DECEMBER 2012 QST Vol 96 No 12

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

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QST reviews:

Inside:

Season's Greetings

$4.99 US $6.99 Can.

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Official Journal of ARRL The national association for AMATEUR RADIO®

The radio... YAESU

HF/50 MHz 100 W Transceiver

FT DX 3000

New Crystal Roofing Filters provide ultimate weak signal receiver performance in crowded, strong signal environments

The amazing Crystal Roofing Filter performance

The Down conversion 9 MHz 1st IF frequency receiver construction, can realize narrow 300 Hz (optional), 600 Hz and 3 kHz bandwidth roofing filters.

Outstanding receiver performance, the heritage of the FT DX 5000!

The high dynamic range IP3 performance that was realized and proven in the FTDX5000.

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

The newly developed LCD has a wider viewing angle and higher contrast.

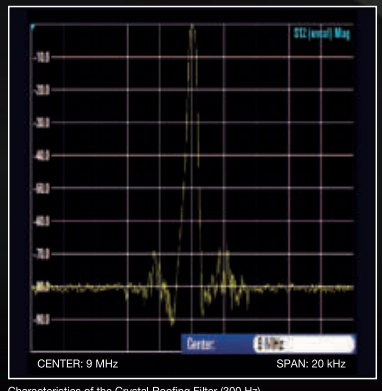
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

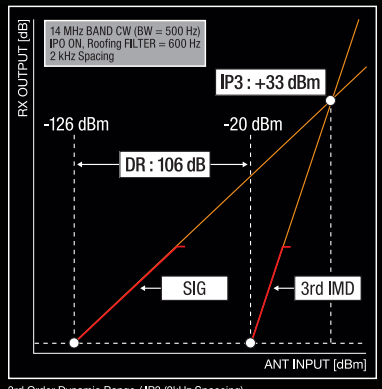
AF SCOPE display and RTTY/PSK encoder/decoder

Other features

The specialized Receiver amplifier for 50 MHz is built in / Three antenna connectors are provided / The "ANT-3" terminal may be assigned to "RX-only" / Signal output for an external receiver and the 9 MHz IF output are furnished / High speed Automatic antenna tuner built in / Optional μ-tune unit available / USB interface equipped



Characteristics of the Crystal Roofing Filter (300 Hz)



3rd Order Dynamic Range / IP3 (2kHz Spaceing)

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6125 Phyllis Drive, Cypress, CA 90630 (714) 827-7600

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The radio YAESU ...

The Dawn of a New Era
Dynamic Range 112 dB/IP3 +40 dBm

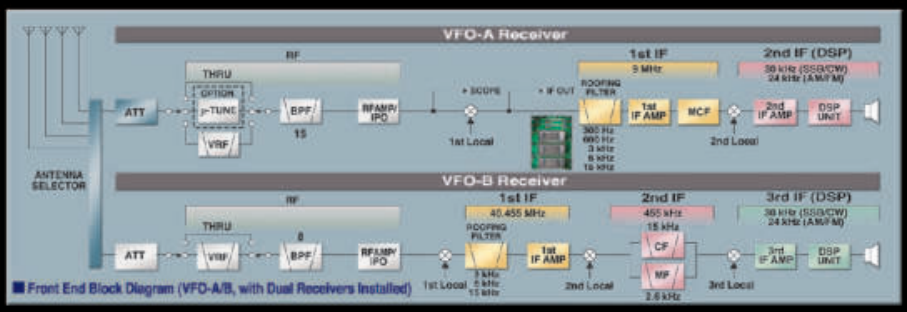
The New Premium HF/50 MHz Transceiver
FT DX 5000 Series

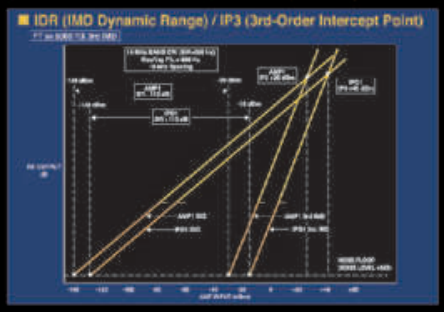
Two Totally Independent Receivers - The VFO-A/Main Receiver utilizes Super Sharp Roofing filters to give you the highest performance and best flexibility

The tight shape factor 6 pole crystal filters and D Quad Double Balanced Mixer design afford incredible improvement in 3rd – Order dynamic range and IP3 performance

Superb 3rd-Order Dynamic Range and 3rd-Order Intercept Point (IP3)

You will be pleased with the astounding 112 dB dynamic range and superb IP3 + 40 dBm at 10 kHz separation (CW/500 Hz BW). Experience the unmatched close-in dynamic range of 105 dB, IP3 +36 dBm at 2 kHz separation (CW/500 Hz BW)! (VFO-A/Main Receiver, 14 MHz, IPO-1)





HF/50 MHz 200 W Transceiver NEW
FT DX 5000MP

Station Monitor SM-5000 included
± 0.05ppm OCXO included
300 Hz Roofing Filter included

HF/50 MHz 200 W Transceiver NEW
FT DX 5000D

Station Monitor SM-5000 included
± 0.5ppm TCXO included
300 Hz Roofing Filter optional

HF/50 MHz 200 W Transceiver NEW
FT DX 5000

Station Monitor SM-5000 optional
± 0.5ppm TCXO included
300 Hz Roofing Filter optional

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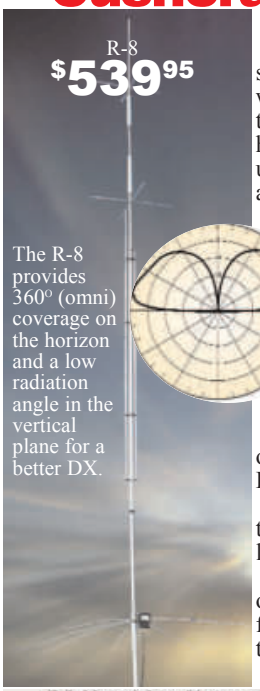
Cushcraft R8 *8-Band Vertical*



Covers 6, 10, 12, 15, 17, 20, 30, and 40 Meters!

The Cushcraft R8 is recognized as the industry gold standard for multi-band verticals, with thousands in use worldwide. Efficient, rugged, and built to withstand the test of time, the R8's unique ground-independent design has a well-earned reputation for delivering top DX results under tough conditions. Best of all, the R8 is easy to assemble, installs just about anywhere, and blends inconspicuously with urban and country settings alike.

Automatic Band Switching: The R8's famous "black box" matching network combines with traps and parallel resonators to cover 8 bands. You QSY instantly, without a tuner!

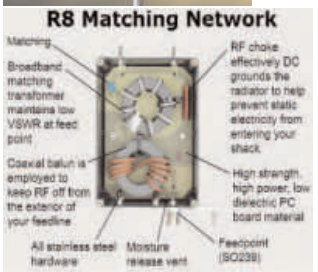
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

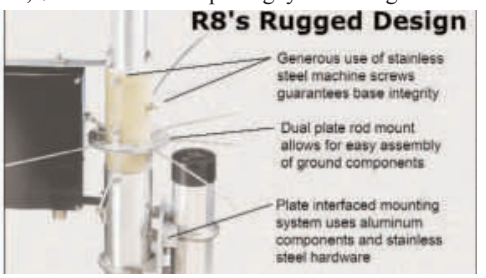
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

Legal-Limit Power: Heavy-duty components are contest-proven to handle all the power your amplifier can legally deliver and radiating it as RF rather than heat.

The sunspot count is climbing and long-awaited band openings are finally becoming a reality. Now is the perfect time to discover why Cushcraft's R8 multi-band vertical is the premier choice of DX-wise hams everywhere!

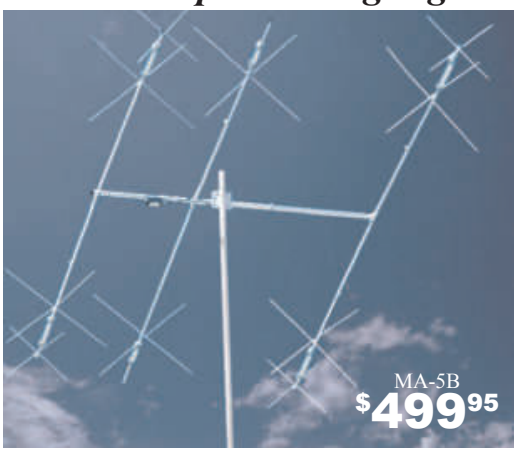
R-8GK, $56.95. R-8 three-point guy kit for high winds.





MA-5B *5-Band* Beam

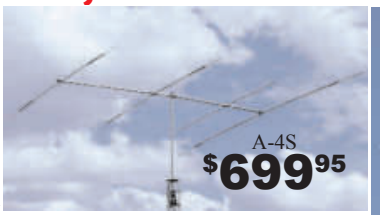
Small Footprint -- Big Signal



The MA-5B is one of Cushcraft's most popular HF antennas, delivering solid *signal-boosting directivity* in a bantam-weight package. Mounts on roof using standard TV hardware. Perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and full-sized array. Its 7 foot 3-inch boom has less than 9 feet of turning radius. Contest tough -- handles 1500 Watts.

The unique MA-5B gives you 5-bands, automatic band switching and easy installation in a compact 26-pound package. On 10, 15 and 20 Meters the end elements become a two-element Yagi that delivers solid power-multiplying gain over a dipole on all three bands. On 12 and 17 Meters, the middle element is a highly efficient trap dipole. When working DX, what really matters are the interfering signals and noise you *don't hear*. That's where the MA-5B's impressive side rejection and front-to-back ratio really shines. *See* ***cushcraftamateur.com*** *for gain figures.*

Cushcraft 10, 15 & 20 Meter Tribander Beams



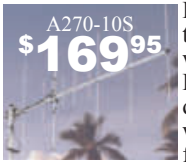
Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to success comes from attention to basics. For example, element length and spacing has been carefully refined over time, and high-power traps are still hand-made and individually tuned using laboratory-grade instruments. All this attention to detail means low SWR, wide bandwidth, optimum directivity, and high efficiency -- important performance characteristics you rely on to maintain regular schedules, rack up impressive contest scores, and grow your collection of rare QSLs!

It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components, stainless-steel hardware, and aircraft-grade 6063 make all the difference.

The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

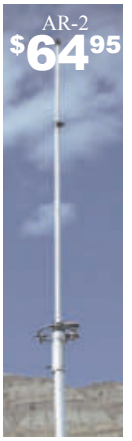
Cushcraft Dual Band Yagis

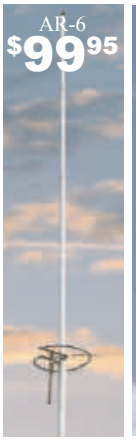
One Yagi for Dual-Band FM Radios



Dual-bander VHF rigs are the norm these days, so why not compliment your FM base station with a dual-band Yagi? Not only will you eliminate a costly feed line, you'll realize extra gain for digital modes like high-speed packet and D-Star! Cushcraft's A270-6S provides three elements per band and the A270-10S provides five for solid point-to-point performance. They're both pre-tuned and assembly is a snap using the fully illustrated manual.

Cushcraft Famous *Ringo* Compact FM Verticals





W1BX's famous *Ringo* antenna has been around for a long time and remains unbeaten for solid reliability. The Ringo is broad-banded, lighting protected, extremely rugged, economical, electrically bullet-proof, low-angle, and more -- but mainly, it just plain works! To discover why hams and commercial two-way installers around the world still love this antenna, order yours now!

***Free* Cushcraft Catalog**
and Nearest Dealer . . . 662-323-5803
Call your dealer for your best price!

Cushcraft
Amateur Radio Antennas
308 Industrial Park Road, Starkville, MS 39759 USA
Open: 8-4:30 CST, Mon.-Fri. ***Add Shipping.***
• **Sales/Tech:** 662-323-5803 • **FAX:** 662-323-6551
http://www.cushcraftamateur.com

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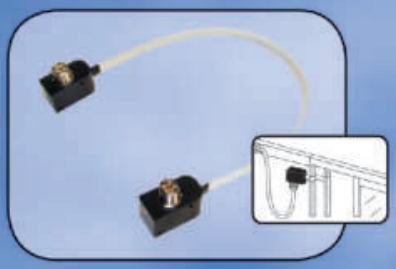
Life is a JOURNEY, Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

Max Power: HF 100W PEP
VHF: 60W FM
UHF: 40W FM
900MHz - 1.3GHz: 10W
VSWR: <500MHz 1.3:1
>500MHz 1.5:1
Impedance: 50Ohm
Length: 15.75"
Conn: 24k Gold Plated SO-239s

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

Unique ground radial system rotates 180 degrees around the base if building side mounting is required.

Max Power: HF 200W SSB/100W FM
6M - 70cm: 150W FM
TX: 80/40/20/15/10/6/2M/70cm
Impedance: 50 Ohm
Length: 8'6" approx
Weight: 5lbs 7oz
Conn: SO-239
Max Wind Speed: 92MPH

Each band tunes independently.
Approx 2:1 band-width:
80M 22kHz
40M 52kHz
20M 52kHz
15M 134kHz
10M 260kHz

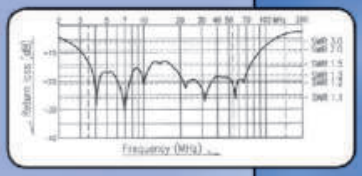
COMET CHA-250B
Broadband HF Vertical!

3.5 - 57MHz with SWR of 1.6:1 or less!

- *NO ANTENNA TUNER NEEDED*
- *NO RADIALS*
- *NO TRAPS*
- *NO COILS*

If you suffer in an antenna restricted area, must manage with space restrictions or you simply want to operate incognito you will be forced to make significant antenna compromises. The CHA-250B makes the most of the situation, making operating HF easy!!

Max Power: 250W SSB/125W FM
TX: 3.5– 57MHz
RX: 2.0– 90MHz
Impedance: 50Ohm
Length: 23'5"
Weight: 7lbs 1 oz
Conn: SO-239
Max Wind Speed: 67MPH



NEW! COMET H-422
40/20/15/10M compact, broadband, rotatable dipole!

Assemble in either a "V or horizontal ("H") configuration.
CBL-2500 2.5kW balun and heavy duty hardware included.

Max Power: 1000W SSB / 500W FM
SWR: Less than 1.5:1 at center frequency
Rotation Radius: "V" 12' 6" "H" 17' 5"
Length: "V" 24' 5" "H" 33' 10"
Weight: 11 lbs 14 ozs
Wind load: 3.01 sq feet
Max Wind Speed: 67 MPH

COMET and Maldol

For a complete catalog, call or visit your local dealer.

Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
909-393-6133 • 800-962-2611 • FAX 909-393-6136 • www.natcommgroup.com

Our mission: To promote and advance the art, science and enjoyment of Amateur Radio.

In This Issue

December 2012 Volume 96 Number 12

Technical

News and Features

Our Cover
As the shadows lengthen and the evening comes, the busy world is hushed and our work is done. When we reflect on the past year — thinking about the good DX with hams in far-away places, as well as the regular ragchews with the friend across town — we can't help but feel the magic of Amateur Radio and marvel how it brings us all closer together. May 2013 bring every one of us safe lodging and peace now, and at the last. Our cover features a combined 40 and 30 meter Yagi antenna atop the 90 foot tower of Bogdan Zdaniak, SP5WA. Photo by Henryk Kotowski, SMØJHF.

Radiosport

Columns

Departments

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e-mail: qst@arrl.org

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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.

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Commercial Grade Field Radio
Submersible Construction

- Large Backlit LCD Display for easy operation
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 800 mW of Loud Audio for noisy field operations
- 200 Memory Channels for Serious users
- Commercial Grade Receivers Performance
- Submersible Construction (3 ft. for 30 min)
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-24 VOX Headset

Wide Range of available Options includes:
- CD-26 Charger Cradle
- VAC-370B 1.5 Hour Desktop Rapid Charger
- External DC Jack for Cigarette-Lighter adapter E-DC-5B or DC Cable E-DC-6
- FBA-25A Alkaline Battery Case (for 6 X AA cells)
- FTD-7 DTMF Paging Unit

Actual Size

VHF FM 5 W COMPACT HANDHELD TRANSCEIVER

FT-270R

Size: 2.4" (W) x 4.7" (H) x 1.3" (D) Weight: 13.8 oz.

NEW 2m MONO BAND

Compact Field Radio with Top Mounted LCD and Loud Audio

- Compact Design with Top mounted LCD Display
- 5 Watts of Stable RF Power with Minimum Components for Reliability
- 700 mW of Loud Audio for outside field environments
- 200 Memory Channels for serious users
- Yaesu Exclusive Power Saving Circuit Design Guarantees Longer Operating time
- Hands Free Operation with Optional VC-25 VOX Headset

Wide Range of available Options includes:
- External DC jack for Cigarette-Lighter adapter E-DC-5B or DC cable E-DC-6
- 6 X AA size Alkaline Battery Case FBA-25A

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

Size: 2.3" (W) x 4.3" (H) x 1.0" (D) / Weight: 12.4 oz.

NEW 2m MONO BAND

YAESU
The radio

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The King of Mobile

- Massive Heatsink guarantees 75 Watts of Solid RF Power with No Cooling Fan Needed
- Loud 3 Watts of Audio Output for noisy environments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

FT-2900R

Size: 6.3" (W) x 2.0" (H) x 7.3" (D) / Weight: 4.0 lb

NEW

2 m MONO BAND

Best Selling, Reliable Mobile

- 55 Watts of Solid RF Power within a compact footprint
- Loud 3 Watts of Audio Output Power for noisy enviroments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

2 m MONO BAND

Size: 5.5" (W) x 1.6" (H) x 5.8" (D) / Weight: 2.2 lb

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(714) 827-7600

NEW COMPACT HF TRANSCEIVER WITH IF DSP

A superb, compact HF/50 MHz radio with state-of-the-art IF DSP technology, configured to provide YAESU World-Class Performance in an easy to operate package.
New licensees, casual operators, DX chasers, contesters, portable/field enthusiasts, and emergency service providers- YAESU FT-450D...This Radio is for YOU!

Compact size: 9" X 3.3" X 8.8" and Light weight: 7.9 lb

HF/50 MHz 100 W All Mode Transceiver

FT-450D

With Built-in Automatic Antenna Tuner

NEW **Illuminated Key buttons**

NEW **300 Hz/500 Hz/2.4 kHz CW IF Filters**

NEW **Foot stand**

NEW **Classically Designed Main Dial and Knobs**

NEW **Dynamic Microphone MH-31A8J Included**

■ **Large informative Front Panel Display, convenient Control knobs and Switches**
■ **The IF DSP guarantees quiet and enjoyable high performance HF/50 MHz operation**

Handy Front Panel Control of Important Features including:

- **CONTOUR Control Operation**
  The Contour filtering system provides a gentle shaping of the filter passband.
- **Manual NOTCH**
  Highly-effective system that can remove an interfering beat tone/signal.
- **Digital Noise Reduction (DNR)**
  Dramatically reduces random noise found on the HF and 50 MHz bands.
- **IF WIDTH**
  The DSP IF WIDTH tuning system provides selectable IF passband width to fight QRM.
  SSB - 1.8/2.4/3.0 kHz, CW - 300 Hz/500 Hz/2.4 kHz
- **Digital Microphone Equalizer**
  Custom set your rig to match your voice characteristics for maximum power and punch on the band.
- **Fast IF SHIFT Control**
  Vary the IF SHIFT higher or lower for effective interference reduction / elimination.

■ **The rugged FT-450D aluminum die-cast chassis, with its quiet, thermostatically controlled cooling fan provides a solid foundation for the power amplifier during long hours of field or home contesting use.**

MOS FET RD100HHF1

More features to support your HF operation

●10 kHz Roofing filter ●20 dB ATT/IPO ●Built-in TCXO for incredible ±1 ppm/hour (@+77°F, after warm-up) stability ●CAT System (D-sub9 pin): Computer programming and Cloning capability ●Large, Easy-to-See digital S-meter with peak hold function ●Speech Processor ●QUICK SPLIT to automatically Offset transmit frequency (+5 kHz default) ●TXW to monitor the transmit frequency when split frequency operation is engaged ●Clarifier ●Built-In Electronic Keyer ●CW Beacon (Up to 118 characters using the CW message keyer's 3 memory banks) ●CW Pitch Adjustment (from 400 to 800 Hz, in 100 Hz steps) ●CW Spotting (Zero-Beating) ●CW Training Feature ●CW Keying using the Up/Down keys on the microphone ●Two Voice Memories (SSB/AM/FM), store up to 10 seconds each ●20 second Digital Voice Recorder ●Dedicated Data Jack for FSK- RTTY operation ●Versatile Memory System, up to 500 memory channels that may be separated into as many as 13 Memory Groups ●CTCSS Operation (FM) ●My Band / My Mode functions, to recall your favorite operating set-ups ● Lock Function ●C.S. Switch to recall a favorite Menu Selection directly ●Dynamic Microphone included ●IMPORTANT FEATURES FOR THE VISUALLY IMPAIRED OPERATOR – Digital Voice Announcement of the Frequency, Mode or S-meter reading

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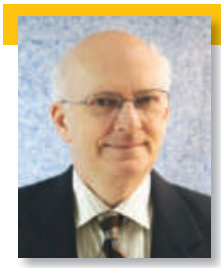

David Sumner, K1ZZ – dsumner@arrl.org
ARRL Chief Executive Officer

Permanent Exam Credit?

"There was a time when in order to renew an Amateur Radio license it was necessary to submit evidence of recent activity, such as an extract from your station log, to the FCC. Operator and station licenses were two different things; you could renew your operator license on the basis of operating someone else's station but you had to operate your own station in order to renew your station license. Eventually the requirement to submit evidence was deleted from the rules but the activity requirement lingered until the mid-1970s when it, too, was dropped."

Times have changed. The license term in those days was five years; now it's ten. Today the FCC treats operator and primary station licenses as inseparable; you can't have one without the other. The only requirement to renew a license is to remember to do so before the two-year grace period expires. Thus the only difference between two people licensed more than 12 years ago, one of whom is still licensed while the other is not, is that the first person went through an administrative procedure proving nothing more than that they were still alive and paying attention.

With that in mind the FCC responded favorably to a petition filed in April 2011 by the Anchorage Volunteer Examiner Coordinator to grant examination credit for any exam elements ever passed by former licensees, rather than requiring them to retest. In a Notice of Proposed Rule Making (NPRM) released on October 2 (WT Docket No. 12-283) the Commission solicited public comment on this and several other proposed changes to its rules. A summary of the proposals is on page 64 of this issue of *QST*.

The proposal is similar to one made by the ARRL in 1994. The Communications Act limits the term of a station license to ten years but there is no such limit on an operator license, which the FCC could grant for the lifetime of the operator. At that time the ARRL proposed that the FCC extend all currently held operator licenses to lifetime. This would have allowed anyone then holding an amateur license to apply for a new station license in the future without having to retest. It was clean, simple, and easy to implement.

But the FCC thought it had a better idea and proposed instead to grant examination credit for expired licenses. This proposal, in WT Docket No. 95-57, attracted more negative than positive comments and in 1997 the Commission decided against adopting its own proposal. The Commission offered this explanation for why it did not opt for the lifetime operator license: "[T]he operator would still have to renew the station license every ten years. We would therefore, have to develop and maintain a separate data base specifically for the purpose of maintaining indefinitely records of amateur operators who allow their station license to expire. It would not be in the public interest to expend resources for such increased record retention." If you find that explanation to be less than persuasive you're not alone. Be that as it may, neither approach was adopted to ease the path of re-entry into Amateur Radio for former licensees.

In resurrecting its earlier proposal in response to the Anchorage VEC petition the FCC stopped short of enthusiastically embracing the idea. By footnote it even referenced the arguments against it that had been made more than 15 years ago: "In view of the opposition expressed in the comments, we decline to adopt our proposal to give examination credit for licenses formerly held. Persons who allow their amateur operator license to expire will have to pass the requisite examinations if they later decide to obtain another amateur operator license. We do not believe that attending an examination session is a hardship. The VEs provide abundant examination opportunities. They must, moreover, accommodate an examinee whose physical disabilities require a special examination procedure, including administering examinations in the home.

"We believe that our procedures provide ample notification and opportunity for license renewal. The license expiration date is shown on our licensee data base, so that it can obtained through the Internet even if the license document is lost. Providers in the private sector often use this information to remind licensees that expiration is about to occur. For those persons who inadvertently fail to renew, a two-year grace period is allowed. At the conclusion of the grace period, the record of the former licensee is purged from the data base and the call sign becomes available for reassignment in the vanity call sign system. Further, we have made the license renewal process as simple as possible by expanding our electronic filing procedures to include license renewal."

While the Commission did not choose to cite it, in 1995 the ARRL had offered another argument against giving examination credit for licenses formerly held: it would impose a new responsibility and burden on Volunteer Examiners. While the current Commission proposal is to *require* that VEs give examination credit to an applicant who can demonstrate that he or she formerly held a particular class of license, the Commission notes the potential for fraud by an applicant who produces evidence of a license previously held by a different person with the same name. Is it fair to force VEs to make decisions about the authenticity of documents that may be older than the VEs themselves?

This is but one of several proposals contained in the NPRM, the full text of which is available at **http://apps.fcc.gov/ecfs/document/view?id=7022026747**. Review the proposals and submit comments if you wish. Whether or not you comment directly to the FCC, please share your thoughts with your ARRL Director. At this time the Board of Directors has not adopted any positions with regard to the proposals contained in the NPRM, except of course with regard to the TDMA proposal made by the ARRL itself. If you want to influence ARRL policy, now's the time!

David Sumner, K1ZZ

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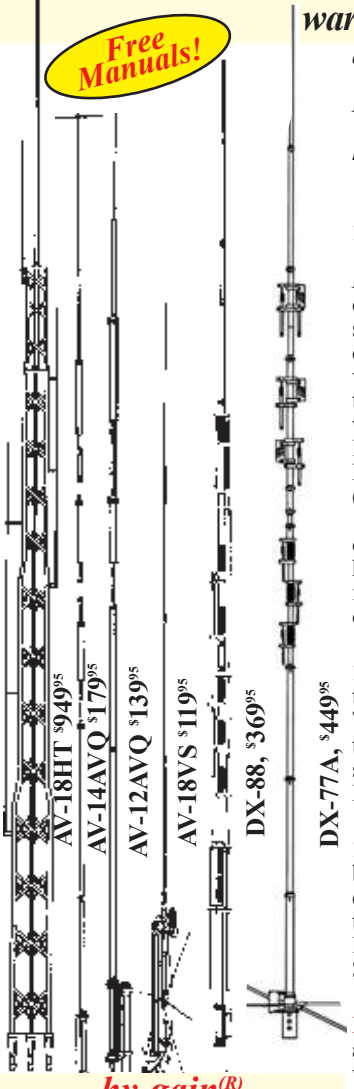

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Includes all stainless steel hardware. Recessed SO-239 prevents moisture damage.

Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low. Two year limited warranty.

AV-18HT, $949.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.

Standing 53 feet tall, the famous *Hy-Gain HyTower* is the world's best performing vertical! The AV-18HT features automatic band selection achieved through a unique stub-decoupling system which effectively isolates various sections of the antenna so that an electrical 1/4 wavelength (or odd multiple of a 1/4 wavelength) exists on all bands. Approximately 250 kHz bandwidth at 2:1 VSWR on 80 Meters. The addition of a base loading coil (**LC-160Q, $109.95**), provides exceptional 160 Meter performance. **MK-17, $89.95**. Add-on 17 Meter kit. 24 foot tower is all rugged, hot-dip galvanized steel and all hardware is iridited for corrosion resistance. Special tilt-over hinged base for easy raising & lowering.

AV-14AVQ, $179.95. (10,15,20,40 Meters). 18 ft., 9 lbs. **The** Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

AV-12AVQ, $139.95. (10, 15, 20 Meters). 13 ft., 9 lbs. **AV-12AVQ** also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, $89.95.

AV-18VS, $119.95 (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs.

All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $199.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

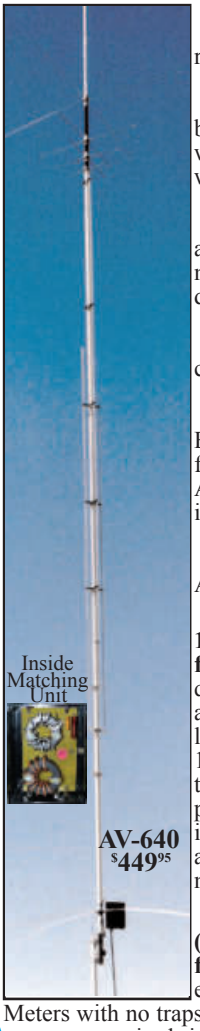
DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.

No ground radials required! Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$949.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$179.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$139.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$119.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 80 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 40 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

hy-gain(R) PATRIOT

Hy-Gain's new PATRIOT HF verticals are the best built, best performing and best priced multiband verticals available today. For exciting DX make full use of your sunspot cycle with the PATRIOT's *low 17 degree angle* signal.



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AV-640, $449.95. (6,10,12, 15,17,20,30,40 Meters). 25.5 ft., 17.5 lbs. The AV-640 uses quarter wave stubs on 6, 10, 12 and 17 meters and efficient end loading coil and capacity hats on 15, 20, 30 and 40 meters -- no traps. Resonators are placed in parallel not in series. End loading of the lower HF bands allows efficient operation with a manageable antenna height.

AV-620, $349.95. (6,10,12,15,17,20 Meters). 22.5 ft., 10.5 lbs. The AV-620 covers all bands 6 through 20 Meters with no traps, no coils, no radials yielding an uncompromised signal across all bands.

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In Brief

- NASA Astronaut Lee Morin, KF5DDB, was the ARRL's guest at its 2012 National Convention at Pacificon in Santa Clara, CA in early October. Morin served as a mission specialist on the space shuttle *Atlantis* in 2002. During this 13th shuttle mission to visit the International Space Station, Morin performed two spacewalks. Attendees were able to meet Morin in the ARRL EXPO area. He was also a Pacificon forum presenter and Saturday night banquet speaker.
- IARU Secretary Rod Stafford, W6ROD, recently presented a look to the 2015 World Radiocommunication Conference. According to Secretary Stafford, the IARU Administrative Council is evaluating agenda items for the 2015 World Radiocommunication Conference with an eye to building the best strategy to deal with those agenda items in a way that is most favorable to the Amateur Radio Service.
- Twelve newly elected or appointed Section Managers attended a training workshop at ARRL Headquarters.
- For the eleventh year running, federal employees can support the ARRL through the Combined Federal Campaign (CFC). Those wishing to select the ARRL to receive all or part of their payroll deductions should designate organization **10099** when completing their CFC donor forms.
- W1AW Station Manager Joe Carcia, NJ1Q, installed a new transceiver that will be used to transmit W1AW bulletins and code practice on 40 meters.
- Team USA scored 13 medals at the 16th ARDF World Championships held in Kopaonik, Serbia.
- Bill Tynan, W3XO, former Conductor of *QST*'s "The World Above 50 MHz" column from 1977-1992, was named the recipient of the of the Radio Club of America's Barry Goldwater Amateur Radio Award. Bill received the award at the RCA's 103rd annual awards banquet in New York City. ARRL Chief Executive Officer David Sumner, K1ZZ, also an RCA Fellow, was the banquet's keynote speaker.
- ARRL Media and Public Relations Manager Allen Pitts, W1AGP, attended the Radio Television Digital News Association's (RTDNA) Convention in Florida.
- The DXCC Desk recently approved 12 operations for DXCC credit.
- The winner of the October *QST* Cover Plaque award was James Klitzing, W6PQL, for his article "Solid State 1 kW Linear Amplifier for 2 Meters."
- ARRL Field and Regulatory Correspondent Chuck Skolaut, KØBOG, handled a number of complaints during the past several weeks including a "buzzing signal" on 40 meters, shortwave broadcasts on 7.120 and 7.110 MHz and unidentified RTTY signals on 14.024 MHz.
- ARRL Regulatory Information Manager Dan Henderson, N1ND, attended the SEDCO event in Sevierville, Tennessee. ARRL News Editor S. Khrystyne Keane, K1SFA, attended a meeting of the North Shore Radio Association in Danvers, Massachusetts. ARRL Chief Operating Officer Harold Kramer, WJ1B, attended a meeting of the Boston Amateur Radio Club, in Boston, Massachusetts. ARRL Education Services Manager Debra Johnson, K1DMJ, attended the ARRL Washington State Convention in Spokane, Washington.

Media Hits

Allen Pitts, W1AGP – apitts@arrl.org
Media & Public Relations Manager

With a department at ARRL headquarters that comprises one person, the ARRL Media and Public Relations outreach depends on the activities of hundreds of ARRL Public Information Officers, club publicity people and self-appointed volunteers who continually reach out, take the risk of being rejected and contact local media. While ARRL Headquarters can support them with materials and tools to use, we cannot do it for them — and without them, nothing could happen. But happily, their desire and motivation to promote all of Amateur Radio remains strong.

When you hear comments that there is little notice of Amateur Radio in the media, it simply means there's no one working in that area to let the public know about us. It's said that "all news is local" and local volunteers are the most effective way to keep Amateur Radio on the media lists. Please be sure to thank them. (If you want to *join* them, just go to **www.arrl.org/pr-courses**.)

Here are some of the media hits that our volunteers achieved in September:

- The city of Hartford is trying to improve its image, so the *Hartford Courant* was quick to post "ARRL Centennial Convention To Be In Hartford July 2014." More Connecticut hits included ARRL historian Michael Marinaro's, WN1M, article on **ConnecticutHistory.org** and in *Stanford Magazine's* article about the Stanford Amateur Radio Club, W6YX, and the history of Amateur Radio at Stanford University with Professor Dave Leeson, W6NL.

- Tim Carter, W3ATB, PR person for the Central New Hampshire ARC, scored with an article in The Weirs Times (NH) titled "Ham radios more popular— and important — than ever," which included not only a page 1 photo but several inside pages praising Amateur Radio activities. Meanwhile in Evanston, Illinois, Charles Bartling, W4TVW, scored with both "Evanston Simulated Emergency Test Underway" on **http://evanston.patch.com** and "Are you ready for this emergency?" on **EvanstonNow.com**.

- Jock Soutar, KC6IIH, has quietly worked the media for many years. It was pleasant to see him profiled in the *Desert Dispatch* (CA).

- The great "car key mystery" reported in the *Wyoming Tribune Eagle* was solved by a ham who chose to remain anonymous. The "mystery" involved people being unable to unlock their car doors when parked at a certain shopping plaza. The local ham discovered that nearly every business in the plaza was emitting a radio signal that corresponded to a frequency of 911.75 to 945 MHz — a band of frequencies reserved for wireless in-store radio systems. He said it was possible that the proximity of so many strong frequencies was responsible for shutting down the cars' key fobs.

- Modern technologies using Amateur Radio skills were highlighted in "Weather and Radio Tower Stationed at Sci-Tech Discovery Center" on **IT News Online.com** when the Sci-Tech weather station and ham radio assembly came to life.

- The hit that topped the list for September was "Zombie Apocalypse Survival Gear: Ham Radios" on **PhysicsCentral.com**, a website of the American Physical Society. Fighting off zombies is a current cultural synonym for emergency preparedness. Their blogger wrote, "While amateur radio may not be as exhilarating as fighting zombie hordes, it may be the most effective tool during an apocalypse."

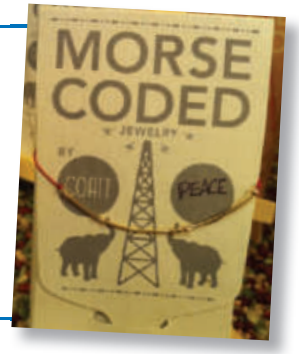
To see a list of all the hits we collected, go to **www.arrl.org/media-hits**.

The Cup of Excellence

At the 2012 ARRL/TAPR Digital Communications Conference in Atlanta, *QEX* Editor Larry Wolfgang, WR1B, presented the 2011 Doug DeMaw, W1FB, Technical Excellence Award to Jim Ahlstrom, N2ADR, for his article "An All-Digital Transceiver for HF," which was published in the January/February 2011 issue of *QEX* magazine.

Morse Code as a Fashion Statement

Bob Salmon, N3JQD, and his wife were out shopping during a recent visit to Philadelphia. Bob followed his wife into a woman's apparel store and stumbled across a particularly attractive piece of jewelry! [Bob Salmon, N3JQD, photo]



Amateurs Become Public Service Partners in Oxford County

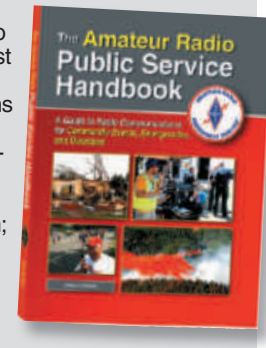
This Diamond X30A is one of several antennas and associated transceivers that appeared at fire stations and other locations in Oxford County, Maine this fall. This particular installation was performed by Gary Gilman, N1ZNJ and Bob Gould, N1WJO, with assistance from Eric Perkins, KB1YMP and Chet Charette, KB1YMT.

During hurricane Irene in 2011, the police and fire communication system failed. In the aftermath of the storm officials turned to Oxford County ARES®/CERT for assistance in crafting an Amateur Radio backup plan. Hams conducted tests throughout the region and demonstrated that they could provide reliable support. As a result, Oxford County received grants to purchase 11 transceivers, power supplies and antennas. The Oxford County ARES/CERT members volunteered their time to install the equipment. [Bob Gould, N1WJO, photo]

Inside HQ

Harold Kramer, WJ1B – hkramer@arrl.org
ARRL Chief Operating Officer/*QST* Publisher

The Amateur Radio Public Service Handbook Debuts



The nautical term "flagship" applies to the ship in a fleet that carries the most important officer, the commanding admiral. Similarly, flagship publications are the most important and carefully crafted works produced by an organization. ARRL flagship publications include: *The Ham Radio License Manual*, our most popular publication; *The General Class* and *Extra Class License Manuals*; *The ARRL Antenna Book*, now in its 22nd edition; and *The ARRL Handbook*, currently in its 90th edition. The ARRL has published these books for decades and they are invaluable instructional and reference works for radio amateurs and radio communications professionals worldwide.

This month we introduce what we believe will become our newest flagship publication: *The Amateur Radio Public Service Handbook*. Although we currently publish other books about public service communications, those titles focus on specialized topics such as backup power and ARES procedures. We also publish the "Public Service" column here in *QST* and we e-mail the *ARRL ARES E-Letter* to 37,000 members each month. While we already publish a large amount of content about public service and emergency communications, we wanted to create an ARRL publication that incorporated much of this information in a single volume that would serve as a timely reference for any amateur involved in public service and emergency communications.

The Amateur Radio Public Service Handbook was written specifically for amateurs who volunteer their time, equipment and skills to serve their communities, first responders and public service agencies. Topics include net operations, ARES and the National Traffic System. There is an entire chapter devoted to digital communication and networking with discussions of EchoLink, IRLP, Winlink 2000 and D-STAR. We also included a section on Training and Readiness that incorporates the latest information on personal safety, leading and training volunteers, and portable equipment and operation. For those amateurs, like me, who participate in public service events, there is a chapter on organizing and planning with real-world examples such as the Boston Marathon.

This new book has taken us more than two years to complete. According to co-editor Mike Corey, KI1U, "The challenge was to pull together much of the ARRL's legacy and current content and incorporate it with the newest material, latest thinking and best practices in the field of Amateur Radio Public Service." Co-editor Becky Schoenfeld, W1BXY, notes that "It was a formidable task to coordinate all of the material from the many authors, editors and content experts that we used for this publication, but we wanted to make sure that we had the best experts in the field help us write and edit this book."

Whatever branch of public service communications you currently support, all of us who worked on *The Amateur Radio Public Service Handbook* hope that you find it useful and informative.

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- **Customized ARRL.org home page**
  Customize your home page to see local ham radio events, clubs and news.
- **ARRL Member Directory**
  Connect with other ARRL members via a searchable online Member Directory. Share profiles, photos and more with members who have similar interests.

ARRL Technical Information Service — www.arrl.org/tis

Get answers on a variety of technical and operating topics through ARRL's Technical Information Service. ARRL Lab experts and technical volunteers can help you overcome hurdles and answer all your questions.

ARRL as an Advocate — www.arrl.org/regulatory-advocacy

ARRL supports legislation and regulatory measures that preserve and protect access to Amateur Radio Service frequencies. Members may contact the **ARRL Regulatory Information Branch** for information on FCC rules; problems with antenna, tower and zoning restrictions; and reciprocal licensing procedures for international travelers.

ARRL Group Benefit Programs* — www.arrl.org/benefits

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
  Insurance is available to protect you from loss or damage to your station, antennas and mobile equipment by lightning, theft, accident, fire, flood, tornado, and other natural disasters.
- **The ARRL Visa Signature® Card**
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Logbook of the World – **www.arrl.org/lotw**

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Radio Clubs (ARRL-affiliated clubs) – **www.arrl.org/clubs**
Hamfests and Conventions – **www.arrl.org/hamfests**
ARRL Field Organization – **www.arrl.org/field-organization**

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ARRL Continuing Education Program – **www.arrl.org/courses-training**
Books, Software and Operating Resources – **www.arrl.org/shop**

Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
Support for Teachers – **www.arrl.org/teachers**
ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
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The American Radio Relay League, Inc.

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.

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President
KAY C. CRAIGIE, N3KN*
570 Brush Mountain Rd
Blacksburg, VA 24060
540-552-3903; n3kn@arrl.org

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

Second Vice President
BRUCE FRAHM, KØBJ
1553 County Rd T, Colby, KS 67701
785-462-7388; k0bj@arrl.org

International Affairs Vice President
JAY BELLOWS, KØQB
1925 Bidwell St,
West St Paul, MN 55118
651-238-4444; k0qb@arrl.org

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Information Technology Manager
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Atlantic Division

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

Vice Director: **Tom Abernethy, W3TOM**
PO Box 73, Accokeek, MD 20607
(301-272-0629); **w3tom@arrl.org**

Central Division

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

Vice Director: **Kermit Carlson, W9XA**
1150 McKee St, Batavia, IL 60510
(630-879-0983); **w9xa@arrl.org**

Dakota Division

Gregory P. Widin, KØGW
13457 Sixth St N, Stillwater, MN 55082
(651-436-8811); **k0gw@arrl.org**

Vice Director: **Kent R. Olson, KAØLDG**
148 Ironwood Dr, Horace, ND 58047;
(701-298-0956); **ka0ldg@arrl.org**

Delta Division

David A. Norris, K5UZ
3040 Campground Rd, Cabot, AR 72023;
(870-613-1606); **k5uz@arrl.org**

Vice Director: **Glen Clayton, W4BDB**
238 Old Parksville Rd, NE, Cleveland, TN 37323
(423-400-9381); **w4bdb@arrl.org**

Great Lakes Division

Jim Weaver, K8JE
5065 Bethany Rd, Mason, OH 45040-8130
(513-459-1661); **k8je@arrl.org**

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

Hudson Division

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

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

Midwest Division

Cliff Ahrens, KØCA*
65 Pioneer Trail, Hannibal, MO 63401
(573-221-8618); **k0ca@arrl.org**

Vice Director: **Rod Blocksome, KØDAS**
690 Eastview Dr, Robins, IA 52328-9768
(319-393-8022); **k0das@arrl.org**

How to Find an ARRL HQ Staff Member

Can't find the department you're looking for? Call 860-594-0200 or e-mail **hq@arrl.org**. Sending e-mail to any ARRL Headquarters staff member is a snap. Just put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send to Allen Pitts, W1AGP, Media Relations manager, use **w1agp@arrl.org** or **apitts@arrl.org**. If all else fails, send a message to **hq@arrl.org** and it will get routed to the right person or department.

New England Division

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

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

Northwestern Division

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

Vice Director: **Grant Hopper, KB7WSD**
PO Box 3318, Everett, WA 98213
(425-238-1433); **kb7wsd@arrl.org**

Pacific Division

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

Vice Director: **Jim Tiemstra, K6JAT**
13450 Skyline Blvd, Oakland, CA 94619;
(510-569-6963); **k6jat@arrl.org**

Roanoke Division

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

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

Rocky Mountain Division

Brian Mileshosky, N5ZGT*
PO Box 20186, Albuquerque, NM 87154-0186
(505-463-9468); **n5zgt@arrl.org**

Vice Director: **Dwayne Allen, WY7FD**
PO Box 1482, Sundance, WY 82729-1482
(307-756-9439); **wy7fd@arrl.org**

Southeastern Division

Greg Sarratt, W4OZK
230 Latigo Loop, Huntsville, AL 35806;
(256-337-3636); **gsarratt@arrl.org**

Vice Director: **Jim Millsap, WB4NWS,**
5127 Bramblewood Dr, Acworth, GA 30102
(770-928-8590); **wb4nws@arrl.org**

Southwestern Division

Richard J. Norton, N6AA
21290 West Hillside Dr, Topanga, CA 90290
(310-455-1138); **n6aa@arrl.org**

Vice Director: **Marty Woll, N6VI**
21301 Candice Pl, Chatsworth, CA 91311-1404
(818-773-9655); **n6vi@arrl.org**

West Gulf Division

Dr David Woolweaver, K5RAV*
PO Box 531605, Harlingen, TX 78553
(956-425-3128); **k5rav@arrl.org**

Vice Director: **John Robert Stratton, N5AUS**
PO Box 2232, Austin, TX 78768-2232
(512-282-7851); **n5aus@arrl.org**

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Eastern Pennsylvania: Robert B. Famiglio, K3RF, PO Box 9, Media, PA 19063-0009 (610-359-7300); **k3rf@arrl.org**

Maryland-DC: James E. Cross III, WI3N, 16013 Dorset Rd, Laurel, MD 20707-5314 (301-725-6829); **wi3n@arrl.org**

Northern New York: Thomas Dick, KF2GC, 11 Jenkins St, Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**

Southern New Jersey: George Strayline, W2GSS, 10 E Pacific Ave, Villas, NJ 08251-2630 (609-741-8322); **w2gss@arrl.org**

Western New York: John Mueller, K2BT, 2011 E Main St, Falconer, NY 14733 (716-489-7001); **k2bt@arrl.org**

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Illinois: Tom Ciciora, KA9QPN, 1887 Irene Rd, Sandwich, IL 60548 (815-498-4929); **ka9qpn@arrl.org**

Indiana: Lou Everett Sr, WA5LOU, 11909 Cardis Ct, Cumberland, IN 46229 (317-622-1130); **wa5lou@arrl.org**

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

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Minnesota: Richard H. "Skip" Jackson, KS0J, 1835-63rd St E, Inver Grove Heights, MN 55077 (651-260-4330); **ks0j@arrl.org**

North Dakota: Lynn A. Nelson, W0ND, 6940 4th St SW, Minot, ND 58701 (701-839-8200); **w0nd@arrl.org**

South Dakota: Chris Stallkamp, W0ADZ, PO Box 271, Selby, SD 57472-0271 (605-870-1784); **w0adz.arrl.org**

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Arkansas: Dale Temple, W5RXU, 5200 Timber Creek Circle, North Little Rock, AR 72116 (501-771-1111); **w5rxu@arrl.org**

Louisiana: James M. Coleman, AI5B, 1530 Military Rd, Bogalusa, LA 70427-2901 (985-516-2632); **ai5b@arrl.org**

Mississippi: Malcolm Keown, W5XX, 64 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**

Tennessee: Keith E. Miller Sr, N9DGK, 1635 Jarratt Dr, Rockvale, TN 37135 (615-631-9952); **n9dgk@arrl.org**

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Michigan: Larry Camp, WB8R, 71 Oakdale Lane, Coldwater, MI 49036 (517-278-0406); **wb8r@arrl.org**

Ohio: Frank J. Piper, KI8GW, 496 Hillview St, Pickerington, OH 43147-1197 (614-589-4641); **ki8gw@arrl.org**

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NYC-Long Island: Mike Lisenco, N2YBB, 1635 E 46th St, Brooklyn, NY 11234-3604 (917-865-3538); **n2ybb@arrl.org**

Northern New Jersey: Richard Krohn, N2SMV, 23 Sweetmans Ln, Manalapan, NJ 07726; **n2smv@arrl.org**

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Iowa: Tom Brehmer, N0LOH, 1114 East Tenth St, Muscatine, IA 52761 (563-263-3097); **n0loh@arrl.org**

Kansas: Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-3758); **kb0dti@arrl.org**

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

Nebraska: Art Zygielbaum, K0AIZ, 6601 Pinecrest Dr, Lincoln, NE 68516-3573 (402-421-0839); **k0aiz@arrl.org**

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

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

New Hampshire: Alan K. Shuman, K1AKS, PO Box 681, New Boston, NH 03070-3520 (603-487-3333); **k1aks@arrl.org**

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

Vermont: Paul N. Gayet, AA1SU, 11 Cherry St, Essex Junction, VT 05452 (802-878-2215); **aa1su@arrl.org**

Western Massachusetts: Ed Emco, W1KT, 37 Bullard Ave, Worcester, MA 01605 (508-853-3333); **w1kt@arrl.org**

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

Alaska: Jim Larsen, AL7FS, 3445 Spinnaker Dr, Anchorage, AK 99516-3424 (907-345-3190); **al7fs@arrl.org**

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

Idaho: Edward Stuckey, AI7H, 2300 W Polo Green Ave, Post Falls, ID 83854-9680 (208-457-0354); **ai7h@arrl.org**

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

Oregon: Bonnie Altus, AB7ZQ, 7770 Harmony Rd, Sheridan, OR 97378 (971-237-0711); **ab7zq@arrl.org**

Western Washington: Jim Pace, K7CEX, PO Box 1602, Centralia, WA 98531 (360-508-8437); **k7cex@arrl.org**

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

East Bay: James Latham, AF6AQ, 1798 Warsaw Ave, Livermore, CA 94550-6140; (925-447-6136); **af6aq@arrl.org**

Nevada: Joe Giraudo, N7JEH, 720 Holyoke Dr, Spring Creek, NV 89815-5306 (775-738-7110); **n7jeh@arrl.org**

Pacific: Bob Schneider, AH6J, PO Box 131, Keaau, HI 96749-0131 (808-966-8146); **ah6j@arrl.org**

Sacramento Valley: Ronald D. Murdock, W6KJ, 998 Bogue Rd, Yuba City, CA 95991-9221 (530-674-8533); **w6kj@arrl.org**

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

San Joaquin Valley: Dan Pruitt, AE6SX, 4834 N Diana St, Fresno, CA 93726 (559-779-2974); **ae6sx@arrl.org**

Santa Clara Valley: Brandon Bianchi, NI6C, 1154 Trivoli Way, Salinas, CA 93905 (559-313-3373); **ni6c@arrl.org**

Roanoke Division (NC, SC, VA, WV)

North Carolina: Bill Morine, N2COP, 101 Windlass Dr, Wilmington, NC 28409-2030 (910-452-1770); **n2cop@arrl.org**

South Carolina: Marc Tarplee, N4UFP, 4406 Deer Run, Rock Hill, SC 29732-9258 (803-327-4978); **n4ufp@arrl.org**

Virginia: Carl Clements, W4CAC, 4500 Wake Forest Rd, Portsmouth, VA 23703 (757-484-0569); **w4cac@arrl.org**

West Virginia: L. Ann Rinehart, KA8ZGY, 1256 Ridge Dr, South Charleston, WV 25309 (304-768-9534); **ka8zgy@arrl.org**

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

Colorado: Jack Ciaccia, WM0G, PO Box 21362, Boulder, CO 80308-4362 (303-587-0993); **wm0g@arrl.org**

New Mexico: Bill Kauffman, W5YEJ, 1625 36th St SE, Rio Rancho, NM 87124-1719 (505-349-0460); **w5yej@arrl.org**

Utah: Mel Parkes, NM7P, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); **nm7p@arrl.org**

Wyoming: Garth Crowe, N7XKT, 1206 Avalon Ct, Gillette, WY 82716-5202 (307-686-9165); **n7xkt@arrl.org**

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

Alabama: David Drummond, W4MD, 5001 Lakehurst Dr, Northport, AL 35473 (205-339-7915); **w4md@arrl.org**

Georgia: Gene Clark, W4AYK, 1604 Lynwood Lane, Albany, GA 31707 (229-888-1090); **w4ayk@arrl.org**

Northern Florida: Paul L. Eakin, KJ4G, PO Box 625, Panacea, FL 32346 (850-591-0442); **kj4g@arrl.org**

Puerto Rico: Rene Fonseca, NP3O, HC 67 Box 15593, Fajardo, PR 00738 (939-579-4134); **np3o@arrl.org**

Southern Florida: David Fowler, K4DLF, 2702 Starwood Ct, West Palm Beach, FL 33406-5145 (561-676-3007); **k4dlf@arrl.org**

Virgin Islands: Fred Kleber, K9VV, PO Box 24275, Christiansted, VI 00824-0275; **k9vv@arrl.org**

West Central Florida: Dee Turner, N4GD, 10132 64th St N, Pinellas Park, FL 33782 (727-548-7474); **n4gd@arrl.org**

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

Arizona: Thomas J. Fagan, K7DF, 10650 E Bridgeport St, Tucson, AZ 85747-5925 (520-574-1129); **k7df@arrl.org**

Los Angeles: David Greenhut, N6HD, 5260 Darro Rd, Woodland Hills, CA 91364-1933 (818-992-5507); **n6hd@arrl.org**

Orange: Carl Gardenias, WU6D, 20902 Gardenias St, Perris, CA 92570 (951-490-2270); **wu6d@arrl.org**

San Diego: Stephen M. Early, AD6VI, 4724 Maple Ave, La Mesa, CA 91941 (619-461-2818); **ad6vi@arrl.org**

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

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

North Texas: Walt Mayfield, KE5SOO, 305 Broken Arrow, Krum, TX 76249-7502 (940-368-4659); **ke5soo@arrl.org**

Oklahoma: Kevin O'Dell, N0IRW, 1405 N 7th St, Perry, OK 73077-2206 (580-220-9062); **n0irw@arrl.org**

South Texas: Lee H. Cooper, W5LHC, 2507 Autrey Dr, Leander, TX 78641 (512-260-7757); **w5lhc@arrl.org**

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Steve Ford, WB8IMY, upfront@arrl.org

Ham Holiday in Oklahoma City

Ham Holiday is one of the premier Amateur Radio gatherings in Oklahoma. Held annually in late July, Ham Holiday draws more than 1000 amateurs from across Oklahoma, as well as from Texas, Kansas and Arkansas. This year ARRL President Kay Craigie, N3KN, joined the festivities.

Kay Craigie, N3KN, and Dr David Woolweaver, K5RAV, visit International Crystal. [Darrell Brehm, WA3OPY, photo]

Stacey Weddington, Director of Development for the Oklahoma City National Memorial, points out to Kay various elements of the National Memorial. In the background are some of the 168 chairs representing the victims of the Murrah Federal Building bombing. [Dr David Woolweaver, K5RAV, photo]

Kay toured the city with the first stop being the Oklahoma City National Memorial. Kay and ARRL West Gulf Division Director Dr David Woolweaver, K5RAV, were escorted by Thomas Webb, WA9AFM, the Oklahoma Assistant Section Manager. Stacey Weddington, Director of Development for the National Memorial, took the group on a guided tour of the grounds. Kay was introduced to the various areas and displays that recall the events of the Murrah Federal Building bombing on April 19, 1995.

Lunch was followed by a tour of International Crystal conducted by Darrell Brehm, WA3OPY, who is the company's engineering manager.

Satellites on the Beach

ARRL Contest Branch Manager Sean Kutzko, KX9X, made a contest expedition to Puerto Rico for the 2011 ARRL November CW Sweepstakes and brought along a handheld transceiver and an Arrow dual-band Yagi antenna to in order to work some FM satellites. Handing out grid square FK68 from Islota on the northern coast, Kutzko made 24 contacts on three passes of the AO-27 satellite.

"As a seasoned HF and VHF contester and DXer, I was skeptical about the enjoyment level of operating the FM birds. However, I was wrong!" said Kutzko. "Ever since getting turned on to the FM birds in July 2011 by Steve Ford, WB8IMY, I've been having a good time with them. My setup is extremely portable and chasing grid squares on the birds is a lot of fun. I'm working on my Satellite VUCC award and have worked 80 grids from my Connecticut home grid of FN31. Being the DX and handing out juicy grids on the FM satellites is just as enjoyable as doing so on 6 or 2 meters over terrestrial paths, and the pileups can be pretty intense. Keep your mind open to other venues for enjoying Amateur Radio; you might be missing out on something that's a lot of fun!" [Ward Silver, NØAX, photo]

Put a Ribbon on It!

Amateur Radio is thriving at Cal Poly. On September 15 the California Polytechnic Amateur Radio Club held a ribbon cutting ceremony for the club's impressive new telescoping tower. [Marcel Stieber, AI6MS, photo]

Seeking Shelter from the Sunshine

Dave Bell, W6AQ, makes the best of a blazing hot Field Day on the shores of Lake Michigan by operating under the protection of "Hiram." (The umbrella promotes the college, not the first ARRL President. No doubt a coincidence!) Dave banged out a number of contacts with just an Elecraft KX1 transceiver and a 26-foot piece of wire. See the complete 2012 Field Day results in this issue. [Alice (Sam) Bell, W6QLT, photo]

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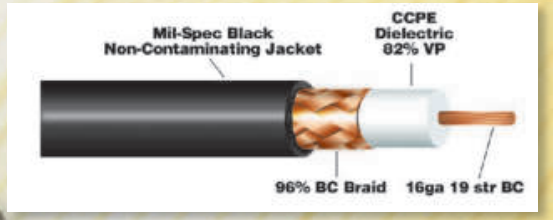

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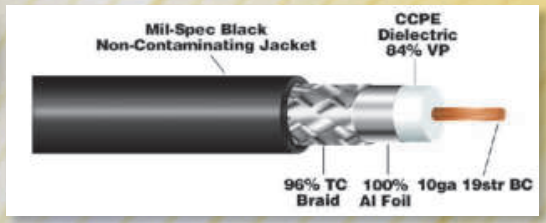

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• 3.3dB @ 450MHz	0.69kW	47.3%

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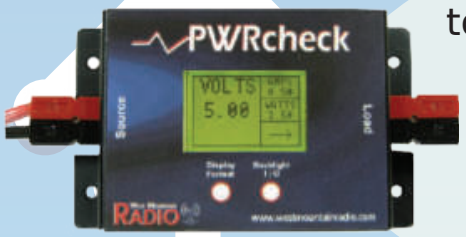

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Letters from Our Members

Plagiarism Is Theft

The comments made by ARRL Chief Executive Officer David Sumner, K1ZZ, were heartwarming in more ways than one ["It Seems to Us: Supporting Those Who Support Us," Nov 2012, page 9]. To me, however, his comments about intellectual property hit the nail squarely on the head. Allow me to elaborate.

My website — **www.k0bg.com** — seems to have become a Mecca for mobile operators. While I do appreciate the numerous e-mails thanking me for my efforts, I am a firm believer that information sharing is an important part of Amateur Radio. It is, for sake of a better word, Elmering! For this reason, I have given permission to other organizations to republish parts of my website on many occasions. To me, it's a win-win situation. Unfortunately, there are two sides to every coin.

Early last year, I purchased a booklet on mobile operation in hopes of garnering some insight or tidbit to pass along to my site visitors that I might have missed. What I found nearly caused an apoplectic attack! Whole paragraphs — and in one case, nearly a whole article — were re-published word-for-word! By any definition, that's stealing. The sad part is that if the author had asked, I would have happily given him permission to publish, as long as he mentioned where he got the data. And like Tom Wagner, N1MM (as mentioned by David), I chose not to pursue the issue. After all, the information is really generic, but that fact alone doesn't excuse plagiarism.

Alan Applegate, KØBG
Roswell, New Mexico

Mobile Maneuvering

The article by John Schwarz, WA9AQN, presents an issue which we, as a community, have to face ["Distracted Driving and Amateur Radio — A Civil (Law) Perspective," Nov 2012, pages 81-82]. I fear that common sense will not prevail in all states. I have done hands-free telephone conversations while driving and, of course, amateur repeater conversations. I can safely testify in my own opinion and experiences that I am not nearly as emotionally engaged or distracted with the repeater as I am the telephone. If traffic or conditions get bad, I can sign off with my call sign and drop the microphone. Perhaps it is because I tend to keep my repeater conversations brief and allow time after the tail tone for other stations to break in. We are amateurs, but only because we can't be compensated for our services, but we are professionals in many ways. Our full legal power is higher than a many college broadcast stations.

I, for one, enjoy mobile operation. The traffic is awful in my area and mobile operation makes the otherwise boring and nerve-wracking commute much less stressful, especially when I am sitting in traffic jams. I would like to see a specific element of questions on the Technician exam that deal with the proper safety in mobile operation, as well as the importance of proper mobile installations. This could include important factors such as not blocking airbags or views and keeping things sturdy.

Many newer hams want to know how to do a proper and safe mobile installation, and they are at the mercy of another amateur to assist them. Perhaps we would leave a better impression and have something to present in our favor when laws are being enacted if we could demonstrate that these safety issues are addressed on our examinations. As a community, I would think that we should also give good example and not give any negative impressions on our end. This would include making sure that our mobile installations are safe and staying off the air when traffic conditions are unfavorable.

Chris Ruhl, N3GBJ
Collingdale, Pennsylvania

In Pursuit of Friendship

Jay Kolinsky, NE2Q, really hit a home run with me ["Op-Ed: "How Many Friends Did You Make?" Oct 2012, page 99]. I'll chase DX, maybe even hand out a few points in a contest, but I love a good ragchew; I really enjoy really getting to know the other ham. Some of the best times that I've had on the air have been when another ham and I have yakked for over an hour, until it got so late we had to stop because we were both falling asleep!

In the process, I've made some good friends, including one in South Korea; we even exchange pictures of our families and chat via e-mail when the bands are poor. Another ham in France, while wading through a pile up, took the time to yak a little with each of us about the weather and such. I've had the same experiences with hams in New Zealand, Hawaii, Canada and even here in the US; our QSOs are so special that it's always a pleasure when I hear their calls out there. We talk about the weather and our stations, then it's on to our age and how many years as a ham, our family, our occupations and other hobbies until it's time for dinner, bed or the dog needs to go out. After these contacts, I have a grin on my face as I tell my wife, "I met this really cool guy on 20 meters tonight." Be it across town or halfway around the world, it's always a thrill.

Joe Falletta, W6UDO
San Diego, California

■ Jay Kolinsky, NE2Q, questions the value of rapid-fire exchanges with no attempt to make friends with the operator on the other end. From the tone of his article, it is almost as if Jay is saying that if you are not taking the time to really get to know the operator on the other end, you are not making the best use of the spectrum space that has been allotted to us. The beautiful thing about our hobby is that short of rude or inconsiderate on-air behavior, there is no wrong way to do Amateur Radio.

Some people enjoy the pursuit of "wallpaper," or adding mode and band endorsements to their DXCC or other certificates. Some people enjoy bouncing signals off the moon. Some people enjoy seeing how far their signals can travel with as little power as possible. Some people get their license to participate in emergency or public service communications. And yes, some people even enjoy contesting!

Jay makes references about how these contest-style types of contacts do not prove anything other than how long you can sit in a chair. Not every aspect of Amateur Radio is about stroking one's ego or proving anything. Amateur Radio is a very personal endeavor for me. Except for those times when I chose to participate in a contest, I come into the shack to relax with no specific goals in mind. Any time I can operate my station and contact another Amateur Radio operator, it is a successful day. If I can add a country on a new band or mode, that is just an added bonus.

Today alone, I contacted stations in the Isle of Man, Hungary, Belgium, Russia, Spain, France and Greece — and I can't tell you much about those operators other than their name. Did I make any friends today? By Jay's definition, probably not. Did I enjoy myself and make good use of the spectrum? Absolutely!

Scott Schultz, NØIU
Wentzville, Missouri

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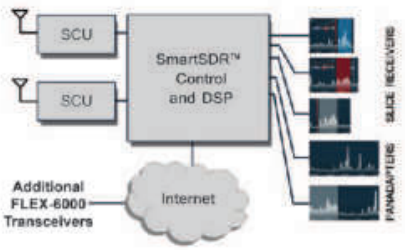

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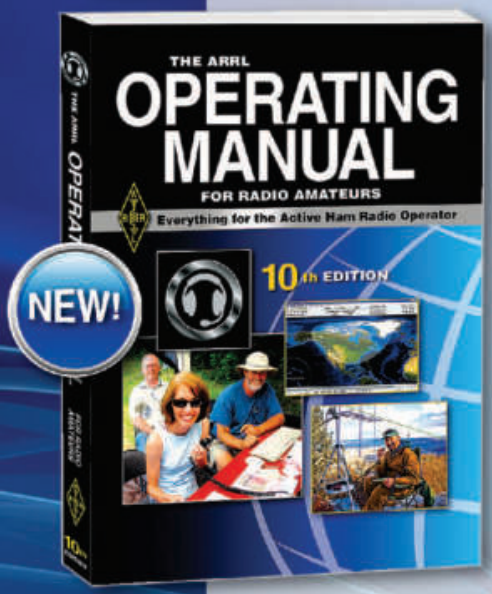

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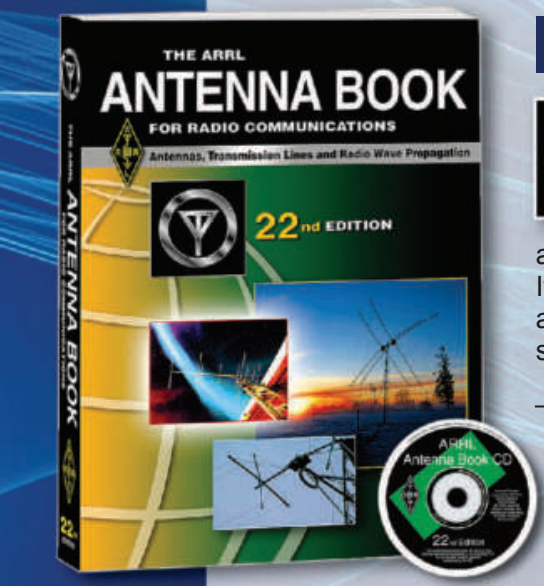

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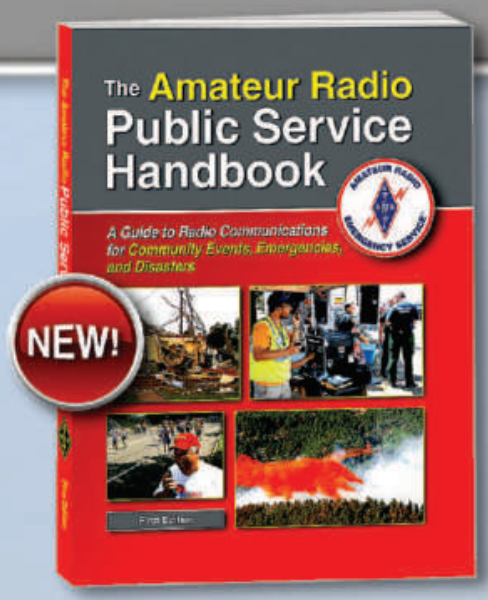

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Delta Loop Collinear Antennas

If one delta loop is good, more can be even better.

James K. Boomer, W9UJ

The full-wave delta loop antenna has been described in detail in the Amateur Radio literature.[1,2] We can get substantial directivity gain by building multielement delta loops in Yagi configurations. We can also get substantial directivity gain by stringing two or more full-wave delta loops end to end, forming a collinear array and feeding the loops in phase. These arrays are easy to build, and their bidirectional pattern provides usable gain over a single loop. While the peak response on harmonics is at higher than optimum angles, there is still usable gain at low angles.

Configuration of the W9UJ Two-Element Delta Loop Collinear Array

In 1994 I put up a two element delta loop collinear array that is still up there. I am blessed with 90 foot tall oak trees, and have room for a 40 meter, two-element collinear array tied between two of them (See Figure 1). The ends of the array are about 80 feet above the ground, with the center at about 70 feet. This antenna has been an excellent performer. It also performs well on harmonics of 7 MHz, which gives me 20, 15 and 10 meter coverage.

Construction

Selecting the proper wire is the key to wire antenna longevity. I have had the best luck with #12 AWG solid copperweld (copper plated steel) wire. It's a challenge to work with, and you have to be careful not to kink it, but I find it well worth the effort. [Some find stranded copperweld a good compromise that is more flexible and easier to work with. — *Ed.*] Of course, you can use larger gauge copperweld for longer antennas.

Wire Length

I calculated the delta loop wire length using the usual quad loop formula, L (feet) = 1005/f(MHz). At a design frequency of 7.025 MHz, this results in 143 feet of wire per loop, or a 47 foot 8 inch length of wire on each of the three sides of an equilateral triangular delta loop. I had sufficient space to separate the loops by 23 feet 10 inches, however, you can separate them further if you desire.

To anchor the ends of the array, I ran a length of #12 AWG copperweld wire from each end insulator to the tree branch, threading it through a length of garden hose around the tree branch to keep the wire from embedding the tree. You can also use a large screw eye, instead of the garden hose approach. I did a standard wire wrap, being careful not to nick the wire. I also left enough sag in the system to avoid breakage in high winds. You can use any strain relief method you desire.

Antenna Feed Subsystem

For maximum weather and aging resistance, I used a coaxial cable feed system with a balun connected to each loop's apex feed point. I used 1:1 voltage baluns because I had them on hand, but I strongly recommend 1:1 current baluns, which provide superior current balancing performance and have less loss than voltage baluns.[3]

My feed apexes are some distance from the station feed line entry point, so I needed to use a length of transmission line from each loop to that entry point.

A half wavelength, or a multiple of a half wavelength of transmission line is a 1:1 impedance transformer, and the input impedance of each of my delta loops is about 150 Ω at the design frequency.[4] I used a half wavelength of coaxial cable from each loop balun to the station lead-in entry point outside the house. Since the impedance looking into each of the half wavelength lines is about 150 Ω, simply terminating the two lines in a coaxial T connector results in a 75 Ω impedance looking into the third port of the T connector. With the same length line to each loop, this provides the required in-phase feed for the two loops.

In addition, I used hooks under the rear eave of the house to support the half wavelength coaxial feed cables from the two loop baluns. Then I simply connected the coax T to them, and to the lead-in coax, which routes through the attic, down the inside of a wall and into the station.

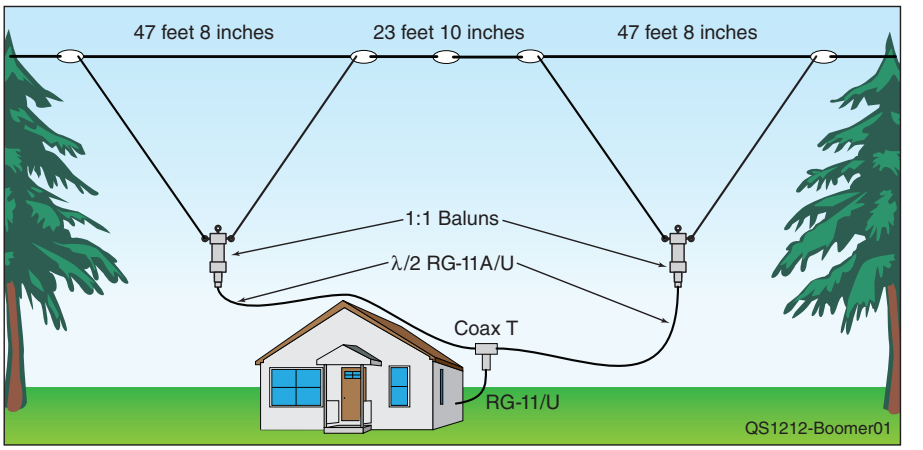

Figure 1 — The W9UJ two element delta loop collinear antenna array.

[1]Notes appear on page 34.

The physical length of a half wavelength of transmission line is calculated as $L\ (\lambda/2) = (491.8/f) \times V_F$, Where, L is the length in feet, f; the frequency in MHz and V_F is the relative velocity factor of the transmission line.[5]

You can use 50 or 75 Ω coaxial cable for the half wavelengths, or multiples thereof, and for the lead-in to the station. I used RG-11A/U 75 Ω coax since I had it on hand, but RG-11 (Belden 8238) will work just fine. Also, RG-213 (Belden 8267) is a good 50 Ω coax choice. The velocity factor of both of these cables is 0.66, so, a half wavelength of either of these cables is 46 feet 2 inches at 7.025 MHz. The matched loss in each half wavelength cable is about 0.2 dB at 7 MHz, and 0.6 dB at 30 MHz, which is reasonable.[6] The additional loss due to SWR is small, since the modeled SWR at the T connector is reasonable on all bands.

The stability and weatherproof characteristics of coaxial cable systems are hard to beat, but you can also use balanced transmission lines from the loop apexes to the station or its lead-in entry point. Remember, however, that snow, ice, rain, soiling and aging (in the case of window line) change the characteristic impedance and may increase the loss in these lines.

Ladder line has a velocity factor of 0.95, so, the physical length of a half wavelength at 7.025 MHz is 66 feet 6 inches. The loss in a half wavelength of this line is about 0.1 dB at 30 MHz. You can also use open-wire line (wire with spacer insulators), which has extremely low loss and a velocity factor of 0.97.

Insulators and Connections

Figure 2 shows how to string the wire through the end insulators. I used a wire tie to insure that the insulator stayed at a fixed point on the loop. Do this at each end of each loop's flattop and solder the wire wraps (four places total). Be careful not to nick the wire.

Use porcelain or similar insulators for each loop feed point. Thread each end of the loop through each end of the center insulator, loop it back and carefully twist the wire around the loop wire to secure it. Use a short length of wire to hang the balun from the center hole in the center insulator. Then, you can make the connections from the balun to each end of the loop wire, leaving a small "drip loop." Solder all loop wire terminations and wraps. To achieve in-phase feed, be sure that you connect the two baluns' terminals to like ends of the loops' center insulator terminations. Use coax connector sealant on all coaxial cable connections, to protect them from the weather.

If using balanced transmission line, connect the balanced transmission line directly to the loop center insulators, using appropriate strain relief (see below). Make sure you connect the lines so that like ends of the loops are connected in phase. That is, the left and right ends of one loop's center insulator terminations need to be electrically connected to the corresponding left and right ends of the other loop's center insulator terminations when the two transmission lines are paralleled at the station lead-in entry point, as described below.

