Wattmeters

Read SWR directly and Forward/ Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

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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
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ADS#31408

MFJ Weather-Proof *Window Feedthrough Panels*

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603
$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

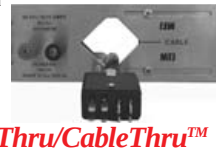
A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.



3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$69.95

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New! MFJ-4600
$79.95

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$59.95
New!

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604
$99.95
New!

All-Purpose FeedThru/CableThru™

***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605
$159.95
New!

Bring cables thru eave of your house

MFJ-4616
shown with standard full-size vent (not included) it replaces. For *6 Cables*
$26.95
New!

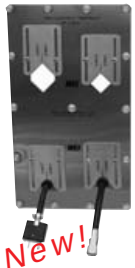
MFJ-4613
shown with standard half-size vent (not included) it replaces. For *3 Cables*
$14.95

Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ *Wall Plates*



MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

New!

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

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Time to upgrade your station? Our quality feedline and accessories put your power where it belongs. Baluns, ladder line, coax, feed through panels, and more.

Tip: Coax used outdoors for more than 3 years is likely to add 3 dB of loss. That's half of your power wasted!

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Panel, Cable & Chassis Mounts
Pre-Assembled Cables
More Powerpole Stuff Than

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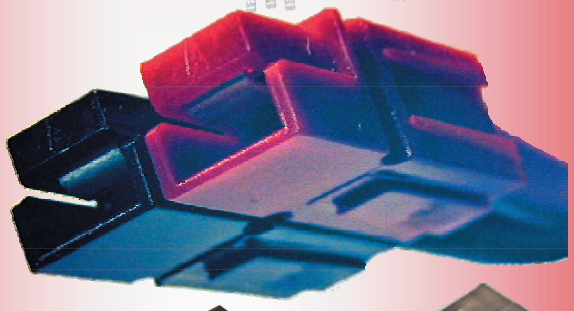
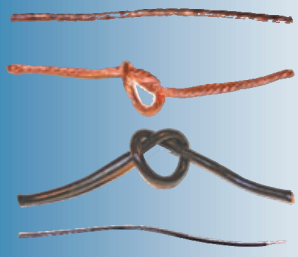


New! Exclusively from Quicksilver Radio, these handy Powerpole splitters are great in the shack, in the field, or in your go-kit. Compact, heavy duty units are built to last.



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Time for a new antenna?
We have the right wire for you.
Plus insulators, UV-proof rope,
marine-grade pulleys,
and handy gadgets.

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(almost) Everything but the Rig

See us at Hamfests from Maine to Maryland, and Beyond

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Better Antenna = Better Signal. Upgrade yours NOW!!

MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

***The** famous G5RV antenna is the most popular ham radio antenna in the world!* You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

MFJ-17754, $59.95. Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A $69.95 160M, 265 ft.
MFJ-1779B $49.95 80-40M, 135 ft.
MFJ-1779C $29.95 20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* 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. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz.

MFJ-919, $59.95. 4:1 current balun,1.5 kW.
MFJ-913, $29.95. 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D inches.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators.
MFJ-16B01, $19.95. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.
MFJ-18G100, $24.95. 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.
MFJ-58100X, $49.95. 100 ft. 50-Ohm RG-8X with PL-259s on each end.
MFJ-18H100, $34.95. 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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MFJ-989D 1500 Watt *legal limit* Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better!

MFJ-989D
$389.95

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter with no price increase. Easily handles *full* 1500 Watts SSB/CW over 1.8-30 MHz.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive*™ peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

New high voltage *current balun* lets you tune balanced lines at high power -- no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. 12⅞Wx6Hx11⅝D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

MFJ *Differential-T*™ *1.5kW* Tuner

MFJ-986
$349.95

Simple two knob tuning makes antenna tuning foolproof and easier than ever! Handles 1.5 kW PEP SSB/CW amplifier output, 1.8-30 MHz. *AirCore*™ roller inductor, *Differential-T*™ capacitor, lighted peak/average Cross-Needle SWR/Wattmeter, Six position antenna switch, balun. 10¾Wx4½Hx15D".

MFJ *compact kW* Tuner

MFJ-962D
$299.95

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, Six position antenna switch, balun, Lexan front panel, 1.8-30MHz. 10¾x4½x10⅞ in.

