DECEMBER 2013 QST Vol 97 No 12

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

December 2013 WWW.ARRL.ORG

Season's Greetings

QST reviews:

42 | **Icom ID-51A Dual Band Handheld Transceiver with D-STAR**

Inside:

$4.99 US $6.99 Can.

12

19260

0 843655 9

Visit the ARRL Website at www.arrl.org

Official Journal of ARRL The national association for AMATEUR RADIO

Exciting New C4FM/FM Digital Mobile Transceiver

C4FM
Clear and Crisp Voice Technology

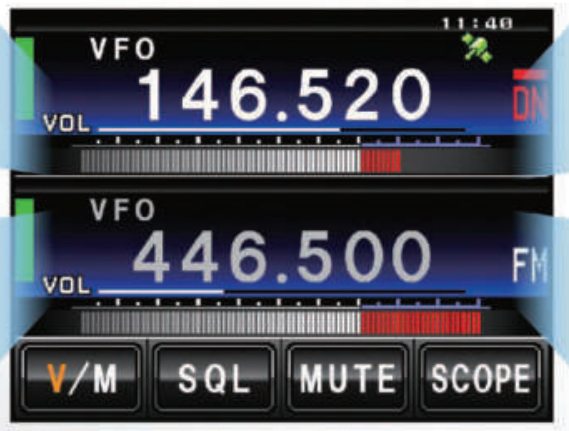
C4FM 144/430 MHz DUAL BAND
50 W DIGITAL/FM TRANSCEIVER

FTM-400DR

- Digital Group Monitor (GM) Function
- Smart Navigation Function
- Snapshot Function (Image Data Transmission)
- Built-in GPS with Antenna in the Controller
- Wideband Receive (108 MHz – 999.99 MHz)
- Equipped with microSD Card Slot

Advanced visibility and operability with full color touch panel Operation

3.5-inch full color touch panel operation



The icon symbols, multi-function key display and pop-up messages are all displayed in high-resolution color thanks to the full-color, high luminance TFT liquid crystal screen.

Band Scope Screen

Altitude Screen

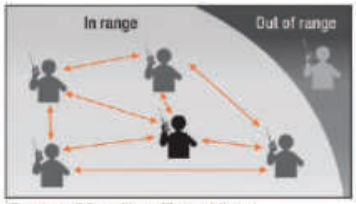
Smart Navigation Screen

Frequency Direct Input Screen

New Functions Enabled by C4FM Digital Communication

Digital Group Monitor (GM) Function

- Automatically checks whether members registered to a group are with the communication range.
- This function can be used to send messages data between group members.



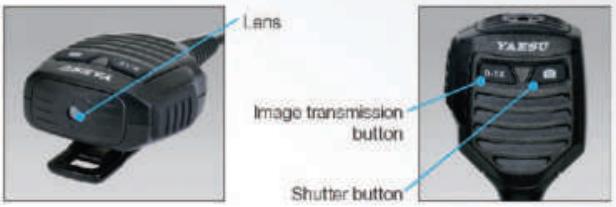
Group Monitor Function

Smart Navigation Function

- Real-time navigation function enables Location checking at any time.
- Backtrack function that starts navigation facing a registered point.

Snapshot Function (Image Data Transmission)

- Image data can be displayed on the screen.
- Image data can be sent easily to other C4FM FDMA digital transceivers.



Additional operating and support features

Wideband Receive Capability

Covers 108 MHz - 999.990 MHz (A(Main) / B(Sub) Band), VHF Marine, Aircraft, Public service channels, etc.

Hands-free operation

Hands-free operation is available by using the optional wireless Bluetooth® unit and headset.

(Optional Bluetooth® unit (BU-2) and Headset (BH-2A) are required.)

C4FM
Clear and Crisp Voice Technology

C4FM 144/430 MHz DUAL BAND
5 W DIGITAL/FM TRANSCEIVER

FT1DR

- **Digital Group Monitor (GM) Function**
- **Smart Navigation Function**
- **Snapshot Function (Image Data Transmission)**
- **Built-in GPS with Antenna in the top**
- **Wideband Receive (504 kHz – 999.99 MHz)**
- **Equipped with microSD Card Slot**

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The radio

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

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

New! Cushcraft R9 . . . *80-6 Meters*

80 Meters . . . No Radials . . . 1500W

Cushcraft's world famous R8 now has a big brother!

Big Brother R9 now includes 75/80 Meters for local ragchewing and worldwide low band DX *without radials*!

It's omni-directional low angle radiation gives you exciting and easy DX on all 9 bands: 75/80, 40, 30, 20, 17, 15, 12, 10 and 6 Meters with low SWR. QSY instantly -- no antenna tuner needed.

Use full *1500 Watts* SSB/CW when the going gets tough to break through pileups/poor band conditions.

The R9 is super easy to assemble, installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

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

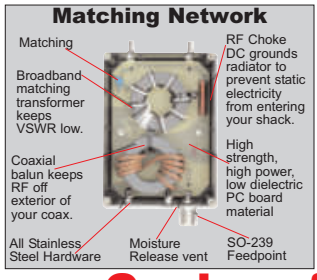
Rugged Construction: Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

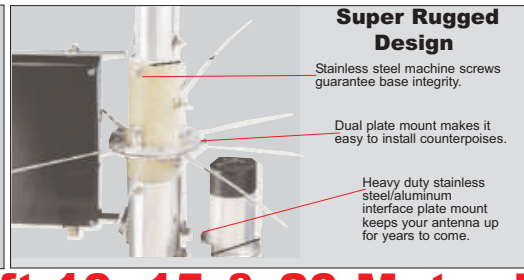
31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

R8, $539.95. Like R9 antenna but less 75/80 Meters.

R-8TB, $79.95. Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

R-8GK, $56.95. 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

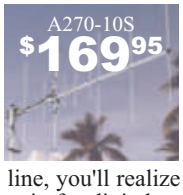
Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to 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.

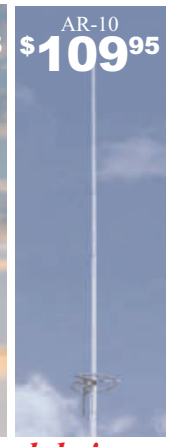
Cushcraft Dual Band Yagis

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!

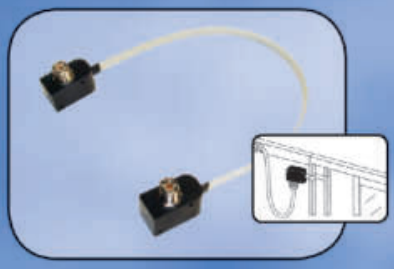
***Free* Cushcraft Catalog**
and Nearest Dealer . . . 662-323-5803
Call your dealer for your best price!

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

Cushcraft . . . Keeping you in touch around the globe!

Visit www.cushcraftamateur.com

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

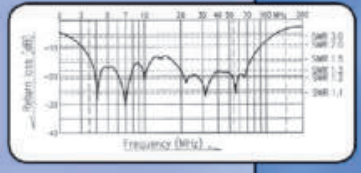
COMET CHA-250B
Broadband HF Vertical!

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.

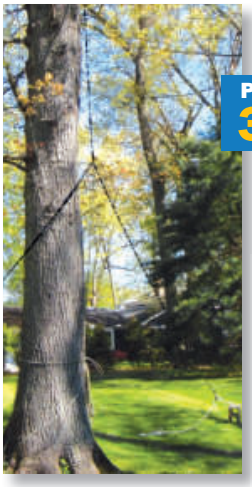
Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
909-393-6133 • 800-962-2611 • FAX 909-393-6136 • www.natcommgroup.com

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

In This Issue

December 2013 **Volume 97 Number 12**

Technical



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News and Features

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Our Cover
Ryan Holm, OZ8RH, of Holstebro, Denmark, is settled in for winter underneath this impressive antenna farm that includes a Comet GP-1 for 144 and 430 MHz, a Tonna five-element Yagi for 50 MHz, a Fritzel UFB 22 for 18 and 24 MHz, an Optibeam OB1-40 rotating dipole for 7 MHz, and a Fritzel FB 53, five-element Yagi for 14, 21, and 28 MHz.

Radiosport

Columns

Departments

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www.arrl.org/qst-author-guide
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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.

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

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

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

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Field Gear That Goes The Distance!

FT-897D

HF/VHF/UHF Portable Operation Powerful Transceiver

- The Ultimate Emergency Communications Radio
- Rugged, Innovative Multi-Band
- Operates on the SSB, CW, AM, FM, and Digital Modes
- Wide Frequency Coverage
- 20-Watt Portable Operation Using Internal Batteries
- 100 Watts When Using an External 13.8-Volt DC Power Source

FT-817ND

The Ultimate Backpack, Multi-Mode Portable Transceiver

- Self-Contained
- Battery-Powered
- Covering the HF, VHF, and UHF Bands
- Provides up to Five Watts of Power Output
- SSB, CW, AM, FM, Packet, or SSB-based Digital Modes like PSK31

FT-857D

The World's Smallest HF/VHF/UHF Mobile Transceiver

- Ultra-Compact Package
- Ideal for Mobile or External Battery Portable Work
- Wide Frequency Coverage
- Optional Remote-Head
- High-Performance Mobile Operation

FT-450D

HF/50 MHz 100 W Easy to Operate All Mode Transceiver

- Illuminated Key Buttons
- 300Hz / 500Hz / 2.4 kHz CW IF Filter
- Foot Stand
- Classically Designed Main Dial and Knobs
- Dynamic Microphone MH-31 A8J Included

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The radio

YAESU USA
6125 Phyllis Drive, Cypress, CA 90630 Phone: (714) 827-7600 http://www.yaesu.com

Heavy-Duty FM Dual Band Mobile with Exceptionally Wide Receiver Coverage*

*108 to 520 MHz/ 700 to 999.99 MHz (Cellular blocked)

NEW

50 W 2 m/70 cm* DUAL BAND FM TRANSCEIVER

*70 cm 45 W

FT-7900R

Size: 5.5" (W) x 1.6" (H) x 6.6" (D) / Weight: 2.2 lb

2 m/70 cm DUAL BAND

The King of Mobile

75 WATTS

Best Selling, Reliable Mobile

55 WATTS

2 m MONO BAND

HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

FT-2900R

NEW

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

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

Commercial Grade Field Radio Submersible Construction

COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-270R

Size: 2.4" (W) x 4.7" (H) x 1.3" (D) Weight: 13.6 oz.

2 m MONO BAND

NEW

Compact Field Radio with Top Mounted LCD and Loud Audio

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.

2 m MONO BAND

NEW

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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.

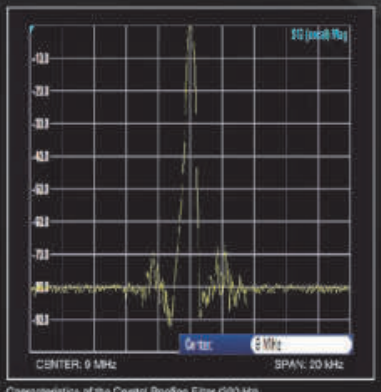
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

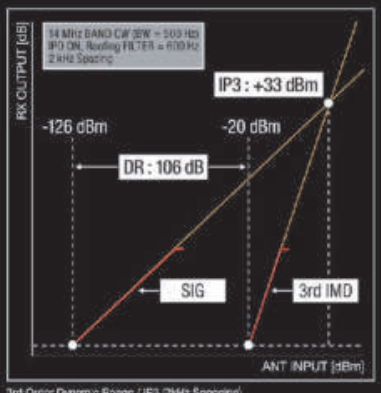
AF SCOPE display and RTTY/PSK encoder/decoder

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 (600 Hz)



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

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It Seems to Us

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

Taking Stock

"How are Amateur Radio and the ARRL doing? It seems timely to address that question in this, the last issue of QST before the start of the ARRL's Centennial Year."

As these words are being composed, the 10 meter band is alive with huge signals from distant corners of the globe. Outside, the New England foliage is in its finest autumn raiment. But the leaves are falling, the days are growing shorter, and the holiday season is drawing near. In just a few weeks we will begin the celebration of the Centennial of the ARRL. But before we cross the threshold into a new year and our second century, let's pause to take stock of our avocation and its national association.

Amateur Radio is healthy. Here in the United States the total number of FCC-licensed radio amateurs stands at about 715,000 and continues to grow slowly as we welcome more than enough newcomers to offset expiring licenses and Silent Keys. By the end of 2013 we expect the number of new licensees to exceed 28,000 for the year, the largest "freshman class" since 2009.

More important than raw figures are the signs that activity is also on the upswing. The great propagation on the higher HF bands will not last forever, but that's just a part of the picture. Developments in software defined radio (SDR) and digital voice technologies are creating whole new fields of experimentation and application. Inexpensive microcontroller platforms such as Arduino and simple computers such as Raspberry Pi offer endless opportunities for creative problem-solving. The continued relevance of Amateur Radio in public service and emergency communications is demonstrated all too frequently, as in Colorado during its widespread wildfires and severe flooding earlier this year.

As the pages of *QST* document every month, radio amateurs are seeking and meeting new challenges: launching high altitude balloons, backpacking their portable gear into the wild, conquering the upper microwave bands, or just squeezing another decibel or two out of an antenna. If you've become bored with Amateur Radio, you're not paying attention; there's always something new to try, always more to learn.

The ARRL is healthy, too. In 2013 we have seen our seventh straight year of membership growth. Members are the most important ingredient in our success, particularly when they become active volunteers. Thanks to our loyal advertisers and the members who purchase their products, the *QST* page count is envied by other association publishers — and we are proud that members can now access the Digital Edition of *QST* with even more content and at no additional cost. The *ARRL Handbook*, always a standard-setter and the flagship in our library of publications, has raised the bar even higher with the 2014 Centennial Edition. The Second Century Campaign, described on this page in the June 2013 issue, is off to an excellent start and is approaching the $6 million mark toward the goal of increasing the ARRL Endowment by $10 million.

There will be much to celebrate next year. It is rare for any association to reach its Centennial Year, much less with its founding vision intact and such a bright future ahead. The ARRL is one of these. Yet, we cannot let our pride blind us to the challenges we face.

Largely because of our continuing role in emergency and disaster communications — our ability to bridge gaps in communications infrastructure and to communicate without having to rely on any infrastructure at all — Amateur Radio in the United States is in the public eye and mind. This has helped offset some of the effect of instant communication via mobile phones and the Internet increasingly being taken for granted, but that is not necessarily true in other countries; many of our sister societies in the International Amateur Radio Union are struggling to retain and attract members. Radio signals do not respect borders; for Amateur Radio to flourish here we must have strong partners throughout the world.

Nor are we immune to demographics. A very large proportion of ARRL members are so-called Baby Boomers, born in the years after World War II. That generation is moving into retirement and eventually will diminish and disappear, as have the preceding generations. We can be certain that Amateur Radio will continue to exist as long as there is a strong organization representing its interests, but there can be no doubt that it will change as newer, younger radio amateurs take the reins.

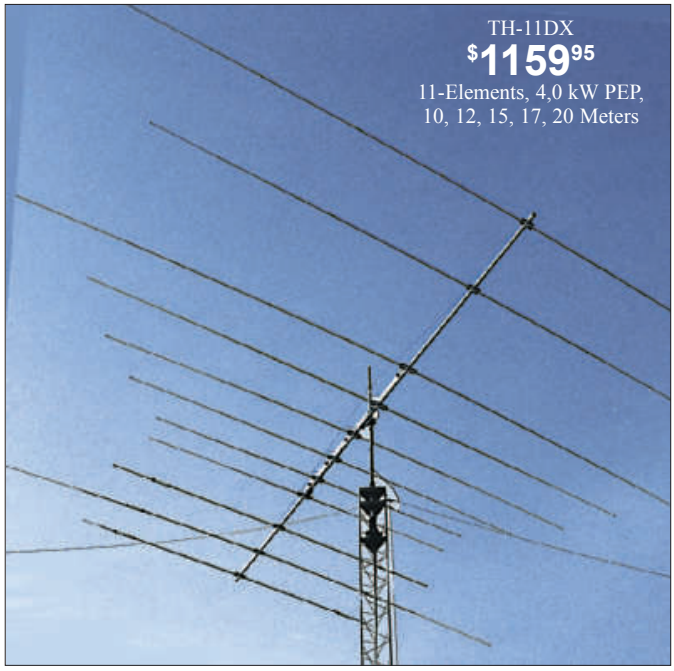
Those of us who are now active owe the enrichment that Amateur Radio has brought to our lives to those who came before us. Whether or not the previous generations of radio amateurs intended to do so, they developed traditions, social frameworks, and activities that made Amateur Radio what it was when each of us discovered it. For whatever reason, we became attracted to what they had built and made it a part of ourselves, in turn adding to their legacy with our own creations and achievements.

Hiram Percy Maxim and many others laid the foundation for what we now enjoy as Amateur Radio. We have built upon that foundation. We have succeeded in protecting and expanding the operating privileges that they bequeathed to us and have developed radio communications capabilities that even Mr. Maxim's powerful intellect could not have led him to imagine.

As the ARRL enters its Centennial Year we can say with confidence that with a strong ARRL, the next generation will be able to do the same.

hy-gain HF BEAMS...

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



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

The choice of top DXers.

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

Handles 2000 Watts continuous, 4000 Watts PEP.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Compact 3-element 10, 15, 20 Meter Tri-Bander
For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV

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

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

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

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

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

Tooled Manufacturing . . . Highest Quality Materials

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

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

3. Thick-wall *swaged* aluminum tubing

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

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

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

Durable precision injection molded parts.

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Customer Appreciation Day

Saturday December 14, 2013, 10AM – 4PM

Manufacturers scheduled to attend this year:

Ameritron, Cushcraft, Heil, Hygain, Icom, Jetstream, Kenwood, MFJ, Mirage, Vectronics and Yaesu.

Presentations, Prizes, Special Pricing

Must be present to enter prize drawing

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7:30 AM FREE testing!

W5KUB will be doing live streaming video in our store on December 14.
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JTPS35BCMA	*35 amp power supply w/battery backup*	**139.95**

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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
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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

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

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!

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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

FTDX1200

This medium-price HF Transceiver Excels on all fronts. The High Frequency Design Technology it has inherited, ensures "Best-in Class Performance". The Outstanding Operability is Perfect for the DX Scene. Superior triple conversion receiver, and optimum gain distribution at each IF stage will eliminate out of band unwanted signals.

DVS6 Digital Voice Memory Unit	65.95
FC40 Auto Tuner for Long Wires	304.95
FH2 Remote Keypad	95.95
MD100A8X Desk Top Mic	149.95
MD200A8X Desk Top Mic	389.95
SCU17 USB Interface Unit	169.95
SP2000 Ext Spkr w/Audio Filters	198.95

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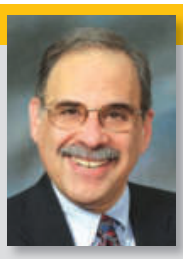

Harold Kramer, WJ1B – hkramer@arrl.org, ARRL Chief Operating Officer/*QST* Publisher

The Digital *QST* Android App and Other Digital Publishing Updates

Starting with this issue, we are publishing a dedicated Android app for Digital *QST.* Android is the operating system Google developed for touch screen mobile devices. This should make many of our members happy because, in the US smartphone market, Android has a 53% market share and iOS (Apple) has a 40% market share, according to Nielsen, an information and measurement company (**www.nielsen.com/content/corporate/us/en.html**).

Until now, members with Android devices used their mobile browsers to read Digital *QST* on the Android platform. This new Android app is available to members who use Android devices, such as smartphones and tablets, and it will be available to download through Google Play. It is compatible with Android based devices using operating systems Gingerbread (2.3), Ice Cream Sandwich (4.0), Jelly Bean (4.1), and later.

Each month, about 60% of readers of the digital edition of *QST* view it on a web browser, 40% on the iOS app, and about 8% on other mobile platforms. (The numbers exceed 100% because some members view it on more than one platform.) A typical issue of Digital *QST* is saved over 6,000 times and viewed by about 25,000 members.

While Digital *QST* currently looks fine on an Android browser, the new, dedicated Android app will permit members to download *QST* to their device for reading offline. We have also added an enhancement that will allow members to quickly search all archived issues of Digital *QST* using a dedicated search function. As an added feature, similar to the iOS app, we have archived all *QST* back issues (starting with January 2012) to the Android archive. For more information about the new *QST* Android app, please visit the Digital *QST* FAQ page **www.arrl.org/digital-QST-faq**.

Our Digital Future

We now publish three different versions of digital *QST* each month: a browser based version, an iOS app, and an Android app. Along with these three, there will be other digital publishing platforms that we will need to consider in the future. Today, the digital version of *QST* that we publish are "replica editions," because they substantially match the look and format of the print version. Our publishing partner, Nxtbook Media, projects that in a few years, we will be migrating to a single version of Digital *QST* that will be published on an advanced HTML platform. This edition will be compatible across all devices and operating systems. However, at that time, the digital edition of *QST* will need to be completely redesigned to accommodate the format and it will look and act differently than the print version.

The League on Facebook

While we are on the topic of digital publications, you may not be aware that the ARRL has its own Facebook page.

The page is appropriately named "ARRL — The National Association for Amateur Radio" (**www.facebook.com/ARRL.org**). The ARRL posts all of its news stories on the Facebook page as soon as they are published on our website. There are currently about 33,000 "Friends" who have "Liked" the page. If you are a Facebook user, please give it a look and "Like" it yourself. There are always a number of interesting and ongoing discussions!

A New Outlet for *The ARRL Letter*

We have also begun publishing *The ARRL Letter* on **QRZ.com**. Thanks to **QRZ.com** owner, Fred Lloyd, AA7BQ, for making this arrangement possible. *The ARRL Letter* is available as a direct e-mail to all ARRL members at no charge. To sign up for the *Letter*, go to your Profile Page on the ARRL website and follow the link to Edit E-mail Subscriptions. The directly e-mailed version contains some additional content that, for technical reasons, cannot be added to the QRZ version.

The world of publishing has changed considerably in the last 5 years and it continues to evolve. Our goal is to provide our members with the best possible reading and viewing experiences regardless of whether we use print, digital, or other formats.

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- **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**
  Every purchase supports ARRL programs and services.
- **MetLife® Auto, Home, Renters, Boaters, Fire Insurance and Banking Products**
  ARRL members may qualify for up to a 10% discount on home or auto insurance.

* ARRL Group Benefit Programs are offered by third parties through contractual arrangements with ARRL. The programs and coverage are available in the US only. Other restrictions may apply.

Programs

★ New! ARRL Centennial 2014 — ARRL2014.org

Second Century Campaign for the ARRL Endowment – **www.arrl.org/scc**
National Centennial Convention, July 17-20, 2014 – **ARRL2014.org**

Public Service — www.arrl.org/public-service

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Logbook of the World – **www.arrl.org/lotw**

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ARRL Field Organization – **www.arrl.org/field-organization**

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Quick Links and Resources

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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**
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ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
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www.youtube.com/ARRLHQ

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.

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

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

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

Membership inquiries and general correspondence should be addressed to the administrative headquarters: ARRL, 225 Main Street, Newington, Connecticut 06111-1494.

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

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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 Hiram Maxim, First President of the ARRL, use **w1aw@arrl.org**, or **hmaxim@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
www.barc.org/nediv

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AMERITRON 600 Watt *no tune* FET Amp

Four rugged MRF-150 FETs at 50 Volts give high efficiency . . . No deterioration with use

ALS-600 **$1499** Suggested Retail

Ameritron ALS-600 *Solid State FET* compact desktop station amplifier is only 4 dB below 1500 Watts -- less than an S-unit!

There are no tubes, no tube heat, no tuning, no worry rugged -- just turn on, select band and operate. 600 Watts PEP/500W CW -- lets you talk to anyone you can hear!

Covers 1.5-22 MHz, (10/12 Meters with $29.95 kit, requires FCC license), instant bandswitching, SWR/thermal protected, extremely quiet, lighted peak reading Cross-Needle SWR/Wattmeter, front panel ALC control, operate/standby switch. 12.5 lbs., 9½Wx7⅛Hx12D in.

Includes ALS-600PS transformer AC power supply for 120/220 VAC, inrush current protected. 32 lbs., 9½Wx6Hx12D inches.

ALS-600 Amp with Switching Power Supply

***New!* ALS-600S, $1599.** ALS-600 amplifier with 10 lb. ALS-600SPS switching power supply combo.

Switching Power Supply

ALS-600SPS **$699** suggested retail

Works with all ALS-600 amplifiers. Extremely lightweight, just 10 lbs. Superb regulation, very low radiated noise. 9Wx6Hx14½D in.

From QST Magazine, March, 2005

". . . the ampifier faulted only when it was supposed to. It protected itself from our boneheaded, sleep-deprived band changing manuevers . . . "

"I found myself not worrying about damaging this amplifier. It seems quite capable of looking out for itself. . . . Kudos to Ameritron."

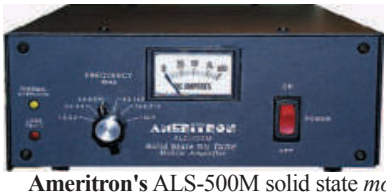
"I couldn't hear any noise at all from the SPS (*switching power supply*) on the vertical or quad…"

"I came to greatly appreciate the size, weight, reliability and simplicity of this amplifier."

"The ALS-600S makes it possible to pack a transceiver and a 600 Watt amplifier, that together weigh less than 30 pounds."

AMERITRON *mobile* 500 Watt *no tune* Solid State Amp

Instant bandswitching, no tuning, no warm-up, SWR protected, 1.5-22 MHz, quiet, compact



ALS-500M **$899** Suggested Retail

Ameritron's ALS-500M solid state *mobile* amp gives you 500 Watts PEP SSB or 400 Watts CW output! Just turn on and operate -- no warm-up, no tuning, instant bandswitching. Fits in very small spaces.

New ALS-500RC, $49 *Remote Head* lets you mount ALS-500M amplifier *anywhere* and gives you full control. Select desired band, turn On/Off and monitor current draw on its DC Current Meter. Has power, transmit and overload LEDs. RJ-45 cables plug into Amplifier/Remote Head.

Covers 1.5-22 MHz, (10/12 Meters with $29.95 kit, requires FCC license).

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Typically 60-70 watts in gives full output. ON/OFF switch bypasses amplifier for "barefoot" operation. Extremely quiet fan comes on as needed. Excellent harmonic suppression, push-pull output, DC current meter. 13.8 VDC/80 Amps. 3½x9x15 in. 7 lbs.

ALS-500M, $849, 500 Watt mobile amp.

ALS-500MR, $929, ALS-500M/Remote Head

ALS-500RC, $49, Remote head for ALS-500M (for serial # above 13049).

ARF-500K, $179.95, Remote kit for ALS-500M serial # lower than 13049. Includes AL-500RC Remote Head, filter/relay board for ALS-500M, cables, hardware, instructions.

Free online manuals! Ameritron brings you the finest high power accessories!

ARB-704 amp-to-rig interface. . . $59.95

Protects rig from damage by keying line transients and makes hook-up to your rig easy!

RCS-4 Remote Coax Switch . . . $159.95

Use 1 coax for **4** antennas. No control cable needed. SWR <1.25, 1.5 - 60 MHz. Useable to 100 MHz.

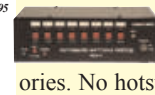
RCS-8V Remote Coax Switch. . . $169.95

Replace **5** coax with 1! 1.2 SWR at 250 MHz. Useable to 450 MHz.<.1 dB loss, 1kW@ 150MHz.

RCS-10 Remote Coax Switch. . . $179.95

Replace **8** coax with 1! SWR<1.3 to 60 MHz.**RCS-10L, $219.95** with lightning arrestors.

New! RCS-12C Fully Automatic Remote Coax Switch Controller. . . $239.95



Band data from transceiver auto selects antennas. Antenna memories. No hotswitching. Rig-to-amp interface. For 3/4 BCD, 1 of 8 relay boxes. **RCS-12, $309.95**, auto controller with 8 coax relay box, to 60 MHz. **RCS-12L, $349.95**, with lightning arrestors.

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with four 811A tubes

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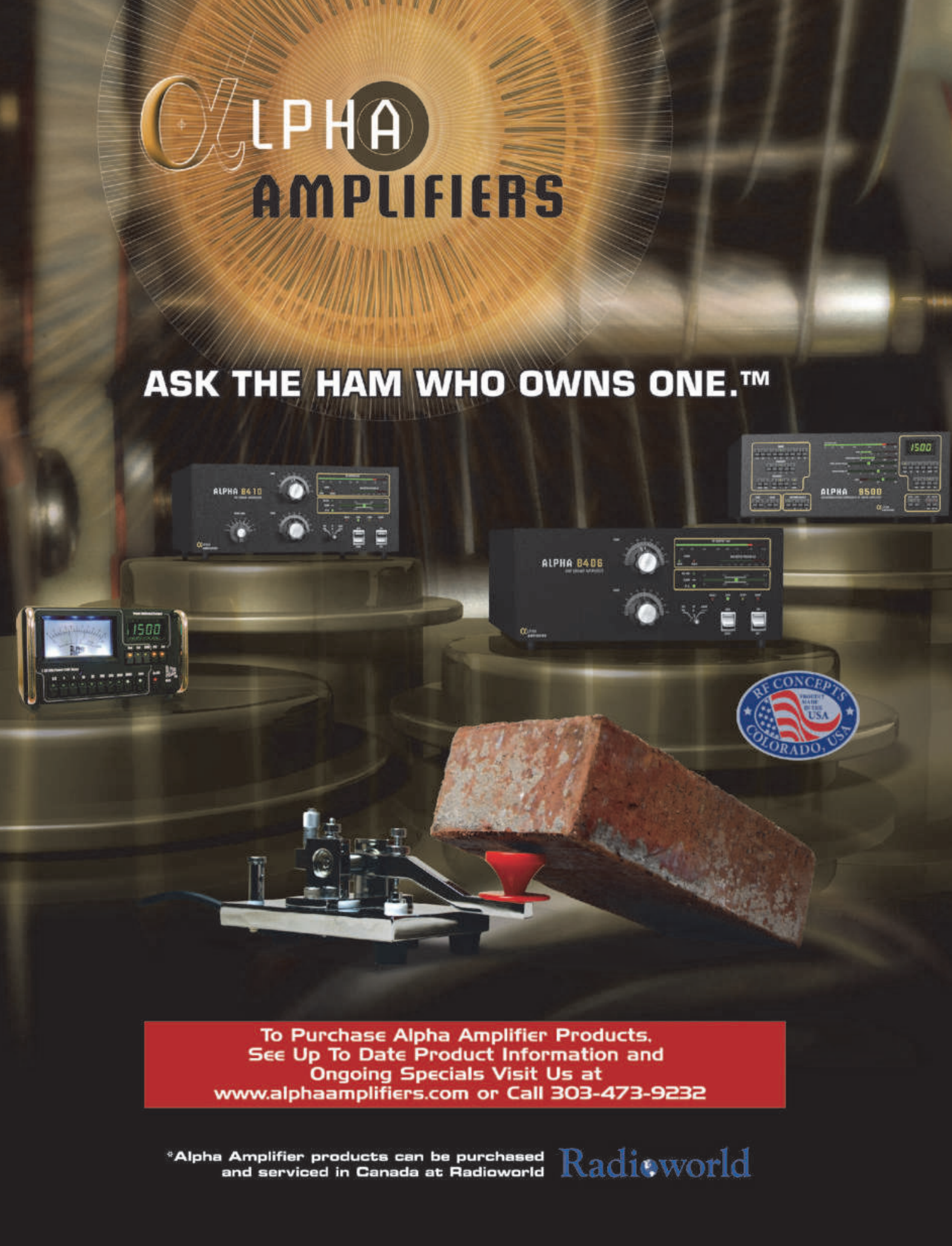
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ELECRAFT KX3

- 160-6 m (internal 2 m option planned)
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Our new KX3 is a competition-grade transceiver that literally puts the world in the palm of your hand. With its large display, rich control set, and adjustable operating angle, the ultra-compact KX3 is equally at home on your desktop, in a vehicle, or in remote field locations. It's a true software-defined radio (SDR), with dual watch, noise reduction, digital voice recorder, RX/TX EQ, VOX, split-band speech compression, and CW keyer. The built-in PSK31 and RTTY modes work with or without a computer. Add the internal ATU, battery pack, and roofing filters for unmatched portability *and* performance.

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Special Technicians

Amateur Radio became the gateway to new adventure for two special education students at Thomas A. Edison High School in Queens, New York. The students, who overcame many personal life challenges, were able to complete their studies and earn their Technician licenses.

The exams were administered by Volunteer Examiners Mike Siegel, W2RT, and Rich Balas, W2RB, from the Broadcast Employees Amateur Radio Society (BEARS) — the Amateur Radio organization at the Walt Disney Company in New York City — and Pete Dobrow, K2IQK, from the Staten Island Amateur Radio Association (SIARA).

The students, Karl Anthony Singh, KD2DMF, and Kolsuma Begum, KD2DME, were mentored by Edison High School teacher Fred Usherson, N2EGQ. A third student, Kashaun Barnes, K2DKB, passed the Technician exam with flying colors at a SIARA VE session. Barnes was so excited about Amateur Radio, he purchased training materials to prepare for the General and Amateur Extra exams.

Singh has since gone on to earn his General license at a second Edison High VE session.

Left to right, background: Edison High School teacher Fred Usherson, N2EGQ; Rich Balas, W2RB; Pete Dobrow, K2IQK and Mike Siegel, W2RT. Foreground: students Kolsuma Begum, KD2DME, and Karl Anthony Singh, KD2DMF.

The Meeting of the "Ns"

Roger Hentershee, N1NN (left), paid a visit last July to Dave Patton, NN1N (right), ARRL Membership and Volunteer Programs Manager, and exchanged QSLs. Turns out Roger and Dave had more in common than scrambled call signs: both are former US Navy Radiomen.

When You Need a Beer, Make It Special!

Ron Young, W8RJL, received a Kegerator for Christmas last year and, while assembling the unit, realized the tap handle needed to be customized. He pulled an 807 transmitting tube from the junk box and adapted it to become the tap handle. Ron frequently hosts Sweepstakes CW multi-op stations, so now the teams can have "cool 807s" on tap!

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Letters from Our Members

Gratitude for Members of ARES

The article, "Taking the Mystery Out of ARES — The Role of the PIO," in the September 2013 issue of *QST* struck a chord. In rural Seneca County, Ohio, our local ARES chapter consists of approximately 50 members who provide emergency communication and much more. These hams go about their work quietly and without fanfare. It's no wonder few know who they are and how vital a role they play in our community.

As a volunteer with our local Emergency Management Agency, I have seen these men and women provide emergency communication, SKYWARN operations, amateur license training, special event communication, and generally just be around in times of great need to lend a hand. Their professionalism and devotion to their craft is known and recognized among our public service and EMA regulars, but is rarely seen by the public.

Like many small communities, we are understaffed and underfunded, particularly in times of wide-scale emergencies, weather events, and disasters. The ARES personnel provide all of us with a valuable service and, most important in times of great stress, peace of mind. It is an honor serving with them.

Dean Henry, KD8RSP
Seneca County, Ohio

[An article in an upcoming issue will further discuss the PIO's role on an ARES team. Keep an eye out for it. — Ed.]

Another Wireless Pioneer

I wish to add Irving Langmuir to the pioneers listed by Michael W. Marinaro, WN1M, in "Pioneers of Wireless," in the October 2013 issue of *QST*, as Langmuir invented the vacuum in the vacuum tube.

Lee de Forest invented the triode tube detector, but his was not a vacuum tube. As de Forest describes in his US patent 879,532, his Audion triode detector was a gas tube, and the "conducting gaseous medium" was required for operation. In the circuits in the patent, the grid circuit requires a series capacitor blocking DC current flow, so the grid DC potential could be controlled by the gas inside the tube.

Irving Langmuir invented the high-vacuum triode tube, and patented pumping out the gas. In his US patent 1,558,436, Langmuir describes how de Forest's Audion depended on gas to operate, and describes the tests needed to ensure a good vacuum free of gas. In the circuits in the patent, there is always a DC path from grid to filament. Langmuir includes both a detector circuit and an oscillator circuit.

Peter Traneus Anderson, KC1HR
Andover, Massachusetts

Experience Doesn't Equal Etiquette

I'm writing in response to the letter titled "Dumbing Down?" in the August 2013 issue of *QST*.

This letter suggests that there is a connection between technical knowledge — knowing how to build antennas, etc — and good, courteous operating. It might help to present evidence that such a connection does exist. What percentage of the bad on-air behavior is carried out by operators who don't know code or how to build antennas, and what percentage is carried out by technically proficient Amateur Extra class operators?

Without such evidence, why does anyone have the conviction that there is in fact a connection between courteous, friendly operating, and superior technical skills? I have been licensed since 1996 and have spent most of my time as a ham in Micronesia, as KHØES and V63PD. I have never been very good at the technical side of radio, but have always appreciated the help of my friends on the air to assist in answering my questions.

I do love radio, though, and always keep trying to learn. One part of radio I care very much about is being a courteous and friendly operator. When I was one of only two V63 calls on the planet for a while, and therefore creating pileups, I insisted on giving my call on each QSO, among other things. I felt it important to strike a reasonable balance between being courteous to each operator and contacting as many as possible. I cannot just say "QRZ," and "You're 5-9," and that's it.

The few occasions on which I have encountered rude operators over the years have almost always involved those with a single letter at the end of their calls. It seems that the cause of rude behavior on the air is often not a lack of knowledge, but just the opposite. Those who have much knowledge sometimes seem to feel superior to less knowledgeable hams, and treat them accordingly. In the "Dumbing Down?" letter, for instance, the writer does not hesitate to write in an insulting way about those who send in questions to *QST*. In doing this he seems to me to be presenting evidence that it is those with more knowledge who more often forget about the value of courtesy.

Radio is about talking to people. The technical side of it is a means to that end. I suggest that *QST* publish much more about good operating and the simple pleasure of talking on the radio. How about helping hams who know how to build antennas learn how to build courtesy and friendliness on the air? When I tell people why I love radio, I talk not about equipment, but about something like the time I talked with a hillside goat farmer in Taiwan, an architect restoring old buildings in Berlin, and a dentist in Japan — all in one evening. I discuss the fun of causing and working through a CW pileup of European operators, or hearing the 1930s radio experiences of an elderly Australian ham.

Peter Denman, KH2VM
Tumon, Guam

Hamfest and Convention Confusion

In planning trips to hamfests, I usually check the website of the particular event for information. But, I've found that while clubs list their events on the Convention and Hamfest Calendar published in *QST*, it takes them much longer to get something on their own website — or there's invalid data on the date, location, contact person, etc.

One recent event had "data sent out on an e-mail list," but hardly anything on their website. When I arrived, no one seemed to know where the events were to be held. I've noted events that didn't get website updates until less than a month beforehand.

Attendees want to know about forums, prizes, testing, lodging (if it's more than a 1 day event), transportation, etc, in advance, so they can plan their trip...or cancel trip plans should things change. There's nothing more discouraging than making a long drive to an event to find little, if anything, available...or finding out the event has been cancelled due to lack of participation, information, etc.

I know things can change at the last minute. But, if the group isn't willing to get the word out in a timely manner, all the other hamfest work (getting facilities, vendors, forums) is basically for nothing.

Daryl Stout, WX1DER
ARRL Life Member
Little Rock, Arkansas

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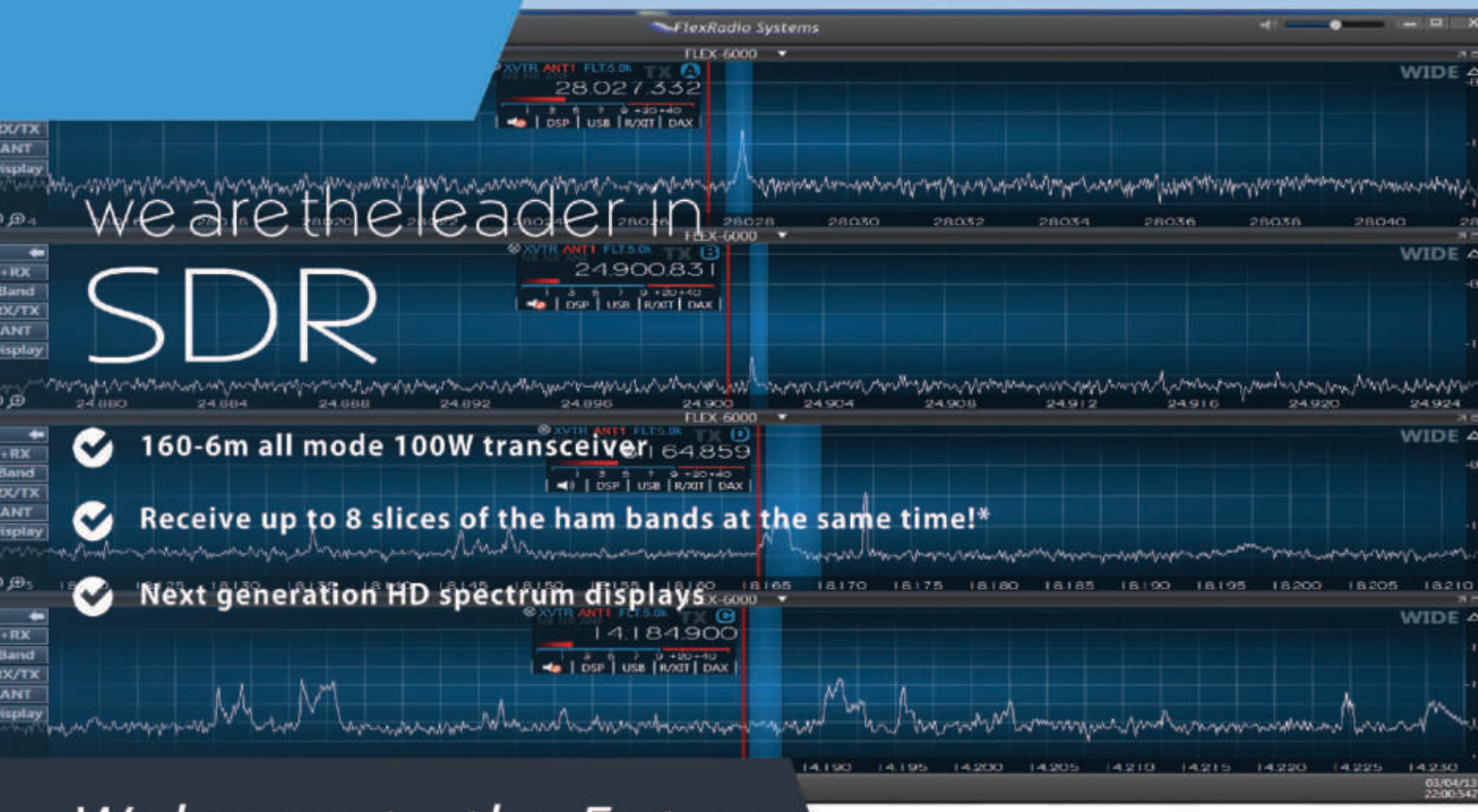

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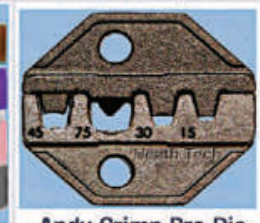

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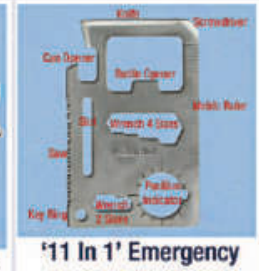

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How Much "Punch" Can You Get from Different Modes?

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Kazimierz "Kai" Siwiak, KE4PT, and Bruce Pontius, NØADL

In chasing DXCC entities, we do everything that we can to improve the chances of logging a new one. Our chances of improving our DX score depend on how flexibly we use frequency bands and operating modes. During a recent quest for the WAS Triple Play Award, one of us (KE4PT) noticed that working the same station on CW was easier than on RTTY, and that RTTY was easier than SSB. We will compare CW, phone, RTTY, and various digital modes — and determine how far each can "talk."