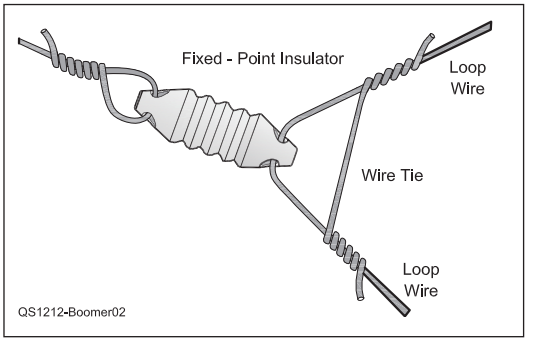

Figure 2 — The use of ties at the corner insulators, as shown, keeps the corners in place.

Use a center insulator intended for the application that provides the required strain relief, such as the Ladder-Lock center insulator for window line (available from most dealers). Also, use appropriate anchors for the transmission line at the station lead-in entry point. In the case of window line, I use the plastic beverage/ladder line standoff insulators (available from Radioware in packages of 25). At the station lead-in entry point, connect the ends of the balanced transmission line together in parallel. Make sure you connect the wires to maintain the in-phase feed. If you elect to connect your equipment to the balanced line, simply splice the required length of transmission line lead-in to the point where the transmission lines from the loops are paralleled. Use a 75 Ω transmission line (75 Ω transmitting twin lead) to minimize VSWR in the station area, since the impedance looking into the paralleled half wavelengths or multiples thereof is about 75 Ω at the design frequency.

For the coaxial cable feed to the station equipment, install a 1:1 current balun at the station lead-in entry point by connecting the paralleled transmission lines to the balun terminals, and running coax to your equipment. You can also use 50 Ω coax if you desire with negligible performance difference.

Loop End-to-End Separation

The loop end-to-end separation is not critical, with increasing gain as the separation increases, until after about ½ wavelength the pattern starts to fragment as shown on 15 meters in Figure 4 (C). At 67 feet separation, for example, the 40 meter 15° elevation gain increases by almost 3 dB. This is obviously a trade off depending on how clean a pattern you want on each band. I used an egg strain insulator in the middle of the section of wire separating the two loops. You may need more strain insulators, depending on how far you separate the ends of the loops. Space the strain insulators at about 14 feet or less to avoid resonance at any operating frequency up to 30 MHz.

Three Element and Four Element Delta Loop Collinear Array Geometry and Feed

The geometry is similar to the two loop array, with the three or four elements positioned end to end and fed in phase. Note that the nominal resonant impedance looking into the combined (paralleled) half wavelength, or multiples of a half wavelength, transmission lines from the loop feed points will be 150/3 = 50 Ω for the three element array, and 150/4 = 37.5 Ω for the four element array. So combining the transmission line inputs will make a nominal 1:1 VSWR match for 50 Ω coax lead-in to the station for the three element array and 1.33:1 VSWR for the four element array.

Performance:

The standing wave ratio (SWR) of my array

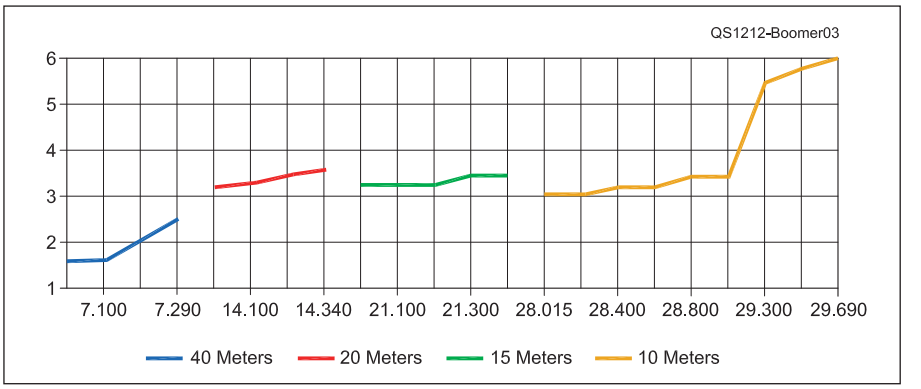

Figure 3 — Measured SWR of two element delta loop collinear array.

Table 1
Two, Three and Four Element Delta Loop Collinear Array Performance Data

Elements	Frequency (MHz)	Elevation Angle (°)	Intensity (dBi)	Beamwidth (°)
1	7	30	6.4	92
1	7	15	3.7	85
2	7	30	8.4	55
2	7	15	5.7	50
2	14	50	9.5	38.4
2	14	15	7.9	26
2	21	45	6.9	26
2	21	10	5.4	22
2	28	60	9.7	24
2	28	10	7.2	12
3	7	15	7.4	33
3	14	15	9.6	16
3	21	10	7.0	13.8
3	28	10	9.0	6.8
4	7	15	8.6	25
4	14	15	10.8	12
4	21	10	8.2	10
4	28	10	10.1	3.4

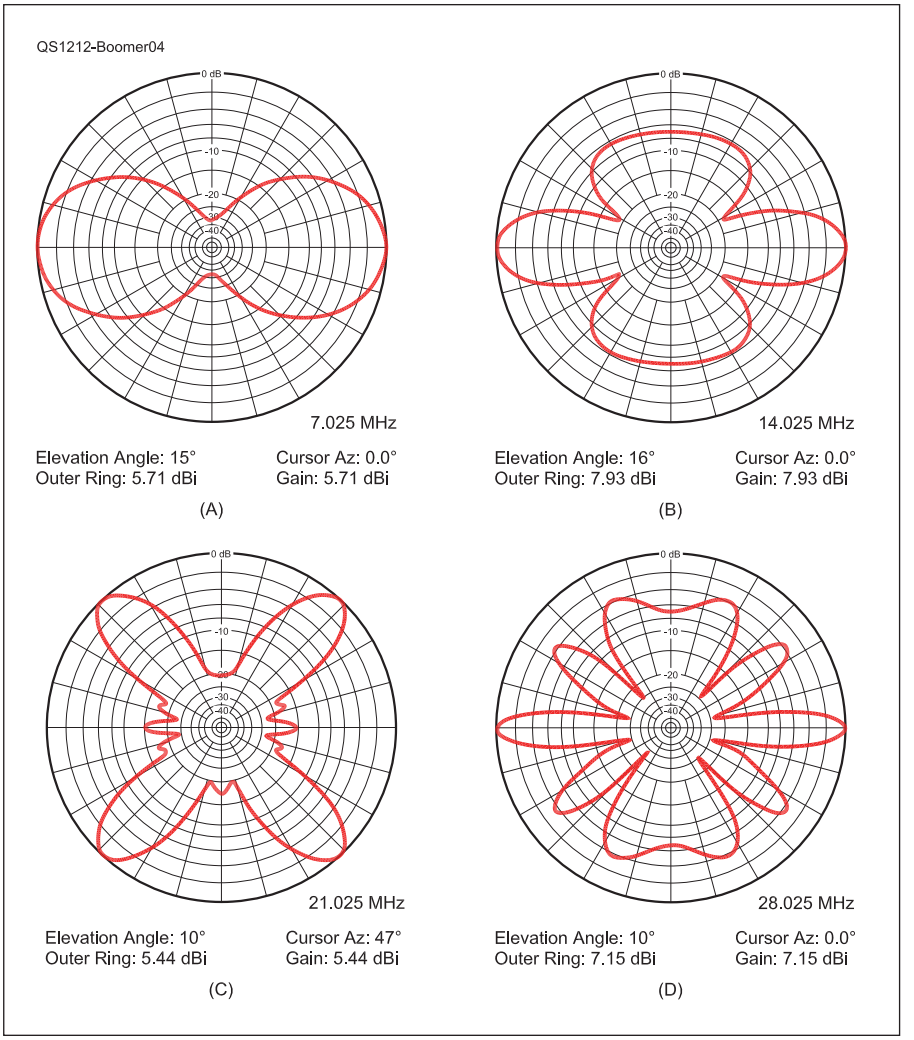

Figure 4 — Azimuth plots of the two element delta loop collinear on the 7- (at A), 14- (at B), 21- (at C) and 28-MHz (D) bands. For 40 and 20 meters, the azimuth pattern at 15° elevation is shown, while 10° was used on the two higher bands, corresponding to the Table 1 data.

(see Figure 3) permits the use of a modest antenna coupler to achieve a very low SWR at the transmitter/receiver. The two element delta loop collinear antenna directivity patterns are shown in Figure 4.

The key two, three and four element delta loop collinear array performance data are shown in Table 1 in comparison with a single delta loop. The three and four element arrays provide more gain as expected. Their radiation patterns are similar to the two element array, but the lobes (beamwidths) are narrower, since the gain is greater. If you have some flexibility on positioning one of these arrays, you can set the system up to have particular lobes aimed at selected station locations.

Notes

[1]F. Koontz, WA2WVL, "A Quad Loop Revisited," *QST*, May 2006, pp 39-40.
[2]W. Orr, W6SAI, and S. Cowan, W2LX. *The Radio Amateur Antenna Handbook*, Radio Publications, Inc.
[3]W. Maxwell, W2DU, *Reflections II Transmission Lines and Antennas*, 2nd Edition, Chapter 21, "Some Aspects of the Balun Problem." Worldradio Books,
[4]*The ARRL Antenna Book,* 22nd Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.
[5,6]See Note 4.

James K. (Jim) Boomer, W9UJ, has been licensed since 1947. He is active on 40 through 10 meters. Jim holds a BSEE degree from the University of Nebraska, and retired in April 2000 after 46 years in the electronics business.

He was a radio design engineer and project engineer at Collins Radio Company from 1954-1964. While at Collins, he was the project engineer on their 62S-1 VHF Converter for the Collins S-Line amateur radio equipment. He took a leave of absence from 1954 to 1957 to serve in the United States Air Force as a jet fighter pilot and instructor pilot.

From 1964 to 1966, Jim was employed at The National Cash Register Company (NCR) where he was project engineer on UHF rescue beacons and a state-of-the-art UHF Homing Receiver for NASA's early space shots.

From 1966 until 2000, Jim was employed at The Magnavox Company (now Raytheon) as senior staff engineer, project engineer, engineering section manager and marketing product manager. He was project engineer on the AN/URC-64 state-of-the-art survival radio used by airmen in Vietnam among other projects.

Jim can be reached at 4031 Dalewood Dr, Fort Wayne, IN 46815 or at **jkboomer1@frontier.com**.

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Super Simple Digital Voice Keyer

Save your voice by using your PC's sound card and two components.

Jack Morgan, KF6T

It is nice to have your computer do your talking for you, especially during long SSB radio contests. The audio output from your sound card is managed by most logging programs and will play prerecorded messages at the appropriate time in a contest sequence. You then need a way to interface the PC audio to your radio while still keeping the microphone active. Sound card output levels are usually too high for most transceiver microphone inputs and often have no chassis ground reference. PC audio attenuated through a simple resistive network may be corrupted by ac hum and RF because of this poor ground. An isolation transformer is required in this situation.

A successful universal interface must thus meet three requirements:

- It must provide proper audio level/impedance matching.
- Ground isolation between the PC and radio must be provided.
- It needs to mix the microphone and PC audio streams at appropriate levels so both can be used.

Fortunately, these requirements can be met with only two components — a potentiometer (pot) and an audio transformer. This interface is designed to work with a radio designed for a low impedance (dynamic) microphone. The keyer interface circuit is shown in Figure 1.

The pot provides a quick and convenient way to adjust the PC sound card output during operation. You could eliminate the pot but then you would have to exit your logging program to get to the level set controls in your PC to vary the output level.

The audio transformer serves three functions. It provides audio ground isolation, impedance (voltage level) matching and PC/microphone audio mixing. The low impedance secondary provides the transformation and also allows the microphone audio to pass through the secondary unattenuated while mixing with the PC audio.

The microphone jack is a shorting type so the interface will still pass the PC audio if the microphone is unplugged.

Construction

The interface components fit comfortably in a 3 × 2 × 1 inch plastic project enclosure. A metal box would actually be a problem because no external ground connection is wanted here. As long as the leads are short, stray pickup is not a problem. The interface layout is shown in Figure 2. All the parts are available from RadioShack.

The two shielded mono cables are actually cut from one six foot audio patch cable with ⅛ inch male connectors on either end. You

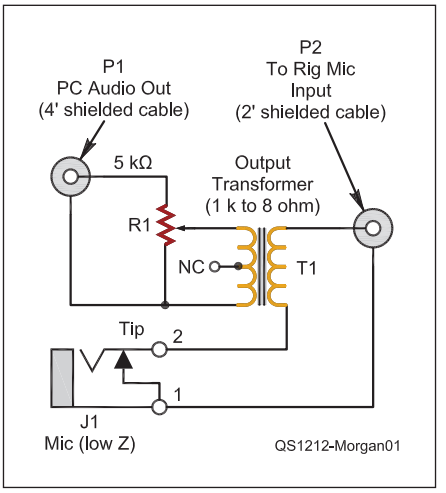

Figure 1 — Schematic diagram and parts list of the simple voice keying interface.

J1 — Mono jack for microphone input. To match microphone plug or ⅛ inch audio type (RadioShack 274-0248).
P1, P2 — Phono plugs made from preassembled audio cable to match sound card and radio MIC jack (see text).
R1 — 5 kΩ audio taper potentiometer (RadioShack 271-1720).
T1 — Audio output transformer (RadioShack 273-1380).
Project enclosure box, 3 × 2 × 1, (RadioShack 270-1801).

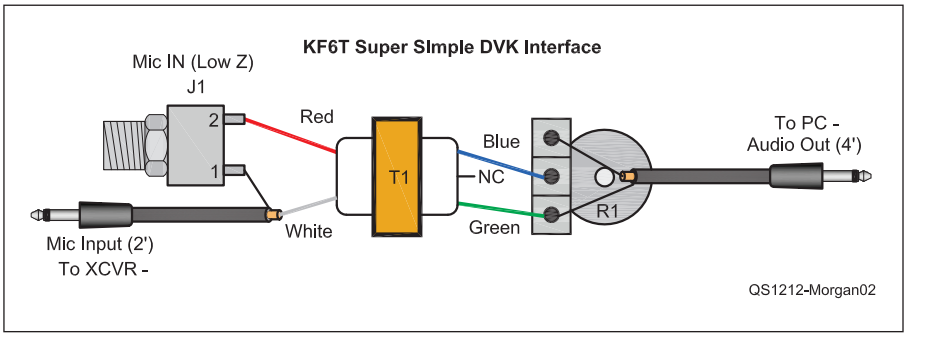

Figure 2 — Pictorial layout showing connection arrangements.

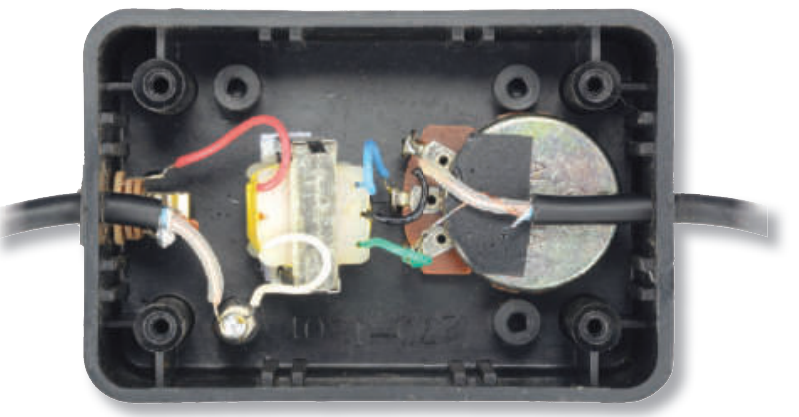

Figure 3 — Inside view of keyer in project box showing assembly technique. The black wire is not connected.

Figure 4 — Front view of box. The nominal box bottom serves as the front panel.

can decide how long to make each segment depending on where the box is going to be located. I made the transceiver side shorter and placed the box next to the radio.

Figure 3 shows the final details of the interface box construction. The output transformer is secured to the bottom of the box with some double-sided tape with the primary side facing the pot. The output cable center conductor is soldered to a solder post threaded into one of the "bosses" molded in the bottom of the box. A small piece of electrical tape is placed on the body of the pot to insulate the input cable ground. Both cable holes in the box walls are sized to hold the cables in place. You might add a drop of epoxy to further secure them.

The box lid becomes the bottom — you can add some rubber feet if you wish. The unit is shown ready for use in Figure 4.

ARRL member Jack Morgan, KF6T (ex W1FEA), was first licensed in 1955 and currently holds an Amateur Extra class license. Jack started working at the ARRL designing projects for *The ARRL Handbook* while working toward his BS and MSEE degrees. He subsequently worked at Eimac and Varian before starting his own Silicon Valley company. After retiring, he started teaching computer technology at a local high school. Jack has been president of the Northern California Contest Club and was voted 2011 NCCC Contester of the Year.

You can reach Jack at 2040 Pheasant Hill Ln, Auburn, CA 95602 or at **jackmorgan.usa@gmail.com**.

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PSK31 Operation on 2 Meter FM

PSK31 isn't just for HF — try it on 2 meters for local keyboard-to-keyboard communication.

Dave Holdeman, N9XU

Several years ago, Benny, W9CZA (SK), and I experimented with PSK on 2 meter FM. We each cobbled together a simple interface of our own design and made contact on simplex using one or two packet frequencies that were not in use in our area. Later on we convinced other club members to join us and we formed a 2 meter FM PSK net.

While PSK on FM worked very well with one or two operators, setting up our transmit levels became a problem as the net grew larger. The net control manager would transmit a carrier and each of the other participants would report back to net control his intermodulation distortion (IMD) reading as indicated by their PSK software. The net control manager would adjust his PSK drive level until the participants read the IMD about –21 or –22 dB at their stations while watching their screens for any spurious sidebands. Each participant in turn would transmit a carrier back to net control and he would do the same, relating to each participant his IMD level and having each one adjust his transmit drive level. Since we had to repeat this procedure every time the net convened, this method became very time consuming and the net died a slow death.

The Need for Speed

Recently I decided to resurrect the net and speed up the check-in process. Since we were all using contemporary FM gear, unlike HF equipment, our FM equipment had no automatic level control (ALC) or output power indicator that would allow us to set transmit drive levels in an instant. Also, none of our FM gear had an auxiliary data port so we had to feed our PSK signal into our MIC jacks. We needed the ability to set PSK transmit drive levels rapidly — and prior to commencing net operations. I decided to experiment using an old computer and three sound cards from different manufacturers.

What I Found

The most significant thing I noticed was that my sound card had a left and a right channel output at the SPEAKER and/or LINE OUT jack. Two sound cards had LINE OUT jacks, but no SPEAKER jacks. One had a LINE OUT jack that could be changed to a SPEAKER jack by moving a jumper. Since I only needed a monaural signal at the MIC input of my FM transceiver, half of the stereo signal was still available. I decided to build a simple level monitor with this unused signal and found that adjusting the speaker or line out level using the PSK software changed the level of both left and right channels simultaneously. This turned out to be a good feature that I took advantage of in my design.

I also assumed that the sound card speaker output impedances were 8 Ω and the microphone and line inputs and line outputs were 500 to 600 Ω.

The Design

The computer I use for 2 meter FM PSK has an embedded sound card equipped with both line and speaker outputs. I chose to use the 8 Ω speaker output to drive my level monitor as the 8 Ω jack has a higher output than the line out jack, plus the microphone jack in the VHF transceiver already receives its signal from that source.

The level monitor is pretty simple. The sound card SPEAKER jack feeds a Y or two-way splitter. In Figure 1 the Y is shown as part of the interface. It can also be seperarate. One leg of the Y (right channel) feeds the transceiver microphone jack via an 8 Ω to 500 Ω impedance matching transformer and attenuator. This is not part of the level monitor, but is part of the interface and is shown for information only. The second leg of the Y (left channel) feeds the level monitor that consists of a step-up transformer with an 8 Ω primary winding, a calibration potentiometer, a bridge rectifier and a microammeter. These compo-

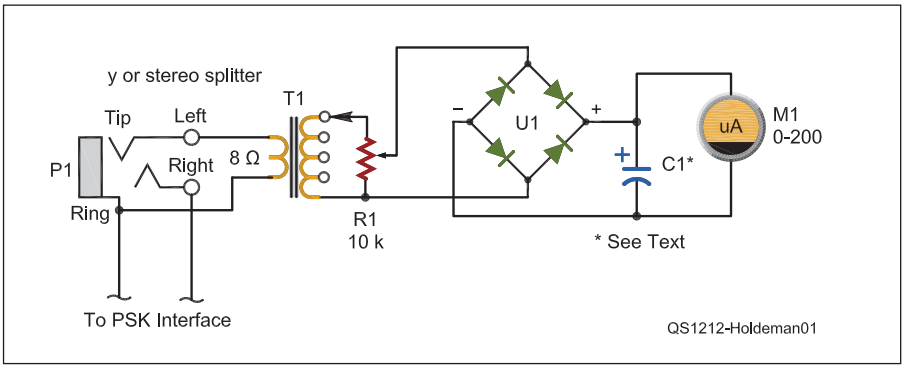


Figure 1 — Schematic diagram and parts list for the signal level monitor.

C1 — 10 V electrolytic capacitor, 220 to 1000 µF.
M1 — Meter, typically 200 µA full scale.
P1 — Connector to match sound card speaker or line output. The typical is a ⅛ inch stereo plug, as shown.
R1 — 10 kΩ, audio taper potentiometer.
T1 — Transformer, 70.7 V to line. Fry Electronics MT2570, or equivalent.
U1 — Low voltage bridge rectifier module, or four general purpose diodes wired as shown.

nents can be found at any Radio-Shack or radio parts dealer and the whole device can be put together in an afternoon. Any 0-50 or 0-200 µA meter will work and the parts layout is not critical. A schematic diagram of the level monitor is shown in Figure 1, and Figure 2 shows the monitor itself.

Construction

The stereo Y can be built into the patch cord or can be a separate item. All it has to do is provide a means of separating the left and right channels at the sound card speaker output. The step-up transformer is a 70 V speaker-to-line transformer connected backwards. It has sufficient taps that, along with the calibration potentiometer (pot), allow one to drive almost any microammeter full scale. C1 dampens the meter swing. After getting my prototype to work as desired, I purchased a *volume unit* (VU) audio level meter from Mouser Electronics (**www.mouser.com**) for the sake of appearance.

Figure 2 — Front view of the completed signal level monitor. [Dave Holdeman, N9XU, photo]

Initial Set-Up

Get on the air with a friend and transmit an unmodulated carrier. Using your PSK software, adjust the transmit level slider(s) until the other end sees no spurious sidebands and reports an IMD at least 22 or 23 dB below the carrier. Select the T1 transformer secondary tap and adjust the calibration pot for the desired swing of the output meter. Send some text or a macro and your friend should be able to copy your text clearly.

The meter will probably swing upward slightly as you send text. Make a final adjustment of the calibration pot and do not touch it again.

The next time you go on 2 meter FM PSK, transmit into a dummy load and use your software adjusters to bring the meter reading up to the same point. You should then be able to go back on the air without the need for further adjustments.

Net Operation

Our net meets every Wednesday at 7:30 PM local time on 144.900 MHz using FM voice mode. At the conclusion of the voice net, the net control operator calls the roll and determines who wishes to continue on, using PSK on FM. The participants switch to PSK31 on the same frequency and the net control operator calls the roll again and starts the net. While listening to stations, I prefer to keep my squelch at a minimum and my receiver audio gain as low as possible consistent with good copy. The audio output of my transceiver feeds a split pad with one leg feeding the sound card MIC IN jack, and the other leg feeding a speaker that can be switched off or on as desired. This is all part of my computer-to-radio interface. I usually keep my speaker turned off at this time and watch the screen.

Macros

While acting as net control operator, I find macros are very helpful. Along with the usual "brag file" and "bio" you can devise a few others depending on how you run your net.

I choose to leave most of my macros open ended. That way I can type in any added remarks such as "over to W9XXX" then click the receive button on the screen.

Conclusion

The PSK level indicator has speeded up net operation as it was intended to do. This is also a fine way of making good use of older computers and radio equipment. I am using an old 900 MHz desktop computer and an older Azden PCS4000 2 meter transceiver for this application.

Your radio does not need more than a few memory channels and does not need a tone encoder, so many older radios will work well. My Azden only puts out 25 W at the high power setting and 5 W at the low. After initial set-up, I find that I am using the 5 W setting for most of my FM PSK contacts.

Dave Holdeman, N9XU, was born and raised in Muskegon, Michigan. After graduation from Muskegon High School, Dave joined the US Army Signal Corps. He attended signal school in Ansbach, Germany and met his future wife, Christa, in Berlin while on temporary duty there. In the service he worked on BC-610 high power HF transmitters, BC-342 HF receivers and other radio and carrier systems.

After his army tour, Dave studied broadcast engineering. He received his FCC First Class Radiotelephone License and joined the staff of WONW-AM in Defiance, Ohio. After licensed engineers were no longer required at broadcast stations, Dave became a microwave communications craftsman at AT&T.

In 1958, Dave passed his Novice exam and received the call KN8OIO. Later he passed his Technician and General class exams and became K8OIO. In 1963 he was promoted to AT&T Chicago Engineering and received the call W9HJL. He now holds an Amateur Extra class license and is a member of the ARRL. You can reach Dave at 415 Barnaby Dr, Oswego, IL 60543, or at **holdex@att.net**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Strays

National Electronics Museum Needs Old *QST*s

The National Electronics Museum in Maryland has an extensive collection of *QST*s and lacks only a few issues for a complete set. The *QST*s needed to complete their collection are: January through July 1916; February, July, October and November 1917; all issues published in 1918; January through September 1919 and February, March, May and October 1920. The museum also collects back editions of the *Handbook*. Anyone who would like to make a tax-deductible contribution of these publications should contact Tom Ballard at **ballardt@verizon.net**.

QST Congratulates...

John Reisenauer, KL7JR, and Don Butler, N4UJW, on the publication of their new e-book *Proven Antennas*. The book is available at **www.hamuniverse.com/provenantennasbook.html**.

Mark J. Wilson, K1RO, k1ro@arrl.org

Elecraft KX3 HF and 6 Meter QRP Transceiver

A small self-contained transceiver with big features and performance.

Reviewed by Joel R. Hallas, W1ZR
QST *Technical Editor*
w1zr@arrl.org

The Elecraft KX3 is a nominal 10 W HF and 6 meter transceiver intended primarily for portable use. With its internal battery compartment and available miniature keyer paddles, it is ready to go from a campsite or picnic table with just the addition of an antenna (see Figure 1). Unlike many low power radios, in addition to CW, this transceiver can operate SSB, AM, FM and digital modes. As we will discuss, unlike many compact portables, it doesn't give up much in terms of features or performance in comparison to full-size high-end radios.

Honey, I Shrunk The K3!

Based on the photo, you could easily be forgiven for thinking that this is a miniature K3. The KX3's front panel is ⅔ the width of the K3's and about ⅞ the height, but the radio is only 16% of the depth of its bigger sibling. Interestingly, the display is exactly the same size and includes the same indicators as that of the K3. The KX3 is somewhat larger than the latest crop of CW-only portable transceivers, but it offers so much more.

What's In The Box?

To say that the KX3 is a direct conversion radio misses the point. It would probably be more descriptive to say that the KX3 is a high performance software defined radio (SDR) with a 0 Hz IF and quadrature component receiver processing that provides single-signal reception. The quadrature outputs are also directly available on a jack. Those signals allow a PC running your favorite SDR software to display the spectrum without the need for an accessory IF-to-quadrature transistor.

The box also includes multiple power supply options. The standard KX3 includes AA size battery compartments for eight cells, all within the box. There is also a connector that can be used to power the radio from a storage battery or a 13.8 V station supply. The radio includes special low voltage drop diodes that power the radio from whichever source has the higher voltage. An optional internal battery charger for NiMH batteries was not available at the time of the review, but is now shipping.

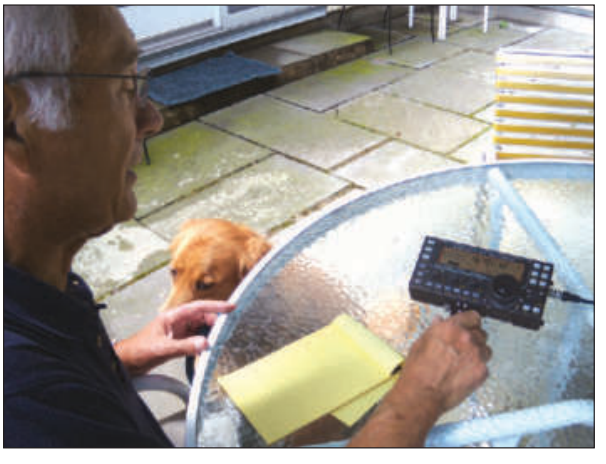


Figure 1 — The KX3's small size makes it a natural for camping or picnic table use. Here the author uses the KX3 in "minimalist" mode, using the internal battery and speaker with the optional paddles attached. Just the connection of an antenna has him on the air.

DSP Features Abound

The quadrature components allow the KX3 DSP (digital signal processor) to demodulate all modes on receive, and the processor also generates the required waveforms on transmit. The DSP also provides most of the other functions that you would expect on a high end transceiver.

The receiver DSP offers K3 style special effects if you listen with stereo headphones or a pair of speakers. A big surprise to me — while a separate subreceiver isn't available, the *dual watch* function allows listening to the signals from VFO A and B on different frequencies in each ear, just as if you had two receivers. The catch is that both frequencies have to be within the passband of the roofing filter, which can be opened as wide as 15 kHz — enough for most CW, and many SSB, DX split operations. For wider splits, you can toggle between the A and B, or reverse (REV) mode can be selected.

The receiver can drive its single internal 1 inch speaker, but I would consider that mainly a backup or trail solution. You will want the stereo capability of at least a pair of ear buds to appreciate the DSP features described above. For base or mobile applica-

Bottom Line

The KX3 offers a large measure of performance and features in a compact but workable enclosure. While it's a wonderful addition to a campsite or picnic table, the KX3 can also form the basis of a competent home or mobile station with the addition of the appropriate accessories.

tions Elecraft suggests the use of external amplified speakers to provide sufficient output. Another mobile option is to use the KX3 audio to drive the AUX AUDIO INPUT jack available in most recent vehicles.

The KX3 is transverter friendly. Up to nine transverter bands can be defined, each with different IF frequency range and output RF power level. The KX3 will then display the transverter's operating frequency on the main tuning dial with the capability to adjust the offset to compensate for transverter local oscillator error. The KX3 does not have separate transverter input and output connections, so the KX3 ANTENNA jack must be used.

Computer Connectivity

The KX3 connects to a computer through a serial connection via a 3.5 mm stereo socket. Elecraft provides your choice of a cable that connects to a computer USB port or an RS-232 socket. If you want both, you can have the other for an additional $29.95.

As with most of their products, the folks at Elecraft keep up with improvements in the feature set and bug fixes as often as needed. Downloading new firmware is easy from an Internet connected computer. The computer connection can also be used with the usual rig control, memory management and logging software. The logging program I tried didn't have a choice for KX3, but seemed to work fine by selecting K3 as the radio. It is possible to control a network connected KX3 from a PC running control software at a different location.

What's Not In The Box?

Every transceiver design is a compromise. With the KX3 offering so much, an obvious question is, "What is it giving up by being so small?" Of course, the first parameter is transmit power, but that's easy to fix. Similarly, the audio output power is low, but it's even easier to fix if circumstances require it. As noted in Table 1, there is not much that could be said to be missing in the performance area.

The most significant limitation that I could see in comparison to my K3 is the connectivity flexibility. Few external connections will be needed for operating on the trail. In fact, if you're operating CW with the optional paddles and have the internal batteries installed, ear buds and an antenna should be all you need. At home, it is a very different story, and the left side panel is likely to be fully utilized (see Figure 2).

Fortunately, during our review, the wizards at Elecraft figured out that they had a potential

Table 1
Elecraft KX3, serial number 0496

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: 0.31-32, 44-54 MHz; transmit excluded in some ranges (varies by country).	As specified. Transmit frequencies on unit tested, 1.7 to 2.7, 3-32, 44-54 MHz; watch band edges.
Power requirement: 8-15 V dc, 1-2 A typical in transmit; receive, 150 mA minimum typical (back lights off, preamp off, no signal).	Transmit, 2.35 A (10 W) at 13.8 V dc, 1.35 A 11.1 V dc (internal battery power); receive, 220 mA (no signal, max audio, maximum lights), 186 mA (no signal, max audio, no lights).
Modes of operation: SSB, CW, AM, FM, DATA.	As specified.
Receiver	**Receiver Dynamic Testing**
Sensitivity (MDS): –138 dBm typical (20 dB preamp); –140 dBm typical on 6 meters (30 dB preamp). Sensitivity decreases gradually below 1.5 MHz due to protective high pass filtering.	Noise floor (MDS), 500 Hz BW, 500 Hz roofing filter: *Preamp off/1/2/3* 0.475 MHz –81/–88/–98/–102 dBm 1.0 MHz –92/–98/–110/–113 dBm 3.5 MHz –121/–126/–137/–139 dBm 14 MHz –120/–125/–137/–139 dBm 50 MHz –120/–126/–137/–141 dBm
Noise figure: Not specified.	Preamp off/1/2/3: 14 MHz, 27/22/10/8 dB; 50 MHz, 27/21/10/6 dB.
AM sensitivity: Not specified.	10 dB (S+N)/N, 1 kHz tone, 30% modulation, 6 kHz bandwidth: *Preamp off/1/2/3* 3.8 MHz 8.70/4.21/1.27/1.00 µV 50.4 MHz 8.12/4.16/1.29/0.90 µV
FM sensitivity: Not specified.	For 12 dB SINAD, 3 kHz deviation, 15 kHz bandwidth: *Preamp off/1/2/3* 29 MHz 1.82/1.12//0.35/0.27 µV 52 MHz 2.51/1.24/0.40/0.29 µV
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz BW, 500 Hz roofing filter: *20 kHz offset, Preamp off/1/2/3* 3.5 MHz >131/>136/131/131 dB 14 MHz >130/>135/131/130 dB 50 MHz >130/135/131/132 dB *5/2 kHz offset, Preamp off* 3.5 MHz >131/131 dB 14 MHz >130/128 dB 50 MHz 130/129 dB
Reciprocal mixing dynamic range (500 Hz BW): Not specified.	14 MHz, 20/5/2 kHz offset: 120/119/114 dB.

ARRL Lab Two-Tone IMD Testing (500 Hz BW, 500 Hz roofing filter)*

Band/Preamp	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–20 dBm	–121 dBm	101 dB	+31 dBm
		–11 dBm	–97 dBm		+32 dBm
14 MHz/Off	20 kHz	–17 dBm	–120 dBm	103 dB	+35 dBm
		–10 dBm	–97 dBm		+34 dBm
		0 dBm	–73 dBm		+37 dBm
14 MHz/One	20 kHz	–25 dBm	–125 dBm	100 dB	+25 dBm
		–16 dBm	–97 dBm		+25 dBm
14 MHz/Two	20 kHz	–41 dBm	–137 dBm	96 dB	+7 dBm
		–29 dBm	–97 dBm		+5 dBm
14 MHz/Three	20 kHz	–44 dBm	–139 dBm	95 dB	+4 dBm
		–30 dBm	–97 dBm		+4 dBm
14 MHz/Off	5 kHz	–17 dBm	–120 dBm	103 dB	+35 dBm
		–10 dBm	–97 dBm		+34 dBm
		0 dBm	–73 dBm		+37 dBm

*ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, Third-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.
**Default values; bandwidth and cutoff frequencies are adjustable via DSP.

Receiver	Receiver Dynamic Testing
ARRL Lab Two-Tone IMD Testing (500 Hz BW, 500 Hz roofing filter)* (continued) *Band/Preamp* — *Spacing* — *Input Level* — *Measured IMD Level* — *Measured IMD DR* — *Calculated IP3* 14 MHz/Off — 2 kHz — –20 dBm — –120 dBm — 100 dB — +30 dBm –10 dBm — –97 dBm — +34 dBm 0 dBm — –72 dBm — +36 dBm 50 MHz/Off — 20 kHz — –17 dBm — –120 dBm — 103 dB — +35 dBm –11 dBm — –97 dBm — +32 dBm	
Second-order intercept point: Not specified.	*Preamp off/1/2/3* 14 MHz +75/+75/+69/+69 dBm; 50 MHz +69/+69/+49/+49 dBm.
DSP noise reduction: Not specified.	15 dB.
Notch filter depth: Not specified.	Manual notch: >70 dB. Auto notch: >70 dB, two tones, 55 dB. Attack time: 50 ms.
FM adjacent channel rejection: Not specified.	Preamp 3: 29 MHz, 85 dB; 52 MHz, 89 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, preamp 3: 29 MHz, 84 dB; 52 MHz, 84 dB. 10 MHz offset, preamp 3: 29 MHz, 99 dB; 52 MHz, 99 dB.
S-meter sensitivity: Not specified.	S9 signal, preamp off/1/2/3: 14.2 MHz, 242/87/29.6/9.76 µV; 50 MHz, 278/116/33.1/13.8 µV.
Squelch sensitivity: Not specified.	At threshold, FM, preamp 3: 29 MHz, 0.75 µV, 50 MHz, 0.33 µV.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth)**: CW (500 Hz): 322-788 Hz (466 Hz); Equivalent rectangular BW: 472 Hz; USB: (2.7 kHz): 125-2865 Hz (2740 Hz); LSB: (2.7 kHz): 125-2865 Hz (2740 Hz); AM: (8.4 kHz): 75-4059 Hz (7950 Hz).
Spurious and image rejection: Not specified.	Direct conversion, image of opposite sideband rejection, 72 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: 10 W PEP (160-15 meters), 8 W PEP (12-6 meters).	With 11-15 V dc, HF: CW, SSB, DATA, FM, 0-12 W (HF), 9 W (6 meters) typical; AM, 0-4 W (HF), 0-3 W (6 meters). With internal batteries (8.8-11 V dc), 0-5.5 W typical.
Spurious-signal and harmonic suppression: >50 dB.	HF, 48 dB (worst case, 1.8 MHz), typically >60 dB; 50 MHz, 65 dB.
SSB carrier suppression: > 50 dB typical.	53 dB.
Undesired sideband suppression: >55 dB.	66 dB (HF). 59 dB (50 MHz).
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order: HF, 10 W PEP, –30/–40/–51/–55 dBc (worst case, 12 meters), typically better than –36/–42/–54/–60 dBc. 50 MHz, 8 W PEP, –32/–54/–52/–51 dBc.
CW keyer speed range: Not specified.	9 to 52 WPM; iambic mode A and B.
CW keying characteristics: Not specified.	See Figures 3 and 4.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 44 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 30 ms; FM, 8 ms.
Composite transmitted noise: Not specified.	See Figure 5.
Size (height, width, depth): 3.5 × 7.4 × 1.7 inches; weight, 1.5 lbs (less options and batteries).	
Price: KX3, $899.95 (kit), $999.95 (assembled); KXFL3 dual passband roofing filter, $129.95; KXAT3 internal antenna tuner, $169.95; KXPD3 iambic paddle, $129.95; MH3 mic, $59.95.	

Figure 2 — The side panel of the KX3 is the location of all the external interconnection points, except for the antenna. By using the optional KX3-PCKT Accessory Cable Set, all the connections except the power cable terminate in right angle plugs allowing neat routing of the accessory cables.

problem and addressed it. They announced the availability of a set of special interface cables, the KX3-PCKT Accessory Cable Set ($19.95) that includes four cables that have right angle plugs and fit into the left side panel of the KX3. Not only do these make it easy to dress the cables by running them to the rear, but they also break out the ACC2 connections into two separate connectors, an RCA for amplifier keying and a 3.5 mm phono jack for other selected functions. In addition to making for a neater operating environment, this option reduces the likelihood that undue pressure on the connectors or cables will damage the KX3's side panel jacks.

KX3 On the Bench

As shown in Table 1, the KX3 is an excellent performing transceiver on both receive and transmit. The KX3 can be powered in a number of ways, and the test results reflect the voltage levels of some of the power supply options. With the latest firmware, the radio will operate with a supply as low as 7.5 V.

Receiver Performance

The receiver dynamic performance is top drawer. In terms of the critical third-order IMD dynamic range, blocking gain compression dynamic range and reciprocal mixing dynamic range it is at the top of the heap.

There are a couple of caveats, however. The first is a limitation particular to its architecture — *image rejection*. In a superhet, the image is twice the IF frequency from the desired signal. This is usually many megahertz from the signal of interest and easy to filter in the front end. In the direct conversion architecture with an IF of dc (0 Hz), the image is just twice the beat note away. The KX3 does an admirable job of reducing that response (we measured

72 dB down), but it will still result in a stronger signal than a third-order IMD signal. Image response is thus the limiting parameter, but only for signals that happen to be at the image frequency (there are many frequency combinations that can result in third-order signals).

Elecraft does have a solution for this. The menu item RX SHIFT can be used to move the receive IF up to 8 kHz from the normal 0 kHz. This moves the image signal up to 16 kHz away. This also can be used to eliminate other audio artifacts and is worth trying if reception is impaired. The downside is that neither dual watch nor the narrow roofing filters can be used if this is selected. The selection is per band, so it will only affect the band with the problem.

The second caveat is that our initial lab measurements indicated that the dynamic performance on 160 and 80 meters was about 10 dB worse than on the higher bands. While this is still better than most radios and should not be noticeable in most operations, metro contesters frequently have trouble on these bands with strong local interference so this may be significant for them. Elecraft was surprised to hear this, but confirmed it with a radio at their lab and made a design change that resulted in the uniform performance across the bands shown in Table 1. The design change will be in all production radios with boards made after October 1, 2012. If you have an older radio and would like to upgrade, contact Elecraft Customer Service to get the details.

Another change that occurred as a result of our testing was poor adjacent channel rejection in FM mode. Elecraft confirmed this and took care of it with a firmware upgrade to MCU rev 1.22/DSP rev 0.99. The results in Table 1 are after the upgrade.

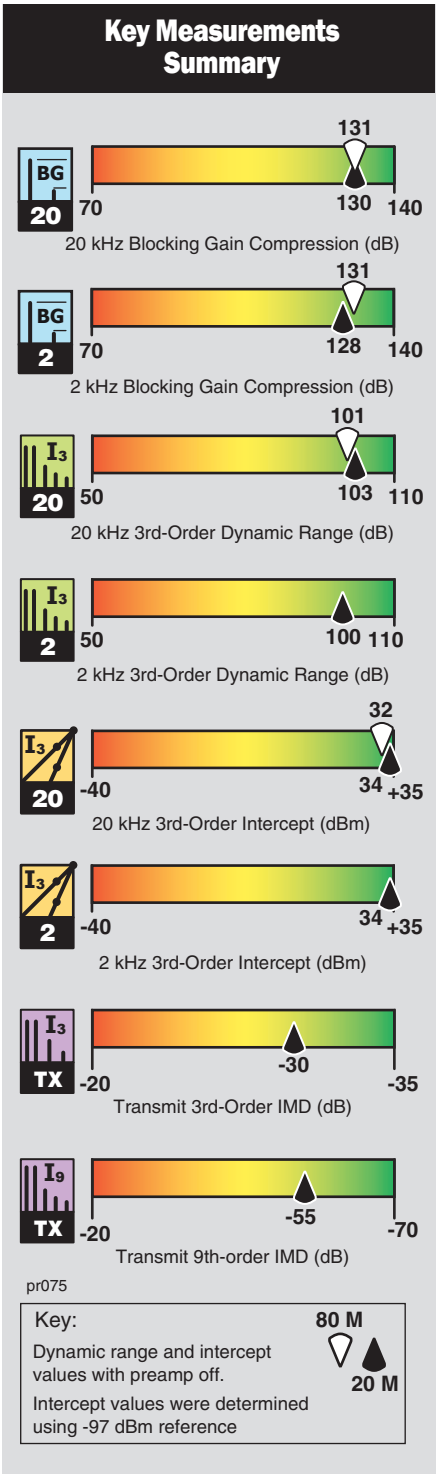
Transmitter Performance

While low power radios don't have to be quite as clean on transmit as their full power brethren, the KX3 needs to make no apologies and can be used with a high power linear without being a noisy neighbor. The CW waveform and resulting spectrum are some of the best we've seen. See Figures 3-5.

While the transmitter's nominal power output is, as noted above, 10 W (8 W on 12, 10 and 6 meters, 50% power suggested on data modes), it does automatically adapt to different supply voltages. Above 13 V, power can be set as high as 12 W on all bands but 6 meters, where the limit is 10 W. If the supply voltage drops below 13 V, the maximum power is 10 W on all bands while if the supply voltage drops below 11 V, as is often the case with internal battery operation, the maximum power is 5 W on all bands. The radio will operate down to at least 8 V with an adjustable warning level (default 10 V) BAT LOW alarm. The lower power output preserves both battery life and transmit linearity.

KX3 On the Air

I don't spend a lot of time using low power, and when I do it's usually on CW. My first



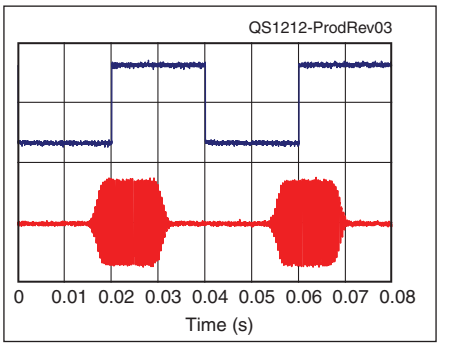


Figure 3 — CW keying waveform for the KX3 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 10 W output on the 14 MHz band.

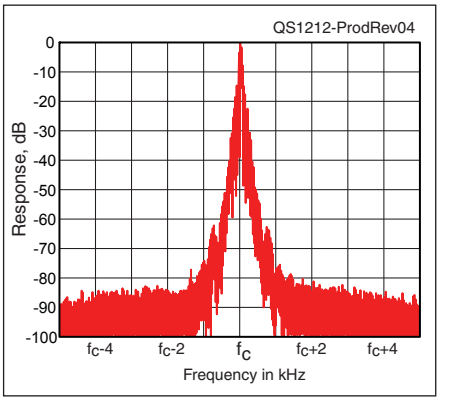


Figure 4 — Spectral display of the KX3 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 10 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

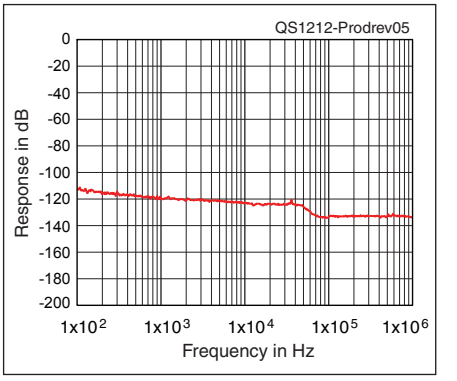


Figure 5 — Spectral display of the KX3 transmitter output during composite-noise testing. Power output is 10 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

Assembling the KX3 Kit

The Elecraft KX3 "kit" is a no-solder, mechanical assembly only kit, similar in that regard to the K3 kit version. The KX3 is, however, a smaller radio with fewer parts and thus is quicker and easier to assemble. The whole process took me just 4 hours of a leisurely Sunday afternoon, with much of the first hour dedicated to unpacking and taking inventory.

Opening the Box

The radio is nicely packed in two inner boxes within the compact outer box. The major parts are all identified with name and number. The bags of small parts are organized by the PC board and assembly they go with. The inventory checklist is organized the same way, so keep them separate for easy checking, as well as to make it easier for you to find the right part for each step.

I took my usual step of sorting the small parts into the compartments of a muffin as shown in Figure A. As shown, there aren't all that many parts to deal with, although many are quite similar and most of the hardware is 2-56 or 4-40, so a magnifier and a scale or digital caliper can be handy to tell one size from another.

Building Your KX3

The KX3 is constructed as two halves of a clamshell that are brought together only at almost the end of the process. Each half of the basic KX3 has a single top or bottom cover and a single PC board. This makes for easy handling since only one handful-sized subassembly is operated on at a time. The first half is the control panel (CP) PC board and top cover. In almost no time, you have a recognizable start to your transceiver (see Figure B) that provides motivation to finish it up and make it play.

Everything went together without much of a hitch. There were just a few spots that delayed me a bit. The back of the CP board has some rather long pins that will connect to the speaker cable. These are easy to bend, if you don't notice them. I found they will straighten at least once after I finally did notice them. A few parts (ANTENNA and MIC connector in my kit) came with extra mounting hardware already on them. After trying to fit them, I realized that the hardware was surplus and needed to be removed (reportedly resolved in current production). A close look at the photos in the *Kit Assembly Manual* would have saved me that trouble. I also had to assemble the RF board into the bottom cover a few times before I got all the holes to line up. Be sure to heed the manual's advice to keep all screws loose at an assembly step until they are all started.

In the last few steps, final chassis hardware is assembled, a ribbon cable is put between the two halves and they are joined with a connection that allows access to the battery compartment.

Figure A — The KX3's parts are sorted into the cups of a muffin pan for easy identification as called out in the instructions.

Figure B — After just a few steps, the KX3 starts to take recognizable shape.

Documentation

The *Kit Assembly Manual*, a spiral-bound volume separate from the similar looking *KX3 Operating Manual*, is excellent. The assembly process is divided into small easy-to-take steps, each accompanied by a photograph with arrows showing the locations and details of each type of hardware required for that step. A list of the required tools — all normal hand tools — is provided, so you can have them at the ready.

The manuals and errata are available on the Elecraft website and I suggest looking them over before you commit to the project, so you'll know what you will need to be able to do and can gather the required tools. You also should check in to the website just before you begin assembly and print out any errata sheets reflecting changes made since your manual version was printed.

contacts were on a very noisy summer evening with poor propagation just after I finished building the transceiver — but who could wait! My first contact was on 40 meter CW using an 80 meter center fed antenna fed with window line and a balun at the bottom. It loaded up fine with the optional internal antenna tuner and I quickly connected with VA1MM in Nova Scotia, 535 miles away. Al was running 500 W and putting in a respectable signal here. He was amazed to find I was running only 10 W, and had solid copy for the whole contact with a report of 579 with higher peaks.

I next tried 75 meter SSB. I joined in a roundtable with folk extending from Boston to Eastern Pennsylvania. They were all running significantly higher power than I was and were also amazed how well I was competing with the heavy static. No one had trouble copying and all thought that the audio from the optional MH3 hand mic sounded great. The MH3 supports PTT and also has UP/DOWN frequency control. They were particularly impressed with the audio quality after I mentioned that I hadn't optimized the transmit audio equalizer yet. Perhaps they were kidding, but a few were talking about selling their big box rigs and replacing them with KX3s.

My original CW contacts were with the optional Elecraft KXPD3 iambic keyer paddles that attach to the front of the unit, as shown in the photos. I adjusted to these quickly and they worked fine. The physical attachment to the radio kept everything in place while sending, often a problem with lightweight portable paddles. The KX3 also has a key jack that can be configured via MENU settings to operate with a straight key or with external paddles. Menu settings also accommodate iambic A or B operation.

In a similar manner, on SSB I started out with the optional compact MH3 mic, perfect for the trail, but couldn't resist trying out my Yamaha CM-500 headset with electret boom mic. By making a few menu changes to the PTT settings, I was able to plug my mono mic plug into the three circuit MIC jack without problems. Again, audio reports were good without resorting to the use of the equalizer. Without the hand mic's PTT function, I made use of the internal voice operated transmit switching (VOX) and it worked fine as well.

I found the front panel intuitive and easy to navigate, once you get past the two-button (BAND-ATU TUNE) power on and off arrangement, designed to avoid inadvertent battery rundown. All the basic controls are readily available and spaced in a similar manner to those on the K3 (but just a bit tighter) — compact, but not hard to use. The TUNING knob at 1.5 inches is a bit smaller (the K3's is 2 inches in diameter), but with its finger dimple is easy to move across the band. There are three front panel accessible tuning speeds that make this easy. The RATE button toggles between two tuning rates with a tap, the default being at 2500 or 250 Hz/revolution for CW, just right for finding and then fine tuning a station. Push it for half a second and it speeds up to 12.5 kHz/revolution — handy for moving around the band. Other modes have different rates selected to be most useful. The display shows one, two or three digits to the right of the decimal point depending on the selection.

The KX3 provides 100 frequency memories as well as message storage buffers for CW and voice modes. On CW six message buffers are provided, each holding up to 250 characters. On voice there are two message memories provided as standard equipment.

A dedicated PBT I/II (passband tuning) knob controls the DSP bandwidth. On CW it toggles with a push between center frequency and width — smoothly down to 50 Hz without ringing and automatically selecting appropriate roofing filter if the option is installed. On voice modes, the same control toggles between high and low filter limits, just as you would want. If operating in frequency shift keying (FSK) data modes such as RTTY, a dual passband is provided, centered on each of the two frequencies.

As with the K3, the KX3 supports RTTY and PSK31 without the need for a PC. Data sent using Morse with the built-in keyer is translated to the appropriate mode for transmission. Reception of those modes, along with CW, can be displayed on the second line of the main display. If you have a PC connected, the *KX3 Utility* software offers a terminal function that will allow looking at a full page of decoded data at a time.

As with the K3, a quick tap of the display (DISP) button changes the lower line of the display to a multifunction meter that can be set with the RIT knob to measure battery voltage, current, operating time, received audio level and a few internal temperature readings — very handy. Speaking of meters, the S meter is calibrated and can be set via a menu item to be absolute so that the reading is just reflective of the signal strength at the antenna terminals — not a function of the preamp (PRE) or attenuator (ATT) settings — in my opinion the most meaningful way to use an S meter.

In addition to the front panel controls, there are a total of 65 menu items, but most are set-and-forget configuration or calibration items that won't need frequent attention. There are two assignable programmable function buttons (PF1/PF2) that can be used to directly access two menu items if desired.
I found it helpful to have the dual watch/virtual second receiver on one. For an on-off function of this sort, the PF button toggles the function each time it is pushed.

Yet to Come

There are a number of options that have been announced for the KX3, but weren't available while we were conducting this review (check the Elecraft website for details). These will serve to make the KX3 even more flexible. The combination of these items with the KX3 will make for a very usable 100 W HF and 6 meter mobile setup or home station.

Manufacturer: Elecraft, PO Box 69, Aptos, CA 95001-0069; tel 831-763-4211, fax 831-763-4218; **www.elecraft.com**.

See the Digital Edition of *QST* for a video overview of the Elecraft KX3 transceiver.

Vertical or Horizontal HF Antennas — What's Best for You?

If you can have only one HF antenna, how do you choose?

Joel R. Hallas, W1ZR

There are many antenna stories that roll through Amateur Radio lore. In many cases they result in confusion for beginning hams trying to make the right decisions while setting up a station. While most have their start in some form of fact, often the key assumptions and conditions are lost along the way, resulting in misinformation or an incomplete picture of what's happening. We'll look at some key areas that are often misunderstood.

Vertical Antennas

Vertical antennas radiate at low angles — great for DX. This is a big issue, perhaps the source of much of both the success and disappointment with verticals on HF. A ground mounted or elevated vertical monopole with a length of ⅝ wavelength or less will tend to radiate at low angles, but how much and how low depends on the ground conditions surrounding the antenna at some distance.[1]

If you have the ability to mount your vertical adjacent to salt water, the radiation at very low angles will indeed be very strong. DXpeditions to islands put out very strong signals with vertical antennas for this reason. The red trace in Figure 1 is the elevation pattern of a ¼ wave vertical over perfect ground, very much like that across sea water. Most of us don't have the advantage of an ocean at our doorstep and we have the pattern resulting from the signal traveling along the surface of a lossy earth.

The comparable pattern of a ¼ wave vertical over the typical earth that most of us have is shown in blue in Figure 1. Note the difference at the low angles. At 5° and 10° elevation, important for DX, the perfect ground has an advantage of 11.6 and 7.7 dB respectively. With typical ground, you can improve the situation somewhat by elevating the monopole so the low angle radiation is less affected by ground losses. For example, at a base height of 60 feet, possible for some in apartment buildings, the 10° difference is reduced to about 3 dB.

Thus, the net-net is that vertical antennas do radiate at low angles, but whether the low angle radiation gets very far depends on factors beyond the control of most of us.

[1]Note that the ground conditions we are talking about are independent of the ground radial system at the antenna base, which plays a major role in the efficiency of such antennas. Here we are talking about the ground at some distance from the antenna.

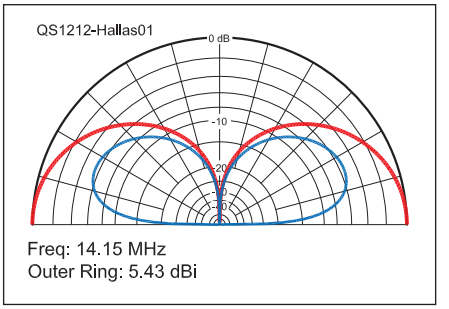


Figure 1 — Elevation patterns of a ¼ wave vertical monopole over perfect ground, simulating the pattern over seawater (red). In blue a ¼ wave vertical monopole over "typical" ground (conductivity 0.005 S/m, dielectric constant 13).

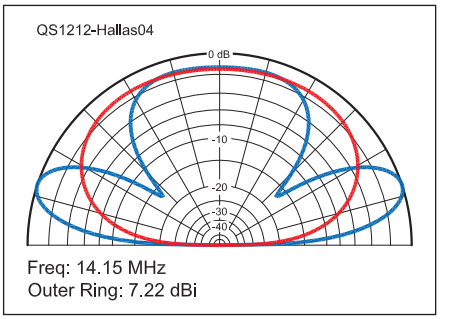


Figure 2 — Broadside elevation pattern of a ½ wave horizontal dipole ¼ wave above "typical" ground (in red). In blue ¾ wave above "typical" ground.

Vertical antennas radiate equally well (or equally poorly) in all directions. Single element verticals do radiate omnidirectionally. This means that with a single antenna it's possible for you to communicate in all directions. This can be beneficial compared to most horizontal antennas that tend to favor particular directions.

Horizontal Antennas

Horizontal antennas offer "ground reflection gain" of typically 6 dB, giving them a leg up on vertical antennas. This is true. However, the rest of the story is that the ground reflection gain reinforces radiation at particular ranges of elevation angles depending on the height of the antenna above ground. Some are more useful than others. This is clearly illustrated in Figure 2.

In the red trace of Figure 2, the elevation pattern of a ½ wave dipole ¼ wave above typical ground, we see that, indeed there is almost 6 dB of gain compared to the vertical monopole of Figure 1 (in blue). Unfortunately, at this height the peak of the gain is at an elevation angle of 64°, useful for some kinds of regional communication, but not for long distances, if that's your interest. At 5° and 10°, the gain is actually less than that of the monopole at the same elevation angles, by 3 and 1 dB respectively.

In the blue trace of Figure 2, the elevation pattern of a similar ½ wave dipole raised to ¾ wave above typical ground, we see that the ground reflection gain has moved downward with the elevation peak at a more useful 18°, along with another high angle lobe. The radiation at 10° elevation is almost the same as the vertical over perfect ground at the same elevation, while at 5° it's about 5 dB less, but 6 dB higher than the vertical over typical ground.

The other issue with a horizontal dipole is that it is directional — favoring the directions perpendicular to the conductor. This is more significant as the dipole gets higher, with one at ¼ wave height only down about 6 dB at the ends. At a height of ¾ wave, the dipole is down 16 dB at the ends, arguing for another antenna, if you want coverage in all directions.

So What's it All Mean?

If your circumstances and property constraints force you to a particular antenna solution, do it and enjoy it — even if you wish for something different. With any HF antenna, there are opportunities for on-the-air fun! On the other hand, if you want long distance communication, and you're stuck with typical ground conditions and must choose one simple antenna, you will find that you can expect better results with a vertical until you can get a horizontal antenna higher than at least ½ wavelength. Note that in terms of height this is very different depending on the bands you want to operate on. A height of ½ wavelength is about 17 feet on 10 meters — pretty easy for most — while it is about 130 feet high on 80 meters.

Joel R. Hallas, W1ZR, is Technical Editor of *QST*. You can reach him at **w1zr@arrl.org**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Joel R. Hallas, W1ZR, w1zr@arrl.org

What Happens if You Bend or Twist that Yagi?

Q Ted, KA2BIG, asks: In a Yagi beam, how much is the radiation pattern or efficiency affected when an element is a little out of line with the others, such as when one isn't exactly parallel to the others or when they are not perfectly in line due to boom sagging?

A An interesting question! I've never seen an analysis of the effects of this kind of Yagi "modification," although it doesn't take long to realize that many hams live with one kind of problem or the other. In order to get a handle on this, I used *EZNEC* to model a three element 20 meter Yagi on a 16 foot boom as described in *The ARRL Antenna Book*.[1,2] I assumed a height of 60 feet over typical ground and tweaked the dimensions to get the nice azimuth pattern shown in Figure 1 at its peak elevation angle of 16°.

The effect of boom sag: For this evaluation, I kept the driven element at 60 feet and lowered the director and reflector in 6 inch steps to 3 feet below the driver while adjusting the horizontal offset to maintain the same boom length. The gain and front to back ratio were virtually unchanged: just a 0.2 dB change in gain, and a 2 dB reduction in F/B at the maximum sag of 3 feet. The peak elevation angle was unchanged at 16°.

The classic way to reduce boom sag is to increase the *beam strength* of the boom material. No matter how strong, a loaded beam (the boom) will, by its nature, deflect a certain amount, however, it shouldn't deflect a lot. The other approach is to lower the Yagi a foot or two down the mast and run a guy wire from the top of the mast to each end of the boom. Because the guy is at right angles to the elements, it can be metallic without affecting the pattern.

[1]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.
[2]*The ARRL Antenna Book,* 22nd Edition, p 11-21. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

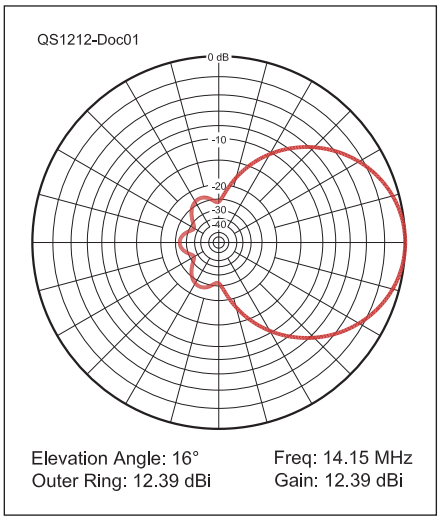


Figure 1 — Azimuth pattern of three element 20 meter Yagi with horizontal elements and boom at its peak elevation angle of 16°.

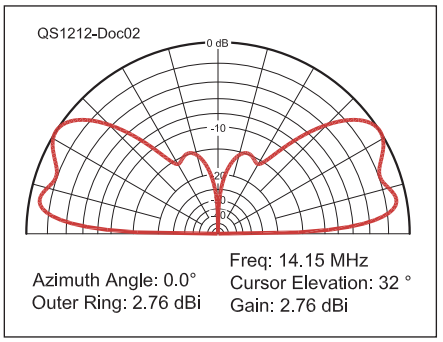


Figure 2 — If the driven element of a Yagi is rotated 90°, it becomes an omnidirectional vertical dipole with its center at 60 feet. The resulting double peaked response is shown in this elevation pattern.

The effect of element rotation: For this evaluation, I rotated the driven element about the boom axis in 10° increments until it reached vertical (90°). As we might expect, this had a more profound effect. In fact at the 90° point, the driven element is acting like a vertical dipole with no coupling to the perpendicular parasitic elements. The gain and front to back ratio at each step for a 16° elevation angle are shown in Table 1. For reference, a single horizontal dipole at 60 feet has a peak gain of 7.16 dBi. A vertical dipole with center at 60 feet has a double peaked response as shown in Figure 2.

Table 1
Effect of Rotation of Driven Element Around the Boom

Angle of Rotation (°)	Forward Gain (dBi)	Front to Back (dB)
0	12.4	26.8
10	12.1	21.0
20	11.2	15.3
30	9.9	11.5
40	8.3	8.7
50	6.7	6.3
60	5.0	4.2
70	3.3	2.3
80	1.9	0.8
90	1.2	0.0

While element rotation is frequently encountered, it often is a result of using inappropriate element-to-boom mounting hardware. Garden variety U-bolts, even those with stamped saddles, can't be tightened effectively without crushing tubing elements. Special clamps with double saddles, available from antenna hardware suppliers, are a much better choice and will likely eliminate the problem.

Q Mark, WB9FPR, asks: Regarding the August 2012 "Doctor Is In" item on lightning protection for balanced lines, I was wondering whether it would work to use a pair of coaxial arrestors at the entrance point, one for each side. I currently have a homebrew spark gap inside a weatherproof box outside the house, but I am not confident that the gap is set appropriately. Would a pair of 1 kW (or higher?) coax protectors be more suitable?

A A pair of arrestors designed for coax is definitely a feasible solution. There are only two issues that may cause concern. The first is that two of them cost twice as much as a single arrestor. Perhaps the more significant issue is the voltage at which they will "fire" to protect you by

shunting a surge to ground. It is important that they not fire in that way with applied RF from your transmitter.

A properly designed lightning arrestor is intended not to arc with a voltage related to its 50 Ω power rating. For example, 1 kW at 50 Ω is 224 V_{RMS} or 313 V_P. If the arrestors are rated at a SWR of 2:1, the peak voltage could be 1.4 times higher or 438. That means if they were going to flash at that voltage (they likely have a 2:1 or higher margin, but who knows — might be worth an e-mail to your manufacturer), and your balanced load was perfectly balanced, the balanced line could have 2 × 438 or 876 V_P across it without arcing. If it did arc with transmitted RF, it could do damage to your transmitter, unless it responds very quickly to the short.

The problem is that most balanced lines are operated at high SWR and will thus have high voltages at some spots. This can be calculated if you model or measure the impedance at the bulkhead point on each band you will use.

So you need to figure out what the voltage could be on your balanced line, and adjust the arrestor power rating to fit, based on the expected voltage, not the transmit power.

Q Roger, WB2YQA, asks: Which antenna will radiate better on 80 through 10 meters; a tuned, loaded ¼ wave trap vertical of 26 foot height or a 26 foot mast tuned via a remote antenna tuner? Assume that both antennas are ground mounted and use the same ground plane.

A I think the real world answer is, it will depend on the details of how it's made and tuned. The biggest challenge for either antenna is likely on 80 meters, which both antennas are short for the wavelength (less than ⅛ wavelength) and the tuner will have to work the hardest.

I did *EZNEC* modeling of an 80 meter monopole over a ground system of four ¼ wave elevated radials at 2 feet. I assumed the antenna was made of ½ inch aluminum tubing and the radials were #14 AWG aluminum wire. This configuration should give very similar results on 80 meters to such an antenna over a very good on-ground or buried radial system, and so provides a useful reference. I looked at three cases for 80 meters:

Case 1 — A full size ¼ wave monopole, 66.5 feet — gain –0.04 dBi with a peak elevation angle of 24° (see Figure 3).

Case 2 — A 26 foot solid tubing fed from the bottom with a tuner. With no tuner loss, –2.1 dBi with a peak elevation angle of 26°.

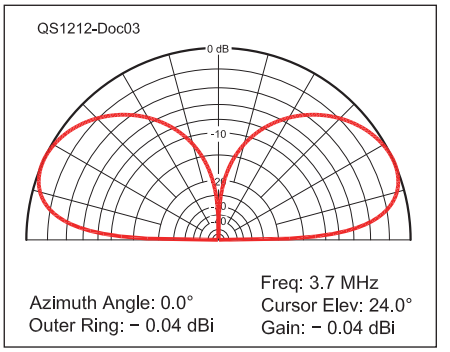


Figure 3 — Elevation pattern of a full size 80 meter ¼ wave monopole. This is the benchmark against which short vertical monopoles are compared.

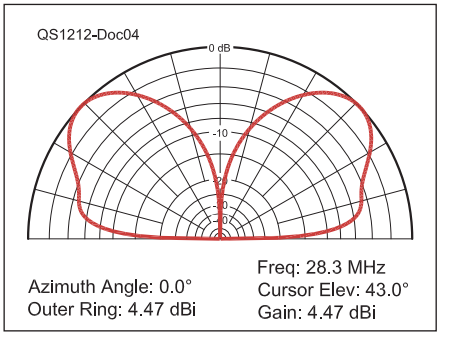


Figure 4 — Elevation pattern of a 26 foot ground mounted monopole on 10 meters. Because the length is greater than ⅝ wavelength on this band, the peak of the pattern is at high angles, but note that the signal at low angles is comparable to the ¼ wave monopole.

Case 3 — A 26 foot length of tubing tuned to resonance with a coil at the center, simulating the effects of all the traps of a multiband trap vertical and resonant at 80 meters. Coil Q of 100 assumed. Gain –3.6 dBi.

Thus the solid tubing would be about 1.5 dB better than the trap antenna, if there were no trap losses. I modeled a number of tuner configurations driving the solid tubing and found losses ranged from 2.7 to 9 dB, depending on tuner design with an L-network tuner (found in most autotuners) having the least loss. All told the trap vertical would have about a 1 dB advantage over the solid tubing, although the trap antenna's multiple connections and components will more likely degrade over time, giving up the advantage unless it is conscientiously maintained.

A real trap vertical will likely be somewhat less efficient than the vertical with the single coil. Some tuners may have trouble tuning the 26 foot mast antenna on 80 meters — it is likely that some will and some won't, without an additional coil in series with the base.[3]

The story on other bands will be similar, at least down in frequency to 30 meters, below which the 26 foot monopole will be longer than ¼ wave and the pole will have a few tenths of a dB gain over the ¼ wave trap antenna until you get to 10 meters, at which point the 26 foot antenna is longer than ⅝ wave and the pattern goes high (see Figure 4). While the peak gain is at a higher angle, the low angle gain is similar to that of the ¼ wave, so not much is lost even there.

I'm forced to conclude that there is no clear cut winner here. The best performance will be a function of the details of the trap construction, versus the tuner loss. The cost difference probably depends on power level. At the 100 W level, there are likely remote tuners that combined with aluminum tubing will cost less than a trap monopole. At the 1 kW level, I suspect the trap monopole will cost the same as it would for 100 W, but the tuner will cost more — perhaps making them about even.

[3]Phil Salas, AD5X, "Extending that High Power Remote Auto Tuner to 160 Meters," *QST*, Nov 2012, pp 50-52.

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**.

New Products

Nifty! Guides for Alinco Transceivers

Nifty! Ham Accessories has added operating and programming guides for Alinco radios to its line of Amateur Radio products. Guides are available for the following Alinco models: DJ-G7, (Mini-Manual and wallet card, $22.25), DJ-G29 (Mini-Manual and wallet card, $22.25), DJ-V57 (Mini-Manual and wallet card, $19.95), DR-135/235/DR-435 (wallet cards, $5.95 each) and DX-SR8 and DR-635 (Mini-Manual, $16.95 each). For more information, or to order, see your favorite dealer or visit **www.niftyaccessories.com**.

Steve Ford, WB8IMY, wb8imy@arrl.org

Glowbug Kits AC-1 Junior Transmitter

There is nothing quite like the fragrance of hot vacuum tubes. It is a distinctive aroma that's almost impossible to describe. I caught my first whiff more than four decades ago, but it had been years since I'd owned a tube radio. That warm, dusty scent had become a fading memory — until I applied power to the Glowbug AC-1 Junior transmitter.

At the heart of the AC-1 is a single 6AQ5 tube. In the AC-1 it functions as a crystal controlled oscillator that generates 1 W output on 40 meter CW. The AC-1 relies on cathode keying, although only about 9 V appears at the key jack so it is safe to use with most modern keyers, if that is your preference.

The AC-1 is a kit, but putting it together is straightforward. Just two hours elapsed from the time I plugged in my soldering iron until the moment I tightened the last cabinet screw and pressed the POWER button.

Building the AC-1

The kit arrived as a collection of small boxes containing the silkscreened enclosure, the hardware and electronic components (including the 6AQ5), a power transformer and what appeared to be an ordinary "wall wart" dc power supply, albeit a rather heavy one.

Upon further inspection I realized that the wall wart was not what it seemed. Rather than being a power supply, it was a hefty transformer designed to convert 120 V ac at the wall outlet to 12 V ac. The 12 V ac is fed to the power transformer within the AC-1. The transformer primary windings are center tapped to provide the 6 V ac for the 6AQ5 filaments. At the transformer secondary the voltage is stepped up to 140 V and converted to dc.

I'm a slow kit builder; I prefer to take my time and do it right. The AC-1 is not a complex kit by any means, but it pays to proceed gradually. Start by identifying and sorting the parts. The parts list consists of a handful of capacitors, several resistors, three chokes, a bridge rectifier, two diodes, an antenna switching relay and a single toroid core that you have to wind. The kit includes two crystals for 7030 and 7040 kHz.

To assemble the kit you need only a soldering iron and a pair of wire cutters. The components are all through-hole; there are no surface-mount parts. Some amateurs find toroid winding intimidating, but with the AC-1 you're only dealing with a single 29 turn toroid required for the Pi-network output circuit. As long as you remember that the first pass of the wire through the "donut" counts as the first turn, the rest is simple.

The AC-1 is intended to be used with a separate receiver or transceiver. You connect your antenna to the AC-1 antenna jack and the receiver or transceiver to the adjacent "receiver" jack. Both are RCA phono jacks.