MFJ *Fully Balanced 1.5 kW* Tuner

MFJ-976
$499.95

MFJ-976 is a *fully balanced* wide range (12-2000 Ohms) antenna tuner that gives you *superb* current balance. Handles *full* 1.5kW SSB/CW, 1.8-30 MHz. Tunes *all* balanced lines -- 600 Ohm *open wire* line, 450/300 Ohm *ladder* lines, 300/72 Ohm *twin lead*. Also tunes wires/coax fed antennas. Cross-Needle meter.

MFJ 2500 Watts *ContinuousCarrier*™ Tuner

Silver plated Edge-Wound Roller Inductor . . .1000/500 pF Variable Capacitors . . . Antenna Switch . . . 4-Core Balun . . . true Peak Cross-Needle Meter . . . Dummy Load . . . Extremely Wide Matching Range . . .

MFJ-9982
$699.95

The MFJ-9982 ContinuousCarrier™ antenna tuner handles 2500 Watts continuous carrier output on all modes and all HF bands into most unbalanced antennas -- even on 160 Meters where even the best antenna tuners fail!

The MFJ-9982 gives you every feature you'll ever want in a high power tuner -- wide matching range, 1.8 to 30 MHz coverage, 6-position antenna switch, 4-core balun, dummy load, true peak/average lighted SWR/Wattmeter, 6:1 reduction drives with detailed logging scales, 3-digit turns counter, extra large knobs.

New Components, New Technologies

The *Heart and Soul* of the MFJ-9982 is its roller inductor and variable capacitors.

MFJ's high power, high-Q *continuous current AirCore*™ roller inductor is no ordinary roller inductor! It's edge wound from thick .06-inch *silver-plated* solid copper strap.

It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn up ordinary roller inductors.

Self-insulating construction reduces stray capacitance -- keeps self-resonant frequencies high and out-of-the-way. Dual, *silver-plated* compression wheels give ultra low-resistance contacts. New fast-tune crank knob.

High-current, *high-capacitance* 1000 pF and 500 pF air variable capacitors have low minimum capacitance and are self-insulating.

These newly developed air variable capacitors give you *very high efficiency* on 160/80 Meters *and* MFJ's patent pending innovation gives you *extremely wide matching range* on 10/12/15 Meters at 2500 Watts -- a feat *only* the MFJ-9982 has achieved.

Hi-Voltage/Current Antenna Switch

The antenna switch is completely isolated to handle high-voltage, high impedance antennas. High-current, low impedance antennas are handled by parallel sets of high-current contacts of *two* ceramic switches.

New 4-Core Balun

Powerful balun -- Four 2½ inch cores, 12-gauge *Teflon*™ wire. Run balanced lines at full 2500 Watts SSB/CW continuous, 24/7.

New Balanced Line Feed-Thru Insulator

Allows massive transmitter currents to flow directly to the antenna without passing through lossy screws or bolts.

TrueActive™ *Peak Reading Circuit*

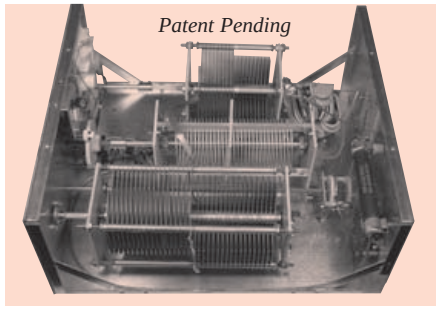
New *TrueActive*™ circuit reads *true* peak or average power on all modes. *Cross-Needle* meter reads SWR/forward/reflected power.

1500 Watt Dummy Load

1500 Watt air-cooled non-inductive 50 Ohm resistor. 100W/10 min., 1.5kW/10 sec.

New Cabinet maintains high Q

New roomy cabinet maintains high Q. Vent holes. Heavy gauge, .08 inch aluminum braced chassis. Vinyl cover, non-stripping PEM nuts, heavy 10-gauge and copper strap wiring throughout. 13¾Wx7Dx16¼D inches. 15 pounds.