Not all Modes Transmit Equally

We account for a complete transmission path that uses a pair of transceivers and antennas shown in Figure 1. Each receiver has a typical noise figure of about 10 dB, while the transmitters emit up to, but no more than, 100 W peak envelope power (PEP). Two factors affect the maximum range: *average transmitter power* and *receiver sensitivity*. For example, PSK31 (upper curve in Figure 2) emits an average of half PEP transmitting "0" bits, and full PEP during "1" bits, so the average power with an equal number of "1" and "0" bits is 75% of PEP.

A Morse code CW signal (lower curve of Figure 2) operates at full PEP during key down dits and dahs, but zero power during key up. Transmitting the standard word "PARIS_" including the inter-word space results in 44% of PEP or 44 W average power. FM voice, on the other hand, generates the full 100 W PEP for the duration of the voice transmission.

Table 1
Average Power for 100 W PEP Transmitter

Mode	Average Power (W)	Compared to CW (dB)
AM	25	–2.5
SSB	25	–2.5
FM	100	+3.6
RTTY	95	+3.3
CW	44	ref: 0
PSK31	75	+2.3
JT65	100	+3.5

When our equipment limits us to a certain PEP, typically 100 W for many ham transceivers, the *average transmitted power differs for different ham radio modes* according to Table 1, and this affects the performance in the radio transmission link of Figure 1.

Our own measurements for FM, CW, RTTY, PSK31, and JT65 transmitter power levels closely correspond with the Table 1 average power values. Clearly, FM voice, RTTY, PSK31, and JT65 can generate more average power than can CW, AM, or SSB voice. Signals like SSB voice can be processed to increase the average power by a few decibels — however we consider unprocessed voice here. But that is not the full story; the receiver sensitivity for each mode also plays a role, as we can see in Table 2.

Different Modes Vary in Receiver Sensitivity

Table 2 shows receiver sensitivity both in traditional microvolts and in decibels relative to a milliwatt (dBm). The last column shows decibels compared to CW sensitivity. We gleaned the receiver sensitivities shown in Table 2 from an average performance of 30 popular ham transceivers that were measured in the ARRL Lab and reported in product reviews.[1] We relied on the ARRL measurements for AM and FM sensitivities, as well as minimum discernable signal (MDS) in a 500 Hz bandwidth from which we derived SSB and CW sensitivities. Although this is lab-measured data and not theory, keep in mind that "white noise" is the only impair-

[1]Notes appear on page 32.

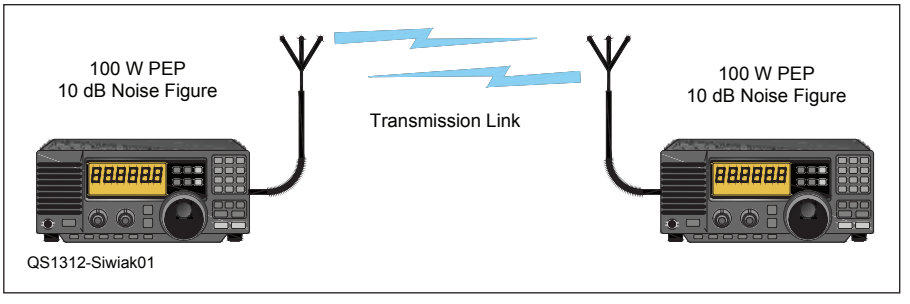

Figure 1 — A pair of transceivers and antennas form the basic radio transmission path link.

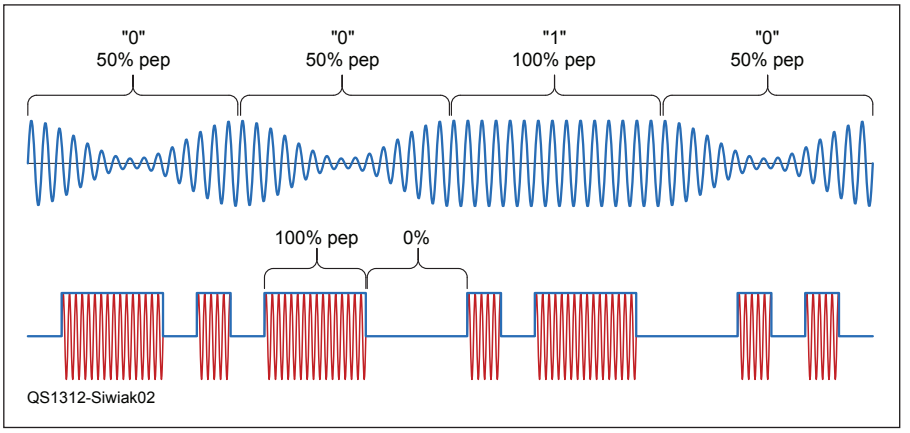

Figure 2 — PSK31 (upper curve) emits half PEP during "0" and full PEP during "1" bits, so average power with an equal number of "1" and "0" bits is 75% of PEP; CW (lower curve) emits 44% of PEP.

ment in these lab measurements. The sidebar above explains what we mean by "receiver sensitivity." Good operators might copy signals at weaker signal to noise ratios than we defined for our almost-perfect-copy measurement standard, especially when using the limited vocabulary of DXpedition exchanges. "Armchair copy" of SSB, on the other hand, may require stronger signals than our measurement standard. The sensitivities measured in the ARRL Lab are of course for the complete receiver with the correct IF filters appropriate to each mode. Our own measurements of PSK31 and RTTY sensitivities for the entire transmitter to receiver path link of Figure 1 are shown by X symbols in Figure 3.

The Full Transmission Link Tells the Story

We might be tempted to compare modes using just the receiver sensitivities in Table 2 and conclude, for example, that JT65 outperforms CW by 21.2 dB. The full transmission link, however, includes the PEP limitation of the transmitter as well as the receiver sensitivity. With a 100 PEP transmitter JT65 generates 3.5 dB more average transmitter power than does CW. So, the full advantage of JT65 over CW is 21.2 + 3.5, or 24.7 dB. Adding up the relative advantages of the modes in both Tables 1 and 2, we arrive at the Figure 3 comparison of modes. The error bars signify estimates of implementation loss variations, and the performance variations across the 30 ARRL Lab measured ham transceivers that we used for the comparisons.

Table 2
Average Receiver Sensitivities

Mode	Receiver Sensitivity (microvolts)	Receiver Sensitivity (dBm)	Compared to CW (dB)
AM	0.72	–109.9	–25.1
SSB	0.22	–120.3	–14.7
FM	0.29	–117.7	–17.3
RTTY	0.096	–127.3	–7.7
CW	0.040	–135.0	ref: 0
PSK31	0.023	–139.8	+7.1
JT65	0.0035	–156.2	+21.2

What We Mean by "Receiver Sensitivity"

Consistent comparisons of receivers and modulation modes require us to apply a consistent standard definition of sensitivity. For voice modes we chose 12 dB SINAD for FM and 10 dB (S+N)/N for AM, straight out of the ARRL product reviews. For SSB we adopted 10 dB above the minimum detectable signal (MDS) measured in the SSB bandwidth, adjusted from the ARRL Lab measured MDS in a 500 Hz bandwidth. Thus, all of the measurements can be traced to ARRL Lab product review tests and test procedures.[A]

For CW and conversational digital modes like RTTY, and PSK31, we defined sensitivity as the signal level needed to decode a random five-character group ("PARIS_") with a 95% reliability. For CW that level is 9.2 dB above MDS in a 100 Hz bandwidth using theory for on-off keying. A 100 Hz bandwidth corresponds to the ERB (effective rectangular bandwidth) of the ear for a 700 Hz CW side tone frequency.[B] Yes, the human ear can act as the final bandwidth filter for aurally decoded CW. CW at 20-25 words per minute occupies nearly 100 Hz of spectrum.

We calculated the PSK31 sensitivity using theory for Differential PSK as 9.4 dB above the MDS in an ideal 31.25 Hz receiving bandwidth, but the necessary or occupied bandwidth is 62.5 Hz. That signal level includes an additional 2 dB for decoder implementation loss. Using 2-FSK theory we calculated that 170 Hz shift two-tone 45.45 baud Baudot RTTY modulation requires 11.9 dB signal to noise ratio to decode the 990 ms string "PARIS_" with 95% reliability. We stated the RTTY sensitivity in a 250 Hz occupied RTTY bandwidth and then allowed 2 dB for decoder implementation loss. JT65 data are encoded with a Reed Solomon (63,12) code and use limited vocabulary messages as well as synchronized transmissions, so we relied on published measurements.[C] We normalized sensitivity to the 2.7 Hz effective noise bandwidth of JT65 tones.[D]

Other sensitivity standards are possible including "20 dB Quieting" level for FM. Different standards result in different audio quality. Short CW exchanges such as with a DXpedition station are not "random groups." They use a very limited vocabulary that often may be copied at much weaker signal to noise ratios than our 9.2 dB standard. Our measurements are in "Additive White Gaussian Noise" (AWGN). Measurements in different noise conditions can alter the results dramatically and differently for each modulation.

[A] *ARRL Lab Test Procedures Manual*, **www.arrl.org/how-equipment-is-tested.**
[B] The effective rectangular bandwidth (ERB) of the ear is (0.108*F* + 24.7) Hz, *F* is the center frequency in Hz: B. C. J. Moore and B. R. Glasberg, "A revision of Zwicker's loudness model," *Acta Acustica*, vol. 82, pp 335-345, 1996.
[C] J. Taylor, K1JT, and B. Walker, W1BW, "WSPRing Around the World," *QST*, Nov 2010 pp 30-32.
[D] S. Ford, WB8IMY, "JT65 – The 'Musical' Mode," *QST*, Apr 2011, p 45.

Comparing Modes in the Full Radio Path

FM compared to SSB is a surprise. Although the typical SSB receiver is more sensitive than the FM receiver by 2.5 dB, the FM radio link performance benefits from FM's 6 dB average transmitter power advantage over SSB, netting a 2.5 dB advantage. Remember that FM was measured using a 12 dB SINAD standard and with an FM detector, while SSB sensitivity was measured at the 10 dB SNR standard using a linear detector, so audio qualities are very different at the threshold signal levels even though their predetection SNRs are about the same. One of us (NØADL) measured and verified FM versus SSB performance, but also noted a strong preference for the SSB audio quality over FM audio at marginal signal strengths, especially at levels below our measurement standard.

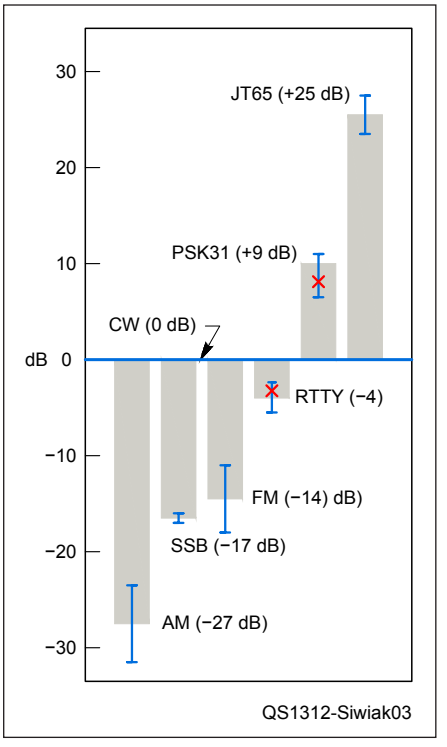

Figure 3 – Comparison of ham radio modes relative to CW.

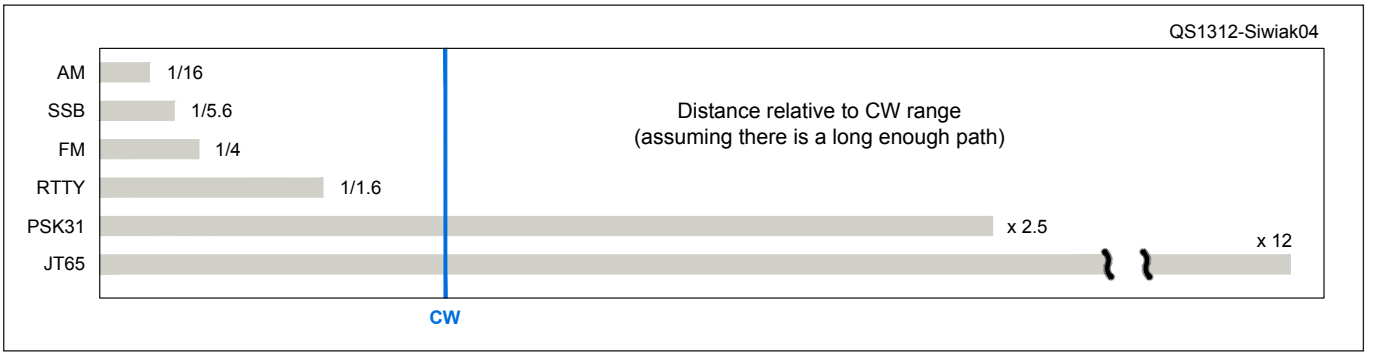

Figure 4 – Relative range of different modes for a radio path link.

Table 3
Occupied Bandwidth and Noise Bandwidth

Mode	Noise Bandwidth (Hz)	Occupied Bandwidth (Hz)	Emission Designator
AM	6000	6000	6K00 A3E
SSB	2456	2500	2K50 J3E
FM	12,500	12,500	12K5 F3E
RTTY	180	250	250H F1B
CW	100	100	100H A1A
PSK31	31.25	62.5	62H5 G1B
JT65	2.692	175	175H F7B

The full spread of performance from AM to JT65 (remember, this is in a white noise environment) is more than 52 dB, a power ratio of 160,000. That's a "big knob" we can crank to choose the radio path link performance. The receiver effective noise bandwidth per mode accounts for much of the huge spread in receiver sensitivity. The receiver audio passband is treated as the "last IF" for digital modes. Digital mode software and its implementation losses further processes the digital signal, applies digital bandwidth filtering and decodes the message. Table 3 shows how noise bandwidths and occupied bandwidths compare for the various modes. The listed SSB noise bandwidth corresponds to an average value for the 30 measured radios. We quote the pre-detection FM noise bandwidth in Table 3, which does not relate linearly to post detection noise bandwidth. The FCC and ITU-R show us how to calculate the occupied bandwidths, and how to assign the emission designators.[2] Although JT65 occupies a bandwidth of about 175 Hz, clever signal design keeps the effective receiver noise bandwidth at 2.7 Hz. Couple that with its powerful error correcting code plus the high average transmit power, and JT65 can place spectacular distance performance at our fingertips. It's easy to see why hams use a version of JT65 for EME (Earth-Moon-Earth) contacts.

So which mode is best? That depends on what you want to send, and how fast you want to send it. A JT65 contact comprises a limited vocabulary of call signs, signal strengths, and locations, and operates at roughly three words per minute. Voice modes, on the other hand, support real-time conversations, but require more power for a given distance. It's all about the noise bandwidth in Table 3 and average power in Table 2. The "best mode" lets you pass the information you want at the rate and distance you want.

How Far Does it Talk?

How much further can one mode "talk" compared to another? For a fair comparison of *distance*, a long enough path must actually exist (we're ignoring skip zones in an ionospheric path). But if a good path does exist for a JT65 contact at the threshold of performance, Figure 4 reveals the range would be 12 times the range of a threshold CW contact.[3] CW range would extend to nearly 6 times that of SSB and AM talks only 1/16 as far as CW. DX operators commonly use CW, RTTY, and SSB, which can have a performance spread of about 17 dB. Those popular DX modes may have a range spread of up to 6 to 1 among them. Individual DX stations, on the other hand, use all modes. One of us (KE4PT) recently snagged a new one (Reunion Island) on two bands using JT65. If you need that rare one in your logbook, concentrate on CW, then on RTTY, and finally SSB *in that order*. Using this strategy the authors have increased their DXCC totals using every mode except AM or FM.

In Conclusion

In this simple comparison we considered "Additive White Gaussian Noise" (AWGN) as the only impairment in the radio link. While we did take transmitter PEP and receiver bandwidth filters into consideration, we didn't account for the Sun, Moon, radio settings, QSB (fading), QRN (natural noise), QRM (man-made noise), or QLF, so your experience may vary.[4] You can target the DX station's operating mode more confidently when you know CW can outperform unprocessed SSB by 17 dB, and RTTY can outperform SSB by 11 dB. If you can't get them on phone, try RTTY or better still, try CW.

Notes

[1]**www.arrl.org/product-review**.

[2]Modes and occupied bandwidths for emissions are defined in US Title 47 Code of Federal Regulations: 2.201 – 2.202, and ITU-R Recommendation SM.1138, 1995.

[3]Range estimates, assuming that a long enough ionospheric path exists, use a 23log (distance) propagation model based on: K. Siwiak, KE4PT, "Optimum Height for an Elevated HF Antenna," *QEX*, May 2011, pp 32-38.

[4]QLF means, in fun, "I'm sending with my left foot," and here refers to operator skill.

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Bruce Pontius, NØADL, can be reached at **bepontius@aol.com**.

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

Making the Switch to LEDs

When a hard-to-find incandescent pilot lamp gives up the ghost, sometimes it's best to replace it with a long-life, low-power LED.

Charles Rankin, WA2HMM

When one of the meter illumination lights on my Kenwood SWR & Power Meter SW-2000 went out, I decided I would just replace them both if I was already going to go through the trouble of partially disassembling the unit. It turned out that I was getting ahead of myself — the incandescent bulbs used for the meter illumination were no longer being manufactured. I was left with two choices: I could try to find a similar incandescent lamp, use it as the replacement, and then worry about having to go through this again at some time in the future, or I could replace both bulbs with LEDs now and be done with it. I chose the latter.

Figure 1 — The Kenwood SW-2000 SWR & Power Meter prior to having incandescent meter illumination lamps replaced with low-power, long-life LEDs.

"LEDology"

Light emitting diodes (LEDs) are now ubiquitous — shining out from everything from GFCI sockets to audio/video equipment. If you have a junk box, you are bound to have some attached to a circuit board…or perhaps a bag of a hundred LEDs bought on impulse off the Internet for a few dollars.

Unlike incandescent lamps, LEDs should be driven by a *current* source, not a voltage source. For LEDs, a reasonable approximation of a current source is simply a resistor inserted between the voltage source and the LED. Unfortunately, LEDs with a junk box pedigree usually come without specifications. However, we can make a pretty good guess at the relevant parameters needed to calculate the series resistor: the maximum operating current and the forward voltage drop across the LED. For miniature, single-die indicator LEDs, the maximum dc current specification is often 20 mA; the forward voltage drop varies with the emitted color. Red LEDs typically have a voltage drop of 1.9 to 2.1 V, while white LEDs can range from 3.0 to 3.4 V. Other colors have other values.

To calculate the series resistor minimum value, subtract the forward voltage drop from the operating voltage and divide the difference by the maximum rated current. This will provide the maximum brightness; however, this may not be the most desirable brightness.

If possible, it's a good idea to try the new LED out in typical shack lighting conditions before putting everything back together. In a 2003 *QST* article, Phil Salas, AD5X, used a potentiometer to empirically determine the series resistor value.[1] With the previously calculated series resistor in place, insert a potentiometer that has a maximum value that will limit the LED current to 1 mA. Varying the pot from maximum resistance to minimum resistance will change the LED current from 1 mA to 20 mA which should cause a substantial variation in the LED's light output. If less than maximum LED brightness is satisfactory, then select a new series resistor roughly equal to the sum of the current pot setting and present series resistor. Of course, if the LED's light out-

[1]Notes appear on page 34.

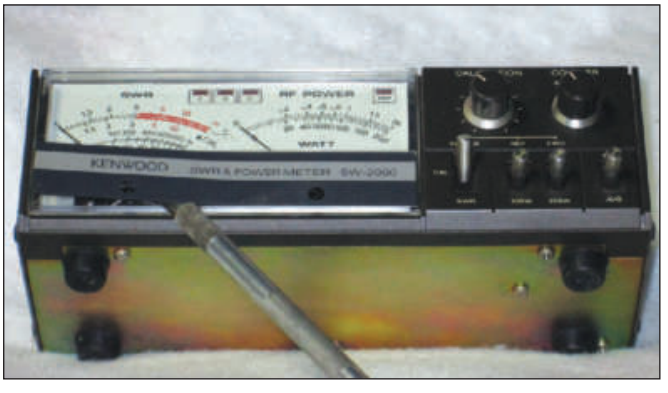

Figure 2 — Removing the name plate.

Figure 3 — Screws at lower left and lower right holding the plastic face to the cabinet.

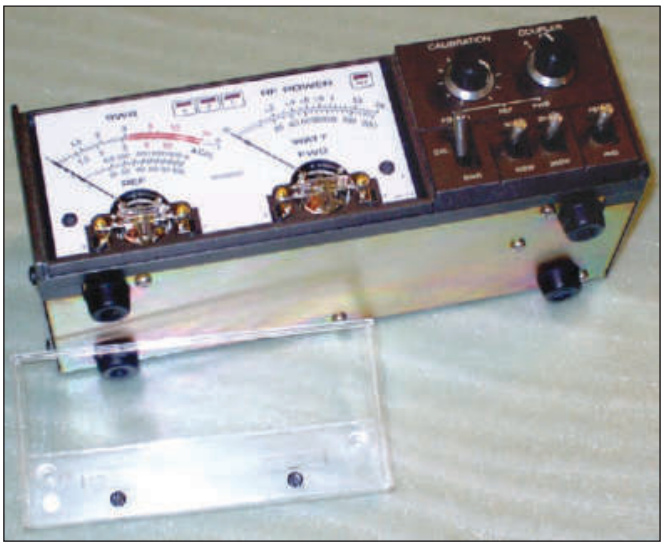

Figure 4 — The plastic face has been removed and the two incandescent lamps are ready to be desoldered.

Figure 5 — The blue LEDs are installed and the plastic face has been reattached.

Figure 6 — The meter faces are now illuminated by long-life blue LEDs.

put is insufficient, then a brighter LED will have to be used.

In a dc circuit, the cathode (the bar part of the diode schematic symbol) must be connected to the more negative voltage for the LED to shine. If it's a new part and the leads are unclipped, the cathode is the shorter of the two. If the leads have been clipped, the cathode is the lead by the flat spot on the ring at the base of the plastic body. If you can't find your reading glasses, the polarity can be determined with a 1 kΩ resistor in series with a 9 V battery.

Finally, two points to consider: power dissipation in the series resistor and LEDs driven from an ac source. The power dissipated by the series resistor is the square of the voltage across it divided by its resistance. It's often considered good engineering practice to derate a resistor's maximum power dissipation by 0.7. This means that for increased reliability you should not put more than 0.7 W through a 1 W resistor. When an LED is driven from an ac source it appears as a half-wave rectifier so the source voltage used to calculate the series resistor should be 0.45 the RMS value (RMS is the ac value read by your voltmeter).

Modifying the Kenwood SW-2000

My SW-2000, shown in Figure 1, has a pair of meters protected by a plastic face. Each meter is illuminated by an incandescent bulb hidden by the name plate attached to the plastic face. My first challenge was to remove the plastic face in order to gain access to the meter lamps. If you've ever had to remove an automobile dashboard you can appreciate how clever product designers can be with hiding screws. Well, Kenwood's designers are no less clever.

It finally occurred to me that the screws were probably hidden under the name plate. I used an X-Acto knife with a thin blade to carefully lift the name plate from the plastic face (see Figure 2). Sure enough, there were the two screws at the lower left and right of the plastic face, holding it to the cabinet (see Figure 3).

Next, I unscrewed the two screws and removed the plastic face, being careful not to touch either of the meter movements. I now had access to the meter illumination bulbs (see Figure 4) and unsoldered them, again taking care around the delicate meter movements.

As you can see in Figure 5, space was tight, so I opted for an LED with a built in series resistor. I chose an LED-12B from All Electronics.[2] This is a blue diffused LED with a luminous intensity of 100 millicandelas (mcd) when operated at 12 V. Before soldering the LEDs in place, I double checked the polarity of the lamp supply and then dressed the leads and positioned the LED bodies so that they would not interfere with the meter movements while equally illuminating the meter faces.

Figure 6 shows it all — the SW-2000 once again shining forth — now with its fancy blue LED illuminated meter faces.

Notes

[1] P. Salas, AD5X, "Solid-State Those Pilot Lamps," *QST*, Sep 2003, pp 38-39. [The editor's comment that $E_{avg} = 0.9\ E_{rms}$ is in error. It should be $E_{avg} = 0.45\ E_{rms}$ because an LED is only a half-wave rectifier. — *Ed.*]

[2] **http://allelectronics.com/**.

Photos by the author.

Charles Rankin, WA2HMM, holds an Amateur Extra class license and is an ARRL member. Charlie was first licensed in the late 1950s as WV2HMM and later received his 20 wpm Extra. He enjoys DXing on the HF bands and 2 meter mobile from his cars and pickup. He has had several items published in *QST*. Charlie works for Motorola Solutions, in the Holtsville, NY facility, where he runs the Engineering GTEM Laboratory (EMI/EMC). He is a charter member of the Symbol Technologies Amateur Radio Club (STARC). Charlie has a US patent for a "Universal Dipole," which is used for testing at WAN radio frequencies (GSM, DCS, PCS). Charlie can be reached at 165 Hickory Ln, Smithtown, NY, 11787-4429 or at **crankin@dialup4less.com**.

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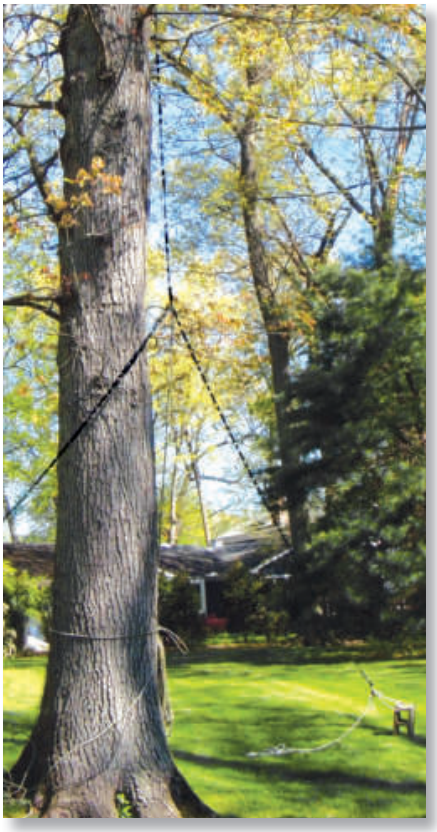
New Products

DX Engineering DXE-400MAX Coaxial Cable

DXE-400MAX is a 50 Ω RG-8 size coaxial cable that features an AWG #10 stranded copper center conductor, gas injected foam polyethylene dielectric, and two layers of shielding — bonded foil and tinned copper braid. The outer jacket is UV-resistant polyethylene suitable for indoor or outdoor applications and for direct burial. Price: $0.82 per foot (ready-made coaxial assemblies with silver/Teflon PL-259s are available at additional cost). For more information, or to order, visit **www.dxengineering.com**.

An Easy to Make Two Band HF Ground Plane

Here's another application of the popular window line coupled resonator antenna.



Joel Hallas, W1ZR

In the May 2011 issue of *QST*, we described a simple and efficient two band *coupled resonator* dipole made from window line. That antenna worked very well, was easy to make, and perhaps more importantly, easy to duplicate.[1] It became very popular and has since been adapted to most combinations of amateur bands from MF to UHF.[2] I recently received a request to further adapt it to vertical polarization.

[1]Notes appear on page 37.

Shifting the Polarization

The original design could, of course, be adapted for use as a vertical dipole, and some have successfully done so, particularly for VHF FM operation. It turns out that a coupled resonator can also be configured as a vertical ground plane in order to minimize the height of the required support. This makes sense, since a vertical dipole needs a support more than half a wavelength high. With a single available support at that height, for most HF applications, an inverted V dipole provides improved performance.

Try a Ground Plane

A *ground plane antenna* is a vertical ¼ wave monopole mounted and fed against an artificial ground system — the "ground plane." As originally developed, the artificial ground consisted of a metallic disc with a radius of ¼ wavelength or more. While that is feasible at UHF, at lower frequencies, the ground plane is usually constructed of multiple ¼ wave conductors, called *radials,* perpendicular to the vertical element and located at its base, as shown in Figure 1. Configured in

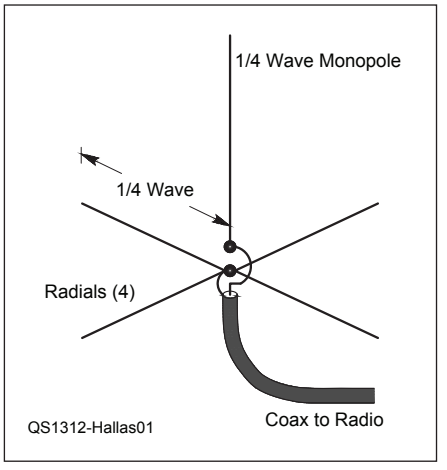


Figure 1 — A traditional ground plane antenna. The four horizontal rods (radials) serve as an artificial ground for the monopole. Note that while they serve in place of a ground, they are not at ground potential. The ends of the radials are at the same potential as the tip of the monopole and people and animals should be protected accordingly.

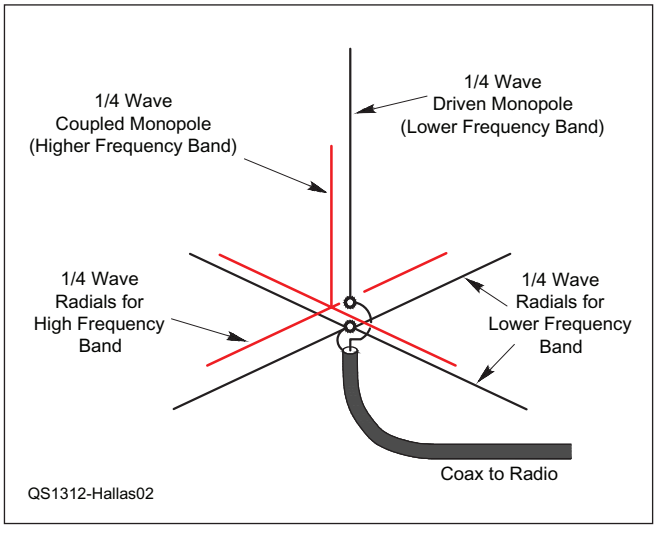


Figure 2 — Simplified drawing of the two band coupled resonator ground plane. Note that there are no electrical connections to the higher frequency unit.

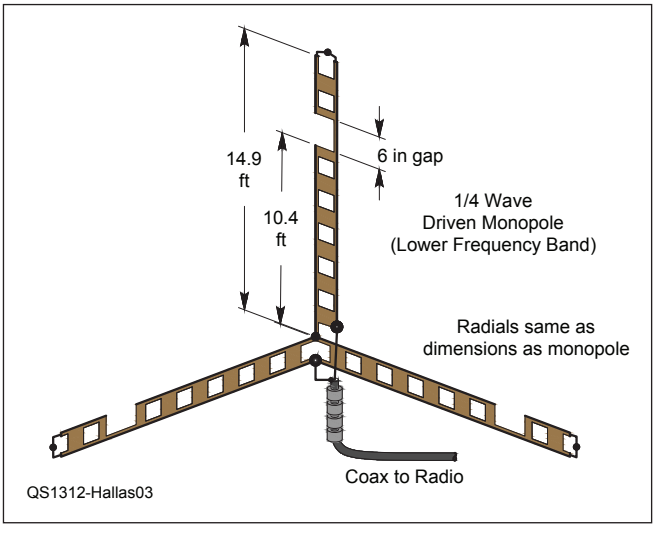


Figure 3 — Dimensions of the window line 20 and 15 meter ground plane. For best match the radials should droop from the horizontal. While 45° is optimum, it will work satisfactorily with a less extreme droop.

Figure 4 — Close up of the feed arrangement for the prototype ground plane. The six ferrite beads that make the common mode choke are shown below the feed point. A permanent antenna would do better with more structural integrity at the feed. The rope adjacent to the antenna is the halyard for a different antenna.

that way, the antenna has a feed point impedance that is half that of a dipole, or 36 Ω, in free space.

While the configuration of Figure 1 is often encountered — sometimes using a *gamma match* to provide a feed impedance of 50 Ω, another alternative is to lower the outboard end of the radials to make a *drooping* ground plane. This skeleton conical arrangement is topologically somewhere between the standard ground plane and a vertical conical dipole. Such an arrangement can provide a good match to 50 Ω coax. We have taken that approach here, although to use even less vertical space, if a small mismatch can be tolerated on the lower frequency band, horizontal radials can be used.

The Coupled Resonator Ground Plane

As with the original two band horizontal dipole, this antenna is really two parallel ground planes made from window line. I selected the 20 and 15 meter bands for this model, however, it could easily be adapted to other pairs of bands. The lower frequency ground plane is fed directly with 50 Ω coax, while no portion of the higher frequency ground plane is connected directly to the driven unit, but receives its energy through parasitic coupling (see Figure 2). While three, four, or even more radials could be used, the two radial configuration I used is within less than 1 dB of being omnidirectional and works very well for those with physical constraints. Some have even used a single radial — picture a bent vertical dipole configuration — but that is more directional and has a higher angled main lobe, so we used two here.

How High Should It Be?

As discussed in a recent *QST* article, a vertical monopole can be ground mounted, but works somewhat better if off the ground.[3] Another consideration is that the ends of the radials are a high voltage point, with a potential comparable to that at the top of the monopole. Thus for optimum safety, those ends should be high enough or otherwise protected from accidental contact. It is important to remember that while the radials serve as an artificial ground, in this configuration they are very much a part of the antenna and must be insulated as well as the vertical monopole.

If we were to have the ends of our radials at a safe height of 8 feet off the ground, and droop our radials at 45 degrees, we would need a support about 36 feet above ground. If we had a single support that high, we would likely be better off with a dual band inverted V for these bands. Thus, in most installations a lower height will be used and sufficient insulation and other protection should be employed, especially if higher power is used.

To Fold or Not to Fold

As with the coupled resonator dipole, it is possible to have either traditional linear elements or use the unused conductor of the window line beyond the end of the 15 meter elements to shorten the lower frequency antenna elements in a "folded" arrangement. At first, I was just going to describe the linear arrangement, but then decided that since available

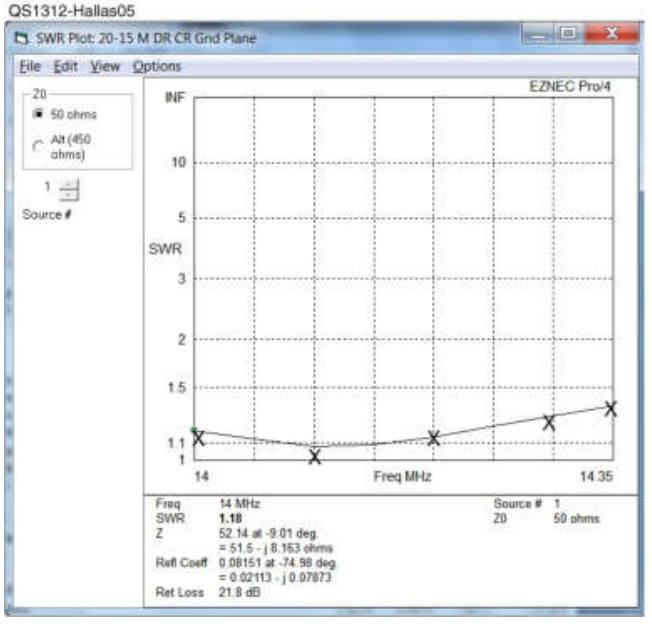


Figure 5 — *EZNEC* predicted SWR of the folded coupled resonator ground plane on 20 meters. The measured results taken through 25 feet of RG-8X are shown with the Xs.

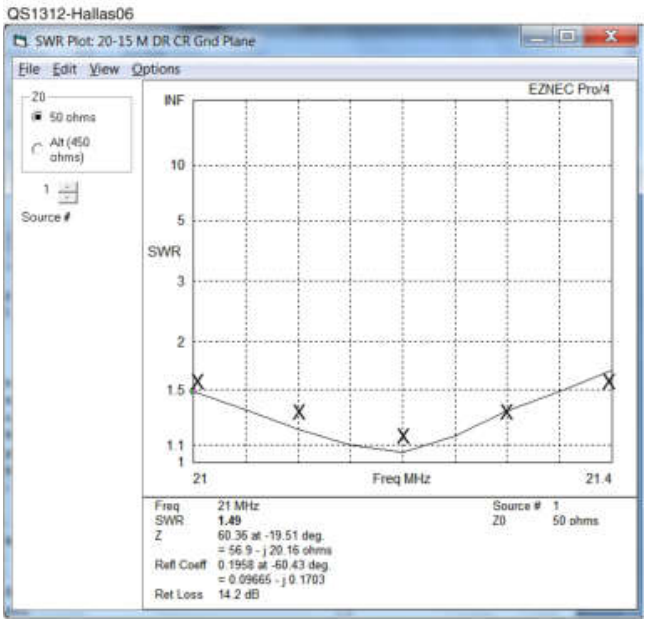


Figure 6 — Same as Figure 5, but for 15 meters.

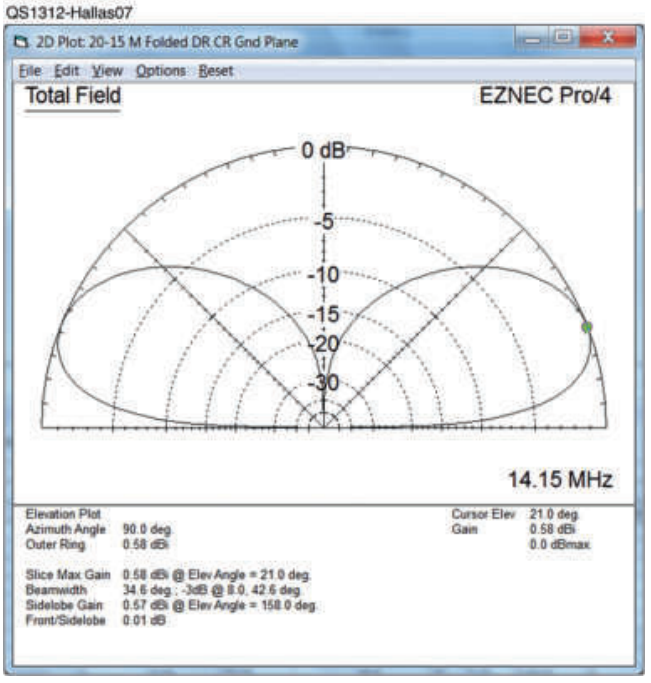


Figure 7 — *EZNEC* predicted elevation pattern on 20 meters. The unfolded version (16.25 feet high) at the same height has a gain only 0.1 dB higher. The antenna was modeled with the base 12 feet above typical ground (conductivity 0.0005 S/m, dielectric constant 13). The azimuth pattern is within 1 dB of being omnidirectional.

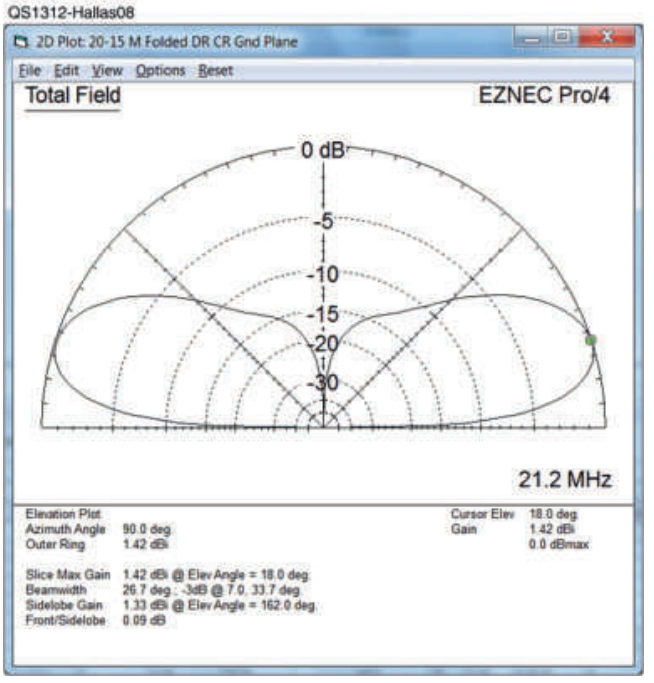


Figure 8 — Same as Figure 7, but for 15 meters.

height was a key issue, I would save a bit more than a foot by using the folded approach. There really is no downside to this arrangement. Note that in the folded configuration, the highest voltage points are at the gap.

Putting it Together

The exact dimensions will depend on the height above ground and the ground conditions. My dimensions (see Figure 3) were set with the base 12 feet above ground. I lowered the antenna so that the feed was at 3 feet, and the radial ends were at about 1.5 feet. As a result, the 20 meter resonance dropped by 270 kHz, while the 15 meter resonance dropped by only 20 kHz. Of course, this is a good direction in which to have a change, since it's easier to trim than stretch antenna wire. My suggestion would be to start with a few inches more than shown and trim as needed. By the way, order a few more feet of line than you think you will need — my order came up a few feet short.

I made my prototype from Davis RF window line that uses #18 AWG stranded copper covered steel wire.[4] While other types of window line could be used, different wire size or dielectric properties will have an effect on the final dimensions, so plan accordingly.

Note that while it looks like there are three distinct pieces, the two radials can be made from a single length of window line with the insulation stripped at the center of each piece. I used a common mode choke made from six slip-on ferrite beads taped in place just below the feed.[5] Of course, other kinds of chokes could be used, however, the beads noted slip nicely over RG-8X, don't require tight turns as on a toroid and are lightweight and compact.

While the design shows the monopole and radials the same length, if you are close to being on frequency, you can just trim the monopole. It makes the antenna the ground plane equivalent of an *off-center fed* dipole. Any unbalance resulting from the small difference will be largely eliminated by the common mode choke (see Figure 4).

Antenna Performance

The antenna came together quickly and works just as *EZNEC* predicted.[6] The measured SWR for both bands at the end of 25 feet of RG-8X is shown on top of the *EZNEC* SWR predictions in Figures 5 and 6. Figures 7 and 8 show the elevation patterns on both bands, with the antenna feed 12 feet above typical ground.

Tests on the air tended to confirm the predictions. In A/B comparison with a three element triband Yagi at about 35 feet, the Yagi always did better by around 3 S units for stations at medium range that needed high elevation angles. DX stations were usually within 1 or 2 S units of the Yagi. Part of the difference was due to the extra 2 dB of line loss getting from my entrance panel to the antenna test position.

In summary, this antenna will not outperform a Yagi on a tower, but it will work DX at low cost and with a small footprint.

Notes

[1]J. Hallas, W1ZR, "Getting on the Air — A Folded Skeleton Sleeve Dipole for 40 and 20 Meters," *QST*, May 2011, pp 58-59.
[2]J. Hallas, W1ZR, "The Folded Skeleton Sleeve Dipole on Other Bands," *QST*, Oct 2011, p 48. An updated list is on the *QST* In Depth web page at **www.arrl.org/qst-in-depth**.
[3]J. Hallas, W1ZR, "How High Should Your HF Vertical Be?" *QST*, Nov 2011, pp 51-52.
[4]Davis RF part LL-450-553, **www.davisrf.com**.
[5]Palomar Engineers FB-56-43 ferrite beads, **palomar-engineers.com/ferrite-beads**.
[6]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

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Modern Breadboarding Tools and Techniques

Today's breadboards accommodate ICs as well as breakout boards and leaded components.

Dick Barnett, N9NP

When I was first licensed in 1964, a breadboard circuit consisted of a wooden board on which bread was sliced (hence *breadboard*). We screwed down octal and miniature tube sockets and terminal strips, and connected up discrete parts using wires. Those at the cutting edge of technology might have included a transistor or two. Today we have integrated circuits (ICs), surface-mount technology (SMT), LCD displays, microcontrollers, and a host of electronic devices that may be applied to do-it-yourself (DIY) circuit projects. These newer devices present a few challenges to the modern breadboarding process.