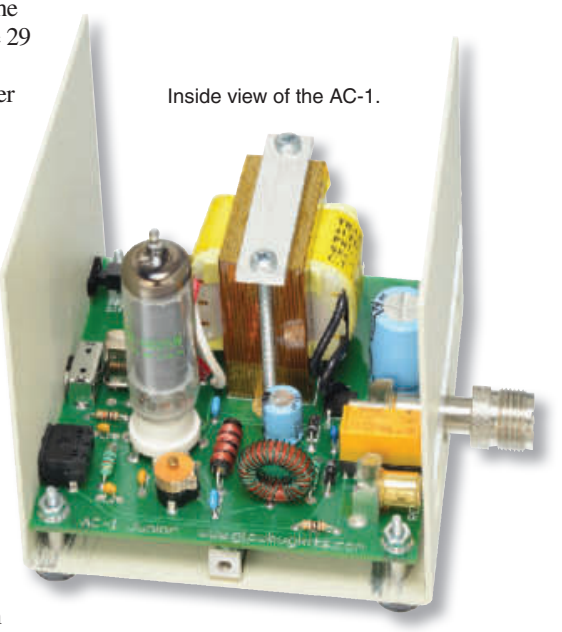
On the Air

After carefully checking my work I attached the 12 V ac line and pressed the POWER button. I couldn't help but smile as I watched (and smelled) the 6AQ5 come to life. After giving the tube a minute to warm up, I plugged in a straight key and selected the 7030 kHz crystal with the front panel slide switch.

When I keyed the AC-1 for the first time, I didn't hear a peep from my monitor receiver. Okay, it was time to tweak the trimmer capacitor in the tank circuit. A slight twist with a screwdriver was all it took to kick the 6AQ5 into oscillation. The output peaked up nicely and the CW note sounded pure. Minutes later I made my first contact and by the end of the night I put several more in the log. Not bad for 1 W to a vertical antenna.

The ARRL Lab later confirmed that my AC-1 was indeed producing a full watt of RF as specified. They also checked for spectral purity and verified that the AC-1 met all FCC requirements.

Because of the high voltage present in the AC-1, I wouldn't recommend this kit for a beginner without an experienced amateur on hand to supervise. That said, building the AC-1 is one of the more satisfying ways to spend an hour or two this weekend. It generates clean RF without a transistor in sight...and you can't beat the aroma!



Inside view of the AC-1.

Manufacturer: Glowbug Kits, PO Box 10366, Jackson, TN 38308; **www.glowbugkits.com**. *$99.97 plus $15 shipping.*

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #119

The Q3Q Balun Redux

Experiment #116, which presented the Quarter-Three-Quarter Wave Balun really captured the interest of readers, generating quite a bit of e-mail!When I receive correspondence that I think might be of interest to readers, I usually post it on the Hands-On Radio web page.[1] This time, the comments needed their own column.

As with so many other techniques and designs, the Q3Q balun was invented long ago and has been applied in many different applications. It first appeared in the amateur literature in a May 1977 *Ham Radio* article, "A New Coaxial Balun" by Jim Dietrich, WAØRDX.[2] As noted in Experiment #116, it is a variation of the hybrid-ring or "rat race" mixers more commonly found in microwave applications.

Going Inside the Q3Q

As discussed in Experiment #81 which is about synchronous transformers, the Q3Q's ¼ wavelength (and ¾ wavelength) sections also perform impedance transformation. Each Q3Q section is terminated in half of the load impedance, $Z_L/2 = Z_0/2$ so the SWR inside each section is 2:1. (For simplicity, we are assuming the load impedance is purely resistive.) At the other end of the ¼ and ¾ wavelength Q3Q sections, because of impedance inverting, the input impedance is $2Z_L = 2Z_0$. Impedance at the input to the section containing the extra ½ wavelength is still $2Z_0$ because impedance repeats every ½ wavelength inside a transmission line. At the T connector, the two input impedances are connected in parallel: $2Z_0$ in parallel with $2Z_0$ is equal to Z_0. This results in a 1:1 SWR in the main feed line.

So, when everything — the main feed line and the two balun sections — is made out of cable with the same Z_0 and the load impedance is the same as Z_0, the Q3Q just acts as a 1:1 balun to make sure each side of the load (usually an antenna's driven element) has equal current.

But wait — how can a pair of feed lines with an SWR of 2:1 create an SWR of 1:1? Remember that SWR is created by reflections and that reflections have both an amplitude and phase. The reflected wave in the longer of the Q3Q's sections has to travel an extra ½ wavelength or 180° before it reaches the T connector. That means the reflections in the two sections are out of phase where they connect together and cancel — even though they have the same amplitude. As far as the main feed line is concerned, there are no reflected waves from the Q3Q and the SWR is 1:1.

As an analogy, consider what happens if you balance a tire by adding a weight to the wheel's rim. The weight does not remove the tire's imbalance; it sets up an equal imbalance that has the right amplitude and phase so that the vibrations from each imbalance cancel when they combine mechanically in the axle. It's exactly the same thing.

Subtracting One Q

What happens if the ¼ wavelength sections are removed from each feed line of the Q3Q? This leaves the main feed line connected directly to one side of the load and the other side connected through the remaining ½ wavelength section. This is the classic ½ wavelength 4:1 voltage balun shown in Figure 1.

If the load impedance is $4Z_0$, each section of the balun is connected to ½ of the load impedance or $2Z_0$. This impedance also appears at the input to the ½ wavelength section so at the junction of the two feed lines, the impedances, each $2Z_0$, are connected in parallel. The result is the main feed line "sees" an impedance of Z_0 for an SWR of 1:1. Without the parallel connection, the SWR inside either line would be 2:1 but again, the reflected waves combine to cancel in the main feed line.

This description assumes that the load impedance is perfectly balanced so that the equal and out of phase voltages create equal and out of phase currents. If the load is not balanced, unequal currents will flow in each half of the load. Since current — not voltage — is what causes antennas to radiate, the antenna's radiation pattern will also be unbalanced. Voltage baluns do not ensure equal currents in the load terminals.

Using the Q3Q for Impedance Matching

Back to the Q3Q design — what happens when Z_L is *not* equal to Z_0? In that case, the impedance ½ wavelength away from the load in each section is no longer $2Z_0$ and the

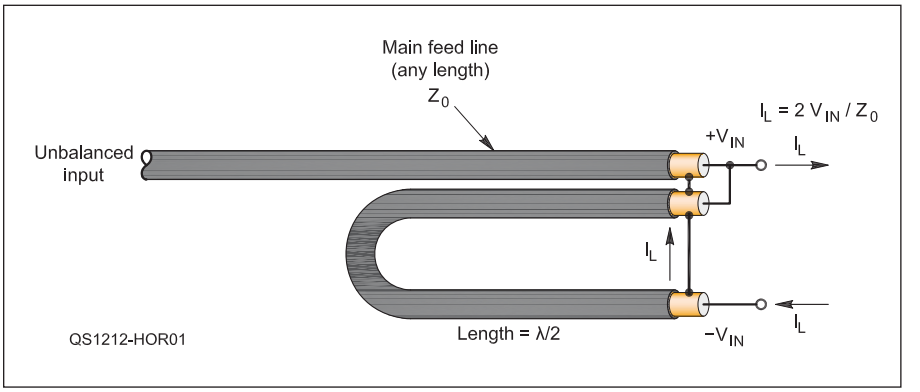


Figure 1 — The 4:1 voltage balun, also known as the ½ wave loop balun, presents out of phase voltages to each half of the balanced load. If the load is imbalanced, current in the load will also be imbalanced.

[1]All previous Hands-On Radio experiments and supplemental information are available to ARRL members at **www.arrl.org/hands-on-radio**.

[2]J. Dietrich, WAØRDX, "A New Coaxial Balun," *Ham Radio*, May 1977, pp 26-28.

paralleled impedances at the T connector no longer combine to give Z_0 and an SWR of 1:1. I hate when that happens.

Never fear, there are more tricks up the sleeve of this balun as WAØRDX's original article demonstrates. The load impedance can still be matched by using transmission line sections with different characteristic impedances, just as if a single ¼ wavelength synchronous transformer were being used.

For example, the WAØRDX article shows that the low driven element impedance of a Yagi — perhaps 10 to 15 Ω — can be matched by constructing the feed line sections from coaxial cable with a characteristic impedance of $\sqrt{(Z_L \times Z_0)} \approx 25\ \Omega$. Paralleling two 50 Ω feed lines creates the required 25 Ω feed line. Similarly, matching a loop with a feed point impedance of 100 Ω requires Q3Q sections with a characteristic impedance of $\sqrt{(Z_L \times Z_0)} \approx 70\ \Omega$. In this case, RG-59 or RG-11 with a $Z_0 = 75\ \Omega$ would do the job.

Quarter Wave Voltage to Current Transformation

Reviewing just a bit, the current that flows in the Q3Q load terminals, I_L, is equal to the voltage at the T connector, V_{IN}, divided by the transmission line's characteristic impedance, Z_0, so that $I_L = V_{IN} / Z_0$. In this somewhat simplified view, the actual impedance, Z_L, of the load between the two terminals does not affect I_L. The current-forcing function of the quarter-wave line depends only on the input voltage and the line's characteristic impedance.

But just how does the line "force" any value of current? There is no source of power at the load or in the line — what if the load impedance is very high? Wouldn't voltage also skyrocket? In a perfect world, yes, but in our real world, no. I consulted Joe Reisert, W1JR, on the subject and he suggested that the limiting factor would be loss in the feed line.

Ah, ha! This is touched on in the classic *Reflections* by Walt Maxwell, W2DU (SK), in which he discusses reflected power and standing waves.[3] When power is reflected from a termination, the reflected waves experience loss just as waves in the forward direction do. With each trip back and forth in the feed line, more energy is dissipated as heat. This puts a limit on how high a voltage can be built up by the resulting standing waves. If the maximum voltage is limited, so too is the maximum current that can be developed at the load.

[3]W. Maxwell, W2DU, *Reflections,* 2nd edition, WorldRadio Books, 2001, Chapters 8 and 9.

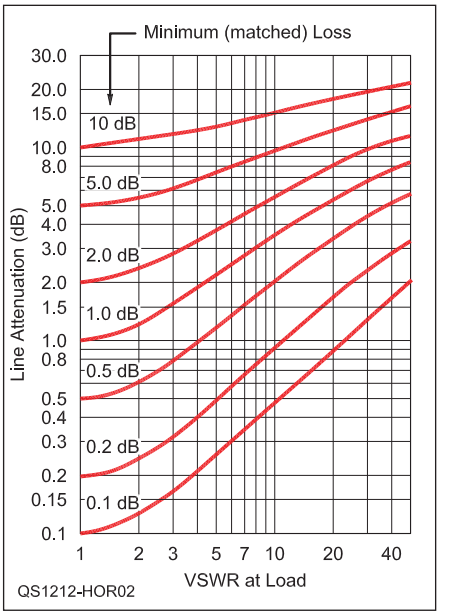


Figure 2 — Total insertion loss in a transmission line terminated in a mismatch. [Courtesy of Joe Reisert, W1JR]

To find out just how much loss is involved, we need to calculate the *total loss* of the line with a given termination. There are charts that show the additional loss which must be added when the SWR is greater than 1:1 but Joe created a single graph that shows total loss for a given SWR and matched feed line loss as shown in Figure 2.[4] To find the total loss, first determine the SWR at the load. From the SWR value on the horizontal axis, proceed vertically to the curve representing the feed line's matched loss (loss with SWR of 1:1). At the intersection, the total loss can be read on the vertical axis. This is less error prone than using two loss charts and adding values together.

The ARRL's *Transmission Lines for Windows* (*TLW*) software by Dean Straw, N6BV (included with *The ARRL Antenna Book*), can also be used to calculate the loss and allows the user to select the type of cable.[5] Length of the feed line can be specified in either physical or electrical length. Let's take a look at typical loss values.

For a 100 foot length of RG-213 terminated in a 50 Ω load, at 14.0 MHz, *TLW* calculates the matched loss to be 0.780 dB. If the load is increased to 100 Ω (SWR = 2:1), loss increases to 0.924 dB. For loads of 1000 Ω (SWR = 20:1) and 5000 Ω (100:1), loss increases to 4.417 dB and 9.884 dB, respectively. The loss from high SWR leaves less and less power to develop high voltages anywhere along the line.

Our ½ wavelength line adds a small additional loss: assuming a 100:1 SWR for an open-circuit termination, the ½ wavelength section of RG-213 has a total loss of 3.088 dB according to *TLW*. Because the SWR at the input to the ½ wavelength section will also be very high, there will be high losses in the main feed line as well — about 9.8 dB for a 100 foot length of RG-213 at 14.0 MHz. The available output power in this case (assuming the transmitter is still pumping 100 W into the line) with 9.8 + 3.088 = 12.9 dB of loss is only 5 W, reducing the available current in the 5000 Ω load to $\sqrt{(5/5000)} = 32$ mA. So there are strict limits on how much current can be "forced" into loads that create high SWR.

[4]J. Reisert, W1JR, "VHF/UHF World," *Ham Radio,* Oct 1987, pp. 27-38.

[5]*The ARRL Antenna Book,* 22nd Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

Summary

Combining a ½ wavelength voltage balun with a pair of ¼ wavelength matching sections was one of today's best kept ham radio secrets. No more! Make sure you add this handy feed line gadget to your toolbox of radio know-how.

New Products

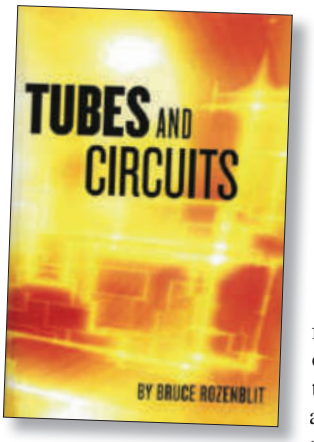
Pigtail Wireless Rig Control for iPad/iPhone/iTouch

Pigtail from Pignology is a device that interfaces amateur transceivers to *HamLog* logging software on Apple's iOS operating system. The Pigtail and *HamLog* were designed for amateurs who take their radios out of the

shack but still prefer a full-featured, software based logging experience. The Pigtail device uses Wi-Fi to expose its built-in serial port via a network connection and operates from a 9 V battery or an optional power connection. The Wi-Fi connection can either be Ad-Hoc or Infrastructure so it can operate standalone, without a wireless access point. Rig support includes popular radios from Elecraft, Yaesu, ICOM and Kenwood. Price: $149.99. For more information, or to order, visit **pignology.net**. *HamLog* is available for iOS in the App Store as well as the Android Market for $0.99.

Tubes and Circuits

By Bruce Rozenblit



Part primer and desk reference and part project guide, *Tubes and Circuits* is a follow-on edition of *The Beginner's Guide to Tube Audio Design*, also by the author. While geared to the vacuum tube audiophile, this book likely will appeal as well to that segment of the Amateur Radio community still attached to gear that glows in the dark. It's a mix of physics and philosophy, with an incredible level of detail crammed into its 268 pages. Rozenblit leaves no electron unturned in his quest to describe the best possible, most economical vacuum tube audio amplifier designs. *Full disclosure*: Rozenblit's company, Transcendent Sound (**www.transcendentsound.com/**) markets tube-type amplifier kits and related products, including this book.

Rozenblit believes that it's impossible "to tell the story of circuits without math," so you'll find quite a lot of it. Chapter 1 is essentially an overview of first-year physics. By page 3 he's into such concepts as *velocity* and *vector quantity* and, by page 11, *potential energy* and *newton meters*. If you're more of an arts and language person than a science and mathematics person, your eyes may glaze over at the escalating level of algebra and trigonometry. Let's face it: Some of us learned just enough formulas to pass the Amateur Extra class examination — at least the one the FCC once administered. By way of introducing ac circuits, the author recommends reading the chapter, putting the book down for a few days, then re-reading the chapter. It is such sections of the book, however, that make it one of those volumes to keep on the bookshelf for handy reference.

Most of the book — or manual, if you will — addresses everything from "basic circuit science," electricity, and ac and dc circuits, to tube characteristics, circuits and, briefly, power supplies. The "Projects" section shows how to construct a couple of "OTL" amplifiers — that is, "output transformerless" — which Rozenblit asserts are "becoming accepted as a mainstream product for a high-end audio system." These vacuum tube amps also feature transformerless power supplies. All of this aims at an overarching goal of maximum audio fidelity at minimum cost.

I found the chapter on vacuum tube construction and chemistry to be the most interesting, if for no other reason than it's possibly the easiest for the mathematically challenged to understand. Rozenblit sacrifices a 6GL6 beam power pentode — "tubicide," as he calls it — and strips it down to offer a thorough post-mortem examination and explanation. This chapter leads directly into a more technical discussion of tube function, tossing out such terms as *linear field distribution* and *electron density variation*.

The lead building project is an economical 15 W (per channel) OTL amplifier employing 12AT7s and EL509s (a high-end 6KG6), plus a power supply. The second is a single-ended 1 W OTL amplifier. All projects feature point-to-point wiring. In addition to the audio amplifiers, the author offers details on building your own simple tube and rectifier testers as well as a tube analyzer that the author bills as "more of a design tool." Radio amateurs who collect or still use vacuum tube equipment may find these particular projects especially valuable.

Some may argue whether vacuum tube audio amplifiers are truly "state of the art" in the 21st century, and others with the author's contention that "measured specifications have little to do with how an amp sounds; playing music is what it's all about." If you're an audiophile or musician of the hollow-state persuasion or simply interested in the nuts and bolts of high-end tube amplifier design, though, this one's for you.

Transcendent Sound Inc, Kansas City, Missouri, **www.transcendentsound.com**. ISBN 978-1477532867, softcover, 6 × 9 in, 268 pp, illus. Available via print-on-demand, **www.createspace.com/3888805**, and from Amazon.com, $34.95.

Feedback

■ In "A Digital Interface for *Fldigi*" [Aug 2012, pp 36-38] Figure 1 shows the connectivity of the output pins of U2 in error. Pin 4 should go to MIC GROUND, pin 5 should go to PTT and pin 6 should be left unconnected. The miniature audio isolation transformers, T1-T3, are no longer listed by RadioShack. Rick, WA6NUT, suggests the Triad TY-145P as a suitable replacement. It is available from the usual suppliers, including Jameco (**www.jameco.com**) and Mouser (**www.mouser.com**).

■ In "My Tuner Tuned My Antenna — But Now It Doesn't!" [Aug 2012, p 47] the caption to Figure 1 should say *TLW* TUNER output, not *EZNEC* TUNER OUTPUT.

■ In "The Uncooperative Tree" [Sep 2012, p 30-32] the value of the inductors in Figure 2 should have been shown as 33 µH.

■ In "Power Carts for Scouts and Field Operations" [Sep 2012, pp 36-40] switch S3 in Figure 6, shown as a DPDT center-off switch, could be a SPDT center-off unit instead.

■ In "The Evolution of DX Spotting" [Oct 2012, pp 71-72] the author noted that he used the word "splitter" when he meant "skimmer" when describing certain terminology related to the Reverse Beacon Network.

■ In "Those Mysterious Signals" [Oct 2012, pp 37-39] the correct URL in note 4 is **wwlln.net/TOGA_network_global_maps.htm**.

■ In "Boat Anchor Buddy" [Nov 2012, pp 53-56] there should have been a footnote indicating that PC board files and other layout information is available on the *QST* in Depth website.

■ In "Building Inexpensive HF Power Attenuators" [Nov 2012, pp 32-33] the first formula on page 32 should indicate 1.41 A, not 0.71 A.

■ In "A Club Project — Automatic Mobile Power Control" [Nov 2012, pp 43-45] in Figure 1 capacitor C1 should be identified as an electrolytic and should have a + sign on the top terminal.

■ In "Have Fun Building the Simplest Transmitter" [Nov 2012, pp 46-49] the author has provided some additional coil data. He notes that his 40 meter L3 is five turns, wound exactly as L2 and that he uses his 40 meter L2 as his 80 meter L3. In addition, the crystal is an FT-243 type that fits into two pins of J1 and the power supply shown in Figure A is missing the + sign on the electrolytic capacitors C1 and C2. These should be on the top terminals.

December 2012 W1AW Qualifying Runs

W1AW Qualifying Runs are held at 10 PM EST Friday, December 7 (0300Z December 8) and at 9 AM EST (1400Z) Tuesday, December 18. The West Coast Qualifying Runs will be transmitted by station K6KPH on 3581.5, 7047.5, 14047.5, 18097.5 and 21067.5 kHz at 2 PM PST (2200Z) Saturday, December 15. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

Steve Ford, WB8IMY, wb8imy@arrl.org

Universal Digital Radio

At this year's Dayton Hamvention® NW Digital introduced an unusual product: the UDR56K Universal Digital Radio. This 70 cm transceiver is unlike anything presently available to amateurs. It is designed to support digital communications in a variety of formats at data rates from 4.8 to 56 kbps with selectable modulation methods including GMSK, FSK and 4FSK. The transceiver features an RF output of 25 W.

Bryan Hoyer, KG6GEU, President of NW Digital Radio, was quoted at Hamvention as saying, "The UDR56K is a radical departure from legacy commercial radio offerings and brings a new, open platform, to the Amateur Radio community by providing a stable, integrated, software managed radio for digital communications combined with a tightly integrated *Linux* based computing platform in a compact package."

The rig itself is only about 4 × 6 inches and lacks the usual knobs, displays and so forth. Instead, it offers a single Ethernet port and four USB ports. All radio functions are controlled by software, using either a web browser interface or a custom application.

The UDR56K is intended primarily for experimenters, although it also has applications for public service communication networks. NW Digital Radio is also in talks with software developers to provide additional digital radio protocols and applications for the UDR56K platform. Some applications of interest to the ham community have already been tested such as AX.25 networking, gpsd, XWindows, Bluetooth integration, wireless 3G/4G broadband and USB sound.

The company anticipates being able to offer the transceiver for sale by the end of the year at a list price of $395. You can find out more at **http://nwdigitalradio.com**.

Droopy LEDs

One of the challenges to widespread adoption of LED (Light Emitting Diode) household lighting is the fact that LEDs always exhibit *droop* — a dramatic drop in efficiency at high currents. A team of researchers at the University of California Santa Barbara has announced that by merely changing the orientation of the semiconductor crystal structures they've created highly efficient LEDs that have extremely low droop.

The LEDs we see in ham equipment are many times more energy efficient than incandescent bulbs of the same brightness, but when you scale LEDs to the sizes and current flows needed for household lighting, their efficiency is substantially reduced.

No one is exactly sure what causes droop, but the UC Santa Barbara team has developed a technique to greatly minimize it by making changes to the way the LEDs are manufactured. As you may know, LEDs are made from layers of doped semiconductor material. When a voltage is applied across the layers, electrons and holes (an absence of electrons) migrate toward an area of the LED called the *active layer.* They combine in the active layer and release a photon in the process. With a sufficiently high current flow you end up with many photons released and a very bright light.

In most commercially available LEDs, the crystals that make up the semiconductor layers are grown in a flat orientation called the *c-plane*. This traditional orientation of the crystals, however, seems to create electrical fields that interfere with the reunion of the electrons and holes (hence the droop). The higher the current, the greater the interference and the greater the droop.

The UCSB researchers' LEDs have non-traditional, tilted crystal orientations that dramatically lessen the interference and they exhibit some of the lowest reported measures of droop. Using this approach the team was also able to fabricate bright LEDs that are smaller than standard commercial LEDs, which could cut down on manufacturing costs. The result may ultimately be less expensive and more efficient LED lighting.

Tiny Vacuum Tubes

Contrary to popular belief, vacuum tubes are not dead. We still find them in devices such as RF power amplifiers and high-end audio gear. Despite the obvious advantages of semiconductors, vacuum tubes still have an edge when you consider their robust nature.

In an interesting development, an international team of researchers from NASA's Ames Research Center at Moffett Field, California, and the National Nanofab Center in South Korea, has announced the debut of tiny vacuum tubes that they've used to create what they are calling *vacuum channel transistors*. These devices are a mere 150 nanometers long and operate at less than 10 V. The tubes were made using conventional semiconductor fabrication methods, which means they can be produced by the same factories that are currently making solid state components.

In a paper submitted to the American Institute of Physics' journal *Applied Physics Letters*, the scientists detail how these tubes could be useful for applications in hazardous chemical sensing, noninvasive medical diagnostics, and high-speed digital communications, as well as in so-called "extreme environment" applications for military and space.

Steve Sant Andrea, AG1YK, hk@arrl.org

Quick Dit Tamer, Easy EMP Protection and Combing Your Coils

Tame Two Bugs for Five Bucks

I was leafing through a catalog from an expensive hardware store and noticed a pair of brass staircase gauges shown in full size. These gauges are intended to be clamped to the edge of a rafter square to facilitate making the repetitive cuts required when building stairs. I thought, "*Wow*, these gauges could be *bug tamers*!"

What is a Bug Tamer?

A bug tamer is an extra weight added to the vibrating arm of a semiautomatic key (bug) to tame (decrease) the dit speed. Alternately, a bug tamer could be an extension to the vibrating arm permitting the original weight(s) to be moved farther from the pivot, also decreasing the dit speed. In this article, the bug tamer is a 27 g brass staircase gauge clamped to the existing vibrating arm along with the original weight(s).

Testing the Bunnell J-36 Bug

I recently acquired a J-36 bug manufactured by the J.H. Bunnell Co during World War II. The friend who sold it to me said it was a nice bug but a bit fast for him. It was a bit fast for me too so I went looking for staircase gauges at a home improvement center. Johnson Level and Tool manufactures them and a pair cost me $5. I drove straight home to test my new toys.

Digging through my *Handbooks*, I found a formula relating CW speed to dit frequency:

WPM = 2.4 × dits per second[1] [Eq 1]

I connected a 9 V battery in series with my Bunnell J-36 and monitored the dit train with my oscilloscope. The time in milliseconds from the start of one dit to the start of the next dit is the *dit period*. The frequency in dits per second was equal to 1000 mS divided by the dit period in milliseconds.

For the Bunnell J-36, with its 22 g cubic weight placed at the maximum radius (minimum speed), the dit period was 70 mS, which per Equation 1 is:

2.4 × (1000/70) = 34 WPM

Placing the cubic weight at the minimum radius (maximum speed) yielded a 40 mS dit period, which per Equation 1 is:

2.4 × (1000/40) = 60 WPM

Ditching Dits

It is no wonder that I was uncomfortable with the J-36. Obviously, it would be hard work to get my dah speed up to match the dit speed! I clamped my 27 g brass staircase gauge, along with the standard 22 g cubic weight, to the arm of the J-36. The minimum dit speed dropped to 27 WPM (90 mS dit period) and the maximum dit speed dropped to 34 WPM (70 mS dit period).

In Figure 1, the cubic weight is at maximum radius and the bug tamer is at minimum radius giving an 80 mS dit period for a speed of 30 WPM on the J-36.

Using the Bug Tamer with Other Bugs

The bug tamer can be attached to a bug having either a rectangular arm (J-36 and Lightning Bug) or a circular-rod arm (Blue Racers[2], Originals, Les Logan, Johnson Speed-X, etc) A comparison of the standard weights is given in Table 1.

Figure 1 — To slow down a bug, attach a brass staircase gauge to the bug's vibrating arm. [T. M. Hamblin, VE3HIE, photo]

If you decide to remove the standard weights, be sure to put them where you can find them. I suggest fastening them to your bug with a cable tie or similar device. If you eventually decide to sell your bug, the buyer will want the original weights (and your bug tamer).

If you have a fast bug that is making you uncomfortable, try using the brass staircase gauge bug tamer. It's not an expensive experiment! — *73, T. M. Hamblin, VE3HIE (sign HN), 9798 Trew Rd, RR1, Campbellcroft, ON, L0A 1B0, Canada*, **ve3hie@arrl.net**

[1]H. W. Silver, NØAX, Ed., *The 2012 ARRL Handbook for Radio Communications* (Newington: 2012), p 8.8.

[2]With the Blue Racers, the maximum and minimum speeds were both 24 WPM with the bug tamer because the arm is just long enough to hold the original weight(s) and the bug tamer. There is no room to adjust them so the maximum and minimum speeds have to be the same.

Table 1
Speed Ranges With and Without the Bug Tamer

Type of Bug Standard Weights	Speed Range Standard Weights	Speed Range With 27g Bug Tamer
Bunnell J-36 One 22 g cubic	34-60 WPM	27-34 WPM
Lionel J-36 One 25 g cubic	30-53 WPM	20-30 WPM
Vibroplex J-36 Lightning Bug One 25 g cubic	20-32 WPM	16-20 WPM
Vibroplex Original Two 14 g cylindrical	26-34 WPM	22-24 WPM
Vibroplex Original Deluxe Two 14 g cylindrical	30-44 WPM	27-30 WPM

Project Boxes

I stumbled upon a product called "painting panels" at the local art supply store. They are white on top and have a wood frame with the top part being similar to a hardwood panel. They come in a wide range of sizes. I bought an 8 × 8 inch box that is 2 inches deep (see Figure 2). It's perfect for some projects that I have in mind, and the price was reasonable at $14. The boxes are made in the USA and are perfect for tube type projects and active component type projects. I can imagine dials, knobs and meters on the front panel already. The painting panel boxes are called Gessobord™ and are manufactured by Ampersand (**www.ampersand.com**). *— 73, Sherry Goeller, VE3DCU, 58 Jones St, Hamilton, ON, L8R 1Y1, Canada*, **sgoeller@cogeco.ca**

Figure 2 — These Gessobord™ artist panels are designed as hardwood boxes that can easily be repurposed to contain electrical projects. [Sherry Goeller, VE3DCU, photo]

Repairing Rubber Keypads

Many radios and other devices use rubber keypads with conductive rubber contacts that complete a circuit when the buttons are pushed. These buttons eventually wear out and contact becomes intermittent or fails.

A number of these have failed on me in the past and I've managed to get them functional for a short period by cleaning them or using a pencil to add some graphite to the rubber. This usually works for a day or two and then the problem returns.

I have considered using instant-bond glue and graphite powder to replace the rubber keypad contacts, but the risk of damage to the keypad seems high. I had considered purchasing conductive paint but decided to look for a homebrew solution first.

A solution appeared when I was trying to repair a keypad for a friend. The product had been discontinued for years and the manufacturer had no parts available. The solution came quite unexpectedly when he went into his shop looking for some instant-bond glue. He came back with a roll of adhesive backed aluminum duct tape. We quickly cut some "pads" from the duct tape and applied them to the rubber keypad, reassembled the controller and tried it out. It worked perfectly! I have since tried it on other devices with good results.

Some keypads do not have enough clearance to use aluminum duct tape. An alternative would be to use ordinary kitchen aluminum foil and instant-bond glue. Kitchen foil is much thinner and requires less clearance.

In either case, use foil that isn't wrinkled as wrinkles will cause problems. Cut the foil before applying it to the keypad. Try to keep the foil the same size as the rubber contact. *— 73, Clint Millett, VE6CMM, 445 Astoria Crescent SE, Calgary, Alberta, T2J 0Y6, Canada*, **ve6cmm@arrl.net**

Quick EMP Protection

Many radio amateurs are concerned about the effect an electromagnetic pulse (EMP) will have on their radio equipment. Earlier rigs had steel or aluminum enclosures but now many do not.

We've all heard about Faraday cages — a copper wire mesh or solid metal enclosure that shields the interior from electromagnetic radiation, which includes EMPs. Wikipedia has a good explanation of them at **en.wikipedia.org/wiki/Faraday_cage**.

I have done some informal testing and have found that, in a pinch, a clothes-washing machine with the lid closed is a fairly good Faraday cage to temporarily protect your radios. I put my 2 meter handheld transceiver in my washing machine, leaving the lid open. It received my base station's 35 W signal perfectly. Then I closed the lid and the handheld stopped receiving. Next, I taped the handheld's PTT switch, put it into the washing machine and closed the lid. I was unable to receive the handheld's signal on my base station 20 feet away. I repeated the procedure with my marine VHF base station and marine VHF handheld with the same results.

It goes without saying that you shouldn't even think about using the low/delicate cycle to clean up your signal. *— 73, Roy Berkowitz, K3NFU, 411 Charles Ct, Slidell, LA 70458*, **royeberk@cs.com**

Comb Coil Form

I like to make loading and trap coils out of #12 AWG wire by rotating a 2 inch nominal (actual diameter 2.375) fiberglass pipe around an arbor while winding the wire. After springing loose, the coils have a mean diameter of 2.75 inches. In order to space the turns at six per inch, I needed some precise spacers. I finally found exactly what I needed in a pair of Conair combs purchased at a drug store (see Figure 3). They will take up to 24 turns and two of them are perfect for holding the coil while the adhesive on the stiffeners hardens. The measured inductance compares well with calculated values. *— 73, Bob Wilkinson, W7VN, 19048 Woodton Ln, Brookings, OR 97415-9796,* **w7vn@arrl.net**

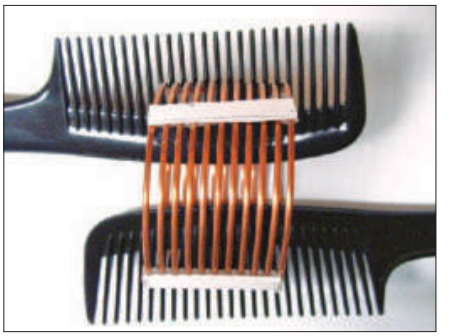


Figure 3 — The tines on this pair of combs provide a convenient coil support while the glue is drying. [Bob Wilkinson, W7VN, photo]

Clip-N-Tune

While trying to load my 75 meter inverted L antenna on 160 meters, I discovered that my manual antenna tuner didn't have enough series inductance for resonance. Rather than place a coil in series with the antenna lead, I placed a small clip-on ferrite RFI choke over the wire where it connected to the antenna tuner output terminal.

The ferrite choke changed the antenna characteristics just enough to allow the tuner to match the antenna impedance. I did not determine the reasonable limits of this technique but it is incredibly easy to apply. A word of caution: The choke could saturate magnetically and produce unwanted harmonic signals if excessive transmitter power is used. *— 73, Bruce L. Meyer, WØHZR, 9410 Blaisdell Ave, Bloomington, MN 55420*, **meyerbl@cpinternet.com**

"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 **hk@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether you are praising or criticizing an item, please send the author(s) a copy of your comments.

The T32C DXpedition to Kiritimati (Christmas Island)

Container conflict nearly cancels 2011 Christmas Island adventure.

Don Field, G3XTT, and Neville Cheadle, G3NUG

Kiritimati or Christmas Island, not to be confused with the island of the same name (VK9/X) in the Indian Ocean, is a Pacific Ocean atoll in the Northern Line Islands and is part of the Republic of Kiribati. Kiritimati lies 144 miles north of the Equator, 4200 miles from Sydney and 3330 miles from San Francisco. It is in the world's farthest forward time zone, UTC + 14. The entire island is a wildlife sanctuary and is perhaps best known for the nuclear tests conducted there. Kiritimati's runway was kept in good repair as a back-up for the space shuttle and there are regular flights to and from Honolulu. The primary source of income is from tourists who come to the island to go bone fishing in the saltwater lagoon.

The name "Kiritimati" is a rather straightforward translation of the English word "Christmas" into Gilbertese, the European name for the Kiribati language — in which the "ti" combination is pronounced "s" — as in the English word *nation*. Similarly, Kiribati is a transliteration of *Gilberts* with the "K" replacing the "G" and the "R" replacing the "L."

The T32C DXpedition was organized by the same group who had previously activated 9MØC (Spratly) in 1998, the record-breaking D68C Comoros DXpedition in 2001 and since then, 3B9C (Rodrigues) in 2004 and 3B7C (Saint Brandon) in 2007.

Why Kiritimati? During our preliminary research prior to the DXpedition, Club Log (**www.clublog.org**) showed Eastern Kiribati (Kiritimati) T32 as the 36th most wanted DXCC entity in Europe and the 61st worldwide. The 2010 *DX Magazine* Most Wanted survey status was:

European ranking — Mixed modes — #37 (2009 — #47)

Worldwide ranking — Mixed modes — #78 (2009 — #91)

Early Planning

The initial idea was to mount a very large DXpedition from the Pacific, targeted particularly at Europe. The path from mid-Pacific traverses the auroral zone, making

Kiritimati is a Pacific atoll that is located about 1200 miles south of Hawaii.

conditions tough on all bands, even when propagation is good. Just after the 9MØC trip, Neville and his spouse, Trish, went on a cruise from Hawaii to French Polynesia during which the ship stopped at Kiritimati for about 4 hours. Neville took the opportunity to check out the Captain Cook Hotel (CCH) as a possible operating site. It was indeed an excellent possibility with a long beach facing northeast, ideal for Europe and North America. Asia could be worked with antennas looking down the beach toward the northwest. Maybe one day, Neville thought.

So in 2009 we started to plan our Pacific trip and we evaluated many locations. We needed somewhere that:

1. Was reasonably rare, particularly in Europe

2. Had a seafront location facing northeast

3. Could accommodate a team of up to 40

4. Could land a shipping container

5. Was accessible by plane or a short sea journey.

This was a tough challenge! We looked at the Austral, Marquesas and Niue islands before deciding that Kiritimati looked like the best fit. Don Beattie, G3BJ, and Neville made a survey trip in January 2010. The CCH "ticked the boxes;" the hotel management was extremely welcoming. We met the port manager who showed us the container facilities — so far, so good. Information on the Web indicated there was a container service once a month from Tarawa, the capital of Kiribati some 2058 miles away. We asked to see the log of ship arrivals — there was in fact an irregular trimonthly service — don't believe everything you read on the Web! Finally, we met as many senior officials as we could. As a result of our research, an action plan took shape. The team would travel to Kiritimati in October 2011 but we would ship the container to Tarawa at least 6 months ahead of the team's arrival.

Our Objectives

We planned a major effort with a target of more than 150,000 contacts. Given the remoteness of the location and uncertainty about propagation during the sunspot cycle, we prepared for 3½ weeks of operation

Paul Rubinfeld, WF5T, did a fine job of running the pileups, as well as being one of the team medics.

including four full weekends. There were to be up to 15 stations active around the clock. We chose October as optimum for HF propagation to the major centers of Amateur Radio activity. We wanted to offer DXers worldwide the chance to make at least one contact with this remote DXCC entity,

Bob, GU4YOX, at the 160 meter station, which doubled as our 6 meter station.

however modest their station, while at the same time allowing more serious DXers the opportunity to complete new band-slots. The team would focus particularly on Europe and the US East Coast. We would operate to the highest standards and make the operation as inclusive as possible with an interactive website.

Work Starts In Earnest

With a plan in mind, we began on the various tasks needed to put Christmas Island on the air:

- We rebuilt our database of worldwide DX clubs whose sponsorship we would be seeking.
- We drafted our brochure for mailing to prospective sponsors.
- We negotiated sponsorship arrangements with our global sponsor, Yaesu, and with our major corporate sponsors, Martin Lynch & Sons (ML&S), Nevada Radio and RedWeb Technologies.
- We built a website **www.t32c.com**.
- We entered into contracts with Frontiers International Travel (for the Air Pacific flights and the CCH booking); with the Ohana West in Waikiki, Honolulu for our stopovers, and bought insurance for the container. Last, but not least, we obtained the T32C license.
- The antenna team began designing the antennas.
- The RF team worked on station design.
- The power team specified the power system.
- We developed technology plans and enhanced our StarSoftware DXpedition management program suite.
- Our treasurer, Gordon Rolland, G3USR, set up a new accounting and forecasting system. After sounding out the participants about affordability, a package was agreed upon.
- Potential team members were invited and the response was very positive.
- To get the sponsorship drive underway, brochures, containing the full details of the operation (including the financials), were e-mailed to over 250 clubs.
- We developed logistics plans for the team and the DXpedition.
- We drafted the team manual.

At this stage we planned to take 16 of the new Yaesu FT-5000 transceivers, 16 VL-1000 linear amplifiers and many Yagis and vertical dipole arrays, together with 3.3 miles of coax, 10.5 miles of radial wire, 20+ computers and two large 10.5 kVA generators. Our container left Southampton, England, on February 27. The authorities on Kiritimati asked us to ship to Fiji rather than to Tarawa "as a regular and more reliable service was to be introduced." It arrived in Fiji on April 29.

Container Issues Emerge

Our expectation was that the container would be shipped from Fiji to Kiritimati in June with an early July arrival date, but then the various agents started to report slippages. We made numerous phone calls and sent many e-mails to Fiji. It became clear that we were getting misleading answers. At this stage, we sought the help of a local amateur, Michael, 3D2MP, to find out exactly what was happening. Michael did a wonderful job of confirming the facts — the ship owner did not have a full load for Kiritimati and in any case had planned another charter to Nauru in August. Team Co-leader Chris Duckling, G3SVL, and Neville agreed that the Fiji to Kiritimati charter was unlikely to happen. It never did!

We then searched for other ways to get the container to Kiritimati and made contact with Manikaoti Timeon, the permanent secretary (PS) on Kiritimati who is also the chairman of the CCH. He was extremely helpful and advised us that the MV *Matangare* should sail from Tarawa to Kiritimati the first week of September 2011. So, with the help of our agent in Fiji we shipped the container to Tarawa. The estimated journey time was 10 days, but with stops at Tuvalu and Nauru, actually took twice as long, arriving after the main team's arrival on September 25.

Meanwhile the MV *Matangare* was being loaded at Tarawa with food that was desperately needed on Kiritimati and on nearby Fanning Island. The authorities in Tarawa were eager for the ship to sail — whether with or without our container. The PS persuaded them to keep the ship in port to await the container. At one stage, we even discussed partly funding an aircraft charter to bring the food from Honolulu to Kiritimati.

Plan B

If these efforts failed, the Kiribati government ruled that the MV *Matangare* must sail — and sail it did! Our container arrived in Tarawa a few days later. What next? The PS worked hard for us and found an oceangoing landing craft that would take our container to the island for arrival in mid-September. There was great relief all round. We developed Plan B based on the assumption that the container would arrive no later than

Here we see Paul Manno, KG4UVU, as he operates the 17 meter CW station.

4 days after the main team. Yaesu offered to loan us five FT-450D transceivers, so we devised a plan to get on the air for the 4 days with this limited equipment. We told the team about Plan B on September 12.

Plan C

Then we heard the really bad news. The oceangoing landing craft had broken down and would have to be towed to Fiji for repairs. Result — no container. Cancel? — No way! Postpone? — No way! We decided to make this DXpedition happen — even without the container. Hence Plan C!

A call to Yaesu got us back on track when they immediately agreed to loan us an additional five FT-450D transceivers and switch-mode power supplies. Chris, G3SVL, rebuilt the inventory, setting out what we needed to borrow or buy in the UK, in Honolulu and on Kiritimati. We found many sources for the fiberglass poles we decided to use for the vertical dipoles and ground planes we set up very close to the sea.

On September 16, we told the team about Plan C and that the DXpedition was on, regardless. We believed we should be able to make at least 100,000 contacts. There was even an outside chance we could make our published target of 150,000.

The response from the team and the Amateur Radio community was tremendous and we received many offers of equipment. Mike Devereux, G3SED, of Nevada UK provided plenty of low-loss Aircell 7 coax; G4HKS, the company station of ML&S, offered us some linears. In a very few days we had commitments for all the equipment we needed. The main team flew out on September 25, just 11 days after we had learned that the container would not reach the island. Three of us had left 7 days earlier — we had a shopping spree in Waikiki and then flew to the island to get the CCH ready for the influx.

There was about a ton of excess baggage flying around the world to Honolulu and then onwards via Air Pacific to Kiritimati. We made excellent deals with the airlines to reduce our costs.

Set Up

The whole team worked very hard on the island. There were huge numbers of plugs to be fitted to coax and real issues to be solved to set up the stations with different transceivers and peripherals than those originally planned. A completely integrated computer network was built from scratch. There was much to do on the power side also. Nevertheless, we went on the air just a day later than we had planned 2 years earlier.

Arnie Shatz, N6HC, one of the team medics, knows how to reel them in on the air and at sea!

The Operation

The operation went very smoothly indeed, bearing in mind the situation we had faced just 3 weeks earlier.

John Linford, G3WGV, had developed a new computer scheduling system, StarSchedule (SS), which worked like a dream. Two of us scheduled the sixty 4-hour slots for the 27 operators 2 days in advance; this task took approximately an hour. SS ensures a fair allocation of operating slots and that everyone has adequate time to sleep.

We participated in the Oceania DX SSB contest during the first weekend of our operation. The SSB contesters had a ball and our claimed score was four times the previous record. It was great to hear so many 160 meter SSB contacts being made with stations thousands of miles away.

The CCH met every request we made. Mealtimes were adjusted to our shift patterns and hot coffee was available from 3 AM for those on the 4 AM shift. The hotel carpenter made many stakes for us and fabricated a mast (for the 6 meter beam).

The 6 meter EME operation was fun to watch. It was incredible how that small FT-450D transceiver heard those weak

The antennas needed constant attention to prevent damage from the sea and salt.

signals undetectable by the human ear. Our main problem was, in fact, our lack of power when transmitting. We did make EME contacts with the US and Europe and quite a few firsts for our terrestrial 6 meter operation, too.

Every day there were tasks to do. We added additional elements to the verticals, the Beverages needed constant attention and all the antennas needed checking regularly for salt intrusion. We kept building new antennas until we ran out of coax! As Don, G3XTT, said, "To the outside world the operation glided along like a swan. On site we were paddling very hard indeed." There were also daily team meetings for those who were not on shift.

Even when we closed down with 213,000 contacts in the log there were still many stations calling. We were pleased to break so many records, a result beyond our wildest dreams. We worked nearly 49,000 unique calls and gave many a new one. A breakdown of contacts, including records broken, as well as a list of all team members and sponsors, appears on the T32C website, **www.t32c.com**.

Eventually the MV *Matangare* did arrive at Christmas Island a few days before the end of the DXpedition. If it weren't for the resourcefulness of our team and the generosity of our sponsors and many DXers, it would have been a real lump of coal in our DX stocking.

Finally, we made some contributions to the local community:

- To Tov Boanereke, T32TV — an FT450D transceiver and power supply on behalf of Yaesu; a computer and much coax and cable from Five Star DXers Association (FSDXA).
- To the local hospital — nearly all of our comprehensive medical kit. Many team members donated their kits, too.
- To the CCH — 500+ meters of Aircell 7 coax for visiting DXpeditioners (and masses of 110 V electrical equipment and Internet cable).

In addition, Bob Beebe, GU4YOX, who holds a senior position at Guernsey Electricity, is planning to send a container load of reconditioned electrical switchgear, meters etc, as there is a severe shortage of such equipment on the island.

Will there be a sixth FSDXA DXpedition? You bet there will!

All photos by Paul O'Kane, EI5DI.

Don Field, G3XTT, an ARRL member, was licensed in 1968 and quickly developed an interest in the competitive aspects of Amateur Radio, notably DXing and contesting. He is at the top of the DXCC Honor Roll and has operated from many locations, both in contests and on DXpeditions. This includes all five FSDXA DXpeditions, of which T32C was the most recent.

Don spent 30 years working in the telecommunications industry before taking early retirement. In addition to the operating side of radio, he writes for several Amateur Radio publications and is the author of two RSGB books. He has also served on the RSGB Board and Management Committee. Don is married and has two married children and one granddaughter. Don can be reached at 105 Shiplake Bottom, Peppard Common, Henley On Thames, RG9 5HJ, England, **don.field@gmail.com**.

Neville Cheadle, G3NUG, Team Leader, an ARRL member, has been licensed since 1959. He is the president of the Chiltern DX Club and chairman of the Five Star DXers Association. He was joint leader of the 2007 Saint Brandon 3B7C DXpedition; team leader of the 2004 Rodrigues 3B9C, 2001 Comoros D68C and 1998 Spratly Islands 9MØC DXpeditions. Neville has 370 DXCC countries and 980+ IOTA island groups confirmed. In 2009 he was admitted to the CQ DX Hall of Fame.

Prior to his retirement, he was chairman, chief executive and senior partner of a major European management consulting practice. Neville is married to Trish and has three adult sons — Timothy, Jeremy and Duncan. He can be reached at Lower Withers Barns, Middleton on the Hill, Leominster, Herefordshire, United Kingdom, **g3nug@btinternet.com**.

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 contribution to the ARRL VEC program.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/ve-session-counts**.

If you're not a VE, become one! See **www.arrl.org/become-an-arrl-ve**.

Examiner	*Sessions*	*Accreditation Date*	*Examiner*	*Sessions*	*Accreditation Date*
Harry Nordman, ABØSX	520	09-Jan-02	Richard Morgan, KD7GIE	326	11-Aug-00
Sammy Neal, N5AF	516	20-Nov-84	Gerald Grant, WB5R	325	04-Jan-85
David Bartholomew, ABØTO	421	22-Mar-02	John Hauner, KØIH	315	11-Jan-85
Franz Laugermann, K3FL	399	01-Dec-91	David Fanelli, KB5PGY	312	01-Oct-91
Kevin Naumann, NØWDG	398	17-Nov-02	Daniel Calabrese, AA2HX	300	01-Nov-91
John Moore III, KK5NU	378	21-May-95	Adolph Koehler, K5VCR	294	29-Sep-95
Karen Schultz, KAØCDN	377	06-Sep-84	E. Drew Moore, W2OU	292	01-Aug-90
Royal Metzger, K6VIP	368	29-Apr-85	Robert Hamilton, NØRN	289	19-May-87
Bill Martin, AIØD	365	01-Nov-84	Michael Faucheaux, N5KBW	287	15-Jul-96
John Mackey Jr, KSØF	348	01-Oct-90	Loren Hole, KK7M	287	06-Sep-84
Paul Maytan, AC2T	341	06-Sep-84	Gary Mangels, AD6CD	286	30-Jul-97
Jeanette Nordman, ABØYX	334	21-Aug-03	Frankie Mangels, AD6DC	282	14-Oct-97
Victor Madera, KP4PQ	330	01-Mar-92			

An Interview with FCC Special Counsel Laura Smith

Where do we stand with Amateur Radio enforcement today?

Dan Henderson, N1ND
ARRL Regulatory Information Manager

On January 20, 2009, Laura Smith was sworn-in as a special counsel at the Federal Communications Commission, replacing Riley Hollingsworth, K4ZDH, who had retired several months earlier. Smith's job is to handle the numerous complaints involving the Amateur Radio Service. She deals daily with a wide-range of topics — from power-line noise complaints to on-the-air issues. As she approaches the end of her fourth year on the job, Smith agreed to an interview with *QST* to assess the current state of Amateur Radio enforcement.

QST: The Amateur Service is in large part "self-policing." How do you think that approach is working today? What can an individual amateur do to help be part of the solution when they come upon problems on the air?

Smith: I believe that self-policing actually works very well in the amateur service. We currently have over 700,000 licensees in the amateur service and the Commission only receives a couple of hundred potentially actionable complaints each year in the Amateur Radio Service. That means that the self-policing "system" is certainly working.

One key factor to the success of the self-policing system is the ARRL's Official Observer (OO) program. The ARRL website states that the OO program "serves as the first line of eyes and ears for the FCC" . . . and these words are very true. The OOs are an incredible group of amateurs who have volunteered their time and energy in order to assist both the Commission and other amateurs in maintaining the integrity of the amateur bands. The OOs really do serve as the amateur community's first line of defense and the Commission greatly appreciates all of their assistance. OOs and other amateurs shouldn't get discouraged if they don't see immediate enforcement action result from their referrals — sometimes the information provided, while helpful, doesn't meet the Commission's high burden of proof. Other times, privacy concerns may prevent us from informing the public about the outcome of a referral. But rest assured, we are reviewing the materials and, even if we can't take action immediately, the information puts the bad guys "on our radar screen" for future scrutiny.

Laura Smith speaking at HamCom 2011 in Plano, Texas.

In addition to the OO program, other amateurs are encouraged to contact the Commission in the event of any problems on air. If you happen to come across someone violating the rules on air, we strongly encourage the amateur community *not* to engage with these individuals. Instead, send an e-mail to the Commission reporting the incident. If you engage, you are likely to become part of the problem yourself and you could end up on the wrong end of an enforcement proceeding. It is better that you hand the matter over to the Commission and go on about your business.

QST: Because of changes in the Federal Privacy Act (enacted before your predecessor retired), the FCC revised its policies about what type of letters and actions could be published. This change resulted in less visibility of enforcement activities. How many and what types of enforcement efforts are "open and active?" Approximately how many different cases of various types have you worked during the past year? Has that number increased or decreased since you started? Has there been a significant increase or decrease in any specific area of Amateur Radio enforcement?

Smith: Because these are active investigations, we cannot give you an exact figure of how many open cases that we have. I can tell you that the Bureau has been very busy this year in amateur enforcement both in my office and in the various field offices. This past year assistance of the field offices has been particularly critical in working on RFI matters. Our field agents have visited the homes of several amateurs, taken readings to determine the source(s) of the interference, and worked closely with both the amateur and the local utility on resolving those sources.

The cases that appear before the Commission vary widely. This past year we received a significant number of RFI cases, unauthorized use of amateur frequencies, and complaints regarding amateurs with criminal convictions. The single largest number of complaints this year revolves around allegations of deliberate interference between amateurs — amateur A alleges that amateur B is deliberately interfering with his ongoing communications.

Surprisingly, the numbers of potentially actionable complaints has remained fairly consistent over the past 4 years. The only area that has seen a marked increase is the area of cheating on amateur exams. The VECs have reported multiple cases to the Commission this year already. This is an increase from past years where we might receive one such complaint during the course of a year. I am not sure why there has been such a significant rise in the area of cheating on exams; but I strongly commend the VECs for their vigilance in this year and encourage them to keep up the good work.

QST: It seems some of the more serious pending cases have taken an extraordinarily long time to resolve. Why doesn't the FCC just send agents to someone's shack and shut the station down?

Smith: I can actually answer this question with the words: *administrative due process*. Every licensee has specific rights attached to the grant of their license. The agency has to follow a specific set of procedures, including an evidentiary review, before a license can be revoked. This protects both the licensee and the agency.

QST: How would you classify the types/kinds of issues that come across your desk? How do you prioritize what goes to the "top of the pile?"

Smith: I handle each case in the order in which it was received. The only time a case might jump to the top of the pile is if it involved safety of life; then it automatically gets the highest priority.

QST: Besides the Amateur Auxiliary, what other resources do you use to build your record in enforcement cases?

Smith: We use the field agents and our monitoring stations to compile our case.

QST: You have been on the job for almost four years now. What have been the biggest challenges and trends you have seen?

Smith: The biggest challenge that I have is to keep reminding the amateur community that this is supposed to be *fun*. If you find that you are constantly embroiled in confrontations on air or are continuously hearing from the Commission, then you have lost the true meaning of Amateur Radio...to have fun!

QST: Where do you see Amateur Radio enforcement five years down the road?

Smith: I see it pretty much like it is today — a symbiotic relationship between the Commission and the amateur community; working together to maintain and protect the integrity of the amateur bands.

You can contact Dan Henderson, N1ND, at **dhenderson@arrl.org**.

Life Members

Elected September 29, 2012

Brian G. Arsenault, **N1FIY**
Mario A. Arvelo, **N2MZZ**
Francis Asuquo, **NA1JA**
Troy R. Atwood, **WVØV**
Douglas G. Bagdasarian, **W4DBM**
Michael Barry, **AE6FL**
Jorj F. Bauer, **AB3AG**
Peter M. Bealo, **WB2MJG**
Robert M. Beatty, **WB4SON**
Georgia Belmont, **NY2GB**
Lawrence E. Bernard, **KG6VOM**
John G. Bonow, **W9IHW**
Timothy M. Boone, **WM3P**
James E. Bowen, **KB6DXN**
John C. Bowman, **K7EZB**
Jonathan Brandenburg, **KF5IDY**
Norman Brooks, **K6FO**
Darrell S. Brown, **KU4U**
David H. Brown, **KI6OR**
Donald H. Bryant, **N9NLE**
Chris R. Burger, **ZS6EZ**
Kenneth Byers, **K4TEA**
Jack L. Campbell, **KZ4USA**
William T. Cantrell, **W4WTC**
Eduardo Cantu Leal, **XE2LTH**
David C. Cleveland, **WA4HSN**
DeVerne D. Coleman, **KCØGFM**
John D. Conway, **KD2CF**
Chad A. Cundy, **K7RDC**
Timothy D'apice, **KA1YBS**
Francis J. D'Auria, **W1AD**
Chris Danis, **N2YYZ**
David E. Dato, **N9WFD**
Paul A. Davis, **K9MR**
Paul R. Decker, **KG7HF**
Michael L. Dennee, **KG4JHL**
Thomas F. Devlin, **AE5TD**
Michael J. Downey, **K4MJD**
James A. Drury, **NC1JD**
Brett Eisenberg, **AI5C**
Steven A. Elliott, **W9RAL**
Jacob R. Ellis, **K5SYN**
Paul H. Fairchild, **AL4G**
Brian J. Falvey, **N1BJF**
Mark D. Farrall, **KC6OPR**
John F. Feet, **K2DCA**
John R. Felton, **KE5RI**
Richard C. Field, **KG6OUK**
Forrest N. Fluckey, **N7FNF**
Gregory T. Galka, **N7GT**
Harold Garron, **AC2BK**
Gregory C. Gaydos, **K2KGG**
Damian Geiss, **KA4LPH**
Brian Gnad, **KB5TSI**
Roman Gonzales, **KDØJXX**
David Bruce Grange, **AE6DK**
Kevin R. Grantham, **N5KRG**
Frank Graves, **KF5ISD**
Wade T. Graves, **KF5AUD**
G L. Green, **NF9O**
Wade Gutreuter, **KK4BVR**
Charles W. Hallett, **K4SC**
Cecil G. Harper, **W5CQG**
Rebecca S. Hartman, **KB9LWR**
Michael L. Hasel, **N3KUN**
Brian J. Haughey, **W2RI**
Jonathan J. Heinlein, **N4ERD**
James D. Heye, **K5WLQ**
William C. Hindenlang, **NY2FL**
Edward Hoffer, **N5ECH**
Brad E. Holcomb, **W9VL**
Kaayla Jaret, **KA6YLA**
Brent W. Jenkins, **W6BWJ**
Thomas C. Jenkins, **WB9WNZ**
William R. Jenkins, **NC4BJ**
Darrin Jewell, **KA2ZLZ**
Christopher R. Johnson, **K6OZY**
David S. Johnson, **WOØN**
Elton Johnson, **NØCVB**
Paul R. Jorgenson, **KE7HR**
Charles D. Joseph, **N5JED**
Abdulhafiz I. Kashkari, **7Z1CQ**
Rick Kaumeier, **KØVJ**
Kevin G. Kerr, **W1KGK**
Christine Kestner, **KC4CK**
William Kiker, **KQ2T**
Joe Kirby, **K1RBY**
Rolf K. Klibo, **N6NFI**
Andrew C. Kramer, **KD4LUG**
Adam A. Kraus, **N4UQV**
Waylon M. Lambert, **N8XBV**
James G. Lanzo, **WB1AIZ**
Bennett A. Laskey, **K6CEL**
Gary E. Lewis, **WG5L**
Steven A. Lewis, **N8TFD**
Naphtali Z. Lichtenstein, **N2UZD**
Thomas A. Linke, **AK2G**
Thorsten Lockert, **W6THL**
Dale E. Long, **N3BNA**
Joseph W. Long, **NØOEG**
Juan Lopez, **AC6ZM**
Richard Lotoczky, **WC8D**
Mark T. Lunday, **WD4ELG**
Anthony J. Luz, **KC2JIM**
Jason D. MacDonald, **NV5DS**
Guadalupe P. Macias, **KD5JJB**
Zachary M. Manganello, **K1ZK**
Jimmie L. Mangus, **KC8NDZ**
Wesley A. Mangus, **KC8NHE**
Michael J. Markowski, **AB3AP**
James Martin, **W1KQ**
James M. Masiclat, **WH6JQ**
Daniel R. Maxwell, **K2DRM**
Earl J. May, **WDØGSV**
Tony R. McAlexander, **KG6ZGW**
Claire E. McCarthy, **KK4JJT**
Vaughn E. McCauley, **K5VMC**
Michael J. McCormick, **K9AMP**
Gary D. McGregor, **KC9UPH**
Charles V. McKinnis, **KB5ZWC**
Paul F. Merrill, **W7IV**
Raymond P. Midura, **W1FF**
Charles R. Milam, **N9KY**
Wyatt H. Miler, **KJ4CTD**
Maurice A. Mitchell, **KE7WWT**
Maxwell G. Moon, **K5EIE**
Leo Moysaenko, **KA8NDR**
Douglas R. Muir, **KD7SUF**
Michael Namorato, **KE5NQP**
Larry D. Neupert, **NJ4O**
Jonathan Newquist, **KCØULD**
Kenneth E. Nichols, **KD3VK**
Alan Nyysola, **K2ARN**
Kieran J. O Hagan, **N2MWE**
Douglas O'Neal, **KC7DO**
Thomas D. Parker, **K5MUD**
Frank H. Pauli, **K6FHP**
Steven Piotrowski, **AG2AA**
Alan J. Pitegoff, **AB4OZ**
John Polak, **NF6N**
Jim C. Pope, **N5JCP**
Nicholas P. Radtke, **KC7MOD**
Michael N. Raisbeck, **K1TWF**
Benjamin E. Raymundo, **K2BEN**
Lawrence A. Reed, **KA2SJJ**
Robert Renfro, **AC7KH**
Gilles Renucci, **VE2TZT**
Mark Richey, **KL3MR**
Roy J. Rieck, **AJ4RC**
John W. Robinson, **K1JR**
Philip B. Robinson, **KB5ASY**
Michael L. Rohwedder, **WU9D**
Julia Royster, **KT4JR**
Larry H. Royster, **K4MWE**
Alexander Rushton, **N3XWM**
Cynthia L. Rushton, **WB3CNJ**
Joseph J. Sauer, **KD5JSD**
Alan Saunders, **VA7BIT**
Scott E. Scheurman, **KI6AON**
Mark A. Schiefelbein, **KØABC**
Gary P. Shuford, **KM5ME**
Dai Sieh, **KT9U**
Jason Skretta, **KCØEDE**
B B. Stanfield, **KC5PIY**
Phil Steffora, **K6TT**
Roger W. Stembridge, **K4OYY**
John R. Stephens, **KJ6FRM**
Michael L. Stevens, **W8EMT**
Jimmy D. Stinnett, **KF5JKS**
Mike Stokes, **K4OS**
Arno Streuli, **HB9VID**
Diana Stuckey, **KB9NPO**
Jeffrey J. Stuparits, **W4DD**
Reed Swasey, **AD7ZW**
David M. Thompson, **K5NDC**
Robert A. Tiller, **AE5YG**
David M. Tipton, **W5DMT**
John D. Titta, **AC2DD**
Thomas N. Tumino, **N2YTF**
Michele A. Tyacke, **KDØRJK**
Fred Villiard, **K3VKY**
Jolyon M. Vincent, **KD8HZY**
Michael F. Vitek, **KE7EVT**
Henry K. Wakeman, **KB1YHG**
JD Wallace, **N8JD**
Bruce K. Wallingford, **WBØMZI**
Donald L. Walters, **W9DKI**
Frederick Wawra, **W2ABE**
Daniel Weilenmann, **PT7ZAP**
Joseph A. Wheelock, **KB1KVA**
Robert C. White, **KØRCW**
Shane Wiggins, **NV7SW**
Brett M. Williams, **WA6SXU**
James W. W. Wilmerding, **W1EMT**
Alan E. Wolke, **W2AEW**
Tim Wood, **VA7TIW**
Brad R. Woodward, **KG4FUS**
Milan C. Wright, **KO1R**
Richard K. Yoo, **N5YOO**

Pacificon Wrap-Up

If you couldn't attend the 2012 ARRL National Convention at Pacificon in Santa Clara, California, here is a glimpse of what you missed!

Ward Silver, NØAX
QST Contributing Editor

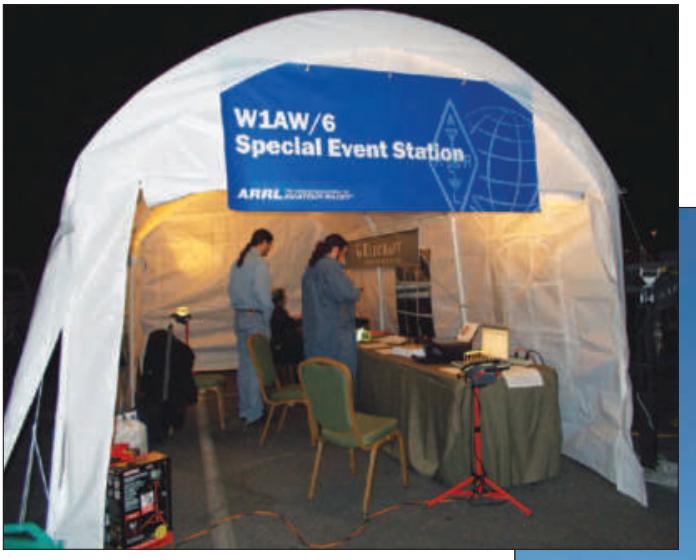
Three days in Santa Clara have just vanished in a blur of ham radio happiness. Pacificon attendance was up to about 2500, filling the halls for forums, lectures, the ARRL EXPO and the occasional airborne affair such as astronauts, ARISS contacts, parachute mobile stations, and of course, Felix Baumgartner's skydive from 24 miles up on Sunday afternoon put the perfect ending on the weekend.

In the way of learning opportunities, the Pacificon committee arranged for ten (!) different tracks of things to do and see. Topics ranged from disaster communications to a video tour of the Arecibo radio telescope to new digital voice protocols for HF to "Ham Radio Tricycle - Mobile Style" by Rem O'Donnelley, K6BBQ. Several groups combined Pacificon with special meetings, such as SATERN and the QRP folks.

The W1AW/6 station was manned almost throughout the evening, racking up a lot of contacts from across the Pacific around to Europe and South America. (Yes, they will QSL 100% if you send a card and on Logbook of the World, too!) One of the highlights was seeing the many styles of operating, including masters at the "bug", a semi-automatic manual key.

The ARRL National Convention was also honored to have Dr Lee Morin, KF5DDB, attend and spend so much time with the hams and kids, who greatly enjoyed meeting a real astronaut. Lee also gave a couple of terrific presentations. I think if they had weighed just a little bit less, several of the kids would have achieved orbit all by themselves! Thank you, Lee.

Saturday evening's banquet was a great wrap-up to a long day for all of us — ARRL staff, Pacificon workers, and Hamfest

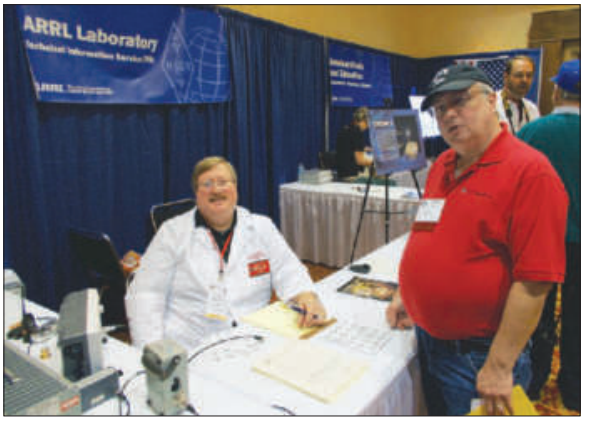


The night shift gets going at W1AW/6 — even in California, it gets pretty chilly under the palm trees. 20 meters was in the process of closing (about 8:30 PM local time) and the gang was anticipating there would be a crowd wanting some 40 meter QSOs! [Ward Silver, NØAX, photo]

Mike, N1TA, Awards and Programs Assistant and ARRL Marketing Manager Bob Inderbitzen, NQ1R, setting up part of the ARRL EXPO area on Friday. [Ward Silver, NØAX, photo]

W1AW/6 raked in the contacts from the sunny Pacificon fleamarket area. [Ward Silver, NØAX, photo]

Capt Lee Morin, KF5DDB, gave kids like Ben a thrill as they met their first real astronaut. At Pacificon Lee had a successful ARISS between Pacificon and the International Space Station via ground station IK1SLD in Italy. [Bob Inderbitzen, NQ1R, photo]



ARRL Lab staff member Bob Allison, WB1GCM, set up a spectrum analyzer and power meter to test the handhelds of Pacificon attendees. John, K7VE's, handheld "rang the bell" and received an enthusiastic "Five watts!" from Bob. The data from informal tests like these also builds information about how radios actually perform while in use. [Ward Silver, NØAX, photo]

Richard Dillman, W6KWO, is a member of the Maritime Historical Radio Society, an organization that has rebuilt and maintains the Coast Guard's Point Reyes coastal station as K6KPH. During Pacificon, many ex-station operators stopped by to share stories and try their hand at putting the station on the air. [Ward Silver, NØAX, photo]

You couldn't ask for a better day for a fleamarket. [Ward Silver, NØAX, photo]

Two of the Parachute Mobile crew. Jim Wilson (left) was the videographer bringing video of the jumps to the viewing audience. Bob Fenn, KC6TYD was on the business end of the QSO and made several jumps through the day on Saturday, keeping a log on his voice recorder all the way down! [Ward Silver, NØAX, photo]

attendees alike — to sit down, take a load off those aching feet, and relax. ARRL CEO Dave Sumner, K1ZZ gave a very well-received presentation after dinner, along with Captain Morin.

A big thank-you goes out to the hard-working Pacificon committee members and volunteers. We all very much enjoyed the show and it seemed that the local hams rose to the occasion, too. As one hamfest veteran was heard to remark, "I don't think I have ever been to such a well-dressed, classy convention." Right in the heart of Santa Clara, with companies like Cisco and Intel right around the corner (literally), palm trees and sunshine made it easy for us to thoroughly enjoy ourselves and many have already put Pacificon on their hamfest list for next year - I know I'll be back!

You can contact Ward at **n0ax@arrl.org.**

Lights, Camera, *Action*! It's the ARRL Video Contest!

If you're handy with a video camera and editing software, this is your chance to show your work to the Amateur Radio world. Shoot a ham-related video, edit it to perfection and send it our way. If your video takes first, second or third place, we'll post it on the ARRL website and the ARRLHQ YouTube channel for everyone to see. We're looking for a few good videos (but only one per ARRL member, please) on any tasteful subject relating to Amateur Radio.

Check out all the details on the ARRL Video Contest Rules and Guidelines web page at www.arrl.org/video-contest

Top: The high altitude balloon video by Erin King, AK4JG, was the first place winner in 2012. Watch it at **www.arrl.org/winners**.

Who can enter

The video author/producer must be an ARRL member; however, the people who appear in your video can be non-members. If you were one of the winners in our 2012 contest, you are ineligible to enter again.

Deadline

Entries must be postmarked by March 1, 2013. Burn your video to a CD or DVD using the appropriate software and mail it to ARRL Video Contest, 225 Main St, Newington, CT 06111. Do not attempt to send it via e-mail, as our e-mail system cannot accommodate large files.

Subject

Must be directly related to Amateur Radio and be in good taste. Videos will be judged on overall quality and composition.

Specifications

Maximum length: 5 minutes.

Format: AVI, MPEG or WMV, 320 × 240 minimum resolution.

Production equipment

We are looking for videos shot by amateur videographers using consumer-grade cameras and editing software/equipment. The use of professional-grade cameras, editing equipment or studios is not permitted. We reserve the right to reject videos that we suspect were commercially produced.

Miscellanea

Accompanying Information: All entries must include the following information: Where the video was recorded, a description of the subject of the video and the names and call signs of any persons shown. **If children appear, you must secure the permission of their parents.** Include the permissions as separate documents when you send your video. Something along these lines is sufficient: "I, John Doe, grant permission for my child, Jane Doe, to appear in a video titled *Two Reasons to Avoid Inserting Forks into AC Outlets* by Hiram Percy Maxim, W1AW."

Rights

The ARRL automatically owns non-exclusive rights to all videos submitted for the contest. This means that by sending a video, you are granting us the right to use your video in any lawful manner. *But* you still retain the original rights to your video and can do with it as you please — even sell or publish it elsewhere.

Music

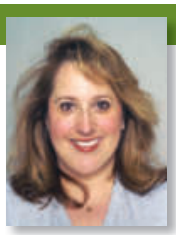
If you add a music track to your video, make sure the music you select is free of copyright restrictions. For example, don't add music by Eric Clapton unless you have Eric Clapton's permission!

Judging

Videos will be judged on overall quality and creativity. The decisions of the judges — composed of ARRL HQ editorial and production staff — are final.

Prizes

The first place winner will be awarded $500, while the second place winner will receive $250 and the third place winner will receive $100. Winning videos will be displayed on the ARRL website and the ARRLHQ YouTube channel at **www.youtube.com/user/ARRLHQ**.



S. Khrystyne Keane, K1SFA, k1sfa@arrl.org

FCC Seeks to Change Amateur Radio Licensing Rules, Allow Additional Emission Types

With the issuance of a *Notice of Proposed Rulemaking*, the FCC is proposing to grant lifetime examination credit and to reduce the two-year grace period and the number of VEs needed to give a license exam, as well as to add additional emission designators.

On October 2, the FCC released a *Notice of Proposed Rulemaking* (*NPRM*) in WT Docket No. 12-283 that seeks to change the Amateur Radio licensing rules, especially as they concern former licensees. Acting upon an April 2011 *Petition for Rulemaking* filed by the Anchorage VEC to give permanent credit to radio amateurs for examination elements they have successfully passed, the FCC proposes to revise Section 97.505 to require that Volunteer Examiners (VEs) give examination credit to an applicant who can demonstrate that he or she formerly held a particular class of license. In addition, the Commission seeks to shorten the grace period during which an expired amateur license may be renewed and to reduce the number of VEs needed to administer an amateur license examination. Also, in response to a *Petition for Rulemaking* filed by the ARRL in March 2011, the FCC looks to amend the Amateur Service rules to allow amateur stations to transmit additional emission types in order to permit Time Division Multiple Access (TDMA) in the Amateur Service. But in doing so, it denied the League's request for a blanket waiver pending the resolution of the rulemaking proceeding.

To be issued a new or upgraded amateur operator license, a person must pass an examination or otherwise receive credit for the examination element(s) required to qualify for the relevant license class. Applications for new or upgraded licenses must be filed through a Volunteer Examiner Coordinator (VEC). A person also receives credit for an examination element if he or she presents either a Certificate of Successful Completion of Examination (CSCE) for that element that was issued within the previous 365 days or an unexpired (or expired but within the grace period for renewal) amateur operator license.

In its *Petition*, the Anchorage VEC asserted that it was unfair that after the grace period for renewal of an Amateur Radio license ends, a former licensee "loses all credit for any elements passed, and must start all over if they want to continue their Amateur Radio activities. Does the passage of time somehow invalidate a person's knowledge?" The FCC stated in the *NPRM* that it recognized that the rules treat a former licensee differently than a licensee who passed the same examination(s) but who continuously renewed his or her license: "We also agree with Anchorage VEC that the fact that an individual allowed his or her license to expire more than two years ago does not necessarily mean that the person no longer possesses adequate knowledge of the subject. That a license was continuously renewed does not establish that the licensee remained active in the Amateur Service, for amateur licensees are not required to operate their stations in order to remain licensed."