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MFJ TUNERS

Ham Radio's ***Most Popular*** 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation

MFJ-949E $179.95

up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full *size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full *size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

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Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

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

MFJ-989D ***Legal Limit*** Tuner

MFJ-989D $389.95

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob ***Differential-T™***

MFJ-986 $349.95

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. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D ***compact*** kW Tuner

MFJ-962D $299.95

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. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

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. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-969 $219.95

MFJ-941E ***super value*** Tuner

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 $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-941E $139.95

MFJ-945E HF/6M ***mobile*** Tuner

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, $6.95,** mobile mount.

MFJ-945E $129.95

MFJ-971 ***portable/QRP*** Tuner

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 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-971 $119.95

MFJ-901B ***smallest*** Versa Tuner

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-901B $99.95

MFJ-902 ***Tiny Travel*** Tuner

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902 $99.95

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

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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.

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MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB.

MFJ-906 $99.95

MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

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Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 $109.95

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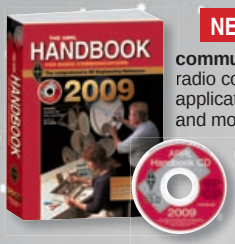

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Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

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.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB 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.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

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-974HB 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-974HB 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.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

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

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

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Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

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True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

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Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

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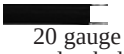
MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead



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The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

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MFJ-993B **$259.95**

The MFJ-993B 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!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

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Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 **$699.95**

300 Watt...*Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

G5RV Antenna

MFJ-1778 **$44.95**

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feed-point insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926 **$399.95**

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 **$259.95**

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

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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 . . .

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 hand-held 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.

MFJ-269 $389.95

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

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.

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

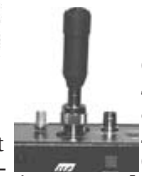
New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting

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.



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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, $40.90.
SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell*™ Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.
MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.
MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO*™ Analyzer

MFJ-269*PRO* $419.95 ***NEW!***

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-259B HF/VHF Antenna *SWRAnalyzer*™

MFJ-259B $289.95

The world's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz.

It's Super easy-to-use -- makes tuning your antenna quick and easy.

Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet. Read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

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Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

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

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

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

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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.

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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.

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MFJ-4125 $109.95

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. $5^{3}/_{4}$Wx3Hx$5^{3}/_{4}$D".

MFJ-4125P, $124.95. Adds 2-pairs *Anderson PowerPoles*™.

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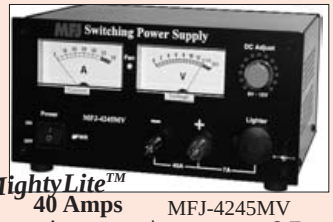
MFJ-4225MV $149.95

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. $5^{1}/_{4}$Wx $4^{1}/_{2}$Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

40 Amp Continuous



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Power multiple Transceivers/accessories from a* single *DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118 $84.95

MFJ-1118, $84.95. 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 provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. $12^{1}/_{2}$x$2^{3}/_{4}$x$2^{1}/_{2}$ in.

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MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112 $44.95

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117 $64.95

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

MFJ-1128 $104.95

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$D".

MFJ-1126 $84.95

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®, extra* fuses -- *no extra cost*. 9Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$ inches.

MFJ-1129 $114.95

PowerPoles™ AND 5-Way Binding Posts

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, $12^{1}/_{2}$Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$D inches.

MFJ-1124 $64.95

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost.*

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. $1^{1}/_{2}$ lbs. Tiny $3^{3}/_{4}$Wx$2^{1}/_{4}$Hx$3^{3}/_{4}$D inches fits easily in an overnight bag.

MFJ-4115 $79.95

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Linear with 19.2 lb.Transformer

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. $9^{1}/_{2}$Wx6Hx$9^{3}/_{4}$D in.