Breadboarding circuits is a fun and relatively painless way to try out circuit ideas and projects. Figure 1 is the third generation of my auxiliary display project, and I've tried out a number of different features and operational modes before soldering anything in a permanent fashion. To encourage more DIY projects, I am introducing some methods and tools to make breadboarding easier. Figure 1, for example, shows a breadboard for my auxiliary display and mode control project. The project displays the in-band frequency (otherwise it indicates "Out-of-Band!") and the license privileges for that frequency, controls the operating mode, and also provides a USB CAT interface for my Elecraft K2 transceiver.

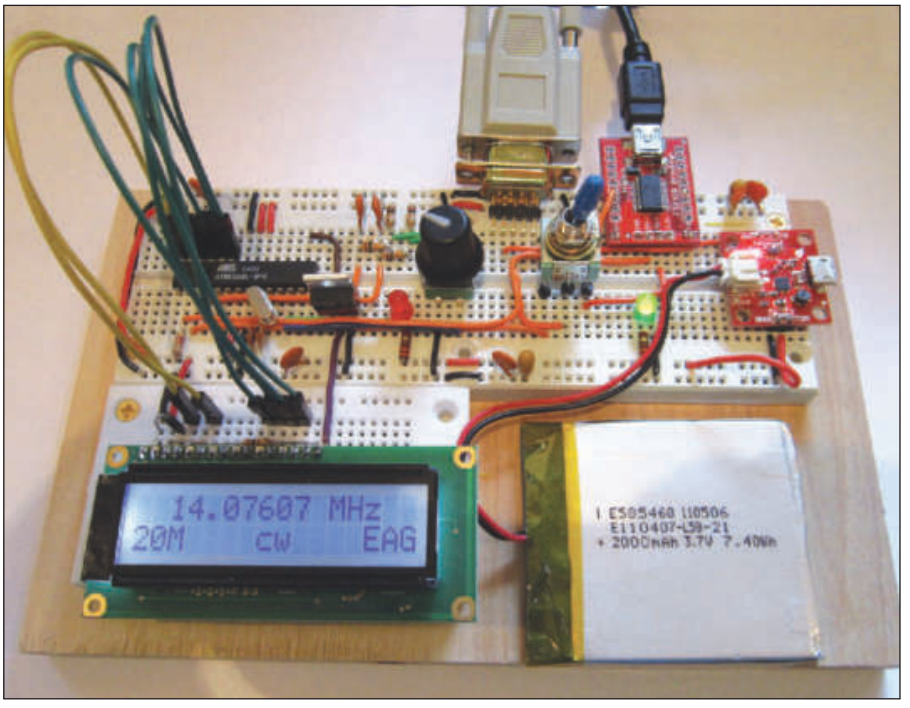


Figure 1 — This breadboard illustrates an auxiliary display and breakout boards in a mode control project. [Dick Barnett, N9NP, photo]

Breadboard Sizes and Shapes

Figure 2 shows three convenient breadboard types and sizes.[1] Each vertical row of five holes connects beneath the surface of the board to a clip that solidly grips and connects wires or pins pressed into any hole of that row. For example, microcontroller IC pin 2 (second pin from the lower left of the IC in the upper left of Figure 1) connects to a 4.7 kΩ resistor and to an orange wire in the same row of holes. The wire then connects to the toggle switch. The other side of the resistor connects to the supply voltage buss (described below). Another orange wire connects pin 3 (next row of holes) to one of the toggle switch connections, and so on.

The horizontal groups of five holes along the breadboard edges usually connect in a long buss that is a convenient connection point for ground or for a supply voltage. A break in these buss connections occurs at the center point of the larger breadboard. In Figure 1 you can see short red and black jumpers that span these gaps to make the busses continuous across the length of the breadboard. I usually route the supply voltage on the inner buss and ground on the outer buss, but you can assign any signal or voltage that needs multiple connection points to the busses.

Breadboard holes are on 0.1 inch centers, the same as many IC pins, such as the microcontroller IC. As long as the parts you are using have pins on 0.1 inch spacing or can be adapted to that spacing, these breadboards provide a convenient way to try out your circuits. The rotary encoder (under the black knob in the center of the breadboard) and the power MOSFET (the TO-220 package just to the left of the red LED) have leads on 0.1 inch centers, so they easily adapt to the breadboard.

I usually attach breadboards to a scrap piece of plywood to hold everything steady. The two larger breadboards have convenient screw holes, but the small red one in Figure 2 does not. I drilled 3/32 inch holes at the ends of the center cutout to accommodate #4 × ¾ inch wood screws that I use to attach everything to the plywood.

Pins and Sockets

Many devices and connectors such as the edge connector of the LCD or the DB-9 connector at the top center in Figure 1 are also on 0.1 inch centers, but do not have pins to insert into the breadboard. Figure 3 shows a variety of pin types that you can solder to these devices for convenient use with breadboards.[2] The right-angle pins at the top are convenient for attaching the DB-9 connector in Figure 1 to

[1]Notes appear on page 41.

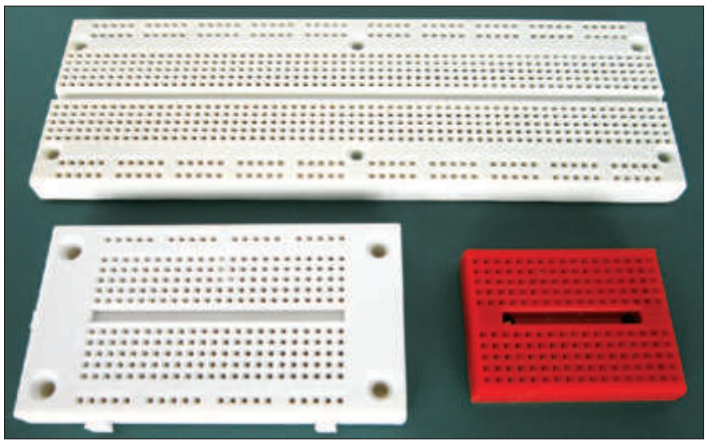


Figure 2 — Breadboards are available in several sizes and shapes. [Dick Barnett, N9NP, photo]

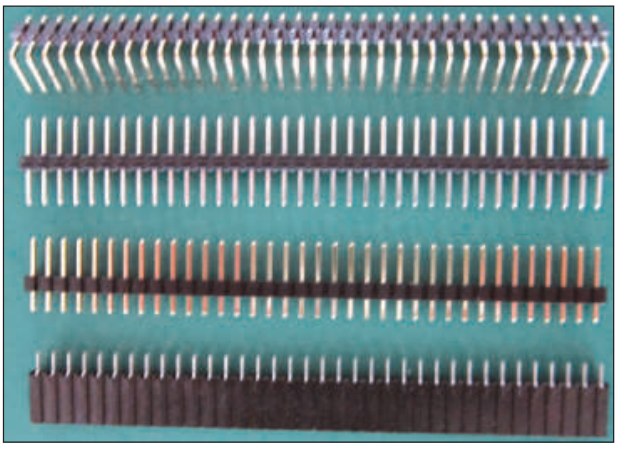


Figure 3 — Several pin styles make soldering devices on breadboards convenient. [Dick Barnett, N9NP, photo]

the breadboard. Note that I've installed pins for only the bottom row of the connector. If you need to connect to the upper row, solder wires into those DB-9 connections that are long enough to reach the breadboard holes.

The straight pins that are equal length on both sides of the plastic center strip are convenient for other devices where the extra length allows some flexibility. The toggle switch in Figure 1 uses these pins because the switch contacts are not spaced at 0.1 inch intervals. I soldered the longer pins to the switch terminals so they have enough length to flex a bit and allow the pins to fit into the breadboard holes. I soldered the straight pins that are longer on one side into edge connectors of the LCD board and the edge connectors of the breakout boards at the right end of Figure 1. The bottom of Figure 3 shows a black strip of female connectors that mate with the pins. These can be used to create connectors or jumpers. You can either snap off the pins you need or cut them to length with diagonal cutters at the convenient breakpoints between each set of pins.

Wiring Up Parts

Small parts such as resistors or capacitors can simply be pushed into the breadboard holes as needed to create circuits. Examples are the four 10 kΩ resistors and the capacitors above and to the left of the rotary encoder in Figure 1. Bare leads should be kept as short as possible to prevent inadvertent shorts and to reduce induction of unwanted signals on the leads.

Always include power supply bypass capacitors on the power busses. Figure 1 shows bypass capacitors at the far upper right, and another set below and to the left of the toggle switch. I recommend tantalum capacitors in parallel with ceramic disks to ensure clean power. The yellow capacitors are 22 µF tantalums and the disk capacitors are 0.001 µF.

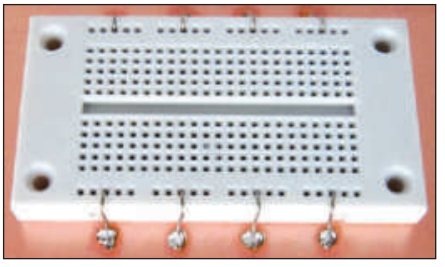


Figure 4 — This breadboard has extra ground plane connections and is useful for RF projects up to 100 MHz. [Dick Barnett, N9NP, photo]

Breadboarding RF and SMT Circuits

You can breadboard high frequency circuits using the breadboard shown in Figure 4. It has an added single-sided printed circuit board ground plane and extra bare wire ground plane connections from the ground buss. That RF breadboard is regularly used up to 100 MHz successfully in the ECET Labs at Purdue University. You may want to spread your circuit out a bit because adjacent connection rows can have up to 11 pF of capacitance between rows.

Many very useful devices and ICs are available only in SMT packages, none of which lend themselves to breadboarding. SurfBoards® from Capital Advanced Technologies are one solution to the SMT challenge.[3] These small circuit boards (see Figure 5) allow mounting SMT parts and provide 0.1 inch spaced pins along one edge of the board that fits into the breadboard. You can mount SMT resistors, capacitors, or other discrete parts on SurfBoards. The downside is that once the SMT parts are mounted, they are difficult to remove and reuse. However, the SurfBoards can be re-used in your final project as a component, saving you time and effort as you finalize your project.

Using Breakout Boards

SparkFun Electronics provides another solution to the SMT challenge in the form of a wide variety of useful SMT parts mounted to small printed circuit boards called *breakout boards*.[4] These boards typically have 0.1 inch spaced holes for pins along at least one edge, and some come with pins installed. Typically you can install pins so that the breakout board fits into your breadboard. Some of the breakout boards have holes along multiple edges, so you need to be selective about where you install pins so they are useful in breadboarding.

I used two breakout boards in my breadboard project shown in Figure 1. The one on the far right end of the breadboard is a SparkFun PRT-10300 Power Cell LiPo Charger Booster. It provides a regulated 5 V or 3.3 V (jumper selectable) and controls the charging of a Lithium Polymer (LiPo) battery using either the 5 V from the micro USB connection or from an external 5 V supply. I installed pins on the 5 V charger input (along the top of the board shown in Figure 1) and on the Vcc output along the bottom of the board to facilitate use in the breadboard. This breakout board handles the fussy charging requirements of the LiPo battery safely and also supplies Vcc for the project. I used the long red wire from the Vcc connection on this board as a power switch by plugging or unplugging it into the 5 V power buss.

The second breakout board is a SparkFun BOB-00718 FT232RL USB to Serial converter. I installed pins only across the end of the board where the Rx, Tx, GND, and 3.3V pins are located. In this way the most common pins conveniently plug into a

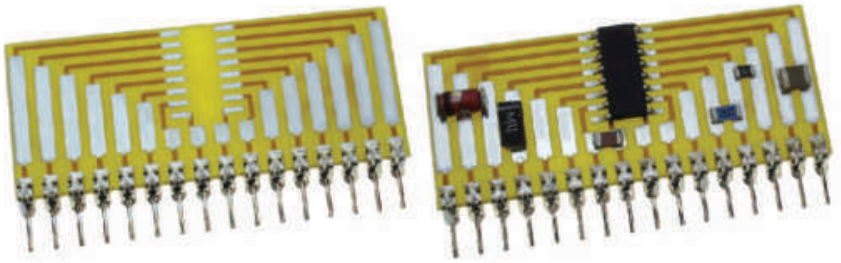


Figure 5 — This SurfBoards® from Capital Advanced Technologies accommodate mounting SMT parts. [Photo courtesy Capital Advanced Technologies, **www.capitaladvanced.com**]

breadboard. The balance of the serial flow control pins (and a few others) are along the sides of the breakout board. You can install wires into any of these that you may need to plug into your breadboard. For example, the orange wire attached to the left edge of this board connects to the 5 V supplied by the USB connection. I connected it to the 5 V charge input of the LiPo charger board so that the battery is charged whenever the USB connection is in use. The GND connection to the board (not visible) is underneath the breakout board.

Breakout boards provide specific functionality as needed. Figure 6 shows two uses of the FT232RL breakout board. I mounted one of them to an Elecraft W1 Power Meter board (green) to provide a USB interface instead of the supplied serial interface. Another FT232RL board connects into a DB-9 connector shell to provide USB to TTL-level serial signal conversion.

Microcontroller Boards

Microcontrollers are often a part of modern projects. Figure 7 shows various development and demonstration microcontrollers and microcontroller boards. The two devices at the bottom are Atmel AVR microcontrollers in through-hole IC packages that are very easy to use in breadboarding.[5] The Atmel ATmega8 microcontroller IC in Figure 1 is also supplied in a through-hole package.

The left-most board in Figure 7, a Cypress PSoC III microcontroller demonstration board, includes various additional components that display the versatility of the device.[6] Included are an accelerometer, a temperature sensor, a wireless port for Cypress wireless modules, a slide controller (the zig-zag circuit traces), eight LEDs and a few other devices. Demonstration boards are usually equipped to allow limited use as development boards as well. In this case the microcontroller port connections (those not committed to the on-board devices) are available in two rows of pins that extend beneath the board. The tops of these pins are visible in two rows that straddle the (white) wireless connector, and are spaced appropriately to be plugged into breadboards. From a breadboarding perspective, the extra components on demonstration boards often limit their usefulness to some extent by consuming I/O ports that might otherwise be useful in projects.

The top center board and the two right-hand boards in Figure 7 are Arduino boards.[7] Arduino boards are very popular among hobbyists, and much software for them is available on the web. The top center board is an Arduino Pro available from SparkFun. The connectors on many Arduino boards are on 0.1 inch centers, however the two connectors along the edges are not spaced correctly to fit conveniently into breadboards. These boards are more correctly termed *development boards* because they contain the microcontroller and the minimum additional circuitry to allow programming and using the microcontroller. Most of the port pins are brought to the edge connectors and the connectors are made convenient to connect to other common devices. For example, the pins along the left sides of the Arduino boards include the signals that are important to connect to Bluetooth® modules or other wireless devices. Arduino boards typically also provide power connectors and power regulation on the boards. Note that pins are not supplied along the top, bottom, and right hand side of

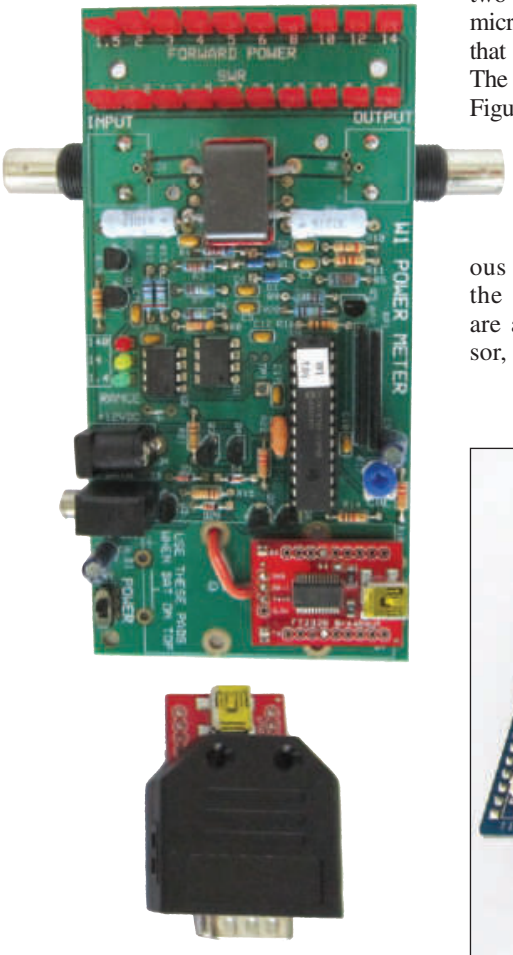


Figure 6 — Breakout boards like the red FT232RL board on the lower right are an easy way to provide a specific function. [Dick Barnett, N9NP, photo]

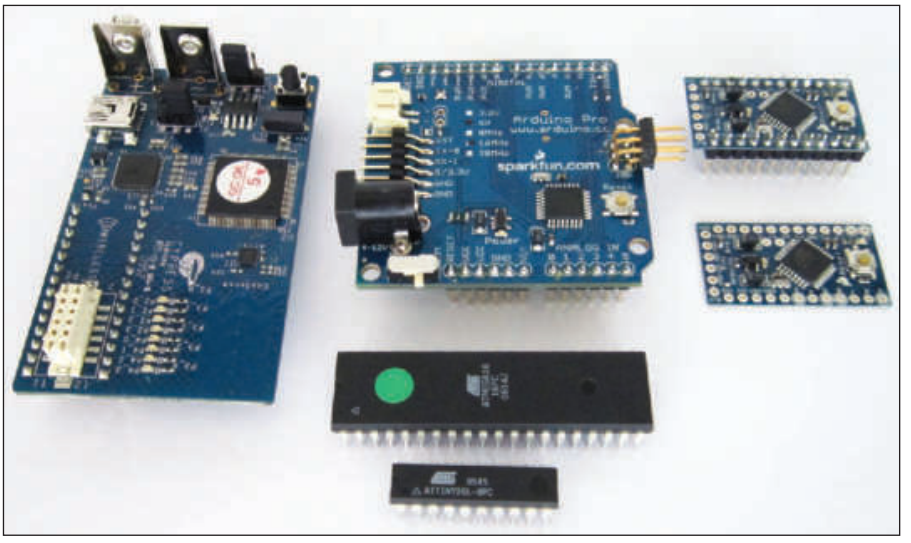


Figure 7 — Microcontrollers like the several microcontroller development/demonstration boards shown here are often a part of modern projects. [Dick Barnett, N9NP, photo]

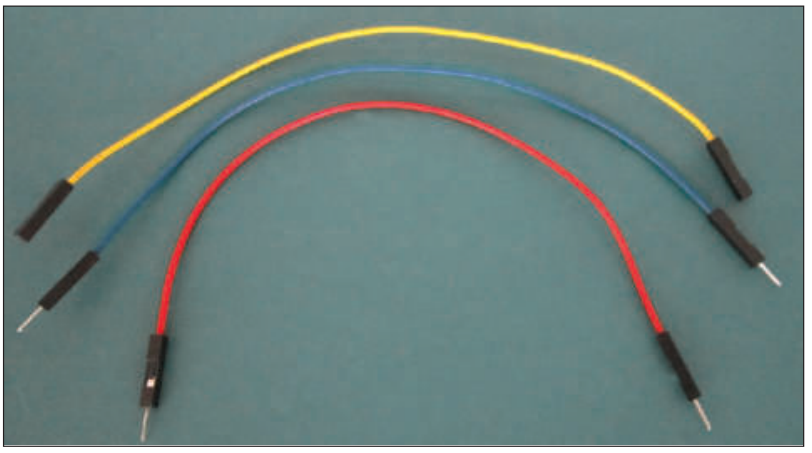


Figure 8 — Connector wires are available with either pins or sockets on the their ends. [Dick Barnett, N9NP, photo]

the board, so I installed pins for convenient breadboarding.

The two boards along the right side of Figure 7 are Arduino Mini Pro boards. One of the boards shown has pins installed for breadboarding while the other does not. These boards use the same microcontroller (Atmel ATmega 328) as the Pro board (top center) but have less on-board circuitry. The port pins along the edges allow connection to other port pins, and the row of holes along the end of the board are set up for connection to serial or wireless modules. Remember that microcontrollers require program code development, but that is beyond the scope of this article.

Breadboards are usually wired with #22 AWG solid wire. Wires should be kept short to prevent noise pick-up (see Figure 1 for examples). For longer connections such as the connections to the LCD in Figure 1, you can use wires with pins on the end (SparkFun PRT-10898), as shown in Figure 8. The connector wires shown in Figure 8 may terminate in either pins or sockets of several sizes. I tend to use socket ends that can easily turn into a pin end by inserting a single pin (Figure 3) to switch the gender of the wire end. You can use pieces of # 22 AWG solid wire for off-board connections.

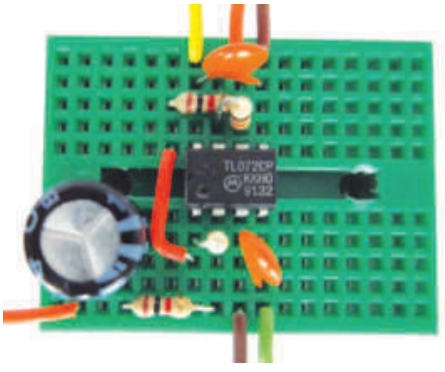


Figure 9 — This analog module has color-coded wire leads attached. [Dick Barnett, N9NP, photo]

Tips and Tricks

■ Follow a consistent color code with your wiring. Compare Figure 1 with the two-stage analog amplifier of Figure 9;

- Black is digital ground.
- Brown is analog ground (the grounds are kept separate except at the power supply for noise reduction).
- Red is digital Vcc (+5V or +3.3V).
- Yellow is positive analog supply voltage.
- Green is negative analog supply voltage.
- Other colors are typically for various other signals.

■ Never allow wires to cross over ICs. It is much too easy to cause shorts or to confuse points if you are trying to make measurements or adjustments through a tangle of wires.

■ Always provide a power-on LED indicator. In Figure 1, the lit green LED near the battery management breakout board connects directly to power. That way it is obvious when power is applied to the circuit. I always provide a "heartbeat" LED whenever my circuit involves a microcontroller. In Figure 1, the red LED just below the optical encoder always blinks slowly indicating that the microcontroller is operating.

■ Keep common elements wired up for future projects. I've used that LCD breadboard in previous projects and keep it wired for future use. That avoids re-wiring circuits that are used commonly in projects. Figure 9 shows another circuit that I've re-used. SurfBoards (Figure 5) are another excellent way to keep commonly used and re-used circuits as needed in your breadboards.

■ Use plenty of bypass capacitors on your power supplies as discussed earlier. In Figure 9 there is a bypass capacitor (orange disc) on both the positive and the negative voltage supply connection.

In summary, breadboarding circuits is a fun and relatively painless way to try out circuit ideas and projects. You can try out a number of different features before soldering up your circuits in a permanent fashion.

Notes

[1]Small breadboards are SparkFun PRT-08800 series, medium breadboards are SparkFun PRT-00137, large board is similar to a RadioShack® 6" Modular IC Breadboard Catalog #: 276-002, **www.radioshack.com**.
Breadboards are available from multiple sources.
[2]Pins are Molex 22-28-4360 (straight) and 22-28-8360 (right angle), available from Digikey, **www.digikey.com**, and Newark, **www.newark.com**.
[3]Surfboards® from Capital Advanced Technologies, **www.capitaladvanced.com**. Available from Digikey.
[4]SparkFun Electronics, **www.sparkfun.com**,
[5]Atmel microcontrollers available through Digikey, **www.digikey.com**.
[6]Cypress Semiconductors, **www.cypress.com**.
[7]Arduino, **www.arduino.cc**, available from SparkFun Electronics.

Dick Barnett, N9NP, is an ARRL member. He ismostly interested in circuit development and operating the newer digital modes. You can reach him at **n9np@arrl.net**.

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

New Products

MacLoggerDX HD Version 1.13 for iPad

MacLoggerDX HD for iPad from Dog Park Software is an Amateur Radio application for the iPad that monitors the spots from your favorite DX Cluster. It alerts you to rare contacts or band openings by looking up and displaying real time propagation paths on a zoomable map. *MacLoggerDX HD* can log your contacts to a database and includes ADIF import, export and log syncing with *MacLoggerDX* for the desktop. Version 1.13 has been redesigned for iOS 7 and includes several new features. Price: $39.99 from the Apple iTunes Store. For more information, visit **www.dogparksoftware.com**.

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

Icom ID-51A Dual Band Handheld Transceiver with D-STAR

Analog FM, D-STAR and much more in a compact, dual-band handheld.

Reviewed by Rick Palm, K1CE
Contributing Editor
k1ce@arrl.org

Just when you thought the ubiquitous handheld transceiver, a staple of Amateur Radio since the early 1970s, had reached its evolutionary limit, it's time to think again. This has certainly been the case with the protocol Digital Smart Technology for Amateur Radio, more popularly known as D-STAR, and the parade of radios released by Icom over the years to support it. The ID-51A is the second in a new series of D-STAR capable handhelds from Icom. A 70 centimeter model, the ID-31A, was reviewed in the August 2012 issue of *QST*.[1]

I was involved as a user early in D-STAR development here in the southeastern portion of the US, where it seemed to take off more quickly than in some other parts of the country. This was probably due to a few dynamic, enthusiastic individuals here who pushed it through, conducting seminars at club meetings and "Elmering" individual operators at conferences and on the air. That was the case with me as I drove down to my local ham radio supply store in Orlando several years ago to have a chip installed in my IC-2200H, which would give me access to the D-STAR system.

Programming and operating the IC-2200H on D-STAR took some patience as there was frustration with entries in fields changing without operator knowledge, caused by some of the early system and radio nuances. The learning curve looked like a Nordic ski jump. Numerous D-STAR radios have succeeded the '2200H for user-friendliness and functionality. Icom's newest in this line is the ID-51A, the first D-STAR radio I've used since the '2200H. The evolution has been profound.

[1]S. Ford, WB8IMY, "ICOM ID-31A 70-cm Handheld Transceiver with D-STAR," Product Review, *QST*, Aug 2012, pp 51-53. Product Reviews are available to ARRL members online at **www.arrl.org/product-review**.

Bottom Line

Icom's ID-51A dual band handheld is a feature laden analog FM and D-STAR digital transceiver with a GPS receiver and a host of available options. This is perhaps the most flexible handheld available, and you'll need to spend some time learning the radio's operation to get the most from it.

Major Innovations

For me, the single most significant enhancement in the ID-51 is the incorporation and application of a GPS receiver. The application that is most useful is when the operator is mobile and pushes the NEAR REPEATER button in the D-STAR Repeater (DR) mode to find and select the closest D-STAR repeater. With access to it, the operator can then proceed with the panoply of functions and networking available to the system. With the DR mode, programming is simplified with UP, DOWN, and ENTER buttons to be pushed while scrolling through the easy-to-read menus. In fact, it's the only way to go while away from your home area and home access repeater. (While in your home area, it's easier to simply program your local repeater and frequently used commands — such as linking to your favorite reflectors — into the rig's memory channels).

Sooner or later, almost every handheld will have a GPS receiver and an updatable, onboard directory for all repeaters, digital or analog. It's just a matter of time before mobile FM and digital operators will simply push the "find nearest repeaters" button, and start talking. (There's an app on my iPhone called *Freq Finder* that updates its repeater listings periodically and displays operating parameters for machines closest to me — it works great.)

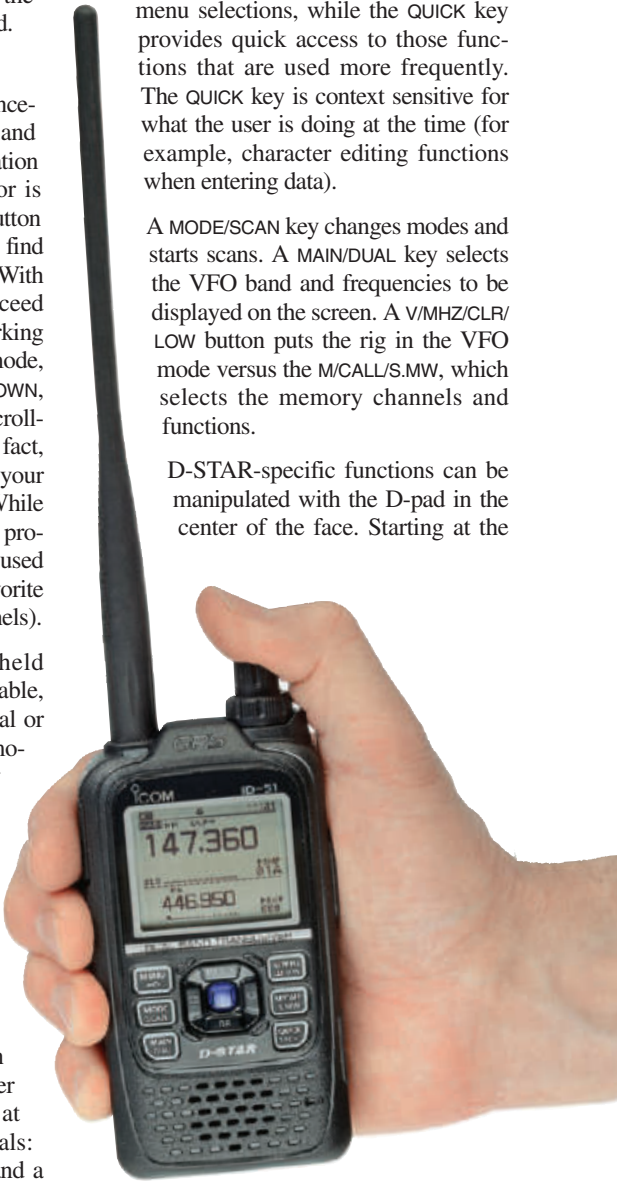
Fun and Function

The ID-51A is laden (not burdened) with the most functions of any radio I've ever used. A bit daunting and intimidating at first, the radio comes with two manuals: A 54 page *Basic Instructions* manual, and a whopping 369 page *Advanced Instructions* manual. But, the power is in the pushbuttons.

Six buttons and a "D-pad" in the middle of the front panel under the large display are all you need to control the radio. For the most part, operation is intuitive, especially if the operator already has D-STAR experience. The MENU key gives access to the comprehensive menu selections, while the QUICK key provides quick access to those functions that are used more frequently. The QUICK key is context sensitive for what the user is doing at the time (for example, character editing functions when entering data).

A MODE/SCAN key changes modes and starts scans. A MAIN/DUAL key selects the VFO band and frequencies to be displayed on the screen. A V/MHZ/CLR/LOW button puts the rig in the VFO mode versus the M/CALL/S.MW, which selects the memory channels and functions.

D-STAR-specific functions can be manipulated with the D-pad in the center of the face. Starting at the



6 o'clock position is the DR key, which turns on the D-STAR Repeater mode and doubles as the down arrow selector. Clockwise, at the 9 o'clock position is the CD (call sign display) button, which, when held down for a second, places received calls on the display with messages and repeater info. It also serves as the "back" key. At the 12 o'clock position is the RX->CS button, which captures the received station's call sign and repeaters and places the call sign into the UR field for call sign routing. The key also serves as the up arrow key. And at the 3 o'clock position is the CS or call sign select button, which, when held down for one second, displays the call sign information currently stored in the four ubiquitous D-STAR operating fields that are at the heart of the system: UR call, MY call, Repeater 1, and Repeater 2. This is a handy feature to have as the operator can quickly confirm that the proper information is coded into the four slots. I used it all of the time. The button also serves to select different menu tiers as does the CD key. At the center of these four buttons is the ENTER key. All of these keys and the menus they are associated with worked very well.

Power levels are selectable from the V/MHZ key described above — there are five levels (SLO, LO1, LO2, MID, and HIGH).

Audio Quality

There have been critical comments circulating about the transmitted audio quality, which some have categorized as "muffled." This was caused by the membrane that is apparently incorporated into the microphone to allow for some measure of water resistance. While the first production units had the thicker membrane, Icom was quick to implement a fix with an upgrade plan that solved the issue in short order. You can tell if you have the new material by looking into the mic opening. If it is white, it is the new membrane. I looked: The test unit has the white membrane and the audio was not at all muffled.

You can check your transmitted audio by two methods. By using the echo function on your local D-STAR repeater, you can hear your audio repeated back to you. Or, you can record transmissions (and indeed both sides of a complete QSO) by using the radio's record function (recordings are made onto a microSD card that is inserted into a slot on the side of the radio). There's even a voice recorder function for simply recording your own notes — reminders, lists, anything. You can evaluate your own audio and compare it to others participating in the QSO. I tried both methods, and the audio quality seemed absolutely fine to me.

Review of Functions

Some might question the utility of recording your QSO onto your radio's SD card, but I immediately realized its value in the context of disaster response and public service communications for served agencies. It helps to have a hard record of messages sent and received during the heat of battle on the disaster field for not only the after-action hotwash, but also in case questions arise. Incident Commanders won't need to rely on subjective answers when they can hear the actual messages themselves. Not as dramatic as all that, listening to your QSOs after the fact can help you hone your basic QSOing and social skills on the air! And, well, truth be told, it's just plain fun, too. This function worked well for me: you can automatically parse the QSO recording into transmissions and receptions, or just keep the recording running.

The GPS receiver discussed briefly at the outset of this review works well, not only for the benefit of finding and entering your nearest D-STAR repeater for almost instant access to the system when mobile, but it also does a fine job of providing your position, elevation, and speed. This information can be transmitted automatically via D-PRS in the Digital Voice mode every time you key the mic, if desired. Software installed in most D-STAR gateways will convert the D-PRS data packet into standard APRS packets and send it on the Internet, allowing your position to be viewed on APRS servers. The GPS logger function stores positions along your course on the microSD card for display using mapping software.

BC Radio and Two Band Monitoring

As with many radios nowadays, the operator can monitor two bands at once, along with the broadcast radio receiver incorporated into this radio. The operator can listen to each one separately, too, of course. The broadcast radio works fine, and it sounds better than my car's FM radio. Both AM and FM bands are available and favorite stations can be stored in memory. Again, from the perspective of an emergency or disaster response communications operator, having access to the AM and FM broadcast bands for general disaster information and alerts is very useful.

Memory Channels

The transceiver has 500 regular memory channels, 50 scan edge channels (25 pairs) and 4 call channels. Also, 26 memory banks, A to Z, can be used to store groups of operating channels, and so on. Up to 100 channels can be assigned to a bank.

I programmed memory channels using the RT Systems (**www.rtsystemsinc.com**) software and cable, with thanks to Scott Freudenthal, K2LSF, from Jacksonville, Florida, for sending me his incredible memory channel file, and for his patient mentoring — you can catch him on Reflector 037C. The software and cable work great with the ID-51A. It is easy to use, and will have your memories uploaded and in use within just minutes. All of the necessary memory channel data fields are there, and many more.

Icom's *CS-51* programming software comes on the CD packed with the radio. Further, a programming cable is not absolutely necessary because the .icf programming file can

Key Measurements Summary

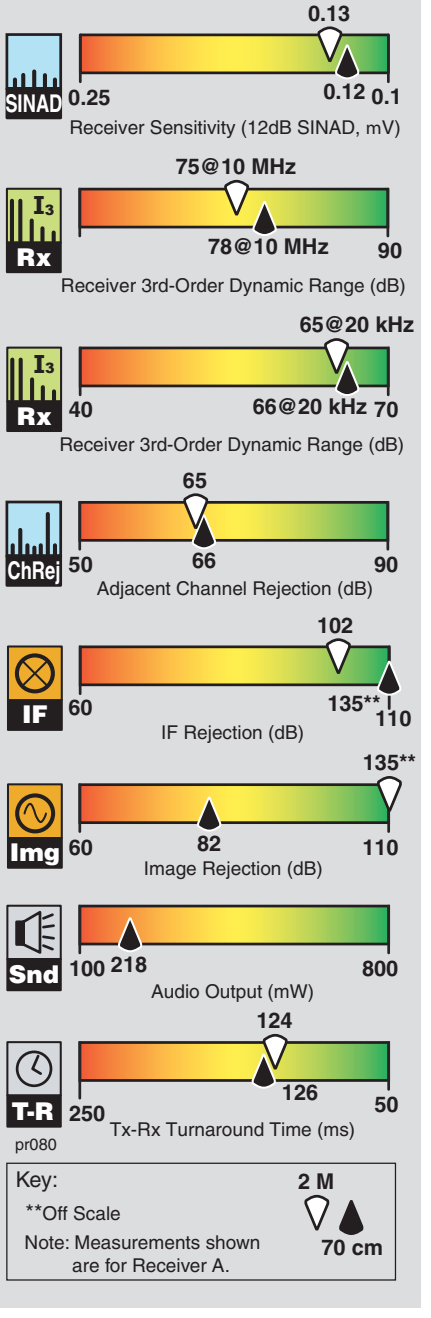


Figure 1 — Despite the size constraints of a handheld radio, the ID-51A's display resolution is high enough to show quite a bit of data clearly.

Figure 2 — The built-in broadcast band radio is a plus for public service operators who need to keep an ear on local news updates.

Figure 3 — The ID-51A features a built-in GPS receiver. The receiver is used to determine which D-STAR repeaters are closest to you. The transceiver can also use the GPS receiver to track your position and share the information over the network.

Table 1
Icom ID-51A, Serial Number 05001656

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 108-174, 380-479 MHz, 0.520-1.710 MHz, 76-108 MHz; transmit, 144-148, 430-450 MHz.	Receive: 137-174, 380-479 MHz (FM, DV); 76-108 MHz (WFM); 0.520-1.710, 108-136.995 MHz (AM). Transmit: as specified.
Modes: FM, NFM, DV, AM (receive only).	As specified.
Power requirements: At 7.4 V dc: receive, FM, <350 mA (internal speaker), <200 mA (external speaker): DV, <450 mA (internal speaker), 300 mA (external speaker); transmit, <2.5 A (5 W output).†	Battery power: FM, receive, internal speaker, 225 mA (max volume, backlight on), 82 mA (standby), 59 mA (standby, backlight off). Transmit: 146 MHz, 1.79 A (high),1.28 A (medium), 0.98 A (low2), 0.62 A (low1), 0.41 A (s-low); 440 MHz, 2.69 A (high), 1.88 A (medium), 1.21 A (low2), 0.91 A (low1), 0.53 A (s-low). External power (13.8 V dc): Receive, 138 mA (max vol, backlight on), 107 mA (max vol, backlight on, external speaker). Transmit: 146 MHz, 1.76 A (high), 1.25 A (medium), 0.88 A (low2), 0.61 A (low1), 0.35 A (s-low); 440 MHz, 2.59 A (high), 1.79 A (medium), 1.15 A (low2), 0.86 A (low1), 0.48 A (s-low).*
Receiver	**Receiver Dynamic Testing****
Sensitivity, FM (12 dB SINAD): <0.178 µV; DV, 0.282 µV.	FM, for 12 dB SINAD, 146 MHz, 0.13 µV, 440 MHz, 0.12 µV; 162.4 MHz, 0.127 µV, 100 MHz, 0.45 µV.
Sensitivity, AM (10 dB (S+N)/N: Not specified.	AM, for 10 dB S+N/N, 1.0 MHz, 0.7 µV, 120 MHz, 0.3 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	146 MHz, 20 kHz offset, 65 dB, 10 MHz, offset, 75 dB; 440 MHz, 20 kHz offset, 66 dB, 10 MHz offset, 78 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 69 dB, 440 MHz, 108 dB.
Adjacent-channel rejection: >55 dB.	20 kHz offset, 146 MHz, 65 dB, 440 MHz, 66 dB.

be written to the micro SD card by the *CS-51* software on a PC and then read by the radio after transferring the card to the radio's card slot. You also have the ability to utilize the SD card storage to backup your configuration. In fact, the SD card can hold multiple .icf files allowing you the ability to restore any configuration file in the field without the need for a computer or cable.

Other Features

The microphone audio can be recorded. It worked fine for me, with some 68 hours of recording available per the display note; I can't imagine listening to myself for all 68 hours! But, for 15 seconds, I could stand it.

Two band monitoring from the two VFOs works well, and the broadcast band radio can be monitored, too, all at the same time: The volume control adjusts the BC radio output to a level where the operator can hear the channel output versus the radio output as a matter of operator preference. This worked well.

An Auto Position Reply function can automatically send your call sign, with or without a GPS position and brief (10 second limit) voice message, when you receive a call and cannot immediately answer. A Voice TX function allows the operator to transmit recorded audio once or repeatedly, from either the main MENU key, or the QUICK menu. It works fine, although I question the utility of repeating the voice memo transmission over and over again for up to 10 minutes — I couldn't figure out why anyone would want to do that.

The Speech function allows the various modes, frequencies, and call signs (DV) to be announced, which is nice while driving — you don't have to look at the radio's display to

Spurious response: Not specified.	IF rejection: RX A, 146 MHz, 102 dB, 440 MHz, >135 dB; RX B, 146 MHz, 101 dB, 440 MHz, >135 dB. Image rejection, RX A, 146 MHz, >135 dB, 440 MHz, 82 dB; RX B, 146 MHz, >135 dB, 440 MHz, 98 dB.
Squelch sensitivity: < 0.178 µV.	At threshold, 146 MHz, 0.3 µV (min), 1.17 µV (max), 0.1 µV (auto); 440 MHz, 0.26 µV (min), 1.05 µV (max), 0.1 µV (auto).
Audio output: at 10% THD, >200 mW into 8 Ω load (external speaker); >400 mW into 16 Ω load (internal speaker).	218 mW at 10% THD into 8 Ω; THD at 1 Vrms,1.4%.
Transmitter	**Transmitter Dynamic Testing**
Power output: 5.0 W (high), 2.5 W (medium), 1.0 W (low2), 0.5 W (low1), 0.1 W (s-low).	146 & 440 MHz, 4.7 W (high), 2.2 W (med), 0.9 W (low2), 0.4 W (low); 0.07 W (s-low, 146 MHz), 0.130 W (s-low, 440 MHz) at full charge and 13.8 V dc external power.
Spurious signal and harmonic suppression: >60 dB (high, med), –13 dBm (low, s-low).	>70 dB; meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, 146 MHz, 124 ms, 440 MHz, 126 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	146 MHz, 52 ms, 440 MHz, 64 ms.
Size (height, width, depth): 4.9 × 2.3 × 1.0 inches (with protrusions); antenna length: 7.0 inches.	
Weight: 9.0 ounces (with battery and antenna).	
Price: ID-51A, $580; OPC-2218LU USB cable, $70.	

†BP-271 7.4 V, 1150 mAh Li-ion battery and BC-167 wall charger supplied. Available options: extra BP-271 battery, $90; BP-272 7.4 V, 1880 mAh Li-ion battery, $125; BC-202 drop-in charger, $60; BP-273 battery case for 3 AA cells, $60; CP-12L cigarette lighter dc power cable with filter, $40.

*Power consumption in DV mode: receive equal to FM; transmit, ≤ 25 mA greater than FM.
**Both Receiver A and Receiver B had equal performance, except when noted. DV not tested; PN9/GMSK signal generator was not available.

see what is happening. I liked this feature a lot. Hold down the QUICK/SPCH button for a second, and the voice tells you your operating parameters on the fly.

A Home CH (home channel) Beep function works well: you can program your favorite (your home repeater, for example) frequency as the Home CH and whenever your VFO dial, or DR, or memory channel selection hits the Home CH, a beep is emitted, letting the user know his/her home repeater has been selected. Again, the idea here is to free the eyes from having to look at the display, and again, that is a safety feature while driving.

Summary

The reader will note that this review is a few pages long, with lab results and graphics. The ID-51A comes with two manuals as I've already noted, for a total of more than 400 pages. Hence, there is no way to cover every nuance of this radio. I have, in this review, attempted to hit the hot buttons for this radio. The menu choices for many of the functions, including the BC radio function, for example, are extensive and frankly, astounding. The programmers at Icom seemed to have left little to be desired in a radio like this. It is incredible, and that is no hyperbole.

The purchaser of this radio, like other D-STAR radios, will benefit from a good understanding of the D-STAR system network, and especially of the four main programmable parameters that are at the heart of the system. And in that subset, the UR call field, with its myriad commands and modes, is the most critical to understanding and enjoying the system. So, especially if you are new to D-STAR, while you are waiting for your package to arrive, get a good source of information (there is a plethora on the Internet) and bone up on it so you'll be able to enjoy this radio out of the box.