With this in mind, the FCC is proposing to revise Section 97.505 to require that VEs give examination credit to an applicant who can demonstrate that he or she formerly held a particular class of license: "We believe [amending Section 97.505] will encourage former amateur operators to become involved again in the technical self-training and public service communications opportunities provided by the Amateur Service. It also could reduce costs (in time as well as money) incurred by former licensees seeking to reenter the Amateur Service. We ask commenters to address these costs and benefits."

The FCC is also seeking to eliminate the element credit distinction between a person who passed an examination and kept his or her license current, and a person who passed the same examination but let his or her license expire. "Arguably, we should also eliminate the element credit distinction between a person who passed an examination and applied for a license within a year and a person who passed the same examination but did not apply for a license in that time, on the grounds that the passage of a year does not substantial [sic] affect the latter examinee's knowledge," the FCC maintained. "We note, however, that a CSCE also provides temporary authority for an upgrading licensee to exercise the rights and privileges of the higher operator class until disposition of the upgrade application or 365 days, whichever comes first. We are concerned that it may be anomalous or confusing to create a difference between the period during which a CSCE provides temporary operating authority and the period during which a CSCE provides element credit."

Reduction of Two Year Grace Period

Section 97.21(b) provides that a person whose amateur station license grant has expired may still apply for renewal of the license during a two-year grace period. According to the FCC, this allows individuals who forget to renew, or experience unforeseen difficulties in renewing their license, a period of time during which they may renew. The FCC noted that a principal reason for providing this grace period "is to allow amateur licensees to restore their operating privileges without sitting for reexamination."

Given that the FCC is proposing to amend the rules to give former licensees examination credit for the element or elements they passed to obtain their expired licenses, it stated that a two-year grace period may no longer be necessary and proposed to reduce the grace period for renewal to six months (180 days), "which we believe is a sufficient period of time for individuals who forget to renew or experience unforeseen difficulties when renewing their licenses. Licensees who do not renew during the grace period would be able to obtain a new license under the rule changes proposed above and could then request their former call sign through the vanity call sign system if the call sign had not already been

assigned to another licensee under the vanity call sign system."

Reduction in Waiting Period for Vanity Call Signs

When the vanity call sign system was implemented, the FCC concluded that call signs should not be available for reassignment for two years following the death of a licensee, or expiration or termination of the license for that call sign; close relatives of a deceased licensee are exempt from this rule, following the licensee's death. The FCC stated in the *NPRM* that it set the waiting period at two years "in part because it corresponds with the renewal grace period. Because we propose above to shorten the grace period to six months, we also propose to reduce the time before a call sign becomes available for reassignment to six months."

Administration of Amateur Radio License Exams

Currently, there must be three VEs at an exam session and they must observe the examinee(s) throughout the entire examination. The VEs are responsible for the proper conduct and necessary supervision of each examination. The VEs must grade the examinee's answers immediately upon completion of each examination. When the administering VEs determine that the examinee has passed the examination elements required for the operator license sought, they must certify that the examinee is qualified for the license grant and that they complied with the administering VE requirements.

Upon establishing the VE system in 1983, the FCC noted that "[t]he use of three examiners provides for cross-checking to assure the correctness of answers to examination questions, to assure proper completion of license applications, and to minimize the likelihood of any possible fraud or abuse. We tentatively conclude that the required number of administering VEs can now be reduced without jeopardizing the integrity of the amateur operator license examination system."

In order to increase the availability of examination opportunities, the FCC is proposing to reduce the number of VEs required to administer an examination to two: "We believe that reducing the number of required VEs can increase the availability of examination opportunities (by enabling VEs to offer more frequent examination sessions, or examination sessions at more locations, or both), while not compromising the reasons the Commission decided that more than one VE is necessary. This in turn would reduce the difficulty and expense that some examinees and VEs experience in traveling to an amateur radio license examination session."

Remote Testing

The FCC is also looking to add provisions in the rules for remote testing of Amateur Radio license exams. On very rare occasions, the FCC has permitted VEs to use such means to remotely observe examination sessions that are held at isolated locations. With this in mind, the FCC is seeking comments on whether or not to amend Section 97.509(c) "to provide that, at the option of the administering VEs and the VEC coordinating the examination session, the VEs may be 'present and observing' an examinee for purposes of the rule when they are using an audio and video system that can assure the proper conduct and necessary supervision of each examination. The FCC stated that it "believe[s] that permitting remote examination administration can increase the availability of examination opportunities, which would reduce the difficulty and expense that some examinees and VEs experience in traveling to an amateur radio license examination session."

Emission Types and Designators

In its March 2011 *Petition*, the ARRL stated that Amateur Service licensees have recently established numerous narrowband UHF repeater facilities using multiple time-slot Time Division Multiple Access (TDMA) repeaters and single-slot TDMA handheld digital transceivers, principally in the 70 cm (420-450 MHz) band.

Part 97 of the Commission's Rules specifies the emission types that may be transmitted on amateur frequencies. An emission designator describes an emission's characteristics. A minimum of three symbols is used to describe the basic characteristics of the radio emission: The first symbol designates the type of modulation, the second symbol designates the nature of the signal modulating the main carrier and the third symbol designates the type of information to be transmitted. For example, in F7D, the F signifies frequency modulation, the 7 means it is used for two or more channels containing quantized or digital information, while the D stands for data transmission.

"Specifically, the ARRL notes that a Motorola system used by some Amateur Radio operators uses two-slot TDMA technology for the repeater and single-slot TDMA emissions for the associated portable and mobile transceivers and that the system 'specifies emission designators 7K60FXE in voice operation and 7K60FXD for data,'" the FCC noted. "The present rules, however, do not appear to permit amateur stations to transmit single-slot TDMA emissions on Amateur Service channels above 30 MHz. Part 97 does not specifically authorize any phone or data emission designators with X as the second symbol. Consequently, the ARRL requests that the Commission amend its rules to revise Section 97.3(c) to include emission type FXE in the definition of a phone emission, and to revise Section 97.307(f)(8) to allow amateur stations to transmit data emission type FXD."

In seeking to change the rules for these emission types, the FCC noted that the purpose of specifying emission designators for the Amateur Service "is to relegate the transmission of certain inharmonious emission types to different segments of the frequency bands, while still allowing great flexibility in the types of emissions that may be transmitted by amateur stations. We do not believe that this purpose is served by excluding FXE and FXD emissions. Accordingly, we propose to amend Section 97.3(c)(5) to allow emission type FXE as a phone emission and to amend Section 97.307(f)(8) to allow emission type FXD as a data emission. We believe that this proposed rule change would encourage individuals who can contribute to the advancement of the radio art to more fully utilize TDMA technologies in experimentation and promote more efficient use of the radio spectrum currently allocated to the Amateur Service."

The entire *Notice of Proposed Rulemaking* can be found at **transition.fcc.gov/Daily_Releases/Daily_Business/2012/db1002/FCC-12-121A1.pdf**.

IARU Region 3 Chairman Michael Owen, VK3KI (SK)

IARU Region 3 Chairman Michael Owen, VK3KI, passed away September 22. He was 75. Owen, who was also President of the Wireless Institute of Australia (WIA) — that country's IARU Member Society — participated in many IARU committees and was a member of the IARU Observer Team at a number of World Radiocommunication Conferences. He is perhaps best remembered for his work on Article 25 — a package of revisions to the International Radio Regulations that are specific to the Amateur

IARU Region 3 Chairman and WIA President Michael Owen, VK3KI (SK) [Robert Broomhead, VK3DN, photo]

and Amateur-Satellite Services — at WRC-03. Amateur Radio societies around the world have benefited from Owen's enthusiasm and experience; he was passionately involved with the Amateur Radio Service since the 1960s, and served as IARU Vice President from 1989-1999.

"I am very saddened to hear about Michael's sudden passing," IARU President Tim Ellam, VE6SH, told the ARRL. "I was only speaking to him a few days ago and he was very enthused about leading the IARU Region 3 Conference in Ho Chi Minh City in a few weeks. Michael was a good friend and mentor to many of us in IARU. His drafting skills were second to none, and his ability to clearly articulate his position on a number of issues was of immeasurable help to us. The IARU extends sympathies to his family, IARU Region 3 and WIA. I speak for all of my colleagues when I say he will be very sorely missed."

From 1989-1999, Owen served as Vice President of the IARU. Later, as President of the WIA, he choreographed its transition from a confederation to a truly national body; the WIA celebrated its 100th anniversary in 2010. Simultaneously, Owen served as Chairman of IARU Region 3 since 2006, and at the time of his death, was organizing November's Region 3 Conference in Ho Chi Minh City.

"Michael Owen was a strategic thinker; he saw past short-term pros and cons and could envision how decisions made today would affect the distant future," recalled ARRL Chief Executive Officer David Sumner, K1ZZ. "He also understood that working in the background — doing one's homework — was essential to success. There is simply no way to replace someone with Michael's experience and wisdom. His death is a searing loss for both the IARU and the WIA, but both organizations are stronger today because of the enormous contributions he made to their well-being."

Peter Lake, ZL2AZ, Appointed IARU Region 3 Chairman

Following Owen's death, the Directors in IARU Region 3 have voted to appoint Peter Lake, ZL2AZ, of Wellington, New Zealand, as its Chairman. "I am extremely grateful to my fellow Directors for their support in this difficult time, and for the procedural work by [IARU Region 3] Secretary Ken Yamamoto, JA1CJP, to formalize an appointment," Lake said in a statement. "I will do my best to carry through all the work that we have in progress, much of it due to items and ideas put in place by Michael. It is my privilege to have the opportunity to serve you, the Member Societies and fellow amateurs in Region 3."

Lake — who has been a licensed amateur for more than 50 years — has been involved with IARU activities for more than 25 years and a Director of Region 3 since February 2005. He began his professional career as an engineer, first with the New Zealand Post Office and then with Telecom New Zealand. He followed this with 14 years at a small and specialized telecommunications consulting company in Wellington that included a wide variety of assignments in the Pacific, Asia and Southeast Asia. "My 'style' will probably be different from Michael's in some ways," Lake explained, "but our goals are the same — to ensure a growing and successful IARU Region 3."

ARRL Invites Nominations for 2012 International Humanitarian Award

Nominations are open for the 2012 ARRL International Humanitarian Award. This award is conferred upon an amateur or amateurs who demonstrate devotion to human welfare, peace and international understanding through Amateur Radio. The League established the annual prize to recognize those radio amateurs who have used ham radio to provide extraordinary service to others in times of crisis or disaster.

As one of the few telecommunication services that allow people throughout the world from all walks of life to meet and talk with each other, Amateur Radio spreads goodwill across political boundaries. The ARRL International Humanitarian Award recognizes the Amateur Radio Service's unique role in international communication and the assistance amateurs regularly provide to people in need.

Nominations should include a summary of the nominee's actions that qualify the individual (or individuals) for this award, plus verifying statements from at least two people having first-hand knowledge of the events warranting the nomination. These statements may be from an official of a group (for example, the American Red Cross, The Salvation Army, a local or state emergency management official) that benefited from the nominee's particular Amateur Radio contribution. Nominations should include the names and addresses of all references.

A committee appointed by the League's President recommends the award recipient(s) to the ARRL Board, which makes the final decision. The committee is now accepting nominations from Amateur Radio, governmental or other organizations that have benefited from extraordinary service rendered by an Amateur Radio operator or group.

Andrey Fedorov, KL1A/RW3AH, received the 2011 ARRL International Humanitarian Award. Fedorov is the former Chief Coordinator of the Russian Amateur Radio Emergency Service (RARES) and has been involved in providing communications support via Amateur Radio for almost 25 years. He has also served in Rwanda, Turkey and Kosovo as an Emergency Rescue Service Officer, and as a Regional Communications Officer for the UN Peacekeeping Mission in Afghanistan.

All nominations and supporting materials for the 2012 ARRL International Humanitarian Award must be submitted in writing in English to ARRL International Humanitarian Award, 225 Main St, Newington, CT 06111 USA. Nomination submissions are due by December 31, 2012. In the event that no nominations are received, the committee may determine a recipient or decide to make no award.

The recipient of the ARRL International Humanitarian Award receives an engraved plaque, as well as a profile in *QST* and other ARRL venues.

In Brief

DXCC Desk Approves 12 Operations for DXCC Credit

ARRL DXCC Manager Bill Moore, NC1L, reports that 12 operations have been approved for DXCC credit: 3B8/IW5ELA (Mauritius), 9A8VB (Croatia), 4O7VB (Montenegro), E40VB (Palestine), E7/UA4WHX (Bosnia-Herzegovina), EY8/UA4WHX (Tajikistan), JY8VB (Jordan), UN/UA4WHX (Kazakhstan), YU9VB (Serbia), Z38VB (Macedonia), ZA/UA4WHX (Albania) and J5IFD (Guinea-Bissau). All operations, with the exception of J5IFD, occurred in 2012; the J5IFD was a 2010 operation. "If you have had any of these operations rejected in a recent application, please send an e-mail to **bmoore@arrl.org**," Moore said. "Please note that due to heavy e-mail volume, you may not receive a reply. Once updated, results will appear in Logbook of The World accounts, as well as online in the daily listings at **www.arrl.org/dxcc**."

Rick Palm, K1CE, k1ce@arrl.org

Hurricane Isaac: ARRL HQ Lessons Learned

It's not enough to learn the lessons; we must remember to apply them.

Mike Corey, KI1U
ARRL Emergency Preparedness Manager,
ki1u@arrl.org

Disasters like hurricanes remind us of the need for an MDEC as the response status rises from the local level to the section level and beyond.

Every event results in a lesson taught to us, whether it is big or small. Hurricane Isaac, while not packing the punch of a Katrina or Ike, still had a tremendous impact on the Gulf Coast when it hit in late August. In the aftermath, consequential lessons emerged for your ARRL® staff at HQ.

As we've seen in the past, a Major Disaster Emergency Coordinator (MDEC) would have been an asset. Disasters like hurricanes remind us of this as the response status rises from the local level to the section level and beyond. Eventually, state assets come into play and the situation ramps up to involve many sections (Isaac involved 13 and Irene in 2011 involved 19 sections). Having a go-between during multisection events would be a great tool, which is why such an MDEC proposal is being developed.

The MDEC was one of the key concepts proposed by the ARRL National Emergency Response Planning Committee in its landmark 2007 report. The MDEC would be a manager who would coordinate Amateur Radio operations, operators and resources supporting served agencies during a major disaster response operation when section and regional ARES® assets were overwhelmed. As seen by the committee, the MDEC's line of authority would be derived from the ARRL's disaster response emergency manager at HQ and would parallel the authority of the affected area's section managers.

Further consideration has the MDEC being responsible for establishing, on an as-needed basis, a disaster response structure called the Disaster Field Team (DFT). The DFT's purpose is to fulfill served agency requests and/or augment the existing ARES structure established by the section manager. The DFT would provide support for the relief organizations bringing resources into a disaster zone that cannot be served by the local Field Organization. Exercises with served agencies and ARES have successfully tested the MDEC function.

Lessons applied are how we get prepared for the next one.

Tap New Assets: Contest Stations and Contesters

We have already seen the value of contest stations and operators during an emergency or disaster response. When net control stations were needed during Isaac, contesters volunteered their skills and stations to serve. When engaged in disaster response planning, be sure to reach out to the contest community, with its top of the line stations and skilled operators who want to assist. Contesters are arguably the best operators. They are experts at pulling signals out of the mud and the massive interference in pileups, as well as being conversant in many modes. They also typically have the best stations, with high power amplifiers and extensive antenna farms.

Contesters are arguably the best operators, experts at pulling signals out of the mud and the massive interference in pileups...

Lessons Learned, Lessons Applied

The methodology we at ARRL HQ employ to obtain critical situation reports (SITREP) and other information from the field needs improvement. Our primary method for receiving updates is via e-mail. These e-mails give us a snapshot of what is happening, but they often lack hard numbers. We may need to upgrade our online reporting system, for both major disasters and routine ARES activations. Information from the field is absolutely essential. It keeps us current and aware of the activity of ARRL field operators, provides us with key information to share with the League's national partners for their own use in response planning and execution, and helps increase our visibility to media, the regulators and the public.

Lessons learned has been a buzz phrase in the disaster response community for many years and these lessons are important. What really matters, however, is *lessons applied*. I've been amazed at how many times the same lessons learned in previous disasters emerge from each new disaster. *Lessons applied* are how we get prepared for the next one. They show that we don't suffer from disaster amnesia. Here at HQ, we'll work on building real change from the lessons learned, as we did after Hurricane Irene and the infamous 2011 Halloween Nor'easter.

Finally, I invite ARES groups and others to share your lessons learned and lessons applied with us at HQ. Remember, someone else may have faced the same problem, found a solution and can share the results for the benefit of all.

Letters: At Ground Zero

I want to thank you for the article in September 2012 *QST* by Bob Hejl, W2IK, on his incredible service at Ground Zero on 9/11. Thanks to Mr Hejl for sharing his very personal and moving story with us. It showed not only the value of Amateur Radio, but also the dedication and caring that so many of us in the service share. Many of us lost relatives, friends and acquaintances on that tragic day. No one will ever know how many heroes there were, but Mr Hejl was certainly one of them. — *Mark Rappaport, W2EAG, Retired Firefighter, New York*, **nccwman@aol.com**

Letters: Internet-based Systems' Fallibility

As a regular reader of the ARRL's *ARES E-Letter*, I've watched the newsletter consistently promote the use of the Internet-dependent D-STAR system for disaster response and communications services. Here in the mid-peninsula area south of San Francisco, "When all else fails, Amateur Radio," is a phrase we take seriously. We regularly train using simple, infrastructure-independent simplex operation, relaying as needed, to ensure all exercise participants get the messages. Among other things, these exercises encourage us to put up more effective antennas to ensure we can communicate on simplex without relying on the numerous local repeaters and/or Internet, which are subject to failure.

I have nothing against D-STAR, the Internet Radio Linking Project (IRLP), EchoLink or repeaters. They can be very useful systems when they are available. My concern is with their emphasis and reliance on the availability of the Internet for emergency communications. I suggest that any emergency exercise that uses an Internet-involved system to pass traffic also include a direct ham-to-ham simplex communication component. Furthermore, the *ARES E-Letter* should encourage this direct communication so that we will truly be prepared for an emergency when and if the Internet is not available.

Recently our ARES/RACES net conducted a "Rubber Ducky Night." Everyone checking in was asked to use their handheld transceiver with either the stock flexible antenna or other after-market antenna to simulate the communications environment if their homes' outside antennas were destroyed. Yes, the net took a bit longer with people relaying messages for those who could not be heard by the entire net, but it was good practice. — *Rich Stiebel, W6APZ, Palo Alto, California, CERT, ARES/RACES*, **w6apz@sbcglobal.net**

Counterpoint: A Northeastern Florida EC Responds

Concerning the above opinion of Mr Stiebel, he links D-STAR to the Internet. While it is true that D-STAR uses the Internet, it is incorrect to say that if the Internet fails, D-STAR fails.

In St Johns County, Florida, we intend to use D-STAR with D-RATS (**www.d-rats.com**) as a tool in emergency situations.[1] We have found that D-STAR in simplex mode is very valuable in sending e-mails (possibly with attachments) via D-RATS to our central EOC from area shelters. This modality is *totally* independent of the Internet *and* repeaters.

We have successfully sent standard e-mail messages and other data formats from an operator in a shelter via simplex to the EOC, and from one operator to another, also by simplex, relayed by an EOC operator when the two operators were unable to connect directly to one another. With e-mail, we are not dependent on one operator understanding another, especially in conditions that require many repetitions.

Our emergency plan is based on situations where simplex is the only means of communications. D-STAR with D-RATS are definitely a part of that plan. Don't make the mistake of assuming that D-STAR is strictly Internet-based. Try it simplex and see what it can do. — *Michael Jordan, WE4MJ, Emergency Coordinator, St Johns County (Florida) ARES.*

[1]D. Smith, KK7DF, "D-RATS — An Application Suite for D-STAR," *QST*, Sep 2008, pp 34-35.

K1CE for a Final: Transporting Your Gear

How many times have you witnessed operators transporting their radios to Field Day or even disaster sites in the radios' original cardboard boxes? I would even submit that this is the method employed by the vast majority of radio amateurs. There is a much better way, and frankly, it is the only way to transport your gear into harm's way — Pelican cases (**pelican.com**). These cases are almost indestructible, use foam padding squares inside that can be easily modified to fit your gear perfectly and are used by public safety professionals all over the world.

K1CE's radios in their Pelican cases. At the rear left is the 1300 case next to the 1600 on the right. In the foreground is the 1030 mini case. [Rick Palm, K1CE, photo]

To transport my own personal radios I use four different Pelican cases. A Pelican model 1600, a large suitcase size case with four heavy duty latches and handle, protects my ICOM IC-7000 HF/VHF transceiver with DC power cable and microphone, plus an ASTRON SS-30 switching power supply and power cable. The manuals fit under the foam padding, out of the way, but available if necessary to decipher some of the functions of that function-laden radio.

I use a Pelican model 1300 case for transporting and protecting my ICOM IC-2200H VHF FM/digital voice/slow data/D-STAR radio, with microphone, DC power cord and manuals.

I use a Pelican model 1030 Micro Case for my ICOM IC-V80 handheld 2 meter transceiver and flexible rubber antenna, which has to be removed from its BNC connector to store inside the case with the radio. There is also room for a connector adaptor — a BNC to SO-239, for example.

Finally, I use a Pelican model 1010 Micro Case to store my identification cards, credentials, driver's license and other laminated cards for protection and ease-of-access when in the field. Don't keep them in your wallet on a major disaster scene! That's just asking for them to be soiled or stolen.

Pelican cases are waterproof, lockable with padlocks and have pressure release ports for changes in ambient pressures at different altitudes. Pelican cases are not cheap, but they are a lot less expensive than the cost of replacing your good HF rig when it slips out of the cardboard box onto the ground, is inundated by water, or ravaged by humidity or an airline baggage handler.

I'm currently reading the first person account of a Navy SEAL's role on the bin Laden raid and deployments in Afghanistan and Iraq. If Pelican cases work for him for transporting his guns, they will work for you for carrying your radios. — *Rick Palm, K1CE*

Contest Corral — December 2012

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

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

Start - Finish Date-Time		Date-Time		Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
Nov 30	2200Z	2	1600Z	1.8 / -	ARRL 160 Meter Contest	CW	RST and ARRL/RAC section if US/VE	www.arrl.org/contests
1	0000Z	3	2400Z	1.8-28 / -	TARA RTTY Mêlée	Dig	RST and State/Province or serial	www.n2ty.org/seasons/tara_melee_rules.html
1	1600Z	2	1559Z	3.5-28 / -	Top Operators Activity Contest	CW	RST, serial, and TOPS/PRO number	www.procwclub.yo6ex.ro
1	2300Z	2	See web	3.5,7 / -	AWA Bruce Kelly QSO Party	CW	RST, Xmtr type, power, name	www.antiquewireless.org
2	0000Z	2	2359Z	28 / -	10 Meter RTTY Contest	Dig	RST and state or province or serial	www.rttycontesting.com
2	1300Z	2	1600Z	3.5-14 / -	SARL Digital Contest	Dig	RST and serial	www.sarl.org.za
4	0200Z	4	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
7	0200Z	7	0300Z	1.8-14 / -	SNS and NS Weekly Sprints	CW Dig	Serial, name, and S/P/C	www.ncccsprint.com
8	0000Z	9	2400Z	28 / -	28 MHz SWL Contest	Ph CW	Log ARRL 10 Meter Contest QSOs	swl.veron.nl/swlcontest.htm
8	0000Z	9	2400Z	28 / -	ARRL 10 Meter Contest	Ph CW	RS(T) and State/Prov or serial	www.arrl.org/contests
8	1700Z	9	See web	1.8-7 / -	UBA Winter Contest	Ph CW Dig	RS(T) and UBA section or serial	www.uba.be/en/hf/contest-rules
8	2300Z	9	See web	3.5,7 / -	AWA Bruce Kelly QSO Party	CW	RST, Xmtr type, power, name	www.antiquewireless.org
9	0000Z	9	2359Z	3.5-28 / -	SKCC Weekend Sprintathon	CW	RST, S/P/C, SKCC nr or power	www.skccgroup.com
9	2100Z	9	2259Z	14 / -	Great Colorado Snowshoe Run	CW	RST, S/P/C, class, CQC number or power	www.cqc.org/contests
11	0000Z	17	0200Z	- / 50-222	NA High-Speed Meteor Scatter Contest	Dig	Both calls, grid square, acknowledgement	www.meteorscatter.org
12	0130Z	12	0330Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
12	1300Z	13	See web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
13	2100Z	13	2300Z	1.8 / -	Russian 160 Meter Contest	Ph CW	RS(T), serial, square ID (see website)	www.radio.ru/cq
15	0000Z	15	2400Z	3.5-28 / -	Feld-Hell Happy Birthday Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
15	0000Z	16	2400Z	3.5-28 / -	OK DX RTTY Contest	Dig	RST and CQ Zone	www.crk.cz/ENG/DXCONTE.HTM
15	1400Z	16	1400Z	1.8-28 / -	Croatian CW Contest	CW	RST and serial	www.9acw.org
16	1800Z	16	2359Z	3.5-28 / -	ARRL Rookie Roundup	CW	Both calls, name, check, S/P/XE or "DX"	www.arrl.org/contests
16	2000Z	16	2359Z	1.8-28 / -	Holiday Spirits Homebrew Sprint	CW	RST, S/P/C, ARCI number or Power	www.qrparci.org/contests
17	0200Z	17	0400Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
21	0001Z	Jan 8	2359Z	1.8-28 / 50,144	Lighthouse Christmas Lights QSO Party	Ph CW Dig	Serial or ARLHS number	arlhs.com
23	0000Z	23	1200Z	3.5-28 / -	RAEM Contest	CW	Serial and lat/long in degrees	raem.srr.ru
26	0000Z	26	0200Z	1.8-28 / 50	SKCC Straight Key Sprint	CW	RST, S/P/C, name, SKCC nr or power	www.skccgroup.com
26	0830Z	26	1059Z	3.5-7 / -	DARC XMAS Contest	Ph CW	RS(T) and DOK or special station code	www.darc.de/referate/dx/contest/xmas/en
27	0130Z	27	0330Z	3.5-14 / -	NAQCC Milliwatt Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
29	0000Z	29	2359Z	1.8-28 / 50,144	RAC Winter Contest	Ph CW	RS(T) and province or serial	www.rac.ca/en/rac/programmes/contests
29	1500Z	30	1500Z	1.8 / -	Stew Perry Top Band Distance Challenge	CW	4-char grid square	www.kkn.net/stew
Jan 1	0000Z	Jan 1	2400Z	3.5-28 / 50+	ARRL Straight Key Night	CW	General QSO information	www.arrl.org/straight-key-night

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates. No contest activity occurs on the 60, 30, 17 and 12 meter bands. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity. XE = Mexican state. Publication deadline for Contest Corral listings is the first day of the second month prior to publication date (December 1 for February *QST*) — send information to **contests@arrl.org**. Listings in blue indicate contests sponsored by ARRL or *NCJ*. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column.

Newsprint, Ink and Electrons Amateur Radio Style — Results ARRL Field Day 2012

With a tip of the cap to Charles Schultz, Al Capp, Scott Adams, Bil Keane and so many more who brought smiles to our faces.

Dan Henderson, N1ND
ARRL Regulatory Information/Field Day Manager

Growing up, one of my great memories was anxiously waiting for Sunday mornings. Why? Sunday morning meant the Sunday paper — which meant the Sunday Comics. The Sunday comics were always longer and in color, as opposed to the daily three or four small panes of black ink on white newsprint. Known in my home as the "funny papers," there was the family ritual of passing the comics along the pecking order — from my dad to my two older sisters through my older brother and finally down to me (and eventually to my younger brother). We each had our favorite strips and characters that we followed passionately.

The comics are part of our American culture — so much so that in 1995 the US Postal Service issued a commemorative series of classic images in honor of the 100th anniversary of the comics. Even today, newspapers still bring us that special slice of fun every Sunday.

In many ways, the variety of content and characters found on those hallowed pages is comparable to the annual celebration known as ARRL Field Day. Just like the comics, each Field Day operation has its own cast of characters and story line. Some are serious, some are humorous, highlighting the fact that Field Day can be different events to almost everyone involved, yet all can enjoy the common experience. So how does Field Day make the transition to the Sunday comics?

Many Field Day setups often begin like the ***Katzenjammer Kids***. People show up at the site ready to get the show on the road and see what mischief might be available in which to indulge. In 2012, a reported 37,567 persons participated in what is annually the largest Amateur Radio event. Whether they are erecting antennas, setting up operating positions, or doing one of the hundreds of other tasks necessary to make Field Day a success, there is something for everyone to do, unless you are the ***Andy Capp*** of your group who only admires the efforts of others.

Do not think for a moment that Field Day is not spread across the US and Canada. This year, 2657 entries and checklogs were received at ARRL, representing all 80 ARRL and RAC sections. We also received logs from several foreign countries. That number falls just short of the record number of entries for Field Day (2666, set in 2011), a strong indication that Amateur Radio is alive and well — and on the air! No need to call in ***Rex Morgan, M.D.*** for Amateur Radio.

Field Day frequently means emergency power. Emergency power means generators — and

Entries by Class

1A	135	10AB	1	4C	1
2A	407	15AB	2	1D	420
3A	317	1AC	14	2D	20
4A	158	2AC	30	3D	6
5A	86	3AC	35	4D	1
6A	43	4AC	11	1E	255
7A	19	5AC	7	2E	30
8A	14	6AC	1	3E	17
9A	3	1B1	59	4E	6
10A	6	2B1	2	5E	2
11A	2	1B1B	112	6E	1
12A	2	1B1C	22	14E	1
27A	1	1B2	26	1F	37
1AB	23	2B2	12	2F	65
2AB	18	1B2B	22	3F	51
3AB	7	2B2B	6	4F	19
4AB	8	1B2C	7	5F	10
5AB	1	1C	44	6F	3
6AB	2	2C	2	7F	3
9AB	1			9F	1

Top 10 Claimed Scores

CALL	Claimed	Class
W3AO	35,984	27 A
W9CA	26,342	8 A
K6EI	25,405	10 AB
W5UR	20,654	6 A
W5YA	19,970	3 AB
W6YX	18,102	3 F
W4IY	18,094	10 A
W4EZ	17,385	9 AB
W6ARA	17,158	4 A
K4FC	17,042	7 A

It's hard to concentrate on the radio when your Field Day site is as spectacular as the K6WCC site in the Santa Barbara section. [Photo courtesy Erik Lundin, N8MJK]

Don, NØYE, making contacts for the WØDK, Boulder (CO) Amateur Radio Club. [Photo courtesy Ulrich Hauser, KB9TTI]

that means a veritable ***Gasoline Alley*** at hundreds of locations. In the field, a total of 1292 Class A and B stations reported using generators (48% of all entries) while another 330 Class A or B stations reported using either battery, alternate or commercial power (12%). Those 759 (29%) stations that chose to operate from the comforts of home as Class D or E stations perhaps understand, like ***Hagar the Horrible,*** that home is a good place from which to operate.

Seven percent (189) of the entries received were for Class F stations demonstrating that ***For Better Or For Worse*** their interaction with emergency officials was up to the test. The final 2% of Field Day summaries came from Class C entries, which chose to operate while in motion — just not sure if they were able to keep up to speed with ***Flash Gordon.***

Do wyou remember when ***Dick Tracy*** replaced his two way wrist radio with a two way wrist TV? Just as changing technologies transform the comics, so too, do they continue to transform the way amateurs operate. Over 1.4 million contacts were made during Field Day 2012. For the first time, over 50,000 digital contacts were reported, continuing the trend that has seen at least a small increase in digital communications every year (except 1999) since we began reporting them separately in 1998.

CW, the mode some consider a throwback to the era of the caveman and ***Alley Oop***, is alive and well, producing over 592,000 contacts during Field Day 2012 — an increase of over 26% in the last decade. What was a bit surprising was that phone QSOs declined by about 7% from 2011. This can probably be explained by the apparent failure of the ***Wizard of Id*** to conjure up significant sunspots, making 10 meters a less desirable option for many operators.

Media hits for Field Day 2012 continued to be solid. We guess ***Brenda Starr*** was impressed when she visited your station. Many of you also posted your best photos on the ARRL Field Day Soapbox website at **www.arrl.org/soapbox**. Be sure to visit the site, read the experiences of others, and post your own. It's a great way to generate some excitement for your club's activities.

One of the more successful recent additions to Field Day has been the online Field Day site locator, first added in 2008. This year, over 1600 groups and clubs posted their Field Day setup information on the website. It is a great way to publicize your activity. Every year ARRL HQ refers many callers to the website when they are looking for a Field Day in their area. It certainly beats having Jeff, from ***The Family Circus***, as their navigator.

In reviewing the thousands of photographs submitted by participants, one thing is clear: Field Day is not only a great operating opportunity, it remains one of the premier social events for amateurs across the country. When amateurs get together they bring enough food to feed Dagwood. We are not sure who serves as the ***Blondie*** for your covered dish supper, but be sure to thank them — before ***Garfield*** samples the repast.

Sometimes when trying to maintain your working relationship with agencies served by Amateur Radio public service communications, you can feel like one of the overlooked employees in ***Dilbert***. Successful Field Days get you noticed — and strengthen our opportunities to give back to the community. This year's entries provided numerous photos and notations about various public officials and representatives of served agencies visiting the event. Whether you are ***Shoe*** entertaining Senator Batson D. Belfry, or ***Beetle Bailey*** undergoing a site inspection from General Halftrack, Field Day is your time to shine. The more organized activity you demonstrate to VIPs, the bigger impact you can make down the road. Don't let your site be akin to ***Barney Google***'s ***and Snuffy Smith***'s QTH in Hootin' Holler.

The GOTA (Get On The Air) station continues to be a popular attraction at over 460 sites that utilize this training tool. It can bring ***Little Orphan Annie***, who has been inactive in the hobby for years, back to the fold or be a place for the next generation of amateurs — the ***Rugrats*** — to whet their appetite for Amateur Radio. Many feel the GOTA station may be the single most important station at a Field Day site. GOTA is where you can introduce ***Dennis the Menace*** to a lifetime of fun and service. If your group does not utilize a GOTA station, consider adding one in 2013 if your category is eligible.

After your Field Day weekend is in the books, there is always work to do. Your club's ***Broom-Hilda*** (a.k.a. Field Day coordinator) must brew up the final potion and submit the entry to ARRL. Most groups will submit their summaries via **www.b4h.net/cabforms**. Once all is assembled, your claimed scores are posted and groups across the country will battle, like ***The Lockhorns,*** to claim victory in their category, state or county. But perhaps your goal was more along the lines of ***Mark Trail*** — to have an environmentally solid event.

For the majority of the participants, Field Day is not about the score — it is about the fun. Just like the variety of comic strips in the Sunday paper, Field Day brings smiles to many faces, no matter how you approach it. Just as ***Doonesbury*** reflects our world and Charlie Brown, Lucy, Snoopy and all of the ***Peanuts*** gang reflect our fun-loving whimsical nature, at the end of the day Field Day reflects the experience and fun of Amateur Radio.

Field Day is always the fourth full weekend in June. So mark your calendars for June 22-23 2013. Who knows, maybe the ideas you sketch up for a successful weekend can blossom into your own syndicated comic strip. Good luck & 73.

General Field Day Statistics

Year	2012	2011	2010	2009	2008	2007
CW QSOs	592,094	577,181	540,419	556,525	506,139	511,580
Digital QSOs	50,908	45,099	41,872	38,340	27,869	22,112
Phone QSOs	757,256	812,083	747,419	765,536	702,847	679,240
Total QSOs	1,400,258	1,434,363	1,329,710	1,360,401	1,236,855	1,212,932
Total Entries	2,657	2,666	2,648	2,642	2,409	2,331
GOTA	461	463	467	470	447	467
Participants	37,567	39,287	37,764	37,592	35,798	34,833

Entries by ARRL / RAC Section

AB	9	ME	21	QC	22
AK	8	MI	85	RI	11
AL	34	MN	56	SB	13
AR	25	MO	63	SC	28
AZ	53	MS	31	SCV	40
BC	22	MT	15	SD	10
CO	47	NC	79	SDG	24
CT	29	ND	6	SF	12
DE	6	NE	15	SFL	24
DX	4	NFL	52	SJV	33
EB	19	NH	19	SK	7
EMA	32	NL	3	SNJ	20
ENY	27	NLI	29	STX	71
EPA	56	NM	30	SV	32
EWA	24	NNJ	32	TN	57
GA	60	NNY	6	UT	23
IA	33	NTX	62	VA	83
ID	24	NV	14	VI	1
IL	82	NWT	4	VT	12
IN	59	OH	122	WCF	25
KS	30	OK	25	WI	53
KY	36	ON	71	WMA	18
LA	19	OR	49	WNY	52
LAX	36	ORG	50	WPA	42
MAR	9	PAC	8	WTX	16
MB	3	PR	7	WV	14
MDC	56			WWA	69

Scores

Score listings are grouped according to the number of transmitters in simultaneous operation and their entry class. 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, total score (including bonus points) and ARRL / RAC section. Entries are listed from highest to lowest claimed score in each class. Class A stations are clubs or groups portable with 3 or more participants. Class B stations are portables with one or two participants. 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.

Class A — 3 or more Participants Portable

1A

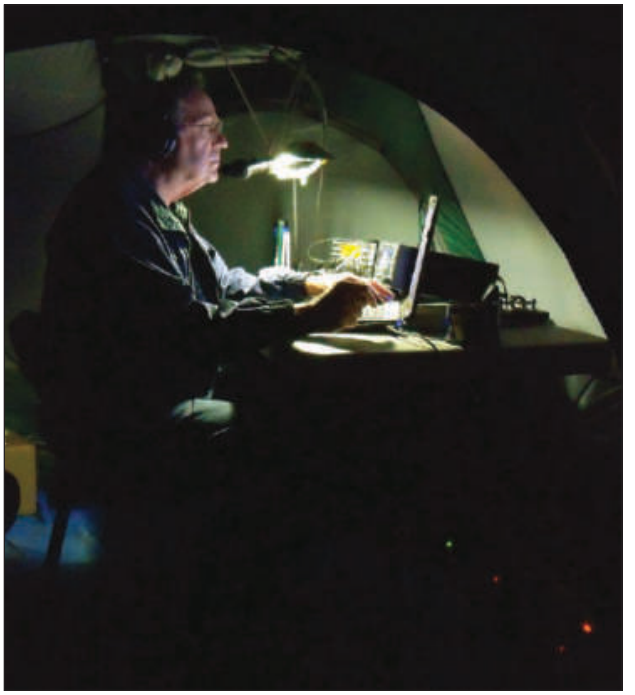
Tilson Contest Club
K5WA 2420 2 8 9,088 STX
Bear Mountain Contest Team
N2IC 2135 2 5 8,156 NM
Robert F Heytow Memorial RC
K9YA 1394 2 3 6,326 IL
Case ARC
W8EDU 1547 2 4 5,964 OH
Hoosier DX and CC
KJ9D 1466 2 13 5,904 IN
Qualcomm ARC
W6QAR 1309 2 9 5,702 SDG
Alberta Clippers CC
VE6TL 1289 2 4 5,664 AB
Oconee District 17 FD Group
N4S 1534 2 9 5,618 SC
Potomac Valley RC
N4A 1369 2 3 5,526 NC
Carolina Contest Consortium
K4FQU 1499 2 3 5,232 NC
Koolau ARC
KH6J 1516 2 41 5,224 PAC
Bozo and the Lids
W9TG 1122 2 4 5,038 IN
Sam Houston AR Klub
AI5M 1089 2 21 4,804 STX
Buckeye DX Club
W8OS 1107 2 7 4,774 OH
Montreal ARC / West Island ARC / Concordia University ARC
VE2ARC 1224 2 25 4,688 QC
ARA of So New England
W1AQ 1464 2 13 4,562 RI
Red Ant Annihilators/SCAN/BVSARC
KI6J 1747 2 5 4,198 SJV
Murphy's Law Radio Group
N5KM 1068 2 26 4,082 NTX
Wayne ARC
W8AV 905 2 11 3,940 OH
Big Hill ARC
KØHP 821 2 5 3,930 SD
Page Valey ARC
K4PMH 1197 2 18 3,902 VA
Sandia National Laboratories ARC
W5MPZ 1309 2 11 3,880 NM
Dr. Loomis Memorial Junior Mechanics League
W3KDR 1046 2 8 3,596 MDC
Souris Valley ARC
KØAJW 858 2 10 3,496 ND
Big Bend ARC
K5FD 1188 2 20 3,460 WTX
RC of Redmond
N7KE 877 2 19 3,292 WWA
Motorola ARC
K9MOT 767 2 20 3,204 IL
Marshall Cty ARC
WØGCJ 671 2 12 3,162 KS
Laurens Cty ARC
W4IT 534 2 5 3,064 SC
N4CWZ 898 2 3 3,032 NC
W9PC 704 2 7 2,950 IN
K4SV 994 2 21 2,842 SC
Athens Cty ARA
W8MHV 522 2 13 2,800 OH
K4WDG 948 2 4 2,706 NC
Newton ARA
WØWML 468 2 9 2,634 IA
WBØSND 615 2 4 2,592 MO
IOOK Vice-Presidents
W8ED 556 2 14 2,518 WV
Union Metropolitaine des Sans-filiste de Montreal
VE2UMS 636 2 25 2,490 QC
Bitterroot AR Contest Group
K7A 454 2 3 2,406 MT
4x4 Ham
W7AZO 392 2 50 2,400 AZ
Wiregrass ARC
WB4ZPI 726 2 15 2,254 AL
Southwest MS ARC
W5WQ 562 2 15 2,190 MS
Central Washington ARC
W7TT 447 2 17 2,124 EWA
SCVRA
KØCD 397 2 20 2,118 WI
Texas DX Society
K5DX 616 2 9 2,100 STX
Bass Hill Rep Group
W1KX 429 2 8 2,076 ME
Jefferson Cty ARC
KBØTLL 648 2 36 2,046 MO
Derangers
N6MI 1361 1 4 2,034 SCV
Hattiesburg ARC
K5PN 825 2 23 2,000 MS
QCWA Chapter 170
W7QD 442 2 3 1,962 EWA
Wasteland Comm Corp
K6WCC 549 2 3 1,952 SB
Hanburger's Helpers ARC
K3HH 550 2 3 1,924 MDC
Eastern Panhandle ARC
K8EP 617 2 12 1,874 WV
Lanark and North Leeds ARES
VE3LCA 412 2 5 1,862 ON
Maui ARC
KH6RS 1404 1 10 1,783 PAC
CRA Rive-Sud Montreal
VE2CLM 431 2 15 1,776 QC
Benton ARS
K5NE 353 2 15 1,714 AR
SPRAG
N9EP 423 2 4 1,704 IL
Salted Hams Club
N5PJ 412 2 3 1,648 OK
Mayerthorpe Flying Tigers
VE6FT 723 1 11 1,646 AB
Paso Robles ARC
W6R 639 1 25 1,635 SB
Juneau ARC
KL7JRC 307 2 41 1,634 AK
Parma RC
W8PRC 356 2 31 1,632 OH
JJ&V Contesters
WAØVPJ 725 2 6 1,608 MN
VE3OD 249 2 10 1,602 ON
Stanly Cty ARC
K4OGB 360 2 14 1,592 NC
Benson Cty ARC
NØBG 229 2 11 1,568 ND
Local Emergency Field Radio Op Group
W9FRG 309 2 12 1,548 WI
Wireless Society of Southern Maine
WS1SM 228 2 10 1,490 ME
ARC of the Univ of Arkansas
K5GOE 240 2 39 1,434 AR
Vicksburg ARC
K5ZRO 290 2 4 1,426 MS
Poly Alumni RC
W3CDI 272 2 6 1,354 MDC
KBØFM 549 2 3 1,348 WI
KB9OFM 549 2 3 1,298 WI
Bitterroot ARC
W7FTX 259 2 54 1,288 MT
Issaquah ARC
W7BI 200 2 6 1,226 WWA
Ether Busters
WØKU 295 2 5 1,220 CO
LOWARS
VE3JJF 212 2 8 1,204 ON
Vaca Valley RC
W6VVR 360 2 8 1,190 EB
Great River ARC
WØDBQ 260 2 13 1,170 IA
Covey Hill ARC
VE2CYH 239 2 20 1,160 QC
Prescott-Russell ARC Inc.
VE3PRD 201 2 10 1,114 ON
Peruvian-American RC
KEØRR 228 2 3 1,036 MN
Heart of Texas Ham Ops Group
WA5HOT 121 2 19 1,034 STX
K7JAN 322 2 3 1,020 ID
Falls Lake ARC
KZ4FL 221 2 3 1,012 NC
Arkansas Radio Em Serv & CAUHF
N5AT 230 2 34 1,010 AR
VE7NA 212 2 26 990 BC
Mountain ARC
W6BW 264 2 13 978 SJV
Dawg Daze Radio Group
W6BIV 156 2 3 968 SB
Texas Interconnect Team
K5TIT 326 2 7 902 NTX
N5K 629 1 3 870 WTX
Decatur Cty ARC
KW4DC 207 2 11 864 TN
Texins ARC / Richardson Wireless Klub/ UTD ARC
K5DM 341 2 15 834 NTX
Calvary E-Free Church
KDØPFC 306 2 6 832 CO
Amargosa ARC
N7A 246 2 6 760 NV
Chautauqua & Erie ARC
NZ2Y 134 2 4 718 WNY
DeKalb Cty ARC
W4GBR 134 2 15 718 AL
Current River ARC
KØCRA 111 2 13 712 MO
River Cities ARA
K4K 72 2 12 704 KY
Inuvik AR Group
VE8NE 81 2 3 704 NWT
South Point ARC
VA3WG 258 2 3 666 ON
KE5FSY 53 2 6 656 AR
Hi-Line ARC
W7HAV 31 2 9 634 MT
MDOT ARC
KM5DOT 108 2 3 610 MS
Black Hills ARC
WØBLK 146 2 10 594 SD
Keeping Amateur Radio Fun
KØARF 173 2 3 582 MN
WA1HRE 189 2 3 576 CT
Okeechobee ARC
K4OKE 37 2 10 574 SFL
Woodchuck ARC
WD8CHK 162 2 8 574 OH
EmComm Ham Operators of Jackson Hole
N7EJH 160 2 6 570 WY
Possum Hollow Rednecks
WD8MQN 117 2 8 564 VA
University ARC
W4UAL 318 1 3 553 AL
WARS
WC7EC 122 2 12 536 OR
WARS
WE7EC 122 2 12 536 OR
Novi ARC
N8OVI 60 2 3 532 MI
VE7IHL 157 2 3 514 BC
NorWesCo
N9PHS 58 2 5 466 WI
Atchison Cty AR Service
KØHK 45 2 7 462 KS
LBCECG
N3RAY 138 2 3 396 EPA
Big Sandy ARC
KCØPBQ 60 2 3 370 CO
KJ4UZG 156 2 3 362 TN
W9GFD 101 2 5 352 IL
Tick Bite Quartet
K4RET 118 2 4 336 VA
Northern MI ARES
NM8ES 30 2 4 310 MI
JVARC
K3DNA 88 2 7 276 WPA
Roadrunners
KB3UDP 10 2 3 272 MDC
Baccalieu AR Klub
VO1BRK 67 2 8 248 NL
Victoria Haliburton ARA
VA3LNZ 64 2 3 228 ON
Aerospace Employees Radio Org Colorado Springs
AEØRO 29 2 14 208 CO
Hualapai ARC
WB6RER 62 2 5 208 AZ
Watertown ARC
N9HR 47 2 10 194 WI
Twin Swamps Radio Ops
KC8NDA 63 2 3 176 MI
Dairyland Xpeditionary Keyers
WE9L 1 1 3 101 WI
St. Marys ARC
VE3SDF 28 2 8 56 ON

2A

Batesville ARC
K5UZ
(+KD5J) 4560 2 20 15,470 AR
Radio Amateurs of Northern Vermont
W1NVT
(+W1PU) 4639 2 28 14,802 VT
Muskogee ARC
KK5I
(+N5KW) 3468 2 10 12,868 OK
Louisiana Cane Field CC
W5ZR
(+W5RZY) 3480 2 27 12,434 LA
REDXA & Marin ARS
W6SG
(+W6KB) 3785 2 60 12,028 SF
Redneck Roviera Radio Sportmodels
N4OX
(+K4ARD) 3889 2 6 11,872 NFL
Sierra Chapter NCCC
K6NV
(+K6ST) 3399 2 9 11,206 SV
Falmouth Amateur RA
K1RK
(+W1HQH) 3057 2 25 10,572 EMA
Raytown ARC
KØGQ
(+KCØMO) 2653 2 35 10,300 MO
Minnesota Wireless Assn
WØAA
(+NØKK) 2227 2 20 9,742 MN
McMinn Cty ARC
NA4K 2942 2 37 9,716 TN
Pacific Cty ARC
W7R (+W7Y) 2583 2 22 9,672 WWA
Randallstown ARC
N3IC
(+K3MZ) 2786 2 20 9,648 MDC
Sakonnet 49'ers
W1LY
(+W1SYE) 2655 2 38 9,388 RI
Canton ARC
W8AL
(+NX8J) 2324 2 69 9,228 OH
Lafayette DX Assn
W9LDX
(+K9IN) 2700 2 12 9,080 IN
Williamson Cty Amateur RC
N5TT
(+N5T) 2384 2 51 8,720 STX
Smithchart ARS
K4OO 2748 2 13 8,666 NC
Central OR DX Club
N7LE 2463 2 9 8,268 OR
Northern Arizona DX Assn & Coconino ARC
W7TB
(+KC7KCN) 2100 2 21 8,268 AZ
Northern Ohio DX Assn
W8DXA 2492 2 23 8,100 OH
Platinum Coast ARS
W4MLB
(+K4QD) 2133 2 86 8,050 SFL
Cold Creek Canyon Campers
WØC 2375 2 5 8,046 CO
Central Virginia CC
W4ML
(+W4MYA) 1907 2 16 7,972 VA
Escondido ARS
N6SD
(+N6WB) 2134 2 80 7,804 SDG
Schaumburg ARC
N9RJV
(+W9RAO) 2036 2 62 7,458 IL
Purveyors of Doom
W9UFO 2526 2 9 7,388 NM
MARA / VARA
W4XD
(+K4MRA) 2022 2 98 7,360 VA
Lynchburg ARC
K4CQ
(+AK4SQ) 1900 2 23 7,230 VA
NA9U
(+KC9TEW) 1864 2 24 7,210 IN
Saratoga ARA
K6SA
(+K6NN) 2290 2 20 7,170 SCV
Rochester DX Assn
W2RDX
(+W2AN) 2024 2 20 7,102 WNY
PARC & PRA
W1HP
(+KD1NA) 1631 2 20 6,988 EMA
Motor City RC
W8MRM
(+W8GTZ) 1946 2 51 6,926 MI
Heart O' Texas ARC
W5ZDN
(+W5TSA) 1925 2 43 6,828 NTX
Tampa ARC
N4TP
(+N4SEX) 1938 2 35 6,796 WCF
Tennessee Valley DX Assn
W4PL
(+WA4AA) 1692 2 31 6,714 TN
W/K ARC of Greater Milwaukee
N9AW 1868 2 10 6,634 WI
Friends and Alumni of LT
K1LT 1862 2 12 6,616 OH
Mississippi Valley ARA
W9MVA
(+W9FCC) 2064 2 15 6,496 WI
Explorer Post 599
WA2DFI
(+W7BSA) 2064 2 13 6,472 AZ
Delaware ARA
K9NN
(+W9DUK) 1700 2 19 6,430 IN
Monroe Co. Radio Comm Assn
W8PI
(+W8DWL) 1918 2 17 6,306 MI
Boulder ARC
WØDK 2036 2 15 6,292 CO
Crawford ARA
W3MIE
(+N3QQH) 1636 2 39 6,292 WPA
N4N
(+KE4UW) 1496 2 27 6,212 GA
Decatur ARC
W4ATD
(+KB4CAY) 2058 2 29 6,196 AL
NHC Em Prep Group
NC4NH 1659 2 36 6,126 NC
PRARL
KP4ES
(+NP3IR) 1485 2 17 6,074 PR

Fauquier ARA
W4VA
(+KW4VA) 1537 2 18 6,052 VA
WJ4N 1685 2 12 6,002 SFL
Trojan ARC
NW0K 1365 2 8 5,980 KS
Montgomery ARC
W4AP
(+AK4FP) 1370 2 56 5,878 AL
Providence RA
W1OP
(+W1PRA) 1801 2 12 5,854 RI
K0LIR 1627 2 24 5,814 MO
Cape Fear ARS
K4MN 1404 2 30 5,788 NC
Suncoast ARS / Sarasota Cty ACS
WC4EM 1724 2 13 5,690 WCF
MARCA
W7MOT
(+AA7OO) 1474 2 25 5,688 AZ
Mining ARC and St Paul RC
W0MR
(+K0AGF) 1744 2 29 5,574 MN
San Mateo RC
W6UQ
(+K6LMJ) 1673 2 25 5,420 SCV
Des Moines RA Assn & AR Technical Society
W0AK
(+W0SCI) 1362 2 52 5,346 IA
Anderson RC
N4AW
(+N4SBA) 1227 2 20 5,242 SC
Marietta ARC
W8HH 1423 2 13 5,196 OH
Palos Verdes ARC
K6PV 1446 2 29 5,188 LAX
St Charles ARC
KO0A
(+WB0HSI) 1044 2 71 5,138 MO
Mountaineer ARA
W8SP 1326 2 22 5,004 WV
Scorpion Ranch
WS4Y 1341 2 6 4,956 KS
Hannibal ARC
W0KEM
(+W0MTL) 1138 2 21 4,934 MO
Williamsburg Area ARC
K4RC
(+N4DJ) 1244 2 30 4,830 VA
Hancock ARC
W9ATG
(+N9TT) 1428 2 42 4,806 IN
Hellgate ARC
W7PX
(+NQ7D) 1327 2 25 4,716 MT
Bristol Cty RA
W1ACT
(+N1JOY) 1303 2 13 4,638 EMA
New Providence ARC
N2XJ
(+W2FMI) 1535 2 35 4,604 NNJ
Beach Boys ARC
W6SL 1269 2 9 4,528 SB
Vintage Iron RC
N3KR
(+N3OD) 1378 2 5 4,392 NNJ
Mid-MO ARC
N0SS
(+K0ETY) 1021 2 58 4,386 MO
Palatine ARES / RACES Group
W9P
(+WX9PAL) 1103 2 66 4,380 IL
North Idaho Contest Group
K7TM 862 2 3 4,308 ID
Anaconda ARC
W7VNE 912 2 11 4,168 MT
Candlewood ARA
W1QI 893 2 25 4,142 CT
Olive Branch ARC
W5OBM
(+K5OLV) 1280 2 17 4,114 MS
Lakes Region Rep Assn
W1UR
(+W1BST) 1337 2 9 4,100 NH
ARES Los Angeles NW District
WA6P 1031 2 49 4,100 LAX
Hambuds
KK5E
(+KF5GLR) 958 2 26 4,098 STX
Radio Farm
N0MA
(+N0MMA) 1290 2 12 4,054 IA
Sioux Empire ARC
W0ZWY
(+W0FSD) 1133 2 30 4,040 SD
Alamance ARC
K4EG
(+W4VGZ) 902 2 48 4,024 NC
Titus-Morris Co ARES
K5K 1054 2 8 4,016 NTX
Heart of Dixie ARS
W4HOD 977 2 12 4,006 AL
Ottawa ARC
VE3RC
(+VE3NCR) 796 2 75 3,982 ON
Halifax ARC
VE1FO
(+VE1TRI) 1149 2 40 3,980 MAR
South Georgian Bay ARC
VE3SGB 1332 2 16 3,964 ON
South Canadian ARS
W5NOR
(+WB5ULK) 859 2 58 3,932 OK
Minden ARA
N5RD
(+KA5KBP) 1296 2 16 3,928 LA
Pine State ARC
N1ME 1024 2 30 3,916 ME
Jasper/Cherokee RCs
K4ACW
(+K4MTX) 762 2 36 3,854 GA
Tallahassee ARS
K4TLH
(+N4PIH) 815 2 68 3,818 NFL
Massillon ARC
W8NP
(+W8DEA) 973 2 35 3,798 OH
PALS Repeater Group
WX9PIA 1429 2 12 3,750 IL
Franklin Cty ARC
AC1L
(+KB1MSU) 886 2 25 3,744 WMA
Montrose ARC
K0IIT
(+KC0QXX) 894 2 48 3,716 CO
Meriden ARC
W1NRG 791 2 20 3,694 CT
W6SFM 648 2 27 3,642 SV
Los Angeles ARC
W6QET 1089 2 15 3,622 LAX
Fox Cities ARC, Inc.
W9ZL 950 2 12 3,600 WI
W1PBR 835 2 10 3,580 ME
Blackstone Valley ARC
W1DDD
(+W1TBR) 762 2 37 3,556 RI
Fort Madison ARC
WF0RT
(+W0NB) 632 2 18 3,486 IA
Owensboro ARC
K4HY 806 2 28 3,468 KY
West Allis RAC
W9FK 958 2 19 3,452 WI
Southwest Louisiana Am Rep Club
W5BII
(+KC5RGW)1124 2 22 3,408 LA
N5EOC
(+KK5HT) 692 2 23 3,378 NTX
ARC of Amite Cty
W5CCW 1008 2 5 3,338 MS
Green Valley ARC
WE7GV 940 2 55 3,336 AZ
Stu Rock ARS
W8NJH 890 2 15 3,324 MI
BARC
K2EC 1219 2 20 3,306 NLI
Reelfoot ARC
K4RFT
(+N4MJ) 637 2 10 3,306 TN
Roanoke Valley ARC
W4CA
(+WG4GW) 1191 2 26 3,266 VA
ARC EmComm Svc
WB2QBP
(+K2ARC) 1079 2 15 3,248 NLI
Tuscaloosa ARC
W4XI 845 2 30 3,188 AL
Davis Cty ARC
K7DAV
(+NM7P) 664 2 41 3,184 UT
Spring Hill ARC
N4WO 676 2 29 3,162 NFL
Tippecanoe ARA
W9REG
(+WB9SWD) 680 2 28 3,160 IN
Tri Cty ARC
W9MQB
(+W9FIB) 735 2 19 3,160 WI
21 Repeater Group
N9VI
(+N9WLW) 837 2 23 3,124 IN
Mimbres Valley RC
AK5D 983 2 4 3,124 NM
EPCOM
VE7PCE 1013 2 25 3,096 BC
Boca Raton AR Alliance
N4BRF 816 2 12 3,088 SFL
Ellsworth Am Wireless Assn
W1TU
(+N1MEA) 665 2 32 3,084 ME
Club Radio Amateur de Quebec
VE2CQ 717 2 45 3,084 QC
Bishop ARC
N6OV 1252 2 26 3,074 ORG
Blossomland ARA
W8MAI
(+W8KIT) 715 2 17 3,042 MI
Morris RC
W2YD 693 2 7 3,006 NNJ
Richmond ARC
VE7RAR
(+VA7ODY) 659 2 25 2,978 BC
Mac's Marauders
K4AOC 835 2 5 2,968 SC
Club Radio Amateur Saguenay-Lac-St-Jean
VE2CRS 810 2 82 2,968 QC
Hidden Valley's ARC/UW-Platteville ARC
KC9KQ
(+W9UWP) 692 2 25 2,958 WI
Heartland DX Assn
NI0DX 738 2 8 2,956 NE
Harris Intersil ARC
K4HRS 796 2 14 2,952 SFL
Okaw Valley ARC
KK9N
(+W9KXQ) 741 2 25 2,934 IL
Hospital Disaster Support Comm System
W6H
(+K6MHD) 635 2 79 2,924 ORG
Peekskill/Cortlandt ARA
W2NYW 968 2 15 2,920 ENY
Half Moon Bay ARES
WR6HMB 713 2 9 2,912 SCV
Wilderness Road ARC
W4CDA
(+WQ4Z) 600 2 16 2,862 KY
Club Radio Amateur de Beauce
VE2CRB 566 2 5 2,854 QC
Saint Lucie Cty ARES
W4SLC
(+KK4ISZ) 687 2 25 2,848 SFL
Irvine Disaster EmComm
N6IPD
(+K6PB) 698 2 32 2,828 ORG
Cedar Valley ARC
W0GQ
(+K0JCX) 544 2 43 2,802 IA
Twin Cities Repeater Club
W0BU
(+KE0NA) 646 2 35 2,778 MN
Amateur Radio Transmitting Society
W4CN 533 2 41 2,774 KY
Sierra Blanca ARC
KR5NM
(+K5RIC) 629 2 14 2,770 NM
Garland ARC
K5QHD 586 2 16 2,726 NTX
Straits Area ARC
W8GQN 705 2 8 2,710 MI
VE3SAR
(+VE3CGC) 569 2 22 2,700 ON
South Kitsap ARC
N7IG 556 2 21 2,686 WWA
Carbon ARC
W3HA 679 2 3 2,674 EPA
Hoodview ARC
W7Q 837 2 17 2,658 OR
Six Meter Club of Chicago
K9ONA 633 2 18 2,654 IL
Ole Virginia Hams
W4OVH
(+W4PVA) 688 2 22 2,648 VA
Gallatin Ham RC
W7ED 722 2 48 2,610 MT
Northwest ARS
W5NC
(+K5ZTY) 579 2 30 2,598 STX
Goochland Cty ARES / Virginia Capital District 6 ARES
N4MI 580 2 55 2,544 VA
Coastside ARC
WA6TOW 829 2 22 2,518 SCV
Mich-A-Con ARC
KG9Y
(+K9TRY) 595 2 14 2,510 WI
Fresno ARC
W6TO 588 2 7 2,490 SJV
Madison Cty ARC
KE8RV 670 2 24 2,456 OH
W8FG 608 2 6 2,440 WV
Fidelity ARC
W1MB
(+K1NQG) 549 2 7 2,430 RI
Boeing Employees ARS
K7NWS 526 2 18 2,410 WWA
Cabarrus ARS
K4WC
(+KI4JCU) 571 2 15 2,394 NC
Littleton Area Radio Klub
K1EME 307 2 28 2,364 NH
Algoma ARC
VE3SOO 605 2 3 2,364 ON
Northwest AR & Electronics Assn
W0KE
(+NX9L) 775 2 37 2,300 MO
W4YMI
(+K4TRP) 495 2 27 2,300 NC
Santa Clara Cty ARA
W6UW
(+W6UU) 481 2 25 2,282 SCV
MooseHorn ARC
KL7AN 451 2 34 2,280 AK
Winona ARC
W0NE 439 2 30 2,280 MN
Bloomington ARC
K9DIY
(+K9SOU) 422 2 42 2,262 IN
Tri-Lakes ARC
KC0M 367 2 13 2,224 MO
Tyler ARC
K5TYR 457 2 49 2,208 NTX
Not All There
N9TO 531 2 11 2,206 IL
Jackson ARC
W5PFC
(+K5TDD) 381 2 30 2,204 MS
Riverside Cty ARA
W6TJ 405 2 64 2,198 ORG
SC4 ARC
W6SCF
(+W6NZH) 409 2 81 2,196 SCV
WPPS RC
W7POE 417 2 3 2,188 MT
San Jose ARES/RACES/ACS
W6SJC
(+KF6IIY) 496 2 50 2,174 SCV
East Greenbush ARA
W2EGB 708 2 22 2,166 ENY
South Bay ARC
W6T
(+K6T) 473 2 60 2,132 LAX
Kamloops ARC
VE7UT 341 2 18 2,130 BC
Palms West ARC
W4SS 727 2 9 2,124 SFL
Sportsman's Paradise ARC
K4WAK
(+K4GKJ) 404 2 5 2,120 NFL
Club Radioamateur de la Vallee du Richelieu
VE2CVR 531 2 12 2,110 QC
Orrville ARS
KD8SQ 875 2 10 2,100 OH
Eastern Shore ARC
K4BW 393 2 20 2,072 VA
Central Mississippi ARA
WM5A
(+AF5CG) 373 2 15 2,068 MS
K5OUR
(+KC5OUR) 314 2 64 2,068 NM
Egyptian RC
W9AIU 459 2 25 2,028 IL
North Shore ARC
VE7NSR 469 2 31 2,016 BC
Zero Beaters ARC
WA0FYA 723 2 10 2,014 MO
Fullerton ERC
N6ER 563 2 20 1,998 ORG
ARC of Augusta
W4DV 381 2 15 1,998 GA
Mid-Atlantic ARC
W3NWA
(+N3MSS) 478 2 33 1,992 EPA
Jim Bell Wireless Assn
K4TNS
(+W4WE) 461 2 22 1,984 AL
Guilford Cty ARES
NA4GC 494 2 30 1,962 NC
W9AXD 332 2 30 1,950 IL
Hendricks Cty ARS
N9HC 435 2 50 1,922 IN
Pamlico ARS
N4PRS
(+AI4WL) 310 2 39 1,910 NC
Rappahannock ARA
K4YM
(+KK4AIO) 491 2 7 1,890 VA
Ashe Cty ARC
W4FD
(+W4APP) 434 2 25 1,884 NC
VE9EMM
(+VE9DDK) 379 2 30 1,880 MAR
Sequatchie Cty ACS
KB4ACS 491 2 4 1,870 TN
Ogden ARC
W7SU 395 2 25 1,870 UT
Stillwater ARA
W0JH 366 2 25 1,864 MN
Ogdensburg ARC
K2RUK 428 2 18 1,856 NNY
Northwest Ohio ARC, Inc.
W8EQ 420 2 18 1,822 OH
Jefferson Cty ARC
W7PT 360 2 9 1,816 WWA
Tri-States ARC
W4GTA 300 2 9 1,810 GA
Puerto Rico FD Group
KP4FD 579 2 7 1,808 PR
Chesapeake Bay RA
WD3E
(+W3YR) 453 2 21 1,806 MDC
Los Alamos ARC
W5PDO 460 2 15 1,804 NM
Washington Area ARC
W0ARC 317 2 28 1,800 IA
Butts Cty EmComm Aux
WX4BCA
(+K3GWK) 522 2 40 1,794 GA
K5HLA
(+N5RMS) 229 2 6 1,790 STX
Chicago Suburban RA
N9BAT 313 2 29 1,782 IL
Theodore Roosevelt ARC
K0ND 560 2 9 1,780 ND
JAWS
K4HH 346 2 7 1,774 KY
Gold Coast ARA
N4FL 299 2 72 1,772 SFL
Vashon-Maury Island RC
W7VMI 220 2 52 1,750 WWA
Milwaukee RAC / Milwaukee Area ARS
W9RH 439 2 15 1,748 WI
Hiawatha Valley ARC
N0DH 466 2 25 1,746 MN
Northeast Wyoming ARA
NE7WY
(+KL3FS) 373 2 16 1,744 WY
Southern Oregon ARC
K7LIX 579 2 17 1,742 OR
Rockwall ARC
K5RKW 289 2 40 1,742 NTX
Rice Family
NX8Y 346 2 3 1,732 OH

Hamilton Cty ARA					
KØKWO	369	2	4	1,730	IA
Stockton-Delta ARC					
W6SF	450	2	26	1,730	SJV
JTRG					
W4J	296	2	60	1,720	SFL
Mt. Magazine ARC					
W5MAG	587	2	12	1,694	AR
Middle Peninsula ARC					
W4HZL	348	2	35	1,692	VA
Barrie ARC					
VE3GCB	346	2	19	1,692	ON
Milton ARC					
W4VIY	341	2	8	1,678	NFL
Orchard City ARC					
VE7OGO	427	2	12	1,674	BC
Quinte ARC / Prince Edward RC					
VE3RL	487	2	15	1,668	ON
ARA of Bloomington					
WCØAAA	348	2	21	1,666	MN
Whitley Cty ARC					
WC9AR	615	2	34	1,660	IN
Bryan ARC					
W5BCS	330	2	57	1,658	STX
UCSC ARC					
AC6P					
(+K6CPA)	258	2	40	1,656	SCV
Mobile Emergency Communication					
VE4MEC	527	2	18	1,644	MB
Western Tidewater RA					
WT4RA	377	2	16	1,638	VA
Low Tide DX Club					
W6LTR	502	2	46	1,634	SJV
Highline ARC					
NC7G	264	2	15	1,614	WWA
Moore Cty ARS					
NC4ML					
(+N4ALH)	145	2	31	1,590	NC
Eastern Washington ARC					
W7GHJ	223	2	14	1,588	EWA
Lake of the Ozarks ARC					
NØZS	488	2	22	1,580	MO
Renton EmComm Serv					
K7FDF	470	2	9	1,554	WWA
Hickman Co. ARES					
WD4CW					
(+KK4JTL)	247	2	8	1,544	TN
Rocky Mountain Hamsters					
KDØNQG					
(+K6RIS)	435	2	12	1,542	CO
Butler Cty Amateur Radio Assn					
W3UDX					
(+AA3YW)	450	2	15	1,530	WPA
San Gorgonio Pass ARC					
W6PRC	174	2	28	1,526	ORG
Lincoln Cty Volunteer Comm					
NC4LC	262	2	28	1,504	NC
Utica ARC					
K2IQ	285	2	12	1,504	WNY
Tompkins Cty ARA					
AF2A	301	2	10	1,494	WNY
NHRC ARS					
W1CUM	486	2	8	1,488	NH
Cleveland Cty AR Service					
NA4CC					
(+N4CLY)	186	2	9	1,482	NC
Metuchen RC					
K2YNT	462	2	9	1,478	NNJ
W1MX					
(+W1AF)	357	2	11	1,466	EMA
VE2RMP Radio Group					
VE2CUR					
(+VE2BRO)	406	2	10	1,462	QC
Arapahoe ARES D22/Aurora Rep Assn/ Cherry Creek Young					
NØARA					
(+WØCCY)	321	2	79	1,460	CO
Soc Of Newfoundland Radio Amateurs					
VO1VON	143	2	9	1,436	NL
Oak Grove Hamsters					
KBØNHW	240	2	4	1,430	MO
Raritan Bay Radio Amateurs / Manalapan RACES					
K2GE	158	2	20	1,402	NNJ
Hall of Science ARC					
WB2JSM	464	2	21	1,398	NLI
Richmond ARC					
W4ZA					
(+W4RAT)	422	2	50	1,392	VA
Club Radio Amateur Matane VA2CMQ					
VA2CMQ	238	2	55	1,392	QC
MCARA / MCARES					
K4ZK					
(+WX4MC)	342	2	30	1,386	SFL
Huron ARA					
WØNOZ	241	2	11	1,382	SD
X Mounties Ottawa Group					
VE3LC	358	2	3	1,376	ON
ARA of Nebraska					
WØWWV	329	2	20	1,374	NE
W5AUU	303	2	50	1,364	AR
VE5MA	428	2	9	1,358	SK
Warren Cty RACES					
WC2EM	363	2	10	1,336	NNJ
Laurel ARC					
W3LRC	342	2	15	1,336	MDC
Santa Clarita ARC					
W6JW					
(+N7TN)	355	2	15	1,330	LAX
W5PMS					
(+K5RDA)	161	2	14	1,312	MS
Oxford Cty ARES / CERT Comm					
W1OCA	314	2	12	1,306	ME
Southern Crescent ARC					
KJ4KPX	237	2	6	1,298	GA
SARES					
K6SNY	159	2	41	1,290	SCV
Pamlico ARC					
K4BCH	405	2	10	1,288	NC
Pocatello ARC					
N7PI	282	2	30	1,284	ID



Tom, WØIVJ, working a night shift for the crew using WØC. [Photo courtesy Tom Thompson, WØIVJ]