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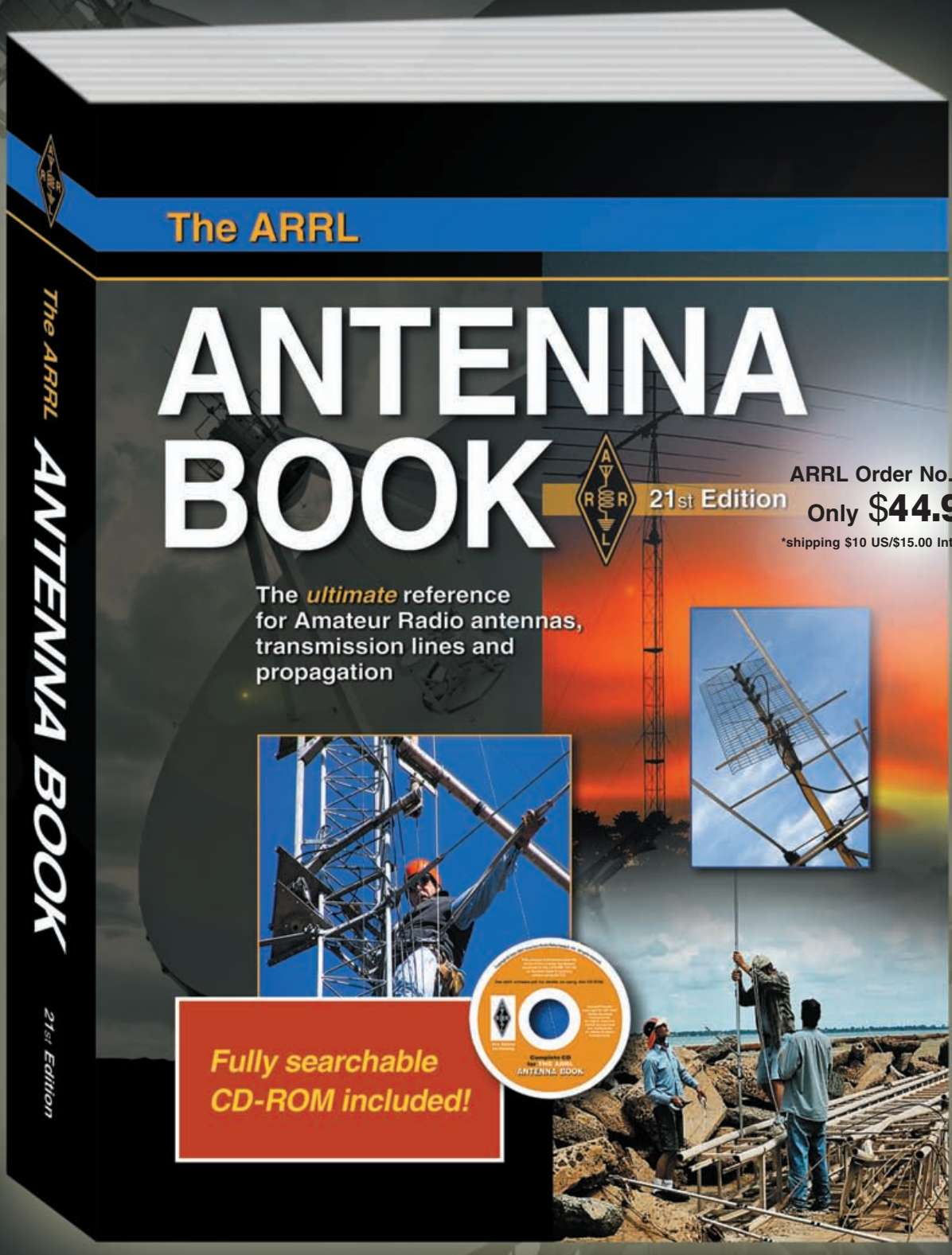

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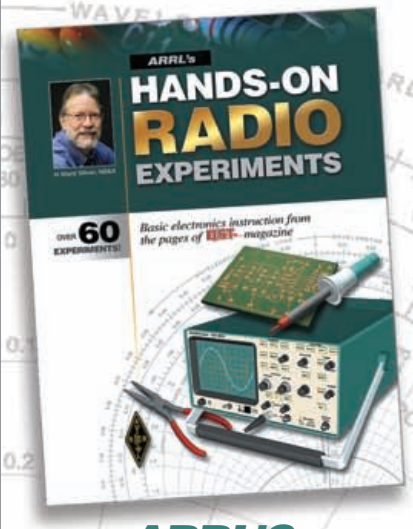

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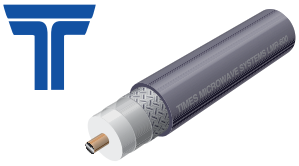

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