Roland Kraatz, W9HPX, adds: "The importance of the UR call field to the successful use of D-STAR's functionality cannot be overemphasized. A lot of new users have difficulty setting up the DR mode so that their transmission passes through the repeater's gateway to the Internet. In that regard, the website **www.dstarinfo.com/Data/Sites/1/GalleryImages/FullSizeImages/id-51-beginner.pdf** has a lot of how-to info for the ID-31 D-STAR radio that is almost exactly applicable to the ID-51, particularly the 'Easy Repeater Operation' section. The other ID-31 sections are also useful for the beginning user."

For me, the ultimate litmus test for a review radio is whether or not I would actually buy one for myself. In this case, the answer is yes, even though the radio is not inexpensive compared to a standard dual band handheld. I loved this radio and opening the package and discovering all of its features and functions.

Manufacturer: Icom America, 2380 116th Ave NE, Bellevue, WA 98004; **www.icomamerica.com**.

See the Digital Edition of *QST* for a video overview of the Icom ID-51A.

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

Horizontal HF Antennas Have an Edge

Q Evan, AA8TK, asks: Why does my 100 foot horizontal dipole fed with window line do so well? I don't have much room for an antenna farm. I do have a multiband monopole and a random-length vertical loop fed with window line but neither matches the performance of the dipole in most situations.

My dipole is up about 35 feet and snakes through the trees between my neighbor's house and mine. On 40 through 10 meters I have no problem working DX, including VK and ZL on 40 and 30 meters. To date, I have worked almost 250 DX entities with my modest setup.

A There may be a number of reasons why your antenna works so well, or at least seems to work so well. The first reason is that a horizontally polarized antenna has about a 6 dB ground reflection advantage over a vertical antenna at a range of elevation angles, depending on the height in wavelengths. The next reason is that on the higher frequency bands, your antenna acts like a multilobed beam with significant additional gain at some azimuths. For example, on 30 meters, a 100 foot center-fed dipole is actually "two half waves in phase," with a maximum intensity in the direction broadside to the antenna of 8 dBi at an elevation angle of 39° (see Figure 1), but still has an intensity of 4 dBi at 15° elevation compared to probably 0 dBi of your verticals, depending on the efficiency of your ground system.

The problem is that the 3 dB azimuth beamwidth of your dipole antenna on 30 meters is about 58°. You have two beams, one on each side with that beamwidth, so for other azimuth angles, which make up the remaining 244 of 360°, one of your vertical antennas will likely work better than the horizontal. Thus, while you do well with DX in the directions that your horizontal antenna focuses, you may not even hear the DX in between the strong lobes on your horizontal, whereas you may on a vertical.

On higher frequency bands, the picture gets somewhat more complicated, with more than two lobes, but they are generally sharper, even more intense (in some cases comparable to a three element Yagi, see Figure 2) and have deep nulls in between the lobes. Thus, your

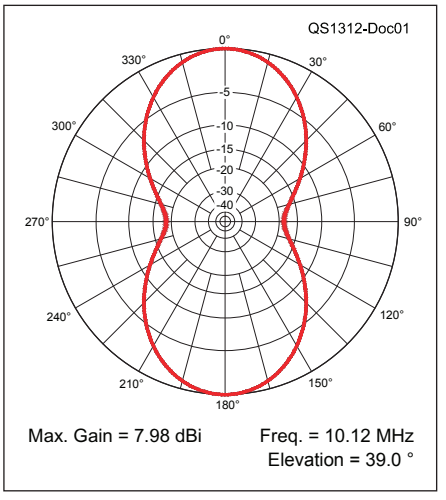


Figure 1 — The *EZNEC* azimuth pattern of a 100 foot center fed dipole 35 feet above typical ground (conductivity 0.005 S/m, relative dielectric constant of 13) on 30 meters. This pattern, in the peak of the elevation lobe, is at an elevation angle of 39°.

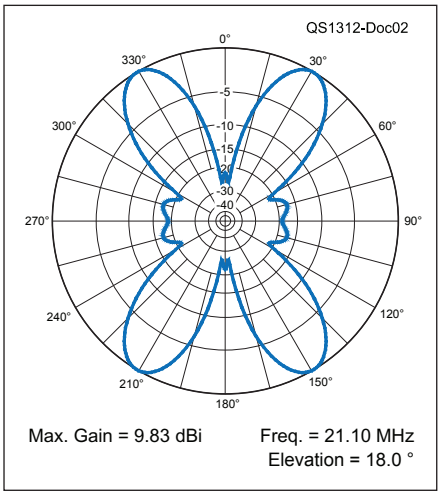


Figure 2 — The azimuth pattern of the same 100 foot dipole on 15 meters. On this band, the peak of the elevation lobe is at 18° and the gain is almost 10 dB in its favored directions compared to an isotropic radiator.

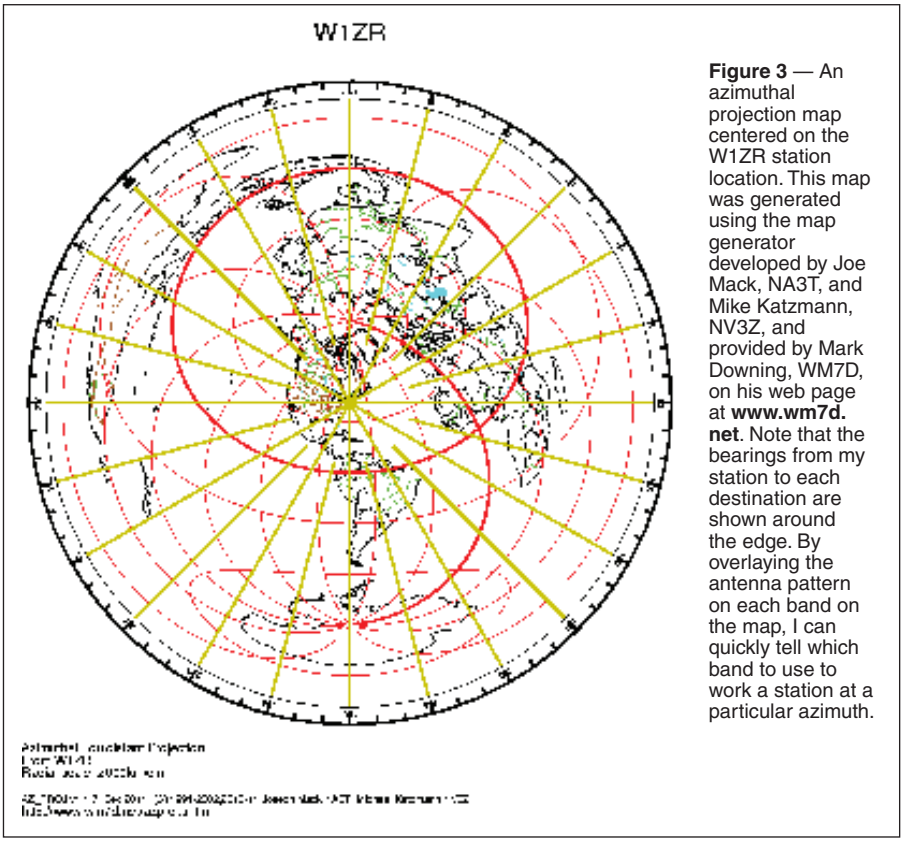


Figure 3 — An azimuthal projection map centered on the W1ZR station location. This map was generated using the map generator developed by Joe Mack, NA3T, and Mike Katzmann, NV3Z, and provided by Mark Downing, WM7D, on his web page at **www.wm7d.net**. Note that the bearings from my station to each destination are shown around the edge. By overlaying the antenna pattern on each band on the map, I can quickly tell which band to use to work a station at a particular azimuth.

horizontal antenna can be about two or more S units stronger for transmit and receive than the vertical in good directions, but you may not even hear stations from the direction of the nulls with the horizontal.

This effect can be used to your advantage. While an HF center-fed Zepp is hard to rotate, an alternative is to take advantage of the fact that the lobes go in different directions on different bands. While I was using such an antenna, I used a hand bearing compass (you can use GPS) to determine the wire axis, then I made *EZNEC* pattern plots on each band and overlaid the –3 dB and –6 dB directions on an azimuthal projection map centered on my location (see Figure 3).[1] By shading the regions between the lines that the antenna worked on each band on multiple sheets, I could quickly decide which band I should use to work a multiband DXpedition, and which bands I should pass on.

Q Bruce, KE1CY, asks: Motivated by my homeowners association restrictions, I decided to spray paint my old five band vertical antenna a flat brown before installing it at the back of my lot. It really does camouflage it well. I then wondered whether this was advisable and if adverse performance should be expected. What are the effects of paint on an antenna's performance?

A I am only aware of two potential concerns. First, with insulated (compared to bare) wire, the insulation of the paint will make the antenna behave as though it is electrically longer (by slowing down the propagation along the conductor surface). Still, since the paint layer is so thin, I would expect that any change in resonance won't be noticeable at HF.

The other possible issue comes up with any insulating materials that are part of the antenna. I would mask any insulating sections, particularly those on traps, before painting, and then remove the masking tape when the paint is dry. Traps can be high-Q devices, with resulting high voltages at resonance across the insulating surfaces and there is no point in putting the paint's electrical properties to the test.

Q Norm, NZ5L, asks: I took a half size G5RV antenna on a recent trip. This is a 51 foot center-fed dipole fed with a 16 foot length of 300 Ω twinlead serving as an impedance matching section intended to make the antenna operate on 40 through 10 meters. When set up as an inverted V with the apex about 16 feet high and using only a short coax lead, the SWR on all bands was in the range of 5 or 6:1, and I was only able to get a match with my tuner on a few bands.

When I returned home, I set the antenna up as a sloping dipole with one end about 40 feet high, and the antenna at a 45° angle to the ground. The bottom was 4 feet off the ground, and I fed the system with 150 feet of RG-8X coax cable. With this arrangement, the SWR on both 40 and 20 is less than 2:1, and very easily matched with my tuner. On the higher frequency bands the SWR is about 3:1, although the performance seems poor. Why should the amount of coax used make such a difference to this antenna?

A I must admit that I also have had poor luck trimming a half-size G5RV to work on multiple bands at low SWR. I call the effect you are observing *transmission line loss matching*. The loss of transmission line increases directly with length and the high SWR increases the loss substantially. On 14 MHz, for example, 150 feet of RG-8X would have a loss of about 1.9 dB if matched, but with a 5:1 SWR, the loss increases to 3.6 dB. This means that if you send 100 W up from the bottom, only 43.6 W will get to the antenna. It will reflect back almost half of the power due to the mismatch and that power will also be attenuated on the way back to the tuner. Note that this reflected power is not lost, it gets reflected from the tuner back toward the antenna — but the loss in the transmission line is real, and happens at each pass.

As far as your tuner is concerned, it is sending up 100 W and the reflected power it sees at the bottom will be around 10 W, so it's very happy and thinks the SWR is around 2:1.

I would suggest using the best coax you can for the shortest possible distance and getting a tuner that can handle it. Alternately, use window line all the way from the antenna to a wide range tuner and call it a center-fed Zepp — it will work even better.

Q Don, WA2HMB, asks: I've recently seen a number of surplus Russian vacuum variable capacitors in the 0 to 50, 100, and 300 pF range with a voltage rating of 15 kV at very attractive prices on websites. I was considering using one as part of an antenna tuner project. Is this type of capacitor useful for antenna tuner applications?

A Well, a 300 pF vacuum variable should work electrically in your tuner as well as any other type of variable capacitor. They tend to be very good capacitors — at least the classic American-made Jennings type are. They are generally adjusted by turning a multiturn lead screw that provides very fine adjustment, perhaps more precise than needed for most tuners.

In addition to the purchase price, which seems competitive with air variables, the one cost element that needs to be considered is that they do need some kind of turn counting dial to allow reading of the adjustment position. While there are suitable commercial dials available, the cost of them might negate any savings from the low purchase price of the capacitor. If you use your ingenuity, however, you may be able to rig up something that provides a mechanical indication — perhaps using gears or pulleys — that can do the trick at low cost. If you do come up with a good solution, consider sharing it with *QST* readers through "Hints and Kinks."

Q Doug, W8YU, asks: I have a 20 meter array of vertical monopoles with elevated radials. Currently, I am using a #14 AWG wire attached to a fiberglass pole for the radiators. What improvement, if any, would I achieve if I substituted telescoping aluminum tubing for each radiator?

A I modeled a single ground plane with four horizontal elevated radials at 6 feet above typical (conductivity 0.005 S/m, relative dielectric constant of 13) ground. If all five wires are #14 AWG copper, the maximum intensity is about 0.1 dBi at 22° elevation. If I change to a 1 inch aluminum monopole, with the same wire radials, the intensity is increased to 0.75 dBi. That difference amounts to about 1/10 of an S unit.

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; for fastest response, e-mail **doctor@arrl.org**.

Feedback

In "Hints and Kinks" [October 2013, p 67] there was an error in the hint "A One Trim Dipole." Near the end of the hint, the length of the dipole is misstated as 17 feet 6 inches. The dipole length should have been 17 feet and would require *adding* 3 inches to be resonant. Please see this month's "Hints and Kinks" for more information.

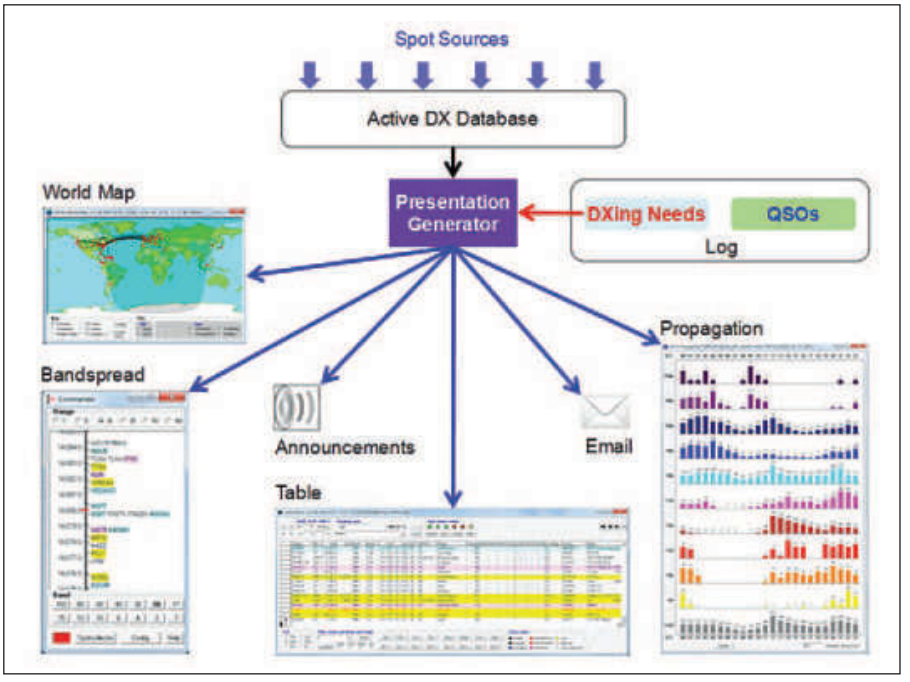
In the article "A Cascaded Current Transformer RF Coupler" by Ralph Crumrine, NØKC, which appeared in the November 2013 *QST*, page 52, the Steward core number shown for transformer T2 is incorrect. The correct part number is 28-0375-400.

[1]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

Steve Ford, WB8IMY, wb8imy@arrl.org

DXLab Suite

The *DXLab Suite* is a set of eight free *Windows* applications that support making QSOs in general and DXing in particular. Each of these applications has a specific role: *Commander* provides transceiver control, *WinWarbler* supports RTTY and PSK operation, *DXKeeper* provides logging and award tracking, *DXView* supports mapping and rotator control, *Pathfinder* automates QSL route discovery, *PropView* predicts and monitors propagation, and *SpotCollector* tracks active DX stations. Whichever of these applications you've installed will seamlessly cooperate as if they were one program. *DXLab* applications also interoperate with several other digital mode applications, like *MultiPSK*, *Fldigi*, *MixW*, *CW Skimmer*, and *DM780*. The eighth application — the *Launcher* — automates initial installation and subsequent updates, and provides the ability to start or terminate all of the suite's applications with a mouse click.



DXLab maintains a database of active DX stations that you can simultaneously "view" in multiple ways.

Impressive Features

The entire suite was impressive, but I particularly liked *Pathfinder*'s ability to search more than 80 websites for QSL information, *PropView*'s ability to generate graphical propagation predictions, and *SpotCollector*'s ability to show active DX stations and help me work the ones I need.

In many countries, licensing authorities or national radio clubs maintain websites where you can search for an address by specifying a call sign. QSL routes can be found in sites maintained by hams like IK3QAR and DL1SBF, and via searches by companies like Buckmaster, QRZ, and Google. Select an active DX station in *SpotCollector* or a decoded call sign in *WinWarbler* or a logged QSO in *DXKeeper* — and *Pathfinder* will provide a search button that queries the appropriate licensing authority or radio club site and displays the result. Twelve additional buttons rapidly search your favorite online sources. *Pathfinder* makes it easy to make multiple queries, and compare their results to obtain the best QSL route.

PropView makes your DXing more productive by showing you when and where to find HF openings to needed counties, districts, oblasts, prefectures, provinces, countries, zones, and continents. Click an active, decoded, or logged call sign, or click a location on *DXView*'s world map; *PropView* will display a 24-hour propagation forecast, in which the thicker the horizontal line, the more likely the opening. You can configure *PropView* to generate forecasts with its included *IONCAP*, *ICEPAC*, or *VOACAP* engines.

SpotCollector can connect to five Internet sources of DX spots: three DX clusters, DX Summit, and the Reverse Beacon Network. It can also connect to a local packet cluster. Information from DX spots received from these sources is used to create an *Active DX Database,* with one entry for each active DX station. This entry specifies the station's call sign, country, CQ zone, time first spotted, time last spotted, mode, receive frequency, and — if operating split — its last-reported transmit frequency (this is a particularly neat feature!). The entry also indicates the regions of the world from which the DX station has been spotted, and the distance between you and the closest spotting station. Entries in the *Active DX Database* are continuously updated as new spots arrive. Connecting to multiple sources speeds updates from spotting stations in distant regions, and ensures updates when some sources are "down."

Information in the *Active DX Database* is presented in six ways:

- A tabular display, highlighting DX stations needed to advance your DXing.
- A scrolling bandspread showing DX stations near your transceiver frequency, with needed DX stations highlighted.
- A world map showing DX stations and the stations spotting them.
- A propagation display showing DX station activity by band over the past day.
- Audible announcements of needed DX stations.
- E-mail announcements of needed DX stations.

Each of these presentations can be filtered independently.

Dave Bernstein, AA6YQ, has been developing *DXLab* since 2000, releasing several new updates each month with help from an enthusiastic user community. You can download the entire *DXLab Suite* at **www.dxlabsuite.com**.

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #131

Coax to Open-Wire Line Balun

I recently designed some Extended Double Zepp (EDZ) antennas that present a reasonable SWR on 14 and 21 MHz. The design uses a specific length of 450 Ω ladder line, resulting in an SWR of less than 2:1 at the end of the ladder line on both bands. Since that length was too short to reach the shack, I chose to transition from the 450 Ω line to 50 Ω coaxial cable. (The EDZ design will be presented in a future column or article.)

One can just connect the coax to the ladder line and hope for the best — it might work, as some designs for multiband antennas will function that way. Unfortunately, the *outside* of the coax shield is also connected at the junction of the two feed lines, creating a *common-mode current path* with impedance depending on the length of the coax and the operating frequency.

The basic idea is explained in Roy Lewallen's, W7EL, classic article "Baluns & What They Do," at **www.eznec.com/Amateur/Articles/Baluns.pdf**. If you haven't read it, this would be a good time to do so.

The Case for Using a Balun

Roy's article shows why a current or choke balun is needed at the transition from the coax to a dipole with the wires at right angles to the coax. What if instead of a dipole, the coax is connected to ladder line? Is a balun still necessary? In transmission lines, the conductors are tightly coupled so that the currents are equal and in opposite directions.[1] That means the same current should flow on the inside of the coax shield and the conductor of the ladder line to which the shield is connected. If any of the current escaped on the outside of the coax feed line as common-mode current, then the balanced current rule would be violated, upsetting the impedance presented at the junction of the two feed lines.

While the coupling of the two conductors in the feed line *should* be sufficient to guarantee balanced currents in each, it's a good idea to raise the impedance of the common-mode current path, especially because you don't know the impedance of that path. Common-mode current on feed lines can cause the antenna system to behave unpredictably.

There is another reason to add some common-mode impedance to the feed line — preserving the symmetry of the antenna system. With a balanced antenna such as a dipole or EDZ, *decoupling* of the feed line's common-mode current path from the antenna's radiated field is also important, as explained in W7EL's article. Since common-mode chokes are difficult to create for ladder line, I oriented that portion of the feed line at close to right angles from the antenna to preserve antenna balance. Adding a choke balun at the junction of coax and ladder line was the next step. (If the coax is parallel to the antenna, add a coiled-coax choke or two along the coax to minimize common-mode current all along the feed line.)

The choke balun can take many forms, as explained in the *ARRL Handbook* and *ARRL Antenna Book*.[2] I decided against the W2DU-style balun of many ferrite beads on the coax because of the expense, and against the coiled-coax balun because it is somewhat heavy and unwieldy when suspended by the feed line (particularly if form-wound). It is also hard to create a scramble-wound choke that works well over the range of 40 to 10 meters (the EDZ is tunable on the WARC bands and 40) so I selected a compromise between all three designs.

Balun in a Jiffy

My choke balun was easily wound on a ferrite toroid core, using a bifilar winding that is really just a very closely spaced parallel-conductor feed line. By using the right mix of ferrite, the choke will create enough impedance across the HF range.

Following the guidance of Jim Brown's, K9YC, tutorials on ferrites and chokes, I chose a 2.4 inch diameter #31 mix with a winding of 10 turns.[3, 4] The ferrite tutorial estimates that the balun's choking impedance at 7, 14, and 28 MHz is 3000, 3500, and 2000 Ω, respectively, as shown in Figure 1. For the bifilar winding, I used two-conductor PVC-insulated #16 zip cord which is fine for 100 W power levels. (If you plan on running high power, use #12 or larger wire.) For this core you need about 3 inches

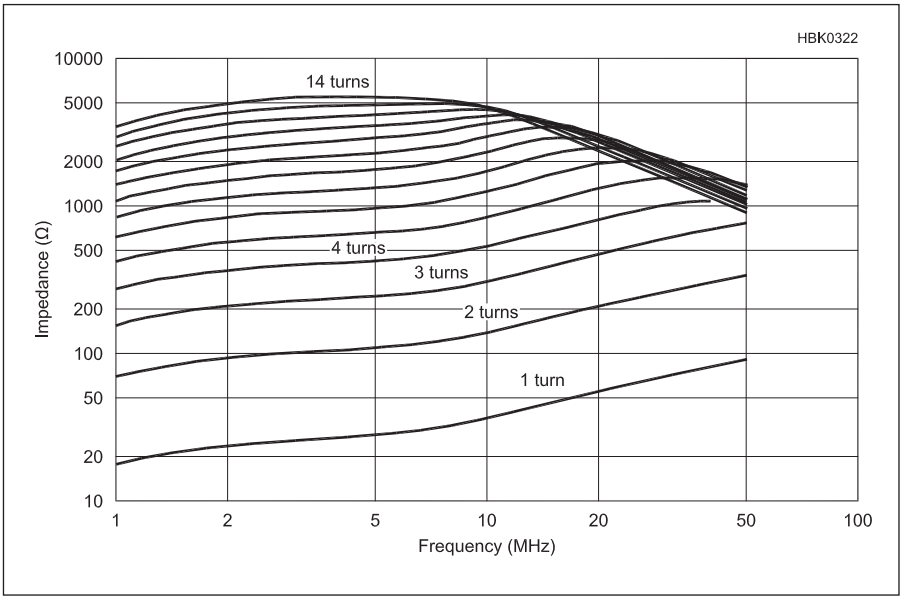


Figure 1 — Data from K9YC shows the broad response of #31 mix with graphs of impedance vs number of turns on a 2.4 inch OD ferrite toroid.

[1]See the discussion of mutual induction and Lenz's law in Experiments #117 and #118. All previous Hands-On Radio experiments are available to ARRL members at **www.arrl.org/hands-on-radio**.

Figure 2 — Use a hole saw, chassis punch, or hobby knife to cut a hole in the bottom of the jar large enough for a PL-259 to go through. Use an awl or small drill to make two holes in the lid for the ladder line conductors. Drill small holes around the bottom of the jar for drainage.

Figure 3 — A close-up of the balun showing the SO-239 connector with winding soldered to the sheet metal screw.

of wire per turn plus the connections at either end for a total of about 36 inches of wire, including the input and output connections.[5]

The balun would be installed outside, suspended in mid-air, with up to 30 feet of coax hanging from the balun. Therefore, I needed a lightweight, non-conductive enclosure that could accommodate an SO-239 connector and the ladder line. New enclosures all seemed to be rectangular, heavy, and expensive. PVC pipe and caps would be *really* heavy. While sorting through a bag of empty food containers that I use to hold parts, I found my balun enclosure in the form of a peanut butter jar.

The 16 oz size turned out to be perfect for a 100 W balun and 28 oz jars are large enough for high-power models (Figures 2-4 show balun assembly). The clear jar is tough and a 2.4 inch toroid fits inside after winding, although you have to squeeze the jar a bit to get it through the threaded part of the jar. To get the ladder line through the lid, punch some holes with an awl or small drill bit. Drill or cut a hole in the bottom of the jar that is a little bit bigger than the shell of a PL-259 connector. Drill three or four small holes around the bottom of the jar for drainage. For UV protection, spray paint the jar and lid with outdoor enamel.

Begin winding by securing the first turn with high-quality electrical tape such as Scotch 33+ or a wire tie. Then wind 10 turns on the core, making sure each turn is snug on the core, securing the final turn. I have tried both a single end-to-end winding and the crossover style of winding introduced by W1JR in which after half the turns are wound, the winding crosses through and over to the opposite side of the core, then continues to the point opposite the first turn.[6] The crossover winding has little effect at HF but it conveniently places the input and output connections on opposite sides of the core. This makes the balun easier to assemble and holds it straight between the top and bottom of the jar. Both styles work fine in this use. The input and output leads should be short enough (about 1 inch for the low-power version) that they are not bent against the jar with the lid on.

To attach the winding to the SO-239, tin the hollow tip of a #4 self-tapping sheet metal screw. Then place a small amount of anti-oxidation compound such as Penetrox on the screw threads and turn it into one of the SO-239 flange holes. (A #6 screw also works but you'll probably have to drill out the SO-239 hole a little bit, depending on the manufacturer.) Then solder one winding wire to the screw and the other to the SO-239 center conductor. Attaching the SO-239 to the jar with more sheet metal screws during installation is optional.

To test the balun before attaching the ladder line, solder a 47 or 51 Ω resistor across the output winding and use an antenna analyzer to measure the balun's input impedance. It should be close to 50 Ω with an SWR of 1:1. Move your hand along the coax and make sure the SWR doesn't change, a symptom of common-mode current on the coax. Polarity of the input and output windings is not important unless you are making a set of baluns in which case you should be consistent in how the windings are attached to the SO-239 and ladder line.

Figure 4 — A version of the balun with the crossover winding. Notice how the input and output connections are in line with the feed lines.

Poke the ladder line conductors through the lid, and then use needlenose pliers to curl the wire into a circle or U for soldering. Solder the output leads to the ladder line wires. If you want, coat those connections with liquid electrical tape or aquarium RTV sealant. Leave the lid off for now.

To install the balun, insert the coaxial feed line's PL-259 through the hole in the jar and screw it on to the SO-239. Use the coax to pull the core into the jar until the lid is against the threads. Screw the jar back into its lid. The PL-259/SO-239 should turn freely and not bind in the hole. Waterproof the coax connectors and you are done!

Parts List

2.4" #31 mix ferrite toroid core (Fair Rite 2631803802, Mouser 623-2631803802)

36" of two-conductor, #16 PVC-insulated zip cord (RadioShack 55057440)

16 oz peanut butter jar

SO-239

#4 self-tapping screw

[2] *The ARRL Handbook* and *ARRL Antenna Book* are available from your ARRL dealer, or from the ARRL Store. Telephone toll-free in the US 888-277-5289, or 860-594-0355; fax 860-594-0303; **www.arrl.org/shop/; pubsales@arrl.org**.

[3] **audiosystemsgroup.com/RFI-Ham.pdf**.

[4] **audiosystemsgroup.com/CoaxChokesPPT.pdf**.

[5] The 36" bifilar winding starts to have an appreciable electrical length at 10 meters and has an additional transforming effect on the impedance that increases with frequency.

[6] **www.njqrp.org/balun/Balun%20Manual%20-%20final.pdf**.

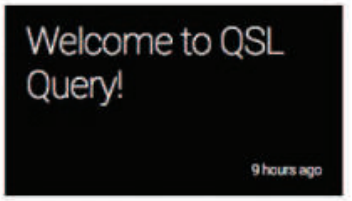
Steve Ford, WB8IMY, wb8imy@arrl.org

The First Amateur Radio App for Google Glass

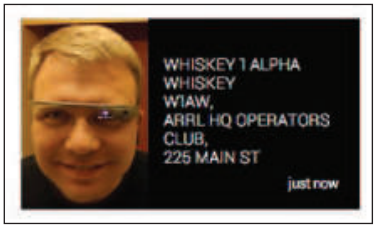
Google Glass is a wearable computer with an optical head-mounted display. If you read the technology press, you've heard a lot about it because Glass has captured the imaginations of gadget lovers worldwide. Google's goal is to produce a wearable, wireless computer that displays information directly in the user's field of vision and interacts with the user (and the Internet) through voice commands.

At the moment Google Glass looks like a pair of eyeglasses without lenses. However, Google is working on partnerships with sunglass retailers and they've stated that, eventually, Google Glass *will* be available in a version that accommodates prescription frames and lenses.

This year Google made Glass available to a limited group of developers and testers they called "Explorers." David Young, AE5DY, was one of those Explorers and he set about writing an Amateur Radio software application for the device.



If you were wearing Google Glass and started *QSL Query*, this is what you would see.



David asked for the QSL address of ARRL Maxim Memorial Station W1AW and received this response (along with his image as the Glass owner).

Dave's app, known as *QSL Query*, allows you to look up call signs. When Glass accesses the Internet, you're asked which call sign you want to look up. You tap the navigation bar on the side of the Glass frame, or simply say "OK Glass," and then select REPLY. At that point you speak the call sign using standard phonetics and that data is sent to Google's servers where it is translated into a call sign and passed to a lookup database.

Within seconds you're presented with the results — literally right before your eyes. You can then tell Glass to forward the information to someone else, share the information on Facebook or Google+, or even have the information read aloud.

Google says it will release Glass to the rest of us sometime next year, but no there's been no mention of the selling price at press time. If you're curious and want to get on Google's mailing list for updates, go to **www.google.com/glass/start/how-to-get-one/**.

WSJT-X Has Gone "Bilingual"

WSJT-X by Joe Taylor, K1JT, is now "bilingual," as Joe describes it. That is to say, the software now transmits and receives both JT9 and JT65, switching between modes automatically as needed.

By now most digitally active hams are well aware of JT65, the highly popular mode that has made HF DX available even to those running 5 W to attic antennas. JT9 isn't as well known, yet, but the user universe is growing as amateurs discover its power. As it turns out, most JT9 activity takes place just above the JT65 watering holes. For example, you'll find the musical sounds of JT65 centered around 14.076 MHz with the longer, steadier tones of JT9 at about 14.078 MHz.

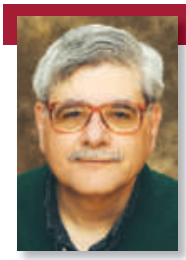
The new version of *WSJT-X* operates across a bandwidth of 5 kHz. Assuming your transceiver supports a bandwidth of, say, 3 kHz in the USB mode, you can park your rig on 14.076 MHz and *WSJT-X* will capture the JT65 activity around that frequency *plus* the JT9 exchanges taking place 2 kHz higher.

WSJT-X uses "mode flags" to tell you which text belongs to JT65 or JT9 transmissions. If you double click on a JT9 line, the software automatically configures itself for a JT9 contact — and vice versa if you click on a line of JT65 text.

Even if you are already familiar with previous versions of *WSJT-X*, you should still read the new online *WSJT-X* User's Guide at **www.physics.princeton.edu/pulsar/K1JT/WSJT-X_Users_Guide_v1.1.pdf**.

You can download the *Windows* installation package at **www.physics.princeton.edu/pulsar/K1JT/wsjtx.html**. The program also runs well under *Linux* and *OS X*, but on these platforms you must compile it yourself.

To make life even easier with *WSJT-X*, Andy O'Brien, K3UK, has written the *K3UK Old Codger's Guide to* WSJT-X. You can find this work in progress at **obriensweb.com/wsjtx.html**.



Steve Sant Andrea, AG1YK, hk@arrl.org

Solar Lite, Piano Wire Antenna, and *Ubuntu* VFO Control

Simple Solar

The students of the Central Middle School Amateur Radio Club (sponsored by the Midland Amateur Radio Club, W8KEA) were building AM radio sets that operate on a 9 V battery. During the meeting, one of the adult volunteers suggested the idea of using a 9 V solar panel to operate the radios. His comment sparked an idea.

I had the solar cells and associated circuitry from six solar yard lights. Each of them had an AA rechargeable battery to store energy during the day and supply it to an LED at night. I decided to make a 9 V supply from these discarded yard lights.

Each light contains a solar cell, a control circuit, an AA battery, and an LED. First I had to understand how the control circuit worked. During the day, the sun shines on the solar cell and recharges the battery. When the sun goes down, the LED lights come on. In order for these units to work as a 9 V supply, I needed to be able to draw current for the radios and charge the batteries at the same time. I also didn't want the LED to drain the battery when the sun wasn't shining.

With no schematic for the circuit available, I used a circuit drawing program called *ExpressSCH* (a free download at **www.expresspcb.com**) to reproduce the circuit as it was laid out on the controller board.

Once completed, I dragged the components around to rearrange the schematic and make it easier to understand how the circuit worked (see Figure 1). The diodes and transistors were unmarked so their exact identities are not known. For the purpose of the circuit analysis I assumed that Q1 and Q2 were bipolar transistors.

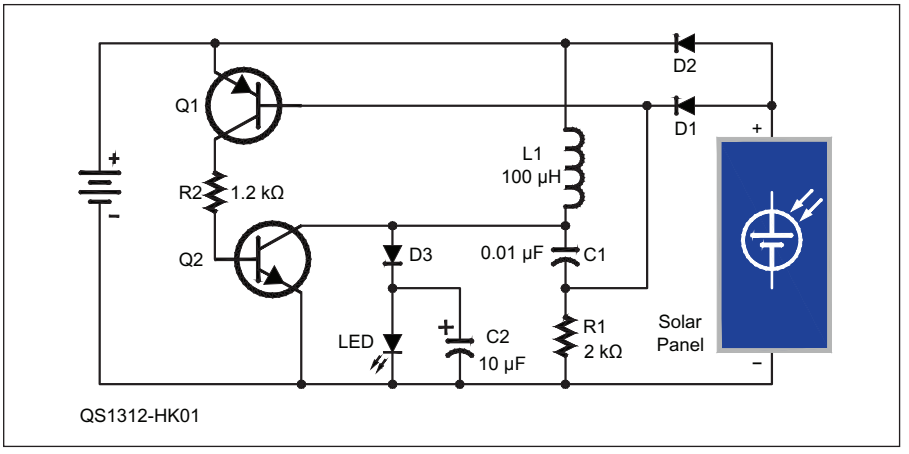


Figure 1 — Schematic of solar LED yard light control circuit. [Dennis Klipa, N8ERF, photo]

The AA battery charges directly from the solar cell through D2. The LED requires about 2.6 V just to turn on, and about 3.5 V for full output, but neither the battery nor the solar cell can supply that much voltage. The voltage is generated by a simple step-up converter (boost converter). While the sun is shining, the base of Q1 is biased off and so is Q2 as a result. As soon as the sun stops shining Q1 is turned on and thus Q2 as well. This causes current to flow through L1 and Q2 to ground. The LED does not light because the voltage is still below 2.4 V. At this point, C1 will briefly pick up a charge and the voltage at the junction of C1 and R1 will cause Q1 and subsequently Q2 to turn off. However, the energy stored in the magnetic field of L1 will cause the voltage at D3 to rise high enough for the LED to turn on and shine. Meanwhile, the voltage at the junction between C1 and R1 will fall to the point where Q1 turns on again,

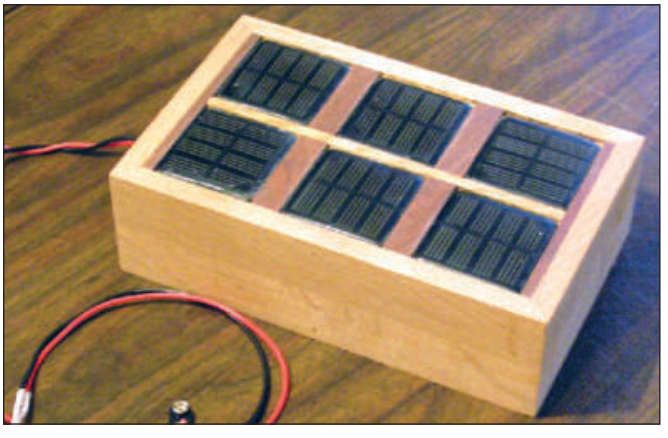


Figure 2 — The completed 9 V solar power supply in an oak walnut case. [Dennis Klipa, N8ERF, photo]

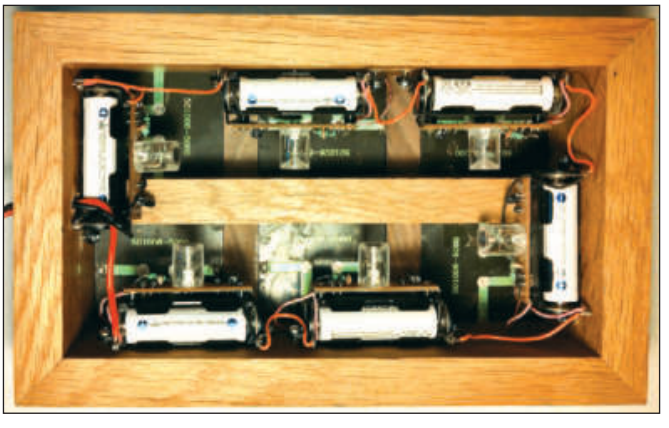


Figure 3 — Bottom view showing the six controllers mounted in the case with their batteries installed. [Dennis Klipa, N8ERF, photo]

causing the cycle to repeat itself. The frequency of this cycle will be influenced by the R1C1 time constant. This cycle will continue until the battery voltage drops too low to operate the LED or the sun comes back up.

I disconnected one side of L1 to disable the step-converter — preventing the LED from draining the battery when the solar cell was in the dark. Furthermore, I could access the solar panel's output at the battery terminals, whether a battery was installed or not.

So with six of these units hooked up in series and mounted in a nice oak and black walnut case (see Figures 2 and 3) I had my 9 V supply ready to go. With the rechargeable AA batteries installed, I can leave it all day in the sunshine and listen to my AM radio at night. — *73, Dennis Klipa, N8ERF, 644 E Whitethorn Dr, Midland, MI 48640,* **n8erf@arrl.net**.

A Piano Plays Radio

I am one of those hams who lives in a townhouse community that does not allow antennas of any kind outdoors. I have found that piano wire in gauges from #0 to #5 works well for a low-visibility antenna. [Steel and piano wire gauge sizes 0 and 5 are similar in diameter to copper AWG sizes 31 and 27, respectively. — *Ed.*] It's available from many suppliers and an Internet search will provide a number of leads.

I went out on a foggy Sunday morning (a stealth antenna has to be raised in a stealthy way) and slung a weight with some 50 lb test line about 35 feet into a tree behind my home. I then ran the piano wire from my shack to the tree for a length of about 150 feet. It has proved successful in that you cannot see the very fine but *very* strong piano wire.

One thing to note, when buying piano wire, be sure to order it on a spool — *not* in a coil. I first bought the coiled wire and learned the hard way that it has a mind of its own. It took me some 2½ hours to get it untangled!

I run 100 W with an AH-4 autotuner and have made many contacts around the world. So, if you also live in a restricted community, give this idea a try. I think you'll be happy with the results. — *73, James Waters, W3BIF, 311 Cherry Ln, Kennett Square, PA 19348,* **captainjimwaters@comcast.net**

More On the One Trim Dipole

In the October "Hints and Kinks" column, the hint titled "A One Trim Dipole," contained an error. In the example given, the target resonate *frequency* was 14.2 MHz. Using the standard formula (*Length* = 468/*frequency*), the *length* of a dipole would be 32.96 feet, or about 16½ feet per side. You would add 6 inches to each side for trimming, making the final *length* 17 feet per side or 34 feet total.

Toward the end of the hint, the *length* is misstated as 17 feet 6 inches, instead of 17 feet. Since the recalculated *length* of the dipole using the real constant is 17 feet 3 inches, you need to *add* 3 inches to the 17 foot dipole to bring it to resonance at 14.2 MHz, *not* trim 3 inches. This makes sense from the standpoint of antenna theory since the first resonance for the dipole was 14.4 MHz, a higher frequency than the desired resonant *frequency* of 14.2 MHz. In order to *lower* an antenna's resonant frequency, you need to add to, not trim, its *length*.

My thanks to Tony Bogusz, W9MT, for noting the error. — *73, Steve Sant Andrea, AG1YK,* **ag1yk@arrl.org**

Using *Fldigi* for VFO Control

I was trying to use *Fldigi* for software control of my rigs but was unable to access the VFOs. In researching the issue, I found an excellent and detailed discussion by Thomas Adsit, K8WDX, of *Fldigi* software on the **ubuntu-forums.org** website, which provided the solution. For those simply interested in allowing *Fldigi* to access their rig's VFO via a USB cable, the following notes may help.

In general, many radios have either a serial or USB port that can connect to a computer. Since most recent computers no longer have serial ports, a USB to serial converter may be necessary.

Fldigi is able to show the current VFO setting and change the VFO frequency. If that functionality is not working on your *Ubuntu Linux* computer, two simple software changes may fix the problem.

Using administrator privileges, edit the file named *group* found in the */etc* directory of the *Ubuntu* file system. Add your "username" to the following two lines:

dialout:x:20:[username]

tty:x:5:x:[username]

Save the changes, log out and then log back in to activate the new permissions. This simple change allows *Fldigi* to access the VFOs of my Kenwood TS-590S (with a standard USB cable) and Icom IC-R75 receiver (with a USB to serial cable). — *73, Thomas Hart, AD1B, 54 Hermaine Ave, Dedham, MA 02026-6321,* **tm.hart@verizon.net**

Mag Mount Sealer

After repairing my 2 meter magnetic mount antenna, I needed to apply a weather resistant seal to the bottom surface. Rows of electrical tape didn't appear to be the best solution. I had some leftover bumper stickers just waiting to be stuck onto something. I cleaned the base of the mount to remove any dirt that might penetrate the covering. Then I cut one of the bumper stickers in half, stuck it to the bottom of my newly repaired antenna, and trimmed the excess with my pocket knife (see Figure 4). Now the bottom of the mag mount was extra clean and smooth, and ready for a scratch-free roof mounting. — *73, Phil Grant, N1YPS, 119 Hoe Shop Rd, Bernardston, MA 01337,* **phill112643@verizon.net**

Figure 4 — An old bumper sticker, cut and trimmed to fit, protects your car's roof against scratches from your mag-mount antenna. [Phil Grant, N1YPS, photo]

Heavy Duty Altoids Tin

If you like to build radios using the ubiquitous Altoids mint tins and have wished for a stronger version (or one without the product information), there is an alternative that you should consider. CountyComm Government Products Group is carrying a plated, food grade steel tin identical in size (3.70 × 2.32 × 0.82 inches) but of heavier gauge construction (**countycomm.com/tin.html**), and is said to be twice the weight of similar tins. These are easier to punch and drill without tearing the metal. CountyComm also sells a nylon pouch that fits the tin to provide a belt-carry option (**countycomm.com/pcc.html**).