W6IER					
(+WA6HP)	313	2	41	1,270	ORG
Kauai ARC					
KH6E	514	1	15	1,264	PAC
Maple Valley ARC					
KC7KEY	249	2	30	1,252	WWA
Blue River Valley ARS					
W9JUQ	348	2	9	1,246	IN
Laguna Beach EmComm Team					
N6L					
(+WO1S)	144	2	55	1,238	ORG
Iroquois Cty ARC					
AD9L	227	2	6	1,224	IL
Not Quite Workable FD Group					
AA8BV					
(+N8JQL)	350	2	7	1,216	OH
Four Rivers ARC					
K4HAO	301	2	17	1,212	GA
Trident ARC					
N4EE	174	2	10	1,198	SC
Owen Cty ARA					
K9EOH	122	2	17	1,194	IN
Big Island ARC					
KH6EJ	81	2	60	1,194	PAC
Sacramento Mountains RC					
KE5MIQ	236	2	13	1,190	NM
Crescenta Valley ARC & Glendale Em Aux Radio Serv					
AD6IZ	257	2	15	1,168	LAX
Southern Kentucky Amateur Transmitting Soc					
KY4AR	186	2	24	1,162	KY
Ramona Outback ARS					
AA6EE					
(+KF6AUP)	116	2	29	1,162	SDG
Clinton ARC					
WØCS					
(+KDØJST)	274	2	21	1,138	IA
SEMO ARC					
WØQMF					
(+WØRMS)	310	2	15	1,120	MO
Daviess Cty ARC					
KC9SFL					
(+KR9E)	194	2	12	1,118	IN
Ottawa Valley Mobile RC					
VE3RAM	208	2	17	1,114	ON
ARC at Univ of Central Florida					
K4UCF					
(+KK4CYA)	127	2	6	1,104	NFL
Orange Cty ARC & ARES					
KB9OHY	119	2	9	1,088	IN
Madison-Oneida ARC					
W2MO	160	2	16	1,088	WNY
Lake Erie ARA					
WB8CQR	329	2	11	1,084	OH
Carolina ARES					
WX4SC	166	2	12	1,082	SC
Okanogan Cty ARC					
W7ORC	262	2	18	1,074	EWA
Anoka Cty EM/RACES					
WØANA	282	2	13	1,074	MN
Frogmore Stew & Brew Crew					
W4ATC	387	2	9	1,066	NC
Crown Radio Group					
W3RP	182	2	4	1,062	WPA
Mizpah Shrine Radio Unit					
W9FEZ	270	2	7	1,058	IN
Spokane DX Assn					
K7SDX	310	2	30	1,052	EWA
Lamorinda Area Radio Interest Group					
K6ORI	100	2	8	1,050	EB
LASSEN ARC					
K6LRC	149	2	6	1,048	SV
KJ6PWP	285	2	3	1,040	SV
Clay Cty ARES					
K4C					
(+KK4JYN)	95	2	10	1,040	NC
Ocean State ARG, Inc.					
K1OS	217	2	6	1,034	RI
University of Akron ARC					
W8UPD	180	2	10	1,028	OH
Southern Piedmont ARC					
WD4NHW	142	2	5	1,022	GA
Shuswap ARC					
VE7RC	148	2	10	1,016	BC
Venango Group					
K3NE	282	2	6	1,014	WPA
N8RGF	303	2	3	1,012	MI
Sooland ARA					
KØTFT	233	2	10	1,010	IA
N3JJT	237	2	3	1,008	OH
West River RC					
WR1VT	209	2	14	1,000	VT
Piedmont ARES					
K4PAR	172	2	10	996	GA
Albuquerque ARC & AR Caravan Club					
N5VA					
(+KD5RHR)	130	2	12	990	NM
Rains ARA / Hopkins Cty ARC					
W5ENT	130	2	15	974	NTX
TARA					
K3TAR	260	2	3	970	EPA
Temple ARC					
W5LM	227	2	20	964	NTX
Davenport RAC					
WØBXR	80	2	40	960	IA
Red Oak Society					
K2OAK	180	2	7	960	NNJ
Ft Armstrong Wireless Assn					
K3TTK	301	2	22	952	WPA
W7TD	101	2	18	952	EWA
Beaufort RAG					
W4BFT	129	2	22	948	SC
Plumas ARC					
K6PLU	171	2	12	932	SV
ARA OF Central California					
KI6GIL	172	2	28	912	SJV
Lake Washington Ham Club					
K7LWH	159	2	18	910	WWA
Ogle Cty ARES					
W9GD					
(+N9QDJ)	251	2	8	902	IL
West Seattle ARC					
W7AW	63	2	5	886	WWA
WØILO					
(+KAØQ)	104	2	6	882	MN
USC ARC					
W6YV	113	2	3	876	LAX
Camp Inda Romeo					
WB9QAF	64	2	9	870	NE
Brunswick Shores ARC					
N4GM	129	2	5	868	NC
W4ODR	517	1	6	867	TN
Jones Cty ARC					
WØCWP	217	2	8	864	IA
Aeronautical Center ARC					
W5PAA	82	2	15	864	OK
Oroville ARS					
W6AF	195	2	21	856	SV
TCARES					
K7MOO	52	2	35	854	OR
Club Radio Amateur de l'Estrie					
VE2RAE					
(+VA2MZ)	248	2	15	846	QC
STARS ARC					
W9SRC					
(+AB9JW)	157	2	32	844	IL
Scott Cty ARES					
NØBHC	147	2	32	844	MN
Insurance City Repeater Club					
K1CRC	115	2	15	830	CT
Port Lavaca ARC, Inc.					
W5KTC	139	2	9	828	STX
ARA of the Southern Tier					
W2ZJ	37	2	23	824	WNY
Sibley Cty ARES/SMARTS RC					
WBØRMK	201	2	7	822	MN
Elmendorf ARS					
KL7YK	17	2	7	808	AK
Central Kansas ARC					
WØCY	252	2	12	804	KS
Lake Oswego ARES					
WA7LO	26	2	10	802	OR
Elmendorf ARS					
KL7AIR	16	2	6	802	AK
W6HA	162	2	3	784	ORG
Wexaukee ARC					
K8CAD	152	2	10	774	MI
Lancaster & Fairfield Cty ARC					
K8QIK	181	2	7	762	OH
Renfrew Cty ARC					
VA3NRR	103	2	18	756	ON
Wolseley Repeater Group					
VE5LA	108	2	8	750	SK
K2EFG	75	2	4	750	NLI
Northeast Iowa RA Assn					
WØMG	93	2	13	732	IA
West Cty ARA					
KB3PSL	35	2	5	730	WPA
KT1I	240	2	3	730	WMA
Seneca RC					
W8ID	158	2	15	716	OH
Amateur RA of Bremerton					
W7VE	134	2	3	704	WWA
Flint Hills ARC					
KBØVAC	112	2	6	686	KS
Walker Cty AR Group					
W5HVL					
(+W5HVL)	61	2	12	682	STX
Westside ARC					
W5ABD	54	2	8	674	LA
Ozark ARC					
K5BAX	133	2	10	666	AR
KF6HTE	108	2	6	666	EB
Albany ARC					
W4MM	258	2	13	666	GA
NC4MC	49	2	6	664	NC
Phillips Cty ARC					
WØZXN					
(+WØRMB)	97	2	9	664	KS
Top of Michigan ARC					
N8PTZ	156	2	10	662	MI
Old Boy Scouts					
N5BXP	127	2	3	642	STX
Lakeshore ARA					
KC9VNO	120	2	3	640	WI
MAARS					
KSØMAN	89	2	6	628	KS
Club de Radio Amateur du Madawaska					
VE9CRM	162	2	24	624	MAR
Lower Yellowstone ARC					
W7DXQ	157	2	15	614	MT
Boy Scouts Troop 5 ARC					
KT5BSA	222	2	9	574	LAX
W8COD	50	2	8	570	OH
Henderson ARC ARES					
W4KVK	9	2	6	568	KY
Desert Circle ARC					
NU7DE	43	2	3	568	NM

RDG2 / NVIS Comm ARC
VE2NVS 106 2 4 562 QC
Carlsbad AR
N5CNM 106 2 5 562 NM
Wellesley ARS
W1TKZ 36 2 23 558 EMA
Mitre Bedford ARC
W1ON 62 2 4 550 EMA
Seaway Valley ARC
VE3VSW 121 2 12 542 ON
Benton Cty ARES
K7CVO 31 2 10 528 OR
Hamilton Cty AR Public Service Corps
K8YOJ 84 2 6 518 OH
220 MHZ GUYS ARC
WM9W 132 2 8 514 IL
Virgin Islands RC
KP2D 96 2 10 454 VI
N8WP 115 2 5 430 SNJ
East Mississippi Field Unit
WE5DX 98 2 4 346 MS
Colusa Cty Emergency Reserve Unit
W6VNQ 62 2 7 324 SV

3A
North Shore RC
K9OR
(+K9RST) 3421 2 95 12,066 IL
Rochester ARC
WØBM
(+KØRGR) 3273 2 39 11,622 MN
Twin City FM Club
WØEF
(+WBØN) 2822 2 50 10,198 MN
South Lyon Area ARC
N8SL
(+K8BRF) 2900 2 26 9,990 MI
Stamford ARA
W1EE
(+K1FC) 2961 2 81 9,940 CT
N1EV
(+W1NLK) 2677 2 25 9,722 CT
Utah DX Assn
AD7KG
(+K7UT) 3207 2 36 9,646 UT
North Shore RA
NS1RA
(+KB1PAL) 2263 2 40 9,282 EMA
Team K1RH
K1RH 3142 2 9 9,030 MDC
Albany ARA
K2CT
(+KM2O) 2580 2 31 8,984 ENY
San Andreas Faultline Survivors
W6SW
(+N6F) 2697 2 15 8,926 SJV
Magnolia DX Assn / Great Southern DX Assn
K5MDX
(+W5NO) 2325 2 18 8,872 MS
Edmond ARS
K5EOK
(+AE5ZF) 2709 2 68 8,760 OK
Oakland Cty ARS
W8TNO
(+N8G) 3068 2 26 8,760 MI
Utah ARC
W7SP
(+AC7RA) 2501 2 145 8,624 UT
Mississippi State University ARC & Magnolia ARC
W5YD
(+N5F) 1921 2 17 8,212 MS
Midland ARC
KD5C
(+W5QGG) 1965 2 12 8,190 WTX
Victor Zulu Field Day Group
N3VZ 2467 2 6 7,948 EPA
Lighthouse AR Alliance
N4WZ 2459 2 28 7,746 SFL
Stanwood-Camano ARC
W7PIG
(+N7KRN) 1962 2 29 7,690 WWA
Jefferson Cty ARC
W7JCR 1659 2 26 7,366 WWA
Murgas ARC
K3YTL
(+W3MTP) 2320 2 32 7,346 EPA
Seattle ACS / MST / Puget Sound Rpt Group / West Sea ARC
W7ACS 1708 2 57 7,252 WWA
Barnstable ARC
N1CP
(+K1PBO) 1925 2 20 7,062 EMA
Fond du Lac ARC
W9EBV 1728 2 25 7,026 WI
South Orange ARA
K6SOA
(+K6WO) 1886 2 52 6,816 ORG
East Bay ARC & W6BB ARC
W6CUS
(+W6BB) 1738 2 60 6,796 EB
Stonewall Jackson ARA
K8DF
(+K8TPH) 1964 2 21 6,590 WV
N5HR
(+K5HV) 1611 2 74 6,580 STX
Kankakee Area RS
W9AZ
(+N9FD) 1502 2 36 6,526 IL
Oakville ARC
VE3HB 1540 2 17 6,442 ON
Johnson Cty RAC
WØERH
(+WØDEW) 1903 2 60 6,234 KS
Arrowhead RAC
WØGKP 1512 2 45 6,152 MN
Scottsdale ARC
K7TR 1910 2 10 6,150 AZ
Montgomery ARC
W3M
(+KV3B) 1350 2 46 5,880 MDC
Owatonna Steele Cty ARC
NØUW
(+KØHNY) 1412 2 41 5,868 MN
San Lorenzo Valley ARC/Santa Cruz Cty ARC
K6MMM
(+N6OTA) 1437 2 96 5,862 SCV
Ski Country ARC
KØRV
(+KQØC) 1654 2 35 5,858 CO
Oh-Ky-In ARS
K8SCH
(+W1SCR) 1640 2 30 5,816 OH
Forx ARC
NØGF
(+NØGFK) 1502 2 18 5,808 ND
Baton Rouge ARC
K5DF
(+K5LSU) 1536 2 47 5,724 LA
Yonkers ARC
W2YRC
(+KF2FK) 1327 2 37 5,544 ENY
SEPAR / LARA / SARC
VE7LSY 1227 2 30 5,536 BC
Dial RC of Middletown
K8PI
(+W8BLV) 1391 2 48 5,404 OH
Nashoba Valley ARC
N1NC
(+K1BG) 1307 2 65 5,242 EMA
TriState ARS
W9OG
(+WA9C) 1416 2 37 5,140 IN
Paducah ARA
W4NJA 1317 2 12 5,118 KY
Foothills ARS
K6YA
(+KG6O) 1318 2 25 4,992 SCV
Milford ARC
W8MRC 1173 2 38 4,970 OH
W1CLA
(+W1MHL) 1443 2 50 4,896 EMA
Cumberland Plateau ARC
W4CV
(+KT4BW) 1148 2 44 4,784 TN
White Mountain ARC
W1KJ 1282 2 25 4,782 NH
Fountain Valley Am Comm Team & West Coast ARC
WA6FV
(+KG6AEL) 1216 2 18 4,738 ORG
Twin City Ham Club
W5EA
(+N5LCC) 1496 2 25 4,698 LA
Saratoga Cty ARA
K2DLL
(+N2MBX) 1431 2 18 4,672 ENY
CRES ARC
W8ZPF 1126 2 35 4,530 OH
Ashtabula Cty ARC
K8CY
(+N8PEG) 1328 2 20 4,500 OH
Central Illinois RC
W9EX 1188 2 30 4,450 IL
Albemarle ARC
W4DO 1206 2 54 4,436 VA
Nittany ARC
W3YA 2924 1 15 4,436 WPA
Coquitlam/Burnaby/New West ARCs
VE7SCC 1229 2 40 4,418 BC
W6AJF 911 2 15 4,362 SF
Villages ARC
K4VRC
(+N8RW) 784 2 35 4,286 NFL
Scranton Pocono Amateur Radio Klub
K3CSG
(+W3BA) 1085 2 56 4,256 EPA
North Franklin ARS
N2NNY 969 2 10 4,212 NNY
Bristol ARC
W4UD 1086 2 51 4,206 TN
FPL Group
K8ESQ
(+AC8IL) 996 2 5 4,154 MI
Wilson's Wonders
N7KN 1046 2 4 4,154 EWA
Xerox ARC
W2XRX 1021 2 10 4,136 WNY
Cape May Cty ARC
N2CMC
(+W2CMC) 1005 2 64 4,124 SNJ
Geezer ARC
N6FR 1025 2 14 4,122 SV
Sturdy Memorial Hospital ARC
W1SMH 1008 2 20 4,118 EMA
Rowan ARS
N4UH
(+W4EXU) 908 2 35 4,092 NC
Chenango Valley ARA
W2RME 995 2 14 4,040 WNY
Dallas ARC
W5FC 1099 2 60 3,936 NTX
Rogue Valley ARC & Jackson Cty ARES
W7DTA
(+KD7EHB) 1168 2 42 3,934 OR
W8MAA
(+W8ERV) 961 2 34 3,878 MI
Nashville ARC
K4CPO
(+K4CPO) 1013 2 77 3,862 TN
Anchorage ARC
KL7AA
(+KL7G) 1425 1 40 3,843 AK
Hilltop Transmitter Assn & Keystone VHF Club
K3H
(+W3ZGD) 988 2 24 3,842 EPA
W7SST 934 2 14 3,766 OR
Blue Ridge ARC
W4YK 745 2 45 3,764 NC
North Augusta-Belvedere RC
K4NAB
(+KK4AMJ) 847 2 51 3,758 SC
Santa Fe Trail ARC
KSØKS
(+AC0KN) 789 2 12 3,716 KS
QSY Society
K2QS
(+WB2LQF) 798 2 25 3,698 ENY
Boeing Employees ARS — St. Louis
WØMA 775 2 11 3,660 MO
Hernando Cty ARA
K4BKV 600 2 11 3,652 NFL
Convair / 220 ARC
W6UUS 998 2 34 3,648 SDG
Parkersburg AR Klub
N8NBL 1025 2 40 3,640 WV
W8M 1167 2 20 3,634 MI
Tri-County ARC
WX4TC
(+KK4FSA) 1143 2 35 3,614 GA
Newton/McPherson ARC
NØNK
(+WØTWU) 771 2 25 3,552 KS
Austin ARC
W5KA
(+K5LBJ) 673 2 66 3,500 STX
Henry Cty ARC
W9OB 1359 2 23 3,488 IN
Ellijay ARS
KE4ZX 854 2 20 3,456 GA
New River Valley ARC
N4NRV 832 2 20 3,414 VA
Nixa ARC
WØA 955 2 15 3,368 MO
Big Rapids Area ARC
N8OE 919 2 9 3,314 MI
Southern Vermont ARC
K1SV
(+WT1B) 1060 2 20 3,302 VT
United Radio Amateur Club
K6AA 747 2 30 3,274 LAX
Maury ARC
W4GGM
(+WBØCJB) 726 2 35 3,252 TN
Overlook Mountain ARC
K2ENY
(+K2UNI) 538 2 25 3,218 ENY
Rolla Regional ARS
WØGS 642 2 15 3,182 MO
K2PUT 610 2 43 3,162 ENY
W4BFB
(+NC4DP) 866 2 43 3,154 NC
Aero ARC
W3PGA 725 2 15 3,130 MDC
Missouri Outlaws
KIØI 726 2 3 3,092 MO
Brandon ARS
K4TN
(+KC4MMR) 617 2 36 3,088 WCF
Mason Cty ARC
N7SK 519 2 20 3,062 WWA
Coshocton Cty ARA
W8C 587 2 21 3,056 OH
Peterborough ARC
VE3RB
(+VE3KRG) 1010 2 20 3,018 ON
South Piedmont Amateur Radio Klub
N4FU 673 2 10 2,996 VA
NCØA 566 2 13 2,992 CO
Panhandle ARC
W5WX
(+N5HPJ) 684 2 21 2,988 WTX
Norteast Wireless RC
NW2C 669 2 10 2,950 NLI
Sonoma Cty Radio Amateurs, Inc.
K6SON
(+W6SON) 640 2 48 2,910 SF
N4GAS
(+K4GNC) 582 2 25 2,902 NC
Shelby ARC / ARES
WA4TV 890 2 33 2,890 NC
Haywood Cty ARC
KW4P 999 2 35 2,888 NC
San Fernando Valley ARC
W6SD 681 2 35 2,860 LAX
Bella Vista Rep Group
KØSNG
(+KD5UFY) 574 2 35 2,830 AR
Federacion de Radioaficionados de Puerto Rico
KP4FRA 592 2 15 2,828 PR
DCARS
K8PL 730 2 20 2,812 MI
DARC - MARA — Tri-State
W4EM 563 2 115 2,806 TN
BEARONS
W7FLY 598 2 9 2,780 WWA
Monessen ARC
W3CSL 739 2 25 2,780 WPA
Springhill ARC, Inc.
N5II
(+KF5QOQ) 707 2 9 2,776 LA
Blue Ridge ARS
W4NYK 693 2 25 2,718 SC
Arlington ARC
K5SLD
(+N5ACK) 532 2 53 2,678 NTX
San Joaquin Valley ARS
W6V
(+N6RBO) 617 2 25 2,668 SJV
Toronto ARC
VE3TNC
(+VE3BGD) 601 2 25 2,660 ON
SPARK
W4QR 714 2 77 2,654 VA
VE2CRO 892 2 45 2,634 QC
Iowa City ARC
WØJV 546 2 18 2,634 IA
Rome RC
W2OFQ
(+N2MG) 531 2 14 2,614 WNY
West Park Radiops
W8VM 717 2 22 2,608 OH
Bainbridge Island ARC
N7BI 1077 2 14 2,604 WWA
Metro DX Club
K9PMV 485 2 15 2,588 IL
Franktown FD Group
NØUA 628 2 15 2,562 CO
Binghamton ARA
W2OW 750 2 28 2,554 WNY
Hot Springs ARC
KØHS 527 2 13 2,546 SD
HAMARC
W8AJT
(+KD8RLA) 502 2 21 2,534 OH
64 Repeater Group
W4MAC
(+K4ACB) 824 2 26 2,530 WCF
Peconic ARC
W2AMC 662 2 25 2,504 NLI
Genesee Cty RC
W8ACW 636 2 11 2,498 MI
Butler Cty ARA
W8WRK
(+KD8OFL) 687 2 42 2,484 OH
Johnson City ARA
W4ABR 655 2 25 2,474 TN
NØFH 560 2 10 2,466 CO
Ramapo Mountain ARC & PC ARES / RACES
WA2SNA
(+NJ2PC) 550 2 18 2,466 NNJ
Tri-County ARA
K6AGF
(+WA6BSW) 459 2 24 2,460 ORG
Hamvaders
N9OB 688 2 4 2,450 WI
Breckenridge Group
K5SMH
(+K5TER) 562 2 3 2,448 NTX
Mohawk ARC
N1WW 856 2 14 2,434 WMA
HSFDG
K6VT 718 2 9 2,434 SJV
Clallam Country ARC & ARES
W7FEL
(+N7BV) 525 2 28 2,428 WWA
Benton Cty Radio Ops
WX5BC 549 2 7 2,424 AR
South Baldwin ARC
AF4I 623 2 46 2,414 AL
Benzie AR Friends
W8BNZ 618 2 34 2,340 MI
Winnipeg ARC
VE4BB 523 2 87 2,292 MB
Allegheny Valley RA
W3RA 601 2 3 2,290 WPA
VE9ND 445 2 22 2,286 MAR
Bloomfield ARC
W1CWA
(+AB1OD) 374 2 45 2,280 CT
Northern Kentucky ARC
K4CO 496 2 36 2,232 KY
Tuscola Cty ARA & ARES
KC8CNN 496 2 12 2,210 MI
Plattsmouth ARC
KBØSMX 309 2 20 2,202 NE
Fallbrook ARC
N6FQ 742 2 46 2,196 SDG
Kettle Moraine Radio Amateurs
N9KS 381 2 8 2,184 WI

Jayhawk ARS
W0LB
(+KD0GIE) 545 2 18 2,184 KS
CTARC
WD5IYF 436 2 13 2,174 OK
Randolph Cty Emergency RC
K4RAN 597 2 7 2,168 AL
Clark Cty ARC
W9WWI 530 2 52 2,158 IN
W8LKY
(+KD8RUQ) 466 2 32 2,152 OH
Dayton ARA
W8BI 528 2 23 2,140 OH
Mount Diablo Amatuer RC
W6CX 684 2 150 2,138 EB
Southern Berkshire ARC
W1BAA
(+K1LEE) 316 2 28 2,126 ENY
Emporia ARS
KB0SSR
(+K0ESU) 525 2 24 2,120 KS
Reading RC, Inc.
W3BN 403 2 45 2,106 EPA
KnightLites QRP Assn
WQ4RP 426 2 7 2,058 NC
High Desert ARC of New Mexico
NM5HD 603 2 60 2,056 NM
Portsmouth ARC / ARES
W4POX 352 2 21 2,030 VA
Wasatch Back Tri-County AR Group
K7GL 547 2 17 2,012 UT
Sullivan ARC
W0T 412 2 31 1,994 MO
Radio Operadores del Este
KP3RE 323 2 35 1,976 PR
Misfits
NV8E 560 2 5 1,950 OH
K4WO 432 2 25 1,928 NC
Easton ARS
K3EMD 447 2 30 1,926 MDC
XWARN
W8XRN 426 2 9 1,914 OH
Cape Ann ARA
W1GLO 207 2 45 1,908 EMA
Coastline ARA
N1EG 626 2 35 1,882 CT
Burlington Cty RC
K2TD
(+AK2S) 349 2 32 1,874 SNJ
Hamilton Cty ARES
N9EOC 412 2 20 1,866 IN
JCARES
W4DOD 457 2 12 1,862 TN
Cumberland Valley ARC
W3ACH 332 2 46 1,856 WPA
Shelby Cty ARES
K8ZUK 419 2 16 1,850 OH
Peace River RA
W4DUX 388 2 27 1,850 WCF
Yolo ARES & Yolo ARS
W6YAR 429 2 34 1,848 SV
Metropolitan ARC
K8NOW 460 2 8 1,810 MI
W6AK 335 2 10 1,810 SV
Harrisburg RAC
W3W 392 2 26 1,802 EPA
Chattanooga ARC
W4AM 499 2 21 1,800 TN
Moreno Valley ARA
AB6PA
(+KJ6MOB) 477 2 22 1,794 ORG
Princeton Ham RC
W4KBL 313 2 32 1,792 KY
Central Wisconsin Radio Amateurs @ UWSP
W9JN 466 2 9 1,790 WI
Reno Cty Kansas ARA
W0WR 298 2 18 1,784 KS
K3IR
(+N3APD) 286 2 9 1,762 EPA
Skyline ARC
K2IWR 664 2 15 1,756 WNY
SCARE.
KC8BOO 552 2 12 1,754 OH
M&M ARC
W8PIF 714 1 60 1,740 MI
KZ9B Field Day
KZ9B 463 2 6 1,734 WI
RADOPS of El Jebel Shrine
K0FEZ 372 2 11 1,734 CO
Regina ARA
VE5NN 386 2 29 1,732 SK
McKinney ARC
W5MRC 277 2 69 1,732 NTX
Dubois Cty Amateur Radio Group
N9NAU 375 2 40 1,730 IN
Schenectady Museum ARA
W2IR
(+KC2UTE) 443 2 25 1,728 ENY
Aux Comm Service
K6RCR
(+AG6MO) 217 2 14 1,710 ORG
North Port ARC
W4NPT 315 2 11 1,708 WCF
Boro of Barrington, NJ OEM
WA2WUN 369 2 34 1,700 SNJ
Tupelo ARC
KK5K 285 2 7 1,698 MS
Northern Lakes ARC
K0Z 394 2 25 1,682 MN
Kings Cty RC
KC2RC 331 2 30 1,680 NLI
Portsmouth RC
N8QA 639 2 20 1,648 OH
Boston ARC
W1BOS 353 2 15 1,628 EMA
Holmesburg ARC
K3FI 386 2 12 1,628 EPA
Winchester Pioneer ARC
AC4YD 378 2 15 1,606 KY
Muscatine ARC
N2AM
(+K0BDU) 336 2 22 1,596 IA
Columbus ARC
W9ALQ
(+W9SCI) 255 2 60 1,590 IN
Kent CommSupport Team
K7CST
(+N7MU) 309 2 14 1,590 WWA
Rainbow Canyon ARC
N7BO 415 2 14 1,588 UT
Englewood ARS
N4EAR 293 2 17 1,576 WCF
Bedford ARC
K5BED 313 2 21 1,576 NTX
Central Toronto ARC
VA3CTA
(+VE3FVU) 333 2 35 1,564 ON
Sun City ARC
K5WPH 311 2 20 1,562 NM
Riverside Radio Amateurs
WA8RRA 328 2 22 1,536 MI
Central Missouri RA
K0SI 269 2 20 1,514 MO
LVSRA
K3LV 218 2 30 1,512 EPA
Pierre ARC
W0PIR 408 2 9 1,486 SD
Joplin ARC
W0IN 308 2 11 1,486 MO
West Palm Beach ARC
W4HAW
(+K4WPB) 211 2 62 1,484 SFL
Bay-Net
K6SRA 198 2 6 1,468 SCV
Wilson Cty ARC
WC4AR 397 2 3 1,464 TN
Oak Forest ARC
W5T 395 2 3 1,440 STX
Northwoods AR Group
N0I 323 2 7 1,434 MN
West Santa Barbara Cty ARES
W9EC 279 2 9 1,432 SB
North East Georgia ARC/Athens ARC
W4G 311 2 25 1,432 GA
San Diego Six Shooters ARC
KI6BJN 566 2 3 1,432 SDG
PJ'S Group/WAFAR
W9FT 389 2 15 1,428 IL
San Jose Cisco ARC
W6IOS 210 2 6 1,416 SCV
W7GRA 385 2 3 1,416 OR
Peoria Area ARC
W9UVI
(+W9PIA) 267 2 28 1,414 IL
HAM Assn of Mesquite
WJ5J 272 2 25 1,410 NTX
ARA de Portneuf
VE2CSP
(+VE2ER) 207 2 20 1,408 QC
Casper ARC
W7VNJ 721 1 25 1,400 WY
DeGray ARC
KD5ARC 222 2 3 1,394 AR
Riverland ARC
WR9ARC 189 2 22 1,358 WI
N4XFF 311 2 3 1,344 KY
Northside ARC
AA0NC
(+KD3DGL) 177 2 10 1,344 MO
Elko ARC
W7V 245 2 16 1,340 NV
Pioneer AR Fellowship
W8CTT 259 2 9 1,332 OH
Austin ARC
W0AZR 236 2 10 1,326 MN
Porter and LaPorte ARC
W9SAL 271 2 12 1,322 IN
Buffalo AR Repeater Assn
W2EUP 409 2 15 1,316 WNY
KK6I 311 2 10 1,316 SDG
Brightleaf ARC
W4AMC 328 2 14 1,306 NC
Bankhead ARC
N4IDX 287 2 19 1,300 AL
South Texas ARC
KF5NJQ
(+N5CRP) 173 2 30 1,298 STX
3 Rivers ARC
KK3ARC 214 2 17 1,278 ID
Desert RATS
WD6RAT 276 2 18 1,278 ORG
Sierra Intermountain Em RA
NV7CV 328 2 17 1,250 NV
RCs of Spokane
N7LC 212 2 26 1,248 EWA
Clay Cty ARC
W0TE 325 2 21 1,244 MO
Portland Internet Radio Group
N7PIR 539 2 4 1,234 OR
Ohio Volunteer Corps.
W8OVC 80 2 9 1,230 OH
Christian Cty ARES
N9KY 138 2 13 1,208 KY
Shore Points ARC
K2B/W2HRW 243 2 22 1,202 SNJ
Seaside Tsunami ARS
WA7VE 294 2 70 1,188 OR
Charleston ARS
WA4USN
(+NT4HI) 235 2 20 1,186 SC
Humboldt Cty ARES
W7TKO 303 2 3 1,156 NV
Las Vegas RAC
K7UGE 224 2 30 1,156 NV
St. Mary's Cty ARA
K3NHK 272 2 25 1,150 MDC
W8SAI 233 2 3 1,140 OH
K4LKW
(+KK4JYA) 78 2 5 1,136 WCF
LUCE Moose-cateers
W8NBY 258 2 5 1,118 MI
Manotick ARG
VE3AIR 226 2 4 1,102 ON
Mountain ARC
W3YMW 209 2 15 1,038 MDC
Montachusett ARA
W1GZ 156 2 12 1,022 WMA
N4T 227 2 3 1,004 NFL
Delaware Valley Ragchew Club
N2HQX 55 2 30 1,000 SNJ
Howard Cty Emergency ARC
N5THS 58 2 6 994 AR
Capital Cty ARS
AA3DC 224 2 4 976 MDC
Riviera ARS
K0XL 36 2 5 974 MN
Woodford Cty ARC
KY4WC 98 2 9 946 KY
Iola ARC
WI0LA 36 2 24 932 KS
WK7I 234 2 6 932 ID
World RC
W3WRC 396 1 3 920 SV
Golden Empire ARS
W6RHC 261 2 14 882 SV
Madison Cty DX Club
KK0G 130 2 10 880 IA
Pisgah Community VFD
WB5DO 61 2 15 872 MS
Inland Empire VHF Club
WR7VHF 59 2 35 870 EWA
Mouth Of The Columbia ARC
KF7TCG 47 2 10 854 OR
Mohawk Valley ARA
KC2AVO 272 2 6 844 NNY
Mile Highlanders Group
W4MHG 113 2 7 816 GA
West Central Ohio ARA
WC8OH
(+W8COH) 102 2 24 812 OH
Elk Grove — Florin ARC
W7KOZ 164 2 24 728 SV
Mystic Valley ARG
N1MV 13 2 50 726 EMA
KF7RNL
(+KF7RNL) 110 2 3 710 AZ
Western Washington Med Svcs EmComm Region 5
AD7AW 75 2 3 700 WWA
IBM/Lockheed ARC
W4IBM 169 2 13 676 GA
Allegan Cty ARC
AC8RC
(+KD8QNX) 85 2 28 612 MI
Brookings Radio Research Club
W0BXO 209 2 24 588 SD
OFOG Group
N0TK 76 2 4 572 CO
Sedalia / Pettis ARC
WA0SDO 55 2 12 560 MO
Norcal ARC
AI5C 48 2 3 546 SF
TARA Mugwumps
AC0VV 14 2 10 528 CO
AD7BF 57 2 4 514 WWA
Wildergeeks
KD8AIV 62 2 3 474 OH
York Cty RS
K4YTZ 125 2 12 452 SC

4A

Palo Alto ARA
W6ARA
(+W6OTX) 5332 2 82 17,158 SCV
Delaware ARA
K8ES
(+W8JK) 4377 2 75 15,456 OH
Huntsville ARC
K4BFT
(+N7KDT) 4297 2 60 14,762 AL
599 DX Assn
NA5NN
(+K5DXA) 3715 2 42 13,458 MS
Ozaukee RC
W9LO
(+AA9W) 3481 2 45 10,842 WI
Old Barney ARC
N2OB
(+N2CW) 3026 2 35 9,834 SNJ
Arrow/UMarc FD Team
W8UM
(+W8PGW) 2582 2 27 9,698 MI
Cuyahoga Falls ARC
W8VPV 2581 2 18 9,440 OH
North Fulton ARL
K4JJ
(+NF4GA) 2647 2 227 9,250 GA
VBARC & VADXCC
W4UG
(+K4IX) 2552 2 45 9,206 VA
Peel ARC
VE3XR
(+VA3SOP) 2539 2 55 9,118 ON
Oregon Tualatin Valley ARC
W7OTV 2269 2 77 8,974 OR
Nassau ARC
K2VN 2406 2 50 8,568 NLI
Sussex Cty ARC
W2LV
(+W2FDB) 2168 2 17 8,518 NNJ
Portage Cty AR Serv
K8BF 2517 2 130 8,392 OH
Sterling Park ARC
K4NVA
(+NQ4K) 2150 2 30 8,178 VA
Arkansas River Valley AR Foundation
K5PXP
(+W5QC) 2104 2 22 8,138 AR
Vienna Wireless Soc
K4XY
(+K4HTA) 1920 2 116 7,728 VA
Contoocook Valley RC
K1BKE
(+K1DFQ) 2320 2 50 7,182 NH
Medina 2 Meter Group
W8HN
(+W8EOC) 1997 2 27 7,084 OH
Westchester EmComm Assn
N2SF
(+W2UL) 1848 2 25 6,754 ENY
LARC-FARL
K8UNS 1602 2 56 6,226 MI
Mid-Del ARC
W5MWC
(+KF5JRP) 1569 2 8 6,104 OK
Eastern Connecticut ARA
K1MUJ 1453 2 20 5,754 CT
Dog Hollow Contest Group
AK9D
(+WG0TA) 1568 2 17 5,610 MO
Green Mountain Wireless Soc
N1VT
(+WA1VT) 1569 2 22 5,428 VT
W7PU
(+KF7FEA) 1419 2 6 5,288 WWA
KVOA ARC
KV4OA 1964 2 3 5,186 AZ
KiloCycle ARC
W5SH 1108 2 11 5,168 NTX
WA3COM
(+KC3HW) 1490 2 19 5,056 WPA
Thunderbird ARC
WK7B 1284 2 25 5,032 AZ
Hamfesters RC
W9AA
(+N9VOK) 1169 2 77 4,958 IL
L'Anse Creuse ARC
N8LC 1444 2 20 4,838 MI
Northwest Illinois ARC
W9F 1370 2 22 4,830 IL
Oakland Radio Comm Assn
WW6OR 1581 2 130 4,758 EB
Mount Vernon ARC
K8EEN 1372 2 25 4,686 OH
Fluvanna ARES
W4XR 1304 2 17 4,618 VA
Phil-Mont Mobile RC
W3EM
(+W3PSH) 1168 2 45 4,446 EPA
North Richland Hills ARC
K5NRH
(+W5HP) 1114 2 53 4,444 NTX
Lakeland ARC
K4LKL 1137 2 45 4,394 WCF
Hamilton ARC
VE3DC
(+VE3DF) 1599 2 62 4,384 ON
Shenandoah Valley ARC
W4RKC 1090 2 43 4,312 VA
Findlay RC
W8FT 851 2 31 4,234 OH
Invisible Order Of Barking Spiders
K0AE 897 2 9 4,176 CO
Twin City ARC
K9CU 1135 2 50 4,130 IL
Clark Cty ARC
W7AIA
(+K7JAO) 1006 2 230 4,118 WWA
Cambridge ARA
W8VP 957 2 30 4,114 OH
Alford Memorial RC
W4BOC
(+KK4JXW) 837 2 89 3,974 GA
Liverpool Am Rep Club
W2CM
(+K9CHP) 889 2 42 3,968 WNY
Lake Area Radio Klub
W0WTN 944 2 45 3,834 SD

Lockheed Martin ARC
W5IU 753 2 32 3,816 NTX
T-CEP Disaster Radio Team
K6TI
(+W6TOP) 797 2 45 3,788 LAX
ARC of National Electronics Museum
K3NEM
(+W3GR) 921 2 15 3,742 MDC
Corona PD CSV Team
W6CPD
(+AE6ED) 839 2 16 3,734 ORG
Granite State ARA
N1QC
(+KB1NH) 832 2 27 3,708 NH
Long Island Mobile ARC
W2VL
(+WV2LI) 783 2 120 3,666 NLI
Catalina RC & Rad Soc of Tucson
W7SA
(+AD7RZ) 686 2 60 3,548 AZ
South Bay ARA
KU6S
(+AG6HJ) 1991 1 33 3,525 EB
Cherryville Repeater Assn
W2CRA 766 2 28 3,518 NNJ
3730 GROUP
VE3ORF 963 2 15 3,500 ON
Fort Myers ARC
W4LX
(+W4DHT) 807 2 20 3,480 SFL
Pasadena RC
W6KA 784 2 34 3,478 LAX
Wheaton Community Radio Amateurs
W9CCU 799 2 30 3,474 IL
St Croix ARC
WW1IE
(+K1BSA) 664 2 25 3,420 ME
Radio Amateurs of Greater Syracuse
W2AE 729 2 32 3,400 WNY
Maryland Mobileers ARC
W3CU 648 2 25 3,324 MDC
Meeker Cty ARC
KØMCR
(+AE0GD) 901 2 17 3,294 MN
WD2K
(+K2RVW) 589 2 35 3,208 ENY
MTARS
W4UOT 763 2 32 3,190 TN
Wireless Assn of South Hills
N3SH 720 2 15 3,180 WPA
PLANO ARC
K5PRK 781 2 25 3,154 NTX
Southern PA Comm Group
K3AE 781 2 33 3,062 EPA
National Trail ARC
K9UXZ 918 2 14 3,046 IL
North Kitsap ARC
KC7Z
(+KF7GWG) 592 2 48 3,024 WWA
Two Rovers ARC
W3OC
(+KB3YRW) 844 2 24 3,004 WPA
Carroll Cty AC
K3PZN 669 2 10 2,898 MDC
Copper Country Radio Amateur Assn
W8CDZ
(+KC8RGO) 609 2 11 2,824 MI
VE7VCC 551 2 14 2,794 BC
Calvert ARA
K3CAL 598 2 15 2,786 MDC
Queen Anne's ARC
K3PG
(+K3LMR) 469 2 21 2,698 MDC
North Ottawa ARC
W8CSO
(+KC8UNY) 384 2 12 2,646 MI
Maple Ridge ARC
VE7CMR
(+VE7CML) 612 2 12 2,636 BC
North Bary ARA
K6LI
(+KO6B) 502 2 15 2,634 EB
Sierra Foothills ARC
W6EK
(+N6BRP) 535 2 24 2,626 SV
San Francisco ARC
W6PW 609 2 17 2,504 SF
Orange Park ARC
K4BT
(+KB4SA) 645 2 45 2,476 NFL
Silvercreek ARA
W8WKY 704 2 8 2,396 OH
Anoka Cty RC
WØYFZ
(+AE0AL) 547 2 25 2,360 MN
San Antonio RC
W5SC
(+WØYVY) 595 2 21 2,328 STX
West Chester ARA
WC8VOA 922 1 20 2,302 OH
Wichita ARS
N5WF 413 2 54 2,248 NTX
Pilot Knob ARC
KSØLV 403 2 8 2,236 KS
W6SCE
(+WB6UCD) 436 2 10 2,232 LAX
Lincoln Cty ARA
W4BV 650 2 18 2,198 TN
San Angelo ARC
W5QX
(+KD5URW) 334 2 44 2,184 WTX
Humboldt ARC
NU6O
(+W6ZZK) 536 2 50 2,158 SF
Coos Cty RC
K7CCH 946 1 30 2,152 OR
Genesis ARS
N1ZIZ
(+KB1EVY) 205 2 30 2,130 EMA
Snohomish Cty Hams Club
WA7LAW
(+KD7EJI) 499 2 24 2,080 WWA
Sun Country ARS
W4CW 376 2 8 2,072 NFL
Western Lake Cty ARS
W9WLC 526 2 10 2,058 IL
Troy Amateur RA
N2TY 443 2 40 2,056 ENY
Island Cty ARC
W7AVM
(+K6ZY) 419 2 38 1,964 WWA
RAS of Norfolk
W4NPS
(+W4ORF) 379 2 15 1,962 VA
Radio Assn of Erie
W3GV 728 2 21 1,958 WPA
KA3PMW 619 2 4 1,946 WPA
Freescale ARS
AC7U 511 2 7 1,944 AZ
Wisconsin Valley RA
W9NA 320 2 13 1,928 WI
Cleveland ARC
W4GZX 285 2 102 1,900 TN
Northern Ohio ARS
K8KRG 501 2 42 1,892 OH
Murray Cty ARC
KDØIXB 506 2 10 1,862 MN
Salkehatchie ARS
KK4BQ 290 2 62 1,838 SC
Lewis-Clark ARC
W7VJD
(+KD5ALU) 227 2 32 1,826 ID
Radio Amateur Club of Knoxville
W4BBB 320 2 32 1,794 TN
Yellowstone RC
K7EFA
(+WN7Y) 269 2 25 1,770 MT
Honeywell-Glendale ARC
K7HON
(+KC9TKC) 514 2 8 1,758 AZ
Miamisburg Wireless Assn
WA8PLZ 454 2 20 1,754 OH
Southern Michigan ARS
W8DF 448 2 31 1,748 MI
Detroit Lakes ARC
WØEMZ 326 2 18 1,736 MN
Sask Alta RC
VE6WP 541 2 10 1,730 AB
Skyview ARS — Field Site
WX3SKY
(+NU3Q) 279 2 19 1,706 WPA
Chelsea ARC
WD8IEL 228 2 12 1,682 MI
Green Bay Mike & Key Club
K9EAM 411 2 17 1,676 WI
Navarre CERT ARC
KC4ERT 219 2 12 1,670 NFL
Aroostook ARA
K1FS 370 2 44 1,668 ME
Huntington Beach RACES
W6O 331 2 26 1,668 ORG
Borderline ARC
W7BAR
(+WX7L) 318 2 30 1,652 UT
Puerto Rico Radio Ops
NP3PR 384 2 7 1,632 PR
Dekalb/Cannon ARC
AB4ZB 255 2 4 1,626 TN
Sylvan Spring ARC
KJ4SWD 268 2 26 1,612 AL
Land of Lakes ARC
K9HD 330 2 10 1,590 IN
Radio Amateurs of the Gorge
W7RAG 77 2 54 1,546 OR
Kochina ARC
W7EH 245 2 31 1,542 AZ
Hoosier Hills Ham Club
W9GUS 166 2 21 1,538 IN
Hillbilly Hams
AB2JT 529 2 4 1,508 WNY
Suffolk Cty RC
W2DQ 261 2 28 1,500 NLI
NBC Burbank ARC
N2EW 314 2 4 1,488 LAX
Mohave ARC
K7MPR 436 2 20 1,470 AZ
Shiawassee ARA
W8QQQ 304 2 8 1,458 MI
Fulton Cty ARC
K9ILS 296 2 36 1,422 IL
W7EI 245 2 33 1,340 AZ
Blacksburg ARS
WQ3C 413 2 13 1,332 VA
Southwest Missouri ARC
WØEBE
(+ACØSR) 223 2 50 1,298 MO
Yuma DX Assn
N7YDX 158 2 63 1,296 AZ
Baytown ARC
K5BAY 231 2 15 1,292 STX
LARA
W2RUI 110 2 24 1,286 WNY
Ozark Mountain ARC
KDØHAV 195 2 4 1,240 MO
Nortown ARC
VE3NAR 590 2 8 1,230 ON
Somerset Cty ARC
K3SMT 339 2 20 1,230 WPA
Calhoun Cty ARA
WB4GNA 66 2 55 1,120 AL
Bates Cty ARC
KDØKDJ 157 2 10 1,114 MO
NS8P 304 2 7 1,098 OH
Yellow Thunder ARC
WB9FDZ 242 2 10 1,034 WI
Sky Valley RC
W7SKY 129 2 12 958 WWA
Pioneer Radio Operators Society
K2PRO 57 2 7 814 WNY
Grundy Cty ARC
KB9SZK 200 2 9 650 IL
Headwaters ARC
N3PC 247 2 12 644 WPA
Cherokee Cty ARC
K5JVL 70 2 10 398 NTX

5A

Loudoun AR Group
K4LRG
(+KE4OKY) 4453 2 35 15,916 VA
Port City ARC
K1T
(+W1WQM) 4467 2 25 14,078 NH
Palomar ARC
W6NWG
(+WD6FWE)3288 2 71 12,082 SDG
BOARS RC
NG5A
(+AD5NR) 2753 2 23 10,832 NTX
Lake Cty ARA
N8BC 2866 2 25 9,822 OH
Columbus ARC & Russell Co. RC
W4CVY
(+W4CHS) 2208 2 66 9,648 GA
Brazos Valley ARC
KK5W
(+NT5SM) 1982 2 60 8,342 STX
Cuyahoga ARS
W8BM 2257 2 28 7,960 OH
Orange Cty ARC
W6ZE
(+W6BAC) 2264 2 26 7,684 ORG
Hazel Park ARC
W8HP
(+W8JXU) 1982 2 29 7,028 MI
Smoky Mountain ARC
W4OLB 1527 2 24 6,452 TN
Saint Petersburg ARC
W4TA
(+W4GAC) 1458 2 69 6,040 WCF
Franklin Cty ARC
W4FCR
(+KE4JFV) 1135 2 14 5,696 VA
York Region ARC
VE3YRA
(+VE3YRK) 1273 2 78 5,232 ON
Greater Beloit Area RC
W9PN 1251 2 15 5,150 WI
Western Carolina ARS
W4MOE
(+N4ANE) 975 2 20 4,940 NC
Lincoln ARC
KØKKV
(+KCØWWR)1477 2 35 4,812 NE
DLARC
W3OK 1170 2 60 4,580 EPA
Andrew Johnson ARC
W4WC 1012 2 30 4,564 TN
Bellevue ARC
WØWYV
(+WBØCAP) 1262 2 40 4,376 NE
RF Hill ARC
W3AI 1010 2 20 4,286 EPA
SPRARC / BCRC
VE3OW 1585 2 30 4,286 ON
Cambridge ARC
VE3SWA 950 2 5 4,242 ON
W6TOI 1553 2 32 4,218 LAX
Columbia-Montour ARC
WC3A
(+K3BD) 830 2 20 4,070 EPA
LaGrange ARC
AB4KE
(+AD4GS) 939 2 50 4,030 GA
Intercity ARC
W8WE
(+W8WER) 939 2 12 4,024 OH
Schenectady ARA
K2AE
(+W2UI) 727 2 30 3,822 ENY
South Pickering ARC
VE3SPC 940 2 15 3,792 ON
Garrett Cty ARES
K3EE 801 2 16 3,790 MDC
Highlands Cty ARC
K4W
(+W4CBS) 825 2 20 3,708 WCF
Penn Wireless Assn
W3SK 903 2 28 3,696 EPA
Wayne Cty ARA
W4HS 840 2 15 3,676 NC
Orange Cty ARC
W2HO
(+K2ULZ) 838 2 44 3,522 ENY
Marion ARC
W8GVB
(+WW8MRN) 729 2 10 3,516 OH
Bridgerland ARC
W7IVM 613 2 73 3,490 UT
Tipp City AR Group
K8ZC 685 2 42 3,484 OH
ARA of SW Florida
W4F 878 2 20 3,434 SFL
Waypoint ARC
WAØRC 680 2 40 3,320 KS
Saginaw Valley ARA
K8DAC 817 2 32 3,290 MI
Iredell Cty ARS
W4SNC 794 2 18 3,268 NC
Denver RC
WØTX
(+WØOUI) 837 2 24 3,262 CO
Siskiyou Cty ARA
K6SIS
(+KJ6UYR) 757 2 8 3,010 SV
ARC of El Cajon
WA6BGS 892 2 84 2,962 SDG
Bay Area ARC
N8NVL 656 2 25 2,814 MI
Starved Rock RC
W9MKS
(+K9ZQ) 549 2 66 2,784 IL
Kalamazoo ARC
W8VY 794 2 25 2,782 MI
Kern Cty-Central Valley ARC
W6LIE 535 2 53 2,774 SJV
Bellbrook ARC
W8DGN 555 2 54 2,682 OH
Kokomo ARC
W9GO 628 2 32 2,626 IN
Outdoor Adventure USA
K6OAU 925 2 25 2,604 ORG
Beaver Valley ARA
W3SGJ 763 2 45 2,494 WPA
London ARC
VE3LON 630 2 26 2,490 ON
Victoria ARC & Coleto Creek ARC
W5DSC 384 2 55 2,466 STX
Chesapeake AR Serv
W4CAR
(+W4FOS) 544 2 40 2,452 VA
Silver Springs RC
K4GSO 828 2 20 2,408 NFL
Blackford ARC
K9VND 541 2 27 2,376 IN
Coastal ARS
W4LHS 682 2 34 2,374 GA
AREA
W9YPC 420 2 12 2,326 IL
Hewlett Packard Boise ARC
AB7HP
(+WV7I) 470 2 10 2,270 ID
Wood Cty EmComm
WC8EC 284 2 25 2,208 WV
Citrus Belt ARC
W6JBT 474 2 20 2,198 ORG
CCARA & HARA
W8O
(+W8GO) 393 2 20 2,190 OH
Fort Herkimer ARA
W2FHA 347 2 16 2,182 WNY
South East Metro ARC
WØCGM 357 2 10 2,142 MN
Tryon ARC
K2JJI 285 2 35 2,034 NNY
Clarksville Operating Radio Enthusiasts
AA4TA
(+K4ORE) 400 2 15 2,028 TN
Jackson Cty ARA
N5OS
(+W5WA) 422 2 35 2,022 MS
Toothless Talkers
N8IVE
(+KA8YTS) 628 2 12 1,982 OH
Morongo Basin ARC
W6BA
(+AE6SG) 239 2 25 1,876 ORG
TCARES
K6TUO 302 2 7 1,756 SJV
Mount Vernon ARC
K4US 367 2 25 1,702 VA
Kings Cty Rep Assn
KC2RA 251 2 12 1,702 NLI
Sabine Valley ARA
K5GVL 334 2 18 1,680 NTX
Sangamon Valley RC
W9DUA 242 2 30 1,654 IL
Hams On The Hill
N7V 255 2 46 1,644 NV
East River ARC
W8MOP 295 2 11 1,540 VA
Magic Valley ARC
K7MVA 161 2 10 1,410 ID
Ogemaw-Arenac ARS
K8OAR 313 2 25 1,378 MI
RECWA
WW2FD 172 2 7 1,344 ENY
Sequoia AR Group

N6KRV 184 2 6 1,260 SJV
Ham Friends of Redlands
WB6WB 56 2 21 1,182 ORG
Jonestown Mtn Repeater Assn
N3CSE 192 2 14 1,174 EPA
Radio Amateurs of Corry
W3YXE 151 2 15 1,152 WPA
Inland ARS
K6DXN 175 2 8 1,000 LAX
K6OX 226 2 11 942 LAX

6A
Albuquerque DX Assn
W5UR
(+K5HAB) 6026 2 26 20,654 NM
Mike & Key ARC
K7LED
(+AE7G) 5363 2 73 16,720 WWA
WY Flamingo Desperadoes
WY7FD
(+WY7SS) 4648 2 19 15,548 WY
South Jersey RA
K2AA
(+W2EA) 4135 2 42 13,318 SNJ
Central Kentucky ARS
AA4NJ 3472 2 21 10,496 KY
W7DK
(+W7OS) 2429 2 90 9,142 WWA
Fort Wayne RC
W9TE
(+KM9DON) 2486 2 57 7,754 IN
Lake Monroe ARS
N4EH
(+KJ4ZPH) 2256 2 95 7,438 NFL
K3PT
(+W3HZW) 2199 2 36 7,280 DE
Warminster ARC
K3DN 1800 2 35 6,154 EPA
Fox River Radio League
W9NE
(+W9CEQ) 1573 2 55 5,666 IL
W5ANR 1141 2 20 5,494 AR
DuPage ARC
W9DUP 1340 2 55 5,206 IL
Northern Berkshire ARC
N1WM
(+KB1DMR) 1045 2 26 4,912 WMA
Holland ARC
K8DAA 1206 2 12 4,768 MI
20/9 RC Inc
K8TKA 1085 2 59 4,544 OH
Sierra Nevada ARS
W7TA 924 2 45 4,468 NV
Turlock ARC
W6BXN
(+AA6D) 1217 2 28 4,182 SJV
Salem ARC
W7SAA 1077 2 20 4,174 OR
Kitchener Waterloo ARC
VC39ØIC
(+CK3IC) 1116 2 29 3,954 ON
Orlando ARC
K1AA
(+W1SE) 851 2 15 3,868 NFL
Antietam RA
W3CWC 722 2 39 3,744 MDC
K9BAR 962 2 31 3,636 IL
Whitman ARC, Inc.
W1N 1113 2 45 3,572 EMA
North Shore ARC
VE3NSR 700 2 20 3,556 ON
Fulton Cty ARC
K8BXQ
(+KD8JBS) 697 2 14 3,350 OH
ARA of Long Beach
W6RO 631 2 51 3,048 LAX
Lakeside ARC
K6SEE 683 2 30 2,946 SDG
Central NH ARC
W1JY 428 2 18 2,796 NH
Bear Bait RC
KC2ZZO 454 2 14 2,692 NNY
CCDX ARC
AD1T
(+W1WWW) 738 2 16 2,628 NH
Peak RA
W7PRA 854 2 12 2,626 OR
Warrensburg Area ARC, Inc.
WØAU 547 2 10 2,470 MO
Barrow ARC
WR4BC
(+W4WYI) 502 2 26 2,332 GA
RASON
N1NW 444 2 39 2,278 CT
KJ4YEN 363 2 33 2,264 NC
Elks Lodge ARC #1004
W5ELK 414 2 12 2,100 AR
International Brotherhood of Radio Operators
KD8KNX 301 2 32 1,862 OH
Keuka Lake ARA
AE1PT 271 2 30 1,736 WNY
Kent ARS
K3ARS 167 2 18 1,736 MDC
Ripley Cty ARC
KK9RC
(+KC9VZC) 114 2 12 1,518 IN
Sierra ARC of the High Desert
N6N 152 2 22 1,286 ORG
St Joseph Cty ARES
WG8V 68 2 8 186 MI

7A
Lake ARA
K4FC
(+KT4Q) 5446 2 40 17,042 NFL
Big Bear ARC
K6BB 1706 2 20 7,144 ORG
W6TRW ARC
W6TRW
(+K6OUE) 2538 2 42 6,840 LAX
Niagara Peninsula ARC, Inc.
VE3VM
(+VA3NRS) 1863 2 40 6,008 ON
Central Mass ARA
W1BIM 1537 2 31 5,984 WMA
Kendall ARS
KB5TX 1252 2 18 5,204 STX
Greater Wichita Field Day
NØW
(+KØW) 1197 2 50 5,096 KS
W3VPR
(+KI3DS) 925 2 38 4,228 MDC
Calaveras ARS
N6FRG 796 2 19 3,908 SJV
Alexandria RC
W4HFH 935 2 27 3,732 VA
Marple Newtown ARC & Mobile Sixers RC
N3NZ
(+W3AWA) 716 2 53 3,658 EPA
Silverado ARS
W6CO
(+KE6O) 922 2 48 3,422 EB

Ross, KR4USA, and his daughter Hope, a "radio princess," look for some magic on the "Magic Band" of 6 meters at K4PJ, the Oak Ridge (TN) ARC Field Day. [Photo courtesy Charlie Hargis, K4PJ]

Maker Faire Field Day
KØC 593 2 134 3,304 MO
MGRA / CGARC
W4R
(+WR4BA) 816 2 75 3,194 GA
South Bay ARS
K6QM 726 2 15 3,126 SDG
Ventura Cty ARC
K6MEP 353 2 15 2,244 SB
W8KEA 443 2 20 2,206 MI
Scarborough ARC
VE3WE 294 2 12 1,544 ON
Western Reserve ARC
W8WRC
(+KD8ELY) 195 2 35 1,520 OH

8A
Cortek RA
W9CA
(+K9IJ) 8041 2 50 26,342 IL
Gloucester Cty ARC
W2MMD 3394 2 70 12,746 SNJ
Hampden Cty RA
W1NY
(+WB1Z) 2904 2 60 10,236 WMA
Gwinnett ARS
W4GR
(+KD8DVY) 2703 2 153 9,624 GA
Mahoning Valley ARA
W8QLY
(+W8IZC) 2545 2 32 9,046 OH
Forsyth ARC
W4NC
(+W4WS) 2011 2 37 7,828 NC
Lancaster NY ARC
W2SO 969 2 12 3,634 WNY
Four Lakes ARC
W9JZ 611 2 41 3,386 WI
Barry ARA
K8BMI 757 2 21 3,298 MI
Crawford Cty ARC
W8BAE 913 2 22 2,880 OH
KØUSA 653 2 40 2,762 NE
Delta ARS
V7SUN 378 2 17 2,460 BC
Delta ARS
VE7SUN 378 2 17 2,460 BC
Muskegon Area AR Council
W8ZHO
(+K8EOD) 376 2 50 2,378 MI

9A
Raleigh ARS
W4DW
(+W4RNC) 4017 2 102 12,998 NC
W9UUU 1711 2 48 6,190 IN
Stanislaus ARA
W6ERE 586 2 39 2,638 SJV

10A
Woodbridge Wireless
W4IY 5311 2 50 18,094 VA
Rappahannock Valley ARC
K4TS
(+N4ENG) 2643 2 32 10,328 VA
Ventura Cty ARS
N6R 1565 2 150 5,838 SB
Broken Arrow ARC
W5BBS 814 2 40 4,064 OK
Toledo Mobile RA
W8HHF 685 2 42 3,332 OH
El Dorado Cty ARC
AG6AU 744 2 31 3,326 SV

11A
Mississauga ARC
VE3MIS
(+VE3ETG) 1689 2 65 6,736 ON
Columbia ARC
W4CAE
(+N4TAL) 765 2 40 4,224 SC

12A
Nashua Area RC
N1FD
(+KB1HYL) 3534 2 30 12,122 NH
Alamo Area Radio Org
AA5RO
(+AE5WT) 35 2 8 1,866 STX

27A
Potomac Valley RC & Columbia ARA
W3AO
(+KE3Q) 11116 2 80 35,984 MDC

1A Battery
Chew's Ridge Gang
K6MI 861 5 6 9,720 SCV
Fresno QCWA chapter 213
W6GV 667 5 5 7,220 SJV
New England Radio Discussion Soc
K1R 433 5 12 4,945 ME
Los Chupacabraderos
K5AXW 369 5 5 2,695 STX
Texas Sparks
AA5TB 230 5 5 2,555 NTX
Burlington ARC
VE3CJ 212 5 10 2,225 ON
Hiawatha ARC
KØJKS 211 5 25 2,055 KS
NØSFF 219 5 11 1,810 IA
Flying Pigs QRP Int — North Cent Tennessee
WA4PIG 156 5 5 1,610 TN
Pennsylvania Knightlites
KA2QPG 145 5 10 1,580 WPA
NP2CB Field Day Group
NP2CB 92 5 7 1,510 NFL
Pinyon Mesa Operators
KØG 107 5 3 1,420 CO
QRP Cheeseheads ARC
NQ9RP 75 5 3 1,400 WI
Terrace ARC
VE7BQO 114 5 5 1,365 BC
NG1P 198 5 3 1,240 ME
CRA Sorel-Tracy
VE2CBS 112 5 12 1,125 QC
North Georgia VHF Society
K4NGA 107 5 8 1,030 GA
Marconi RC of Newfoundland Signal Hill Splinter Group
VO1MRC 17 5 9 1,025 NL
K2QR 44 5 4 990 WNY
Northern Vermont QRP Soc
N1QS 133 5 4 915 VT
Yarmouth RC Inc
W1YAR 43 5 7 765 ME
ARC of Alameda
K6QLF 10 5 3 585 EB
Omarc Lite
KC2SVS 25 5 5 345 NNJ
2A Battery
Colorado QRP Club
WØCQC
(+NAØTC) 1532 5 5 15,890 CO
Explorers RC
NA3DX
(+NA1DX) 557 5 10 5,730 MDC
Dixie ARC
W7DRC
(+NA7UT) 661 5 32 5,480 UT
Tri-State Mountaineers
AC3V
(+KB3VPA) 414 5 9 4,075 EPA
Walton RA
W2LZ
(+W2CD) 285 5 8 3,190 WNY
Barstow ARC
WA6TST
(+KC6IIH) 285 5 23 2,990 ORG
RARC-QRP
WØMXWW 155 5 10 2,560 MN
Pueblo West ARC, Inc.
NAØPW
(+KDØMBL) 170 5 15 2,095 CO
Iowa QRP Club
KQØRP 170 5 5 2,035 IA
Ottawa Valley QRP Soc
VA3OVQ 122 5 5 1,970 ON
Head Lake Group
VE3LM 220 5 3 1,915 ON
French Creek QRP Renegades
W3PBC 172 5 3 1,905 EPA
Yellowknife ARS
VE8YK 66 5 10 1,590 NWT
Glenn ARS
KJ6HCG 90 5 10 1,410 SV
University ARC
N7UW 109 5 10 990 WY
K5TED 61 5 3 885 STX
Portland Amateur Wireless Assn
W1KVI 49 5 16 755 ME
Pacific Area Naturist ARS
NU6DE 50 5 3 705 ORG

3A Battery
Rancho Escondido
W5YA
(+K5KM) 1937 5 10 19,970 NM
PART of Westford
W1IS 587 5 50 6,345 EMA
Reno QRP Group
W7FST 506 5 20 5,870 NV
North DeKalb QRP Club
W4DGH 604 5 15 5,780 AL
Naval Postgraduate School ARC
K6LY
(+K6NPS) 611 5 15 4,705 SCV
NØYJ 177 5 3 2,170 MO
Nova — QRP
WA4MM 143 5 3 1,830 VA

4A Battery
Zuni Loop Mtn Expeditionary Force
N6GA 1079 5 8 9,995 LAX
St. Louis QRP Society
NFØR 541 5 9 6,360 MO
Portland ARC
W7LT 462 5 20 4,440 OR
McMinnville ARC / YCARES
W7YAM 319 5 17 3,895 OR
Elgin ARS
VE3RSE 251 5 10 3,165 ON
Houston QRP Club
W5MSQ 179 5 11 2,130 STX
Snake River ARC
K7SI 203 5 8 1,970 ID
Lodi ARC
N6SJV 195 5 30 1,895 SJV

5A Battery
South Park Marauders
WVØH 469 5 20 5,165 CO

6A Battery
Durham Region QRP Club
VE3QDR 374 5 6 4,095 ON
David Sarnoff ARC
N2RE 254 5 55 3,595 SNJ

9A Battery
Orange Cty RA / Durham FM Assn
W4EZ 1796 5 50 17,385 NC

10A Battery
West Valley ARA
K6EI
(+W6ZZZ) 2827 5 25 25,405 SCV

15A Battery
USECA ARC
K8UO
(+KD8JFF) 1538 5 150 15,020 MI
Conejo Valley ARC
AA6CV 1273 5 80 12,895 SB

1A Commercial
Pathfinders ARC
VA4PAR 964 2 10 2,278 MB
Callaway ARL
KSØB 687 2 12 2,024 MO
Cavalla Historical ARS
N5BPS 628 2 4 1,636 STX
AuSable Wireless Club
N8KV 457 2 3 1,558 MI
Waupaca Cty ARES
W9WAP 351 2 8 1,404 WI
W2NRC 75 2 14 500 NNJ
450'Antenna Group
KG4CDI 149 2 7 448 NC
Tri-County D-Star
N8NOE 153 2 3 356 MI
Tyndall family ARC
W4TFR 69 2 3 346 GA
Sudbury ARC
VE3AR 55 2 7 260 ON
BSA Venturing Crew #80
W3BSA 17 2 5 224 VA
WB4JFA 15 2 12 130 SFL
Hawkins Cty ARES
KM4XE 27 2 7 104 TN
UN Global Service Centre ARC
4U1GSC 35 1 3 85 DX

2A Commercial
Radio Central ARC / Order of Boiled Owls of NY
W2RC
(+KW2O) 2336 2 21 7,684 NLI
West Texas Consortium
K5M 1123 2 3 4,002 WTX
K-State Alumni Radio Team
KØDNG 1165 2 3 3,820 MO
Macon Cty ARC
NØPR
(+ABØC) 838 2 15 3,664 MO
Franklin Cty ARC
WE4A
(+W3MSG) 751 2 24 2,950 NC
Quad Cty ARC
N3QC
(+K3HWJ) 811 2 26 2,550 WPA
Kootenai ARS
K7ID 518 2 18 2,234 ID
Nassau Cty Police ARC
NC2PD 746 2 17 2,122 NLI
K8OCB 511 2 4 1,734 OH
Columbia Cty ARC
K4KNS
(+WE4GW) 246 2 40 1,730 GA
Southern Illinois University ARC
W9UIH 629 2 5 1,522 IL
AK4I 334 2 5 1,430 GA
Canadian Lakes ARC
K8PAO 572 2 8 1,394 MI
Cascades ARS
W8JXN 412 2 10 1,380 MI
Chicago FM Rep Club
WA9ORC 316 2 40 1,338 IL
Manteca Amateur RC
K6MAN
(+W6RCA) 392 2 20 1,262 SJV
Mora Open Rep Assn
KDØCI 243 2 9 1,084 MN
Community Service RC
WØCSR 165 2 7 964 MO
K3IVO 91 2 4 952 MO
Charles Cty ARC
K3SMD 225 2 12 900 MDC
Chickasaw ARA
W5K
(+W5GWD) 272 2 15 890 MS
Grummann ARC
WA2LQO 355 2 15 888 NLI
Lewes ARS
W3LRS 31 2 3 712 DE
KD6HWI
(+KD6HWI) 256 2 3 562 IN
Arlington ARC
W4WVP 119 2 20 560 VA
Illinois Valley RA.
K9AVE 67 2 7 328 IL
Pikes Cty ARC
W9UL 104 2 6 304 IN
Brooksby Radio Amateur Group
W1BBV 21 2 6 242 EMA
Coyote ARC
KS5TX 94 2 3 188 STX
Rifles and Radios
W9RAR 33 2 7 116 IL

3A Commercial
Splitrock ARA
K2RF 1786 2 25 5,720 NNJ
Zamora Shrine RC
W4ZHR
(+K4HAL) 1439 2 30 5,688 AL
Cascade RC
W7EK 553 2 26 2,096 WWA
High Point ARC
W4UA 673 2 24 1,996 NC
Onslow ARC
NC4OC
(+WD4FVO) 430 2 22 1,956 NC
Fayette Cty ARC
KK4GQ
(+W4PSZ) 674 2 15 1,912 GA
Camden Cty ARS
KB4CC 370 2 10 1,904 GA
New York City Transit ARC
K2IRT 458 2 7 1,766 NLI
Mississippi Coast ARA
W5SGL 590 2 17 1,758 MS
Pioneer ARC
KØJFN
(+KDØPGV) 390 2 12 1,752 NE
W9TAZ 610 2 23 1,604 IL
Lakes Area ARC
W5JAS 369 2 10 1,500 STX
Northeast Arkansas RC
K5NEA 409 2 17 1,478 AR
Coon Valley ARC
NØNAF 417 2 3 1,468 IA
W5RIN 280 2 19 1,400 STX
N5BTC 280 2 19 1,400 STX
Grayson Cty ARC
K5GCC 273 2 25 1,368 NTX
Cumberland ARC
K3IEC 366 2 12 1,358 EPA
Ste. Genevieve Cty ARC
KØQOD
(+W6ZPC) 183 2 7 1,320 MO
Hillsdale Cty ARC
K8HRC 236 2 36 1,264 MI
Almonte ARC Inc
VA3AAR 422 2 11 1,146 ON
Skyline Tower ARC
W7DTV 572 2 15 1,144 OR
Atascosa Cty ARC
WA5AR 54 2 17 958 STX
AB8VV 218 2 4 930 MI
Bosque Cty ARC
W5BCR 162 2 30 824 NTX
W4FAR 136 2 10 722 NC
Thomaston ARC
W4OHH
(+W4TFR) 297 2 7 704 GA
Red River Valley ARC
WB5RDD 64 2 29 630 NTX
KØDCA 187 2 13 624 MO
Chautauqua AR Serv
KC2YHE 147 2 15 554 WNY
VE6MRF 50 1 10 532 AB
Southeast Louisiana Amateur Club
WB5NET 203 2 9 506 LA
North Georgia Tri-State ARC
W4NGT 118 2 12 436 GA
Georgian Bay ARC
VE3OSR 238 1 12 413 ON
ARES
(Webster Co. Missouri)
NØRT 26 2 22 52 MO

4A Commercial
W7AC 1933 2 5 7,422 OR
Sawnee ARA
N4NE 1289 2 59 4,616 GA
Central Ohio Operator Klub Extra-Novice
W8FD
(+WW8OH) 1197 2 21 3,888 OH
CBF ARC
W8CBF 1365 2 22 3,404 OH
R.L. Drake ARC
K8UU 950 2 21 3,312 OH
K4MVA 803 2 9 2,116 VA
Radio Assn of WNY
W2PE 420 2 28 1,704 WNY
Black River Amateur RC
K8BRC 519 2 19 1,672 MI
N4IQ 824 1 4 1,358 SC
Tri Cty Hams
KC9OLF 252 2 6 1,086 IN
K9LNX 78 2 12 176 IN

5A Commercial
W3T
(+N3WXW) 2026 2 55 8,258 EPA
Wisconsin ARC
W9CQ 915 2 15 2,946 WI
Milledgeville ARC
W4M 701 2 13 2,880 GA
Hay Bay ARC
VE3FRG 684 2 5 2,090 ON
Fort Verango Mike and Key Club
W3ZIC 659 2 5 1,928 WPA
Volusia ARES
KV4EOC 231 2 35 1,314 NFL
Black Diamond ARC
WV8BD 460 2 28 1,090 WV

6A Commercial
Four Corners Field Day
N5M 387 2 12 1,134 NM

Class B — 1 or 2 Participants Portable

1B-1 Op
KØDI 603 2 1 2,662 WV
KA2OUO 601 2 1 2,356 MDC
N4UF 502 2 1 2,128 NFL
WW7D 480 2 1 1,852 EWA
NØFCD 696 2 1 1,762 IA
WA9Z 415 2 1 1,760 IA
AB9CA 362 2 1 1,698 AL
KIØE 246 2 1 1,684 ND
W9KHH 303 2 1 1,654 WI
K8ER 346 2 1 1,584 MI
K3WGR 321 2 1 1,468 EPA
KB8UHN 535 2 1 1,220 OH
N6RK 311 2 1 1,208 SV
K8BTU 231 2 1 1,174 OH
WA5TVO 220 2 1 1,162 SDG
AD7DD 85 2 1 990 EWA
KC7O 296 2 1 950 ORG
K6KS 250 2 1 850 SV
K4CMD 279 2 1 808 VA
AA1PL 241 2 1 736 RI
W5JBO 150 2 1 650 STX
VE3EDX 102 2 1 642 ON
WW6O 186 2 1 622 NTX
NK5G 90 2 1 608 STX
WF5W 123 2 1 592 STX
AC7CJ 20 2 1 590 EWA
W6F 133 2 1 566 SB
KC8HQS 148 2 1 546 OH
WC6R 93 2 1 522 UT
VA2NU 55 2 1 460 QC
W5HLP 101 2 1 452 NTX
KE7NO 92 2 1 442 MT
VE3FME 40 2 1 360 ON
KØARY 51 2 1 352 MO
K6IMZ 76 2 1 342 IA
NØBHT 145 2 1 340 CO
AF5DM 64 2 1 306 NTX
KFØG 26 2 1 302 SV
KØACP 98 2 1 298 IA
W9JRF 46 2 1 292 IN
KD2AAE 20 2 1 290 NNJ
NG2E 12 2 1 274 NNY
KB3TDF 1 2 1 272 MDC
KD5DLZ 58 2 1 266 OK
N4QET 74 2 1 248 GA
KK7OQ 45 2 1 240 OR
AK4OH 43 2 1 236 VA
AC2HJ 38 2 1 226 WNY
KC2RXS 17 2 1 218 ENY
AF5BZ 33 2 1 216 WCF
K5NLX 14 2 1 206 AR
KE3FL 10 2 1 200 MDC
N7TOX 21 2 1 192 UT
N8HOB 9 2 1 186 OK
K2EVD 39 2 1 178 NLI
AB8XX 10 2 1 170 OH
AG3BI 7 2 1 164 MDC
WA7TPB 10 2 1 120 WWA
K8HUG 22 2 1 106 OH

2B-1 Op
KBØYTO 24 2 1 498 NE
N6LB 11 2 1 272 WWA

1B-1 Op Battery
N4TY 924 5 1 9,390 KY
N7OU 840 5 1 8,650 WWA
KØMF 636 5 1 6,560 CO
KXØR 573 5 1 6,080 WY
K5WNH 569 5 1 5,940 NTX
K7IA 445 5 1 4,800 NM
W3TS 426 5 1 4,710 EPA
AE8M 451 5 1 4,530 OH
KØPC 400 5 1 4,250 MN
NN7ZZ 392 5 1 4,130 UT
NØEVH 340 5 1 3,850 MO
KEØG 335 5 1 3,550 MN
AA4GA 329 5 1 3,500 GA
AA5CK 286 5 1 3,140 OK
N2JR 272 5 1 3,070 VA
NR8Z 235 5 1 2,800 OH
AC7A 267 5 1 2,780 AZ
W8RTJ 269 5 1 2,740 OH
KD2JC 254 5 1 2,690 NNJ
K4RDU 247 5 1 2,670 VA
N6CMF 251 5 1 2,660 ORG
N3AB 244 5 1 2,580 EPA
NZ5A 221 5 1 2,560 STX
W9NJY 225 5 1 2,500 WI
KB4QQJ 187 5 1 2,330 NC
N8TD 204 5 1 2,290 OH
K5SI 217 5 1 2,270 STX
WUØL 180 5 1 2,150 SD
KØCEA 178 5 1 2,030 MO
K8ZT 177 5 1 1,985 WV
K1PDY 162 5 1 1,970 NH
N3ZP 185 5 1 1,885 EPA
W3WT 148 5 1 1,830 EPA
KIØII 134 5 1 1,690 NE
KB5FIO 104 5 1 1,490 STX
K6GCN 150 5 1 1,335 SCV
W7BV 120 5 1 1,300 AZ
AB4FH 103 5 1 1,280 SC
W1JCW 243 5 1 1,265 OK
NK8I 100 5 1 1,250 OH
W1XH 108 5 1 1,225 WMA
K9SIU 107 5 1 1,220 IL
K9IA 95 5 1 1,200 NFL
KA9VHG 82 5 1 1,170 WI
WA9PYH 101 5 1 1,160 IN
N2DM 90 5 1 1,150 WNY
WB3CEG 85 5 1 1,100 STX
WO6M 104 5 1 1,090 LAX
K5CAO 100 5 1 1,050 SV
N7XW 79 5 1 1,040 WWA
K9VP 76 5 1 1,010 IN
K2KGJ 81 5 1 1,010 ENY
KC9ZO 89 5 1 990 IL
K7ING 93 5 1 980 AZ
W8NNC 82 5 1 970 OH
KE4PT/6 60 5 1 940 EB
KA1HSP 67 5 1 920 WMA
W6AQ 55 5 1 900 MI
K4PP 74 5 1 890 AL
KA2BEO 53 5 1 880 SNJ
K8EG 59 5 1 840 OH
KCØURL 71 5 1 810 MN
WC4U 72 5 1 805 NFL
KCØINP 67 5 1 795 MN
VE6ZC 55 5 1 755 AB
WB4JJJ 63 5 1 730 VA
AB7HU 48 5 1 730 AZ
WB2PEF 67 5 1 720 WNY
K3TW 25 5 1 700 NFL
WD5HNI 43 5 1 655 STX
W7WJ 40 5 1 650 ORG
NN5E 30 5 1 650 NTX
KFØUU 40 5 1 650 MN
KD2MU 52 5 1 645 NLI
W6GJB 58 5 1 630 SCV
N4QX 33 5 1 580 VA
W4TTY 43 5 1 580 VA
KK4CUH 36 5 1 530 KY
WB6HVH/7 37 5 1 520 UT
W2EB 26 5 1 510 WNY
K4EOR 31 5 1 510 GA
KI6TPX 30 5 1 500 LAX
KØPE 25 5 1 500 IA
KØNE 45 5 1 500 NE
W9SRB 47 5 1 485 IL
AE5KA 23 5 1 480 OK
WD9EWK 26 5 1 480 AZ
AB4EL 30 5 1 420 NC
N5VWN 35 5 1 400 SJV
K2RNY 35 5 1 400 WNY
WB6AAJ 31 5 1 395 SCV
KBØHQM 27 5 1 385 KS
ACØQG/5 13 5 1 380 STX
K6AR 33 5 1 380 SDG
KBØQND 20 5 1 350 IA
N2ESE 25 5 1 350 NNJ
WA4HWT 50 5 1 350 GA
K1EHZ 20 5 1 350 EMA
K7SDS 39 5 1 345 NV
N9GQ 19 5 1 345 WI
K5YQF 16 5 1 310 STX
AD7AN 15 5 1 300 AB
ACØSX 16 5 1 295 KS
KB1QKB 13 5 1 265 NH
VE6SKY 29 5 1 245 AB
KH6CS 12 5 1 220 PAC
W6OLA 19 5 1 205 EWA
KK6C 4 5 1 190 SJV
K2BCM 5 5 1 175 WNY
K4YND 12 5 1 170 VA
K4LCM 21 5 1 155 VA
KCØZLR 3 5 1 130 CO

1B-1 Op
K7DR 840 2 1 3,402 MI
KB9UWU 977 2 1 3,082 IL
KP4DXC 190 2 1 1,410 PR
W3IZ/2 205 2 1 992 ENY
K4XD 214 2 1 840 NC
VYØ/K9DXA 139 2 1 704 NWT
VYØ/AH6EZ 315 1 1 501 NWT
W8IDW 62 2 1 476 WV
KB5EO 136 2 1 396 STX
K5JJR 117 2 1 384 NTX
NØKEN 83 2 1 316 MN
WB5LAI 125 2 1 300 MS
WA4IZK 108 2 1 266 NH
AF6VN 20 2 1 230 MI
N3JNX 80 2 1 210 EPA
N4NTO 38 2 1 202 NC
W7DRA/7 42 2 1 168 WWA
VE5KC 57 2 1 164 SK
KØVG 38 2 1 154 MN
AC9CF 20 2 1 130 WI
W5CYF 37 2 1 124 MS
K7VBY 5 2 1 64 OR

1B-2 Op
N5OE 1261 2 2 5,294 NTX
VE6KC 956 2 2 4,074 AB
K7GGG 1041 2 2 3,464 AZ

Larry, WA5TVO, enjoying his 1B solar-powered operation from Lake Miramar in San Diego, CA. [Photo courtesy Larry Sweet, WA5TVO]

W8AWE	399	2	2	1,470	MI
K7AUO	409	2	2	1,202	WWA
NXØP	512	2	2	1,174	MN
KX4O	238	2	2	1,160	VA
K6SB/7 (W6GL)	245	2	2	1,114	AZ
NR7E	315	2	2	880	UT
WA6RC	98	2	2	848	LAX
N4C	120	2	2	690	NC
VE3EEE	105	2	2	656	ON
N7VZU	230	2	2	610	EWA
KØNR	203	2	2	556	CO
AE7HS	139	2	2	528	ID
KC8MLB	7	2	2	464	NFL
N6IV	117	2	2	396	SJV
NR5ON	30	2	2	390	NM
K4PMT	75	2	2	388	NFL
KE9SA	92	2	2	374	WI
W3GS	101	2	2	366	EPA
WR6E	45	1	2	295	SCV
KA1YDI	37	2	2	270	VA
W7JT	56	2	2	262	NTX
WAØKRL	67	2	2	234	MN
NZ5G	39	2	2	228	STX

2B-2 Op

KW8N	2931	2	2	9,926	OH
K7EUG (+W2VJN)	795	2	2	2,680	OR
NØUY	437	2	2	1,858	MN
W3SW	600	2	2	1,806	WNY
KG5E	426	2	2	1,782	NTX
AK7AT	253	2	2	1,242	ID
AD6Q	64	2	2	778	NC
AE6FD	210	2	2	770	SJV
KD8PZD	294	2	2	638	OH
N7K	13	2	2	576	ID
W3ZYF (+KB3YRX)	143	2	2	486	WPA
KØYBV	14	2	2	380	KS

1B-2 Op Battery

KE8M	648	5	2	6,530	OH
VA3DF	670	5	2	6,360	ON
N3CU	517	5	2	5,345	WPA
K1DFT (+KA1RM)	401	5	2	4,110	ME
VA3YV	438	5	2	3,805	ON
K2WNY	294	5	2	3,590	WNY
K7PJT (+K7CVU)	336	5	2	3,560	OR
W6LPW	273	5	2	2,660	SCV
N4RE	236	5	2	2,610	NC
NGØR	101	5	2	1,380	MN
WØAZ (+W9KV)	95	5	2	1,150	CO
WIØS (+KDØARC)	56	5	2	760	MN
KG6HM	70	5	2	645	SJV
WE7H	64	5	2	570	AZ
WA5DSS	65	5	2	560	STX
KG8YT	37	5	2	420	MI
N6AE	20	5	2	350	SV
WJ3K	8	5	2	330	MDC
N2JFS	36	5	2	330	VT
WA2EZG	11	5	2	305	NNJ
WA4ZKO (+KI4WEF)	1	5	2	215	KY
KE7WHC	2	5	2	160	AZ

2B-2 Op Battery

K3ZZ	940	5	2	7,470	MDC
NY4G	273	5	2	3,015	SC
W6JFE (+K6RHB)	180	5	2	1,400	SB
W1IE	142	5	2	1,090	VA
KJ6TUE	52	5	2	610	ORG
VE3DTI	27	5	2	385	ON

1B-2 Op

VE3RCN (+VE3WIZ)	275	2	2	960	ON
W5RMB	432	2	2	914	AL
K5PA	123	2	2	322	STX
KD5BBR	114	2	2	278	OK
KE8E	107	2	2	264	OH
W9DK	21	2	2	192	WI
KK4DDF	64	2	2	178	VA

Class C — Mobile Stations

1C

K4MTI	710	2	1	2,940	NFL
K7VO	665	2	1	1,580	WWA
K1GGI	322	2	1	1,438	EMA
WA7ZZB	284	2	1	1,146	WWA
K2NV/VE3	244	2	1	1,026	ON
W9XS	151	2	1	854	IL
N7DLV	225	2	1	800	EWA
WU3U	157	2	1	772	EPA
KD9KC	104	5	1	770	WTX
W4BAB	126	2	2	754	GA
K5TDA	148	2	2	742	WTX
W7CGA	118	2	1	722	MT
K7UQH	131	2	1	624	WWA
KK4PQ	55	2	1	480	GA
W4ZPR	67	2	1	468	VA
KB1CTC	22	2	1	412	CT
NA1GB	74	2	2	406	WMA
N3AWS	111	2	1	372	MS
NE9T	67	2	1	318	IN
K6BBQ	27	2	1	304	SF
AG1YK	54	2	1	258	CT
ABØYM	50	2	1	250	CO
W1RO	47	2	1	234	SDG
NQ7R	45	2	1	230	WTX
WA4CHJ	29	2	1	208	VA
W6VCE	40	2	2	202	SDG
N3TG	26	2	1	202	VA
KCØJQO	20	2	1	190	MN
K9JK	15	2	1	184	IL
KA3KSP	38	2	1	176	WPA
W3WL	11	2	1	172	GA
K9CEW	9	2	1	168	IL
VA7ANI/MM	56	2	1	162	BC
AE6JV	4	2	1	158	WV
N4YHC	52	2	1	154	KY
KJ6MG	50	2	1	150	GA
K7SIG	46	1	1	146	WY
K6VHF	18	2	1	136	UT
K9JDG	17	2	1	134	CO
N5SQR	39	2	1	128	SDG
KB6NN	3	2	1	112	SF
AA1PR	4	2	1	108	VT
WL7OU	24	2	1	98	STX
W8TLS	18	2	1	86	OH

2C

KW9A	47	2	2	344	IL
PJ2OF	7	2	2	84	DX

4C

W6WC	703	2	6	2,860	ORG

Class D — Home Stations Commercial Power

1D

N9TK	1022	2	3	4,104	IL
NA5TX	1201	2	3	4,026	STX
NW2K	858	2	1	3,294	WNY
AA2BJ	879	2	2	3,240	EPA
K9ZC	2263	1	5	3,067	IL
K3WW	759	2	1	3,044	EPA
VE3KP	711	2	1	2,994	ON
KH2D	586	2	1	2,394	NFL
W6AEA	1141	1	1	2,332	EWA
VE1RGB	560	2	1	2,290	MAR
VA7ST	531	2	1	2,274	BC
K9UQN	546	2	1	2,196	TN
N2RI	480	2	1	2,070	NLI
W9AV	537	2	1	1,880	WI
W6SX	1046	1	1	1,867	SJV
N7MZW	831	2	1	1,712	WY
KI1U	475	2	1	1,636	CT
VE9HF	1435	1	1	1,616	MAR
W4ARM	385	2	1	1,554	SFL
ACØBH	355	2	1	1,470	MO
WAØBJR	388	2	5	1,406	MO
N6JF	344	2	2	1,338	ID
WA7LNW	716	1	2	1,309	UT
N8XI	315	2	1	1,260	MI
AI7AA	315	2	1	1,260	WWA
KE1AF	589	2	1	1,246	RI
W4SUN	312	2	1	1,216	WCF
KA8HOK	523	1	1	1,196	AL
KØUK	286	2	1	1,188	CO
VE3XB	555	1	1	1,160	ON
K7NX	266	2	1	1,114	AZ
WB3ESR	259	2	1	1,066	EPA
WJ2D	319	2	1	1,060	NC
K2MK	507	1	1	1,038	SNJ
VA3ATT	245	2	1	1,030	ON
K4DJ	251	2	1	964	NC
W5PQ	226	2	1	954	LA
AE1T	226	2	1	946	NH
K8BZ	776	1	1	931	MI
N7UVH	219	2	1	926	ID
N5RGV	219	2	1	926	STX
VA3IC	262	2	1	904	ON
N5VU	510	1	1	874	LA
KK4R	205	2	1	870	VA
W7QN	204	2	1	866	WWA
WØGN	199	2	2	854	IA
K3CCR	265	2	3	852	MDC
K3KU	241	2	3	846	MDC
KS4X	219	2	1	826	TN
VA3FN	192	2	1	818	ON
K6CSL	190	2	1	810	SJV
WB7FJG	261	2	1	810	WWA
KJ4IWZ	188	2	1	802	TN
K6LRN	183	2	1	782	SV
W7GVE	386	2	1	772	AZ
K5SS	180	2	1	770	NTX
KMØH	355	2	1	760	MN
W6AFA	703	1	1	753	LAX
KD2HE/VE3	186	2	1	744	ON
KØLWV	173	2	1	742	MO
KC3Q	173	2	1	742	EPA
WO2N	173	2	1	742	NLI
VE3XAT	172	2	1	736	ON
N3GGT	167	2	1	718	EPA
K7RL	334	1	1	717	WWA
W8ICN	166	2	1	714	MI
KM2T	166	2	1	714	SNJ
AA5VU	164	2	1	706	STX
WA2JQK	265	2	1	706	ENY
WT7B	325	2	2	700	ID
KA2FHN	177	2	1	678	WNY
AA8R	157	2	1	678	MI
N5PU	151	2	1	654	MS
KM4JA	161	2	1	644	AL
WA7NPX	146	2	1	634	CO
KR2AA	144	2	1	626	NLI
AC5T	156	2	1	624	NTX
W6ABR	286	2	3	622	SF
VY2DM	155	2	1	620	MAR
W8PNA	154	2	1	616	MI
K3TKV	110	2	1	608	EPA
N2EY	113	2	1	602	EPA
W8BXG	220	2	2	598	OH
K2DBK	273	2	1	596	NNJ
WO8L	160	2	1	584	NC
WD1H	133	2	1	582	EMA
K5BZH	132	2	1	578	WTX
K2CYE	134	2	1	574	ENY
WB9GHD	105	2	1	570	SDG
NB7N	164	2	1	564	WWA
N9JWR	186	2	3	562	IN
W4EE	140	2	1	560	MDC
KB6A	122	2	1	538	ORG
K2NCC	122	2	1	536	OR
N1NN	121	2	1	534	EMA
W4NHO	68	2	1	522	KY
K7JQ	359	1	1	521	AZ
KD6FW	259	2	1	518	SJV
WA8FRE	512	1	1	512	MI
W1WIU	177	2	1	512	RI
W9OA	128	2	1	512	IL
WKØX	125	2	4	512	MN
N6NC	247	1	1	494	SDG
N4KHI	167	2	1	484	NFL
WX9DX	475	1	6	475	IL
WB9ICL	106	2	1	474	IN
KC2MBV	126	2	1	456	NLI
K8CPA	101	2	1	454	MI
W6AWB	202	2	1	454	ORG
AA6SS	100	2	1	450	ORG
N6RY	197	2	1	444	SDG
NA6E	98	2	1	442	AZ
AA8IA	98	2	1	434	OH
AA8V	95	2	1	430	MDC
NE8J	201	1	1	430	NFL
WA4MIY	95	2	1	428	SC
W6CT	69	2	1	426	SCV
VE3RSA	94	2	1	426	ON
W2LK	115	2	1	424	ENY
KD3SB	136	2	1	422	WPA
WT9S	184	1	1	418	AZ
N4NC	92	2	1	418	NC
KE1R	66	2	1	414	NM
NØFU	200	1	1	400	SDG
K8RJW	100	2	1	400	OH
KB7N	87	2	1	398	WWA
WØPAN	173	2	1	396	AZ
WE1SPN	196	2	6	392	CT
W4HAY	90	2	1	360	TN
WA6JRZ	153	1	1	356	SJV
WS2N	65	2	1	356	NLI
KF7DS	76	2	1	354	OR
K1GI	78	2	1	354	SCV
W4XK	76	2	1	354	TN
K4FPF	100	2	1	348	VA
K2FEO	99	2	2	348	WNY
KO6OP	148	2	1	346	SJV
K4RUM	87	2	1	346	NLI
VE2KOT	84	2	1	336	QC
KE8PG	141	2	1	332	TN
NØPVZ	139	2	1	328	MO
K1YAN	69	2	1	326	EMA
WT3O	138	2	1	326	MDC
NM4SH	69	2	1	326	VA
ABØOA	135	2	1	320	MO
W7KAM	159	2	1	318	MO
WA7NWL	133	2	1	316	AZ
K9GDF	79	2	1	316	WI
W4JHU	66	2	1	314	VA
WA7YNU	129	2	1	308	MT
N2YO	153	1	1	306	VA
NY4JB	86	2	1	304	TN
WB9RFV	124	2	1	298	IN
KL1WE	153	1	2	297	AK
VA3SB	74	2	1	296	ON
N7NEV	36	2	1	294	AZ
ND3R	82	2	1	294	WPA
N6RZR	143	2	1	286	SV
WB3CJU	117	2	1	284	EPA
K6TIG	58	2	1	282	SJV
KA5VZG	58	2	1	282	TN
AA6RR	56	2	1	274	EWA

W9WXN	10	2	1	270	IN	K5FRS	49	2	3	136	STX	KK4RP	3	2	1	62	NFL	NØOE	226	5	1	2,610	MN
WB4OMM	78	2	1	266	NFL	KF6VB	85	1	1	135	EB	KCØVDP	5	2	1	60	MN	K4WOP	575	2	2	2,506	VA
K5LRW	106	2	5	262	NM	KAØB	42	2	1	134	CO	KDØKIM	30	2	1	60	MN	W8TOM	214	5	1	2,490	MI
WV7T	63	2	4	262	CO	KO8S	40	2	1	130	MI	AE3A	3	2	1	60	ENY	W2IMU	632	2	8	2,478	SNJ
W9VLE	105	2	1	260	IN	W2AJW	40	2	1	130	AZ	KG9HM	2	2	1	58	IN	KD5ASV	140	2	1	2,430	NTX
KØEQH	130	2	1	260	KS	KB3INE	39	2	1	128	SC	KC2WMR	4	2	1	58	NLI	NU7B	531	2	2	2,430	AZ
K7BUG	54	2	1	258	SF	WA5OYU	64	2	1	128	MS	K7IP	2	2	1	58	WWA	K4KSR	205	5	1	2,400	VA
W6YRA	75	2	2	258	LAX	KB4FB	38	1	1	126	WCF	KJ4TIP	2	2	1	58	SC	N5ZC	1026	2	1	2,372	WTX
K3WWP	51	2	1	254	WPA	KF7UIN	38	2	1	126	EWA	VE2PIJ	3	2	1	56	QC	WØOTV	542	2	2	2,362	KS
KE4KE	102	2	1	254	MN	AA8DN	38	2	1	126	OH	W6LGB	3	2	1	56	LAX	KCØUXC	200	5	2	2,290	SD
K7JL	101	2	1	252	UT	K4IJK	37	2	1	124	RI	AA6WH	55	1	1	55	SB	W3AG	203	5	1	2,280	WPA
K2HT	53	2	1	252	MO	WD4BMG	62	2	1	124	NC	KD6WKY	1	2	1	54	EB	WB2REM	912	2	3	2,264	SNJ
NE3K	51	2	1	250	MDC	KB5UEJ	37	2	1	124	MS	KØLAI	2	2	1	54	CO	AH6V	527	2	1	2,260	PAC
W6RLL	100	1	1	250	AZ	AD7XV	32	2	1	124	WWA	KJ6MSS	2	2	1	54	EB	WA1ENO	1053	2	2	2,256	EMA
K6III	50	2	1	250	SV	KE4JVY	62	2	1	124	NC	KB7QAG	2	2	1	54	WWA	K4WW	600	2	1	2,250	KY
AB7LA	100	2	1	250	ID	KO9A	28	2	1	122	IL	KF4YRK	2	2	2	54	IN	W7GB	521	2	1	2,238	EWA
K7EIQ	50	2	1	250	EWA	NS7F	31	2	1	122	AZ	VA7LBE	1	2	1	52	BC	N1CC	733	2	1	2,182	NTX
K3TXT	50	2	1	248	MDC	W7REA	23	2	1	120	WY	K6BSD	1	2	1	52	ORG	K7EA	533	2	1	2,140	UT
KC4QYG	62	2	1	244	VA	WA4JM	35	2	1	120	WCF	KJ6PRH	1	1	1	51	ORG	KU4A	219	5	1	2,130	KY
AC6TU	48	2	1	242	LAX	VA3PAW	35	2	1	120	ON	N7QMT	23	2	1	48	WWA	AA8MI	191	5	1	2,060	OH
KX5G	48	2	1	242	NTX	AE2NG	34	2	1	118	WNY	KB5DRJ	24	2	1	48	NTX	NI7R	180	5	1	1,950	AZ
NØRZT	37	2	1	240	AL	N4JRG	17	2	1	118	KY	WB9MII	11	2	1	42	IL	K4CX	382	2	1	1,888	TN
AG4HG	95	2	2	240	TN	KD2AJO	33	2	2	116	WNY	WB3DLS	19	2	1	38	MDC	VE5JZ	168	5	1	1,880	SK
N2DD	44	2	1	238	WNY	W7JSD	19	2	1	114	AZ	WE5ET	18	2	1	36	STX	N7NB	156	5	1	1,810	WWA
N5WSS	54	2	2	238	AR	WA9LKZ	16	2	2	114	IL	KO6YG	17	2	1	34	SCV	WA4FOM	166	5	1	1,780	NNJ
N9WKW	118	1	1	235	IN	W3TMS	61	1	1	111	MDC	W7ARF	16	2	1	32	OR	KU4V	611	2	1	1,772	NC
KC2QIL	46	2	1	234	SNJ	NF8M	15	2	1	110	MI	K3TUF	30	1	1	31	EPA	NX9K	149	5	2	1,740	WI
W3TZ	234	1	1	234	AR	AC8KI	19	2	1	108	OH	KQ3Q	15	2	1	30	MDC	K1TW	160	5	1	1,650	EMA
K2JX	93	1	1	233	NLI	KI4CPL	46	2	2	108	TN	WA5YNE	27	1	1	27	OK	VA5LF	416	2	1	1,602	SK
N4BFR	91	2	1	232	GA	K7IJB	54	2	1	108	EWA	N8TMB	24	1	1	24	MI	NY6J	355	2	1	1,576	IN
KAØADZ	91	2	1	232	MT	K2AVI	57	1	1	107	WWA	KCØRQH	9	2	1	18	MN	K2OGT	331	2	1	1,574	EPA
KDØFIP	20	2	1	230	KS	JA1YNE	29	1	1	107	DX	K4GRE	8	2	1	16	SC	NB4M	140	5	1	1,550	TN
WD8LYB	115	2	1	230	MI	K3IT	15	2	1	106	MDC	K2CMH	5	2	1	16	GA	WØRU	130	5	8	1,515	MN
KJ4VTH	89	2	1	228	VA	WA1OOH	28	2	1	106	AZ	W4WSF	7	2	1	14	VA	K2SM	126	5	1	1,505	WNY
KG2NI	114	2	1	228	WNY	WA3ERQ	28	2	1	106	EPA	WD4PAQ	6	2	1	12	GA	K9OZ	363	2	1	1,496	IL
KX9DX	44	2	1	226	IL	K4GOP	52	2	1	104	NFL	KD8IGK	6	2	1	12	AL	KF6I	334	2	1	1,484	ORG
W2PQG	37	2	4	224	NNJ	WA8PYR	27	2	3	104	OH	N6DY	7	1	1	7	SCV	VE6AO	1307	1	7	1,461	AB
NFØT	64	2	1	224	IA	K7VY	27	2	1	104	NV	KJ4ADA	3	2	1	6	VA	K3OSS	125	5	1	1,450	GA
KC9DKQ	112	2	1	224	WI	KG6PO	27	2	1	104	SCV	AE1H	6	1	1	6	ME	W7ZRC	462	2	1	1,436	ID
K9GPC	87	2	2	224	WI	VE3ZW	51	2	1	102	ON	AH6SZ	1	2	1	2	PAC	W9CHD	308	2	1	1,432	WI
VE3TU	61	2	2	220	ON	KB1MU	26	2	1	102	WMA							KK7EL	121	5	1	1,425	AZ
KC5YWN	85	2	1	220	AR	N5KGV	25	2	1	100	LA	**2D**						W1REP	105	5	1	1,410	NC
N8OQ	84	2	1	218	VA	K6HOM	25	2	1	100	SV	K5UA	1646	2	2	4,742	LA	VE2AWR	352	2	1	1,400	QC
W5LEW	46	2	1	216	CO	K4PZZ	24	2	1	100	VA	N5KWN	789	2	4	2,968	STX	NT6X	413	2	1	1,352	ORG
N1EK	83	2	1	216	MDC	AI4CJ	99	1	1	99	SFL	W3FT	410	2	12	1,464	MDC	W9GHX	128	5	1	1,330	MO
W4BWQ	107	2	1	214	NFL	KØTNT	20	2	1	98	MN	WA4T	224	2	23	1,274	WCF	KØRFD	331	2	2	1,302	CO
AD9O	32	2	1	214	NE	AG6AN	14	2	1	98	LAX	W4SVI	229	2	23	1,028	SFL	N1EP	170	5	1	1,300	ME
W8BFX	82	2	1	214	WWA	K6BMD	24	2	1	98	EB	W7EAT	276	2	13	876	WWA	WI7J	571	2	2	1,292	UT
K7DAC	160	1	1	210	UT	N9WF	48	2	1	96	IL	AK6D	363	2	3	776	ORG	AD1L	544	2	1	1,258	WMA
K3WQ	80	2	1	210	MDC	KD4QMY	23	2	1	96	GA	W9HW	297	2	5	666	IL	W1PNS	109	5	1	1,240	EMA
KC8RTW	29	2	1	208	MI	KB4CP	35	1	1	95	WCF	NT1CS	126	2	6	602	EMA	AD4Z	276	2	1	1,208	SFL
WØDD	79	1	1	208	MN	KB3OUK	12	2	1	94	WPA	AJ5Q	196	2	14	598	OK	K3TN	250	2	1	1,206	MDC
WA4CZD	76	2	1	202	TN	KCØSVE	14	2	1	94	IA	K4YNZ	145	2	2	540	AL	N2MTG	526	2	1	1,202	ENY
KF7PBM	76	2	1	202	EWA	N2SQW	44	1	1	94	ENY	N3IJW	94	2	1	426	VA	N1AL	262	2	2	1,162	SF
K5SRT	16	2	3	202	OK	N5BLY	21	2	1	92	MS	N4EMP	124	2	3	324	AL	W6RKC	253	2	1	1,162	SV
W8FLX	38	2	1	202	OH	KJ4ZQG	21	2	1	92	VA	W1ORS	141	2	6	312	CT	K6Q	252	2	1	1,150	SCV
W4ATL	124	1	1	200	GA	KX7L	20	2	1	92	WWA	W4KPR	136	1	14	292	WCF	K6UF	283	2	1	1,138	SCV
K7JKM	100	2	1	200	OR	KA6WBQ	21	2	1	92	NLI	K4TAK	39	2	1	282	TN	KDØFW	533	2	1	1,116	MO
KF6FIX	31	2	1	200	LAX	AB7MP	10	2	1	90	EWA	W1VCM	30	2	4	218	CT	KD3FG	342	2	1	1,100	MDC
KG6UEF	65	2	1	198	EB	KF6JG	40	1	1	90	SV	N5GAR	43	2	1	156	NTX	K7E	302	2	1	1,090	AZ
W4EGR	74	2	2	198	AL	W3RLO	19	2	1	90	DE	KI6DAR	37	2	2	124	SCV	KD7MSC	309	2	1	1,082	OR
WD4DC	99	2	1	198	WCF	N4PCC	20	2	1	90	NFL	KK4HBW	12	2	1	74	WPA	KB2MN	279	2	2	1,078	SNJ
WZ6P	98	2	1	196	SB	WS6T	20	2	1	90	EB							KC9QQ	231	2	1	1,074	IN
WØNFS	73	2	1	196	MO	KC7WZL	20	2	1	90	ID	**3D**						KØGEO	280	2	2	1,064	STX
W9ILY	36	2	1	194	IL	K2DSL	45	2	1	90	NNJ	W4V	1781	2	11	3,612	AL	KB3FJJ	81	5	1	1,060	EPA
KJ4QAN	22	2	1	194	NFL	KD7JS	20	2	1	90	OR	W5RTA	959	2	4	3,224	STX	W5JMW	251	2	1	1,054	WTX
VA3TQX	71	2	2	192	ON	KF0XB	20	2	1	90	IA	NO8N	503	2	8	2,006	OH	WG4FOC	70	5	1	1,050	NFL
KG4WNA	35	2	1	190	KY	N1RLR	19	2	1	88	EMA	W8USA	448	2	6	1,608	MI	WA9STI	325	2	1	994	LAX
N6BHX	34	2	1	186	EB	WA5NWS	38	1	1	88	WTX	W4NJK	129	2	1	562	SCV	N1AGE	360	2	1	970	EMA
VE2XL	92	2	1	184	QC	WC1Y	18	2	1	86	WMA	W5OKT	56	2	10	162	OK	W7YMS	175	2	1	950	OR
K1NV	67	2	1	184	SV	KA1RWY	35	1	1	85	CT							K6TY	123	2	4	942	LAX
KJ6MSG	54	2	1	180	SJV	KI6WIR	17	2	1	84	LAX	**4D**						W9LAS	396	2	1	942	WI
VE1BZI	37	2	1	180	MAR	K8VFR	21	2	1	84	MI	K4SWR	116	2	32	454	NC	NW3H	164	2	4	938	EPA
AI3G	41	2	1	178	DE	KA1BSZ	21	2	1	84	VT							KK6TV	60	5	1	930	SDG
KA1RFD	32	2	1	178	ME	N5LUL	17	2	1	84	WTX							W3KS	373	2	1	896	DE
KA1PPV	31	2	1	174	CT	KA6MLE	17	2	1	84	SB							AA4LR	212	2	1	896	GA
N9ACD	87	2	1	174	IN	KB4VC	21	2	1	84	WCF							KL1JP	106	2	1	862	AK
N4REF	62	2	2	174	SC	KC4WBE	16	2	2	82	OR							KU4WD	242	2	1	836	TN
K5FYI	61	2	1	172	WTX	VA2RIO	40	2	1	80	QC							K7ISQ	146	2	3	830	WWA
KE7IEE	30	2	1	170	OR	KY4LDS	40	2	1	80	KY							N7VEA	172	2	1	796	ID
KS4VOL	118	1	1	168	NC	K4LED	40	2	1	80	GA							K4TRH	62	5	1	770	TN
WA7NE	59	2	1	168	WWA	K2WJ	15	2	1	80	STX							N4DXI	151	2	1	740	NFL
KC8R	29	2	1	166	OH	KC8KXC	14	2	1	78	OH							KF7HB	57	5	1	720	OR
NS4T	53	2	1	166	AL	W1WAB	7	2	1	78	WCF							W7ATC	180	2	1	714	ID
KA2IWK	6	2	1	162	WNY	KK7CG	14	2	1	78	OR							N3FJP	317	2	2	700	MDC
N1KHL	33	2	1	160	EMA	KD8GRG	14	2	1	78	MI							KØPVW	160	2	1	690	KS
NK1X	55	2	1	160	WMA	N8HM	7	2	1	78	MDC							K3HX	49	5	1	690	WPA
K9ZM	60	1	1	159	IL	W5GZ	19	2	1	76	NM							W5UGD	206	2	4	684	SC
WBØNRE	107	1	1	158	ORG	KC4EZN	38	2	1	76	NC							AE5MM	106	2	1	674	OK
K9OSC	78	1	1	156	MN	K1RDX	37	2	1	74	NH							K7PIR	184	2	1	674	AZ
WD4OHD	26	2	1	154	TN	KE6PPE	12	2	1	74	SCV							WG5F	74	2	4	644	OK
N7QLK	76	2	1	152	VA	N9NUZ	11	2	1	72	WI							WA7LK	144	2	1	638	WWA
W7RNX	76	2	1	152	ID	K6XYZ	10	2	1	70	NH							KE4UKY	122	2	4	638	VA
NB7O	51	2	1	152	OR	K5WRN	10	2	1	70	STX							KCØVEP	78	2	1	630	NE
KJ6KCG	50	2	1	150	ORG	KK4FYV	10	2	1	70	VA							AJ4CG	98	2	1	620	GA
WB9LRK	49	2	1	148	IN	W1HFN	10	2	1	70	WMA							K5RWP	139	2	1	610	NTX
AI4CO	74	2	1	148	NFL	NS4H	34	2	1	68	NFL							KK5JY	114	2	1	606	OK
K2CED	31	2	1	148	NM	W8KNO	6	2	1	68	OH							KB5JO	45	5	1	600	STX
N8LGQ	144	1	1	144	VA	VA3RJ	4	2	1	66	ON							AK4QU	146	2	1	596	TN
KU1Q	68	2	2	144	CT	WB7TPH	8	2	1	66	AZ							KA6T	85	2	1	590	OR
N3UR	71	2	1	142	MDC	NØICV	8	2	1	66	IL							KG9DN	530	1	1	580	MN
KC4YBO	46	2	1	142	GA	WØMI	33	2	2	66	NM							KD5MTG	165	2	3	580	STX
W8CJS	70	2	1	140	MI	KCØFUE	7	2	1	64	KS							NJ7W	81	2	1	574	WWA
W4PGM	70	2	1	140	TN	JA3JM	3	2	1	62	DX							WA3SWJ	53	2	1	556	MDC
WA5J	38	2	1	140	NM	KB3ANZ	6	2	1	62	MDC							KB5EZ	153	2	1	556	AL
AE7WE	70	2	2	140	MS	KC9TEZ	6	2	1	62	IL							KT4NN	62	1	1	553	NFL
NAØBR	35	2	1	140	CO	K9MEV	3	2	1	62	IL							KB6CC	200	2	1	550	CO
WBØIXI	36	2	1	138	MO	AA3MG	31	2	1	62	WPA							KØCQ	166	2	1	546	IA
AD5XR	87	1	1	137	MS	KH6OU	6	2	1	62	NFL							N4MUH	170	2	1	538	NFL
																		W7RT	133	2	1	532	AZ

Class E — Home Stations
Emergency Power

1E

AA3B	2238	2	1	9,202	EPA
N4BP	1865	2	1	7,710	SFL
N4PN	3005	2	1	7,606	GA
N6WIN	1949	2	5	6,660	ORG
K4QPL	641	5	1	6,560	NC
VE3KI	581	5	1	6,060	ON
WØUO	1555	2	2	5,690	NTX
W1ECH	600	5	1	5,655	VT
AA6PW	1218	2	1	5,322	ORG
AF4OX	475	5	1	5,060	SC
W9TS	475	5	1	5,000	IL
W8HW	470	5	1	4,865	SFL
N8BV	1104	2	1	4,466	OH
NØTT	1076	2	1	4,454	MO
W9HB	933	2	2	3,982	WI
W7WA	2239	1	2	3,945	WWA
AE5GT	947	2	1	3,938	STX
WØCO	822	2	4	3,732	CO
VE7NI	315	5	1	3,720	BC
NQ2W	336	5	1	3,610	ENY
WA8KAN	354	5	1	3,590	WV
W3HGT	1070	2	7	3,366	NC
AE2T	311	5	1	3,360	WNY
WA2EQF	809	2	5	3,222	NNJ
K1EEE	988	2	4	3,214	NH
K4AXF	295	5	1	3,200	VA
W5TTE	300	5	1	3,150	NM
K1DW	1001	2	2	2,936	LA
W6CIT	290	5	1	2,890	LAX
W8TM	266	5	1	2,810	OH

KG6S	111	2	2	520	SV
KCØDWX	135	2	2	520	KS
NU6N	66	2	1	514	SJV
WB8DC	181	2	1	512	OH
N1ZX	115	2	1	510	SFL
KU7Y	46	5	1	510	ID
AC4RF	130	2	2	510	NC
N4UYV	229	2	1	508	WMA
WU9B	105	2	1	506	AZ
WA9AQN	89	2	1	506	IL
WA7PRC	173	2	1	504	WWA
NV4B	35	5	1	500	AL
K3STL	100	2	1	498	WPA
KC7RG	58	2	1	476	WWA
WU9Z	101	2	3	472	IN
AB5JR	109	2	1	468	NM
KB3LGO	79	2	1	466	WPA
W6DMS	57	2	1	464	ORG
K3ORS	107	2	1	464	TN
WA3YZD	181	2	1	462	EPA
K8QI	21	5	1	460	WCF
KI4ZNV	72	5	1	460	VA
WM7Y	128	2	1	456	NV
W4PTH	146	2	2	442	AL
NV5M	29	5	1	440	NM
WO3X	95	2	1	440	OH
WB7D	141	2	1	432	KY
AJ7T	135	2	1	420	AZ
N6VNO	80	2	1	420	SCV
N5JZD	92	2	1	418	NTX
WD5FGZ	63	5	1	415	STX
W0KIE	41	2	1	414	OK
W2MRD	80	2	1	410	ENY
KC2ELS	73	2	1	406	OR
VE3VID	69	2	1	400	ON
AC0VC	150	2	1	400	CO
KC2LNC	124	2	1	398	NC
K7KXO	67	2	1	384	WWA
VE5MX	165	1	1	380	SK
NI1E	111	2	1	372	NH
N8EN	76	2	1	368	MI
KI7N	82	2	1	368	OR
W5VDM	26	5	1	360	STX
N8KZ	53	2	1	360	MI
WE5T	104	2	1	358	NTX
KG4GWB	52	2	1	352	NM
K3IZ	50	2	1	350	VA
K7NJC	42	2	1	334	MT
K6OTT	31	2	2	332	SCV
KA0EIC	70	2	1	330	KS
KC2SYK	100	2	1	328	NNJ
KA8WEP	88	2	1	326	STX
WD8RYC	55	2	1	320	TN
KG5OA	74	2	1	316	NTX
AD7MC	25	2	1	308	WWA
KC9SNI	78	2	1	306	IL
N8VNR	77	2	2	304	NC
KB3ORR	75	2	1	300	WPA
NX1K	15	5	2	300	WI
AB4SF	91	2	1	296	VA
N9BT	14	5	1	290	IL
KD8PHG	18	2	1	286	OH
KE6TDP	12	2	1	274	NC
N7WBZ	11	2	1	272	OR
KE8CQ	55	2	1	260	MI
KD4GBA	55	2	1	260	LA
KC3T	45	2	2	258	MDC
N4RWH	78	2	1	256	WCF
KD0QLQ	3	2	2	256	CO
KB0BRY	103	2	1	256	ND
WB0IWG	41	5	1	255	WI
N5IAC	77	2	1	254	NM
KS4FE	80	2	1	252	KY
KD7BYU	51	2	1	252	UT
W3WOT	45	2	1	240	NC
NY6U	35	2	1	240	SCV
KN7N	18	5	1	230	AZ
KL1B	15	2	1	230	AK
KG6LJO	64	2	1	228	NV
K5HFI	82	2	1	226	STX
W7EEI	35	2	1	220	OR
W3HII	33	2	1	216	NFL
AA0W	40	2	1	214	NE
KC8RHC	80	2	1	210	EPA
KG4OCJ	27	2	1	204	KY
AH6JD	26	2	1	202	PAC
N6PIA	51	2	1	202	SF
WD4NIT	25	2	1	200	GA
WS9M	25	2	1	200	WNY
KQ0J	64	2	1	190	NE
NU1H	69	2	1	188	ME
K7RQN	39	2	1	178	AZ
WB4M	21	2	1	176	NC
VA7HZ	56	2	1	176	BC
KD8DJB	1	2	1	172	MI
NM4A	11	2	1	172	KY
N2WN	32	2	1	172	TN
W0AAW	57	2	2	164	MO
WA9QNN	30	1	1	160	WI
W9BNO	1	5	1	155	CO
AC2GD	2	2	1	154	NLI
W0PPA	45	2	1	140	MN
AD7T	34	1	1	134	WWA
N4MM	9	2	1	130	VA
KD0MEZ	30	1	1	130	CO
W7YG	13	2	1	126	ORG
VE2CKM	9	2	1	118	QC
WB4QNG	32	2	1	114	KY
WB2TVB	6	5	1	110	LAX
AJ4HK	5	2	1	110	NC
WA0DYJ	25	2	1	100	ME
N8LWF	19	2	1	88	OH
KI4EBD	9	2	1	72	NFL
KB8YGA	10	2	1	70	MI
KB4ZVM	2	2	1	54	SC

2E

K6AM	4094	2	2	12,564	SDG
W2RR	2164	2	7	9,228	WNY
W2TZ	2520	2	2	7,632	WNY
KK7PR	2353	2	8	7,232	OR
N1UR	2222	2	2	7,110	VT
W5CT	1835	2	6	6,258	STX
K5SAR	1728	2	50	5,108	LA
KU1U	353	5	4	4,275	ME
KE0UI	992	2	2	3,936	CO
N1GN	1000	2	4	3,542	NH
K5PO	877	2	5	3,292	AR
W5ROS	303	5	21	3,100	STX
N3DUE	680	2	2	2,810	MDC
K7SEL	757	2	10	2,426	ID
AD5YB	843	2	2	2,206	MS
W5ROK	559	2	7	2,122	NTX
VA7MM	399	2	5	2,004	BC
KX9X	311	2	2	1,320	CT
WB5LVI	478	2	10	1,260	STX
W7FD	403	2	4	1,006	SJV
N9QID	209	2	3	868	IN
KN0BS	176	2	8	702	IA
W6BBL	169	2	3	688	ORG
K4HSM	187	2	8	674	TN
KB2URI	24	2	1	598	WNY
N8PVC	133	2	4	516	OH
KN1GHT	34	5	4	510	CT
N5HRK	109	2	5	488	NTX
WA1MHE	38	2	3	426	VT
W8WML	101	2	3	364	MI

3E

W4NT	4175	2	6	12,980	GA
W4DXA	2732	2	17	9,946	NC
W8CCI	1101	2	25	4,644	OH
VE3YAA	1229	2	8	4,642	ON
W3VPJ	948	2	20	4,114	EPA
W3KWH	1016	2	17	3,380	WPA
WB2ELW	672	2	35	2,470	WNY
W5SSV	429	2	60	2,050	STX
W8DYY	1108	1	24	1,968	OH
AA9UF	350	2	3	1,848	IL
W3HRK	448	2	5	1,782	WPA
N5BL	395	2	16	1,390	NM
AB1MS	515	2	5	1,380	CT
W5FQ	141	2	30	1,354	MS
KJ4ND	165	2	5	742	KY
N7PR	469	1	4	587	SV
W3FME	29	2	3	432	DE

4E

W4GJ	1825	2	10	7,694	NFL
K3MJW	1911	2	15	6,392	WPA
N8CV	1526	2	5	4,838	OH
N2MO	743	2	24	3,582	NNJ
W4NH	884	2	25	3,198	GA
W0IW	998	2	4	2,646	IA

5E

N2BJ	2991	2	6	9,630	IL
WG0D	292	2	5	1,454	MN

6E

N8YFM	186	2	6	1,242	OH

14E

W0NT	3724	2	40	13,008	CO

Class F — EOC Stations

1F

AA3E	1030	2	5	3,240	EPA
W2EF	568	2	10	2,736	NNJ
W0FT	559	2	8	2,372	CO
K6NX	695	2	3	2,250	ORG
K9WM	562	2	11	2,128	IL
N0KGM	532	2	7	2,054	UT
W0YL	406	2	16	2,038	IA
NI2S	510	2	7	1,730	NNJ
WR4MC	261	2	5	1,472	GA
K8FAY	367	2	10	1,384	OH
W9LYA	328	2	20	1,306	IL
W0LSD	513	2	6	1,276	CO
K2FN	223	2	1	1,242	NNJ
WX5FWD	434	1	8	1,184	NTX
W3BAL	288	2	8	1,104	MDC
N1NRA	195	2	10	1,090	VT
WA4NZD	158	2	12	994	AL
K5T	150	2	2	950	STX
K8BTP	90	2	12	730	OH
W7AQ	210	2	2	690	EWA
K5EPH	134	2	11	668	NTX
AE6E	75	2	4	650	SC
VE1WRC	181	2	9	628	MAR
NC4CC	230	2	8	610	NC
W4DCG	230	2	7	510	NC
KA5EZQ	65	2	1	480	LA
KB1JJE	55	2	1	460	EMA
W1BCG	18	2	8	436	CT
W4FLO	153	2	5	390	TN
KC2TXB	58	2	2	366	SNJ
VE3BA	160	2	6	320	ON
KE7EGG	115	2	2	300	UT
KE5UES	50	2	2	250	NTX
WC7EOC	69	2	4	236	OR
WX5EOC	16	2	10	182	OK
W7GDY	82	2	3	164	AZ
WW7RC	15	2	1	80	WWA

2F

K9UW	1751	2	4	6,586	WI
KY4KY (+W4KBR)	1553	2	59	6,144	KY
WA5JRS (+AE5FN)	2280	2	16	5,834	NTX
AE7OC (+KF7LXF)	1523	2	51	5,504	MT
W2ORC (+WA2DQL)	973	2	33	4,394	WNY
W0HCA	1078	2	15	4,308	MO
K4PJ	899	2	41	4,174	TN
AA5AR (+KE5YKN)	876	2	27	3,796	AR
N4THM (+N4IF)	776	2	35	3,284	AL
W9YRC (+NN9L)	942	2	17	3,218	IL
W2GSA (+W2XYZ)	1360	1	21	3,011	NNJ
W4RYZ	445	2	32	2,874	NFL
N5I	530	2	20	2,738	LA
K4WFM (+KE4TP)	791	2	50	2,732	WCF
W9EAU	840	2	15	2,654	WI
W6ICR	743	2	20	2,632	SDG
K2ZV (+KB2LAV)	500	2	13	2,624	NNJ
KS1R	372	2	25	2,596	ME
KB6EOC	738	2	58	2,594	EB
K5ABI	713	2	35	2,338	WTX
K4TG (+KY4LAW)	344	2	18	2,326	KY
KE5LOT	393	2	18	2,250	STX
K1PQ (+WA1JMM)	361	2	6	2,152	ME
W7OEM	412	2	7	2,128	OR
KI4HUS (+N4STW)	367	2	21	2,070	KY
AB5ER (+N5HU)	529	2	35	2,044	AR
W0ECA	522	2	10	1,978	MO
W9VMW (+KV9N)	339	2	20	1,882	IN
W4CQ	486	2	15	1,810	NC
W2EOC	427	2	10	1,794	WNY
W1LAS	657	2	7	1,772	CT
W5LOC	358	2	6	1,648	STX
K0LH	422	2	24	1,628	MO
W2ZQ	211	2	30	1,612	SNJ
W1AW	1055	1	10	1,607	CT
W3EOC	490	2	14	1,544	EPA
K6HBC	361	2	8	1,474	LAX
N9XH	282	2	19	1,406	WI
W4CIT	327	2	6	1,324	NFL
WB9EOC	259	2	11	1,244	IN
NC4AR	197	2	18	1,154	NC
KA9FAJ	276	2	6	1,132	IL
KC2CJX	134	2	15	1,114	NLI
N4SER	167	2	6	1,068	WCF
AE5EE	5	5	2	975	AR
W6PWT	277	2	10	904	ORG
AJ4IR (+W4NLX)	614	1	12	899	SFL
WX0EK	106	2	15	862	KS
N3TWT	223	2	15	850	EPA
W7NYE	148	2	20	846	NV
AD7OY	189	2	7	842	NV
AB9VW	90	2	6	830	IL
W4BKM	334	2	12	826	GA
KP4NM	76	2	7	802	PR
W3SAT	376	2	8	802	WPA
KC5EZC	116	2	5	774	OK
AB5BC	37	2	9	724	AR
K1BCI	185	2	26	720	CT
N7SS	127	2	15	704	WWA
KF6NNM	189	2	3	622	SV
W4LBT	83	1	7	564	NC
W5HRC	46	2	8	484	NTX
W5NFL	114	2	14	478	NTX
N4VEM	351	1	6	423	VA
KI4EXI	42	2	8	106	VA

3F

W6YX (+K6SU)	5343	2	62	18,102	SCV
K2NJ (+W2KN)	3437	2	33	13,354	NNJ
N4FR (+W4SQD)	2490	2	100	8,624	TN
K9ESV (+K9RN)	1585	2	25	6,262	IL
W5WB (+W5AUY)	1373	2	46	6,242	NTX
K7RDG	1238	2	21	5,614	AZ
K9IQP (+N9APD)	1444	2	24	5,374	IL
N4IV	796	2	18	3,612	NC
K6CCR (+K6RMP)	734	2	46	3,370	LAX
AB8I (+KD8RWD)	775	2	18	3,332	MI
WC1SW	744	2	20	3,050	WMA
W9AWE	685	2	20	2,990	IL
KM0HP	847	2	8	2,958	MO
W4AAZ	862	2	11	2,784	NFL
W0RR	602	2	21	2,780	MO
W3KGN	595	2	14	2,568	EPA
K8CHR	761	2	12	2,486	MI
W1C	630	2	23	2,412	WMA
K5BWD (+KF5UDM)	462	2	12	2,378	NTX
K4WD	532	2	25	2,350	SC
KC4EM	274	2	33	2,164	TN
K4MSU (+W4GZ)	482	2	46	2,108	KY
W8B	548	2	23	2,072	OH
W5BMC	651	2	26	1,852	LA
K6CME (+KG6SYA)	332	2	14	1,750	SJV
WC4DC	325	2	14	1,740	TN
W4DAK	314	2	8	1,602	NFL
K7MAR	179	2	12	1,592	OR
WR4CC	340	2	40	1,530	TN
W5L	590	2	30	1,520	NTX
W9JOZ	241	2	40	1,464	IN
K4WRC	275	2	38	1,334	SFL
WX8EMA	96	2	4	1,326	OH
KJ6M	267	2	12	1,310	SCV
KJ4LOP	150	2	6	1,308	VA
W9VCF	562	2	10	1,274	IN
W6LY	331	2	15	1,270	ORG
K6SSF	163	2	16	1,268	SCV
ND5MS	198	2	9	1,200	OK
KB1RDE	129	2	5	1,196	RI
W8VVL	261	2	12	1,180	OH
K6KP (+WA2KDX)	63	2	25	1,166	SCV
W9EOC	110	2	12	870	IN
WA9RDF	259	2	25	870	IN
W4BKK (+WA4FRI)	98	2	10	866	GA
W5SLA	75	2	15	840	LA
K4GAR	72	2	17	786	GA
W4ARC	38	2	7	776	KY
W6RDX	265	2	12	580	SDG
WA5EC	76	2	8	452	STX
KD5YBU	42	2	6	154	MS

4F

W0HF (+KF0X)	1306	2	106	5,122	AZ
W8FY	1332	2	27	4,778	OH
W4UCJ (+KJ4NBG)	898	2	90	4,420	GA
W5NEM (+KE5LUX)	878	2	40	4,284	MS
VE7CVA	1230	2	27	3,798	BC
W7S	521	2	30	2,848	WWA
W9VT	511	2	13	2,672	IL
W2SEX (+K2LED)	482	2	35	2,436	WNY
K0KEX	483	2	16	2,366	MO
W4FPC	325	2	24	1,892	NFL
KI4NJJ (+AJ4YS)	176	2	14	1,442	TN
NF1Y	335	2	4	1,320	CT
W7DCO	95	2	4	1,186	OR
W4GS	209	2	50	1,136	SC
W2MPX	121	2	21	1,066	NNJ
KB5A	107	2	27	990	NTX
N8IHI	162	2	8	832	OH
K2OQ	103	2	6	830	WNY
KB0UFL	123	2	6	496	MO

5F

W4SHL (+W4YXU)	1628	2	20	5,684	AL
K2BR (+AC2NJ)	1106	2	30	5,358	SNJ
W2GSB (+W2TOB)	1195	2	75	5,136	NLI
K2BAR (+KC2YKA)	1550	2	46	4,944	NNJ
N1EM	933	2	18	3,554	EMA
AF2C	626	2	31	3,156	NFL
W1EDH	727	2	10	2,622	CT
N2E (+AB2CT)	546	2	7	1,772	WNY
W4MCO (+W4MCA)	261	2	18	1,552	NFL
N3EP	277	2	16	1,346	EPA

6F

K8GC (+KD8SMD)	386	2	22	2,818	MI
NC4CA	726	2	6	2,502	NC
W4UC	150	2	32	1,526	NFL

7F

W8VA	481	2	62	2,846	WV
N8SE	454	2	21	2,624	MI
W1SAT	320	2	50	2,474	ORG

9F

W1BRS (+K9OEM)	924	2	12	4,156	CT

June ARRL VHF Contest 2012 Results

Sporadic E pleased some and teased others.

Rick Rosen, K1DS, rick1ds@hotmail.com

In the weeks preceding the contest weekend, 6 meters was showing great promise as sporadic E (Es) was abundant and people were making transcontinental and intercontinental contacts by the dozens. The "205 Morning Report"[1] compiled by Stan, KA1ZE, had daily reports of 6 meter openings including the Caribbean, Central and South America, Europe and Asia. Last year's event with its strong 6 meter Es was also still fresh in many operators' minds. Some rovers fretted that with the opportunities on 6, stations would not QSY "up the bands" with them, while other well equipped stations with microwave capability thought that all the efforts to get those bands working and ready would be for naught. Pete, K1PXE, mused, "If 6 meters is wide open and the higher bands have a band closing, I'll probably read a good book."

On June 3, a week prior to the contest, the sad news of the passing of Gene Zimmerman, W3ZZ, VHF guru and raconteur extraordinaire was shared with the Amateur Radio community. Two new VHF contest operating awards honoring Gene, W3ZZ, were created just in time for the ARRL June VHF Contest, his favorite VHF+ operating event. Tim, K3LR, and Dave, W9ZRX, are sponsoring the brand-new W3ZZ First Log Award for the top Single Op, Low Power score made on a minimum of two bands by an operator submitting a log in the contest for the first time (there is no limit on how long the operator has been licensed). The initial winner of the award is Bill Glynn, WAØARM of Topeka, KS, who operated from a hilltop on a cattle ranch in EM19, submitting a score of 68,875. In addition, since Gene was a long time member of the K8GP Grid Pirates who frequently operated in the Limited Multioperator category, the ARRL Contest Branch has renamed the Overall Limited Multioperator plaque the Gene Zimmerman W3ZZ Memorial Plaque. Thanks go to Jeff, K1TEO, who graciously gave up his sponsorship of the plaque to the ARRL Contest Branch.

Just three days prior to the event, the ARRL released a bulletin announcing that the event formerly known as the June VHF QSO Party would have a new name. The starting gun sounded promptly at 18:00 UTC on June 9 for the first *June ARRL VHF Contest* and the fun began.

Many operators found 6 meters open right from the start, only for it to fade within minutes. There were very short periods of recurrence where they could find one or two more distant grids. Stan, KA1ZE, reminds us in his report that it is called *sporadic* E. Many others had the same comment. Larry WØPAN, added, "Now I know what is meant by sporadic E — in and out in one minute or less."

Yet the story of the weekend would be perseverance, as there were recurring opportunities to add grids and contacts from near and far on all bands. It was especially true if you were on the East Coast or in the Pacific Northwest where conditions were some of the most intense. Marshall at K5QE in Texas lamented that they watched the propagation maps and were rewarded with some action on Saturday and a good run on Sunday afternoon, but nothing that came close to the more northern openings or what they had experienced last year. Many of the stations across the south from Florida to Texas were disappointed with the conditions, as they'd had high expectations. Jim, WD5IYT, in Austin, TX predicted that the excellent openings of the previous weekend guaranteed crummy propagation for the contest and he wasn't disappointed. He found flat conditions on the higher bands and 6 meters was mediocre with very spotty openings. Up in Maine, the K1WHS crew was taking Saturday easy, but realized Sunday with the great openings across the US and the Atlantic that they could pile up points.

[1]205MorningReport is available from **ka1zenr1l@hotmail.com**

This *was* the June VHF Contest, right? At 6400' elevation, the seasons can change rapidly as Gene, KB7Q discovered! [Photo courtesy of KB7Q]

Top Ten

Single Operator, Low Power

K2DRH	354,063
KØSIX	297,434
AF1T	232,407
WB1GQR	230,850
NØLL	214,599
K9MU	210,441
K1KG	140,901
W3SZ	140,650
VA6AN	130,968
KC9BQA	126,474

Single Operator, High Power

K1TEO	682,641
WDØT	461,154
WØUC	417,890
WB9Z	234,415
NN1N	226,996
K1TR	219,360
W3PAW	201,520
K8MD	193,224
W9RM	184,758
WØGHZ	180,840

Single Operator Portable

N6NB	136,840
W1MR	84,760
WD5AGO	38,016
N8XA/P	28,196
KJ5RM	17,836
W9SZ	16,732
NØJK	12,802
KB5WIA	12,555
W4RXR	7,847
N7QF/7	7,700

Limited Multioperator

K1WHS	762,745
K9NS	698,030
K2LIM	409,360
W4IY	326,186
AA4ZZ	280,224
W4NH	249,660
NØEO	233,280
N8ZM	229,017
W2LV	208,624
VE3CX	131,408

Multioperator

W2SZ	1,638,400
K8GP	1,036,917
W3CCX	687,354
K5QE	543,996
N6VI	509,922
K9CT	380,952
K3YTL	341,598
KBØHH	309,396
VE3WCC	278,496
WØKVA	253,946

Rover

W6XD/R	272,500
KI6FGV/R	256,875
K6AH/R	249,067
N6HD/R	243,906
WA6WTF/R	218,845
K9AOG/R	215,895
VE3NPB/R	107,100
KF8QL/R	58,320
AG4V/R	45,480
W9FZ/R	37,060

Limited Rover

AL1VE/R	115,116
WB2SIH/R	63,066
K2QO/R	50,828
WAØVPJ/R	47,215
K9AKS/R	39,936
WW7D/R	38,950
N5RZ/R	26,384
VE7JH/R	24,735
W0ETT/R	24,219
K9JK/R	21,097

Unlimited Rover

WA3PTV/R	51,597
KJ1K/R	13,014
KCØP/R	10,962
NØHZO/R	2,619
NV6C/R	1,411
AF5CC/R	806
KL3JI/R	546
VE3KGC/R	270

Regional Leaders

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

AF1T	232,407	A
WB1GQR	230,850	A
K1KG	140,901	A
W3SZ	140,650	A
NA2NY	92,140	A
K1TEO	682,641	B
NN1N	226,996	B
K1TR	219,360	B
W3PAW	201,520	B
W3EP	118,128	B
W1MR	84,760	Q
WB2AMU	7,488	Q
N2SPI	2,850	Q
N1PRW	1,720	Q
NK1N	390	Q
K1WHS	762,745	L
K2LIM	409,360	L
W2LV	208,624	L
VE1SKY	99,603	L
W1QK	90,792	L
W2SZ	1,638,400	M
W3CCX	687,354	M
K3YTL	341,598	M
W3SO	153,690	M
N1JEZ	149,100	M
NN3Q/R	30,586	R
K1DS/R	24,766	R
WA2BTR/R	22,355	R
W3HMS/R	16,131	R
NJ1F/R	10,998	R
WB2SIH/R	63,066	RL
K2QO/R	50,828	RL
W3TM/R	5,406	RL
W3ICC/R	4,074	RL
N2GKM/R	1,960	RL
WA3PTV/R	51,597	RU
KJ1K/R	13,014	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

N4QWZ	114,608	A
KX4R	82,752	A
N3LL	69,732	A
K5RPD	48,087	A
AD4Z	44,160	A
W4ZRZ	118,188	B
K4PI	103,356	B
W3IP	83,475	B
N4BP	74,655	B
KN4SM	66,216	B
W4RXR	7,847	Q
N3AWS	6,344	Q
W0PV	1,938	Q
KC8KSK	975	Q
KC5FWE	210	Q
W4IY	326,186	L
AA4ZZ	280,224	L
W4NH	249,660	L
N3MK	91,698	L
W5ANR	49,731	L
K8GP	1,036,917	M
K4HZ	37,076	M
K1KC	30,552	M
W5ZN	25,216	M
K4MM	23,754	M
AG4V/R	45,480	R
W5VY/R	4,524	R
N3TG/R	100	R
WA4JA/R	1,900	RL
K6PFA/R	1,820	RL
AD4IE/R	1,288	RL
WA5KBH/R	117	RL

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

K2DRH	354,063	A
K9MU	210,441	A
KC9BQA	126,474	A
N9ISN	84,560	A
N8BI	75,548	A
W0UC	417,890	B
WB9Z	234,415	B
K8MD	193,224	B
W9GA	162,042	B
KB8U	94,927	B
N8XA/P	28,196	Q
W9SZ	16,732	Q
KD0EBT	1,431	Q
K8AX	1,050	Q
WB0IWG	988	Q
K9NS	698,030	L
N8ZM	229,017	L
VE3CX	131,408	L
N0EDV	94,446	L
W9RVG	41,340	L
K9CT	380,952	M
VE3WCC	278,496	M
K8MM	146,744	M
N9UHF	93,612	M
N8UR	52,515	M
VE3NPB/R	107,100	R
KF8QL/R	58,320	R
W9FZ/R	37,060	R
K9JK/R	21,097	RL
W9YOY/R	12,408	RL
K8DOG/R	11,245	RL
VA3ELE/R	6,732	RL
VE3RKS/R	2,856	RL
VE3KGC/R	270	RU

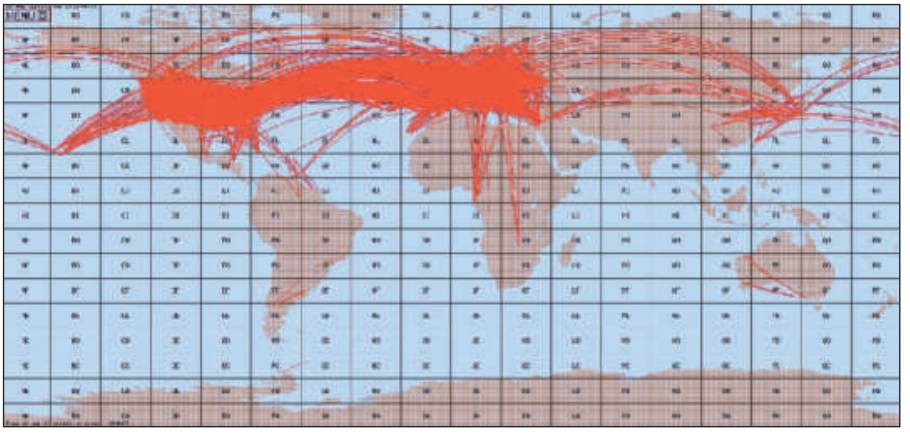
Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

K0SIX	297,434	A
N0LL	214,599	A
N0POH	91,520	A
WA0ARM	68,875	A
K0NR	62,040	A
WD0T	461,154	B
W9RM	184,758	B
W0GHZ	180,840	B
ND0B	176,204	B
K5TR	150,015	B
WD5AGO	38,016	Q
KJ5RM	17,836	Q
N0JK	12,802	Q
N7QF/7	7,700	Q
W0DJM	1,938	Q
N0EO	233,280	L
W0LSD	93,150	L
KC0VFO	35,960	L
W0FRC	26,880	L
W0VB	19,456	L
K5QE	543,996	M
KB0HH	309,396	M
W0KVA	253,946	M
N0MA	159,111	M
N5JB	56,550	M
W7QQ/R	28,783	R
W0ZQ/R	14,008	R
KC0IYT/R	11,247	R
AE5P/R	5,282	R
WA0RKQ/R	4,235	R
AL1VE/R	115,116	RL
WA0VPJ/R	47,215	RL
K9AKS/R	39,936	RL
N5RZ/R	26,384	RL
W0ETT/R	24,219	RL
KC0P/R	10,962	RU
N0HZO/R	2,619	RU
AF5CC/R	806	RU

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

VA6AN	130,968	A
WJ0F	70,044	A
NQ7R	67,680	A
K7BG	49,773	A
N7XU	42,560	A
W7EW	164,952	B
K7CW	150,654	B
N7CW	81,796	B
VA7FC	56,304	B
KG6IYN	50,268	B
N6NB	136,840	Q
KB5WIA	12,555	Q
KE7UQL	1,960	Q
K6TUJ	280	Q
KI6TQT	98	Q
N7NW	119,730	L
WA7JTM	110,208	L
W7MEM	93,600	L
K7TM	60,750	L
N6ML	25,080	L
N6VI	509,922	M
W6TV	141,564	M
K7AWB	101,010	M
K7ZS	57,057	M
K6ST	41,724	M
W6XD/R	272,500	R
KI6FGV/R	256,875	R
K6AH/R	249,067	R
N6HD/R	243,906	R
WA6WTF/R	218,845	R
WW7D/R	38,950	RL
VE7JH/R	24,735	RL
K6BRW/R	15,631	RL
KE6QR/R	12,956	RL
KI6CG/R	9,490	RL
NV6C/R	1,411	RU
KL3JI/R	546	RU

I guess that for many without specific expectations, the contest conditions were a big crowd pleaser. Welcome newcomer Dave, KC9CLM, explained, "This was my first radio contest of any kind and I found it was more interesting and fun than I thought. The more contacts I made the more I wanted! [The] main thing was I enjoyed myself." John, N3AM, said, "Six was a blast with new directions popping up right to the end of the contest." Charlie, KX7L, reported, "Holy cow! Unbelievable! The propagation just wouldn't quit!" George, WA2VNV, commented, "I have never before heard such piled up station activity all the way up to about 50.275." For those operators who favor the lower segments of the band and CW, the results were also fulfilling. Matt, K7BG, reported that he stayed on 50.080, and in a 3 hour stretch on Sunday ran almost 200 QSOs in that period. Jim, K1TN, in EN55 reported that about 90 percent of his QSOs were on CW.



Justin, K9MU/P, captured 6 meter spots from the ON4KST website for the first 24 hours of the contest. [Graphic courtesy ON4KST]

John, NØJK, in Kansas had various difficulties in keeping antennas up in the wind, and with his 10 watts and a 2 element Yagi managed to snag CT1HZE and VO1TA. Modest stations like ABØRX, operating portable at a campsite on Missouri's highest point, Taum Sauk Mountain, was able to work 94 grids on 6 meters, despite having his antenna totally surrounded by dense forest. Fred, KH7Y, in Hawaii had openings to BY, JA, HL and to W6, W7 and W8 land on Sunday. Bob, MDØCCE, on the Isle of Man reported, "Best opening to North America of the season so far, great signals!"

Jeff, K1TEO, noted fewer rovers with microwave gear this time, hurt the 903 MHz and up scores quite a bit. Dick, WA2AAU, with the Mt. Greylock Expeditionary Force, W2SZ, reported that the higher bands had less activity than usual with everyone on 6 meters much of the time. They found some nice signals on 2, 3 and 5 GHz out to the west on Sunday evening at about 250 miles; when only a few hours earlier they'd had a hard time working the

same station at a substantially better location only 230 miles away. Joe, N5QYC, says the highlight of his weekend came when he was able to complete his first out of state contact on 1296 MHz, a new band for him. The distance of 98 miles on 1296 MHz gave him as much of a thrill as working his first DX on 10 meters.

Logs

The number of logs received was 1222, 11 fewer than last year, but there was a good geographic distribution. Many DX stations sent in their logs as the conditions were unique and call signs not previously recorded in the past 10 years showed up in the listings. There was also an interesting change in the number of operators in each of the categories. There was a drop in the submitted Single Operator logs from 931 last year to 888 this year, but an increase in the number of Unlimited Multioperator (MU) station logs from 103 to 140. The number of submitted QRP Portable logs increased by 25% this year, from 37 to 46. This seems to be a fun category for those who pack their gear and head out to a good spot. The other category that saw a modest loss was the number of Classic Rovers, down from 49 in 2011 to 34 in 2012. As always, the number of logs submitted is far less that the total number of participants; WDØT shows 1486 QSOs in his 6 meter total, and of course, groups of operators participate in the Multioperator and many of the Rover categories.

Based on a review of the submitted logs, another 33 section and eight division scoring records were set this year. This continues a pattern where we saw 39 scoring records set in 2010 and another 43 in 2011. The previous contest score records are available for review on the ARRL website at **www.arrl.org/contest-records** and will be updated with the new records set in 2012, thanks to Curt, K9AKS.

DX

Christopher, 9Y4D, from Trinidad and Tobago managed 27 6 meter QSOs in 14 grids. The Multiop team at C6ABB from the Bahamas had a total of 265/107 on 6 meters. Cuban station T43S showed 223/90 on 6 meters and 24/9 on 2 meters with a score of 19K while T48K had a 42K score with 391/108 on 6 meters alone. Operators at CO2QU with 25/17 and CO8LY 229/83 satisfied many with those calls in their logs.

Thanks to K1DS

This is Rick's final June VHF writeup. The ARRL wishes to thank him for his years of service to the contest and VHF+ community as a contest writeup author!

VP2MRT in Montserrat had a result of 38/25. HA5PT reported only one QSO. JP1LRT had 4/4 6 meter contacts. Logs from Hawaii included KH6HI scoring 53/27 and KH7T with 29/18. The Canadian participation was high with 70 logs submitted. Six stations in Mexico submitted logs. Zalo, XE3N, led the charge with 328/116, while the LM team at XE2K scored over 33K using four bands. YW4B managed to have nine 6 meter QSOs. The logs represent North America, Central America, the Caribbean, South America, Europe, the Pacific and Asia.

Single Operator

The mainstay of the activity belongs to the Single Operators. Bob, K2DRH, in IL has a multiband stations with a big tower and plenty of aluminum in the air and has been a perennial first-place station in the Single Operator, Low Power category. This year he paced the crowd with a score of 354K, using bands through 3456 MHz although he had only a total of three contacts between 2.4 and 3 GHz. His solid efforts on the lower four bands, plus a handful of contacts and multipliers on 902 MHz and 1296 MHz helped him lead the way. With 297K, Vince, KØSIX, from Minnesota placed second with a huge effort on 6 meters, collecting 1101 contacts in 229 grids plus several more contacts and multipliers on 2 meters and 70 centimeters. In third place was Dale, AF1T, from NH with a score of 232K, based on an 11 band operation. He started with a nice 6 meter total and complemented it with contacts and multipliers on bands through 24 GHz. Mitch, W1SJ, operated the WB1GQR station from a great mountaintop in Vermont and came in fourth with a score of 230K, using all bands up to those needing dish or horn antennas. Larry, NØLL, in Kansas came in 5th with 214K on the strength of an excellent 6 meter total of 892/215.

In the Single Operator, High Power group we again find Jeff, K1TEO, on top with a score of 682K. Jeff has been one of the most skillful operators in VHF+ contests for over a decade. Certainly his 10 band station, antennas and location are excellent, as is his family's support for his contesting. His ability to rapidly coordinate and run the bands is outstanding. Todd, WDØT, from South Dakota won the second spot with a score of 461K using the bottom four bands. He was in the right place at the right time for this contest and managed 1486/279 on 6 meters and some additional QSOs and multipliers on bands BCD (144, 222 and 432 MHz). Paul, WØUC, in Wisconsin copped third place, also taking advantage of the great 6 meter conditions and adding to that with contacts on bands though 2 GHz. Jerry, WB9Z, in Illinois found himself in 4th place with a six band effort. He also was in the midst of the 6 meter maelstrom. In 5th place Dave, NN1N, scored 227K with a single band 6 meter total of 938/242 including 76 QSOs with European stations in 51 different grids.

Affiliated Club Competition

Unlimited Club Category

Club	Logs	Score
Society of Midwest Contesters	53	1,581,175

Medium Club Category

North East Weak Signal Group	22	2,425,181
Southern California Contest Club	20	2,209,845
Potomac Valley Radio Club	45	1,943,381
Northern Lights Radio Society	18	1,541,766
Mt Airy VHF Radio Club	23	1,197,005
Yankee Clipper Contest Club	23	922,657
Contest Club Ontario	26	914,437
Badger Contesters	15	724,640
Pacific Northwest VHF Society	16	603,379
Nacogdoches ARC	3	551,250
Grand Mesa Contesters of Colorado	11	494,802
Florida Contest Group	15	450,318
Carolina DX Association	8	351,485
Minnesota Wireless Assn	14	300,464
Central Texas DX and Contest Club	6	287,676
Chippewa Valley VHF Contesters	3	271,752
Maritime Contest Club	8	252,555
Mad River Radio Club	7	236,791
Arizona Outlaws Contest Club	28	234,969
Northern California Contest Club	28	213,807
Tennessee Contest Group	14	186,734
Clovis Amateur Radio Pioneers	3	164,215
Florida Weak Signal Society	12	117,792
Roadrunners Microwave Group	4	111,106
North Texas Microwave Society	3	99,246
Contest Group Du Quebec	7	90,539
Frankford Radio Club	10	87,872
North Texas Contest Club	3	67,391
South East Contest Club	10	64,903
Willamette Valley DX Club	4	61,315
Alabama Contest Group	8	39,948
Louisiana Contest Club	3	9,277
South Jersey Radio Assn	3	4,026

Local Club Category

Bergen ARA	3	95,150
Stoned Monkey VHF ARC	7	93,904
Rochester (MN) ARC	4	90,662
ORCA DX And Contest Club	4	68,480
Granite State ARA	3	60,206
Colony Mountain Contest Club	3	52,877
Delara Contest Team	3	37,928
DFW Contest Group	6	34,982
Portage County Amateur Radio Service	5	26,887
Bristol (TN) ARC	4	21,195
Raritan Bay Radio Amateurs	3	6,774
Burlington County Radio Club	5	5,245
Sterling Park ARC	3	694

Multioperators

Pooling their operating skills and time and often their gear, multioperator stations hope to capture every bit of the excitement on each band. The trade-off here is finding or building a station that is set up for multioperator activity. The challenges include networking of computers, filtering or blocking competing transmitted signals while maintaining the sensitivity and selectivity of receivers, and having enough towers and rotators to support efforts on each of the bands. Doing a web search for some of the top scoring calls will lead you to fascinating stories and pictures of the large multioperator stations.

The Limited Multiops can use more than the lower four bands, but can only include the results of the lower four for their scores. In the lead spot this year is K1WHS from Maine, with a score of 763K. The K9NS Mt Frank Contesters of Illinois were in 2nd place with a score of 698K, again taking advantage of location and conditions, with their antennas placed well in the air at 150 feet and above.

Sponsored Plaque Winners

Thanks to the generous sponsorship of numerous clubs and individuals, we are pleased to announce the winners of a sponsored ARRL June VHF QSO Party plaque. The ARRL thanks the plaque sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque Program would not be possible.