These tins have only two issues: They're $3.45 — not free, and they lack the fresh minty bouquet of Altoids tins. — *73, Dean Lewis, W9WGV, 1193 E Azalea Ln, Apt D, Palatine, IL 60074-1566,* **w9wgv@arrl.net**

"Hints and Kinks" items have not been tested by *QST* or the ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **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.

Once Upon a Christmas

Finnish amateurs bring Christmas magic to the world via Amateur Radio.

Martti J. Laine, OH2BH

For many — and for children in particular — the white-bearded Santa Claus is a symbol of the Christmas season. He represents the warm spirit of the holiday, one that inspires us to do something special for family and friends.

Perhaps it is no surprise that some of the most creative Christmas activities come from those of us who live closest to Santa Claus — the Finnish hams who catapult Santa onto his world tour every year. During Christmas 2012 we used Amateur Radio to do something special indeed!

Point Your Beam at Lapland

Many nations lay claim to being the location of Santa's home and workshop. During my years of travel, I have seen Santa in many forms and in many places, including *both* Christmas islands — Australia (VK9X) and the Central Pacific (T32) — and places such as Greenland (OX), Iceland (TF), and nearby Nordic countries in Europe. For children living in the US, however, tradition states that Santa Claus resides at the North Pole.

Here in the "real" Santa country, we don't fuss about such claims, but it is true that the Republic of Finland, Santa's home, indeed lies *next* to the North Pole. When swinging your beam our way, your signals end up here in a mysterious northern village. It is said that Santa Claus resides at the Arctic Circle (66° N), in Finnish Lapland, which is where most people who live above the Arctic Circle reside.

Anyone who contacted both OF9X and OH9SCL earned a Santa Certificate.

In our Finnish tradition, Santa's home base is the city of Rovaniemi, the capital of Lapland (OH9). The city boasts an extensive workshop complex and a mammoth Santa post office that regularly receives more than 600,000 letters a year from those who believe. It is probably not widely known that Santa is a powerful tourist attraction, employing more than 10,000 people whose livelihood is attributable not only to the spectacular Arctic landscape, but also the five-star hotels and ski resorts served by direct flights to Rovaniemi Airport (also known as "Santa Claus Airport") from many major European locations. There is even non-stop service from Tokyo, Japan. Local legend says that the workshop is filled with elves assisting

Figure 1 — This is how the interactive Santa window looked through the two selected web portals, with live audio and video streams. The OF9X QSL card shows the organizers: Santa-Martti, host Kopi Pietikainen and Juha Hulkko, OH8NC.

Figure 2 — The Sun never rises during Christmas time in Lapland, which makes outdoor work a bit tricky. Here, Aaro Hyvarinen, OH9RJ (right), and Kimmo Rautio, OH9MDV (who made the majority of the Santa QSOs), are preparing antennas for Santa Radio.

Santa, while Mrs Claus resides in nearby Korvatunturi.

Rovaniemi is the spot from which Santa is said to start his journey around the world on Christmas Eve. In Finland and other European countries, Santa traditionally appears "in person" to delighted families on Christmas Eve. In the US, with its busier lifestyle, stockings are hung near the chimney for Santa to fill with goodies in the wee hours of Christmas Day, while the family is still asleep.

Santa Radio at OF9X

In 2012, the folks at Radio Arcala, OH8X, near Lapland, wanted to use Amateur Radio to bring Santa to the children of the United States and other parts of the world. The kickoff for "Santa Radio" was organized in the village of Muonio (67.55° N, 23.39° E) where both stations, OH9SCL, and OF9X, were outfitted with the latest radio and computer technology.

The plan was that Santa Radio, OF9X, would

The kickoff for Santa Radio was organized in the village of Muonio (67.55° N, 23.39° E) at the official Santa Claus Land station, OH9SCL.

My Special Christmas Morning Contact

Dear Santa Martti, OH2BH…

Thank you for being my first contact ever! My name is Maile, I am 10 years old, and my call sign is K7MKD. Making my first contact with you on Christmas Day was very special to me and has helped open the door of possibilities to talk to other hams all over the world.

My dad, NT7U, was excited to have a new rig for Christmas and quickly set it up. That is when he heard "this guy in Finland near the North Pole dressed up like Santa." After he talked to you it changed my attitude about giving it a try, and I climbed on his lap. He helped me a bit with what to say because I was really nervous. I kept saying, "But what if I screw up, and the FCC ends up on our stoop?"

Ten year old Maile Danilchik, K7MKD.

Dad said I could write some notes on what to say. My hand shook so much that I had to rewrite it. Usually I have really good penmanship. "K7MKD, kilo seven mike kilo delta." I didn't want to mess up my own call sign! We had to wait for you to call for our call area, as Dad calls it. I forget now how many times I had to try before you heard me.

"Dad, he heard me!" I kept thinking — my gosh, I did it! Dad had to whisper to me a few times to help get me out of la-la land.

I think that you thought someone else was the control operator, so I repeated that it was my call sign and that you were my first contact. Maybe it was in the stars, because so many things lined up for this to happen. I shrieked after we were done and gave my dad a big hug! We were still in our pajamas since we had just opened our gifts. This was the best Christmas surprise.

Getting my ham radio license was a father-daughter bonding project this summer and with school starting right after I have been busy with other things. We studied for months before I was ready to take the test. Now I hope to pick up the microphone more often and see who else wants to talk. We only have an American flag pole tied to the roof of the garage for an antenna, but it was good enough. I am going to work with Dad to build a bigger one so we can talk to you again someday.

I believe in Santa but I noticed that you didn't have a beard when I saw your picture — that was a tipoff! I'm just happy to be able to say that I know someone at the official station of Santa. That is good enough for me.

Thanks for the special contact and 73,

Maile Danilchik, K7MKD, Poulsbo, Washington USA

The Santa Claus Polar Path

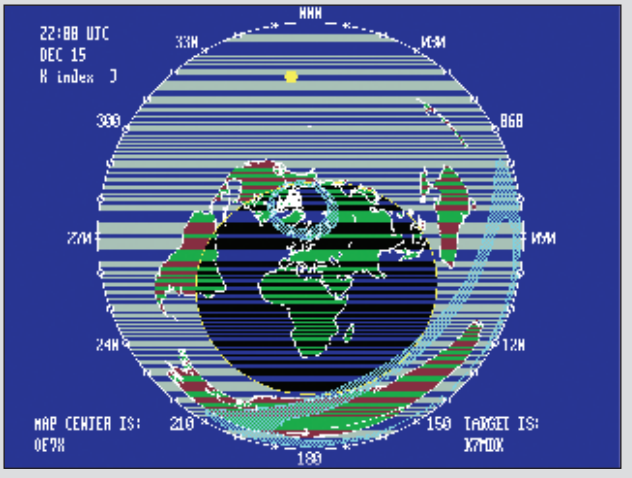
OF9X (Santa Radio) and OH9SCL (Santa), enjoyed unique 20 meter propagation to North America that was not available to other, more southern, Europeans.

Normally we wouldn't expect *any* propagation on 20 meters from these high northern Finnish latitudes to North America at night in winter due to low F_2 region MUFs (maximum usable frequencies) on the Finnish end of the path (the North American end would be okay). The accompanying image shows the path between OF9X and K7MKD for their 1900 UTC QSO on December 25. Two modes of propagation may explain these QSOs.

The first mode is auroral-E, and it would mostly be associated with contacts to the US East Coast and Midwest. From August 1991 to August 1992 Bob Hunsucker, AB7VP (then KL7CYS), and Bob Rose, K6GKU, studied a 960 km east-west path in Alaska on 25.545 MHz. They discovered that the path was nonexistent until the K index rose high enough to put the auroral oval over (and tangential to) the path. This mode occurred during all months (it was most prevalent during the equinoxes) and was centered around the local midnight portion of the auroral oval (the thick portion).

The second mode is drifting patches of F region ionization across the dark polar cap, and it would mostly be associated with the QSOs to the West Coast of North America. Bob Brown, NM7M (SK), brought this mode to the attention of radio amateurs in 1993, and these patches occur in the Northern Hemisphere winter, when the polar cap is dark. The patches offer F region ionization several times greater than the background ionization, and can even support 28 MHz.

In summary, the unique location of northern Finland with respect to the auroral oval and the polar cap appears to have enabled these contacts. Whether they're due to auroral-E or drifting patches of F region ionization across the dark polar cap is not important. What's important is they're available on a rather regular basis in winter and are available only to the northern Scandinavian areas. — *Carl Luetzelschwab, K9LA*



The polar opening between OF9X and K7MKD during their 1900 UTC QSO on December 25.

remotely access and operate the powerful Radio Arcala station, OH8X, while OH9SCL was to be activated from various locations within Lapland. Anyone who contacted both stations earned a Santa Certificate via e-mail, inscribed with the names of the children or grandchildren of the family.

The 2012 results were impressive with 5557 call signs in the log, 3734 of which were American. We issued more than 700 certificates.

More High-Tech Magic

Santa's friendly voice on 20 meters prompted many children to talk to the white-bearded old man. The use of a live Internet audio/video stream, with Santa waving his hand and talking to the children, only improved the experience. The video stream also allowed distant amateurs to hear playbacks of their signals. With the massive 24 element array on a rotating 350 foot tower at Radio Arcala, many participating hams were surprised at the strength of their signals.

The whole multimedia machine was built and run using the world's largest ham radio web portal, **QRZ.com**, in parallel with Radio Arcala's world renowned DX Summit website. The person who orchestrated the Internet magic was Santa's webmaster, Vlad Lambrianov, UA6JD, who is also part of the **QRZ.com** support team.

Look up OF9X on **QRZ.com** and you'll find various interactive elements from Santa's village such as current weather, online logs, and a write-to-Santa option. It also displays web traffic statistics for the entire Santa Radio operation. More than 35,000 hits were registered during the holiday period. The site is still up and running for your viewing pleasure.

Radio Station and Propagation

For the convenience of the scattered Santa Radio operators here in Finland, we made it possible for them to get on the air using OF9X via Internet remote control, rather than using local station facilities. This gave them the option to spend Christmas at home while still transmitting during prime hours for the US on 20 meters. We chose times in the US and elsewhere that would make it possible for children to be at the radio.

The aurora borealis (northern lights) frequently blaze in the skies of the Far North and typically kill radio propagation when active. Fortunately, the December 2012 auroral activity was such that it allowed us to ride the rare polar openings on 20 meters and establish the only European signal presence across a large footprint in the US. This added to the overall success of the program. Even if Santa was sandwiched beneath the auroral oval, the unique polar or "Santa" path on 20 meters did the trick (see the sidebar "The Santa Claus Polar Path").

In 2013 the Radio Arcala group hopes to once again bring some Christmas magic to delight youngsters and old timers alike, during this special time of the year. Check the OF9X page on **QRZ.com** for the latest updates.

Martti Laine is an avid DXpeditioner who has served the DXCC program for more than 50 years, most recently in the context of his "Missionary DXpeditioning" concept in which he attempted to inspire Amateur Radio activity in various DXCC entities. Although Martti is retiring from DXpeditioning, he remains active on the air as OH2BH from Finland and CU2KG from his second home in Azores. You can contact Martti at **oh2bh@sral.fi**.

Colorado Flooding and Ham Radio: Public Service at its Finest

A father calls for help, and Amateur Radio relays the answer.

Sean Kutzko, KX9X
ARRL Media & Public Relations Manager

Nobody ever expects to be involved in an actual emergency situation. But we think about it, we talk about such a scenario with our friends, and some even train for such occasions. When a very real emergency happened in Colorado — the devastating flooding during September — Amateur Radio stepped up during the first critical days in a way that many non-hams say made a huge difference in the initial response and subsequent recovery efforts. In the middle of the storm, ham radio provided a father in Nebraska peace of mind that no other source of information did.

Between September 9 and 13, almost 15 inches of rain fell in rugged northern Colorado. This was double the state's previous record for a single storm, which was set in May 1969. The mountains and streams simply couldn't manage that much water in that short of a time frame; gentle creeks became raging rivers, expanding far beyond their banks. Seventeen Colorado counties were affected, with the flood covering nearly 4500 square miles, or an area roughly the size of Connecticut. It was confirmed that six lives were lost and over 18,000 homes were damaged or destroyed. Bridges and roads were wiped out, and entire communities lost all utilities and communications, cutting them off from the rest of the world.

When the magnitude of the event became apparent, state and county disaster plans went into effect. Part of that plan was a group of Amateur Radio operators throughout Boulder and Larimer and counties who are part of the Colorado Amateur Radio Emergency Service, or ARES. These ham radio operators are ordinary people from the local communities who have been federally licensed to use the ham frequencies. They have undergone training to respond to such emergencies, including routinely practicing message handling under duress.

Radio Amateurs Called for Communication Assistance

Several dozen amateurs participated in the emergency response throughout the 17 affected counties and provided critical information and support to federal, state, and county served agencies (including the Federal Emergency Management Agency, the Red Cross, and the Office of Emergency Management for Boulder and Larimer counties). One request for assistance, however, stood out for Doug Tabor, N6UA, and David O'Farrell, WBØIXV. Both men live in Estes Park, a mountain community of about 6000, located about 75 miles north-northwest of Denver at the border of Rocky Mountain National Park. Tabor is a pilot and IT consultant; O'Farrell is retired. Both became interested in Amateur Radio as young men in the mid-1960s.

Above: Estes Park was just one of several communities flooded out; they received as much as 15 inches of rain over a period of four days. Communities throughout the flood area will be cleaning up for months. [Kris Hazleton, photo. Courtesy Estes Park News, Inc, used with permission.]

As members of both the Colorado ARES team and the Estes Valley Amateur Radio Club, the two men were asked to set up at the Estes Park Fire Station on Thursday, September 12. Tabor said, "US 34 was washed out around noon, and with it went the fiber optic cable that provided cell phone and landline service and almost all of the Internet service to the Estes Park valley." While the low-lying downtown area was flooded, large portions of Estes Park still had electricity. They found out later that the other two routes out of town — US 36 and State Highway 7 — were also washed out. They were sent to the Estes Park Fire Department on Thursday evening, to help handle communications between the Red Cross shelters in the area and to keep the Larimer County Office of Emergency Management informed on the Estes Valley's status. They spent the better part of four days there, relaying messages and information from their cars in the Estes Park Fire Department parking lot using radios on

Dave O'Farrell, WBØIXV (left) and Doug Tabor, N6UA (right), spent the better part of the first four days of the flooding in the parking lot of the Estes Park (CO) Fire Department handling health and welfare traffic, including the call from Ron Young, KDØHCH, about his daughter who was stranded in nearby Allenspark. [Dave O'Farrell, WBØIXV, Photo]

Loy Young, KDØIHF, of Hastings, Nebraska and her husband Ron, KDØHCH, are relieved to find out their daughter is safe. Ron made the call to Estes Park via the Internet Radio Linking Protocol (IRLP) to get information about his stranded daughter. [Ron Young, KDØHCH, photo]

VHF and UHF frequencies designed for local area communications. Tabor and O'Farrell took turns — one manning the radios, with the other taking notes, to ensure accurate reporting and gathering of information. Sometimes they would both be on a radio at the same time. One would retrieve regular status reports from the Red Cross shelters and the Estes Park Medical Center; the other would be talking with hams stationed throughout the Estes Park valley, getting information about the condition of roads, diminishing supplies of food and fresh water, or the needs of evacuees at Red Cross shelters throughout the area. Sometimes one of them would drive to the Red Cross shelter or the medical center to take care of a problem, and then head back to the fire department. Other members of the Estes Valley Amateur Radio Club provided communications at locations throughout the Valley.

They had two different radios with antennas on the roofs of their cars, which connected them to other hams throughout the affected area via several Amateur Radio transmitter receiver combinations known as "repeaters" all throughout Larimer and Boulder counties. Repeaters allow signals from lower-powered transmitters, like the ones in Tabor and O'Farrell's cars, to be retransmitted with higher power and a better antenna, allowing Tabor and O'Farrell's signals to cover a much wider area than they could on their own in the mountainous terrain."Things quieted down at night, and we were both fortunate to be able to sleep in our own beds," Tabor said. "The last thing you want to do during a flood event is to be wandering around at night and become a victim." They would go back to the Fire Department each morning and stay until 10 or 11 at night, relaying whatever information was needed to provide assistance.

Concern Arises For Woman Isolated by Flooding

475 miles away in Hastings, Nebraska, Thursday, September 12 was the beginning of a very long three days for Ron Young, KDØHCH.

Young and his wife Loy, KDØIHF, have two daughters living in Estes Park. He is a member of the Estes Valley Amateur Radio Club and knows some of the members due to his regular visits to see his daughters. While his older daughter was safely in Estes Park when the flooding hit on Thursday morning, his younger daughter made it to Allenspark, 18 miles to the south, where she worked as an administrative assistant. She had a condition that required medication at very specific times. Young said, "She called me on Thursday and told me it had been raining really hard since Wednesday, and she drove through a washed-out road just to make it to work." That was the last he heard from her. "We were concerned, but not too concerned. But when we started getting reports from friends before communication was lost, we knew she was stranded at work and was low on medicine. We knew there could be a problem." Young didn't know how much medicine she had with her at work. Without the medication, Young's daughter gets tired and lethargic very quickly; going without medication for a long time could be life-threatening to her.

There was no word from Young's daughter on Friday. "I woke up about three AM on Saturday, and that's when it all hit me," Young recalled. "Not having heard from her in three days, all I had to go on was my imagination, guessing what her condition could be. She could be on a cot at work, and the others with her would think she's just sleeping in, but actually, she's dying. At three AM, I got really scared."

Information Brings Comfort in Times of Crisis

Saturday morning in Estes Park saw slight improvement. A very spotty Internet connection was established to the repeater site in Estes Park. That allowed amateurs to use a protocol known as the Internet Radio Linking Protocol (IRLP), which provides dedicated voice communication links between amateur repeater systems via the Internet. It took several attempts but, using his iPad, Ron Young in Nebraska was finally able to make contact with Doug Tabor on the Estes Park repeater via IRLP around 9:30 AM Saturday and explain his daughter's situation.

"Ron told us his daughter was stranded in Allenspark at work and hadn't had her medication in three days," O'Farrell said. Tabor asked Young to stand by and then made a call for assistance via an Amateur Radio repeater in Allenspark; Bob McDonald, KDØSCC, a resident of Allenspark and newly licensed amateur, answered.

"I was monitoring our local repeater and heard [Doug Tabor] trying to raise the Allenspark Fire Department with no response," McDonald said. "After a second call by Doug, I broke in and asked if he needed to get in touch with the Fire Department. When he told me what he needed and because the phones were not working, I offered to drive over to the station and get him in touch with the dispatcher. The Fire Station is less than two miles from my home, so within a few minutes I was at the station and initiated a third party link between Doug and the Allenspark Fire Department dispatcher." Paramedics were dispatched to find and retrieve Young's daughter.

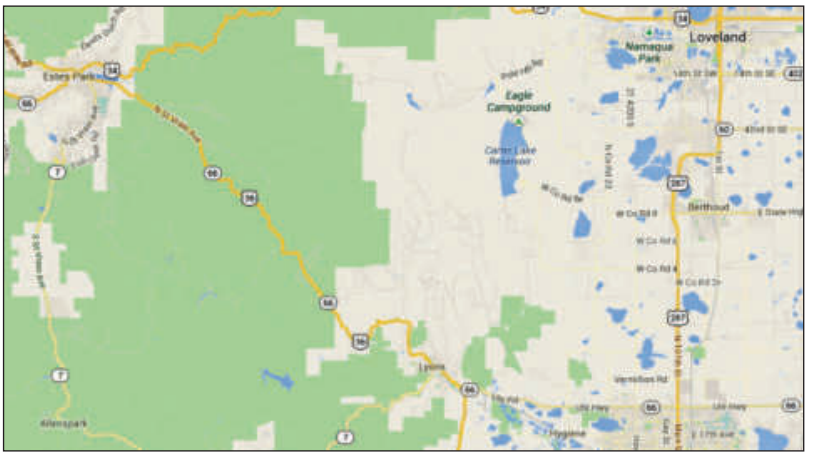
"When I got hold of Doug, you don't know how good I felt," Young said. "It brought me to tears. There was no other way to get info. I heard him

radio for assistance to Allenspark, and I just knew then that things were going to be okay."

As it turned out, Young's daughter had decided to take a chance on her own. By Saturday afternoon, her condition worsening and running low on food and potable water, she opted to get in a car with a couple of her coworkers and make an attempt to get out on their own. Firefighters at the Allenspark fire station told the women that State Highway 7 was believed to be passable, but if they tried to make the trip, they were doing so at their own risk.

The dispatched paramedics missed Young's daughter by only a few minutes.

The women eventually made it safely to Estes Park. Young received word that his daughter was at the Estes Park Red Cross shelter, and was in good hands.



Estes Park is in Larimer county; Allenspark is 18 miles south of Estes Park, in Boulder county, approximately 75 miles north-northwest of Denver. [Map courtesy of Google Maps]

"Ron was very grateful and thankful," Tabor said. He and O'Farrell continued relaying other messages and information about conditions in the Estes Valley until Sunday morning, when the major fiber optic line into Estes Park was repaired, restoring landline telephone and internet service. All in all, 155 man-hours were put into Amateur Radio emergency communications efforts in Estes Park by nine members of the Estes Valley Amateur Radio Club from September 12 through 15. Damage assessment and rebuilding will continue for several months throughout the 17-county affected area.

Young said his daughter is going to be okay, but it will take a couple months to get her medical condition stabilized again. He looks forward to returning to Estes Park to thank the men who, through Amateur Radio, gave him the peace of mind he needed at a very difficult time.

"It was well run, boy," Young said. "It was simple but it was effective."

Sean Kutzko, KX9X, is the ARRL Media and Public Relations Manager. He has been licensed since 1982 and employed at the ARRL since 2007. He enjoys HF and VHF contesting, DX-ing, and backpack QRPing. He can be reached **kx9x@arrl.org**.

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Jonathan Allen, K2KKH
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Zoe Belliveau, W1ZOE
Adam Bernard
Shelly Bloom, WB1ENT
Kathy Bouchard
Margie Bourgoin, KB1DCO
Ann Brinius
Al Brogdon, W1AB
Hugh Brower, KB1NFI
Dennis Budd, K3DGB
Steve Capodicasa
George Carbonell, N1RMF
Joe Carcia, NJ1Q
Donald Chandler, K1SDF
China Chaney
Paul Ciezniak, K1SEZ
Richard Claing, W1RGC
Lauren Clarke, KB1YDD
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Mike DeChristopher, N1TA
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Steve Ewald, WV1X
Martin Ewing, AA6E
Sue Fagan, KB1OKW
Maureen Farmer
Trish Feeney
Jackie Ferreira, KB1PWB
Gloria Flores
Marie Fredrickson, KB1TFU
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Norm Fusaro, W3IZ
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Scott Gee, WB9RRU
Al Gerke, N1JWF
Stew Gillmor, W1FK
Marc Goldstein, K8LSB
Alan Gosselin
Perry Green, WY1O
Amanda Grimaldi, KB1VUV
Mike Gruber, W1MG
Joel Hallas, W1ZR
Nancy Hallas, W1NCY
Ed Hare, W1RFI
Carey Harmon, KB1SCS
Penny Harts, N1NAG
Dan Henderson, N1ND
Mary Hobart, K1MMH
Ian Humphreys
Gail Iannone
Chris Imlay, W3KD
Bob Inderbitzen, NQ1R
Karen Isakson, W1KLI
Sabrina Jackson
Deb Jahnke, K1DAJ
Joseph Johnsky
Debra Johnson, K1DMJ
Jon Jones, NØJK
David Kaplan, WA1OUI
Alan Karenko, N1OX
Michael Keane, K1MK
Linda Kleinschmidt
Lori Kosior, KB1ZML
Ethel Kramer, KB1NMO
Harold Kramer, WJ1B
Carol Krukiel
Stanley Kugler, W1XK
Lisa Kustosik, KA1UFZ
Sean Kutzko, KX9X
Greg Kwasowski, W1GJK
Zachary Lau, W1VT
Richard Lawrence, KB1DMX
Rose-Anne Lawrence, KB1DMW
Amy Leary, KB1TLM
Monique Levesque
Woody Lewis, W1SL
Rick Lindquist, WW1ME
Maryann Macdonald, KB1ZTH
Virginia Macfarlan, KD4VSK
Effie Mangllara
William Marchand, W1WAM
Mike Marinaro, WN1M
Bernie McClenny, W3UR
Mike McKaughan, K1DM
Gary McManus, NQ1G
Kim McNeill, KB1WUX
Diane Middleton
Joe Moell, KØOV
Bill Moore, NC1L
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Jodi Morin, KA1JPA
Anthony Nesta, AA1RZ
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Cassandra Parkman, KB1WQY
Dave Patton, NN1N
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Diane Petrilli, KB1RNF
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John Proctor, K1JMP
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Kim Rochette
Steve Sant Andrea, AG1YK
Lauri Schaffer
Cathy Scharr
Michael Scharr
Gary Schmid, WA8GCR
Becky Schoenfeld, W1BXY
Greg Secord, K1MVQ
Barry Shackleford, W6YE
Andrew Shefrin, KB1YHB
Barry Shelley, N1VXY
H. Ward Silver, NØAX
Jon Siverling, WB3ERA
Kai Siwiak, KE4PT
Chuck Skolaut, KØBOG
Maria Somma, AB1FM
Cathy Stepina
David Sumner, K1ZZ
Diane Szlachetka, KB1OKV
Sharon Taratula
Lisa Tardette, KB1MOI
Jim Todd, WB1GIE
John Troster, W6ISQ
Deborah Voigt
Yvette Vinci, KC1AIM
Paul Wade, W1GHZ
Dan Wall, W1ZFG
Pete Warner, K1HJW
Maty Weinberg, KB1EIB
Mike White, W1RSX
Rosalie White, K1STO
Mark Wilson, K1RO
Larry Wolfgang, WR1B
Janice Wytas, KB1ODH
Sani Zanovic

A Contact I'll Never Forget

Amateur Radio forms a bridge between two famous men.

Lowell Thomas was one of the most well-known journalists of his day, with a career that extended from World War I into the 1950s. [Wikimedia Commons]

Paul Danzer, N1II

The evening was warm, and the daylight was fading into night. I was tuning 15 meters and the signals there were also fading in and out with the weakening of the ionosphere.

There was still some daylight at my shack in Norwalk, Connecticut. One minute there were a few signals indistinguishable from the S-2 noise level, and the next minute a host of JAs would pop up S-7 or S-8. It was a usual summer evening on 15. Then, suddenly, it went from typical to exceptional.

At about 0120Z, "Nine Nancy One Mickey Mouse" appeared. Father Moran had the only station operating from Nepal at that time. A missionary, he became well-known in Amateur Radio circles as a DXer and in the popular press for his work with the residents of Nepal.[1] His position brought him into contact with any number of world famous leaders — from presidents and kings, to explorers and entertainment personalities. He was featured in innumerable magazines and newspaper stories.

I was surprised to hear his short CQ, and shocked when he came back on my first call. My station at that time was rather modest — 100 W to a three element trap Yagi, about 40 feet off the ground. We exchanged signal reports; he was a solid 56 and he gave me a 57. Then, instead of the usual small talk about his station and the weather, he asked me how far I was from the New York state line. I told him I wasn't far and he asked me if I could run a phone patch.

Phone What?

Before the Internet, long distance calls were often very expensive — running from 25 cents up to a several dollars a minute. Many hams had an accessory called a *phone patch*, which interfaced your rig to the telephone line. If you had a friend in a distant city, you could call a directional CQ, looking for a ham in that city. The ham who answered your CQ would place a local call to your friend, connect his rig to the phone through the phone patch, and you could talk to your friend via the airwaves.

My patch was homebrewed — with a junk box switch and a miniature RadioShack audio transformer — for a total cost of approximately $2. Once a standard station accessory, phone patches have faded into technological history because long distance calls have become so inexpensive — often included as part of a cell phone plan.

The Contact Gets Interesting

I told 9N1MM I would be happy to run a phone patch and asked who he wanted to talk to. Very casually he said that his friend, Lowell Thomas, lived just over the New York/Connecticut border and gave me his phone number.

For those of you who have never heard of Lowell Thomas, or don't remember his prominence, this was roughly equivalent to someone on the air giving you Steven Spielberg's phone number and asking if you minded calling him.

Lowell Thomas was a world-famous broadcaster, writer, explorer, and producer of documentary and travel films, known for his commanding voice on the radio. Similar to Father Moran, Thomas quite often appeared in the company of various presidents, kings, and other noteworthy individuals. He is credited with making T. E. Lawrence — better known as Lawrence of Arabia — famous.

Apparently Moran and Thomas met and became good friends when Thomas was in Nepal shooting a film.

A Chat Across the Continents

With some hesitation I took the number and dialed. Someone answered and I explained that I had Father Moran on the other end of a radio link (no use in trying to explain Amateur Radio!) and that he wanted to talk to Mr Thomas. The voice on the other end, without missing a beat, said, "Just a minute," — and sure enough the next voice was immediately recognizable as belonging to Lowell Thomas. Briefly I explained that this was not a telephone system — only one person could talk at a time and when he was finished with his sentence and wanted a response he should say "over."

Then I became nervous. Signals were 56 or 57, but the band was unstable and I did not really want to have to explain that the call was dropped due to propagation. Thankfully, the band held and no one broke in. For about 15 minutes, these two distinguished gentlemen chatted while I threw the patch switch from receive to transmit and back again.

When they were though, both parties thanked me as though this was a common occurrence. I signed, and with a shaking and sweating hand logged the contact — July 26, 1979. Figure 1 is the front of the QSL 9N1MM sent me, but I hardly need a reminder to bring back my memories of this incredible contact.

[1]U. Bihlmayer, DJ9KR, "In Loving Memory: Father Moran, 9N1MM," *QST*, Jun 2006, pp 48-49.

Figure 1 — Paul's, N1II, QSL card from Father Moran, 9N1MM. [Paul Danzer, N1II, photo]

Paul Danzer, N1II, an ARRL member, has been an active ham since his teenage years. He has had a number of interesting contacts, but the one described here is certainly one of the most memorable. After a career as an electronic engineer in the defense business, he is now a Professor of Computer Science at a local community college. You can reach Paul at 2 Dawn Rd, Norwalk, CT, 06851-1106, **n1ii@arrl.net**.

Rick Lindquist, WW1ME, ww1me@arrl.org

ARRL Executive Committee Okays Filing Symbol Rate

ARRL General Counsel receives authorization, comments on other regulatory matters.

The ARRL Executive Committee (EC) has authorized ARRL General Counsel Chris Imlay, W3KD, to file a *Petition for Rulemaking* on the League's behalf, calling for the deletion of symbol rate references for data emissions in the HF bands. The EC met October 5 in Aurora, Colorado. The League's *Petition*, still in the final stages of preparation, would substitute an authorized bandwidth of 2.8 kHz for all data emissions in the bands below 30 MHz. Current FCC rules limit data emissions to a symbol rate of 300 baud below 28 MHz and to 1200 baud on 10 meters. The current limits date to 1980, when US amateurs first were authorized to use ASCII, reflecting the state of the art back then, which, the League points out, has been overtaken by technology.

At its July meeting, the ARRL Board of Directors, on the recommendation of the Ad Hoc Symbol Rate Rule Modernization Committee, directed Imlay to draft a *Petition for Rulemaking* with the FCC seeking to modify §97.307(f) of the Amateur Service rules to delete all references to symbol rate. The *Petition* will ask the FCC "to apply to all amateur data emissions below 29.7 MHz the existing bandwidth limit, per §97.303(h), of 2.8 kHz." In digital systems "symbol rate" refers to the number of times per second that a change of state occurs. The ARRL chose the 2.8 kHz bandwidth, since the FCC already has applied it to emissions on the channelized 60 meter band and because it's slightly wider than the data mode bandwidths currently in use by amateurs on HF.

The Ad Hoc Committee had determined that the current symbol rate restrictions in §97.307(f) "no longer reflect the state of the art of digital telecommunications technology," and that the proposed rule change would "encourage both flexibility and efficiency in the employment of digital emissions by amateur stations." ARRL Chief Executive Officer David Sumner, K1ZZ, discussed the symbol rate issue in detail in the September 2013 issue of *QST*'s "It Seems to Us" editorial (**www.arrl.org/news/arrl-ceo-explains-board-s-action-on-symbol-rate-regulation**).

On another FCC-related matter, Imlay told the EC that the FCC shutdown had delayed the League's review of comments in ET Docket 13-84, the FCC's reexamination of its RF exposure rules. The ARRL wanted to determine whether any of the comments required an ARRL response.

Imlay further noted that the FCC has yet to take action in ET Docket 12-338 to formally reflect the *Final Acts* of the 2007 World Radiocommunication Conference in its rules. Comment deadlines were more than 6 months ago. The Commission also has taken no action on the ARRL's November 2012 petition to implement a 472-479 kHz allocation, which stemmed from WRC 2012. Imlay said the subject may be considered in a *Further Notice of Proposed Rulemaking* in the proceeding.

Imlay told the EC that FCC action is expected soon on WT Docket 12-283 and WT Docket 90-209, which contain several proposals to amend rules governing the administration of Amateur Radio examinations. The League has argued against a proposal to reduce the number of volunteer examiners required at an exam session from three to two.

The EC reviewed and approved a draft FCC filing prepared by ARRL Chief Technology Officer Brennan Price, N4QX, that supports recommendations approved last month by the FCC Advisory Committee for World Radiocommunication Conference 2015. The comments were filed October 17.

The complete minutes of the ARRL Board and Executive Committee meetings are online at **www.arrl.org/board-meetings**.

FCC Issues Warnings for Amateur Radio Infractions, Unlicensed Operation

The FCC's Enforcement Bureau made public warning letters to several individuals for earlier alleged infractions of the Part 97 Amateur Service rules or Section 301 of the Communications Act of 1934, as amended. On August 9, Special Counsel Laura L. Smith wrote Jack Hartley, K4WSB, of Tampa, Florida, citing evidence received from members of the Amateur Auxiliary (Official Observers) that Hartley had operated outside of his Advanced class privileges.

"According to the OOs, the operator refused the contact noting that you were not authorized to be operating in the band," Smith wrote. "This was your 4th attempt to contact this operator...your continued attempts to contact the operator on Kwajalein Atoll constitute a violation of our rules, as you are not authorized to be operating in that band."

Smith cautioned Hartley about revocation or suspension and fines. "It could also jeopardize any attempts to obtain an upgraded Amateur Radio license," she added.

On June 24, Smith sent warning notices to Eric J. Christianson, KNØCW, and Thomas E. Barnes, N7OVC, both of Reno, Nevada, to inform them that the trustee of the WA7DG repeater in Sparks, Nevada, had requested that they refrain from using his repeater.

"The written request was issued as a result of your failure to follow operational rules set forth by the licensee/control operators of the repeater system for their users," Smith said.

Smith advised the licensees that the FCC expects them to abide by the repeater owner's request. She said continued use of the WA7DG repeater could subject them to "severe penalties, including license revocation, monetary forfeiture (fine) or a modification proceeding to restrict the frequencies upon which you may operate."

On July 8, Smith warned James E. Richburg, address withheld and unknown, against unlicensed radio operation in the Amateur Radio bands.

Smith pointed out that operating transmitting equipment without a valid FCC license may subject the responsible parties to substantial monetary forfeitures, *in rem* arrest action against the offending radio equipment, and criminal sanctions including imprisonment."

All of Smith's warning notices concluded with the advisory, "Fines normally range from $7,500 to $10,000."

FCC Reopens, ARRL VEC Processing Resumes

Along with most of the rest of the federal government, the FCC ground to a halt on October 1, save for emergencies, and it remained shuttered until October 17, when Congress resolved the funding crisis. With the Commission's Gettysburg, Pennsylvania, facility, main website and Amateur Radio call sign database (ULS) dark for the duration of the shutdown, no Amateur Radio applications were able to be filed, even on paper, and the FCC made no license or call sign grants.

Once the FCC was up and running again, it was not long before application processing resumed. During the shutdown, exam session paperwork continued to flow into the ARRL VEC, and work was piled up. "We had approximately 250 sessions and over 1500 forms in the queue," ARRL VEC Manager Maria Somma, AB1FM, said as the FCC reopened. By the end of the day, the VEC staff had filed the entire backlog with the FCC for processing.

Beyond that, Somma said, "day-to-day operations at the ARRL VEC office ran smoothly despite this unusual event."

ARRL VEC staffers Amanda Grimaldi, KB1VUV (left), and China Chaney review some of the exam session paperwork that began to pile up during the FCC shutdown. [Maria Somma, AB1FM, photo]

ARRL Designates Six Regional ARRL Centennial Events

As part of its 2014 Centennial Celebration (**www.arrl.org/centennial**), the ARRL has designated six major ham radio gatherings as "Regional ARRL Centennial Events." The action was approved October 5 when the ARRL Executive Committee met in Colorado. ARRL Marketing Manager Bob Inderbitzen, NQ1R, developed a way to bring the ARRL Centennial celebration to more radio amateurs across the US.

"While ARRL has planned a premier national-level Centennial Convention for 2014 in Connecticut, organizing some regional events will encourage greater awareness of the anniversary and greater participation by members, for whom traveling to New England will be too far, too costly, or otherwise not practical," Inderbitzen suggested in his proposal to the EC.

The centerpiece of the League's centennial is the 2014 ARRL National Centennial Convention (**http://arrl2014.org/**) in Hartford, Connecticut, July 17-19. EC members approved six Regional Centennial Events to complement the National Convention.

- Orlando Hamcation® — Orlando, Florida, February 7-9, 2014
- Dayton Hamvention® — Dayton, Ohio, May 16-18, 2014
- SEA-PAC — Seaside, Oregon, June 6-8, 2014
- Ham-Com — Plano, Texas, June 13-14, 2014
- Huntsville Hamfest — Huntsville, Alabama, August 16-17, 2014
- Pacificon — Santa Clara, California, October 10-12, 2014

In addition to celebrating ARRL's 100th anniversary, sanctioning the regional centennial events is aimed at enhancing the all-volunteer ARRL Field Organization, generating greater interest in League membership, program, services, and publications, and helping to promote the ARRL's Second Century Campaign (**www.arrl.org/arrl-second-century-campaign**).

Window Opens for 2014 Dayton Hamvention Award Nominations

Dayton Hamvention® solicits nominations for its 2014 awards for Amateur of the Year, Special Achievement, Technical Excellence, and Club of the Year. All Amateur Radio operators are eligible. Nominations must be received by January 17, 2014. Winners will be recognized at the 2014 Dayton Hamvention®, May 16, 17 and 18.

- The Amateur of the Year Award goes to an individual who has made a long-term, outstanding commitment to the advancement of Amateur Radio.
- The Technical Excellence Award is awarded to an individual who has made an outstanding technical advancement in the field of Amateur Radio.
- The Special Achievement Award honors someone who has made an outstanding contribution to the advancement of Amateur Radio, usually by spearheading a significant project.
- The Club of the Year award goes to a club that has made a significant contribution to the advancement of Amateur Radio.

The Dayton Hamvention Awards Committee makes the final decision on all awards, based in part upon the information it receives, not on the number of nominations. Documentation that informs the Awards Committee of a nominee's accomplishments may include magazine articles, newsletters, newspaper clippings, and even videos (these materials become the property of Hamvention and will not be returned).

Additional details on these awards and a nomination form are available on the Dayton Hamvention website (**www.hamvention.org/awards.php**). E-mail nominations to **awards@hamvention.org** or mail to Dayton Hamvention Awards, PO Box 1446, Dayton, OH 45401-1446. — *Dayton Hamvention®, c/o Henry Ruminski, W8HJR*

FCC News

FCC Dismisses "Encryption" Petition

The FCC has dismissed a *Petition for Rulemaking* (RM-11699) that sought to amend the Part 97 Amateur Service rules to permit the encryption of certain amateur communications during emergency operations or related training exercises. Don Rolph, AB1PH, of East Walpole, Massachusetts, had requested an additional exception to §97.113, which currently prohibits "messages encoded for the purpose of obscuring their meaning," but the FCC said in a September 18 *Order* that it's not persuaded that Rolph's petition provides sufficient reasons to support the change.

In his petition Rolph suggested excepting "intercommunications when participating in emergency services operations or related training exercises which may involve information covered by HIPAA [medical privacy requirements — *Ed.*] or other sensitive data, such as logistical information concerning medical supplies, personnel movement, other relief supplies or any other data designated by Federal authorities managing relief or training efforts."

The ARRL had called on the FCC to deny Rolph's petition. "While Mr Rolph has concisely stated his argument, it is ARRL's considered view that there is no factual or legal basis for the assumption that encryption of transmissions…is necessary in order to continue and enhance the utility of Amateur Radio emergency and disaster relief communications," the League said in comments July 8 with the FCC.

The FCC concluded, "Thus, while the proposal could advance one purpose of the Amateur Radio Service — value to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications — it would undermine other characteristics and purposes of the service."

The League allowed in its comments that "the Commission may be asked to revisit this matter."

Army MARS Seeks Partnership with ARRL, ARES

Representatives of the US Army Military Auxiliary Radio Service (MARS) met with ARRL staff at League Headquarters October 2 to discuss ways the two organizations might collaborate in emergency response activities. Army MARS Region 1 Director Bob Mims, WA1OEZ, headed the delegation. Mims, who is also manager of the Army MARS National Net, said most of the discussion centered on how ARRL Headquarters and the Amateur Radio Emergency Service (ARES) might interact with MARS during an early November national-level test of backup communications, and going forward. ARRL has an Army MARS station, AAN1ARL, located at the Maxim Memorial Station, W1AW.

Army MARS invited Air Force and Navy-Marine Corps MARS to take part in the joint national communication exercise, aimed at measuring the auxiliary force's capabilities, should normal communication systems be disrupted throughout North America. A joint Army/Air Force/Navy-Marine Corps team responsible to the US Department of Defense for homeland security was set to monitor the 48-hour exercise. According to Army MARS Program Manager Paul English, WD8DBY, the exercise culminated a year-long series of escalating preparations by Army MARS for responding to complex emergencies that might crash or compromise national communications.

MARS/ARRL get together at W1AW (L-R): Ken Bailey, K1FUG; John Weinland, N1ATB; Jon Perelstein, WB2RYV; Joe Carcia, NJ1Q; Bob Mims, WA1OEZ, and Matt Hackman, KB1FUP.

Joining Mims were MARS Southern New England Emergency Operations Officer John Weinland, N1ATB, and MARS members Jon Perelstein, WB2RYV, and Matt Hackman, KB1FUP. The MARS contingent met with ARRL Emergency Preparedness Manager Mike Corey, KI1U, ARRL Emergency Preparedness Assistant Ken Bailey, K1FUG, and W1AW Station Manager Joe Carcia, NJ1Q.

Subsequent to the meeting at League Headquarters, ARRL Southwestern Division Vice Director Marty Woll, N6VI, paid a visit on October 8 to Army MARS Headquarters in Fort Huachuca, Arizona. Woll says he enjoyed an extended conversation with Army MARS Chief of Operations David McGinnis, K7UXO.

McGinnis recounted that he and Woll discussed conducting regular checks with W1AW, using both Amateur Radio and MARS circuits, and quarterly drills on both circuits. Woll is also an ARES assistant District Emergency Coordinator.

Tibet Radio Operator, Diplomat Robert W. Ford, ex-AC4RF, SK

Robert W. Ford, who operated from Tibet as AC4RF from 1948 to 1950, died September 20 in London at the age of 90. His fascinating autobiography, *Wind Between the Worlds,* was published in 1957 and is now available as a free Internet Archive download. The book describes his time and travails in Tibet and how his radio work nearly cost him his life.

As Ford explains, he first came to Tibet "by accident" to relieve the radio officer at the British Mission in Lhasa. He returned later as a member of the Tibetan government to establish Radio Lhasa. His stay in Tibet coincided with the Chinese invasion of the Himalayan nation. Ford eventually was imprisoned by the Chinese in 1950; He was tried for "radio espionage" and spent 5 years in jail before being released.

He later became a member of the British Diplomatic Service, serving in various postings before retiring in 1987. He was awarded Commander of the Order of the British Empire. Last spring Ford was given the International Campaign for Tibet's Light of Truth Award by the Dalai Lama.

Rick Palm, K1CE, k1ce@arrl.org

A Look Back, Books and SKYWARN® Recognition Day

The books highlighted here make great gifts for the ARES® operator on your holiday shopping list.

It has been a busy and demanding year in terms of major exercises and disaster operations across the country. One need not look further than the Colorado flash flooding, the California wildfires, or the Boston Marathon for examples of critical emergencies.

The government, in the pursuit of *interoperability*, remains committed to making the country's emergency responders able to communicate with each other more efficiently and effectively on the disaster scene. The ubiquitous Incident Command System (ICS) is the template for government emergency response that puts all players on the same page, regardless of the size of the incident. Whether it is a car crash on the Los Angeles Freeway, a Category 5 hurricane slamming into the Gulf States, or a major earthquake along the New Madrid fault line, the ICS adapts to the event.

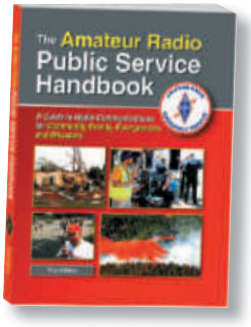
In Florida, a state-wide exercise was held in February that was on a larger scale than had been seen before. Dubbed "Operation RADAR II," it combined rolling communications vans from the state EOC at Tallahassee with many county vehicles and operators from local EOCs across the state. They convened on a sprawling military campus outside of Jacksonville for this multiday interoperability exercise. Amateur Radio played a major role, as was reported in the May issue of *QST*.[1]

FEMA has grown its Independent Study Program (ISP) offerings. The Department of Homeland Security's Office of Emergency Communications (OEC) has offered more of its Auxiliary Emergency Communications courses across the country to help train those deployed as part of an ICS Communications Unit. Bill Smith, Jr, W7HMV, the emergency coordinator for Clark County, Nevada, wrote: "I was able to attend the first Department of Homeland Security (DHS) Auxiliary Emergency Communications Course in Nevada. It was simply excellent. I learned a lot, especially how to build the Incident Command System (ICS) forms."

[1]R. Palm, K1CE, "Public Service," *QST*, May 2013, pp 77-79.

The Amateur Radio Public Service Handbook, First Edition

Published last year by the ARRL®, *The Amateur Radio Public Service Handbook* is the authority on the topic, superbly written and edited by the ARRL Headquarters' Emergency Preparedness Manager Mike Corey, KI1U. Corey pulled together a group of qualified contributors who lend the book a fresh perspective. The first few chapters concern the basis and purpose of Amateur Radio as applied to public service and especially disaster communications, and the League's ARES program. A nice example of Washington State's ARES programs and the cooperation that exists between its two sections (Eastern Washington and Western Washington, divided roughly by the Cascade Mountains), lends interest and readability.



Part 2 covers served agencies. ARRL has signed memoranda of understanding with many major entities, including the American Red Cross, the subject of Chapter 3. There is true insight to be found here: "The best advocate for the ARRL and Red Cross relationship is someone who is a member of both organizations. The culture and politics of each will then be understood, enabling a volunteer to more effectively transition from the duties of one role to the other."

There is a good section on the SKYWARN program and its longstanding partnership with Amateur Radio operators as the eyes and ears of the NWS, radioing in "ground truths" to local NWS offices to give early warning to the citizenry.

Working with local emergency management agencies is a critically important topic that is covered in Chapter 6. It is a topic that appears frequently in this column, too. As I said last month regarding Amateur Radio's role within the emergency operations center, "We are there to provide a transparent service to the emergency manager, who is the professional." Chapter 6 expands on this basic concept to define our role in the emergency management function.

"Leading and Training Volunteers" is the subject of Chapter 7, and is arguably the most demanding responsibility of the ARES Emergency Coordinator. With FEMA's expanded Independent Study Program courses, the ARRL's Emergency Communications training course, and books like Corey's, there is simply no excuse for not having well-trained volunteer ARES operators. Motivating volunteers is more art than science, and is also addressed in this chapter.

A volunteer operator's home and family come first in any disaster situation, but when they have been secured and the operator is deployed, his or her personal safety, survival, and health are the next priorities, and are the subject of Chapter 8. There is an excellent chapter on the "science of radio" and another one on network theory for the emergency communicator, which will help the operator understand and choose best practices, including best modes and frequencies for the task at hand. It's a good technical review for any radio amateur, actually. Go-kits, "going portable," and Field Day as a training exercise are covered extensively. Traffic handling, the essence of what we do, and network theory as it applies to emergency communications is covered well. Other radio services on the ARES operator's periphery are addressed to enhance his or her grasp of the overall disaster response environment.

Community Communications

Not only are emergency and disaster response communications covered, but support for public service events is addressed as well. A chapter on the complex communications planning and operation for the Boston Marathon is included. This section certainly has new meaning after the events that occurred in April.[2] It hammers home the mes-

sage that public event environments are not guaranteed to be benign.

Two of my favorite chapters in this book are Chapters 20 and 22, on the popular digital modes for emergency communications: NBEMS (Narrow Band Emergency Messaging System) and the Winlink 2000 global e-mail messaging system, respectively. They are my favorites simply because I have been experimenting with both systems. Both sound card-compatible suites have unique qualities of interest to the emergency operator: NBEMS for its impressive multimode capability and for its ICS message and form templates; Winlink 2000 for its ability to receive, store and forward e-mail messages independent of local Internet infrastructure.

Both systems' advantages are undeniable. Both are easy to use, with simply a radio, free software, and a laptop with sound card or external sound card and digital interface device like a RIGblaster or SignaLink USB. There's a chapter on D-STAR applications, which are hardly Internet-independent, although local simplex and repeaters can be used for local area networks and county EOC applications. D-STAR incorporates GPS, and is an asset for emergency applications.

Chapters on MARS, the Handiham program, international aspects, and an extensive set of appendices — including technical information on emergency power sources — round out this 300-plus page essential book. Congratulations to Mike Corey, KI1U, and his team for a fine contribution to the literature. Put it on the top of your to-be-read pile.

Personal Emergency Communications

Andrew Baze's, AB8L, *Personal Emergency Communications — Staying in Touch Post-Disaster: Technology, Gear & Planning*, is an excellent review for radio amateurs in CERT teams and ARES organizations. Written primarily for the lay public, the book seeks to answer the question, "How will you contact anyone if your landline phone, cell phone, and Internet connection don't work?" It appropriately starts off by emphasizing the need for a family emergency plan with realistic options for backup communications. True stories are included, which support this argument and lend human interest and readability. The first four chapters are devoted to drafting the plan.

The next section is devoted to listening strategies for gaining hard information and advisories on unfolding disaster conditions. The discussion includes pros and cons of a simple AM/FM/SW radio, NOAA weather radio, the EAS, scanners, TV and even the crystal radio, which doesn't need a power source.

Turning to two-way radio systems, technologies covered include: FRS/GMRS (two-way radios available at Wal-Mart and most sporting goods stores), CB radio, eXRS radio, VHF/UHF Amateur Radio, HF radio, Satellite phones, Personal Locator Beacons, scanners, and basic backup power supply recommendations. For each system, pros and cons are discussed, along with the specific problems they tend to solve, and recommendations for their use.

The largest section of the book is devoted to "Amateur Radio — The King of Emergency Communications," which does a good job of reviewing its flexibility of modes and frequency bands for short, medium, and long range communications, and digital and voice applications. Baze lays out a good argument for the public to obtain a ticket, and explains licensing and testing.

Chapters on emergency backup power sources, training and skills for using radios and communicating, eg, "How to Talk on the Radio," and a good set of appendices round out this well-written book. I highly recommend it, especially for neighborhood CERT teams for use in their own training, and for possibly handing out to the neighbors they serve. It would make a great stocking stuffer!

SKYWARN ™ Recognition Day, December 7

The annual SKYWARN ™ Recognition Day (SRD) will take place this year on Saturday December 7, 2013. This is a day when Amateur Radio operators visit National Weather Service (NWS) offices and contact other operators around the world. The purpose of the event is to recognize the vital public service contribution that Amateur Radio operators make during National Weather Service severe weather warning operations. It also strengthens the bond between Amateur Radio operators and the local National Weather Service office. The event is co-sponsored by the ARRL and the National Weather Service. Please remember that this is not a contest, so no scoring will be computed.

Object

For all radio amateur stations to exchange QSO information with as many National Weather Service Stations as possible on the 80, 40, 20, 15, 10, 6, and 2 meter bands as well as the 70 centimeter band. Contacts via repeaters are permitted. SKYWARN ™ Recognition Day serves to celebrate the contributions to public safety made by Amateur Radio operators during threatening weather.

Date

National Weather Service stations will operate December 7, 2013, from 0000 – 2400 UTC.

Exchange

Call sign, signal report, QTH, and a one or two word description of the weather occurring at your site ("sunny," "partly cloudy," "windy," etc).

Modes

National Weather Service stations will work various modes including SSB, FM, AM, RTTY, CW, and PSK31. While working digital modes, special event stations will append "NWS" to their call sign (e.g., NØA/NWS).

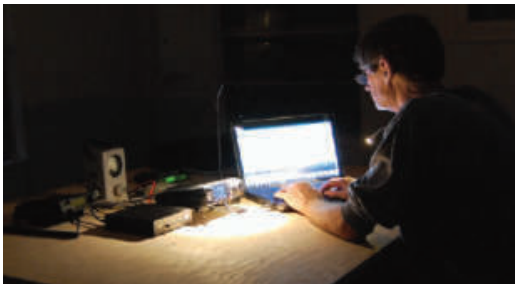
Station Control Operator

It is suggested that during SRD operations, a non-National Weather Service volunteer who is a licensed radio amateur serve as a control operator for the station that is set up at a NWS office.

Event and QSL Information

The National Weather Service will provide event information via the internet. Event certificates will likely be electronic and printable this year. Stay tuned!

Details about this year's event may be found at **www.wrh.noaa.gov/mtr/hamradio/**.



Season's greetings from your column editor Rick, K1CE, from his 1940s country cabin shack, across from the Ichetucknee River, Fort White, Florida. My rig consists of an Icom IC-7000, with an LDG IT-100 autotuner, classic Bird 43 wattmeter, SignaLink USB digital interface, Rigblaster Plug and Play digital interface, and Icom IC-2200H with D-STAR chip. [Rick Palm, K1CE, photo]

[2]R. Palm, K1CE, "Public Service," *QST*, July 2013, pp 77-79.

Contest Corral – December 2013

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
1	1300Z	1	1600Z	3.5-14 / -	SARL Digital Contest	Dig	RST and serial	www.sarl.org.za
6	**2200Z**	**8**	**1600Z**	**1.8 / -**	**ARRL 160 Meter Contest**	**CW**	**RST and ARRL/RAC section if US/VE**	**www.arrl.org/contests**
7	0000Z	7	2359Z	1.8-28 / -	TARA RTTY Mêlée	Dig	RST and State/Province or serial	www.n2ty.org/seasons/tara_melee_rules.html
7	1200Z	8	1200Z	3.5-28 / -	VU International DX Contest	Ph CW	RS(T) and Indian state or prefix	www.arsi.info/contests/international
7	1600Z	8	1559Z	3.5-28 / -	Top Operators Activity Contest	CW	RST, serial, and TOPS/PRO number	www.procwclub.ro/TAC%20Rules.html
7	2300Z	8	See website	3.5,7 / -	AWA Bruce Kelly QSO Party	CW	RST, Xmtr type, power, name	www.antiquewireless.org
8	0000Z	8	2359Z	28 / -	Ten Meter RTTY Contest	Dig	RST and state or province or serial	www.rttycontesting.com
8	1200Z	8	2359Z	3.5-28 / -	Straight Key Weekend Sprintathon	CW	RST, S/P/C, SKCC nr or power	www.skccgroup.com
8	2100Z	8	2259Z	14 / -	Great Colorado Snowshoe Run	CW	RST, S/P/C, class, CQC number or power	www.cqc.org/contests
10	0200Z	10	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
11	0000Z	17	0200Z	- / 50-222	Meteor Scatter Contest	Dig	Both calls, grid square, acknowledgment	www.meteorscatter.org
11	0130Z	11	0330Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	www.naqcc.info
11	1300Z	12	See website	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
13	0230Z	13	0300Z	1.8-14 / -	NS Weekly Sprint	CW	Serial, name, and S/P/C	www.ncccsprint.com
14	0000Z	15	2359Z	28 / -	28 MHz SWL Contest	Ph CW	Log ARRL 10 Meter Contest QSOs	swl.veron.nl/swlcontest.htm
14	**0000Z**	**15**	**2359Z**	**28 / -**	**ARRL 10 Meter Contest**	**Ph CW**	**RS(T) and State/Prov or serial**	**www.arrl.org/contests**
14	1700Z	15	See website	1.8-7 / -	UBA Winter Contest	Ph CW Dig	RS(T) and UBA section or serial	www.uba.be/en/hf/contest-rules
15	2000Z	15	2359Z	1.8-28 / -	Holiday Spirits Homebrew Sprint	CW	RST, S/P/C, ARCI number or Power	www.qrparci.org/contests
16	0200Z	16	0400Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
18	0130Z	18	0330Z	3.5-14 / -	NAQCC Milliwatt Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	www.naqcc.info
19	2100Z	19	2300Z	1.8 / -	Russian 160 Meter Contest	Ph CW	RS(T), serial, square ID (see website)	www.radio.ru/cq
20	0001Z	Jan 1	2359Z	1.8-28 / 50,144	Lighthouse Christmas Lights QSO Party	Ph CW Dig	Serial or ARLHS number	arlhs.com
21	0000Z	21	2400Z	3.5-28 / -	Feld-Hell Rudolph Hell Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
21	0000Z	22	2400Z	3.5-28 / -	OK DX RTTY Contest	Dig	RST and CQ Zone	www.crk.cz/ENG/DXCONTE.HTM
21	1400Z	22	1400Z	1.8-28 / -	Croatian CW Contest	CW	RST and serial	www.9acw.org
22	**1800Z**	**22**	**2359Z**	**3.5-28 / -**	**ARRL Rookie Roundup**	**CW**	**Both calls, name, check, S/P/XE or "DX"**	**www.arrl.org/contests**
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
28	0000Z	28	2359Z	1.8-28 / 50,144	RAC Winter Contest	Ph CW	RS(T) and province or serial	www.rac.ca/en/rac/programmes/contests
28	1200Z	29	1159Z	3.5-28 / -	Iron Ham Contest	Ph CW Dig	RS(T) and CQ zone	www.araucariadx.com
28	1500Z	29	1500Z	1.8 / -	Stew Perry Top Band Distance Challenge	CW	4-char grid square	www.kkn.net/stew
29	0000Z	29	1200Z	3.5-28 / -	RAEM Contest	CW	Serial and lat/long in degrees	raem.srr.ru
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 dates 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.

ARRL's Centennial QSO Party

A special year-long operating event in which every ARRL member is worth points.

Dave Patton, NN1N, nn1n@arrl.org

A 100 year anniversary is an event that calls for recognition and celebration! In honor of the ARRL Centennial, we have created a unique operating event that has not been previously attempted. The Centennial QSO Party — a year-long operating event — will be the first ARRL-sponsored operating event where every member will be worth at least one point.

Operating Period

0000Z, 1 January, 2014, through 2359Z, 31 December, 2014. W1AW will operate portable from each state and most US territories throughout the year. See the W1AW schedule online for details. Each state will be activated twice, so if you miss one operation, there will be another opportunity to work the station.

Participation

Everyone may participate. Only ARRL members and appointees/elected officials/staff/W1AW are worth points. See the table for a complete list of QSO values.

Bands and Modes

To count for points, all QSOs must be two-way (no cross-band or cross-mode), using CW, phone (FM, SSB, AM, digital voice), or digital (any digital mode, PSK31, RTTY) on nearly all the bands (see the complete listing online). Additionally, one QSO with each eligible station on any satellite, regardless of mode, is allowed for points.

QSO Information Exchange

Many stations will try to keep their QSOs short and, for many, the exchange will be a signal report and ARRL abbreviation (see table.) QSOs do not have to be contest style, and it isn't necessary to give the ARRL organizational information. A Centennial database will be used to assign point values to logs submitted electronically via ARRL's Logbook of The World (LoTW). Those who do not use electronic submission will need to obtain the QSO information from their contacts. This event is not a contest, so feel free to make contacts in any way you like.

Scoring

The values of all eligible, completed QSOs will be totaled. There are no multipliers or bonus points. See the table for QSO values.

Awards

Work each of the 50 states using QSOs with W1AW operating portable. W1AW at Headquarters does not count for Connecticut for this award. Connecticut credit is given only for working W1AW/1 in Connecticut. A W1AW WAS plaque and certificate will be available. For the biggest challenge, work each of the 100 W1AW portable operations (both operations from each state) — essentially a double WAS with W1AW!

Endorse the W1AW WAS with the Territorial Stickers for working W1AW/KH2, KP4, KP2, and any others that may be active, and also endorse with W1AW/3 in the District of Columbia.

Centennial QSO Party certificates are available for making QSOs with point-level achievements at four levels. If you do not use LoTW, printable forms are available online. Please see the web page for final award point levels and for award prices.

Centennial QSO Party web page
www.arrl.org/centennial-qso-party

Centennial QSO Party Points Table

Abbreviation	Full Position/Title Name	Point value
PRES	ARRL President	300
PE	President Emeritus	275
PP	Past President	275
HVP	Honorary Vice President	250
VP	ARRL Vice President	250
DE	Director Emeritus	225
PVP	Past Vice President	225
DIR	Director	225
VD	Vice Director	200
SM	Section Manager	175
OFF	Staff Officer, Treasurer, Counsel	150
PD	Past Director	150
PV	Past Vice Director	125
ARRL	W1AW ARRL HQ Station	100
CLM	ARRL Charter Life Member	100
PSM	Past Section Manager	100
DM	ARRL HQ Department Manager	75
HQ	ARRL HQ Staff Member/Volunteer	50
AC	CAC/DXAC/ECAC Advisory Members	40
AD	Assistant Director	40
ASM	Assistant Section Manager	35
ACC	Affiliated Club Coordinator	30
DEC	District Emergency Coordinator	30
NCJ	*NCJ* Editor	30
OOC	Official Observer Coordinator	30
PIC	Public Information Coordinator	30
QEX	*QEX* Editor	30
SEC	Section Emergency Coordinator	30
SGL	State Government Liaison	30
STM	Section Traffic Manager	30
TC	Technical Coordinator	30
LAB	W1INF Lab Museum Operations	25
CM	Contest Managers/Log Checkers	20
QSM	Incoming QSL Bureau Manager	20
LC	W1HQ HQ Ops	15
VC	Volunteer Counsel	15
VCE	Volunteer Consulting Engineer	15
ADEC	Assistant District Emergency Coordinator	12
ANM	Area Net Manager	12
ASEC	Assistant Section Emergency Coordinator	12
EC	Emergency Coordinator	12
LGL	Local Government Liaison	12
OBS	Official Bulletin Station	12
OES	Offical Emergency Station	12
OO	Official Observer	12
ORS	Official Relay Station	12
PIO	Public Information Officer	12
RNM	Region Net Manager	12
TS	Technical Specialist	12
TA	Technical Advisor	10
AM	Awards Manager	5
CC	Card Checker	5
RI	Registered Instructor	5
USA	W1AW/x around the USA	5
VE	Volunteer Examiner	5
MS	Monitoring System Volunteer	3
QSL	Incoming QSL Bureau Sorters	3
LM	ARRL Life Member	2
AFF	ARRL Affiliated Club Call Sign	1
MEM	ARRL Member	1

Centennial QSO Party Competition — The Centennial Points Challenge

In order to compete in the **Centennial Points Challenge**, logs must be submitted through LoTW in standard ADIF or Cabrillo format. The system will automatically look for points-qualifying QSOs and apply them to each participant's Centennial QSO Points table. QSOs do not have to be matched in LoTW for points to be achieved — *this is an honor-based QSO Party*. We cannot accept any paper forms or information.

- Repeater contacts are not valid.
- Mobile and portable operations are okay, but do not count for points in addition to home operation; ie, one QSO with KØGW counts for KØGW, whether it is made with KØGW/4, KØGW/m, or PJ4/KØGW.
- Stations outside the USA may also count for points. Some members outside the US are also VEs and Card Checkers.
- ARRL appointees/staff/officers should choose their QSO exchange from the appointment or office held that is the highest point value (this is how the database will work also). For instance, KI9XX is an ARRL Life Member (LM is worth 2 points), and a Volunteer Examiner (VE is worth 5 points), and a State Government Liaison (SGL is worth 30 points). Therefore, if he wants to send the appointment information as part of a QSO, he should use SGL, as that is the highest point value. Regardless of what designation is chosen, the database will credit the highest point value.

QSLs

QSL cards from W1AW and W1AW operating portable will be sent automatically via the QSL Bureau system to each US station that signs up to receive such cards. This is a one-time only use of the QSL Bureau for this purpose. QSLs will automatically be sent to stations outside the US via the QSL Bureau as normal. QSLs may be requested directly also, with an SASE required for return.

2013 ARRL June VHF Contest Results

Where did all the propagation go?

Bob Striegl, K2DRH, k2drh@arrl.net

After several years of above average propagation during the June VHF Contest, it was almost inevitable that we were due for a down year. While conditions on 6 meters were relatively good the week before the contest, for most participants it did not carry through to the weekend of June 15-17. Tropospheric ducting or other enhanced modes on 2 meters and above did not seem to play a major role for the majority of stations either. Ryan, KB9OWD, in EN53 IL may have overstated things slightly by comparing it to a recent root canal, but he was not the only one feeling frustrated; Mike, K7ULS, in DN41 (UT) felt similarly. Most other stations voiced similar perceptions of poor band conditions and slow QSO rates in their post contest comments. Bobby, N3LL, in EL86 (FL) claimed these were the worst June VHF Contest conditions he has experienced in over 35 years of operating. Jeff, K1TEO, in FN31 (CT) made only 17 6 meter sporadic E (Es) contacts in the whole contest, fewer than he did in September or even January. Bill, K3WA, in EN50 (IL) summed it up: "A long, slow slog. Read a good book. Watched the grass grow. Mowed the grass. Watched the grass grow again. Worked out on my treadmill. And worked the desultory sparse openings to get very few QSOs and 9 new grids. Just wait 'til next year."

Logs

1010 logs were submitted — significantly fewer than the 1222 that were submitted in 2012 — but that's not surprising considering the lack of exciting propagation in most areas. As always, the number of logs submitted was far less than the total number of participants. Overall QSO and grid totals were significantly lower this year. The number of Classic Rovers has also continued to drop — down from 49 in 2011 and 34 in 2012, to 25 in 2013.

Based on a review of the submitted logs against the June contest records published on the ARRL website (except for one multiop record noted below) no existing section or division scoring records were broken. However, initial record scores for the new SO3B (Single Operator, Three-Band) and SOFM (Single Operator, FM-Only) categories and the new Canadian sections were established. One long-standing record for the Mississippi section was broken when Unlimited Multioperator (UM) WN2E scored 21,008 points to break the record of 8804 points set in 1988 by N5KDA. K8DOG posted the first Unlimited Rover (RU) score for the Michigan section and Great Lakes division. The previous contest score records are available for review on the ARRL website at **www.arrl.org/contest-records** and will be updated to reflect the new records set in 2013.

DX

Fewer DX stations sent in their logs than last year because 6 meter conditions did not favor much in the way of DX. Canadian participation was also lower than last year — 70 logs submitted in 2012, but only 42 in 2013. Nine stations in Mexico submitted their logs. Jorge, XE2X, mounted a respectable 6 meter-only effort, as did Julian, XE2JS, and Javier, XE2CQ. Three stations submitted logs from Cuba including Limited Multioperator (LM) T43S. Three stations from Alaska; KL7YK, KL7AIR, KL7UW, as well as KH7Y from Hawaii all submitted multiband efforts. Finally, Pedro, HI8PJP, submitted a log with one QSO for the SO3B category.

On the Bands

Despite the majority of stations experiencing only short Es openings with sharply defined footprints, some sections had much better luck with 6 meter propagation — notably Colorado, Texas, New Mexico, and Arizona. During the past few years 6 meter QSO and grid totals have significantly boosted the scores of stations in these areas, and this year was no exception. Jay, W9RM, at his soon-to-be-permanent QTH in DM58 (CO) had constantly shifting 6 meter openings both days, often in multiple directions at once. He took full advantage of them by logging the most 6 meter QSOs of anyone in the contest while using only a single 5-el Yagi on a push-up pole at 25 feet. Perennial STX 6 meter powerhouses George, K5TR, in EM00, and George, NR5M, in EM10, also made good use of their more impressive antenna farms to mine the band. And despite reporting poor 6 meter conditions in EM31 (STX) the gang at K5QE was still able to log more 6 meter multipliers than any other station.

Other notable 6 meter totals were logged by Pete, WA7JTM, in DM33 (AZ) and Mark, K5AM, in DM62 (NM), and the operators at WØKVA, in DM89 (CO). The multiops at W2SZ and K8GP also made high QSO numbers despite the lack of sustained Es apparent in their much lower grid count. But unlike last year, with six stations reporting more than 1000 QSOs and another 51 with more than 500 contacts on the band, only Keith, W9RM, came anywhere close to the thousand QSO mark with 920; only 17 stations made it over 500.

In June, 2 meters is the go-to band when 6 meters closes and is most often a springboard for multiple band runs. Despite significantly less 6 meter propagation, the number of stations working more than 100 QSOs on 2 meters remained about the same with 27 this

Top Ten

Single Operator Low Power

K2DRH	169,926
AB5EB	88,615
WB1GQR	84,249
NØPOH	80,088
N4QWZ	78,960
AF1T	69,156
NØLL	68,425
KC9BQA	63,840
N9DG	63,802
KKØQ	59,760

Single Operator High Power

K1TEO	373,250
W9RM	230,622
K1RZ	218,816
K5TR	200,999
NR5M	196,448
K1WHS	151,677
K5AM	148,890
WA2FGK	123,888
W3PAW	117,450
W6OAL	113,064

Single Operator Portable

N6NB	96,036
KJ5RM	32,384
W1MR	26,400
W9SZ	16,600
KB5WIA	15,650
K9AKS	8,496
N2SPI	4,773
AF6RR	3,103
WB9PNU	2,205
WB2AMU	1,675

Single Operator Three Band

AA5AM	72,488
K7XC	63,510
KØNR	48,117
KO9A	41,944
KF7NP	23,532
N7IR	22,632
KI5YG	16,432
K6MI	16,402
W9PA	13,608
N9ISN	9,936

Single Operator FM-Only

KBØLYL	1460
K6TDI	360
W2EV	312
VE6CCL	242
N9VM	216
KB1YNT	75
W7DMU	66
KD2DLL	27
AK2S	12

Limited Multioperator

K5QE	383,691
W3SO	214,140
K2LIM	165,725
WA7JTM	142,780
N5RZ	126,000
AA4ZZ	119,250
N8ZM	96,775
W2LV	78,648
W4NH	76,311
K4MM	35,632

Multioperator

W2SZ	940,416
K8GP	650,076
N6VI	475,200
W3CCX	315,668
W4IY	197,580
VE3WCC	194,575
WØKVA	183,359
K9CT	131,776
KBØHH	119,780
AA7XT	93,786

Rover

K6AH/R	208,254
KI6FGV/R	182,637
N6HD/R	164,780
VE3OIL/R	141,372
KJ5MSY/R	126,126
VE3SMA/R	116,775
NN3Q/R	55,776
W9SNR/R	54,908
VE3WJ/R	52,074
K1DS/R	43,706

Limited Rover

AL1VE/R	34,959
K2QO/R	33,562
WW7D/R	27,588
W9YOY/R	22,875
N6ORB/R	17,766
KK6MC/R	17,563
N6GP/R	15,768
KV2X/R	15,120
W5VY/R	13,272
N2ZBH/R	12,672

Unlimited Rover

W6TE/R	189,000
WA3PTV/R	47,044
W3HMS/R	19,520
KJ1K/R	12,696
KRØVER/R	10,416
WØBL/R	9,936
KCØP/R	4,401
NØHZO/R	3,575
K8DOG/R	3,042
NV6C/R	3,038

With conditions comparable to pulling teeth, Mike's, K7ULS, Single Op Portable might as well have been a mobile dental surgical office.

year versus 29 in 2012. But it's no surprise that 7 out of the 10 highest 2 meter QSO totals were made by multiops K8GP, W2SZ, K2LIM, W3SO, W3CCX, N6VI, and W2LV. Jeff, K1TEO, turned his lack of 6 meter Es into the 3rd highest 2 meter QSO total. Andy, K1RA, and Art, K1BX, operating at K1WHS filled out the rest. N6VI is notable as the only West Coast station among the top 2 meter QSO scorers. While most of the multiops also do WSJT meteor scatter and a few do EME contacts to boost their 2 meter grid totals, one really stands out. K5QE used both meteor scatter and EME to accumulate 102 grids on 2 meters, ¾ more than K8GP at 68. As is true of most western stations, Marshall has many fewer 2 meter neighbors than you would find in other areas, so his pool of stations that are workable by terrestrial propagation is limited.

222 MHz is a great band but there is a limited amount of commercial equipment available since the "Big 3" Japanese rig manufacturers (Icom, Kenwood, and Yaesu) do not normally support it. Most of the time it has as good or better propagation than 2 meters and better immunity to manmade noise. QSOs score the same higher point value as 432 as well as providing additional multipliers. While competitive multiops, rovers, and single ops know they must have it, many stations justify not having a separate rig or transverter for this band because of increased cost and significantly lower QSO total than 2 meters (roughly 35%) or 432 (about 60%). Unfortunately this also tends to make rig unavailability and lower QSO totals on 222 a self-fulfilling prophecy. Only three stations in the June VHF contest had more than 100 QSOs on 222, all of them multiops. While it is more commercially available on multiband rigs, 432 generally has more difficult propagation characteristics and coax loss can be a significant factor. More attention to detail is required to be successful on this band. Six stations in the June contest had 432 QSO totals over 100, four of them multiops.

QSOs on 902 MHz and above count for more points and additional multipliers; the technical complexity and difficulty rises with the frequency, and so does the cost to put together an effective station while the QSO total continues to go down. Adding SHF and microwave bands with their higher point values tends to be the province of the more technically minded as well as being a necessity for the more competitive stations. But diminishing returns come with low geographical population density where there are few, if any, other stations available to work. Generally rovers and portables have an easier time adding these bands than fixed stations since high-gain antennas are significantly smaller and coax runs are shorter. The ranks of the Classic and Unlimited Rovers who do carry them continues to dwindle, and along with that the number of QSOs other stations make on these bands.

Sponsored Plaque Winners

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 Operator 3-Band	Northern Lights Radio Society	AA5AM
Overall Single Op Low Power, First Log	W3ZZ First Log Award — Memorial by Tim K3LR and Dave W9PA	KF7PSM
Overall Multioperator	Randy Stegemeyer, W7HR	W2SZ
Overall Limited Multioperator	Gene Zimmerman, W3ZZ Memorial — ARRL Contest Branch	K5QE
Overall Rover	73 Tim KE3HT/SK, Microwave DX Addict	K6AH/R
Atlantic Division Rover	Potomac Valley Radio Club	NN3Q/R
Dakota Division Single Operator Low Power	Northern Lights Radio Society	WA3EOQ
Hudson Division Single Operator Low Power	NY2NY — In Memory Of Dick, W2GFF	WB2SIH
Northwestern Division Single Operator High Power	Boring, OR Amateur Radio Club	W7EW
Northwestern Division Multioperator	Randy Stegemeyer, W7HR	N7NW
Northwestern Division Rover	Pacific Northwest VHF Society	KD7DCR/R
Roanoke Division Rover	Potomac Valley Radio Club	W4STR/R
Southeastern Division Single Operator High Power	Southeastern VHF Society	K4PI
Southwestern Division Single Operator Low Power	Bud Semon, N7CW	WJ0F
Canada Single Operator Low Power	Northern Lights Radio Society	VA3ZV

Single Operators

The majority of contest activity originates with the Single Operators who take advantage of their station capabilities, ranging from a single band with modest antenna to a multiband station with stacked arrays. The Single Operator, Low Power (SOLP) category has had the most logs submitted since its inception and has seen successful portable as well as fixed station efforts. The Overall SOLP W3ZZ Memorial First Log Award has been sponsored by Tim, K3LR, and Dave, W9PA, for a second year and goes to KF7PSM in DM26 (NV). I'm proud to confirm I worked Pete! Good job and welcome to the ranks of SOLP VHF+ contesting!

Bob, K2DRH, in EN41 (IL) built a single-tower multiband station with pairs of long boom antennas on each band that has helped him earn 1st in the SOLP category for 9 of the past 10 years. This year, with the help of a new 6 meter tower and array he attained a score of 169K using eight bands through 3456 MHz to put win number 10 in the books. In only his second June VHF Contest, Mike, AB5EB, added an Innovantenna 3-el OWL (Optimized Wideband Low-impedance) stack to his 7-el LFA (Loop-Fed Antenna) and took advantage of the STX 6 meter propagation with a single-band effort that took 2nd place with 88K. Frequent Top Ten finisher WB1GQR manned by Mitch, W1SJ moved up to 3rd this year with 84K, also using eight bands through 3456 MHz. NØPOH placed next with a seven-band effort of 80K and Todd, N4QWZ, completed the Top Five with a 78K six-band log.

The Single Operator, High Power (SOHP) category is where the true heavyweights in the VHF world exercise their capabilities. Jeff, K1TEO, in FN31 (CT) has built a very effective 10-band station; his continuing success over more than a decade shows his dedication. Once again Jeff takes top honors with 373K, even after a 5760 MHz failure soon after the contest started. This is about half of his winning score in 2012, attesting to the generally poor conditions experienced in most places. The big news in SOHP was Jay's, W9RM, three-band effort from DM58 (CO) who moved up from 8th place last year to take 2nd place in his second June VHF outing from his soon-to-be new QTH. Using only Field Day-style antennas with a temporary setup in a pole barn he racked up a great score of 230K, mostly on the merits of his 6 meter effort. Jay was a 6 meter operator at the now silent K9NS EN52 (IL) Limited Multiop and says to watch out when he puts up some "real antennas."

Dave, K1RZ, is also no stranger to the Top Ten and posted a nine-band effort of 218K to take third place. George, K5TR, came in 4th with 200K from respectable totals on the bottom four bands and George, NR5M, came in 5th with a 6 meter-only effort of 196K.

The Single Operator, Portable (SOP) category limits stations to 10 W, which makes it more difficult to attract the attention of other stations. Wayne, N6NB, who is a living legend in VHF+ contesting and has built more tower trailers than most folks have erected towers, once again succeeded in this category. With his 96K score it is evident that conditions play a somewhat lesser part in his winning strategy than the pursuit of the Southern California Contest Club rover pack. Jory, KJ5RM, found a great spot in EM12 to take advantage of the 6 meter propagation to TX and with three bands took second place with 32K. Chris, W1MR, (NH) took 3rd this time with his six-band station scoring 26K. 4th place is held by Zack, W9SZ, with 16K who takes 10 bands to a hill in EN50 (IL) every year. It's definitely worth seeking out his 10 dB weaker signal on 2 meters since he and I can usually sweep on all of my eight bands. Dave, KB5WIA, in CA took the 5th spot with a 15K four-band effort and over 100 more QSOs than Zack, but the additional multipliers and points on the microwaves worked to Zack's advantage.

Two new single operator categories were added to this year's June VHF Contest. Single Operator, Three-Band (SO3B) is already looking like a big hit with 108 entries that mostly put a dent in the SOLP log totals. Single Op, FM-Only (SOFM) generated nine log submissions. The majority of these entries set the first section, division, and contest records for these categories.

It was a battle of NTX stations for the initial first-place score in SO3B. Scott, AA5AM, in EM13 made the switch from SOLP and parlayed the 6 meter openings to edge out Tim, K7XC, with 72K. K7XC used his tower trailer for the first June VHF Contest at his new QTH in EM12 to score 2nd place with 63K. They were only separated by seven QSOs but Scott managed to find 20 more multipliers on 6 meters, pushing him well over the top. We hope to see many more battles like this with these two stations in the future! Bob, KØNR, in DM78 (CO) also used his operating skills to rack up good 6 meter totals and secure 3rd place with 48K. Jim, KO9A, in EN52 (IL) made the best of the meager Midwest 6 meter openings on Sunday and leveraged good results on 2 meters and 432 to take 4th place with 42K. Rounding out the Top Five was Burke, KF7NP, in AZ who also took advantage of 6 meters with 23K to barely squeak by Gary, N7IR, in an adjacent grid by less than 1K.

While entries in the SOFM category were few, they did span both coasts and most included QSOs on all of the bottom four bands. The initial top score in the SOFM category was logged by Art, KBØLYL, from EN34 (MN) with 146 2 meter QSOs in 10 grids for 1460 points — congratulations! Art was closely followed by Terry, K6TDI, with 23 Qs and 12 grids for 360 points and Ev, W2EV, from the opposite coast with 312 points. Fourth place went to Bob, VE6CCL, from AB — the only Canadian to participate in this new category.

Multioperators

These stations and the crews dedicate much time and effort in finding just the right spot to operate from; many carry and set up equipment and antennas in remote locations every year. The Limited Multiops (LM) can operate on as many bands as they wish but can only submit the results from four bands for scoring. Most acquire their best score from the bottom four bands (50, 144, 222, and 432 MHz). The Unlimited Multiops (UM) can score QSOs from practically dc to daylight. These stations are on the air all the time and they set the limits of what's possible for VHF+ contesting.

Despite their disadvantageous distance from major population centers that have more stations to work, K5QE posted a score of 383K to win the LM category this year. Being in the area with some of the best 6 meter openings during a down year, and posting the highest 6 meter grid total certainly didn't hurt their score. But it was really their all-out efforts on 2 meters really put them over the top with the highest grid total of the contest on that band as well. W3SO garnered 214K to take second place with much lighter 6 meter results but solid performances on the other three bands. K2LIM with 165K has a firm hold on 3rd place for the second year in a row with more QSOs then W3SO but fewer multipliers on 222 and 432. The crew at WA7JTM in AZ took advantage of conditions and had an excellent run on 6 meters that propelled them into 4th place with 42K. And Gator, N5RZ, with Deborah, N5RZA, turned their mostly 6 meter effort into a 5th place finish with 126K. Sadly, missing this year was the top three finisher efforts of K9NS in IL due to harsh winter ice storms taking out many of the antennas at veteran VHF+ contester Frank's, K9HMB, QTH. I know all of us in the Midwest miss their big signal and hope that things get back to normal soon.

The stalwart crew at W2SZ on Mt Greylock posted another win in the UM category. Despite significantly lower grid totals than last year on 6 and even 2 meters they were still able to log a score of 940K on the strength of their 902 and above efforts. This group has been in the June VHF Contest every year since 1983 and has claimed the top spot in this category 23 times. Their dedication year after year is admirable. The Grid Pirates, K8GP, relative upstarts since 1993, along with their sorely missed muse, Gene, W3ZZ (SK), are among the few who have also reached the top of this category. For the second excursion to their new spot in

The AB5EB three-element 6 meter OWL Yagi array. [Mike Crownover, AB5EB, photo]

Affiliated Club Competition

Southern California Contest Club	23	1,369,498
Potomac Valley Radio Club	35	1,339,392
Florida Contest Group	13	127,548
Contest Club Ontario	19	642,152
Mt Airy VHF Radio Club	13	636,754
North East Weak Signal Group	17	606,322
Society of Midwest Contesters	47	547,744
Grand Mesa Contesters of Colorado	11	509,554
Central Texas DX and Contest Club	9	419,111
DFW Contest Group	10	335,230
Northern California Contest Club	22	308,932
Badger Contesters	14	305,211
Pacific Northwest VHF Society	20	269,307
Arizona Outlaws Contest Club	27	232,468
Northern Lights Radio Society	15	229,000
Yankee Clipper Contest Club	20	202,371
Carolina DX Association	5	139,663
North Texas Contest Club	3	88,434
Tennessee Contest Group	7	81,800
Cold Brook Contest Club	5	49,316
Frankford Radio Club	9	45,049
Mad River Radio Club	7	44,317
Alabama Contest Group	7	22,274
CTRI Contest Group	4	20,380
South Jersey Radio Assn	3	13,301
Georgia Contest Group	4	5,133
South East Contest Club	5	4,969
Minnesota Wireless Assn	6	2,655
Rochester (NY) DX Assn	3	2,046
Willamette Valley DX Club	4	1,864
Hudson Valley Contesters and DXers	3	632

Local Club Category

Badger Contesters	14	305,211
Stoned Monkey VHF ARC	4	46,333
Florida Weak Signal Society	4	31,776
Chippewa Valley VHF Contesters	3	22,028
Bristol (TN) ARC	8	21,231
Kansas City DX Club	3	11,887
Granite State ARA	3	9,847
Hilltop Transmitting Assn	3	8,302
Contoocook Valley Radio Club	3	5,577
Portage County Amateur Radio Service	3	3,790
Bergen ARA	3	2,916
Raritan Bay Radio Amateurs	4	2,713
10-70 Repeater Assn	3	279

Regional Leaders

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

WB1GQR	84,249	LP
AF1T	69,156	LP
WB2SIH	51,612	LP
K1KG	48,654	LP
K2KIB	38,658	LP
K1TEO	373,250	HP
K1RZ	218,816	HP
K1WHS	151,677	HP
WA2FGK	123,888	HP
W3PAW	117,450	HP
W1MR	26,400	QRP
N2SPI	4,773	QRP
WB2AMU	1,675	QRP
K2FR	1,638	QRP
N1PRW	744	QRP
KV2M	8,400	3B
W1FW	5,976	3B
N3UM	4,699	3B
N2SLO	4,454	3B
W3LL	3,948	3B
W2EV	312	FM
KB1YNT	75	FM
KD2DLL	27	FM
AK2S	12	FM
W3SO	214,140	LM
K2LIM	165,725	LM
W2LV	78,648	LM
W1QK	34,320	LM
W3HZU	21,183	LM
W2SZ	940,416	UM
W3CCX	315,668	UM
K3EOD	51,408	UM
WB3IGR	14,213	UM
W1AN	7,832	UM
NN3Q/R	55,776	R
K1DS/R	43,706	R
KA3KSP/R	99	R
K2QO/R	33,562	RL
KV2X/R	15,120	RL
N2ZBH/R	12,672	RL
KC2SFU/R	8,154	RL
N3XUD/R	5,436	RL
WA3PTV/R	47,044	RU
W3HMS/R	19,520	RU
KJ1K/R	12,696	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

N4QWZ	78,960	LP
N3LL	44,388	LP
KX4R	41,529	LP
N4TWX	15,810	LP
AA5AU	13,112	LP
W5MRB	42,075	HP
W3IP	37,856	HP
K4PI	37,050	HP
W4ZRZ	34,989	HP
KE2N	31,995	HP
NV4B/5	770	QRP
KC8KSK	35	QRP
K3TW	1	QRP
K1TO	9,636	3B
W4ATL	6,110	3B
K4UB	4,092	3B
N5QO	2,193	3B
N5BLY	1,989	3B
AA4ZZ	119,250	LM
W4NH	76,311	LM
K4MM	35,632	LM
K5KDX	23,517	LM
K5GDX	22,311	LM
K8GP	650,076	UM
W4IY	197,580	UM
W5ZN	32,805	UM
WN2E	21,008	UM
N4JQQ	14,857	UM
AG4V/R	24,528	R
W4STR/R	84	R
K4YRK/R	50	R
W5VY/R	13,272	RL
WB0POH/R	570	RL
AI4GR/R	558	RL
KI1U/R	180	RL
KS4YX/R	133	RL

Central Region
(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South and Greater Toronto A)

K2DRH	169,926	LP
KC9BQA	63,840	LP
N9DG	63,802	LP
K8GDT	17,056	LP
VA3ZV	16,985	LP
W0UC	95,765	HP
K9EA	72,708	HP
VE3ZV	70,980	HP
K8TQK	52,096	HP
W9GA	52,029	HP
W9SZ	16,600	QRP
K9AKS	8,496	QRP
K9PLS	30	QRP
W9LGP	12	QRP
K9TMS	4	QRP
KO9A	41,944	3B
W9PA	13,608	3B
N9ISN	9,936	3B
NT9E	7,728	3B
N9TF	7,728	3B
N8ZM	96,775	LM
W9RVG	9,796	LM
WW8OH	6,240	LM
W9TE	5,831	LM
VE3EG	1,275	LM
VE3WCC	194,575	UM
K9CT	131,776	UM
N9UHF	46,287	UM
K8MM	28,737	UM
AJ9C	14,175	UM
VE3OIL/R	141,372	R
VE3SMA/R	116,775	R
W9SNR/R	54,908	R
VE3WJ/R	52,074	R
KF8QL/R	5,184	R
W9YOY/R	22,875	RL
K9JK/R	11,220	RL
K9GY/R	4,056	RL
VE3GJ/R	3,240	RL
W8ISS/R	465	RL
K8DOG/R	3,042	RU

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

AB5EB	88,615	LP
NØPOH	80,088	LP
NØLL	68,425	LP
KKØQ	59,760	LP
N5JR	37,760	LP
W9RM	230,622	HP
K5TR	200,999	HP
NR5M	196,448	HP
K5AM	148,890	HP
W6OAL	113,064	HP
KJ5RM	32,384	QRP
WB9PNU	2,205	QRP
NØJK	110	QRP
KD7WPJ	72	QRP
AA5AM	72,488	3B
K7XC	63,510	3B
KØNR	48,117	3B
KI5YG	16,432	3B
WBØGAZ	5,035	3B
KBØLYL	1,460	FM
K5QE	383,691	LM
N5RZ	126,000	LM
WØLSD	29,008	LM
WØFRC	21,620	LM
NØEO	19,758	LM
WØKVA	183,359	UM
KBØHH	119,780	UM
AA7XT	93,786	UM
WQØP	62,556	UM
WØRIC	29,302	UM
KØMHC/R	12,648	R
W7QQ/R	8,550	R
N7SMI/R	500	R
AL1VE/R	34,959	RL
KK6MC/R	17,563	RL
KØBBC/R	10,248	RL
KR5J/R	7,701	RL
NØLP/R	7,314	RL
KRØVER/R	10,416	RU
WØBL/R	9,936	RU
KCØP/R	4,401	RU
NØHZO/R	3,575	RU

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

WJØF	33,264	LP
NQ7R	22,572	LP
KE0CO	14,706	LP
K6ATZ	14,384	LP
K2GMY	13,530	LP
K6KLY	73,168	HP
W7EW	48,488	HP
VE7JH	41,412	HP
N7EPD	36,757	HP
AJ6T	34,989	HP
N6NB	96,036	QRP
KB5WIA	15,650	QRP
AF6RR	3,103	QRP
WA9STI	1,674	QRP
KE7UQL	672	QRP
KF7NP	23,532	3B
N7IR	22,632	3B
K6MI	16,402	3B
K7BG	8,680	3B
VE7DAY	7,888	3B
K6TDI	360	FM
VE6CCL	242	FM
N9VM	216	FM
W7DMU	66	FM
WA7JTM	142,780	LM
KØDI	13,200	LM
N6ML	11,690	LM
K7NG	9,398	LM
AA7A	8,255	LM
N6VI	475,200	UM
W6TV	74,375	UM
N7NW	58,926	UM
WB6W	40,664	UM
N7CW	34,055	UM
K6AH/R	208,254	R
KI6FGV/R	182,637	R
N6HD/R	164,780	R
KJ5MSY/R	126,126	R
KE6QR/R	21,112	R
WW7D/R	27,588	RL
N6ORB/R	17,766	RL
N6GP/R	15,768	RL
K6LMN/R	6,380	RL
N6ZE/R	2,709	RL
W6TE/R	189,000	RU
NV6C/R	3,038	RU

FM19 this year, they posted a 2nd place finish of 650K with outstanding totals on 6 and 2 meters, but were unable to take the same command of the higher bands. N6VI on the West Coast moved up into the 3rd spot in this category with a solid performance on 10 bands. W3CCX also posted a solid performance of 315K including 15 QSOs on Light to take 4th and W4IY came in 5th with 197K narrowly beating VE3WCC by 3K.