Plaque Category	Plaque Sponsor	Winner
Overall Single Operator High Power	Southeastern VHF Society	K1TEO
Overall Single Operator Low Power	Society of Midwest Contesters	K2DRH
Overall Single Op, Low Power, First Log	W3ZZ First Log Award — Memorial by Tim, K3LR and Dave, W9ZRX	WAØARM
Overall Single Operator QRP Portable	Dave Carlson, AA9D	N6NB
Overall Multioperator	Randy Stegemeyer, W7HR	W2SZ
Overall Limited Multioperator	Gene Zimmerman, W3ZZ Memorial — ARRL Contest Branch	K1WHS
Overall Rover	*73 Tim KE3HT/SK, Microwave DX Addict*	W6XD/R
Atlantic Division Rover	Potomac Valley Radio Club	NN3Q/R
Dakota Division Single Operator Low Power	Northern Lights Radio Society	KØSIX
Hudson Division Single Operator Low Power	In Memory Of Dick, W2GFF de: Jay, NY2NY	NA2NY
Northwestern Division Single Operator High Power	Boring, OR Amateur Radio Club	W7EW
Northwestern Division Single Operator Low Power	Mike Coogan, KB7ME	K7BG
Northwestern Division Multioperator	Randy Stegemeyer, W7HR	K7AWB
Roanoke Division Rover	Potomac Valley Radio Club	N3TG/R
Southeastern Division Single Operator High Power	Southeastern VHF Society	W4ZRZ
Southeastern Division Single Operator Low Power	Southeastern VHF Society	KX4R
Southwestern Division Single Operator High Power	W5UWB — In Memory of John Chambers, W6NLZ	N7CW
Southwestern Division Single Operator Low Power	Bud Sermon, N7CW	WJØF
DX Single Operator High Power	K1TEO, W2GKR, W2GKO, KA1FVG	XE2X
DX Single Operator Low Power	Sean Kutzko, KX9X	T48K (CO8ZZ, op)

Unsponsored plaques may be purchased by the plaque winner. If you wish to purchase an unsponsored or duplicate plaque, please contact ARRL Contest Branch Manager Sean Kutzko, KX9X at 860-594-0232 or by e-mail at **kx9x@arrl.org**. Plaques cost $75 each, which includes all shipping charges

The K2LIM team, in 3rd place with 409K, had a steady performance across the four bands. The W4IY group in Virginia usually can be found on a nice high mountaintop and their operators scored 326K in this outing for a 4th place finish. It looks as if they are adopting SDR technology with their web posted pictures. In 5th place the AA4ZZ group had 280K. Paul and a group of friends from the Carolina DX Association (CXDA) participate in the ARRL VHF+ contests from their mountaintop site near Boone, NC EM96 (Watauga County) using the AA4ZZ call sign.

The W2SZ Mt. Greylock Expeditionary Force has held first place in the Unlimited Multioperator category for many years. With their outstanding location on Mt. Greylock at 3488 feet and their well equipped radio trucks and team of rovers, they are primed for this event annually. Their score this year of 1.64 million points was built on 2172 contacts and 512 multipliers on bands through 47 GHz. They managed to have one of the best East Coast 6 meter QSO totals of 1204 with 265 grid multipliers. The Grid Pirates at the new K8GP location captured 2nd place with just over a million points. Their 10 GHz gear wasn't on the air, but their 2 meter score was superb with 444/75. The Packrats at W3CCX were again in third place with 687K. Their 6 meter counts and multipliers were considerably lower than the 1st and 2nd place stations, but their showing on the rest of the bands was strong and comparable. The southern Texas station at K5QE had a 509K score for 4th place. Conditions there were down from last year and many of the stations across the southern tier of the US did not experience as much Es as the northern tier. The N6VI group coordinated with the Southern California Contest Club rovers on 10 bands to score 509K for a 5th place finish.

Rovers

The top finisher in the Limited Rover category was Tim, AL1VE/R, with 115K, using only bands ABD. He covered six grids and had a ball on 6 meters with a result of 585/159. Bill, WB2SIH/R, placed 2nd with a four band effort across four grids with a score of 63K. Mark, K2QO/R, and his roving partner Paul, W2TAU, traversed seven grids and scored 50K for 3rd place. John, WAØVPJ/R, and his roving partner Mark, AIØZ, spread their activity over eight grids around Minnesota to collect 47K points for 4th place. Curt, K9AKS/R, focused his activity on 6 meters and visited four grids while piling up 39K points for 5th place.

The top six finishers in the Classic Rover category were all from the Southern California Contest Club; W6XD/R, KI6FGV/R, K6AH/R, N6HD/R, WA6WTF/R, and K9AOG/R all had scores between 272K and 215K. Each was equipped with 10 bands and they each roved through 10 grids and completed between 700 and 800 contacts each and between 111 and 125 multipliers.

The Unlimited Rover category was created a few years ago to try to level the playing field for various rover configurations, operator numbers and pack-roving. The eight entrants in this group had modest scores, with WA3PTV/R in first place with 51K points, using 10 bands across 4 grids in the Mid-Atlantic area.

QRP Portables

Stations in this category may only use 10 W maximum output and must have a completely portable station operating on portable power. Wayne, N6NB, captured 1st place again with his 10 band vehicle, scoring 137K points and linking up with the Southern California Contesting Club rovers. Chris, W1MR, from NH placed 2nd with a six band station scoring 84K. He has been a regular entrant and winner in this category under his old call, KA1LMR. Tommy, WD5AGO, had a four band effort from Oklahoma and scored 38K for 3rd place in this category.

Club Competition

There were 47 club entities that submitted aggregate scores, representing 529 entries. The only entry in the Unlimited Club class with 53 logs and a total of 1.6 million points is the Society of Midwest Contesters. They have worked diligently over the past several years to stimulate VHF+ activity for this contest and get their members to submit logs.

The North East Weak Signal Group took first place honors in the Medium Club category with 22 logs and 2.4 million points. There are many strong VHF+ operators in that group and many with gear through the millimeter wavelengths. In 2nd place, the Southern California Contest Club had 20 logs and 2.2 million points based on their team of 10 band equipped rovers, N6VI Limited Multiop, and N6NB QRP Portable. The Potomac Valley Radio Club with 45 logs and 1.9 million points placed 3rd. Their K8GP Unlimited Multiop station contributed more than half of the points and this was well supplemented by their operating membership.

The Bergen ARA was in 1st place among the Limited clubs with 3 logs and 95K points. The Stoned Monkey VHF ARC (with the most colorful club name) placed 2nd with seven logs and 94K points. In 3rd place we have the Rochester (MN) ARC with a 90K score based on their four logs.

Epilogue

You had to be on the air to get the thrill of the chase, a taste of propagation and, if lucky, some DX in your log. So get a head start now for this coming year's VHF-and-up activities. Check your gear, make a plan, add a band, up your power, try a new mode and improve your feed lines and antennas. Next year the ARRL June VHF Contest will be held June 8-10, 2013.

The Band Is Open Online

Rick wrote a whole lot more which you can read online at **www.arrl.org/contest-results** including a band-by-band breakdown of the top scoring stations!

The 2013 ARRL DX Contest

CW: 0000 UTC Saturday, February 16 - 2359 UTC Sunday, February 17
SSB: 0000 UTC Saturday, March 2 - 2359 UTC Sunday, March 3

Happy couples share domestic chores: dishes, laundry, and tower maintenance! Carl and Sue Cook (P40V and P49YL, respectively) are up on the tower in Aruba, fixing an antenna before the start of the 2012 ARRL DX Phone contest [Robert Wood, W5AJ, photo]

- While it may still be winter in much of the US and Canada, the bands will be hot with DX for the 2013 ARRL DX Contest!
- Conditions haven't been this good in years! With 10 meters open almost daily around the world, now is the time to warm up your rigs and see what you can work. US and Canadian stations work only DX; DX work only US and Canada.
- Choose from 3 power levels: QRP (5 W or less), Low Power (150 W or less) or High Power (More than 150 W). Then choose if you want to go it alone as a Single Operator or have some friends over and enter as a Multioperator.
- Log submission deadlines:
CW: 2359 UTC Tuesday, March 19.
Phone: 2359 UTC Tuesday, April 2.
- Logs must be e-mailed in electronic Cabrillo format to **dxcw@arrl.org** or **dxphone@arrl.org**. Paper logs can be submitted to ARRL DX Contest,
225 Main St, Newington, CT 06111

Complete rules can be found at
www.arrl.org/arrl-dx

Scan this QR code with your smartphone to go directly to the ARRL DX Contest rules page.

2013 ARRL Straight Key Night

0000 UTC-2359 UTC Tuesday, January 1

- "The Code" has been around longer than Amateur Radio. It's the original mode of wireless communication. In today's world of PCs and solid state rigs, the pure tone of CW sent by hand remains one of Amateur Radio's great legacies. While CW is available to all of us any time we wish to use it, January 1 has long been reserved as a day to send Continuous Wave by hand, as was the norm long ago.
- Straight Key Night isn't a contest; no need for quick exchanges. Take your time and enjoy a good ragchew...or several! Many enjoy dusting off vintage rigs for the occasion, but this isn't required.
- Send us your list of stations worked, along with your votes for Best Fist and Most Interesting QSO, to **straightkey@arrl.org** before January 31, 2013. A paper summary of your activity can be mailed to ARRL Straight Key Night, 225 Main St, Newington, CT 06111. Be sure to post your story and photos of your evening at **www.arrl.org/soapbox**; we love reading detailed stories and seeing photos!
- CW is more popular than ever. Come have fun on Straight Key Night!

Scan this QR code with your smartphone for more information.

Colin Phoon, AE3A of Scarsdale, NY, had a great time in SKN 2012. With his trusty Nye Viking Speed-X straight key and his Yaesu FT-840 running 20 W he made 9 QSOs in a very pleasant evening of operating. [Photo courtesy Colin Phoon, AE3A]

The 2012 December Rookie Roundup – CW

1800 UTC - 2359 UTC Sunday, December 16

- It's time to let your CW shine! This 6-hour competition is aimed at those who have been licensed for three years or less. Elmering is strongly encouraged!

- Enter as a Single Operator, or invite some friends over and participate as a Multioperator group. Clubs, open up the station and invite your newer members to try out their CW fist! Team Competition is also available; up to five Rookie single-ops, each operating from a separate station, report their scores both individually and collectively as part of a team. Put your team together and challenge a rival to do the same!
- Rookies can work anybody, while non-Rookies work only Rookies. The exchange is your name, the last two numbers of the year you were licensed, and your state, province or "DX" if you're outside the US and Canada.
- Complete rules, team registration and score reporting info can be found at **www.arrl.org/rookie-roundup**.
- All scores must be reported by 2359 UTC Wednesday, December 19, 2012. [Certificates to all Rookie participants!]
- Let's hear some new fists on the air in the CW bands this weekend!

The 2013 ARRL RTTY Roundup

1800 UTC Saturday, January 5 - 2359 UTC Sunday, January 6

- Digital modes remain the fastest-growing aspect of Amateur Radio. If you haven't tried RTTY, the RTTY Roundup is fun and easy to enter! All you need is a PC, a rig and a sound card interface between the two. Be sure to check out the website of veteran RTTY contester Don Hill, AA5AU, for tips on how to get started in RTTY at **http://aa5au.com/rtty.html**.
- Enter as a Single Operator using low power (150 W or less) or high power (more than 150 W), or share the fun with friends and enter in the Multioperator category. Stations in the US and Canada send a signal report and your state or province; DX stations send a signal report and a sequential serial number.
- All logs must be received or postmarked no later than 2359 UTC Tuesday, February 7, 2013. E-mail Cabrillo-formatted electronic logs to **rttyru@arrl.org**. Paper logs go to ARRL RTTY Roundup, 225 Main Street, Newington, CT 06111.

Complete rules and entry forms can be found at
www.arrl.org/rtty-roundup

Scan this QR code with your smartphone to go directly to the RTTY Roundup rules page.

W1AW Station Manager Joe Carcia, NJ1Q, shows how easy it is to become active on RTTY. A Netbook PC, a rig and an interface will have you working stations in no time!

The 2013 ARRL January VHF Contest

1900 UTC Saturday, January 19 -0359 UTC Monday, January 21

- The action returns to the VHF+ spectrum for the January VHF Contest. How many amateurs can you contact on 6 meters and up?
- There are two new categories this year: Single Op, 3 Band (6 meters, 2 meters, & 432 MHz) and Single Op, FM Only (6 meters, 2 meters, 222 and 446 MHz). Both are Low Power categories...perfect for those new to VHF+ with a all band, all mode rig!
- The contest exchange is simply your Maidenhead grid square. More info on grid squares is at **www.arrl.org/grid-squares**.
- Logs must be e-mailed or postmarked no later than 0359 UTC Wednesday, February 22, 2013. Electronic Cabrillo formatted logs are strongly preferred. E-mail Cabrillo logs to **januaryvhf@arrl.org**; paper logs go to ARRL January VHF Contest, 225 Main St, Newington, CT 06111.

Complete rules are available at
www.arrl.org/january-vhf

Zack Widup, W9SZ, will be operating portable from EN50 again, just as he is here. Zack's efforts have been rewarded with numerous Division level victories and Top Ten placings over the years. [Zack Widup, W9SZ, photo]

Scan this QR code with your smartphone to see the January VHF Contest rules.

2013 January Kids Day

1800 UTC - 2359 UTC Sunday, January 6

- The first Sunday in January is the time to get youngsters on the air and share the joys and fun that Amateur Radio can provide!
- Sponsored by the Boring (Oregon) Amateur Radio Club, this event has a simple exchange suitable for a younger operator: First name, age, location and favorite color. After that, the contact can be as long or as short as each participant likes.
- Kids Day opens doors and opens minds. Open your shack doors and invite the youngsters over to learn and enjoy themselves. Let's all work to get some fresh, young voices on the air on January 6!

Complete rules and entry forms can be found at
www.arrl.org/kids-day

Scan this QR code with your smartphone to see the Kids Day rules.

Fourteen year old Tommy James, KJ4SWI, of Moultrie, GA, loves using his ICOM 707 with a G5RV antenna to make QSOs! [Thomas James, W4TBJ, photo]

Bernie McClenny, W3UR, w3ur@arrl.org

The Republic of Kosovo

Kosovo's tumultuous history has brought it just one step away from attaining DXCC status.

It's been said that religion and politics have no place in Amateur Radio. Both topics can definitely heat up a conversation on the air. This month's subject may be a little touchy, but it's important that Amateur Radio operators and especially DXers be aware of world affairs, particularly when it comes to potential new DXCC countries. For this month's column I have tried to remain as unbiased as possible while explaining the overall picture. — 73, Bernie, W3UR

During the medieval era in Europe Kosovo was at the heart of the Serbian empire. Kosovo fell to the Ottoman Empire in the 15th century with Ottoman rule continuing until 1912. By then Serbs were in the minority in the territory now known as Kosovo, which became part of Yugoslavia when that country was created after World War I. Kosovo became an autonomous province within Serbia in the Socialist Federal Republic of Yugoslavia after World War II. The 1974 Yugoslav Constitution gave Kosovo a status almost equal to that of a republic.

After the death of Marshal Tito in 1980, Yugoslavia began to unravel. In Kosovo tensions between Serbs and the majority ethnic Albanians escalated and in 1989 its special autonomous province status was revoked. Kosovo's Albanians responded first with passive resistance and eventually with armed resistance. In March 1999, NATO intervened militarily to force Yugoslavia to end "ethnic cleansing" of Albanians. Afterwards the United Nations (UN) implemented UN Security Council Resolution 1244 by installing the UN Interim Administration Mission in Kosovo (UNMIK). From late 2005 through 2007, talks were held between Serbia and Kosovo to resolve the conflict, but no agreement was reached.

On February 17, 2008, Kosovo declared independence, which was recognized first by Costa Rica and then the United States. Currently, 91 UN member countries and 22 (of 27) European Union nations recognize Kosovo as a country. In June of 2008, UNMIK reduced its presence as Kosovo welcomed the European Union Rule of Law Mission. By early October of that year, the UN asked the International Court of Justice for an "advisory opinion on the legality of Kosovo's declaration of independence." In July 2010 the court affirmed the decision that "Kosovo's declaration of independence did not violate general principles of international law, UN Security Council Resolution 1244, or the Constitutive Framework."

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Shortly after Kosovo's independence was affirmed, an International Steering Group (ISG) for Kosovo was established to institute the UN envoy's settlement plan. By September 10, 2012 Kosovo had met all the requirements of the plan and international supervision of its independence ended.

DXCC Program

During the January 1996 ARRL Board of Directors (BOD) meeting the following vote was taken: "79. On motion of Mr. Kanode (N4MM), seconded by Mr. Wyatt (K6WR), it was VOTED that ARRL President assign a committee to review the entire DXCC Program and make necessary recommendations in order to encourage broader participation by more amateurs, make the program more equitable, create better understood criteria for DXCC 'Countries,' improve the process of reviewing requests for additions and deletions to the ARRL DXCC List and increase efficiency in the administration of the program."[1] This decision came just after the BOD approved the Membership Services Committee's recommendation to approve the Scarborough Reef addition to the ARRL DXCC Countries List.

The appointed group was named the DXCC 2000 Committee and the DXCC 2000 rules were implemented at 2359Z on March 31, 1998. The new rules made very clear which countries were (and weren't) eligible to be added to the list, while trying to avoid getting the organization embroiled in politics. A new country or "entity" can be added to the ARRL DXCC List in one of two ways: either as a Political Entity or a Geographical Entity. For the purposes of this article, I will focus only on the Political Entity criteria.

The original DXCC 2000 rules defined several conditions to add a new country to the list, only one of which was necessary to qualify as a Political Entity: The country had to be a member of the UN; the International Telecommunication Union (ITU) had to issue it a call sign block; or it needed to be a member society in the International Amateur Radio Union (IARU). Between the additions of Ducie Island (VP6/D) and Swains Island (KH8/S) the IARU criterion was removed and replaced with the June 15, 2006 rule change, which included the US Department of State's list of "Dependencies and Areas of Special Sovereignty" or the UN's list of "Non-Self-Governing Territories."[2]

Kosovo Now Using Z6 Prefix

In August 2012 Kosovo's Prime Minister Hashim Thaci announced that Amateur Radio stations in Kosovo will use the prefix Z6. (Apparently the same designator will be used for aircraft.) The use of this previously unused call sign block appears to have been agreed upon while Kosovo was under the governance of the ISG. On September 12, 2012 the Republic of Kosovo's Telecommunications Regulatory Authority (TRA) adopted Amateur Radio regulations. The TRA issued Kosovo's first license (Z6ØK)

[1]"Moved and Seconded," *QST*, Mar 1996, p 74.
[2]B. McClenny, W3UR, "How's DX — The Game Changes," *QST*, Jul 2012, p 89.

Kosovo's Telecommunications Regulatory Authority (TRA) issued Z6 licenses in a formal ceremony to (from left) Mustafa Xhoni, Z61LA; Avni Jashari, Z61AJ; Feti Fazliu, Z61FF; Durmishali Smani, Z61DD; Sabit Zymberi, Z61AA (President SHRAK); Agim Sadiku, Z61AS (behind Sabit); Vjollca Belegu, Z61VB; Avni Berbati, Z61AB; Naim Sadiku, Z61NS, and Driton Sadiku, Z61DX. "Several of them have already taken the first steps to getting back on the air" says Nigel, G3TXF. [Photo courtesy of Nigel Cawthorne, G3TXF]

for use by an international delegation and members of the Amateur Radio Association of Kosovo. Also issued were 11 individual licenses, many to former holders of old Yugoslavian YU8 call signs, who had not been QRV for over 2 decades.

In mid-September 2012, an international group of hams from Croatia, Finland, the UK and the US went to Pristina as part of a team led by IARU Region I President Hans Blondeel Timmerman, PB2T. Also on board were Nigel Cawthorne, G3TXF; Bob Barden, MDØCCE/N2BB; Nik Percin, 9A5W; Emil Balen Zdravko, 9A9A; Emir Mahmutovic, 9A6AA; Martti Laine, OH2BH; Jorma Saloranta, OH2KI, and Pekka Holstila, OH2TA.

The goals of the trip, set out in the Z6ØK team's press release, were not to claim DXCC status for Kosovo but rather:

- "to help insure that plans were in place for the re-establishment of an Amateur Radio infrastructure consisting of regulations similar to those in other IARU countries,
- the establishment of a radio society open to all amateurs in Kosovo,
- the development of new licensees and new entrants into Amateur Radio, and
- the development of a robust society in all aspects that would eventually allow them to apply for IARU membership."

DXCC Status of Kosovo

After the Z6ØK operation ended, ARRL Awards Branch Manager Bill Moore, NC1L, welcomed its participants "back to the airwaves." That being said, Bill stated "As of this time Z6ØK, and/or any other Z6 station, will not count for any entity for DXCC awards purposes as they do not qualify under the DXCC rules."

At this time Kosovo is not seeking to join the UN. If the ITU adds Kosovo to its Table of International Call Sign Series, Kosovo will be added to the DXCC List. If the ITU takes no action, Kosovo will not be added to the DXCC list, despite its recognition by the US, unless there is a change in the DXCC rules. However, Kosovo is valid for the CQ DX Award and is a multiplier in the CQ World Wide DX Contests and the Worked All Europe DX Contests.

DX News Around the Globe

5T — Mauritania

A group of Polish hams including SP2EBG, SP3CYY, SP3GEM, SP6EQZ, SP6FXY and SP6IXF will be teaming up with Jean, 5TØJL (ON8RA), as 5TØSP from November 24-December 12. Thanks to the "kindness of the l'Autorité de Régulation of Mauritanie and with the great help of Jean, 5TØJL" activity will be on CW, SSB and the digital modes on 1.8-28 MHz.

At the moment, this group's license doesn't authorize 6 meter activity; however, that might change. Also, "If they have Internet the logs will be uploaded daily to the ClubLog" says Tom, SP5UAF; if not the logs will be uploaded afterwards. You can see the 5TØSP DXpedition website at **5t0sp.dxing.pl**, which includes the latest news and a band/mode survey. Please send questions and suggestions to **5t0sp@dxing.pl**. As of press time the group has not decided on a QSL manager.

5X — Uganda

Members of the Provins ARC, F6KOP, have announced a DXpedition to Uganda in February 2013. This is the same group that produced the PJ4C DXpedition. Plans are to have "more than 20 operators, 6 stations for 12 days in this beautiful African country." The group has a website at **www.5x2013.com**.

EL — Liberia

EL2A will be the Liberian call sign for the Voodoo Contest Group in its 24th annual operation, November 21-27, including a CQWW DX CW contest operation November 24-25, multi-multi. Before and after the CQWW, the participants will use their personal Liberian call signs: Ned, AA7A = EL2ES; Roger, G3SXW = EL2A; Fred, G4BWP = EL2WP; John, G4IRN = EL2RN; Mike, KC7V = EL2MF; Lee, KY7M = EL2LF, and Bud, N7CW = EL2WS. QSL all of these EL stations to their home call (except EL2WP, which goes to G5LP). Also joining the team will be Dickson, EL2DT (QSL via EL2FM). The log will be on LoTW.

H4Ø – Temotu Province

The H4ØFN DXpedition to Temotu Province will be December 22, 2012-January 7, 2013. Sigi, DK9FN, said the "flight tickets have been booked." The new 12 month license renewal was issued July 3 and is valid until July 2013. Target frequencies are 1825; 3505; 7005; 10,105; 14,005; 18,075; 21,005; 24,905; 28,005, and 52,105 kHz.

VKØ/M — Macquarie Island and Tasmania

Steve, VK3ZAZ (VK3OT), hopes to get on the air from Macquarie during the winter of 2013-2014. Six meters will be a priority. Antennas will include two 6 meter HO loops; a 6 meter M5, 5/8 vertical; HF dipoles; a TH3, and a Carolina Windom. He also plans to take an FT-2000 transceiver and VL-1000 amplifier.

In July 2013, Steve plans to be on Tasmania (VK7). He is looking into a special call from this rare one. Watch your favorite DX outlet for more news.

Photos courtesy of Nigel Cawthorne, G3TXF.

Wrap Up

That's it for this month. A special thanks to G3TXF, K1ZZ, KE3Q, VK3ZAZ and *The Daily DX* for making this month's column possible. Please send your DX news, DX club newsletter and photos to **w3ur@arrl.org**. Until next month, see you in the pileups! — *Bernie, W3UR*

Jon Jones, NØJK, n0jk@arrl.org

The Brendan Trophy

Two meters across the pond — the next great hurdle.

On September 14–15 a strong coastal inversion set up along the Eastern Seaboard. Hepburn's tropo forecast suggested the possibility of tropospheric propagation across the North Atlantic. Many stations were active both in Western Europe and the northeastern US and Canada trying to make a 2 meter terrestrial contact. Why? One reason is that the first pair of stations achieving a terrestrial 2 meter SSB/CW contact between Europe and North America will be awarded the Brendan Trophy.

The Irish Radio Transmitters Society offers the Trophy for the "first traditional mode 2 way contact" on 144 MHz between North America and Europe. In addition, there are two other categories — the Brendan Shields for digital mode contacts and the Brendan Plates for the first verified reception of a 2 meter transatlantic signal of any mode.

"The two stations involved must be located on land or non-tidal waterways within the continental shelves of Europe and North America. Note that the limit of the continental shelf of Europe is deemed to lie along the line of maximum depth between the European land mass and Iceland, while that of North America is defined to lie along the line of maximum depth between Canada and Greenland."

"A contact is defined as two-way communication where each station has:

"a) received both call signs in full

"b) received a signal report (Minimum two characters of any generally recognized system ('Generally accepted systems of reporting are the RS and RST systems, and the meteor scatter system.'))

"c) received confirmation (R or Roger) that the other station has satisfied above conditions (a) and (b)."

"This Information must be exchanged within a maximum period of four hours, after which the contact must be recommenced. The contact must be made via natural reflectors within the atmospheric mantle of the earth, which for these purposes may be taken as a distance of 1000 km. Thus, man-made reflectors (aircraft, satellites, etc.) as well as EME are excluded. The onus of providing proof of the contact satisfactory to the Panel rests on those involved. The level of proof required by the Panel will depend on the circumstances involved. For example, if the contact is the result of pre-arranged tests, then the Panel will expect a higher level of proof than if the contact were 'random,' such as complete recordings of the signals from both sides. If on the other hand, the contact is made spontaneously, the signed statements of both operators and witnesses on one or both sides may be acceptable. All relevant facts will be taken into consideration when evaluating a claim, and the Panel will pursue whatever line of enquiry they choose to evaluate a claim."

Unfortunately, no transatlantic 2 meter contacts were made during the September tropo opening — see "On the Bands." Who will be the first to claim this award? More information on the Brendan awards can be found at **www.irts.ie/cgi/brendan.cgi**.

Solar Cycle 24 — One Peak or Two?

There was a definite spike in solar 10.7 cm radio flux during mid November 2011. For almost a week transcontinental F2 occurred on 50 MHz and on two days F2 openings occurred from the eastern and middle US, and Canada to Europe. From the end of October to early December solar flux was high with great 10 meter conditions reported in the CQ WW contests and the ARRL 10 meter contest. The question is, was this a "first peak" of Cycle 24?

Carl Luetzelschwab, K9LA, and Jim Kennedy, K6MIO/KH6, believe this was not a first peak. Carl notes, "The smoothed sunspot numbers do not indicate a Cycle 24 peak in the Fall of 2011." Jim, K6MIO, found that the sun's northern hemisphere did reach a "maximum" in the first half of 2012, based partly on analysis of smoothed and unsmoothed solar data. This, however, is not the same as a solar cycle "peak."

The Solar Cycle peak is a combination of the smoothed sunspot numbers in the northern and southern hemispheres. Solar Maximum $R_i = (R_n + R_s)$ where R_i is the International Sunspot number and R_n and R_s are sunspot numbers for the sun's northern and southern hemispheres. The high solar flux in November 2011 was a short term variation in solar activity. Day to day and month to month variations are very large. This high solar flux occurred, fortunately, when the MUF was seasonally highest in the Northern Hemisphere. Perhaps we may have another spike in solar flux by the time you read this.

VK3ATN SK

Bill Smith, WØWOI, informed me that Thomas "Ray" Naughton, VK3ATN, (see Figure 1) of Birchip, Victoria, Australia passed away on September 15. Ray was an early EME pioneer who used a "4 wire stacked Rhombic" array on 144 MHz for EME.

Figure 1 — Thomas "Ray" Naughton, VK3ATN, one of the early pioneers of EME became an SK on September 15. This photo, taken in 1967, shows Ray using a theodolite to align his 2 meter rhombic for an EME contact. [Photo courtesy Ray Naughton, VK3ATN]

On the Bands

50 MHz E_s and TEP Openings Are Magic!

Sporadic E (E_s) and Transequatorial Propagation (TEP) came to life September 5-6. E_s was spotted by AC4TO (EM70) to YS1AG at 0127 UTC. Earlier E51USA worked K6QXY 5×9 and N7AMA AZ at 2350 UTC on the 5th. KF6A (EN73) logged CE4WJK (see Figure 2) and LU8EEM around 2030 UTC. N5DG also worked CE4WJK. LU9EHF worked Colorado (KØYW, DM67), Arizona (WA7JTM, DM33) and California (K6QXY, W6XK, N6RW) around 0245 UTC on the 6th.

This opening had the hallmark of E_s – TEP for the northern stations and possibly direct TEP for those along the Gulf Coast. On the 7th, Rich, K1HTV, "was pleasantly surprised to hear 6 meters open via TEP to South America. It started around 2240 UTC and lasted about an hour in FM18. I worked PY1RO, PY1NX and PY2XB on CW and heard but did not work LU9EHF and PY1NS weakly on SSB. There is still some 'Magic' in the 'Magic Band.'"

Table 1
September 9 Spots

KBØHH	0050Z 50125.0 EM84ab<E_S>EM06vu	W4IMD
E51WL	0044Z 50104.9	N5DG
HR1/K2LCT	0039Z 50110.0 EL96<>EK64jb	K4LFK
NØJK	0037Z 50125.0 EM84ab<E_S>EM28	W4IMD
YN2N	0036Z 50118.0 EM84wx<>EK71au	W4TUN
CE4WJK	0035Z 50140.0	K7JA

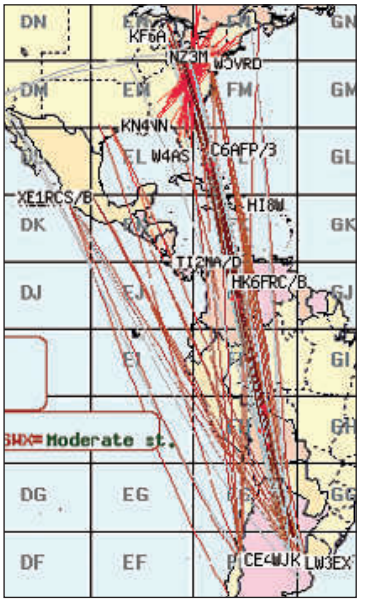


Figure 2 — A combination of E_s and TEP brought a receiver full of activity to 6 meters on September 5. [DXMAPS.COM]

The September VHF QSO Party had outstanding conditions (see Figure 3). There was E_s Saturday afternoon and evening, and E_s – TEP links for some fortunate stations both days of the contest. Two hours after the contest started on the 8th, K1TOL logged CX2TQ at 2000 UTC. Later, N5DG spotted CX9AU at 2201 UTC, as did K1CP, K1SIX, K1VUT and W1FV. K1VUT caught PY1RO and LU9EHJ from FN41. WZ1V (FN31) worked PY1RO "on my little Moxon, 4808 miles" (Thanks *205MorningReport*). Bernie, VE1UT (FN63) heard the LU6EE/b, LU5EGY/b and CX9AU call CQ on CW at 2200 UTC. Perhaps these contacts resulted from direct TEP to south Texas and likely E_s – TEP to New England and Nova Scotia. Lefty, K1TOL, later spotted both the ZD7 and ZD8 beacons around 2200 UTC. At 2209 UTC Lefty said CX9AU was "40 over S9 into Maine!" At 2325 UTC NZ3M (FN10) worked E51USA (BG08)!

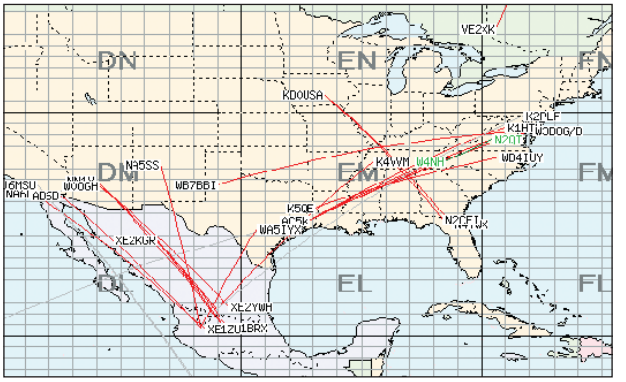


Figure 3 — The September VHF QSO Party heats up with the help of some E_s – TEP links. [DXMAPS.COM]

Saturday evening around 0000 UTC Sept 9th, K1HTV (FM18) reported a 90 minute E_s opening to LA, MS, OK and TX. Jeff, K1TEO, made around 60 contacts via E_s. He did not hear any of the South Americans. The E_s – TEP footprints were small at times. From KS, WAØARM (EM19) and I (NØJK) had strong E_s to W4 at the same time. W3GMT (EM92), WA4NJP and W4IMD both EM84, and WB4PPW (EM73) were strong. This was likely a cross path off the same E_s center K1HTV encountered. E_s also reported from the Gulf Coast to Central America — YN2N and HR1/K2LCT were into EM64 and EM84. Some of the E_s and E_s – TEP spots are shown in Table 1.

Bob, K2DRH (EN41) commented that from the Midwest "the contest E_s opening had a limited footprint and no real depth." Nevertheless, any E_s is a real treat in the September contest. K1TEO said that this was the first time his September 6 meter contest total was higher than 2 meters! At 0102 UTC K5RK spotted FK8CP. On the 10th UTC, K1HTV "worked PY5EW on SSB and PY2XB on CW." KA9CFD (EN40) also spotted PY2XB at 0054 UTC on the 10th. The Sunday afternoon of the contest a direct F2 opening may have occurred between the Gulf Coast and Ecuador. HC5CR and HC5VF worked stations in Florida and Georgia around 2200 UTC.

In the contest's last hour, KBØHH (EM06) had E_s to Southern California. At the same time, W6XK (CM97) spotted FK8CP. The great openings in the September contest were mostly due to E_s linking to TEP. The geomagnetic field was relatively quiet with a "24 hour maximum K_p [average planetary K index — *Ed.*] of 2" reported for both the 9th and 10th.

The Swains Island DXpedition, NH8S, reported 15 contacts on 6 meters with five countries. They had a strong 3 hour TEP opening to Hawaii September 15. Fred, KH7Y, logged them for a "new one" with 599 signals. NH8S peaked 40 over S9 and was so strong, Art, KH6SX, was able to work them with his Yagi lying on the ground! One NH8S 6 meter op was Alan, K5AB, who operates a widely heard beacon from EM10.

K1TOL (FN44) at 2335 UTC on the 22nd worked the rare Paraguay station ZP5SNA. Lefty worked several PYs including PY3NZ and PY5EW.

On the 24th, Lefty, K1TOL, and N1BUG worked C5YK around 1850 UTC with S9 + 40 signals and very little fading. This was possibly direct F2. On September 23, Rich, K1HTV, worked PY2XB and PY1RO around 2345 UTC, possibly E_s – TEP. PY2XB is one of the 6 meter operators for the upcoming PTØS operation (**pt0s.com**). CX2TQ worked K1TOL and K2MUB. Tim, NWØW, tested his new "LFA-HZE" Yagi on the 25th. It has a very high F/B claim. It is working well; he copied the CE6B/b at 2100 UTC!

Fred, KH7Y, on the Big Island worked Peter, PP5XX, as 3D2XX/mm on the way to Conway Reef via TEP on the 25th and 3D2C on the 26th for a "new one." He also contacted ZL2PY and BV2DQ. The next day Jack, OA4TT, and Yuri, UT1FG/mm (FI01) appeared in his log. He had a very strong opening to South America on the 28th. Javi, LU5FF, was "20 over S9" for hours along with many others in Argentina. Fred concludes, "6 meters is looking up from Hawaii."

The 3D2C Conway Reef DXpedition also experienced some phenomenal propagation and reports making 676 phone contacts and 600 CW contacts on 6 meters.

A strong aurora occurred the evening of September 30 (October 1 UTC). K1TOL worked MMØAMW via aurora E_s at 0105 UTC on the 1st. I'll have more on the aurora next month.

144 MHz Labor Day and Maritime Tropo

A strong inversion occurred over the upper Midwest Labor Day weekend. On September 2, Rick, WØRT (EM27) worked KØMVJ (EN36) Duluth, MN at 1420 UTC. That evening JD, NØIRS (EM29) reported "a strong duct" building to the north. NØIRS and ABØYY (EM29) worked *WØANH* in the rare grid *EN47* (northern MN) at 0300 UTC on the 3rd. Greg, WQØP (EM19) caught WØANH using 600 W and "a big wheel at 60 feet."

The tropo continued the next morning on Labor Day from eastern KS, EM28 — I (NØJK) worked as far as WØANH (EN47) 1060 km (just south of the Canadian border) at 1332 UTC Sept 3. WØGHZ (EN34) and WB9LYH (EN54) were both 20 over S9 on my 7 element Yagi. NØIRS logged KD9NH (EN44). Rick, WØRT (EM27) worked KAØPQW, KAØKYZ (EN33), WØVB, WØGHZ, KCØLXB (EN34) and WØKT (EN21) starting at 1326 UTC.

Tropo was good out east as well. Ron, WZ1V, and K1PXE (FN31) worked W8MIL (EN74) at 1058 km (thanks *205Morning Report*). KØAWU (EN37) was at the edge of the duct and worked NØMST (EM27) at 1442 UTC. He listened "last night and this morning and NØMST was the only station heard well enough to work."

A strong coastal opening set up September 14-15. Several stations such as K1MAP and Rich, K1HTV, suspected a possible tropo opening from the Northeast US to Europe based on Hepburn's maps. Many stations including VE1SKY, K1HTV, K1MAP and others called toward Europe the morning of the 14th. K1HTV and VE1SKY both ran on 144.325 MHz with G4LOH but no luck bridging the North America to Europe path. Rich said he "tried for hours to work Europe." Jeff, K1TEO, also participated.

A few years ago, 90 MHz commercial FM broadcast stations from Maine and eastern Canada were heard via tropo in Ireland. RTE Radio 1 at 93.2 MHz, Maghera Mt, Co Claire, West Ireland runs 160 kW and may be one for NA stations to listen for (thanks K1MAP and the *205MorningReport*).

WZ1V (FN31) and N2GHZ (FN30) worked VE1SKY (FN74) and VE1AHM (FN76) around 0250 UTC on the 15th. VE1SKY filled a log page with W1 contacts including KT1R in rare FN64. VE1AHM worked as far as FM17 — KO4YC at 1391 km and FM29.

On the 16th, Chad, NØYK (DM98) worked KAØKYZ (EN33) with 559 signals at 1510 UTC for a distance of 574 miles on a narrow tropo duct. W2ACR reports contacts on 2 meters with stations as far away as W8MIL (EN74) 411 miles and K8TQK (EM89) 405 miles on September 21 running just 10 W and a 17 element Yagi on a 20 foot mast in the yard.

222 and 432 MHz

On Labor Day morning, a strong tropo opening to MN occurred on 70 cm from NØJK (EM28). I logged WØGHZ (EN34) and WØLGQ (EN21) with 10 W and an N6NB 8 element Quagi on 432. KØAWU (EN37) worked NØMST (EM27) at 1452 UTC on 432 MHz. Conditions were good enough for some ATV DX — KCØHFL (EM17) had the 70 cm WRØATV repeater in Kansas City "P2" quality at 1304 UTC. During the northeast coastal opening, WZ1V (FN31) and N2GHZ (FN30) worked VE1SKY on 432 MHz September 15 at 0300 UTC. On the 25th, N6ZE operated the 222 MHz Sprint portable from an elevation of 2300 feet above sea level in the Santa Monica mountains, DM04. His best DX was W6PQL at 492 km with a FT-736 transceiver and 10 element M^2 Yagi.

1296 MHz and Up

WØRT (EM27) heard WØGHZ (EN34) on the 2nd, but WØGHZ was unable to hear Rick's 10 W on 1296 MHz. NØIRS (EM29) worked WØGHZ (EN34) on 902 and 1296 MHz at 0334 UTC, but no luck on 2304 MHz the same evening. The next morning September 3, JD worked KG5MD (EM36) "5×9" and WØRT (EM27) at 1350 UTC on 1296.

EME

Mick, W1JJ, worked E6M via EME on 50 MHz for a "new country." Lance, W7GJ, operated from Niue as E6M on both 6 meter EME and terrestrial in early September. Lance heard the KH6HI/b via TEP on the 9th and JR2HCB via TEP on the 11th.

Here and There

Bill, NDØB, gave an interesting presentation on EME for the ARRL DIY Forum at Dayton. See **www.youtube.com/watch?v=uIQqZL_3xR0** — thanks Jerry, VE6CPP.

CY9M made 433 contacts in 6 DXCC counters on 50 MHz including (Scott, KF2ZQ, who related his tale of working CY9M on 6 meters July 28, 2012). CY9 still is rare on 6 meters — hint for potential DXpeditions next summer. Optimum time for multihop E_s would be around July 1 for E_s to Asia, North America and Europe.

The Radio Club of America announced this week that **William A. Tynan, W3XO**, a club Fellow, is the recipient of its 2012 Barry Goldwater Amateur Radio Award. The award recognizes Bill's lifelong service to the public through Amateur Radio. It will be presented at the club's annual awards banquet in New York on November 16th. ARRL CEO David Sumner, K1ZZ, also a club Fellow, will be the keynote speaker.

Bill, one of AMSAT's charter members, is a past president and chairman of the board. For many years, he conducted this column in *QST*. He is also a past President of the Central States VHF Society. Bill played a key role in starting the Amateur Radio from the Space Shuttle and the International Space Station programs.

The Radio Club of America, founded in 1909, is the world's oldest radio communications association. For more information, see **www.radioclubofamerica.org**.

ZL9HR plans to be active from Campbell Island November 28-December 9. They have received approval for operation on 50 MHz. An OptiBeam OB5-6 antenna will be used on 6 meters.

Fred, KH7Y, says the KH6HME Mona Loa VHF/UHF and microwave beacons will continue to operate.

Special Events

Maty Weinberg, KB1EIB, events@arrl.org, www.arrl.org/special-event-stations

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Nov 23, 1300Z-2100Z, W1P, East Falmouth, MA. Falmouth Amateur Radio Association. Steamship *Portland* Commemorative Special Event Station. 14.260 7.260 3.997. QSL. Henry Brown, 19 Sao Paulo Dr, East Falmouth, MA 02536 **www.falara.org**

Nov 24-Nov 25, 1300Z-1900Z daily, WA1NPO, Plymouth, MA. Whitman Amateur Radio Club. The First Pilgrim Landing at Plymouth. 18.160 14.260 7.240 3.860. Certificate & QSL. Whitman ARC, PO Box 48, Whitman, MA 02382. WA1NPO-R IRLP:8691. **www.wa1npo.org**

Nov 24-Nov 25, 2000Z-2000Z, KB9WQF, Mauston, WI. Juneau County Amateur Radio Club. Boorman House Christmas Program. 14.250 14.054 7.240. QSL. Howard Fischer, N2450 Scoville Rd, Mauston, WI 53948.

Dec 1, 1600Z-2300Z, W3R, Pittsburgh, PA. Western Pennsylvania Model Railroad Museum. 25th Anniversary Holiday Train Show. 28.400 14.250 7.240 7.050. Certificate. Bill Jacobs, 308 Anawanda Ave, Pittsburgh, PA 15228. **srakiecz@hotmail.com**

Dec 1, 1700Z-2300Z, W9CAP, Chicago, IL. Illinois Wing Civil Air Patrol. 71st Anniversary of Civil Air Patrol. 18.125 14.250 7.255. QSL. ILWG CAP, Major Ron Walerowicz, 5912 N Northwest Hwy, Chicago, IL 60631. *Frequencies will move as band conditions change.*

Dec 1-Dec 2, 1200Z-0400Z, WØUPR, Pocatello, ID. Union Pacific Amateur Radio Club. Celebrating 150 Years of Union Pacific Railroad. 14.235. QSL. John Wilson, KØIP, 1019 Sagewood Pl, Pocatello, ID 83201. *Many WØUPR stations operating from many locations on many frequencies, see* **www.pocatelloarc.org/uprr**

Dec 7-Dec 8, 0200Z-0400Z, W5LEX, Ingleside, TX. South Texas Amateur Radio Club. USS *Lexington* (CV-16) Pearl Harbor Day. 28.485 14.325 14.265 7.275. QSL. South Texas Amateur Radio Club, USS *Lexington* (CV-16), PO Box 2182, Corpus Christi, TX 78403. **www.n5crp.org**

Dec 7-Dec 9, 0000Z-2300Z, K5A, Springdale, AR. Amateur Radio Klub of the Arkansas Northwest. 150th Anniversary — Battle of Prairie Grove, AR. 14.280 14.040 7.180 7.040 PSK 14.080 7.080. Certificate. Don Banta, 3407 Diana St, Springdale, AR 72764. **arkanhams.org**

Dec 8, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. Pearl Harbor Remembrance Day. 14.320 7.250 PSK-31 14.070 D-STAR 012C. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Dec 8-Dec 9, 1400Z-2000Z daily, W2W, Baltimore, MD. National Electronics Museum Amateur Radio Club. Pearl Harbor Commemoration. 14.241 14.041 7.241 7.041. Certificate & QSL. K3NEM, c/o National Electronics Museum, PO Box 1693, MS 4015, Baltimore, MD 21203. **k3nem.org**

Dec 8-Dec 9, 1500Z-1500Z, K5K, Texarkana, TX. Four State Amateur Radio Club. Texarkana USA 139th Birthday. 21.290 14.265 7.265 3.930; 15 20 40 80 m. Certificate.* Four States Amateur Radio Club, PO Box 7810, Texarkana, TX 75505. **4sarc.org**

Dec 8-Dec 9, 1500Z-2130Z, N4WIS, Virginia Beach, VA. USS *Wisconsin* Radio Club. Pearl Harbor Special Event. 14.264 7.264. Certificate. USS *Wisconsin* Radio Club, PO Box 6682, Virginia Beach, VA 23456. *Sunday hours start at 1700 UTC*. **www.n4wis.org/n4wis/index.php**

Dec 8-Dec 9, 1700Z-2000Z, WR4BC, Bethlehem, GA. Barrow Amateur Radio Club. Bethlehem Christmas Special Event Station. 21.300 14.250 7.200 3.850. QSL. Barrow Amateur Radio Club, PO Box 951, Auburn, GA 30011. **www.barrowhamradio.org**

Dec 9, 0100Z-0400Z, W9BSP, Olathe, KS. Marshall Ensor Memorial Organization. 1938 W9BSP Ensor Transmitter Returns to Air. 3.885 AM Primary 3.863 AM Alternate. QSL. Joe Krout, Trustee W9BSP, Marshal Ensor Memorial Organization, 514 N 83rd Pl, Kansas City, KS 66112. *Last operated as W9BSP in 1941 and as WØUA in 1971; the hand built W9BSP transmitter has been restored to operating status. Join us on the air to commemorate this unique piece of Amateur Radio history. See "Eight Years Before the Mike" in the Feb 1939* QST. **www.ensorparkandmuseum.org**

Dec 15-Dec 16, 1300Z-0000Z, N5W, Fayetteville, AR. WBØRUR and K5KVN. Wreaths Across America. 21.280 14.240 7.230. QSL. Gary Darnell, WBØRUR, 825 N Fox Hunter Rd, Fayetteville, AR 72701. *National Wreath Laying Day at US National Cemeteries worldwide.*

Dec 16, 1600Z-2100Z, W2GSB, Babylon, NY. Great South Bay Amateur Radio Club. Holiday Party. 146.685. Certificate. Peter Portanova, 99 Beach Rd, Massapequa, NY 11758. **www.gsbarc.org**

Dec 18-Dec 24, 1500Z-2200Z, KC5OUR, Belen, NM. Valencia County Amateur Radio Association. Christmas in Bethlehem. 28.372 21.372 14.272 7.222. QSL. VCARA, PO Box 268, Peralta, NM 87042. *Merry Christmas from Bethlehem (Belen), New Mexico*. **www.kc5our.com**

Dec 20-Dec 22, 2200Z-2359Z, W2E, Cookeville, TN. Buck Mountain DX Club. W2E — Doomsday 2012. 28.366 14.266 7.266 3.866. Certificate. Dennis M. Barrett, N4ECW, 1035 E 6th St, Cookeville, TN 38501. *W2E (World 2 End) event celebrates the end of the Mayan Calendar and what has been characterized in popular culture as Doomsday 2012. Special emergency power has been arranged in the event commercial power connections are inexplicably terminated. Also, 7.266 MHz will be manned using a vintage Hallicrafters transmitter and receiver should solid state transceivers become non-functioning.*

Dec 22, 0000Z-2359Z, WC5C, Azle, TX. Tri-County Amateur Radio Club. Day After Doomsday Operation. 28.340 28.040 14.340 14.040. Certificate. Tri-County ARC WC5C, Day After Doomsday, 820 Wood Lane, Azle, TX 76020. **wc5c@azletexas.net** *or* **www.wc5c.org**

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 website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; 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 ARRL Web Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through October 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

See the Digital Edition for a special Holiday video from the *QST* staff.

S. Khrystyne Keane, K1SFA, k1sfa@arrl.org

Gearing Up for WRC-15

Building on the success of the 2012 World Radiocommunication Conference, Amateur Radio officials prepare for 2015.

Preparations for the 2015 World Radiocommunication Conference (WRC-15) have begun on both the domestic and international fronts. These plans will be intensely studied by IARU volunteers and IARU Member Societies over the next 30 months as they work to develop the best strategies for dealing with those agenda items that concern the Amateur Radio Service.

In 2015, WRC delegates will consider one agenda item that deals specifically with the Amateur Radio Service, and another four agenda items that could indirectly affect radio amateurs.

Agenda Item 1.4

WRC-15 Agenda Item 1.4 calls on the delegates "to consider possible new allocation to the Amateur Service on a secondary basis with the band 5250-5450 kHz." According to ARRL Chief Technology Officer Brennan Price, N4QX, this is a unique opportunity for Amateur Radio, but by no means is a positive outcome assured. "Delegates to WRC-07 declined to make such an allocation just five years ago," he explained. "While the WRC-15 Agenda Item is more narrowly focused than the one before WRC-07 (which considered allocations to all Services between 4 and 10 MHz), early contributions to the ITU-R preparatory process indicate substantial opposition to be overcome."

Price pointed out that the case for an allocation is nevertheless persuasive: "The Amateur Radio Service continues to grow, with more than 3 million licensed operators around the world. The radio amateur's ability to conduct experimentation, communicate in the wake of natural disasters and enhance international goodwill depends on access to frequency bands throughout the radio spectrum, particularly in the HF range. In order to maintain effective and reliable communications capability at all times of day and throughout the sunspot cycle, the maximum desirable interval between HF frequency bands in a radio service is 1.4:1. At present, the interval between the 3.5 and 7 MHz bands varies from 1.84:1 in ITU Region 1 (Europe, Africa and the Middle East) and 1.75:1 in ITU Region 2 (the Americas)."

In the higher latitudes, there are many times when the maximum usable frequency (MUF) is below 7 MHz, but Price noted that it this is too far above the next lowest amateur frequency band (3.8-4 MHz, depending upon the ITU Region) for communication to be supported in that band using typical amateur antennas and power levels. "As amateur communication increasingly uses digital rather than analog modes of emission," he said. "Intersymbol distortion caused by multipath propagation becomes a more important factor, requiring an operating frequency as near as possible to the MUF."

Other Agenda Items Affecting Amateur Radio

According to Price, a number of items require vigilance, if not outright defensive efforts: "No less than five agenda items (1.1, 1.4, 1.6.1, 1.10 and 1.18) have the potential to impact almost every Amateur Radio allocation from 420 MHz-81 GHz. Within this range, only the 47 GHz allocation is unquestionably safe from reallocation or degradation."

- *Agenda Item 1.1*: "To consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications."
- *Agenda Item 1.6.1*: "To consider possible additional primary allocations to the fixed satellite service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1."
- *Agenda Item 1.10*: "To consider spectrum requirements and possible additional spectrum allocations for the mobile-satellite service in the Earth-to-space and space-to-Earth directions, including the satellite component for broadband applications, including International Mobile Telecommunications (IMT), within the frequency range from 22 GHz-26 GHz."
- *Agenda Item 1.18*: "To consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band."

"While Agenda Item 1.1 — which seeks to allocate additional spectrum to the mobile service for broadband applications — has received most attention from stakeholders and the popular press, proposed additional allocations to satellite services may impact the Amateur Radio allocations at 10 and 24 GHz," Price explained. "It is quite likely that the radiolocation service will be elevated to primary status at 77.5-78 GHz, with the Amateur Service at best retaining co-primary status. Affirmative outcomes on these many agenda items are not necessarily catastrophic to the Amateur Radio Service, but shaping the outcomes to retain meaningful and useful access for radio amateurs will require as much if not more work than efforts at 5.3 MHz on Agenda Item 1.4."

IARU Secretary Rod Stafford, W6ROD, concurred: "With seemingly everyone around the world gaining some degree of broadband access, the search for radio spectrum to satisfy the needs for mobile connectivity will become even more intense as we draw closer to WRC-15. National telecommunication authorities around the world and the ITU are in search of spectrum to fill these mobile connectivity requirements. As this agenda item develops, the IARU will be there to maintain the Amateur Radio spectrum."

Pointing out that many entities, mainly universities, are using the Amateur Radio spectrum for small satellites, Stafford noted that "it is becoming an increasingly difficult situation to accommodate the number of small, non-commercial satellites within the amateur bands. These education-based satellites do not really fit within the definition of the Amateur Radio Service, but have been accommodated there. These small satellites are categorized as nanosatellites (weighing between 1-10 kg) and picosatellites (weighing less than 1 kg). The ITU is trying to deal with this issue in an orderly manner and a 'preliminary' WRC-18 agenda item is to consider whether these satellite operations can be accommodated in an already crowded radio spectrum. As these issues develop, the IARU will keep its Member Societies, such as the ARRL, aware of developments."

John Dilks, K2TQN, k2tqn@arrl.org

Recapturing the Thrill

The Ameco AC-1 Novice transmitter is an easy project packed with nostalgia.

My first transmitter was a homebrew built from the 1950s vintage ARRL book, *How to Become a Radio Amateur*. It was very similar to the Ameco AC-1, a popular Novice kit in the '50s era. As inexpensive as the AC-1 was, my homebrew rig cost much less because my mentor, Bill Savell, W2LS (SK), donated many of the parts.

The day my Novice license arrived, it took about 5 minutes to go from picking up the mail and opening the envelope to getting on the air. I still remember the excitement and my shaking hand on the key as I tried to make my first contact on that hot July day. My little 6V6 transmitter performed well and after several attempts I made my first — very short — contact. Over the next few weeks, I became more experienced and had many nice contacts on 80 meters.

Other new hams back then chose to purchase their first transmitter from one of the many companies that produced the greatest catalogs of the day. Novice kits were available from under $25 up to the Johnson Ranger, which was the Cadillac of Novice transmitters at the time.[1] No matter which transmitter the new Novice used, the excitement was the same. I'll never forget that first contact.

Trying to recapture that excitement is, I believe, one of the reasons I started collecting vintage radios. I've made a few contacts over the years using several early transmitters from my collection. It's fun, but after those few contacts they get put back in storage or on the display shelf and I go back to my vintage Collins station or my ICOM IC-765 transceiver because, for me, they are so much easier to use. Nevertheless, it's impossible to surmount those memories of sitting before that homebrew one-tuber sending out that first CQ. I'm sure many of you have similar memories and I am equally sure many of those recollections include the Ameco AC-1.

[1]G. Grammar, W1DF, "Recent Equipment — The Viking Ranger," *QST*, Sep 1954, pp 42-43.

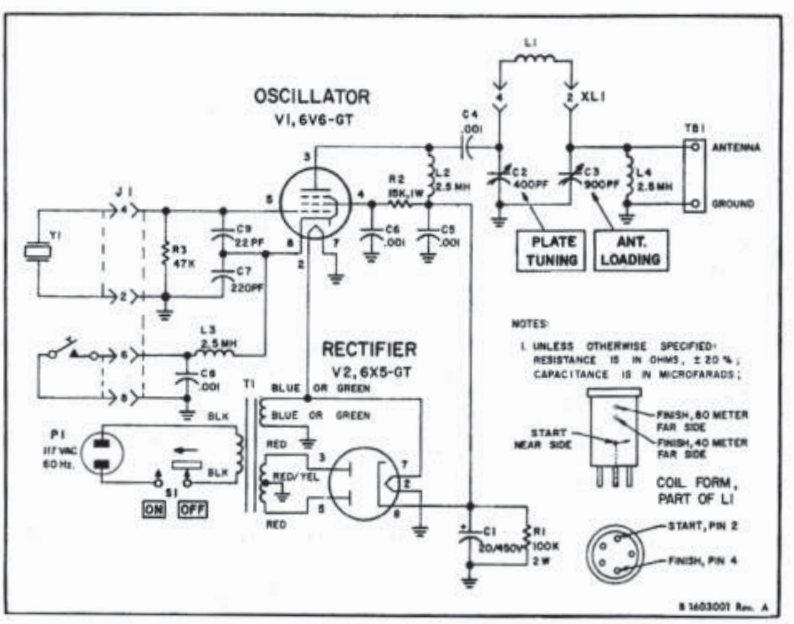
Ameco AC-1

The Ameco AC-1 was one of the most popular transmitters of the 1950-60s and one of the most attractive of the early Novice transmitters. It was originally available as a kit or wired. Being a one-tube transmitter, the AC-1 was also affordable.

It was inexpensive and very popular then and it is still very popular today — but no longer inexpensive. Word has spread about its popularity and finding one for under $100 is difficult. More likely, you will spend over $200 for one found at a hamfest. Over the years, I've passed up several in the $200-300 range. I finally found one in good condition for

Mike's, DL3ECN, replica Ameco AC-1 kit of parts. [Mike Vogel, DL3ECN, photo]

Here are K2TQN's AC-1 transmitter, Hallicrafters S-38A receiver and classic J-38 straight key all ready to get a 1950s Novice on the air. [John Dilks, K2TQN, photo]



Ameco AC-1

This is a copy of the AC-1 schematic from the Ameco manual. [Ameco AC-1 Manual]

under $100 at a Cape Cod hamfest a few years ago.

On eBay they usually go for more than $200, sometimes much higher. On September 21, 2012, an unassembled AC-1 kit sold for $521. This was not a fluke, as there were 32 active bids. The eBay seller told me, "I picked it up in a package deal with some other old rigs at a hamfest. I am more of a restorer of the old discarded radios and just never had the heart to open a piece of history and build it."

The debate on many e-mail user groups is: after finding an unassembled kit, do you build it or keep it as a kit in your collection? If you build it, you have the fun and experience of days gone by, but the unbuilt value is then gone and you now have a nice radio that is worth much less. Only the new owner of the kit knows for sure what they want to do.

A Replica for the Kit Builder

If you want to recapture the thrill, one way is building a replica. Searching on eBay turned up a replica Ameco AC-1 chassis, painted and silkscreened, at a reasonable price. A kit of the major parts is also available from the seller. This kit would make a great present to oneself, especially during the holidays when you can find the time to build it.

If you have a good junk box, perhaps you only need the chassis; however, it may be easier to purchase the parts kit if you are in a hurry to build it. The seller, Mike Vogel, DL3ECN, is in Germany. You can find him at **www.qrz.com/db/DL3ECN** or e-mail him at **mike-vogel@gmx.de**.

Roll Your Own AC-1

If you prefer to work from scratch, schematics and manuals are readily available on the Internet. (See list of links below.)

My searches have located several web pages where builders constructed replicas on a regular aluminum chassis. I even found one built on an inverted cake pan. Whether you decide to use a replica chassis or roll your own, the fun is in the building and later in using.

The best links I found are by Joe Tyburczy, W1GFH. His site is "Dedicated to AC-1 enthusiasts who wish to restore or homebrew their own version of this rig." He has two similar URLs: **www.qsl.net/wb1gfh/ameco.html** and **www.qsl.net/wb1gfh/ameco1.html**. The pages feature a .JPG file that a silkscreener can use to create a negative/positive image for an AC-1 front panel (courtesy of Frank Allen, W9BMW), an AC-1 chassis layout (with dimensions, so you can build your own chassis), a component list and a downloadable PDF file of the original AC-1 manual.

Terry R Fletcher's, WAØITP, web page has photos and information about an original unassembled Ameco AC-1 kit. Frank Henrikson, KLØSW, donated the kit to the Ozark-Con 2012 QRP Conference (**www.ozarkcon.com**) last April as a Special Prize (**www.wa0itp.com/ac-1.html**).

Michael Tyler, WA8YWO, built a nice AC-1 replica from scratch. His web page is **www.wa8ywo.com/Ac1.html**.

Season's Greetings

This is my 156th column since January 2000. I want to thank you for your continued support by sending me e-mails, suggestions and tips for articles you would like to see. I save them all and try to locate additional information and photos for use in future columns.

I still volunteer at the InfoAge Science/History Learning Center and Museum, in Wall, New Jersey at the site of the former Camp Evans.[2] I'd like to share one of my part time jobs there: **www.youtube.com/watch?v=I6jKocChY4E**

I should be there on several weekends after Thanksgiving. You are welcome to visit me there and don't forget to bring your wish list. For exact dates visit **www.infoage.org**.

[2]J. Dilks, K2TQN, "Vintage Radio," *QST*, Dec 2010, p 96-97.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Locust Fork) — Jan 5 D H R T V
8 AM-2 PM. *Spr:* Blount County ARC. Locust Fork High School, 155 School Rd. *Tl:* 146.7 (91.5 Hz). *Adm:* $5. Tables: $5. Chuck Walley, KF4TCU, 115 Oak Hill Dr, Remlap, AL 35133; 205-681-8354; **kf4tcu@bellsouth.net**; **w4blt.org**.

Louisiana (Minden) — Dec 15 D F H R S V
8 AM-2 PM. *Spr:* Minden ARA. Minden Civic Center, 520 Broadway St. *Tl:* 147.3 (186.2 Hz). *Adm:* $5. Tables: $5 (Vendors, $10 with electricity). John Beck, KB5LE, 3457 Harbor Ln, Shreveport, LA 71107; 318-636-5845; fax 318-221-3922; **kb5le@arrl.net**; **www.n5rd.org**.

Mississippi (Poplarville) — Dec 8
D F H Q R S T V
8 AM-4 PM. *Spr:* Pearl River County ARC. Old National Guard Armory, Hwy 26W and Hwy 11. *Tl:* 145.21 (136.5 Hz). *Adm:* $5. Tables: $10. Ron Smith, KE5WJL, 927 W Lakeshore Dr, Carriere, MS 39426; 601-798-2079; fax 601-798-4001; **vawheelr@bellsouth.net**; **W5PMS.info**.

Missouri (Springfield) — Jan 5 D F H R T V
8 AM-1 PM. *Spr:* Ozark Mountain AR Group. Faith Lutheran Church, 1517 E Valley Water Mill Rd. *Tl:* 147.015 (162.2 Hz). *Adm:* $5. Tables: No charge. James French, KCØTQD, 1505 E Glenwood St, Springfield, MO 65804; 417-425-9962; **kc0tqd@gmail.com**; **www.w0omd.org**.

Tennessee (White Pine) — Jan 5 D H R S V
Set up Friday noon-6 PM; public Saturday
8 AM-2 PM. *Sprs:* Lakeway ARC, Hamblen County ARES, and Cocke County ARES. Walter State Expo Center, 1615 Pavilion Dr. *Tl:* 147.03. *Adm:* $8. Tables: $16 (1 table), $10 (space only). Robert Green, N3DMI, 2225 Kingswood Dr, Morristown, TN 37813; 423-438-4112; **robertgreen2225@comcast.net**; **www.LakewayARC.org**.

Wisconsin (Waukesha) — Jan 5 D F H R V
8 AM-2 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum, 1000 Northview Rd (County Trunk FT). 41st Annual Midwinter Ham Radio, Computer, and Electronics Swapfest. *Adm:* advance $4 (5 for $18 or 10 for $35 before Dec 20), door $5. Tables: 8-ft, $20 (before Dec 20), $24 (Dec 21 and after), electrical outlet $21 (advance only). Send #10 business size SASE for advance reservation by Dec 25 to WARAC Swapfest, Box 1072, Milwaukee, WI 53201. Phil Gural, W9NAW, 414-425-3649; **janphil68@att.net**; **www.warac.org**.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Coming ARRL Conventions

November 17-18
Indiana State, Fort Wayne*

December 1-2
West Central Florida Section, Palmetto*

January 6
New York City/Long Island Section, Bethpage

January 15-25
Quartzfest, Quartzsite, AZ

January 18-19
North Texas Section, Fort Worth

January 19
Southern Florida Section, Fort Myers
Georgia ARES, Forsyth

January 25-26
Mississippi State, Jackson

January 26-27
Puerto Rico State, Hatillo

February 2
South Carolina State, North Charleston

February 8-10
Southeastern Division, Orlando, FL

*See November *QST* for details.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

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. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL Web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

Sean's Picks

Sean Kutzko, KX9X

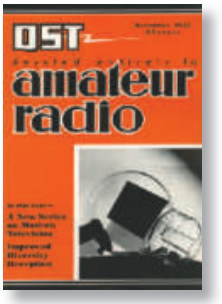
All dates/times are in UTC.

- **State QSO Parties this month:** None
- **QRP Contests this month:** ARS Spartan Sprint (Dec 4), CQP's Great Colorado Snowshoe Run (Dec 5), NAQCC's monthly QRP Sprint (Dec 12), QRP-ARCI Holiday Spirits Homebrew Sprint (Dec 16), Flying Pigs' Run for the Bacon (Dec 17), NAQCC's Milliwatt Sprint (Dec 27).
- **ARRL 160 Meter Contest (Nov 30 - Dec 2):** Don't be intimidated by Top Band; it's not that hard to get on the air on 160. String up as long a wire as you can muster, run it through a good antenna tuner and you'll be making QSOs in no time. ARRL/RAC Sections and DXCC entities are the multipliers.
- **10M RTTY Contest (Dec 2):** Last year was the inaugural run for this event, and they received almost 700 logs. Veteran RTTY contesters AA5AU and WØYK have hit a home run by creating this new contest. Check it out!
- **ARRL 10 Meter Contest (Dec 8-9):** In 2011,the activity was so good, we received 5,300 logs, more than any single ARRL contest in the League's history. Conditions were just spectacular! Will we see the same conditions again? Let's hope so! The 10 Meter Contest has something for everybody: Technician class licensees can work DX aplenty, and the rates will keep even the most seasoned contester busy. Get in on it!
- **ARRL Rookie Roundup - CW (Dec 16)** This is the month for CW in the "RR," created especially for those licensed three years or fewer. Clubs, open your doors and let the newbies take a crack at CW! See page 88.
- **Stew Perry Distance Challenge (Dec 29-30):** This 160 meter contest uses distance-based scoring: Stations you work far away are worth more than stations close to you. This is a lot of fun, even for casual 160 meter ops.

75, 50 and 25 Years Ago

Al Brogdon, W1AB

December 1937



- The cover photo shows a television iconoscope, with the caption, "A New Series in Modern Television."
- The editorial reports that new allocations have been made in the ultra-high frequencies, 30 to 300 Mc, and that 56-60 Mc remains the exclusive property of amateurs.
- James Lamb reports on "Radio Amateurs in the Television Picture."
- Marshall Wilder, W2KJL, gives us an "Introduction to Modern Cathode-Ray Tube Reception" that describes scanning and the make-up of a television signal.
- J.L.A. McLaughlin and Karl Miles report on "An Improved Dual-Diversity Receiver for High-Quality 'Phone Reception."
- HQ staffer George Grammer, W1DF, tells about "Applying Inverse Feedback to the Universal Speech Amplifier," in order to improve frequency response and increase power output.
- Charles Lugar, W8MRR, describes building "A Rotary Spider-Web Loop Antenna with Reflector." Yes, it *does* look like a spider web!
- In "… 78° North, 72° West," A. G. Sayre, W2QY/OX2QY tells of being frozen in for the winter at northern Greenland's Reindeer Point. The article was dictated by Gerry to W1EH on a ham frequency over a 45-minute period, with a HQ stenographer recording it!
- Howard Lawrence, W2IUP, reports on "A Compact 56-Mc. Portable-Mobile Transmitter-Receiver."

December 1962

- The cover shows ol' Santa delivering a gift-wrapped package that might be a new piece of radio gear.
- The editorial *again* asks us to give honest, accurate signal reports. We are that sure all hams will respond.
- B. E. Harris, W6ANU/4, describes "A Tunable I.F. Amplifier Using Transistors."
- Lew McCoy, W1ICP, tells us "How to Protect Your Station from Lightning."
- Ellen White, W1YYM, gives us the "1962 Field Day Results," noting a record 15,000 entrants!
- In "A Low-Noise Preamplifier for 432 Mc.", Leo Schmalenbach, W4TVP, describes his effective circuit, built around a 416B tube.
- Bob Sutherland, W6UOV, and Harold Barber, W6GQK, describe "A Two-Kilowatt P.E.P. Amplifier Using the 3-10000Z."
- George Grammer, W1DF, tells us how to use the station receiver as an analyzer, in "Looking at Phone Signals."
- Samuel Bases, K2IUV, tells about building "A Compact Six-Meter Transmitter" at low cost that runs 100 watts input.

December 1987

- The cover photo looks into a home's window to see an array of Christmas goodies on a table beside the Christmas tree. *Wait a minute!* There's a 30-meter VFO built into that gift tin, a 40-meter QRP CW transmitter in a bandage tin, a "ritzy" audio amplifier built into a Ritz tin, etc. *Ho-ho-ho!*
- The editorial is entitled "Defending 220: The Battle Continues." One hopes that the battle will soon be over and hams will triumph.
- Doug DeMaw, W1FB, tells us "How to Build and Use a VHF Wattmeter."
- Steve Powlishen, K1FO, presents Part 1 of the series, "An Optimum Design for 432-MHz Yagis."
- In "An Extended Double Zepp Antenna for 12 Meters," John Reh, K7KGP tell us how to get 3 dB gain in a little over 50 feet of horizontal wire. John goes forward with the idea, suggesting using two of the antennas in a phased array.
- In Part 3 of "Amateur Radio and the Blind," Butch Nussen, WAØVJR, looks at the station computer, modem, and terminal software.
- Doug DeMaw, W1FB, tells us how to build "A Laboratory-Style RX Noise Bridge."
- Lee Hayford, AH2W, urges the new Novice to keep climbing up the licensing ladder, in "One Ticket Leads to the Next."
- Mary Schetgen, N7IAL, reports, "Father Moran 1986 ARRL International Humanitarian Award Recipient."

Field Organization Reports

September 2012

Public Service Honor Roll

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/public-service-honor-roll**.

510
W5KAV

465
KØIBS

454
KI4KWR

370
KT2D

365
W8DEC

347
W4JVM

343
WM2C

339
W7FQQ

330
W4LHQ

300
WB9YBI

290
K8RDN

289
WB9FHP

285
KB2RTZ

276
W9YQ

270
KA2ZNZ

265
KB2ETO

263
KB8VXE
WB8RCR

253
WB8R

225
KD8HSV

218
KC5ZGG

215
WE2G

212
W2MTA

210
K2HAT

190
N2WKT

184
WA2BSS

182
KT5SR
KD8LSM
KJ4OPX

181
WW4CC

175
W5DY

171
WD8USA

167
KF4JQP

165
KE5HYW
KD8QPF
KB2KOJ

161
N3FKR

160
KGØGG
KK4BVR
W4DNA
KB8RCR
KK3F

153
KF7PDV

150
KB2BAA
WK4P
N7CM
K7EAJ

147
KC8QWH

145
WB4ZIQ

142
K2ABX

141
N9WLW

140
WB9WKO
N9VC
K7OAH
AK4RJ
KJ4JPE
NM1K

138
W4AVD

135
AG9C
KB3MTW
N8IO
W3YVQ

132
KB3JCP

131
WA4YWM

130
NX9K
WØRJA
W7EKB
K6JT
WB2FTX
WB6UZX
W9BGJ
W9WXN
K4IWW
WI2G
KW1U

127
KK5NU

126
WS6P

W7JSW

125
K9LGU
N2JBA
KD7THV
KC2SFU
K2TV

124
KA8ZGY

120
K6HTN
K6FRG
KB3ANO
N3SOQ
N3YNH
NN7H
KB5SDU
N2GJ
KB5KKT
KE4CB
KA4FZI
WA3EZN
KD2AXP
KI4AAN
WB8WKQ
NA7G

116
WJ3P

115
WØLAW
NX8A

114
AD4BL
KØLQB
WB8YYS

112
K4JUU

110
W7QM
N7EIE
KC5OZT
N5NVP
K7BDU
W7QM
WA5LOU
WB8HHZ
W2EAJ
W2DWR
KA1G
N9MN
N7XG
KB1NMO
KB1RGQ
N1IQI

108
W3CB

105
KØVTT
KF7GC
N8SY

104
N3RB
KA8IAF

101
N8OSL

100
K4SCL

N3SW
W3TWV
AA5VZ
KF5IOU
N5OUJ
N1JX
WØCLS
NØMEA
WAØVKC
N9VT
W4OTN
WA4BAM
WA2NDA
K2UHF
KC2PDO
N2RAI
WB6OTS
WG8Z
W8DJG
WB8SIQ
KJ4RUD
NU8K
N7YSS
KD8CYK
K8VFZ
AA3SB
K3IN
N7IE

99
KJ7NO

98
W8CPG
KB3LNM

97
KJ6IJJ
K2GW

96
W4TTO
N2VQA

95
WA1STU
KF4OCU
KK7DEB
N1TF

92
N3RAY
KC8EIA

90
K5AXW
N5RL
KB5KKT
NC3F
KB8HJJ
N2VC
W3GQJ
KJ4HGH
W8IM
KC8BW
N3ZOC
K1YCQ
N2WGF

89
N2DW
KC5MMH

88
W2CC
N1LKJ

87
K7FLI
KJ4G
KD8HPG
AK4HU

86
N2GS
KE5LTA
K4MSG
N8FVM

85
N8CJS
WB3FTQ
K1HEJ

84
AE5VY
KC2EMW
N2RTF

83
KB3GJT
KC4PZA

82
KB9KEG

81
WB6N
KD8LZB

80
KØDEU
NIØI
NØMHJ
KFØXO
KCØZDA
KB7RVF
W8MAL
KS4PG
WB4RJW
WB8TQZ
K8KV
WS4P

79
WDØGUF

78
AL7N
K4VWK
K6GPZ

77
KD8EBY

76
KE5YTA

73
KJ6CNO

71
KD8OEE
N5ASU
KBØDTI

70
KDØAYN
KØDLK
NØDUW
NØDUX
WØFUI
N3NTV
KØPTK
KØRXC
KD7ZUP
N2YJZ

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CT, EB, EMA, ENY, EPA, GA, ID, IL, IN, KS, LA, LAX, MDC, ME, MI, MN, NC, NFL, NLI, NNJ, NTX, OH, OK, OR, WCF, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WI, WNY, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: DE, ENY, EWA, GA, IA, ID, IN, MDC, MI, MN, MO, MT, NLI, NM, NTX, OH, STX, WV, WTX.