Rovers

In the RL category Tim, AL1VE, once again captured the field with 3 bands and a score of 35K with good totals on 6 meters and by roving in seven grids in OK. Mark, K2QO, with Paul, W2TAU, by his side came in a close second with 33K by visiting eight grids in WNY. Darryl, WW7D roved in nine relatively rare grids in WWA and OR to amass a score of 27K to capture 3rd place. Rounding out the Top Five were Charles, W9YOY, who added eight grids in IL with a score of 23K and Dave, N6ORB, who activated three grids and logged a score of 17K.

The stalwart rovers of the Southern California Contest Club took the top three spots in the R category. Andre, K6AH, was the leader of the pack with 208K — amassed on 10 bands through 10 grids. Jim, KI6FGV, took second place using 10 bands with 182K by visiting nine grids and Dave, N6HD, took 3rd also operating on 10 bands from nine grids. Perennial rover Russ, VE3OIL, ran 11 bands in nine grids around Ontario with a score of 141k to take 4th place. Mark, KJ5MSY, also ran with the SCCC rovers in nine grids to amass a score of 126K.

The K7XC SO3B antennas at his new QTH in TX. [Photo by K7XC]

There were ten entries in the Unlimited Rover (RU) category. Dave, W6TE, roamed a whopping 11 grids in the SJV SCCC stomping grounds with 10 bands to dominate the field with 189K. Joe, WA3PTV, ran four grids in the hills of WPA with 10 bands to garner 47K for second place. John, W3HMS, also fielded 10 bands for a three-grid rove through EPA that netted him 19K. Sig, KJ1K, placed 4th with nine bands on a six-grid rove in WMA with 12K. In 5th Eric, KRØVER, roamed through six grids for 10K.

Epilogue

A common observation among 6 meter operators who have been through a few sunspot cycles is that Es propagation is less prevalent during the peak sunspot years. When I've voiced this observation on the ON4KST chat page several very knowledgeable and respected stations who keep statistics on such things told me in no uncertain terms that it's without merit. True or not, you certainly won't disprove it from the QSO and grid totals reported during this June contest.

See you on June 21-23 in 2014!

2013 Field Day Results

36,560 operators celebrate 80 years of portable Amateur Radio.

Sean Kutzko, KX9X, kx9x@arrl.org

June 10, 1933 was not a typical Saturday morning. For the first time in Amateur Radio history, an organized "Field Day" activity was taking place. That year, the May issue of *QST* announced that all US and Canadian stations were invited to "...schedule 'field activities,' excursions with concentrated operation of portable transmitters and receivers....[T]he object will be for each 'portable' station to work as many other amateur stations as possible." Eighty years later, Field Day has become the most popular on-air Amateur Radio activity on the planet.

The Saturday morning of Field Day is always an exciting time. For most participants, the day starts early; after all the setup work that began on Thursday or Friday, last-minute details need addressing. The scenario is one we are all familiar with: the generator decides not to work (although it was working perfectly on Friday night), or there's suddenly a shortage of operators for a station that was fully staffed at the last planning meeting.

But Field Day is all about making adjustments. Plans go awry, equipment malfunctions, and power sources mysteriously run out of juice. You devise another operating plan, the malfunctioning gear is repaired, and the generator fires up again. Clubs come together, work out problems, and keep on making QSOs.

For others, Saturday morning is just the beginning. One- or two-person teams begin their hike to the mountaintop, remote beach, or lakeside camping site. Their entire station is packed in with them, often weighing just a few pounds. The draw of the solitude, the noise-free operating site, and the fantastic views are just as important as the QSOs made on a small rig running only a few watts.

Sunday comes, the final QSO is made, and the dust settles. The task of teardown begins. Tired but happy, hams lower the antennas, pack up their radios, save their logs, collect the sup-

The flag is flying, and so are the pigs, atop one of the makeshift towers at the site of the Stanwood Camano ARC, W7PIG, near Stanwood, WA.

Entries by Class

1A	138	4AB	1	3D	5
2A	440	2AC	5	4D	2
3A	350	3AC	4	1E	251
4A	169	4AC	1	2E	30
5A	79	1B1	69	3E	18
6A	45	1B1B	132	4E	8
7A	17	1B1C	12	5E	2
8A	8	1B2	27	6E	1
9A	8	2B2	12	7E	1
10A	5	1B2B	31	1F	33
11A	2	2B2B	7	2F	72
12A	2	1B2C	4	3F	47
15A	1	2B2C	2	4F	17
16A	1	1C	55	5F	8
29A	1	2C	1	6F	4
36A	1	3C	1	7F	3
1AB	3	1D	380		
2AB	1	2D	26		

Using only a handheld VHF/UHF transceiver, Gary Morris, KK6YB, of Redlands, CA, set up atop Mt Baldy, overlooking Los Angeles. [Gary Morris, KK6YB, photo]

11 year old Sylvia Riddell and her father Tim stopped by the Williamsburg (VA) ARC, K4RC, to investigate their Field Day operation. Sylvia made almost 30 QSOs at their GOTA station, thanks to GOTA Coach Don Johnson, N4DJ (pictured). Sylvia and Tim had so much fun, they both earned their Technician licenses! Listen for Sylvia, KF5WZF, and her father Tim, KF5WZG, as they travel across the country in their RV. [Dan Ewart, WG4F, photo]

Top 10 Claimed

Call Sign	Score	Class
W3AO	33,724	29 A
W6ZE	21,258	12 A
K5UZ	20,696	2 A
W4IY	19,924	9 A
K6EI	18,885	9 AB
W4EZ	17,675	9 AB
K4LRG	17,392	5 A
NA5NN	16,750	5 A
W6YX	16,074	9 F
K4FC	15,954	7 A

Important Field Day Statistics

Total CW QSOs	528,569
Total Digital QSOs	51,103
Total Phone QSOs	689,244
Total QSOs	1,268,916
Number of People	36,560
Entries Active	2548

porting documentation of their efforts, and make their way home. Another Field Day is in the books.

Conditions this year weren't ideal. Indeed, the number of participants actually dropped slightly from last year's number, largely because some of the bands didn't show up. With a solar flux around 128 and elevated A and K indices, the bands just didn't play as well as years past. 10 meter QSOs were significantly off this year — nothing like the 2011 Field Day, where hundreds of QSOs could be easily made on 10 meters. 2013 was also an off year for 6 meters, and Field Day weekend was no exception, despite being in the middle of the summer sporadic E season.

Small club efforts remain the most popular way Field Day is enjoyed. 2A had more entries in 2013 than any other category, providing a good balance of stations with those choosing to participate either solo or with a friend in the "B" category, or others who stay at home and enter either D (home station on commercial power) or E (home station on emergency power).

Regardless of what you made Field Day — a contest, an emergency preparedness exercise, a public outreach effort, a camping trip, or a great club event — we hope FD2013 was a fun, safe, and rewarding experience for all involved. We look forward to working you from the field again on June 28-29, 2014!

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 and total score including bonus points and ARRL section. Entries are listed from highest to lowest claimed score in each class. Class A stations are clubs or groups portable with three 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.

1A

Colorado QRP Club					
W0CQC	1167	5	6	12,225	CO
Tilson CC					
K5WA	2392	2	8	8,308	STX
K1R	631	5	18	6,970	ME
Case ARC					
W8EDU	1545	2	4	6,054	OH
Hunters Ridge Hams					
NK9R	501	5	7	5,960	GA
W6GV	525	5	5	5,700	SJV
Boomer CC					
NN5Z	1313	2	5	5,356	OK
VE2FET	1103	2	4	4,778	QC
Nashoba Valley ARC					
N1NC	1237	2	35	4,700	EMA
Lafayette DX Assn					
W9LDX	1284	2	9	4,682	IN
Gunnison Valley & Pitkin ARCs					
W0FD	1268	2	8	4,652	CO
Dr. Loomis Mem Jr Mechanics League					
W3KDR	1484	2	8	4,500	MDC
Why Gee ARG					
K2YG	388	5	4	4,220	NNJ
Greer ARC					
K4SV	1465	2	15	4,184	SC
Page Valley ARC					
K4PMH	933	2	13	3,774	VA
RAA / BVARC					
W6NW	1388	2	7	3,768	SJV
RAA/BVSARC					
K6NW	1388	2	7	3,768	SJV
Los Chupacabraderos					
K5AXW	416	5	7	3,765	STX
Associated Radio Amateurs of Southern NE					
W1AQ	980	2	13	3,762	RI
Alberta Clippers					
VE6EX	315	5	5	3,520	AB
VE2CWI	766	2	22	3,284	QC
Neurosa Gopher Munchers					
AE6C	658	2	4	3,122	SV
Athens Co ARA					
W8MHV	555	2	11	3,092	OH
South Georgian Bay ARC					
VE3SGB	937	2	11	2,982	ONS
Big Lake AR Enthusiasts					
W0G	1252	2	6	2,854	MN
Wasteland Com Corp					
K6WCC	719	2	3	2,820	SB
Koolau ARC					
KH6J	1309	1	37	2,738	PAC
IOOK Outback In The Hills					
W8I	632	2	14	2,718	WV
Souris Valley ARC					
K0AJW	659	2	11	2,704	ND
N5JB	649	2	3	2,676	NTX
Berwick Contest Team					
KY3W	872	2	3	2,652	WPA
VE6NQ	580	2	9	2,622	AB
Southwest MS ARC					
W5WQ	753	2	16	2,476	MS
First State ARC					
K3QBD	508	2	15	2,338	DE
Union Metropolitaine des Sans-filistes de Montreal					
VE2UMS	670	2	40	2,336	QC
Los Angeles ARES NW District					
K6MA	494	2	50	2,302	LAX
Benton ARS					
K5NE	511	2	15	2,252	AR
PA Knightlites					
KA2QPG	226	5	10	2,175	WPA
Alamance Co ARES					
WX4BUY	159	5	3	2,160	VA
K0LG	518	2	3	2,134	MO
SSRC					
K4DAE	1009	2	3	2,068	NFL
Newton ARA					
W0WML	351	2	10	2,060	IA
Burlington ARC					
VE3CJ	172	5	5	2,055	GTA
Bass Hill Repeater Group					
W1KX/1	451	2	7	2,046	ME
Peekskill / Cortlandt ARA					
W2NYW	768	2	14	2,040	ENY
RC of Redmond					
N7KE	627	2	11	2,018	WWA
N0SFF	750	2	12	2,006	IA
Jefferson Cty ARC					
KB0TLL	746	2	25	1,992	MO
SCVRA					
K0CD	376	2	12	1,948	WI
KC4AA	932	2	4	1,914	GA
Central WA ARC					
W7TT	441	2	34	1,904	EWA
Arkansas River Group					
W0UY	427	2	4	1,854	CO
Le Club Radioamateur de Beauce					
VE2CRB	300	2	5	1,726	QC
Three Men and a Radio					
K0JV	365	2	3	1,676	SD
Wiregrass ARC					
WB4ZPI	611	2	17	1,672	AL
Parma RC					
W8PRC	274	2	26	1,634	OH
York Co Contesters					
W4YCC	594	2	6	1,620	OH
VE2CLM	325	2	14	1,562	QC
Patrick Henry ARA					
K4MVA	433	2	25	1,536	VA
Marshall Co ARC					
W0GCJ	292	2	7	1,524	KS
Senoia ARC					
KK4SRC	339	2	3	1,496	GA
WA0W	87	5	21	1,480	KS
Salted Hams Club					
N5PJ	316	2	3	1,452	OK
Amargosa ARC					
N7A	187	2	6	1,450	NV
Juneau ARC					
KL7JRC	210	2	40	1,438	AK
Mountain Eagles					
AC3V	142	5	3	1,375	EPA
Playground ARC					
W4ZBB	194	2	13	1,372	NFL
NP2CB FD Group					
NP2CB	83	5	6	1,325	NFL
Fayette FD Hams					
N9TU	241	2	11	1,298	IN
Flying Pigs QRP Int — No Central TN					
WA4PIG	104	5	5	1,290	TN
4X4 Ham					
W7AZO	310	2	22	1,236	AZ
TERAC					
K7AUO	418	2	3	1,176	WWA
Hanburger's Helpers ARC					
K3HH	270	2	3	1,174	MDC
Middle Peninsula ARC					
W4HZL	169	2	10	1,098	VA
W5NC	299	2	41	1,090	STX
Rocky Fork FD Group					
W8BXG	360	2	6	1,086	OH
Mayerthorpe Flying Tigers					
VE6FT	434	1	12	1,068	AB
U of Akron ARC					
W8UPD	403	2	7	1,066	OH
Yarmouth RC					
W1YAR	80	5	6	1,050	ME
K5GOE	250	2	10	1,050	AR
Bitterroot ARC					
W7FTX	258	2	31	1,016	MT
Howard Hettinger Hams					
WA7GVT	321	2	3	1,002	ND
DeKalb Co ARC					
W4GBR	265	2	15	998	AL
Nanaimo ARA					
VE7NA	191	2	20	996	BC
Richardson Wireless Klub					
K5RWK	214	2	23	994	NTX
WA5HOT	166	2	6	982	STX
Bartow Co ARES					
N4QET	154	2	9	966	GA
Hamilton Co ARA					
K0KWO	93	2	4	934	IA
WA4JUK	145	2	3	924	VA
Tick Bite Trio					
K4RET	139	5	3	890	VA
K2QR	24	5	4	890	WNY
Club RA de St-Hyacinthe					
VE2CAM	45	5	12	885	QC
Atchison Co. Radio Services					
K0HK	70	2	10	880	KS
MDOT ARC					
KM5DOT	251	2	4	878	MS
North Georgia VHF Soc					
K4NGA	382	2	7	854	GA
N0ZTO	134	5	4	830	CO
Peruvian-American RC					
W0PNA	124	2	3	808	MN
Minnesota AR Technical Society					
AA0MN	182	2	6	802	MN
Tidelands ARS					
K5BS	42	2	20	786	STX
Chautauqua & Erie ARC					
NZ2Y	117	2	6	784	WNY
KA2BEO	122	2	5	778	SNJ
Ether Busters					
W0KU	154	2	6	748	CO
Eastern Michigan ARC					
K8EPV	155	2	12	748	MI
USS Jurassic (Star Trek & ARC)					
K8SSJ	89	2	4	716	OH
Portland Amateur Wireless Assn.					
W1KVI	81	2	14	696	ME
N9NX	168	2	5	678	WI
K3TAR	246	2	9	642	EPA
Central Dakota ARC					
W0ZRT	175	2	18	620	ND
Club de RA du Madawaska					
VE9CRM	181	2	15	612	MAR
W7HAV	20	2	14	604	MT
Pocatello ARC					
N7PI	224	2	40	598	ID
Honeywood Club					
KF7HB	26	5	3	555	OR
Kent Co ARC					
KC3ARC	123	2	20	554	DE
SMARC					
KC0IHJ	149	2	8	548	MN
450' Antenna Group					
KG4CDI	195	2	7	540	NC
Maxims Old Men					
AD7IC	137	2	3	524	OR
Marconi RC of Newfoundland — Signal Hill					
Splinter Group					
VO1MRC	6	5	8	510	NL
Novi ARC					
N8OVI	100	2	4	496	MI
Possum Hollow Dads Club					
WD8MQN	65	2	10	480	VA
K2CC	157	2	8	464	NNY
Northern MI ARES					
NM8ES	27	2	7	458	MI
LBCECG					
N3RAY	143	2	3	442	EPA
Tres Hermanos					
AB3KC	123	2	3	416	MDC
Keeping AR Fun					
K0ARF	132	2	3	414	MN
KB9OFM	65	2	3	380	WI
AC7KY	111	2	8	372	STX
Ocean State ARG, Inc.					
K1OS	85	2	5	370	RI
St Marys ARC					
VE3SDF	22	2	5	344	ONS
WA8Q	142	2	23	334	OH
Team PIR					
K7PIR	77	2	3	304	AZ
Central Halifax AOS					
N2JFS	30	5	3	300	VT
Burlington ARC					
VE3RAB	21	2	3	292	GTA
WA9LKZ	14	2	3	284	IL
Sao Paulo CG					
PX2F	82	2	3	264	DX
KYPN					
K4KPN	10	2	3	220	KY

Watertown ARC
N9HR 35 2 11 170 WI
IL Valley RA
K9AVE 59 2 5 168 IL
KC7LHV 45 2 3 140 ID

2A

Batesville ARC
K5UZ (+KD5J)
6085 2 10 20,696 AR
Kansas Cirt CC
KSØMO 1518 5 10 15,715 KS
Radio Amateurs of No VT
W1NVT (+W1PU)
4547 2 30 13,876 VT
Newport Co RC / Sakonnet 49ers
W1LY (+W1SYE)
3354 2 64 11,130 RI
Muskogee ARC
N5KW (+NN5Q)
2685 2 16 10,754 OK
Chew's Ridge Gang
K6MI 1043 5 8 10,630 SCV
LA Cane Field CC
W5ZR (+W5RZY)
3171 2 30 10,538 LA
WK5T 2631 2 7 9,554 NM
Canton ARC
W8AL (+KD8XD)
2240 2 39 9,424 OH
Pacific Co ARC
W7R (+W7Y)
2791 2 21 9,306 WWA
Randallstown ARC
N3IC (+K3MZ)
2696 2 17 9,278 MDC
REDXA & Marin ARS
W6KB (+W6SG)
2832 2 42 9,254 SF
N4TP (+W4DUG)
2584 2 45 8,864 WCF
Smith Chart ARS
K4OO 2639 2 14 8,752 NC
Blue Lake Brothers
NØAT 1911 2 5 8,296 MN
Northern OH DX Assn
W8DXA 2358 2 20 8,262 OH
SARA
K6SA (+K6NN)
2242 2 15 8,102 SCV
W/K ARC of Greater Milwaukee
N9AW (+KC9WPS)
2108 2 16 8,090 WI
Suncoast ARS / Sarasota Co ACS
WC4EM 2363 2 15 8,048 WCF
Falmouth ARA
K1RK (+W1HQH)
2200 2 43 8,048 EMA
Order of Boiled Owls / Radio Central ARC
KW2O (+W2RC)
2353 2 22 8,016 NLI
W9JP (+WD9BSA)
2317 2 35 8,010 IN
NCCC Sierra Chapter
K6NV 1924 2 8 7,554 SV
Schaumburg ARC
N9RJV (+AC9CG)
2123 2 57 7,530 IL
NA9U (+KC9TEW)
2025 2 13 7,120 IN
Central OR DX Club
N7LE (+WN7K)
1958 2 11 7,028 OR
Kanawha ARC
W8GK (+N8LW)
1948 2 31 7,002 WV
Lynchburg ARC
K4CQ (+KV4MW)
1787 2 70 6,980 VA
Platinum Coast ARS
W4MLB (+AF4Z)
2294 2 35 6,968 SFL
WCARC
N5TT (+N5T)
1983 2 86 6,854 STX
Big Bend ARC
K5FD (+AD5BB)
1936 2 15 6,768 WTX
N3VZ 2037 2 5 6,752 EPA
NHC Em Prep Group
NC4NH (+N2WG)
1751 2 51 6,634 NC
NA3DX (+NA1DX)
616 5 14 6,555 MDC
Williamsburg Area ARC
K4RC (+AK4WL)
1967 2 46 6,532 VA
Montgomery ARC
W4AP (+AK4ZE)
1519 2 75 6,354 AL
Explorer Post 599
WA2DFI (+W7BSA)
1973 2 26 6,336 AZ
N4AW (+N4SBA)
1549 2 12 6,278 SC
Massanutten ARA/ Valley ARA
W4XD (+K4MRA)
1652 2 89 6,234 VA
Bishop ARC
N6OV (+W6TD)
1674 2 25 6,232 ORG
Portland Radio Contester Club
KK7PR (+AE7YP)
1810 2 21 6,104 OR
Cape Fear ARS
K4MN (+K4KMI)
1397 2 20 6,044 NC
Blackstone Valley ARC
W1DDD (+W1TBR)
1482 2 38 6,006 RI
WØEF 1438 2 30 5,992 MN
Oconee District 17 RC
N4S 1738 2 20 5,952 SC
Philips ARC
W1HP 1544 2 15 5,916 EMA
Wyoming 7 Flamingo Desperadoes
WY7FD (+WY7SS)
1266 2 10 5,860 WY
PRARL
KP4ES 1491 2 10 5,812 PR
Olive Branch ARC
W5OBM (+KW5GP)
1847 2 28 5,734 MS
WØMR (+KØAGF)
1605 2 43 5,632 MN
Providence RA
W1OP (+W1PRA)
1740 2 13 5,600 RI
McMinn Co ARC
NA4K 1276 2 28 5,518 TN
Mountaineer ARA
W8SP 1338 2 26 5,342 WV
Tallahassee ARS
K4TLH (+N4PIH)
1403 2 51 5,298 NFL
Trojan ARC
NWØK (+WYØI)
1102 2 7 5,266 KS
Three Guys and a Girl
WB6BFG 1455 2 4 5,256 SDG
Delaware ARA
K9NN 1377 2 15 5,238 IN
Marietta ARC
W8HH 1378 2 13 5,180 OH
Lake Region Rep Assn
W1UR (+W1BST)
1593 2 46 5,124 NH
Candlewood ARA
W1QI 1190 2 25 5,110 CT
The 1900 Club
K3PT (+W3QJ)
1417 2 15 5,036 DE
Beach Boys ARC
W6SL 1309 2 10 5,034 SB
KØLIR 1300 2 12 5,010 MO
KE2D 1634 2 5 5,000 SNJ
Motorcity RC
W8MRM 1265 2 52 4,996 MI
Crawford ARS
W3MIE (+N3QQH)
1130 2 22 4,996 WPA
Prairie Dog ARC
WØOJY (+WØEJ)
1025 2 14 4,986 SD
AR Guild of Pleasant Hill
N6VV 1686 2 22 4,936 EB
San Mateo RC
W6UQ (+K6VJ)
1397 2 28 4,930 SCV
Montrose ARC
KØIIT (+KCØQXX)
1227 2 50 4,794 CO
NØSS (+KØETY)
971 2 68 4,558 MO
Fort Madison ARC
WFØRT (+NF5B)
998 2 18 4,548 IA
Monroe Co Radio Com Assn
W8PI 1433 2 35 4,526 MI
New Providence ARC
N2XJ (+W2FMI)
1371 2 51 4,496 NNJ
Tuscaloosa ARC
W4XI 1387 2 15 4,474 AL
Northern OH QRO Club
KS8M 422 5 4 4,470 OH
Palatine ARES / RACES Group
W9P (+WX9PAL)
1110 2 75 4,462 IL
Meriden ARC
W1NRG (+W1FD)
944 2 20 4,358 CT
Wilderness Road ARC
W4CDA (+WQ4Z)
946 2 25 4,256 KY
Palos Verdes ARC
K6PV (+AI6DF)
1157 2 36 4,248 LAX
Alamance ARC
K4EG (+W4VGZ)
1025 2 42 4,220 NC
MARCA
W7MOT (+AA7OO)
1153 2 16 4,210 AZ
Ellsworth Amateur Wireless Assn
W1TU (+KB1NEB)
823 2 20 4,140 ME
Hellgate ARC
W7PX (+W7INW)
1052 2 20 4,120 MT
Mills CO ARC
K5TRO (+N5QBU)
1199 2 11 4,064 NTX
Escondido ARS
N6SD (+N6WB)
888 2 50 4,044 SDG
Tri Co ARC
W9MQB (+KD9PM)
786 2 13 3,908 WI
Ottawa ARC
VE3RC (+VA3BIT)
844 2 65 3,852 ONE
Minden ARA
N5RD 1145 2 15 3,842 LA
Heart O' Texas ARC
W5ZDN (+W5TSA)
1056 2 56 3,788 NTX
Livngston AR Klub
W8LRK (+N8EOC)
1638 1 10 3,760 MI
Sioux Empire ARC
WØZWY (+WØFSD)
1040 2 25 3,758 SD
Harris-Intersil ARC
K4HRS 1449 2 10 3,756 SFL
Palms West ARC
W4SS (+AI4PW)
942 2 15 3,752 SFL
Spring Hill ARC
N4WO 811 2 26 3,748 NFL
Northern AZ DX Assn / Coconino ARC
W7TB (+KC7KCN)
879 2 26 3,732 AZ
Spartanburg ARC
K4II 952 2 35 3,728 SC
North Shore ARC
VE7NSR (+VE7WRS)
1049 2 28 3,722 BC
Rice Family
NX8Y (+AB8FF)
872 2 10 3,706 OH
High Desert ARC of NM
NM5HD 803 2 29 3,662 NM
The Villages ARC
K4VRC (+N4FP)
768 2 35 3,642 NFL
SW LA Am Rep Club
W5BII (+W5LLH)
1318 2 34 3,606 LA
Massillon ARC
W8NP (+KB8STV)
905 2 40 3,572 OH
Derangers
N6MI 1985 1 7 3,492 SCV
Hannibal ARC
WØKEM (+WØMTL)
798 2 14 3,472 MO
Fox Cities ARC
W9ZL 725 2 93 3,410 WI
Hancock ARC
W9ATG (+N9TT)
709 2 31 3,302 IN
Irvine Disaster Em Comm
N6IPD (+K6PB)
913 2 40 3,252 ORG
Paso Robles ARC
W6R (+N6KKS)
1193 1 25 3,246 SCV
Walton RA
W2LZ (+W2CD)
274 5 10 3,235 WNY
WT4RA 1059 2 28 3,232 VA
St Croix ARC
NP2VI 1975 1 22 3,221 VI
Rogue Valley ARC
W7DTA (+K7TFC)
879 2 32 3,214 OR
Acadiana ARA, Inc.
W5DDL (+W5EXI)
964 2 34 3,208 LA
Morris RC
W2YD 698 2 8 3,192 NNJ
Hospital Disaster Support Com Sys
N6NH (+W6KOS)
699 2 90 3,180 ORG
Southern VT ARC
K1SV (+WT1B)
900 2 20 3,140 VT
Maui ARC
KH6RS 2073 1 15 3,129 PAC
K5QHD (+KF5FWK)
580 2 46 3,112 NTX
Radio Farm
NØMA 977 2 20 3,092 IA
Carbon ARC
W3HA 770 2 6 3,074 EPA
Univ of MS ARC
W5UMS 771 2 15 3,072 MS
Carteret Co ARS
W4YMI (+K4TRP)
974 2 16 3,038 NC
EPCOM
VE7PCE 1043 2 25 3,036 BC
Half Moon Bay ARES
WR6HMB 743 2 15 2,998 SCV
Decatur ARC
W4ATD (+KB4CAY)
855 2 18 2,970 AL

Members of the KnightLites QRP Society, WQ4RP, in Raleigh, NC know how to keep Field Day simple! Their 3A effort was good for 718 QSOs, while running a mere 5 W. No word on how many contacts their canine companion contributed. [Marc Sullivan, W4MPS, photo]

West Allis RAC
W9FK 867 2 14 2,962 WI
Straits Area ARC
W8GQN 769 2 8 2,950 MI
KO0A (+WB0HSI)
689 2 18 2,950 MO
Club Radioamateur Saguenay-Lac-St-Jean
VE2CRS 625 2 7 2,938 QC
Suwannee ARC
N4SVC (+WA4ZET)
866 2 31 2,906 NFL
Samuel F Morse ARC
W6SFM 484 2 18 2,906 SV
Club RA de Quebec
VE2CQ 716 2 43 2,904 QC
AR Transmitting Soc of Louisville
W4CN 791 2 60 2,884 KY
Rome RC
W2OFQ (+N2MG)
660 2 12 2,868 WNY
Anaconda ARC
W7VNE 723 2 5 2,864 MT
Raytown ARC
K0GQ (+KC0MO)
765 2 50 2,860 MO
Briston Co Rep Assn
W1ACT (+N1JOY)
781 2 11 2,858 EMA
Shelby Co ARES
K8EMA (+KD8RLF)
622 2 23 2,828 OH
K-State Alumni Radio Team
K0DNG 823 2 3 2,822 MO
Trident ARC
N4EE 630 2 13 2,810 SC
Richmond ARC
VE7RAR (+VA7ODY)
554 2 27 2,806 BC
Northwest FL ARC
KE4FD 693 2 7 2,790 NFL
Barstow ARC
WA6TST (+KJ6YJF)
276 5 30 2,790 ORG
ARC of Amite Co
W5CCW 700 2 5 2,788 MS
Gallatin HRC
W7ED 841 2 20 2,778 MT
Fidelity ARC
W1MB (+W1MB)
494 2 15 2,760 RI
K4WAK 559 2 6 2,734 NFL
Pine State ARC
N1ME 766 2 26 2,724 ME
W3BN (+W3CCH)
634 2 40 2,718 EPA
Littleton Area Radio Klub
K1EME (+AB1SX)
418 2 54 2,712 NH
Port Lavaca ARC
W5KTC 486 2 6 2,710 STX
Panhandle ARC
W5WX 543 2 15 2,692 WTX
Blossomland ARA
W8MAI (+W8KIT)
654 2 35 2,692 MI
Cedar Valley ARC
W0GQ (+K0JCX)
588 2 32 2,666 IA
Murray St Univ ARC
K4MSU (+W4GZ)
415 2 25 2,646 KY
ARC EM COMM SVC
WB2QBP (+K2ARC)
929 2 15 2,634 NLI
Sandia National Labs ARC
W5MPZ 596 2 17 2,632 NM
Pamlico ARS
N4PRS (+AI4WL)
584 2 34 2,620 NC
Warren Tech RC
KC2WT (+WC2FD)
536 2 38 2,612 NNJ
Tyler ARC
K5TYR 576 2 63 2,604 NTX
California City ARC
KE6RN (+KK6EZO)
495 2 15 2,596 SJV
W4FD 450 2 30 2,594 NC
Gold Coast ARA
N4FL 553 2 64 2,558 SFL
Goochland Co ARES / VA Capital District 6 ARES
N4MI (+N4HOK)
569 2 40 2,528 VA
W8VM 688 2 14 2,528 OH
Pearl River ARC
W5PMS (+K5RDA)
408 2 48 2,512 MS
Central Mississippi ARA
WM5A 415 2 22 2,506 MS
K4YTZ 514 2 30 2,440 SC
Fresno ARC
W6TO 491 2 20 2,432 SJV
Franklin Co ARC
AC1L (+KB1MSU)
552 2 28 2,418 WMA
RATS / RARC Joint Operation
W4RAT (+W4ZA)
762 2 38 2,396 VA
Coastside ARC
WA6TOW 550 2 15 2,380 SCV
Rogue RF Project
K7KO (+KF7IBN)
490 2 9 2,376 OR
Wireless Society of So ME
WS1SM (+KB1HNZ)
583 2 16 2,370 ME
Tri-Co FD
W4C (+KI4OAS)
443 2 16 2,358 TN
Green Valley ARC
WE7GV 485 2 59 2,354 AZ
Coastline ARA
N1EG 801 2 50 2,348 CT
Story Co ARC
W0YL 478 2 15 2,336 IA
VE3SOO 598 2 14 2,336 ONN
Valencia Co ARA
K5OUR (+KC5OUR)
337 2 74 2,334 NM
DNB ARC
K6EMI 650 2 5 2,334 ORG
NE WY ARA
NE7WY 503 2 22 2,302 WY
Mid-Atlantic ARC
W3NWA (+W3ZV)
503 2 54 2,302 EPA
York RC
W9YRC 573 2 25 2,284 IL
W3OC 654 2 25 2,280 WPA
W5AUU (+AE5NW)
511 2 50 2,270 AR
K8OCB 614 2 4 2,256 OH
Hidden Valley ARC
KC9KQ 398 2 23 2,246 WI
RF Wireless ARC of Burley
W7JQ (+W7BRC)
607 2 33 2,242 WWA
Radio Operadores Del Este
KP3RE 330 2 36 2,240 PR
Pamlico ARC
K4BCH 524 2 10 2,240 NC
Pen Bay ARC
W1PBR (+W1PBR)
364 2 15 2,222 ME
Winona ARC
W0NE 373 2 23 2,192 MN
Bloomington ARC
K9DIY (+K9SOU)
300 2 53 2,192 IN
N7IG 324 2 15 2,192 WWA
Anoka Co RC
W0YFZ (+AE0AL)
647 2 37 2,168 MN
Matagorda Co ARC
W5WTM (+KE5KVR)
497 2 34 2,166 STX
WPPS RC
W7POE 419 2 3 2,148 MT
Santa Clara ARA
W6UW (+W6UU)
506 2 35 2,144 SCV
Just Havin' Fun QRP Club
W8WOO 217 5 4 2,135 OH
Los Alamos ARC
W5PDO 482 2 20 2,132 NM
Lauderdale Co EOC
WX5MEI 271 2 60 2,118 MS
MCARES
K4ZK (+WX4MC)
490 2 30 2,112 SFL
WB4GNA 496 2 48 2,100 AL
Franklin Co ARC
WE4A (+W8EMD)
488 2 13 2,060 NC
Sierra Blanca ARC
KR5NM (+K5RIC)
459 2 12 2,058 NM
Jasper RC
K4ACW 464 2 34 2,042 GA
Not All There
N9TO 390 2 7 2,040 IL
SC4 ARC
W6SCF (+W6NZH)
268 2 44 2,030 SCV
Eastern Shore ARC
K4BW 505 2 20 2,028 VA
The Happy Hams
K2DXU 556 2 15 2,024 ENY
Laguna Mt.
KK6I (+W6BAF)
418 2 11 2,012 SDG
North Arkansas ARS
W5LR 468 2 40 2,006 AR
Union Co. ARS
NC4UC (+KB4NET)
594 2 13 1,988 NC
San Jose ARES / RACES
W6SJC (+KF6IIY)
282 2 29 1,976 SCV
Jefferson Co ARC
W7PT (+KG7AVA)
335 2 15 1,972 WWA
Great Bay RA
W1FZ (+N1YGH)
377 2 7 1,968 NH
High Forest ARC
K4H (+KK4RVE)
438 2 6 1,966 TN
South Bay ARC
W6SBA 376 2 17 1,958 LAX
NA4CC 386 2 7 1,956 NC
Kamloops ARC
VE7UT 358 2 27 1,938 BC
French Creek QRP Renegades
W3PBC 174 5 4 1,935 EPA
Benzie AR Friends
W8BNZ 509 2 14 1,928 MI
Crown Radio Group
W3RP 405 2 5 1,928 WPA
East Greenbush ARA
W2EGB 735 2 20 1,920 ENY
Thousand Islands Repeater Club
KD2CPX (+K2MJC)
383 2 23 1,894 NNY
W6UUS 331 2 63 1,890 SDG
Legion of Indianapolis DXers
W9VW (+W9SU)
436 2 8 1,886 MI
Twin Cities Repeater Club
W0BU (+W0HO)
333 2 10 1,880 MN
Ogden ARC
W7SU 431 2 29 1,874 UT
Rainbow Canyon ARC
WR7AAA 147 5 13 1,865 UT
Caribbean ARG
WP4CRG 383 2 18 1,856 PR
Vashon / Maury Island RC
W7VMI 292 2 22 1,854 WWA
Pathfinders ARC
VA4PAR 800 2 15 1,850 MB
WA0DX 696 2 7 1,834 IA
Hiawatha ARC
N0DH 442 2 20 1,806 MN
Lenoir ARC / Caldwell ARES
N4LNR 368 2 19 1,806 NC
Oak Grove Hamsters
KB0NHW 426 2 4 1,802 MO
Rappahannock ARA
W4NNK 543 2 8 1,778 VA
Southern Kentucky ATS
KY4AR 401 2 12 1,772 KY
Columbia Co ARC
K4KNS (+WE4GW)
278 2 7 1,768 GA
AB9PN 351 2 3 1,754 WI
Larkfield ARC
W2LRC (+KC2TAF)
489 2 22 1,746 NLI
Issaquah ARC
W7BI (+KG7DTK)
327 2 23 1,744 WWA
Grant ARC
W8STZ 336 2 10 1,700 OH
Washington Area ARC
W0ARC 360 2 20 1,696 IA
Chickasaw ARA
W5K (+W5GWD)
289 2 20 1,692 MS
Big Sandy ARC / CO ARES D17
KD0TOS (+N0EMU)
179 2 18 1,690 CO
BPI Alumni RC
W3CDI 377 2 7 1,688 MDC
Ellijay ARS
KE4ZX 390 2 8 1,652 GA
W0CA 226 2 30 1,648 CO
K5GCC 413 2 27 1,638 NTX
Emerald ARS
WA7FQD 297 2 15 1,634 OR
Floyd ARS
W4FCV (+W4VZH)
302 2 20 1,598 VA
NE WA ARC
W7GHJ 170 2 8 1,586 EWA
East Pasco ARS
K4EX 413 2 28 1,582 WCF
Newport Beach Repeater Club
K6NBR 319 2 25 1,578 ORG
Jim Bell Wireless Assn
K4TNS (+W4WE)
289 2 9 1,564 AL
Kansas City Area Blind ARC
WA0FQL 229 2 8 1,562 MO
Bryan ARC
W5BCS 393 2 65 1,554 STX
K8SWD 430 2 3 1,548 MI
Yellowstone RC
K7EFA (+WN7Y)
232 2 35 1,540 MT
Central Toronto ARC
VA3CTA 360 2 25 1,540 ON
Okanogan Co ARC
W7ORC 467 2 6 1,534 EWA
K5LIB (+KS5Z)
389 2 21 1,528 WTX
Fullerton ERC
N6ER 379 2 10 1,528 ORG
Aeronautical Center ARC
W5PAA 349 2 34 1,510 OK
North Okanagan RAC
VE7NOR (+VA7XN)
195 2 10 1,496 BC
Ellis Co ARC
WD5DDH (+KB5YYK)
447 2 20 1,494 NTX
Will Work 4 Kentucky Bourbon
WW4KB 499 2 6 1,486 KY
W4MM 255 2 14 1,480 GA
Chicago Suburban RA
N9BAT 239 2 18 1,476 IL
Steubenville-Weirton ARC
W8CWO 502 2 15 1,472 WV
Sam Houston ARK
AI5M 226 2 28 1,472 STX
London Bridge ARA
K7LHC 206 2 11 1,470 AZ
SPARC
KH6EL 917 1 20 1,467 PAC
W5PFC (+N5WDG)
248 2 18 1,458 MS
Stillwater ARA
W0JH 280 2 25 1,456 MN
K2YNT 402 2 9 1,454 NNJ
Comunity Service RC
W0CSR 263 2 6 1,454 MO
Laurel ARC
W3LRC 311 2 25 1,432 MDC
Guilford Co ARES/ Greensboro ARA
NA4GC (+W4GSO)
366 2 29 1,428 NC
West AL ARC
KC4UG (+KK4QXJ)
256 2 18 1,422 AL
UCSC ARC
AC6P 405 2 23 1,420 SCV
Jones Co ARC
W0CWP 297 2 6 1,420 IA
VE3RAM (+VE3ZZU)
227 2 9 1,416 ONE
Barrie ARC
VE3GCB 243 2 25 1,406 ONS
VE3OSR 323 2 16 1,406 ONS
N3TN 262 2 15 1,398 WPA
NA1RL 223 2 26 1,390 CT
Mtn State Transmitters
K8VNQ (+KD8MIV)
182 2 28 1,388 WV
Queen Creek ARC
N2QOJ 249 2 8 1,388 AZ
VARES / DBARA
K4BV 329 2 50 1,378 NFL
Morrow Co ARES
W8NL 342 2 13 1,374 OH
Lake Erie ARA
WB8CQR 266 2 10 1,374 OH
Tuscola Co ARA
KC8CNN 321 2 12 1,374 MI
Greenwood ARS
W4GWD 394 2 8 1,372 SC
St Albans ARC
K2KI 253 2 14 1,362 VT
Whitley Co ARC
WC9AR 406 2 15 1,362 IN
Spokane DX Assn / PARC
K7SDX 369 2 25 1,358 EWA
Maple Valley ARC
KC7KEY 249 2 35 1,352 WWA
Mountain ARC
W6BW (+KJ6JZU)
265 2 12 1,340 SJV
OARS
KD8SQ 495 2 6 1,340 OH
VA5DR 285 2 9 1,330 SK
Club Radio Amateur Matane
VA2CMQ 243 2 7 1,318 QC
Moosehorn ARC
KL7AN 240 2 43 1,302 AK
Utica ARC
K2IQ 198 2 8 1,284 WNY
Theodore Roosevelt ARC
K0ND 316 2 17 1,282 ND
ARG of Youth in Lowell
K8LHS 323 2 10 1,276 MI
Yellowknife ARS
VE8YK 42 5 10 1,270 NWT
Lake of the Ozarks ARC
N0ZS 327 2 17 1,266 MO
Calexico ARS
K6CLX 502 2 11 1,254 SDG
Kings Co RC
KC2RC 202 2 20 1,246 NLI
Greater NE ARL
K0GNE 289 2 15 1,238 NE
Socorro ARA
W5AQA 317 2 13 1,234 NM
Soc of Newfoundland Radio Amateurs
VO1AA 96 2 18 1,212 NL
NHRC ARS
W1CUM 386 2 10 1,206 NH
K5LBK (+KF5QIS)
116 2 15 1,202 WTX
Mizpah Shrine Radio Unit
W9FEZ 296 2 6 1,198 IN
N Bass Island OH Expedition
N8B 76 5 3 1,195 OH