Brass Pounders League

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. Call signs of qualifiers and their monthly BPL total points follow.

W5KAV 3672, WB9FHP 2993, NX9K 2552, KK3F 1707, K6HTN 1180, KW1U 1161, N9VC 1160, WØRJA 740, WB8WKQ 734, K7BDU 623, KD8CYK 569, KB8RCR 531, K6FRG 520, W9WXN 503.

The following station qualified for BPL with Originations plus Deliveries: NM1K 105, K8LJG 102.

The following stations qualified for BPL in August, but were not recognized in this column yet: K6HTN 1253, WØRJA 864.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

WA1AFM **Aubin**, Gerald C., Lyndonville, VT
WB1AOU **Carlson**, Dennis J., Swanzey, NH
N1CIR **Boyd**, Robert R., Sunapee, NH
♦W1CKA **Neveu**, Paul A. Jr, Bristol, CT
N1CQS **Godfrey**, Richard L., Winthrop, ME
♦WX1D **Biernacki**, Daniel I., Meriden, CT
W1EKB **Simone**, Madeline B., West Haven, CT
WB1G **Gauthier**, Judith S., Nashua, NH
WA1HOD **Murdock**, Christopher L., Clinton, ME
W1IGP **Miller**, William, Cranston, RI
N1ILD **Mullen**, Gerald, Sandy Hook, CT
W1JNS **Du Pont**, Emil N., Northborough, MA
♦K1JO **Hipp**, John G., Colebrook, NH
N1MJU **Gomez**, Damaso E., Weymouth, MA
W1NFG **Steele**, George D., Cheshire, CT
AC1Q **Fecteau**, George R., Portland, ME
WQ1Q **Mac Kinnon**, Charles W., Warwick, RI
W1REK **Foss**, William H., Cumberland, RI
KA1RFC **Ames**, Ralph L., Dresden, ME
K1SN **Scheimer**, James F., Vienna, VA
WA1UME **Levesque**, Barney, Torrington, CT
N1ZJ **Zornig**, John G., Lincoln, MA
♦ex-WD2AIY **Briggs**, Homer B. Jr, Kings Park, NY
K2AVS **Sturm**, John G., Buffalo, NY
W2BHK **Sheinman**, Joseph, Penhook, VA
AA2FA **Rumsey**, Charles R., Coatesville, PA
N2FLR **Grabel**, Dan, Rye Brook, NY
W2GKN **Wallace**, Francis X., Mission, TX
W2GMV **Nalavany**, John, Linden, NJ
W2IKI **Shrum**, Edgar V., Red Bank, NJ
W2JLN **Nagi**, John L., Albany, NY
KB2KFV **Davis**, Kenneth T., Green Island, NY
KC2LLE **Thew**, Richard S., Plattsburgh, NY
KB2MRD **Montague**, Elizabeth, Ridgefield Park, NJ
W2MRN **Mucha**, John E., Garfield, NJ
N2MZS **Sullivan**, Michael G., Broadway, NY
K2NRA **Rider**, Charles E., Red Hook, NY
KC2NU **Blakley**, Merlin F., Rochester, NY
♦NW2P **Lund**, Eric H., Green Brook, NJ
W2RDC **Campbell**, Von C., Syracuse, NY
W2TAZ **Adams**, Glenn C., Elmont, NY
N2TSF **Rodda**, William H., Morrisville, NY
KC2UXM **Bissonnette**, Clarence A., Dannemora, NY
KB2XS **Lehnert**, Rudolf F., Princeton, NJ
KA2ZEB **Seiler**, Arthur J., Barnegat, NJ
K3BTU **Gersbach**, Willard C., Slatington, PA
G3BVU **Beanland**, C., Acton, MA
AA3CG **Bowers**, Warren F., Frederick, MD
K3DA **Gunnoe**, George H. Jr, Tucker, GA
♦KC3DI **Lange**, Roger, Green Lane, PA
K3DO **Whidden**, Glenn H., Fort Washington, MD
W3EDB **Donovan**, Robert W., Middletown, DE
W3GGM **Supplee**, Theodore H., West Chester, PA
K3HEC **Flick**, Bertram H., Lancaster, PA
W3HSO **Mercer**, Wallace P, Point of Rocks, MD
W3JNO **Weisz**, Paul B., State College, PA
KZ3K **Anderson**, Peter H., Bel Air, MD
KB3KDI **Hooten**, Gerard P., Browndale, PA
KB3PD **Phillips**, Richard L., Newark, DE
KA3PPL **Sill**, Lawrence F., Pittsburgh, PA
K3QBA **Peters**, Bruce S., Ravenna, OH
N3QIL **Duff**, James A., Bethlehem, PA
KA3RMP **Cullison**, Dan L., Harrisburg, PA
KA3VUW **McNaughton**, Bernard, Laurel, MD
KE4APL **Carter**, J. D., Fayette, AL
WD4BSB **Minnick**, Douglas B., Christiansburg, VA
WA4BVH **Adams**, Lucy J., Greenville, NC
K4BWN **Kane**, Richard, Saint Petersburg, FL
KY4D **Fitzner**, Gary R., Tega Cay, SC
KE4DKV **Johnson**, Bernice M., Gulfport, FL
WD4EUY **Berman**, Max, Charlottesville, VA
W4EWL **Rush**, J. W., Owensboro, KY
W4FS **Gorlinsky**, Victor W., Reston, VA
WA4FUM **McAliley**, Stephen C., Riviera Beach, FL
KE4GYR **Graham**, Alex C., Bartlett, TN
W4IBJ **Vignali,** John A., Arlington, VA
W4IKV **Bell**, Allen N., Cape Canaveral, FL
WB4IOB **Kirby**, Matthew O., Knoxville, TN
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Continued on page 108

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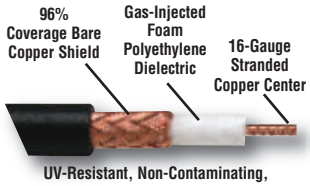


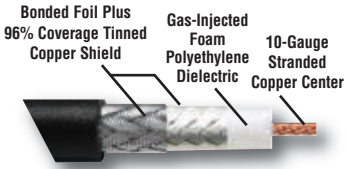
DXE-8X Low-Loss Foam Dielectric Cable (also known as RG-8X or Mini-8)

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

Cable Only		
DXE-8X	By the foot	**$.31/ft.**
DXE-8X-1000	1,000 ft.	**$259.99**

Pre-cut Cable with Connectors		
Part Number	**Length/Ft.**	**Price**
DXE-8XDU003	3	**$9.88**
DXE-8XDU006	6	**$10.88**
DXE-8XDU012	12	**$12.88**
DXE-8XDU025	25	**$17.88**
DXE-8XDU050	50	**$26.88**
DXE-8XDU075	75	**$35.88**
DXE-8XDU100	100	**$44.88**
DXE-8XDU150	150	**$62.88**



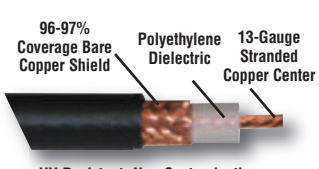
DXE-400MAX Low-Loss Cable

- Low-loss, gas-injected foam polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density polyethylene jacket is UV resistant, ideal for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	6.9 kW	93%
0.5 dB @ 10 MHz	4.8 kW	90%
0.8 dB @ 30 MHZ	2.8 kW	83%
1.1 dB @ 50 MHz	2.1 kW	79%
1.8 dB @ 150 MHz	1.2 kW	65%
3.3 dB @ 450 MHz	0.7 kW	47%

Cable Only		
DXE-400MAX	By the foot	**$.82/ft.**
DXE-400MAX-500	500 ft.	**$364.99**

Pre-cut Cable with Connectors		
Part Number	**Length/Ft.**	**Price**
DXE-400MAXDU003	3	**$11.88**
DXE-400MAXDU006	6	**$14.88**
DXE-400MAXDU018	18	**$26.88**
DXE-400MAXDU025	25	**$33.88**
DXE-400MAXDU050	50	**$58.88**
DXE-400MAXDU075	75	**$83.88**
DXE-400MAXDU100	100	**$100.88**
DXE-400MAXDU150	150	**$158.88**



DXE-213U MIL-Spec Cable

- .405" Type II jacket is non-contaminating and UV-resistant, suitable for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

Cable Only		
DXE-213U	By the foot	**$.89/ft.**
DXE-213U-500	500 ft.	**$409.99**

Pre-cut Cable with Connectors		
Part Number	**Length/Ft.**	**Price**
DXE-213UDU003	3	**$11.88**
DXE-213UDU006	6	**$14.88**
DXE-213UDU012	12	**$20.88**
DXE-213UDU025	25	**$33.88**
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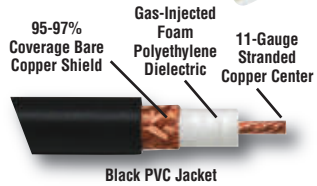

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket
- Low-loss foam dielectric

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	5.4 kW	93%
0.5 dB @ 10 MHz	4.1 kW	90%
0.9 dB @ 30 MHZ	2.2 kW	81%
1.2 dB @ 50 MHz	1.8 kW	77%
2.2 dB @ 150 MHz	1.0 kW	60%

Cable Only		
DXE-8UDU	By the foot	**$.79/ft.**
DXE-8UDU-500	500 ft.	**$359.99**

Pre-cut Cable with Connectors		
Part Number	**Length/Ft.**	**Price**
DXE-8UDU002	2	**$10.48**
DXE-8UDU003	3	**$11.48**
DXE-8UDU006	6	**$14.48**
DXE-8UDU025	25	**$30.48**
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Strong, High-Quality, Corrosion-Resistant, Unique, Purpose-Designed Clamps

Our Clamps are Specified by Scientific, Military & Government Designers! Used by Antenna Builders: Both Commercial & Amateur!

Saddle Clamps with Cast Saddles

- Stainless steel flat washers, lock washers, nuts and bolts
- Corrosion-resistant aluminum saddles with as-cast rough finish for secure grip

U-Bolt Style, designed and sized to fit tubing

- Full 360° grip for specified tubing size

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-SAD-050A	0.50	1/4-20	$4.95
DXE-SAD-075A	0.75	1/4-20	$5.35
DXE-SAD-100A	1.00	1/4-20	$5.70
DXE-SAD-125A	1.25	1/4-20	$6.55
DXE-SAD-150A	1.50	1/4-20	$7.40
DXE-SAD-175A	1.75	1/4-20	$8.55
DXE-SAD-200A	2.00	5/16-18	$9.75
DXE-SAD-200B	2.00	3/8-16	$10.95
DXE-SAD-250A	2.50	5/16-18	$11.75
DXE-SAD-250B	2.50	3/8-16	$13.25
DXE-SAD-300A	3.00	5/16-18	$13.30
DXE-SAD-300B	3.00	3/8-16	$14.90
DXE-SAD-400A	4.00	3/8-18	$34.40
DXE-SAD-450A	4.50	3/8-16	$39.90

Dimensions in Inches.

V-Bolt Style, sized to accommodate ranges of tubing sizes

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-CAVS-1P	0.50 to 1.75	1/4-20	$9.95
DXE-CAVS-11P	0.50 to 1.75	5/16-18	$10.45
DXE-CAVS-2P	1.00 to 2.00	5/16-18	$11.95
DXE-CAVS-3P	2.00 to 3.00	3/8-16	$14.95

Dimensions in Inches.

Clamps with black powdercoated saddles are also available in U-Bolt and V-Bolt styles, designed and sized to fit ½" to 2" tubing.

Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads.

- A356-T6 cast aluminum saddle, with rough, as-cast finish for high-torque grip on masts, etc
- Cast stainless reinforcement plate included
- Armor coated bolt sets sold separately

Part Number	Tube O.D.	Price
DXE-SDS-200P	2.00	$32.00
DXE-SDS-250P	2.50	$39.00
DXE-SDS-300P	3.00	$49.00

Dimensions in Inches.

Resin Support Blocks

Securely mount tubing to any flat surface. An insulated mount between tubing and plates, ideal for antenna construction and electrical applications.

- Optional stainless steel reinforcement plates available

Part Number	Tube O.D.	Price
DXE-RSB-I02500	0.250	$2.65
DXE-RSB-I03125	0.3125	$2.65
DXE-RSB-I03750	0.375	$2.65
DXE-RSB-I05000	0.500	$2.90
DXE-RSB-I06250	0.625	$2.90
DXE-RSB-I03400	0.750	$3.05
DXE-RSB-I10000	1.000	$3.05
DXE-RSB-I11250	1.125	$4.70
DXE-RSB-I12500	1.250	$4.70
DXE-RSB-I11500	1.500	$4.70
DXE-RSB-I13400	1.750	$7.15
DXE-RSB-I20000	2.000	$7.15
DXE-RSB-I22500	2.250	$7.95

Dimensions in Inches.

Cushioned P-Clamps

- Provides strain relief of coaxial cable connections
- Grips the cable jacket without nicking or cutting

DXE-CPC-250 For RG-8X, RG-6, RG-59 cable.....pack of 10 **$14.95**

DXE-CPC-375 For RG-213, RG-8, RG-11 cable.....pack of 10 **$14.95**

V-Bolt Style Saddle Clamps with Stainless Steel Saddles

- Stainless Steel Saddles, serrated to secure hard pipe surfaces
- Stainless steel V-bolts and hardware

Part number	Nominal Size	Price
DXE-SSVC-1P	.50 to .75	$6.95
DXE-SSVC-150P	1.00 to 1.50	$9.95
DXE-SSVC-2P	1.00 to 2.00	$11.95
DXE-SSVC-3P	2.00 to 3.00	$14.95

Dimensions in Inches.
Also available with a tab and 1/4" hardware for grounding as shown.

Coaxial Cable Grounding Brackets

- Stainless steel bracket supplied with stainless steel V-Bolt and hardware

DXE-CGB-150 Fits .50" to 1.50" O.D. tube **$15.95**

DXE-CGB-200 Fits 1.00" to 2.00" O.D. tube **$15.95**

Stainless Steel, Studded Band Clamps

- Welded 10-24 stud
- Easy connection to aluminum elements
- Useful for mounting items to round or irregularly shaped structures

Part Number	Nominal Size	Price/Pack of 2
DXE-ECLS-050	0.500	$9.99
DXE-ECLS-062	0.625	$9.99
DXE-ECLS-075	0.750	$9.99
DXE-ECLS-087	0.875	$10.99
DXE-ECLS-100	1.000	$10.99
DXE-ECLS-125	1.250	$11.49
DXE-ECLS-150	1.500	$11.49
DXE-ECLS-175	1.750	$11.49
DXE-ECLS-200	2.000	$11.49
DXE-ECLS-225	2.250	$11.49
DXE-ECLS-250	2.500	$11.99
DXE-ECLS-275	2.750	$11.99
DXE-ECLS-300	3.000	$11.99
DXE-ECLS-325	3.250	$11.99

Dimensions in Inches.

Tell us how you used DX Engineering clamps. The best design will win 200 DX Bucks! One winner every month. Details at DXEngineering.com!

The current winner: a side mount for an EMCOMM trailer using RSB-series Resin Support Blocks and DXE Aluminum Tubing to provide easy deployment of antennas by the K8CY Ashtabula County Amateur Radio Club. See it on the Customer Showcase at DXEnginering.com.

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Source Code: QST 12/2012

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A patented*, sophisticated receiving system with time delay phasing for broadband performance. Optimized to produce wider and deeper rear nulls and a narrower main lobe. Noise and undesirable signals are greatly reduced by a superior front-to-rear ratio (F/R). Better control of phase and currents provides a cleaner pattern than found on available TX four-square arrays.

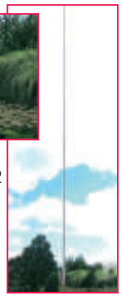
- Less susceptible to high angle signals compared to EWE, Flag, Pennant, and K9AY antennas
- Excellent directivity with better signal-to-noise ratio
- Switchable in four 90 degree-spaced directions
- Usable over a very wide frequency range with DXE-ARAV3 active elements
- Requires less area than a Beverage antenna
- Active elements require minimal ground system
- Enhanced relay contact reliability

The complete system includes all electronics, four ARA active antennas, TVSU sequencer, 1,000 feet of F6 flooded cable, connectors, and assembly tools.

DXE-RFS-SYS-4P	Complete System with antennas	**$1,650.00**
DXE-RFS-SYS-2P	Controller and Switch only	**$389.95**
DXE-RFS-SYS-3P	160/80/40M Electronics	**$799.00**

US Patent Number 7,423,588

Full Size 75/80 Meter Quarter-Wave Vertical Antennas



The 68 foot tall, high-performance, full size antennas have rugged base sections (2, 3 or 4 inch diameter) made from aircraft-grade aluminum tubing. The VA-1 requires simple guying. The VA-2 and VA-3 models are very stout and don't require guying. The VA-2 and VA-3 antennas are supplied with a Heavy Duty Plus Stainless Pivot Base and can be lowered easily with the optional, DXE-VRW one-man, manual winch.

- 2:1 bandwidth up to 500 kHz
- DX Engineering structural design + high strength tubing manufactured to rigid specifications **= Highest Wind Ratings**
- High strength, UV-protected Extren® insulator **= High Power Handling Capacity**
- Specially manufactured stainless steel and aluminum saddle clamps, stainless steel bolts, and precision machining **= Reliability Second to None**
- Specially manufactured Pivot Base supplied with VA-2 and VA-3 antennas **= Easy Tilt Up and Down**

DXE-7580FS-VA-1	Vertical Antenna, standard HD, 2 inch O.D. base section	**$379.50**
DXE-7580FS-VA-2	Vertical Antenna, Heavy Duty, 3 inch O.D. base section	**$825.00**
DXE-7580FS-VA-3	Vertical Antenna, Super Duty, 4 inch O.D. base section	**$1,775.00**

DXE-VRW-1 Manual Winch

A great option, this winch allows one person to easily raise or lower a VA-2 or VA-3 vertical antenna.

DXE-VRW-1 Manual Winch.....**$169.99**

Sale Priced!

Made in USA

SignaLink™ USB Unit from Tigertronics

- Software included on CD ROM
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Easiest installation and setup—for Mac or PC
- Supports all sound card digital and voice modes, including MT63, EchoLink®, PSK-31, SSTV, CW and RTTY

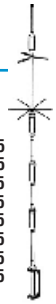
TIG-SL-USB **$84.50**

•Requires a radio interface cable

Any radio interface cable (except the special Elecraft K3 cable), is only **$12.95** when purchased with a SignaLink™ unit

Hustler Vertical With DXE Performance!

Add Bands to Your BTV!

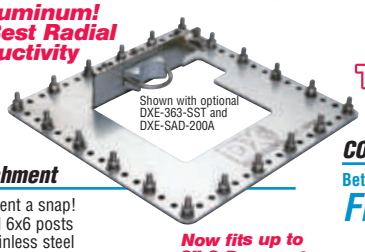


DX Engineering stocks replacement parts for all BTV antennas

Easiest assembly and tuning of any multi-band vertical!

HUS-4BTV	(10, 15, 20, 40M)	**$124.95**
HUS-5BTV	(10, 15, 20, 40, & 75-80M)	**$159.95**
HUS-6BTV	(10, 15, 20, 30, 40, & 75-80M)	**$189.95**
DXE-8X19-RT	Coax Jumper Cable to BTV Base	**$16.95**
DXE-A0K-DCF	SO-239 Add-On Kit for BTV Base	**$22.95**
DXE-AOK-12M	12M Add-On Kit for BTV	**$59.95**
DXE-AOK-17M	17M Add-On Kit for BTV	**$69.95**
DXE-AOK-60M	60M Add-On Kit for BTV	**$74.95**

Not Cheap Aluminum! Guarantees Best Radial System Conductivity Over Time



Stainless Radial Plate with Coax Attachment

Makes radial attachment a snap!

- Fits 3" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

Now fits up to 3" O.D. mount

DXE-RADP-3	Complete with 20 stainless bolt sets	**$54.50**
DXE-RADP-1HWK	20 sets of 1/4" stainless hardware	**$7.50**
DXE-SSVC-2P	Stainless Saddle Clamp for attachment to steel tube 1" to 2" O.D.	**$11.95**
DXE-SSVC-3P	Stainless Saddle Clamp for attachment to steel tube 2" to 3" O.D.	**$14.95**
DXE-363-SST	Silver/Teflon® bulkhead connector	**$6.95**
DXE-VFCC-H05-A	Vertical Feedline Current Choke	**$134.95**
DXE-RADW-500K	Radial Wire Kit, 500 feet of wire, 20 lugs, 100 steel anchor pins	**$74.95**
DXE-RADW-1000K	Radial Wire Kit, 1,000 feet of wire, 40 lugs, 200 steel anchor pins	**$142.95**
DXE-STPL-100P	Steel Radial Wire Anchor Pins, 100 pack	**$16.00**

Biodegradable Anchor Pins Also Available

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	**$39.95**
DXE-UT-808X	Cable Stripper for RG-8X, 9258, etc	**$39.95**
DXE-UT-80P	PL-259 Assembly Tool	**$22.95**
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CNL-911	Coax Cable Cutters	**$23.75**
DXE-170M	Precision Shear Side Cutters	**$7.95**

Now available in cost-saving tool kits with carrying case

DXE-UT-CASE	Molded carrying case only	**$22.95**
DXE-UT-KIT1	Basic Coax Cable Prep Kit	**$99.95**
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Antennas

FREE! RBA-1:1 Balun or RU-4:1 Unun
When You Buy A S9V 43', 31' or 18' Multiband Antenna

Purchase an S9v 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!

S9v43 $199.99
80-6 meters *Fixed Operation*

The S9v 43' is a high-performance lightweight telescoping fiberglass vertical. The best value in high-performance 'tall' verticals!

S9v31 $99.99
40-6 meters *Fixed or Portable Operation*

S9v18 $49.99
20-6 meters *Fixed or Portable Operation*

The S9v 31' and 18' are tapered, ultra-lightweight fiberglass vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

S9rp $39.99
Aluminum Radial Plate
Includes 20 sets of stainless steel nuts & bolts

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

NEW! Z-817H
The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal Alkaline batteries (not included). 2000 memories cover 160 through 6 meters.
Suggested Price $159.99

- RF Sensing
- Tunes Automatically
- No Interface Cables Needed

AT-200ProII
The AT-200ProII now includes LEDs to show antenna position and if the tuner is in bypass. A two position antenna switch stores 2000 memories per switch. Handles up to 250 watts SSB or CW on 1.8 to 30 MHz and 100 watts on 54 MHz. Rugged and easy to read LED bar graphs simultaneously show RF power and SWR. Includes a six foot DC power cable. **Suggested Price $259.99**

AT-1000ProII
LDG Electronics' new flagship 1KW tuner features: 5 to 1,000Watts PEP; RF Sensing; Auto and Semi Tuning Modes; 1.8 to 54 MHz range; 6 to 800 ohm range (15 to 150 on 6M); simplified operation; and an optional external 4.5" analog meter. With the two position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six foot DC power cable. **Suggested Price $539.99**
Optional M-1000 external analog meter $129.99

IT-100
Matched in size to the IC-7000 and IC-706, for either manual or automatic tunes, and status LEDs. Control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. For your Icom radio that is AH3 or AH-4 compatible.
Suggested Price $179.99

YT-100
For Yaesu FT-857, FT-897 and FT-100 (and all D models) an integrated tuner, powered by the interface. Press the tune button on the tuner, and everything else happens automatically.
Suggested Price $199.99

KT-100
For AT-300 compatible Kenwood transceivers (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies.
Suggested Price $199.99

YT-450
Designed for Yaesu's newest 100 watt radios. Interfaces directly with the Yaesu FT-450 and FT-950 radios. Press the tune button on the tuner and the rest happens automatically. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1. 2000 memories recall settings in an instant! Seamless connection to a PC. **Suggested Price $249.99**

YT-847
YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the tune button on the tuner and everything else happens automatically! **Suggested Price $249.99**

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We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

LDG ELECTRONICS

radio not included

AT-897Plus
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-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and 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 $199.99***

NEW! AT-600ProII

Building on the success of the AT-600Pro, we refined and expanded the model with an optional external 4.5" analog meter. The new AT-600ProII keeps many of the same features of the previous model, but simplifies the operation. With the two-position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six-foot DC power cable.

Suggested Price $369.99

Optional M-600 external analog meter $129.99

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes six foot DC power cable. ***Suggested Price $159.99***

AT-100ProII

• RF Sensing
• Tunes Automatically
• No Interface Cables Needed

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 with LEDs, allowing you to switch instantly between two antennas. The AT-100ProII requires just 1 watt for operation, but will handle up to 125 watts. Includes six foot DC power cable.

Suggested Price $229.99

Z-11ProII

Meet the Z-11ProII, 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. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes six foot DC power cable. ***Suggested Price $179.99***

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - 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. 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. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required.

Suggested Price $129.99

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with DCU-2

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T-2X
$799.95
T-2XD2
$899.95
with DCU-2
See more info below

For large medium antenna arrays up to 20 square feet wind load. Has 5-second brake delay and Test/Calibrate functions. Low temperature grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, 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 maximum mast size.

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.

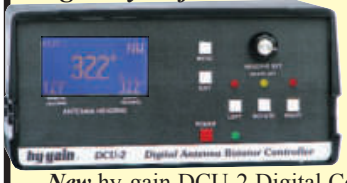
HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel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

TAILTWISTER 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 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.**

hy-gain® DCU-2 Digital Rotator Controller

. . . gives you full automatic and manual control of hy-gain rotators



DCU-2
$399.95

New!

New hy-gain DCU-2 Digital Controller gives you fully automatic or manual control of your *hy-gain HAM or Tailtwister Rotators*. Just dial in your beam heading and press the rotate button or let *Ham Radio Deluxe* (or other program) control your DCU-2. Your antenna automatically rotates to your desired direction precisely and safely.

First, the DCU-2 makes sure your antenna is free and safely unlocked before turning begins and then turns off your motor before your antenna reaches its final destination. Your antenna gently coasts to a stop before the brake locks. This greatly reduces potentially damaging overshoot.

Fine tuning and full manual control is effortless with *automated* Left and Right direction buttons - - no more worrying about manually releasing and relocking the brake. Brake automatically releases before fine tuning begins and relocks after fine tuning is completed.

Bright blue LCD displays actual heading, dial-in beam heading, computer controlled beam heading in one degree increments and your call sign.

Advanced Features

AutoBrake *Release* - no need to remember to release brake or release too soon - release time is automatic and settable 0-8 seconds.

Coast feature allows antenna to gently stop before the brake locks. Adjustable coast delay (*0-10 degrees*) turns off motor before antenna reaches its final destination to reduce potentially damaging overshoot.

AutoJog unlocks and frees your antenna before turning begins. Great for older rotators with "sticky" brakes. It jogs your rotator backwards slightly to ease brake pressure enough to release.

Offset feature allows you to calibrate your display to show actual beam heading.

USB and RS-232 ports for computer control. Compatible with *Ham Radio Deluxe* and other programs. Adjustable LCD sleep time. Field upgradeable Firmware. 8.5W x 4.3H x 9D inches. 110 VAC. **Order** DCU-2X for 220 VAC.

HAM-VI

HAM-VI
$749.95
with DCU-2

New!

New HAM-VI, $749.95, like HAM-IV but with DCU-2 digital controller. For medium antennas up to 15 square feet wind load.

Rotator Options

MSHD, $109.95.
Above tower heavy duty mast support. For T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$ to $2^{5}/_{8}$ inch OD. Centers on 2 ½ inches.

TSP-1, $34.95. Lower spacer plate for HAM-IV, HAM-V and HAM-VI.

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.**

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- TX: 144-148, 222-225, 430-450 MHz
- RX: 0.1-1300 MHz (cell blkd) • Dual band RX
- FM Wide/Narrow, AM, SSB and CW receive modes
- Power: 5/0.5/0.05W • Memories: 435

TH-D72A 2M/440 FM HT Built-in GPS

- TX: 144-148, 430-450 • RX: 118-174, 320-524 MHz
- Power: 5/0.5/0.05W • Memories: 1000 • USB Port
- 1200/9600 bps packet TNC • SkyCommand and APRS
- Stand-alone Digipeater • Built-in High Performance GPS
- GPS logging - stores up to 5,000 points of track data
- Echolink® ready • KISS mode protocol

TM-281A 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 65W • Memories: 200

TM-D710A Dualband FM Mobile w/TNC

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G6 & EchoLink® ready

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- Plug-and-play adds GPS for TM-D710A & RC-D710
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- Longer cable sold separately to mount on vehicle's glass

TM-V71A Dualband FM Mobile

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready
- The optional RC-D710 can replace the TM-V71A control panel to enable all the features of the TM-D710A.

TS-480HX 200W HF/6M Mobile

- TX: HF/6M • RX: 0.5-60 MHz • Power: 10-200W (with two optional 22A power supplies) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-480SAT 100W version with built-in automatic antenna tuner.

TS-2000 100W HF/VHF/UHF Transceiver

- TX: HF/6/2M/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
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

TS-590S 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz
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- Memories: 110 + 10 Quick Channels
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- Optional HM-189GPS Speaker Mic adds GPS capabilities

IC-92AD 2M/440 D-Star & FM HT

- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/2.5/0.5/0.1W • Dual RX
- Optional HM-175GPS Speaker Mic adds GPS capabilities

ID-880H 2M/440 FM & D-Star Mobile

- TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W
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- SSB, CW, RTTY and AM (2-40W)

IC-7000 HF/6/2M/440 MHz Mobile

- TX: HF/6/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
- Memories: 503 • 41 band-widths w/sharp or soft filter shape

IC-7200 HF/6M Portable

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 201 • Rugged design for outdoor use
- 32-bit IF-DSPs + 24-bit AD/DA Converters
- USB Port for CI-V Format PC Control & Audio In/Out

IC-7410 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- 15kHz 1st IF filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
- Automatic antenna tuner • USB connector for PC control

IC-9100 HF/6/2M/440 MHz All Mode

- TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
- Power: 2-100W HF/6/2M & 2-75W 440 MHz
- Memories: 297 • Optional D-Star Board • Auto Tuner
- USB Port for CI-V Format PC Control & Audio In/Out

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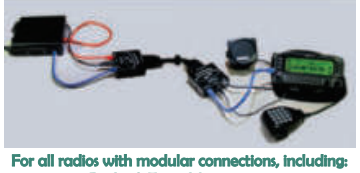

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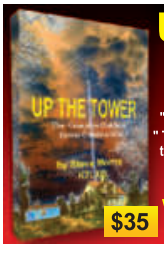

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• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
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FT-2000D

RF output is 200W, PS is external

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- Maximum output SWR: 2:1
- SWR protection: automatic switching to STBY
- Tube: GU84b Ceramic tetrode
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Introducing the

VNA *uhf* two-port Vector Network Analyzer

Operates from 5 kHz to 600 MHz. For details on this new product, see the Array Solutions webpage.

New pushbotton

Integrated Controller

NEW!

For 8-pak and 4x8-pak systems.

4X8-Pak: Four Radio, 8 Antenna Switch System

- The heart of your multiple (up to 4) radio system
- Switches up to 8 antennas to 2, 3, or 4 radios (2-radio version available)
- Zero risk of connecting radios together
- Perfect for competitive Multi-Single, Multi-Two, or Small Multi-Multi Contest Stations
- High isolation between all ports
- Economical 4-wire control & network cable
- Networks with BandMaster, Filter Max, and AS-419 Bandpasser
- Manual and/or remote control via supplied PC Application and Basic Controllers
- Manual and/or Fully Automatic switching when used with BandMaster or Integrated Controllers
- Programmable for tri-banders and other multi-band antennas
- USB Interface

SSB Electronics Antenna Switches and Preamps

Array Solutions now carries the full line of SSB's top of the line VHF, UHF, and SHF sequencers, switches and preamps.

Bird Wattmeter Digital Display Conversion Kits

Upgrade for your Bird analog watt meter that will transform your Model 43 into a state of the art digital meter! AS-43A Average Power Reading and the AS-43AP Average and Peak Power Reading Bird Wattmeter Digital meter kits.

Stack Match II Plus!

Stack two yagis on any HF band or 6m and take advantage of high or low angle propagation with upper/lower/BIP/BOP without any phasing lines!

Prosistel Rotators

The most powerful antenna rotators available for amateur, commercial, government or military purposes.

RigExpert AA-1000

Antenna Analyzer

RigExpert AA-1000 is a powerful antenna analyzer designed for testing, checking, tuning or repairing antennas and antenna feedlines.

Other top-quality brands represented by Array Solutions...

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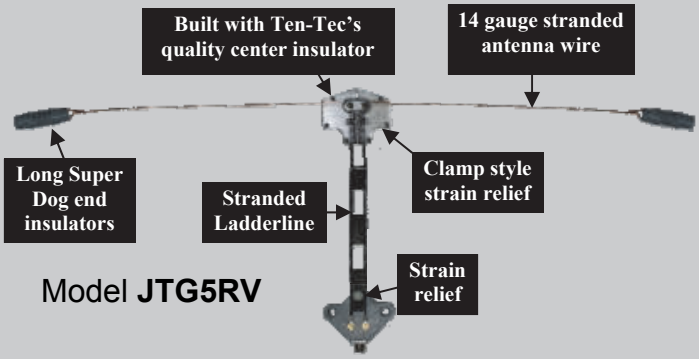
JETSTREAM

Premium G5RV

10-80 meters

102' overall length



Model **JTG5RV**

$69.95

Customer Appreciation Day

Saturday December 8, 2012, 10AM – 4PM

Presentations, Prizes, Special Pricing

Must be present to enter prize drawing

Manufactures scheduled to attend this year:

Ameritron, Cushcraft, Heil, Hygain, Icom, Jetstream, Kenwood, MFJ, Mirage, Vectronics and Yaesu.

Take Your Ham Radio Test
8:00 AM FREE testing!

YAESU
The radio

FTDX3000D

Yaesu is pleased to announce the introduction of our FT-DX3000D 100W HF/50MHz Transceiver - the new Leader in the mid-price range of HF/50MHz radios. Continuing the proud Yaesu "FT DX" Legacy of Excellence established decades ago, the FT-DX3000D brings forward critical design concept advancements created for the FT-DX5000 and FT-DX9000. Yaesu's proved IF DSP package of features for effective and optimized QRM rejection make the FT-DX3000D a pleasure to use even on a crowded band.

DVS6 Digital Voice Memory Unit 65.95
FC40 Auto Tuner for Long Wires 304.95
MD100A8X Desk Top Mic 149.95
MD200A8X Desk Top Mic 389.95
SP2000 Ext Spkr w/Audio Filters 198.95
XF127CN 300Hz CW Filter 199.95

FT950

This superb radio features DSP filtering, 100 Watts of power output, factory installed antenna tuner and many of the outstanding ergonomic and performance features first introduced in our FTdx-9000 and FT-2000 flagship radios.

DMU2000 Data Management Unit ..... Call
FH2 Remote Keypad 95.95
MD100A8X Desk top mic 149.95
MD200A8X Desk top mic 389.95
SP2000 External Speaker 198.95
UTUNINGKIT A, B, or C model ..... Call

FT1900R

The ruggedly built yet compact new FT1900R 2m transceiver brings you Yaesu's legendary mechanical toughness along with outstanding receiver performance and 55 watts with crisp, clean audio that will get your message through!

JTPS14M Jetstream Power Supply 49.95
MLS100 External Speaker 47.95
MX2 Hustler 2m Mag Mount 32.95

FT8800R

If you're ready for the best in a Dual-Band FM Mobile Transceiver, the FT-8800R is ready for you! With easy operation, outstanding receiver performance, and crossband repeat capability, the FT-8800R is the new standard of comparison!!

ADMS2I Software and cable 39.95
JTPS14M Jetstream Power Supply 49.95
MLS100 External Speaker 47.95
MMB60 Quick Release Mobile Bracket 37.95
YSK8900 Separation Kit 45.95

FT7900R

Yaesu's economically priced One-Touch Operation FT-7900R Dual band FM mobile. Back-lit push button controls ensure extraordinarily easy and safe operation while driving at night. The exceptionally wide receiver coverage provides all sorts of additional uses!

ADMS2K Programming software and cable ... 39.95
MEK2 Microphone Extension Kit 47.95
JTPS14M Jetstream Power Supply 49.95
MLS100 External Speaker 47.95
MMB60 Quick Release Mobile Bracket 37.95
YSK7800 Separation Kit 39.95

Escape with the TM-281A

On or off the road, Kenwood's TM-281A is a mobile radio you can always count on.

As tough as nails, this MIL-STD-compliant transceiver delivers powerful performance, excellent audio clarity, and a host of advanced features. It offers superb operating ease day or night thanks to the large backlit LCD and illuminated keys. So the next time you take off, take the TM-281A.

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Scan with your phone to download TM-281A brochure.

MFJ-259B *World's* most popular Antenna Analyzer is super easy-to-use!

MFJ-259B
$289.95

The MFJ-259B is the world's most popular Antenna Analyzer and the easiest to use! Just select a band and mode. Set frequency. Your measurements are instantly displayed!

Handheld Antenna Lab

Owning the MFJ-259B is like having an entire antenna lab in the palm of your hand!

Measure SWR quickly or make sophisticated measurements such as Return Loss, Reflection Coefficient, Resonance, Complex Impedance (R+jX), Impedance Magnitude (Z) plus Phase in degrees. Covers 1.8 to 170 MHz -- no gaps.

Coax Analyzer

Determine coax cable velocity factor (Vf), loss in dB, coax length, distance to open or short plus detect wrong coax impedance.

Frequency Counter

Measure frequency of external signals using the separate BNC counter input.

Signal Generator

Use as a signal source 1.8-170 MHz with digital dial accuracy for testing and alignment.

Inductance and Capacitance

Measure Inductance (uH) and Capacitance (pF) at RF frequencies not at audio frequencies used by most L/C meters.

Digital and *Analog* Meters

A high-contrast backlit LCD gives precision readings and *two* side-by-side *analog meters* make antenna adjustments intuitive.

Smooth, Stable Tuning

Velvet-smooth reduction drive tuning and precision *air-variable capacitor* makes setting frequency easy and stable.

Battery Saver & More

Battery-saver, low-battery warning, battery voltage meter and charger are all built in. Use ten Alkaline, NiCad or NiMH AA batteries (not included) or 110 VAC with MFJ-1312D, $15.95. 4Wx6¾Hx2D inches.

Here's What You Can Do

Find true antenna resonant frequency
Tune *antenna quickly for minimum SWR*
Match complex loads to your feedline
Adjust *mobile whips without stressing finals*
Determine safe 2:1-SWR operating windows
Adjust *tuners without generating QRM*
Find exact location of shorts and opens
Cut *stubs and phasing lines accurately*
Check cable for loss and contamination
Find *value of unknown coils and caps*
Test RF transformers and baluns
Troubleshoot *filters and networks*
Find self-resonance and relative Q
Check *patterns and compare gain*
MFJ-259B does all this and more!

MFJ Analyzer Accessories

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Special foam-filled fabric cushions blows, deflects scrapes and protects knobs and meters from harm. **MFJ-39C, $24.95.** Like MFJ-29C, but for MFJ-269.

MFJ-66, $24.95. Plug-in coils turns any MFJ Antenna Analyzer into a sensitive and accurate *band switched* dip meter. 2 coils.

MFJ-92AA10, $29.95. Ten MFJ *SuperCell*™ Ni-MH AA rechargeable batteries.

MFJ-99B, $88.90. ***Save $7!*** MFJ-259B Deluxe Accessory Pack: MFJ-29C Pouch, 10 Ni-MH batteries, dip coils, AC adapter. **MFJ-98B, $88.90.** Like MFJ-99B but for MFJ-269.

MFJ-99, $60.85. ***Save $5!*** Like MFJ-99B, less batteries, for MFJ-259B. **MFJ-98, $60.85.** Like MFJ-99 but for MFJ-269.

MFJ-99C, $40.90. ***Save $5!*** AC Adapter and 10 Ni-MH batteries for MFJ-259B/269.

MFJ-917, $29.95. Current balun lets you make balanced line antenna measurements on HF with your MFJ Analyzer. **MFJ-7702, $3.95.** MFJ-917 to MFJ Analyzer adapter.

MFJ-731, $99.95. Tunable RF filter allows accurate Antenna Analyzer measurements in presence of strong RF fields. 1.8-30 MHz.

MFJ-5510, $9.95. Cigarette lighter cord.

MFJ-269 ...1.8-170 MHz and 415-470 MHz plus 12-bit A/D!

The MFJ-269 does everything the MFJ-259B does - and much more!

Expanded Frequency Coverage

MFJ-269 adds UHF coverage from 415 to 470 MHz -- right up into the commercial band. With it, you can adjust UHF dipoles, verticals, Yagis, quads and repeater collinear arrays with ease -- plus construct accurate phasing harnesses and timed cables. Also use it as a signal source to check UHF duplexers, diplexers, IMD filters and antenna patterns.

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!*

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!*

MFJ-269
$389.95

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 coax loss 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!*

Logarithmic Bar Graph

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Uses instrumentation grade N-connector to ensure minimum mismatch on all frequencies. Includes N to SO-239 adapter.

MFJ-269*PRO*™ Analyzer

Like MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

MFJ-269PRO
$419.95

MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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MFJ . . . The World Leader in Amateur Radio!

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.

***No Matter What*™ Warranty**

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

MFJ-969 **$219.95**

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-941E *super value* Tuner

MFJ-941E **$139.95**

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M *mobile* Tuner

MFJ-945E **$129.95**

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$119.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$99.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

MFJ-902 **$99.95**

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-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.

MFJ-16010 *random wire* Tuner

MFJ-16010 **$69.95**

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$99.95**

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 **$89.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 *artificial* RF Ground

MFJ-931 **$109.95**

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.

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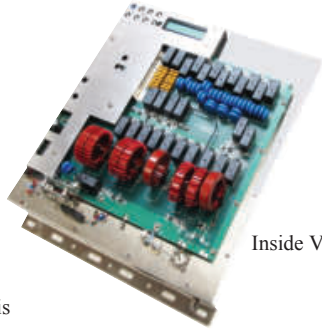
MFJ 1500 Watt *Remote* Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes -- greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$769.95

Bottom Chassis



Inside View

Tune your antenna AT your antenna!

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and *prevent tuning* caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive *StickyTune™ always* tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has *ceramic* feed-through insulator for wire antennas. 2 kV *Teflon*® insulated SO-239 -- prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at *full* 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ *InstantRecall™* recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ *Intelli-Tune™* measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ *AdaptiveSearch™* searches *only* the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional MFJ-1316, $21.95. Weighs 9.5 lbs. 13¼Wx6¾Hx17½D inches.

600W *Remote IntelliTuner™*

MFJ-994BRT
$399.95

MFJ-994BRT -- perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for outdoor use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet, 9¼Wx3Hx 14¼D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

300W *Remote IntelliTuner™*

MFJ-993BRT
$299.95

MFJ-993BRT handles 300 Watts SSB/CW and matches an *extra-wide* 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for remote outdoor or marine use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet measures 9¼Wx3Hx14¼D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

200W *Remote IntelliTuner™*

MFJ-926B
$279.95

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

200W *Remote Econo Tuner™*

MFJ-927
$259.95

MFJ-927, 200 Watts SSB/CW, 6-1600 Ohms, Coax/Wire antennas, 1.8-30 MHz. Weather-sealed, BiasTee. 7½Wx5¼Hx8½D in.

MFJ-2990
$359.95

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide-range *MFJ automatic tuners* at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you *simply put it up!* Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $34.95.** All band ground radial system.

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Show your support for Amateur Radio and ARRL!

ARRL Backpack

Black and silver backpack imprinted with the ARRL diamond against a hemisphere of the world. Features two zippered main compartments, front pocket and side mesh water bottle pocket. Great for carrying ham radio supplies! Size: 18"H x 15"W x 6"D.

ARRL Order No. 0127
Only $19.95*

ARRL Globe Polo Shirt

Classic sport polo featuring the ARRL diamond logo against a hemisphere of the world. Around the perimeter are the words **ARRL–the national association for AMATEUR RADIO** on the front left chest. Sizes: S-4XL

- **Royal Blue Globe Polo**
  Order No. 0146, Only 19.95*
- **Stone Globe Polo**
  Order No. 0211, Only $19.95*

ARRL Globe T-Shirt

Steel blue t-shirt featuring the ARRL diamond on the front left chest, with a large diamond against a hemisphere of the world on the back. Sizes: S-4XL.

ARRL Order No. 0041
Only $12.95*

ARRL Globe Pin

This colorful blue and gold pin will symbolize your support of Amateur Radio and ARRL. Size 1" round. Globe decals and stickers are also available at **www.arrl.org/shop**.

ARRL Order No. 1065
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MFJ-1798
$349.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter *Rotatable* Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency.*

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's 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 M as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint 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.

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Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868
$149.95

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5 1/2Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 7 1/4Wx4 1/2Hx4 1/2D in.

MFJ-891
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MFJ *high-accuracy* Digital SWR/Wattmeter

MFJ-826B has a large high-contrast, high-accuracy *backlit* LCD display. Auto-ranging selects optimum full-scale range from 25W, 250W and 1500W ranges with full 10-bit resolution on each range. Covers entire amateur power spectrum. Built-in frequency counter selects frequency compensated data set to insure highest accuracy for each band. Displays frequency, provides digital read-out for older rigs and QRP rigs. *True* peak/average and forward/reflected power, SWR and frequency are *simultaneously* displayed. Select bargraphs to display forward/reflected power *or* forward /SWR *or* SWR only. MFJ's *PeakHold*™ freezes highest forward power displayed 1, 2 or 3 seconds. When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds. Use 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6 1/2Wx2 5/8Hx6D inches.

MFJ-826B
$179.95

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MFJ-815C
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Lighted 3" VHF SWR Wattmeter, 2M/C/N Meter, SWR/Watts, 1.8 -30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

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220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B
$149.95

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7 3/4Wx4Hx2 1/8D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403
$119.95

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

MFJ-1164B
$79.95

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

MFJ-655B
$219.95

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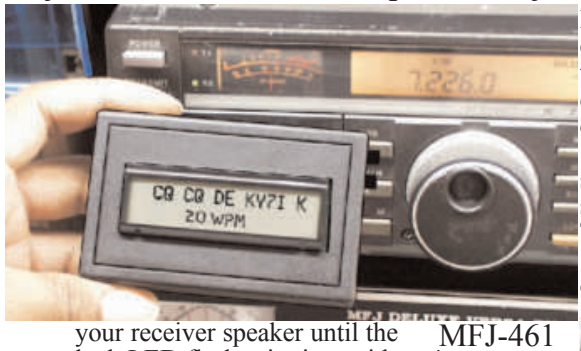
MFJ *Pocket size* Morse Code Reader™

Hold near your receiver – it instantly displays CW in English! Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . . More!



Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW. Digs out weak signals. Phase-Lock-Loop even tracks slightly drifting signals.

MFJ-461 **$89.95**

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable. A battery saving feature puts the MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery. Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny $2^1/_4$x$3^1/_4$x1 inches. $5^1/_2$ ounces.

Super easy-to-use! Just turn it on -- it starts copying instantly!

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $16.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ Morse Code *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-464 **$199.95** *(Keyboard, paddle not included.)*

MFJ-551, $39.95. RFI suppressed keyboard, a must to avoid RFI problems.

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MFJ-564B Black
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***Miniature* Travel Iambic Paddle**

MFJ-561, $24.95. $1^3/_4$Wx$1^3/_4$D x$^3/_4$H inches. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

MFJ Code Oscillator

MFJ-557 **$39.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. $8^1/_2$x$2^1/_4$x$3^3/_4$ inches.

MFJ-550, $14.95. Telegraph Key Only with adjustable contacts. Handsome black.

MFJ Deluxe CW Keyer

Deluxe MFJ Keyer has all controls on front panel for easy access -- speed, weight, MFJ-407D tone, volume knobs, and tune, semi/ **$79.95** auto, on/off push-buttons. You get all keyer modes, dot-dash memories, self completing dots/dashes, jam- proof spacing, sidetone, built-in speaker, type A /B keying. RF proof. Solid state keying. 7x2x6 inches.

MFJ-401D, $69.95. Econo Keyer II has front-panel volume/ speed controls (8-50 wpm), tune switch. Internal adjust weight, tone. Solid state keying. Tiny 4x2x$3^1/_2$ inches.

Keyer/Paddle Combo

MFJ-422D **$189.95**

Best of all CW worlds -- a *deluxe MFJ Curtis*™ *keyer* that fits right on *Bencher paddle*! Adjustable weight and tone, front panel volume and speed controls (8-50 WPM), built-in dot-dash memories, speaker, sidetone, semi-automatic/tune or automatic modes. Use 9V battery or 110 VAC with MFJ-1312D, $15.95. $4^1/_8$x$2^5/_8$x$5^1/_4$ in.

MFJ-422DX, $99.95.

MFJ *Curtis*™ Keyer only, fits on your Bencher paddle or MFJ-564 (chrome) or MFJ-564B (black) paddles above.

MFJ*Pocket* Morse Tutor

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations MFJ-418 or any combination or words or **$89.95** QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ *ClearTone*™ Speaker

MFJ-281, $12.95. Makes copying easier, enhances speech, improves intelligibility, reduces noise, static, hum. 3" speaker, 8 Watts, 8 Ohms.

MFJ 24/12 Hour Station Clock

MFJ-108B, $21.95. Dual 24/12 hour clock. Read UTC *and* local time *at-a-glance*. High-contrast 5/8" LCD, brushed aluminum frame. Batteries included. $4^1/_2$Wx1Dx2H in.

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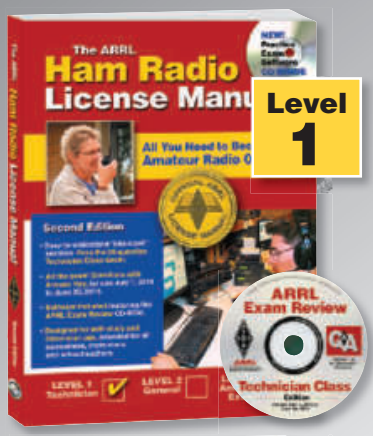

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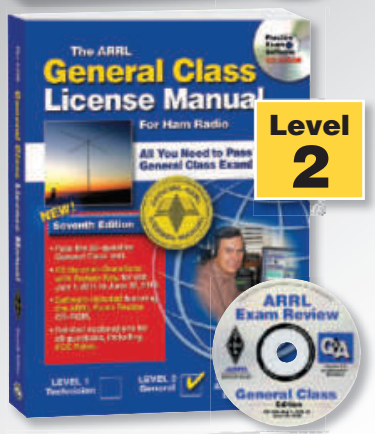

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QST 12/2012

MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$279.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

***Free* MFJ Catalog**

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http://www.mfjenterprises.com *for instruction manuals, catalog, info*

VECTRONICS RF Accessories

300 Watt Antenna Tuner

VC-300DLP
$179.95

VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and 1000 Volt variable capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

300 Watt Mobile Tuner

VC-300M
$129.95

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

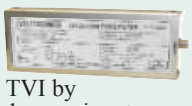
PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front 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. Handles 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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Nearest Dealer, Free catalog, To Order . . .
800-363-2922
Voice: 662-323-5800 **Fax:** 662-323-6551

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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	--	--
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

6 Meter Amplifier

FCC Type Accepted

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.

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

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

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).

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.

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

http://www.mirageamp.com
Nearest Dealer, Free catalog, To Order . . .
800-647-1800
Tech: 662-323-8287 **Fax:** 662-323-6551

MIRAGE
300 Industrial Park Rd Starkville, MS 39759
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Transceivers/Amplifilers

NEW! KENWOOD TS-990S Coming Soon!

This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

$150 Coupon

ICOM IC-7410
HF/6M 100W
USB, LSB, CW, RTTY, AM, FM

$200 Coupon TS-2000S
$250 Coupon TS-2000X

KENWOOD TS-2000S/TS-2000X
High performance true
IF/stage DSP on main band

YAESU VL-1000
High performance linear amplifier covers
160 to 15 and the 6 meter amateur bands

$175 Coupon

KENWOOD TS-B2000
A silver version of the TS-2000. Suitable for mobile applications with the use of the optional RC-2000 Mobile Controller.

$50 Mail-in Rebate

YAESU FT-950
100 Watts of power output on
SSB, CW, and FM (25 Watts AM carrier),
exceptional performance both on
transmit and receive

$300 Mail-in Rebate

YAESU FTDX-9000C/D/MP Series
200/400 watts, dual meters & LCD, VRF
installed in main receiver, extra key & head-
phone jacks, internal power supply

KENWOOD TS-590S
160-6 meters, Noise Reduction,
Keypad Entry, Roofing Filters,
HF and 6M Antenna Jacks

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ICOM IC-7100
Affordable all-mode HF/VHF/UHF mobile

$100 Coupon

ICOM IC-7600
Selectable roofing filters at 3kHz,
6kHz and 15kHz, IF-DSP
technology

$25 Coupon

ICOM IC-7200
HF/6 100W easy-to-use controls,
DSP filtering with 51 passband widths,
digital twin passband tuning

$400 Mail-in Rebate

New Low Price!

YAESU FT-2000
Provides a full 100 Watts of power
output (AM: 25 W) on the
160-6 Meter Amateur bands.

New Low Price!

YAESU FTDX-5000/D/Series
Shown above withSM5000
Station Monitor
(optional on some versions)

New Low Price!

$50 Mail-in Rebate

YAESU FT-450D
HF Tranceiver, State of the art IF DSP
technology, world class performance

$250 Coupon

KENWOOD
TS-480HX/TS-480SAT
Base Mobile, HF/6M, Electronic
Memory Keyer, Audio D.S.P, Digital NL

New Low Price!

YAESU FT-2000D
Incorporates an amazing
number of advanced features

$400 Mail-in Rebate

NEW!

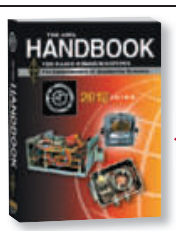
YAESU FTDX3000D
Premium HF/50MHz Transceiver,
Full color TFT display

Nissei NS-508 Microphone
Output voltage:
0-30mV (RMS)
Output impedance:
500 - 100K ohms

Nissei LP-350 Lightning arrester
Frequency:
DC-500 MHz
Power: 300 W Max

KENWOOD Coupons good through February 28, 2013. ICOM Coupons good through December 31, 2012.
YAESU Mail-in Rebate Promotion valid until December 31, 2012.

Prices, products and policies may vary between dealer locations. Not all dealers have all product lines. All prices and products subject to change. Not responsible for typographical errors.



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from HamPROS!

Ideas on all the latest Amateur Radio Equipment

Mobile Radios

YAESU FT-1900R
200 Memories
8 Memory Banks,
Automatic Power-Off

YAESU FT-2900R
200 Alpha-numeric
Memories

YAESU FT-7900
Five One Touch
1000 Memories

YAESU FT-8800R
2M/440MHz
Dual Band, Dual RX,
50/35 watts

YAESU FT-8900R
10M/6M/2M/440MHz
FM Quad Band

YAESU FTM-10R
2M/440Mhz
50/40W Mobile

YAESU FTM-350AR
2M/440 50W
220MHz 1W
APRS & WIRES Ready

ICOM IC-2300H
144-148 MHz,
207 Memories, Scanning,
Squelch Attenuator

ICOM IC-2820H
2M/440 50W
(DSTAR option
IC-UT123)

ICOM ID-880H
144/440MHz 50W FM
D-STAR ready

KENWOOD TM-281A
2M, FM Mobile
Transceiver, 200 memory
channels

KENWOOD
TM-D710A
2M/70cm Mobile
50W/50W

KENWOOD
TM-V71A
1000 Alpha
Memories,
Dual Display

ICOM IC-7000
100 Watts HF+6M
50 Watts 2M, 35 Watts,
All band Multimode

Handheld Radios

Priced from $55.95

YAESU FT-250R
5 Watts RF
Output,
Backlit Keypad

YAESU FT-270
5 watts
RF Output
200 Memories

TYT TH-UVF1A
Dual Band HT
144-148 MHz
VHF(TX)

ICOM IC-T70A
2M/440MHz
Wide/Narrow
channel spacing

YAESU VX-6R
Triple band
2M, 222,
440, 5W

KENWOOD
TH-D72A
5W HT/GPS/TNC,
LCD Dot Matrix
Display

YAESU FT-277
Backlit LCD,
compact,
high-performance
FM mono-band

YAESU FT-60R
2 meter,
440 MHz
5 watts output
on both bands

Wouxun
KG-UVD1P
Dual Frequency,
Dual Display
144-148 MHz

YAESU
VX-3R
2M/440MHz
Micro-mini 1.5W
2M 1.0W

YAESU
VX-8GR
Full 5 watts
Integrated GPS,
CTCSS/DCS

KENWOOD
TH-F6A
Compact
144/220/
440MHz

Baofeng UV-5R
Dual Band HT
136-174/
400-480MHz
128 Channels

Wouxun
KG-UV6D
Dual Band
VHF/UHF
199 channels

ICOM
ID-31A
440MHz HT,
Full Dot Matrix
Display,
Navigation
D-STAR ready

We also carry many other products manufactured by Alinco, Coaxial Cable and Connectors, Princeton Antennas, Heil Sound, LDG Electronics, Samlex America, Comet, MFJ, Astron, W5YI, and more!

ICOM IC-92AD
Dual Band
Operation
1304 Memories

YAESU VX-8DR
FM on
50/144/430
MHz

YAESU
VX-7RS – Silver
VX-7RB – Black
Triple band

YAESU FT-857D
HF/6/2/440 all mode,
Electronic Keyer
200 Alpha Memories

YAESU FT-817ND
HF/6/2/440
all mode
5W QRP all bands

YAESU FT-897D
HF/6/2/440 all mode
Portable 100W HF/6,
50W 2M, 20W, 440MHz

Antennas and Mounts

Surmen Max-1 Antenna Black
SO-239
Now in Black and Natural
Frequency (MHz): 144/430
Max. Power(W): 60
V.S.W.R: <1.5
Length (M): 0.92
Weight(g): 135
Connector: PL-259

PRESENTING the Surmen NEW Max-1 NMO in Black!
Frequency (MHz): 144/430
Max. Power(W): 60
V.S.W.R: <1.5
Length (M): 0.92
Weight(g): 135
Connector: PL-259

S-850B Antenna
Frequency (MHz): 144/430
Max. Power(W): 150
V.S.W.R: <1.5
Length (M): 1.04
Connector: PL-259

WP-115
Frequency (MHz): 144/430 MHz
Z (ohms): 50
Max Power: 10W
Length (mm): 400
Weight: 42g
Connector: SMA or BNC

KY-66
Trunk Lid/Hatch Back Door Mount
Color: Chrome
Weight: 168g

P-800 External Speaker Speaker
Max Power: 5 Watts
Cord: 4M
Plug: 3.5mm mono
Size: 90x85x35MM

Magnetic mount
2 in diameter, accepts a SMA antenna either K-800 SMA F(female) or a K-800 SMA M (male) with matching cable.

Princeton Antenna
80M Windom 131' overall length, black jacketed wire, 200 watts

Princeton Antenna
40/80D-Black, 109' overall length, black jacketed wire, 1500 watts

Princeton Antenna
G5RV, 102' overall length, 34' of 450 ladderline, 1500 watts

Power Supplies

QJE PS30SWV
DC Power Supply
DC 13.8V
Output: (9-15V adjustable)

QJE PS50SWIII
Switching Power Supply
13.8 VDC at
40 amps
continuous

QJE PS30SWI
DC Power Supply
Output voltage:
DC13.8+0. 3V

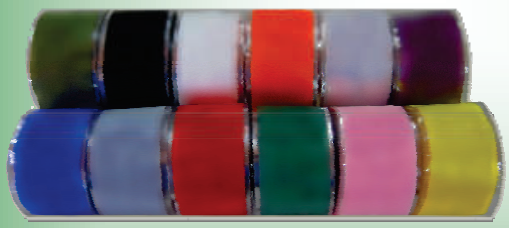
QJE PS30SWIV
30 amps Max
(10% duty cycle),
20 amps
continuous
110/220 VAC.

QJE PS30SWIII
DC Power Supply
Output DC
13.8V (9-15V
adjustable)

Quicksilver Radio

See us at Hamfests
From Maine to Florida
Visit our Huge Display at Dayton

New Item!
WATER-SHED™
Coax Connector Sealing Tape



Seal Those Connectors!
**Water is your enemy.
Water-Shed™ is your friend.
No messy adhesive, sticks to itself. Many more uses, now available in twelve colors.**

New Item!
Grab-N-Go Bag
**Perfect for your Em-Comm kit. It's 13" x 9" x 7", with 9 different pockets to store your gear.
Heavy duty weather resistant material.**

Sale Price $19.73

Great Price
**40W variable temperature soldering station.
Blowout Sale price**
$29.73

Yes!
**Cinch-Jones plugs are quite hard to find.
We have them in 2-4-6-8-12 pin versions.**

Yes!
We carry DC power cables and connectors for most radios.

Yes!
We have Red/Black Zip-Cord for all of your DC wiring needs. #18 through #6 are in stock.

Cheap Coax Is No Bargain!
**Poor quality coax can easily eat up half of your transmit power or more, and keep those rare ones down in the "mud" where you'll never hear them.
We carry a wide variety of high quality, low loss coax to meet your needs.**

And Neither Are Bargain-Bin Connectors!
You spent good money on your radio. Don't blow it with substandard connectors and adapters. Our high quality parts will ensure a solid connection.

Santa Shops Here!

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Quicksilver Radio

We Have Holiday Gifts to Fit Every Budget

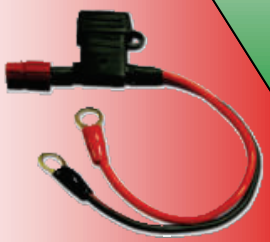
Great New Items!

PWR-Blok™
4-6-8-10-12 Way
Powerpole Splitters

Andy-Crimp *Pro*™

15-30-45-50-75 Amp Powerpoles
***And* Many Other Connectors**

On Sale $49.73



Fused Powerpole Cables
Many Types Available

We Have More Powerpole Stuff Than Anybody!

And we sell only *genuine* Anderson Powerpoles.
No Chinese copies here!

The Ultimate Powerpole *and* Coax Prep, Strip & Crimp Kit

Full-cycle ratchet crimper with Andy-Crimp Pro™ die set, two coax die sets, coax strippers, wire strippers, and coax cutter, in a sturdy ABS case. Crimps 15-30-45-50-75A Powerpoles, Molex, insulated and uninsulated terminals, LMR-400, 9913, RG-8, RG-213, RG-8X, RG-58, RG-316, RG-174 and more. High quality N, PL-259, Mini-UHF, BNC, TNC and SMA connectors are always in stock.

On Sale $129.73

Santa Checks His List Here!

Gadgets and Gizmos Galore

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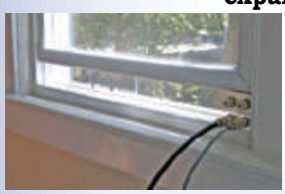

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QST QuickStats

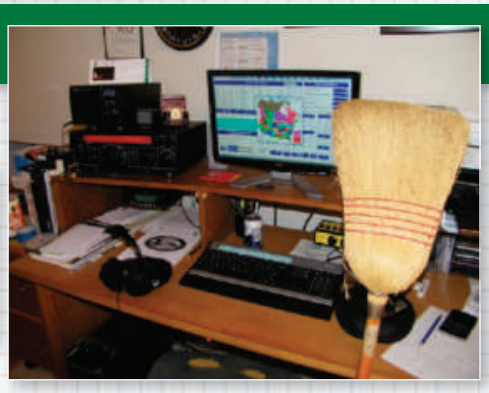
sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for September 4 through October 2, 2012.

Get on the web and vote today at **www.arrl.org/quickstats**!

Will you be participating in the CW or Phone Sweepstakes contests in November?

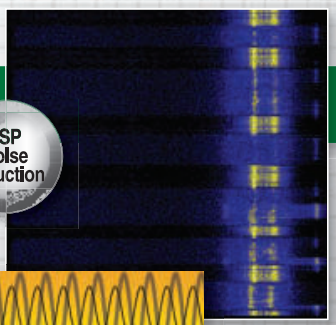


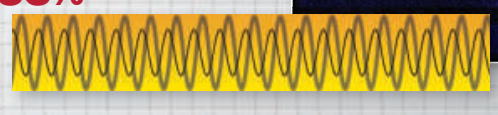
Yes, Phone: **25%**
Yes, CW: **10%**
Yes, both: **15%**
No: **50%**

Are you "fluent" in any computer programming languages?

Yes, one: **15%**
Yes, several: **31%**
No: **54%**

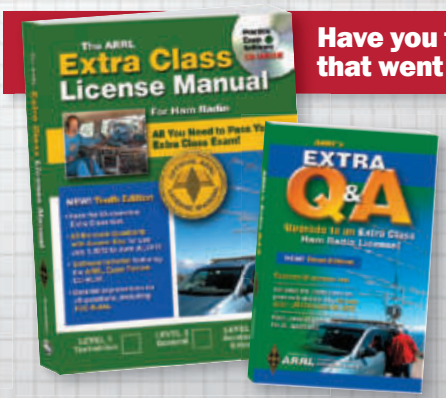
Does your HF transceiver have a DSP noise reduction feature?



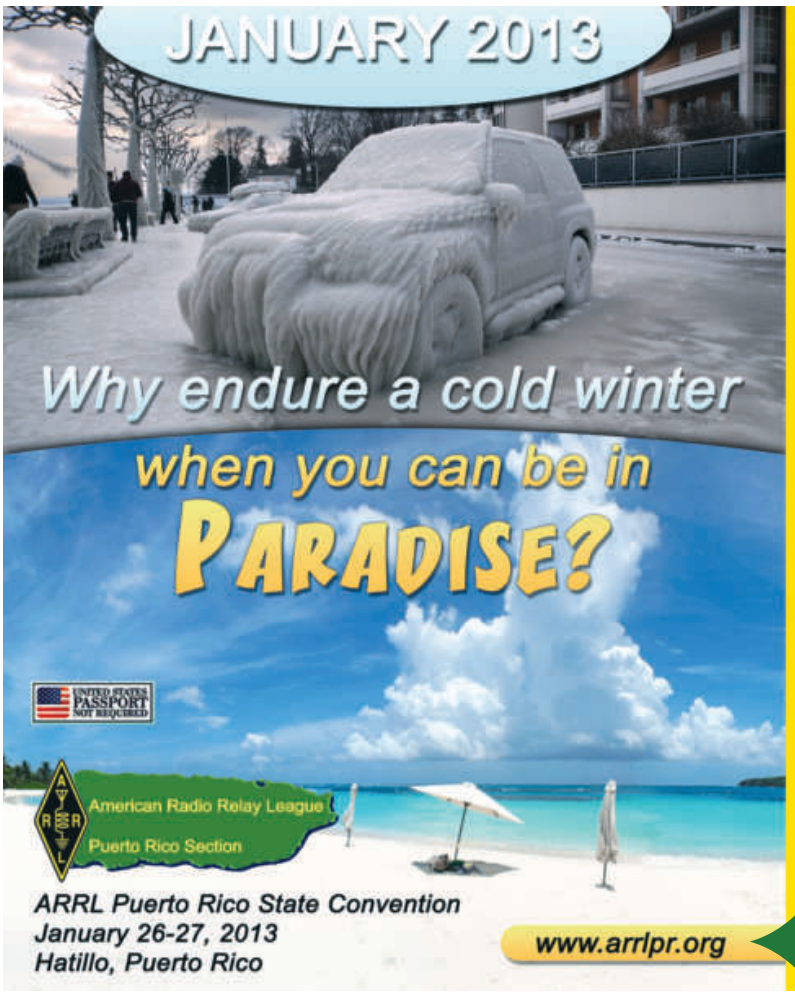


Yes, and I use it often: **42%**
Yes, and I use it occasionally: **33%**
Yes, but I never use it: **21%**
No: **4%**

Have you taken the new Amateur Extra (Element 4) exam that went into effect on July 1?



Yes: **3%**
No, but I plan to soon: **12%**
No, I'm not interested in upgrading at this time: **10%**
No, I already have my Extra: **75%**



ARRL Puerto Rico State Convention

January 26-27, 2013

Friday January 25, 2013
10:00am – 5:00pm Exhibit Setup
3:00pm – VIP tour to Arecibo Observatory (Depart from Coliseum) (invitation only)
7:00pm – ARRL Members Welcome Reception (Invitation only) (TBA)

YAESU The radio Platinum Sponsor

Saturday January 26, 2013
8:00am – 9:00am Exhibit Setup
9:00am – 5:00pm Exhibit Open
8:00am – 12:00pm ARRL VEC Session (annex room)
1:00pm – 4:00pm Forums (Arena Room)
4:30pm – Prize Drawing (Main Arena)

Sunday January 27, 2013
9:00am – 3:00pm Exhibit open
9:00am – 10:00am Forums (Arena Room)
1:00pm – Awards and Recognition (Main Arena)
2:00pm – Major Price Drawing (Main Arena)

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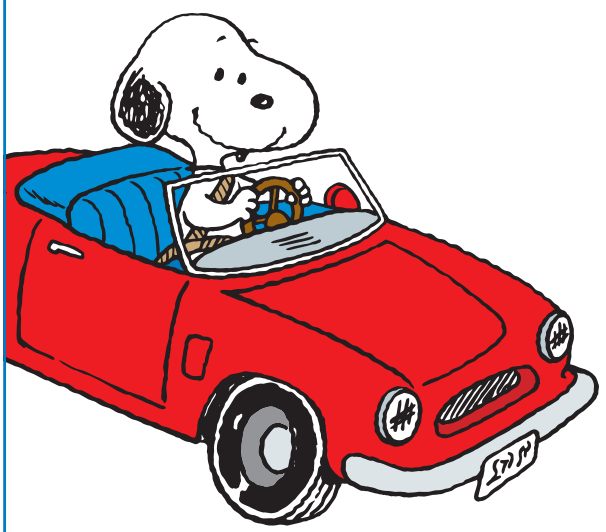

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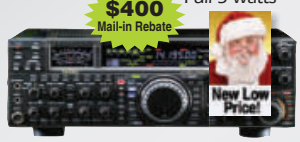

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TM-281A
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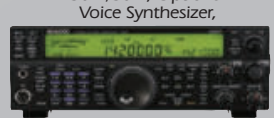
$25 Coupon



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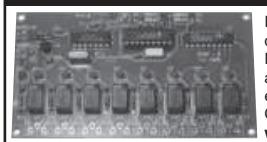

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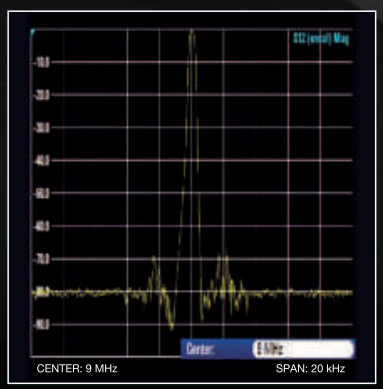

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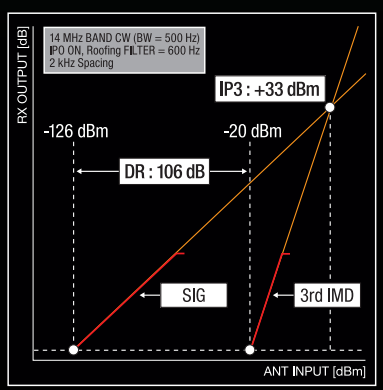

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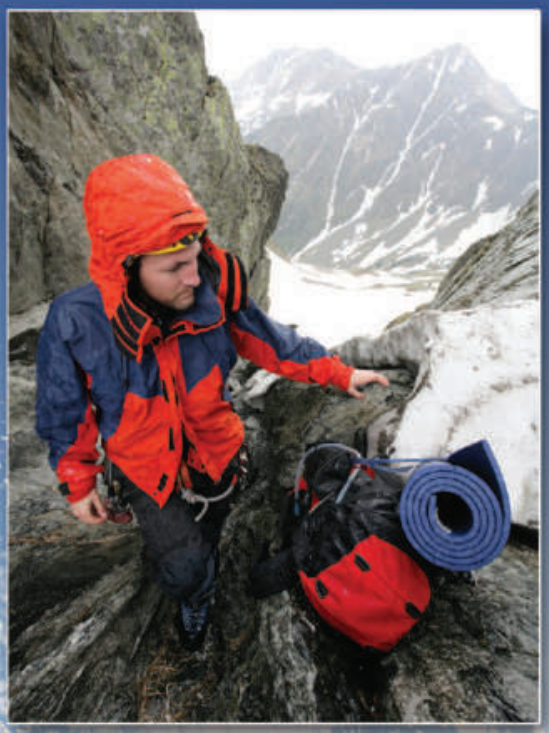

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