Madison-Oneida ARC
W2MO 155 2 13 1,190 WNY
Combined ARES/CUHF/CAVHS
N5AT (+KDØJKM)
234 2 33 1,190 AR
DCARES
K4D (+KK4JQG)
143 2 23 1,188 GA
Lake Wales Rep Assn
K4LKW 115 2 20 1,180 WCF
Laguna Beach Em Com Team
N6L (+WO1S)
120 2 70 1,170 ORG
Beaufort Radio Amateur Group
W4BFT 165 2 24 1,166 SC
ROARS
KK6IL (+KF6AUP)
156 2 36 1,162 SDG
Owen Co ARA
KB9MZZ 103 2 8 1,162 IN
Jefferson ARC
W5GAD 250 2 20 1,160 LA
Mora Open RA
KDØCI 177 2 12 1,160 MN
Six Retired Guys and a Dog
KG7O 82 5 6 1,160 WWA
W8GUC Group
W8GUC 196 2 3 1,146 OH
Southern Oregon ARC
K7LIX 230 2 31 1,120 OR
Arapahoe Co ARES/Aurora Rep Assn/
Cherry Creek Young ARC/Rocky
NØARA (+WØCCY)
185 2 51 1,120 CO
Greenville ARC
KDØMRV 112 2 35 1,114 MO
Stanly CO ARC
K4OGB 90 2 11 1,112 NC
Central KS ARC
WØCY 265 2 12 1,090 KS
WØGKP 207 2 30 1,088 MN
Lancaster Radio Transmitting Soc
W3AD 465 2 25 1,080 EPA
Seaway Valley ARC
VE3VSW 262 2 7 1,072 ON
Bloomington Com Group
WCØAAA 260 2 20 1,070 MN
Callaway ARL
KSØB 173 2 13 1,052 MO
Phillips Co. ARC
WØZXN 216 2 7 1,042 KS
Citrus Co ARC
W4CRA (+W4R)
62 2 25 1,042 NFL
El Paso ARC
W5ES 241 2 12 1,032 WTX
Kauai ARC
KH6E 257 1 10 1,027 PAC
Huron ARA
WØNOZ 202 2 11 1,022 SD
Kansas Antenna Club in Johnson Co
KØANT 225 2 7 1,020 KS
Cuerpo de Voluntarios RadioAficionados
KP4CVR (+KP4CVR)
184 2 20 1,020 PR
Woodford Co ARC
KY4WC 169 2 25 1,008 KY
Gumman ARC
WA2LQO 334 2 14 992 NLI
Top of MI ARC
NM8RC 104 2 6 986 MI
Coronado Emerg Radio Ops
W6MLI 93 2116 984 SDG
GREAT Club
AK4I 165 2 4 980 GA
Ottawa Valley QRP Soc
VA3OVQ 39 5 6 980 ONE
Shuswap ARC
VE7RC 89 2 13 978 BC
Big Island ARC
KH6EJ 37 2 47 976 PAC
Montgomery ARS
NC4MC 115 2 8 970 NC
Laredo Hams ARC
W5LRD 201 2 16 956 STX
Midwest ARS
W9MAR (+KA9NOO)
158 2 10 956 IN
W4BI 220 2 8 950 AL
Snoring Beagle Ranchers
WB8SIW 322 2 3 948 MI
Fort Armstrong Wireless Assn
K3QY 289 2 30 948 WPA
VE7MIR 109 2 10 934 BC
BSA Venturing Crew 80
W3BSA 261 2 8 932 MDC
Gulf Coast ARC
WA4GDN 141 2 30 932 WCF
W9O 89 2 23 928 WI
Central MO RA
KØSI 137 2 10 924 MO
WE1SPN 320 2 13 924 CT
Stockton-Delta ARC
W6SF 235 2 17 920 SJV
Clinton ARC
WØCS 185 2 16 920 IA
WD5IYF 84 2 17 918 OK
Shore Points ARC
K2B/W2HRW 91 2 15 918 SNJ
Old Friends AR Team
NV1O 275 2 5 918 AZ
WØMG 135 2 8 912 IA
Apple City ARC
W7TD 114 2 28 898 EWA
Elmendorf ARS
KL7AIR 52 2 8 896 AK
Saint Lucie Co. ARES
W4SLC (+KK4RLZ)
506 1 15 884 SFL
MCARC / RCWA
WX5MC 166 2 20 882 OK
Crescenta Valley RC / Glendale Em Aux
Radio Service
AD6IZ 166 2 15 882 LAX
Cherokee CO ARES
KJ4GTK (+W4MXY)
67 2 9 872 NC
N7POR 153 2 8 866 MT
Denver North Stake
ACØMU (+KTØKT)
55 2 30 860 CO
Seward Penninsula ARC
KL1US 5 2 7 860 AK
Mobile Ohm Volunteer Examiners
N9OQU 80 2 4 840 IL
Dalton ARC
W4DRC 40 2 20 840 GA
Scott Co ARES
NØBHC 139 2 20 828 MN
Fort Ord ARC
K6WAE 182 2 22 822 SCV
Cold Lake ARS
VE6YOD 326 2 4 822 AB
K9IYP 133 2 10 816 IL
Nassau Co Police ARC
NC2PD 151 2 11 812 NLI
River Cities ARA
K4K 74 2 22 810 KY
Henderson ARC
W4KVK 43 2 15 802 KY
Sandia Vista ARC
WV5X 51 2 5 752 NM
N7LYY 228 2 10 742 MT
Mercer Island Radio Ops
W7MIR 40 2 14 734 WWA
STARS ARC
W9SRC (+KC9TIR)
39 2 22 728 IL
Huber Heights ARC
NO8I 134 2 11 718 OH
ARA of the Southern Tier
W2ZJ 63 2 10 718 WNY
USC ARC
W6YV 79 2 3 708 LAX
ARC at UCF
K4UCF 38 2 5 702 NFL
Tupelo ARC
KK5K 97 2 8 696 MS
Martinez ARC
KF6HTE 68 2 20 686 EB
Pierre ARC
WØPIR 115 2 6 680 SD
Knox Co. RC, Inc.
W9GFD 134 2 6 676 IL
Westside CRC
KE5WMA 49 2 11 674 LA
Westside ARC
W5ABD 49 2 11 674 LA
Frank Phillips Memorial Rep Assn
AB5J 11 2 3 672 OK
QCWA Chapter 162
K9AKG 60 5 6 650 WI
Panther ARC
W3YI 168 2 6 648 WPA
Royal Rangers NJ
N2R 78 2 85 606 NNJ
Valley RC of OR
W7PXL (+N7IY)
114 2 12 588 OR
Lower Yellowstone ARC
W7DXQ 160 2 10 586 MT
Big Horn Basin ARC
KI7W 108 2 11 566 WY
Silver Tipped Rats
K6CAW 156 2 3 566 NV
K7FDF 55 2 5 560 WWA
York Pirates
KB9DVC 135 2 3 554 IL
Hualapai ARC
WB6RER 82 2 3 550 AZ
Wellesley ARS
W1TKZ 42 2 21 548 EMA
Warren Co ARA
WC8EMA 27 2 12 532 OH
Club Radio Amateur de la Visitation
VE2CVN 72 5 3 525 QC
Ellington CERT Team
K1ECT (+W1HEN)
61 2 7 504 CT
MVARA
KC2AVO 93 2 10 500 NNY
Renfrew Co ARC
VA3NRR 74 2 14 498 ONE
Clarksville ATS
KF4L 68 2 10 492 TN

Members of the West Valley ARA in San Jose, CA, seem happy with their 18,000 point score in the 9A (battery) category! [Jim Peterson, K6EI, photo]

K4CXS 110 2 5 482 GA
Champlain Regional Rep Assn
VE3STP 36 2 3 452 ONE
Hamilton Co AR Public Service Corps
K8YOJ 46 2 15 442 OH
North Platte Progressive ARC
NEØNP 19 2 6 388 NE
Univ ARC
N7UW 54 2 15 376 WY
Rich and Ron's Field Day
KJ6HRO 84 2 4 368 SV
Livingston ARS
W5LRS (+KB5TMD)
141 2 16 366 LA
Peace Country ARC
VE6ARC 56 2 3 362 AB
KB3WZT 25 2 3 300 WPA
Musselshell ARC
KF7ELT 25 2 5 300 MT
Citrus Co. FL CERT
K4RLK 39 2 20 278 NFL
KD2AJN 31 5 3 265 WNY
Cherokee Co ARC
K5JVL 50 2 6 250 NTX
Kingston ARC
VE3KAR 99 2 8 248 ONE

3A

Rancho Escondido ARC
W5YA (+K5SSR)
1536 5 11 15,865 NM
Rochester DX Assn
W2RDX (+W2AN)
3530 2 30 13,438 WNY
Carolina Contest Consortium
K4FQU 3717 2 7 11,798 NC
North Shore RC
K9OR (+K9RST)
2984 2115 11,552 IL
North Shore Radio Assn
NS1RA (+KB1PAL)
3080 2 50 11,336 EMA
N4N Field Day Group
N4N (+N4G)
2995 2 30 11,020 GA
Rochester ARC
WØBM (+ABØBW)
3129 2 25 10,914 MN
Lighthouse AR Alliance
W4QN 3356 2 20 10,254 SFL
Edmond ARS
K5EOK (+WB5GCX)
2810 2 68 9,300 OK
Greater Norwalk ARC
N1EV (+W1NLK)
2615 2 30 9,258 CT
Stanwood - Camano ARC
W7PIG (+W7FLY)
2269 2 83 9,118 WWA
Stamford ARA
W1EE (+K1FC)
2550 2 78 8,910 CT
Great Southern DX Assn / Magnolia DX
Assn
K5MDX (+W5NO)
2593 2 27 8,898 MS
Midland ARC
KD5C (+W5QGG)
1928 2 32 8,568 WTX
Oakland Co ARS
W8TNO (+W8P)
2889 2 22 8,546 MI
MS Valley ARA
W9MVA (+W9FCC)
2127 2 13 7,668 WI
South Lyon Area ARC
N8SL (+N8AR)
2106 2 24 7,572 MI
W5YD ARC
W5YD (+N5F)
1721 2 24 7,516 MS
Paducah ARA
W4NJA (+KK4RGM)
1965 2 26 7,380 KY
PART of Westford, MA
W1IS 722 5 40 7,355 EMA
Surrey ARC / SEPAR
VE7SAR (+VE7HME)
1689 2 30 7,262 BC
KnightLites QRP Soc
WQ4RP 718 5 6 7,160 NC
Oakville ARC
VE3HB (+VE3HG)
1749 2 18 7,160 ON
Fauquier ARA
W4VA (+KX4O)
1674 2 17 7,064 VA
Stonewall Jackson ARA
K8DF (+K8TPH)
2070 2 16 7,056 WV
Zamora RC
W4ZHR (+N4ZUM)
1880 2 24 7,002 AL
K2CT (+KM2O)
1981 2 35 6,874 ENY
Barnstable ARC
W1NP (+K1PBO)
1755 2 25 6,810 EMA
AR Klub of the AR NW
AA5AR (+NW5AR)
1579 2 15 6,734 AR
Bristol ARC
W4UD 1769 2 62 6,418 TN
Bill Gremillion Memorial RC
K4NRC 1811 2 39 6,374 GA
Dial RC of Middletown
K8PI (+W8BLV)
1678 2 42 6,308 OH
Ski Country ARC
KØRV (+KQØC)
1698 2 47 6,296 CO
Baton Rouge ARC
W5XU (+K5LSU)
1605 2 55 6,204 LA
North DeKalb QRP Club
W4DGH 624 5 10 6,090 AL
CRES ARC
W8ZPF 1616 2 27 6,082 OH
Oh-Ky-In ARS
K8SCH (+W1SCR)
1855 2 31 5,964 OH
Fluvanna ARES Group
W4XR 2016 2 14 5,964 VA
Blue Ridge ARC
W4YK 1345 2 56 5,932 NC
QSY Society
K2QS (+WK2T)
1218 2 19 5,798 ENY
South Orange ARA
K6SOA (+K6WO)
1667 2147 5,758 ORG
Ashtabula CO ARC
K8CY (+KD8PTE)
1677 2 30 5,618 OH

United Radio Amateur Club
K6AA 1236 2 27 5,544 LAX
San Andreas Faultline Survivors
W6SW (+K6F)
1604 2 11 5,332 SJV
Culpeper Area Rep Assn
W4CUL (+AE4ML)
1254 2 8 5,250 VA
Des Moines Radio Amateurs Assn / AR Technical Soc
WØAK (+WØSCI)
1211 2 50 5,212 IA
Bella Vista Rep Group
KØSNG (+KD5UFY)
1082 2 24 5,146 AR
JCARC
W7JCR 1078 2 25 4,996 WWA
San Lorenzo Valley ARC
K6MMM (+N6OTA)
1190 2 82 4,988 SCV
Easton ARS
K3EMD (+W3ATA)
1337 2 30 4,940 MDC
Fond Du Lac ARC
W9EBV 1244 2 38 4,926 WI
Rip Van Winkle ARS
WD2K (+K2RVW)
1117 2 31 4,844 ENY
Eastern CT ARA
K1MUJ (+K1AGL)
1204 2 20 4,692 CT
Estes Valley ARC
NØFH 913 2 25 4,648 CO
Utah ARC
W7SP (+K7LO)
1197 2 98 4,646 UT
Central IL RC
W9EX 1313 2 43 4,580 IL
W4VIY 1045 2 10 4,514 NFL
NØGF 1226 2 10 4,490 ND
Brandon ARS
K4TN (+WJ4G)
1012 2 30 4,434 WCF
SW Dallas Co ARC
W5WB (+W5AUY)
1045 2 49 4,414 NTX
Roanoke Valley ARC
W4CA (+AB4A)
1040 2 27 4,324 VA
ARES of Douglas and Elbert Cos.
WAØDE 1265 2 22 4,318 CO
Greater Beloit ARC
W9PN (+W9DL)
1079 2 15 4,234 WI
Reelfoot ARC
K4RFT (+N4MJ)
833 2 11 4,232 TN
Central OH Op Klub Extra-Novice
WW8OH (+W8TNX)
1175 2 26 4,224 OH
White Mtn ARC
W1MWV (+N3LYT)
941 2 20 4,112 NH
Milwaukee Rep Club
WQ9A (+K5GBW)
1379 2 47 4,072 WI
North American QRP CW Club
N3AQC 352 5 4 4,070 WPA
Boeing Employees' ARS
WØMA 896 2 19 3,926 MO
McKinney ARC
W5MRC 818 2 22 3,870 NTX
Austin ARC
W5KA (+K5LBJ)
698 2150 3,806 STX
Reno QRP Group
W7FST 298 5 12 3,760 NV
Central MI ARC
W8MAA (+N8TSP)
884 2 22 3,738 MI
Saratoga Co ARA
K2DLL (+NR2J)
1034 2 25 3,716 ENY
Anchorage ARC
KL7AA 1510 1 40 3,698 AK
K6YA (+W6DLF)
932 2 60 3,662 SCV
K5SLD (+N5ACK)
888 2 50 3,644 NTX
Rolla Regional ARS
WØGS 762 2 48 3,608 MO
VE2CVR 882 2 28 3,594 QC
Muscatine ARC
WØM (+KCØAQS)
845 2 27 3,586 IA
Owensboro ARC
K4HY 786 2 20 3,568 KY
Aero ARC
W3PGA 678 2 52 3,552 MDC
FPL Goup
K8ESQ 829 2 4 3,534 MI
Geezer Natomas ARC
N6FR 843 2 12 3,520 SV
Cumberland Plateau ARC
W4CV (+KT4BW)
757 2 11 3,508 TN
W2XRX 976 2 19 3,488 WNY
Wilson's Wonders
N7QT 749 2 3 3,478 EWA
Hernando Co ARA
K4BKV 510 2 11 3,476 NFL
Charleston ARS
WA4USN (+NT4HI)
924 2 18 3,470 SC
W4BFB 1020 2 36 3,452 NC
AC7U 1005 2 7 3,432 AZ
Hilltop Transmitter Assn & Keystone VHF Club
W3HZU (+W3ZGD)
878 2 26 3,426 EPA
Randolph Co ERC
K4RAN 966 2 8 3,420 AL
Albemarle ARC
W4DO 845 2 43 3,400 VA
Splitrock ARA
K2GG 812 2 23 3,378 NNJ
Milford ARC
W8MRC (+KD8OUT)
761 2 18 3,358 OH
New River Valley ARC
N4NRV 751 2 12 3,352 VA
W7SST 922 2 7 3,324 OR
North Port ARC
W4NPT 699 2 16 3,318 WCF
Clay Center ARC
W1CLA (+WX1CLA)
947 2 53 3,260 EMA
San Joaquin Valley ARS
W6V (+WY6L)
603 2 22 3,260 SJV
Coquitlam/Burnaby/NewWest ARCs
VE7SCC 847 2 35 3,246 BC
Hambuds
KK5E (+K5KTF)
760 2 57 3,214 STX
SPARK
W4QR (+W4HPT)
849 2 73 3,142 VA
TriState ARS
W9OG (+WA9C)
702 2 33 3,138 IN
Scranton-Pocono AR Klub
K3CSG (+NA2T)
619 2 19 3,108 EPA
Kankakee Area RS
W9AZ (+N9FD)
756 2 12 3,086 IL
Granite State ARA
N1QC (+KB1NH)
607 2 25 3,086 NH
ARCNEM
K3NEM (+W3GR)
728 2 10 3,080 MDC
Parkersburg AR Klub
N8NBL 900 2 32 3,044 WV
Quinte ARC / Prince Edward RC
VE3RL 808 2 25 3,036 ON
Boca Raton ARA
N4BRF 934 2 20 3,028 SFL
Wireless Assn of South Hills
N3SH 760 2 20 3,022 WPA
Henry Co ARC
W9OB 1118 2 10 3,006 IN
MRAC / MAARS / GTCARC
W9RH (+N9GTC)
622 2 20 3,000 WI
Sonoma Co Radio Amateurs
K6SON (+W6SON)
509 2 45 2,980 SF
Grand Rapids ARA
W8DC 682 2 25 2,976 MI
Rockwall ARC
K5RKW 1000 2 25 2,974 NTX
Lambton Co RC
VE3SAR (+VE3CGC)
665 2 24 2,966 ONS
JTRG
W4J 790 2 46 2,964 SFL
Coshocton Co ARA
W8CCA 578 2 19 2,958 OH
Fayette Co ARC
KK4GQ 843 2 33 2,946 GA
Emporia ARS
KBØSSR (+KØESU)
1034 2 23 2,940 KS
West Palm Beach ARG
W4HAW (+K4WPB)
769 2 72 2,938 SFL
Onslow ARC
NC4OC (+WD4FVO)
564 2 15 2,936 NC
Cape May Co ARC
N2CMC (+W2CMC)
744 2 36 2,918 SNJ
Springhill ARC
N5II 798 2 8 2,916 LA
Genesee Co RC
W8ACW (+WA8MY)
684 2 13 2,906 MI
Moore Co ARS
NC4ML (+KR4W)
845 2 35 2,892 NC
Tri-Co ARA
K6AGF (+KK6CRP)
633 2 20 2,858 ORG
Tri-Co ARA
K6ASK (+KK6CRP)
633 2 20 2,858 ORG
KU6S 1573 1 53 2,813 EB
Haywood Co ARC
KW4P 988 2 12 2,776 NC
Peoria Area ARC
K9P 620 2 30 2,770 IL
N1WW 889 2 21 2,766 WMA
Nixa ARC
NØC 818 2 30 2,758 MO
Boro of Barrington OEM
WA2WUN 840 2 37 2,742 SNJ
Newton/McPherson Group
NØNK 515 2 10 2,714 KS
21 Rep Group / Kendallville Contesters
N9VI (+N9WLW)
617 2 32 2,688 IN
Nashville ARC
K4CPO (+WA4VGZ)
615 2 37 2,662 TN
Dixie ARC
W7DRC (+NA7UT)
312 5 24 2,605 UT
Northeast Wireless RC
NW2C 511 2 10 2,604 NLI
Association Radioamateur de Portneuf
VE2CSP 477 2 24 2,566 QC
Royal Gorge ARC
NCØA 461 2 17 2,558 CO
Delaware Lehigh ARC
W3OK (+WX3MAS)
1086 1 68 2,541 EPA
Blue Ridge ARS
W4NYK 497 2 21 2,540 SC
Shelby ARC / ARES of Clev Co
KM4C 663 2 17 2,526 NC
Sturdy Memorial Hospital ARC
W1SMH 563 2 15 2,512 EMA
OKC Autopatch Assn
W5MEL 457 2 10 2,484 OK
Wyandot Area Ham Op Org
KD8BNV (+KD8FLT)
453 2 10 2,452 OH
Golden Spike ARC
K7UB 643 2 25 2,434 UT
Bloomfield ARC
W1CWA (+KB1YNT)
345 2 71 2,426 CT
MO Outlaws ARC
KØSKC 499 2 3 2,426 MO
Kennehoochee ARC
W4BTI 490 2 40 2,422 GA
M&M ARC
W8PIF 1277 1 55 2,345 MI
North Kitsap ARC
KC7Z (+K7SQD)
521 2 23 2,334 WWA
Hughes ARC
W6HA (+KG6NWJ)
459 2 39 2,330 LAX
Middle TN ARS
W4UOT 287 2 20 2,316 TN
Oakland Radio Com Assn
WW6OR 421 2138 2,316 EB
Vancouver Em Community Telecom Org
VE7VCT (+VA7VCT)
366 2100 2,308 BC
Sachse ARA
K5S (+KF5NBO)
403 2 21 2,294 NTX
W2AMC 455 2 29 2,290 NLI
North Shore ARC
VE3NSR 420 2 12 2,290 ON
W6SD 446 2 35 2,276 LAX
Gaston Co ARS
N4GAS (+K4GNC)
444 2 33 2,258 NC
Valley of the Moon ARC
W6AJF 472 2 15 2,248 SF
Troy ARA
N2TY 545 2 30 2,246 ENY
Lincoln Co ARA
W4BV (+W4LCS)
615 2 8 2,238 TN
Kettle Moraine Radio Amateurs
N9KS 426 2 8 2,236 WI
Bedford ARC
K5BED 461 2 22 2,230 NTX
Ramapo Mtn ARC
WA2SNA 540 2 8 2,230 NNJ
Okaw Valley ARC
KK9N (+W9KXQ)
457 2 19 2,228 IL
WAFAR/PJ'S Group
W9FT 708 2 20 2,222 IL
Irving ARC
N5BB 339 2 25 2,218 NTX
NB6GC (+W6BB)
513 2 15 2,218 EB
CBF ARC
W8CBF 928 2 17 2,206 OH
Southern OK DXC
W5CSC 435 2 20 2,192 OK
NC4LC 419 2 39 2,188 NC
W8JXN 545 2 15 2,184 MI
Middlesex FD Group
K3GT 529 2 4 2,154 WPA
Southington ARA
W1ECV 759 2 13 2,152 CT
ARC of Augusta
W4DV 416 2 19 2,136 GA
JCARES
KN4EM 504 2 10 2,136 TN
Boston ARC
W1BOS 446 2 10 2,122 EMA

Paul Wardner, KAØNDS, took to the hills of Wyoming for FD 2013. His dipoles and verticals for 80m – 6m played very well, he reports. [Paul Wardner, KAØNDS, photo]

Yolo ARS / Yolo ARES/ UCDARC
W6YAR 364 2 36 2,122 SV
Skyline ARC
K2IWR 508 2 19 2,108 WNY
Tipp City ARG
K8ZC 430 2 22 2,080 OH
Yonkers ARC
W2YRC (+KF2FK)
372 2 70 2,064 ENY
Mt Magazine ARC
W5MAG 587 2 10 2,064 AR
MAARC / Tri-Co ARC
VE9EMM 402 2 15 2,040 MAR
VE9ND 344 2 20 2,032 MAR
W8WRK 470 2 16 2,026 OH
Liverpool ARC
W2CM (+K9CHP)
483 2 54 2,026 WNY
EPARA
N3IS (+W3PRK)
419 2 12 2,018 EPA
West River RC
WR1VT 360 2 28 2,006 VT
KZ9B 481 2 6 1,994 WI
Elko ARC
W7V 407 2 17 1,992 NV
South Georgia ARC
W4NUN 457 2 5 1,984 GA
Cascade RC
W7EK 457 2 30 1,968 WWA
Elkhart ARC
AE9U 532 2 18 1,956 MI
Big Thicket ARC
N5BTC 416 2 34 1,944 STX
San Angelo ARC
W5QX (+W5MAT)
307 2 66 1,942 WTX
Cumberland Valley ARC
W3ACH 349 2 35 1,892 WPA
PGCARES
K3ERA (+KI3DS)
287 2 20 1,886 MDC
Tri-Co ARC
WX4TC 404 2 20 1,874 GA
Regina ARA
VE5NN 434 2 26 1,858 SK
Mt Diablo ARC
W6CX 400 2 45 1,852 EB
Franktown FD Club
NØUA 357 2 14 1,830 CO
Albemarle ARS
K4WO 534 2 38 1,828 NC
Delta Co ARS
K8PL 299 2 15 1,818 MI
North Woods ARG
NØI 287 2 12 1,814 MN
ROADS
W7ORE 263 2 30 1,806 OR
Club de Radio Amateur de l'Outaouais
VE2CRO 575 2 21 1,800 QC
Binghamton ARA
W2OW 338 2 18 1,800 WNY
Holmesburg ARC
K3FI 386 2 12 1,794 EPA
3Rivers ARC
KK3ARC 369 2 12 1,788 ID
Southern Berkshire ARC
W1BAA (+K1LEE)
224 2 30 1,754 ENY
Murray Co ARC
KDØMC 267 2 6 1,718 MN
Peace River RA
W4DUX 310 2 17 1,716 WCF
W1GLO (+KB1PGH)
313 2 35 1,710 EMA
Gainesville ARS
K4GNV 405 2 16 1,706 NFL
Cleveland ARC
W4GZX 334 2 93 1,696 TN
Plattsmouth ARC
KBØSMX 197 2 15 1,694 NE
Brownwood ARC
K5BWD (+KE5UDM)
251 2 12 1,674 NTX
NW MO ARES
WDØSKY 264 2 6 1,656 MO
Hiawatha ARC
KDØNEB (+NØQIX)
305 2 47 1,654 IA
Tri-States ARC
W4GTA 322 2 10 1,636 GA
Athens ARC & Northeast GA ARC
NE4GA 341 2 34 1,632 GA
W4KBL 261 2 31 1,622 KY
Lake Oswego ARES
WA7LO 301 2 11 1,620 OR
Northern Lakes ARC
KØZ 351 2 30 1,610 MN
Olympia ARS
NT7H 218 2 32 1,602 WWA
Putnam Am Em Rep League
K2PUT 202 2 29 1,598 ENY
Silver Springs RC
K4GSO 252 2 20 1,598 NFL
Fallbrook ARC
N6FQ 412 2 49 1,594 SDG
Moreno Valley ARA
AB6MV (+KK6CXA)
233 2 23 1,584 ORG
High Point ARC
W4UA 553 2 25 1,576 NC
N8ARA 337 2 40 1,574 OH
WI Valley RA
W9NA 186 2 7 1,568 WI
Arctic ARC
KL7KC 32 2 16 1,556 AK
Portsmouth ARC / ARES
W4POX 118 2 30 1,540 VA
Montchusett ARA
W1GZ (+N1QDX)
265 2 12 1,538 WMA
Genesis ARS
N1ZIZ 141 2 40 1,516 EMA
Winchester Pioneer ARC
AC4YD 433 2 14 1,512 KY
Lee DeForest ARC
N6CG (+K6SSI)
149 2 35 1,482 ORG
North Franklin ARS
N2NNY 286 2 10 1,472 NNY
South AL RC
WC4M 211 2 6 1,468 AL
Harrisburg Radio Amateurs Club
W3UU 438 2 20 1,468 EPA
Big Rapids Area ARC
N8OE 460 2 8 1,464 MI
Not Quite Workable FD Group
AA8BV 424 2 4 1,458 OH
NT4K 645 1 26 1,456 NFL
Aroostook ARA
K1FS 356 2 32 1,452 ME
ARCC of Churchill Co
NV7CC 182 2 24 1,452 NV
Winnipeg ARC
VE4BB 422 2 67 1,446 MB
Ham Assn of Mesquite
WJ5J 291 2 42 1,440 NTX
Bankhead ARC
N4IDX 367 2 10 1,432 AL
Charles CO ARC
K3SMD 197 2 27 1,418 MDC
Humboldt ARC / Redwood ARC
W6IES 449 2 50 1,414 SF
ARC of Alameda
K6QLF (+KF6UVB)
111 2 18 1,414 EB
Coastal ARS
W4LHS 527 2 19 1,404 GA
Land of Lakes ARC
K9HD 367 2 7 1,398 IN
The Road Show ARC
WA4TRS (+K2JB)
317 2 15 1,390 NC
Sask-Alta RC
VA5AA 302 2 12 1,374 SK
LI-QRP
W2GL 413 2 3 1,364 NLI
Cumberland ARC
K3IEC 334 2 18 1,358 EPA
Clallam Co ARC
W7FEL 324 2 22 1,356 WWA
OCRACES
W6ACS 298 2 20 1,350 ORG
Columbia ARA
N7EI 299 2 15 1,348 OR
Monessen ARC
W3CSL 210 2 27 1,346 WPA
Hall of Science ARC
WB2JSM 290 2 23 1,344 NLI
Lakeshore ARA
W9LRC 342 2 5 1,334 WI
Paulding ARC
W4TIY 261 2 16 1,332 GA
Clay Co. ARC
WØTE 350 2 17 1,316 MO
High Desert Amateur Radio Group
W7JVO 144 2 7 1,314 OR
Colquitt Co Ham Radio Soc
AA4P 268 2 31 1,306 GA
Westmoreland ARC
NN4VA (+W4WHD)
181 2 6 1,294 VA
Orchard City ARC
VE7OGO 290 2 20 1,288 BC
Sacramento Mountains RC
KE5MIQ 221 2 8 1,250 NM
Hurst ARC
W5HRC 148 2 4 1,248 NTX
Lewis & Clark Radio Club
K9HAM 307 2 21 1,238 IL
Greenwood ARC
VE1ARC 188 2 12 1,238 MAR
NE AR RC
K5NEA 342 2 10 1,234 AR
IBM ARC / Lockheed ARC
W4IBM 323 2 16 1,210 GA
Victor Valley ARC
K6QWR 148 2 20 1,202 ORG
Canwarn Quebec
VE2CWQ 211 2 20 1,194 QC
Waukesha Co ARES
W9AUK (+KC9UEA)
197 2 7 1,194 WI
Robins Group
N4R 306 2 4 1,176 GA
West Santa Barbara County ARES
W9EC 158 2 6 1,166 SB
Wood Co. ARES
W9DQA 282 2 15 1,164 WI
STARS
WA7VE (+KE7RRO)
172 2 64 1,164 OR
Wexaukee ARC
K8CAD 250 2 18 1,160 MI
The Lancaster & Fairfield Co. ARC
K8QIK 187 2 22 1,144 OH
Northwest Ohio ARC
W8EQ 244 2 14 1,134 OH
W7GRA 301 2 5 1,130 OR
Mendocino Co AR Com Serv
NC6MC 228 2 20 1,106 SF
Elmore Co ARC
N2VPZ 66 2 16 1,082 ID
Radops of El Jebel Shrine
KØFEZ 186 2 21 1,078 CO
Hayward RC
K6EAG 172 2 9 1,066 EB
Portsmouth RC / SCARES
N8QA 297 2 15 1,064 OH
N9NAU 265 2 30 1,060 IN
Metropolitan ARC
K8NOW 180 2 5 1,058 MI
Warren Co RC
W2WCR 194 2 23 1,038 ENY
Hot Springs ARC
KØHS 112 2 10 1,028 SD
Buffalo AR Rep Assn
W2EUP 380 2 15 1,022 WNY
Ouachita ARA
W5HUM 130 2 10 1,014 AR
VE3AIR 127 2 4 1,004 ONE
Insurance City Repeater Club
K1CRC 247 2 16 994 CT
Pioneer AR Fellowship
W8CTT 191 2 6 988 OH
Santa Clarita ARC
W6JW 157 2 11 984 LAX
Mountain ARC
NXØG 173 2 4 948 CO
Lakes Area ARC
W5JAS 87 2 15 940 STX
Las Vegas ARC
K7UGE 223 2 40 934 NV
WK7I 234 2 12 930 ID
Hillsdale Co ARC
K8HRC 191 2 25 922 MI
Mouth of the Columbia ARC
KF7TCG 26 2 10 902 OR
AB8VV 168 2 3 902 MI
Almonte ARC
VA3AAR 289 2 6 892 ON
N9KY 112 2 13 880 KY
Club Radio Amateur de l'Estrie
VE2RAE 175 2 22 876 QC
Assn Radio Amateur de la Mauricie
VE2MO 122 2 18 876 QC
Carlsbad AR
N5CNM 152 2 5 874 NM
Captital City ARC
W7TCK 59 2 26 868 MT
Manhattan Area ARS
KSØMAN 56 2 5 868 KS
CARS
N2MQ 207 2 30 854 WNY
Lamorinda Radio Interest Group
K6ORI 120 2 10 850 EB
World RC
W3WRC 501 1 4 831 SV
Capital City ARS
AA3DC 210 2 9 810 MDC
Yakima ARC
W7AQ 128 2 8 806 EWA
Cullman ARC
N4TUN 172 2 21 794 AL
OFOG Group
WI6T 92 2 5 792 CO
Mason Co ARC
N7SK 93 2 15 780 WWA
Upper Pinellas ARC
N4WGL 192 1 15 742 WCF
W6AK 192 2 7 734 SV
West Wash Med Svcs Emer Comm Dist
AD7AW 42 2 4 734 WWA
Western CO ARC
WØRRZ (+AKØTQ)
30 2 40 730 CO
KØKSN (+KØKSN)
97 2 10 714 KS
Mystic Valley ARG
N1MV 4 2 22 708 EMA
Mountain Wave Em Comm
K7MTW 243 1 3 707 EWA
WAØZQG 77 2 3 704 IA
Indy Midtown ARC
NE9T 76 2 10 702 IN
VHARA
VE3LNZ 118 2 25 686 ONE
Inland Empire ARC
W6IER 80 2 24 632 ORG
WC8OH 31 2 12 612 OH
Brunswick-Glynn Co
WE8J 227 2 3 604 GA
Mercer Co ARC
W3LIF 260 2 18 570 WPA
Yellow Thunder ARC
WB9FDZ 75 2 20 556 WI
Radio Adventurers of ME
K1AOM 236 2 8 550 ME
WE4HOE 12 5 3 515 AL
Hill Country Mtn Toppers Assn
W5F 158 2 5 502 STX
Eastern New Mexico ARC
KA5B 115 2 25 312 NM

4A

HARC
K4BFT 4347 2 60 15,476 AL
Delaware ARA
K8ES (+W8JK)
4391 2 56 15,458 OH
Palo Alto ARA
W6ARA (+W6OTX)
4308 2 115 14,172 SCV
No Fulton ARL
K4JJ (+NF4GA)
3761 2 205 11,574 GA
Zuni Loop Mtn Expeditionary Force
N6GA 1094 5 6 11,010 LAX
Old Barney ARC
N2OB (+N2CW)
3150 2 40 10,610 SNJ
Sterling Park ARC
K4NVA (+NQ4K)
2662 2 25 9,736 VA
Contoocook Valley RC
K1BKE (+K1DFQ)
3380 2 37 9,734 NH
PCARS
K8BF (+WB8LCD)
3035 2 136 9,526 OH
PCARS
K8CAV (+WB8LCD)
3035 2 136 9,526 OH
K2VN 2573 2 42 9,186 NLI
Sussex Co ARC
W2LV (+KD2DTD)
2622 2 32 8,772 NNJ
Peel ARC
VE3XR (+VE3AZA)
2406 2 37 8,334 GTA
Va Beach ARC / VADXCC
W4UG 2167 2 47 8,312 VA
Arkansas River Valley AR Foundation
K5PXP (+W5QC)
2379 2 15 8,290 AR
Sawnee ARA
N4NE 2348 2 77 7,640 GA
Montgomery ARC
W3M (+KV3B)
1953 2 43 7,444 MDC
Vienna Wireless Soc
K4XY (+K4HTA)
1830 2 95 7,238 VA
Westchester Em Com Assn
N2SF (+N2GDY)
2003 2 35 7,236 ENY
Murgas ARC
K3YTL (+W3MTP)
2083 2 33 7,138 EPA
OR Tualatin Valley ARC
W7OTV (+N7QR)
1746 2 101 7,056 OR
Lake Monroe ARS
N4EH (+WA2FRW)
1910 2 75 6,452 NFL
Dog Hollow Contest Group
AK9D (+WGØTA)
1846 2 32 6,440 MO
LARC-FARL
K8UNS 1960 2 53 6,364 MI
Saint Petersburg ARC
W4TA (+W4GAC)
1408 2 66 6,262 WCF
Columbus ARC / Russell Co RC
W4CVY 1569 2 43 6,144 GA
Arrow/UMarc FD Team
W8UM 1467 2 20 6,142 MI
Medina 2 Meter Group
W8HN (+W8EOC)
1466 2 25 5,710 OH
Franklin Co ARC
W4FCR 1181 2 9 5,356 VA
Warminster ARC
K3DN 1661 2 39 5,312 EPA
K8EEN 1293 2 30 5,200 OH
W8VP 1134 2 35 5,126 OH
K4NAB (+KK4AMJ)
1433 2 40 5,018 SC
W5SH 1157 2 42 4,974 NTX
Peterborough ARES
VE3RB (+VE3KRG)
1298 2 30 4,696 ON
Lakeland ARC
K4LKL 1184 2 51 4,676 WCF
Northern Berkshire ARC
N1WM (+KB1DMR)
1060 2 25 4,610 WMA

So PA ARC
K3IR 1002 2 22 4,610 EPA
W7PU 1074 2 5 4,604 WWA
Johnson Co ARC
W0ERH (+W0AR)
844 2 41 4,594 KS
Alford Memorial RC
W4BOC (+KK4NFV)
844 2 78 4,510 GA
W5IU 1148 2 42 4,454 NTX
MARC / ARES
W7YAM (+KF7QZA)
394 5 29 4,440 OR
Hamfesters RC
W9AA (+K9MS)
1004 2 47 4,422 IL
3730 Group
VE3ORF 1174 2 40 4,404 ONE
Downey ARC
W6TOI 1469 2 35 4,380 LAX
Green Mountain Wireless
N1VT (+WA1VT)
1202 2 20 4,262 VT
W2AE 765 2 39 4,092 WNY
Alliance ARC
W8LKY 960 2 46 3,964 OH
Thunderbird ARC
WK7B 813 2 35 3,948 AZ
Salem ARC
W7SAA 1147 2 22 3,898 OR
Chattanooga ARC
W4AM 1227 2 23 3,824 TN
St. Louis QRP Soc
NF0R 261 5 11 3,660 MO
WCRA
W9CCU (+N9MWF)
749 2 30 3,652 IL
Pasadena RC
W6KA 1086 2 67 3,624 LAX
Dallas ARC
W5FC 1019 2 100 3,522 NTX
NW IL ARC
W9F 791 2 24 3,516 IL
Hamilton ARC
VE3DC (+VE3HTF)
914 2 45 3,504 ONS
Owatonna Steele Co ARC
N0UW 687 2 43 3,464 MN
Hoodview ARC
W7Q 990 2 24 3,446 OR
Columbia-Montour ARC
WC3A (+K3BD)
655 2 15 3,394 EPA
W7AIA (+K7JAO)
832 2 200 3,390 WWA
Texas Baptist Men
W5TBM (+K5PBA)
796 2 20 3,376 NTX
Portland ARC
W7LT 315 5 16 3,200 OR
Butler Cty ARA
W3UDX (+AA3YW)
732 2 12 3,194 WPA
K4CME (+KK4EQF)
900 2 4 3,188 WCF
North Richland Hills ARC
K5NRH (+W5HP)
708 2 45 3,140 NTX
Maryland Mobileers ARC
W3CU 674 2 42 3,134 MDC
Southern PA Com Group
K3AE 760 2 37 3,100 EPA
Orange Park ARC
K4BT 896 2 56 3,084 NFL
WW1IE 541 2 25 3,022 ME
PARC/HDXA
K0JFN (+KD0PGV)
731 2 10 3,012 NE
Shenandoah Valley ARC
W4RKC 687 2 16 3,010 VA
Fort Myers ARC
W4LX (+KK4RYG)
479 2 20 3,004 SFL
W0WTN 573 2 29 2,930 SD
Triangle ARC
K8BLP (+AC8JB)
662 2 8 2,876 OH
High Sierra FD Group
K6VT 955 2 9 2,870 SV
Hendricks Co ARS
N9HC (+WA9YI)
644 2 50 2,838 IN
Starved Rock RC
W9MKS (+K9ZQ)
452 2 49 2,832 IL
Snohomish Co Ham Club
WA7LAW 585 2 30 2,778 WWA
Colorado QRP Club - Aloha
N0CQC 173 5 28 2,770 CO
Kaw Valley ARC
W0CET 648 2 30 2,760 KS
Sun Country ARS
W4CW 536 2 20 2,714 NFL
CBRA & SLRC
K3CF 555 2 25 2,692 MDC
RAC of Knoxville
W4BBB 681 2 51 2,650 TN
Plano ARC
K5PRK (+K5LRK)
700 2 100 2,638 NTX
Sierra Foothills ARC
W6EK (+WB6VYH)
608 2 40 2,634 SV
Chenango Valley ARA
W2RME 543 2 21 2,616 WNY
Shy-WY
N7WY 593 2 13 2,562 WY
Cherryville Rep Assn II
W2CRA 430 2 25 2,514 NNJ
San Antonio RC
W5SC 504 2 23 2,472 STX
Calvert ARA
K3CAL (+KC3ADG)
565 2 30 2,392 MDC
Ole Virginia Hams ARC, Inc.
W4OVH (+W4PVA)
482 2 32 2,312 VA
K9MCE (+N9LQF)
366 2 18 2,310 IL
K6SIS 573 2 6 2,306 SV
Navarre CERT ARC
KC4ERT 469 2 20 2,222 NFL
Middlesex ARS
W1EDH 461 2 13 2,168 CT
North Bay ARA
K6LI (+K6LI)
388 2 50 2,166 EB
ARALB
W6RO 295 2 32 2,162 LAX
West Coast Ara
VE7VCC 470 2 25 2,118 BC
Elgin ARS
VE3RSE 167 5 10 2,085 ONS
Salkehatchie ARS
KK4BQ 344 2 53 2,082 SC
W6BA 529 2 15 2,050 ORG
K7CCH 312 2 37 2,040 OR
ARC El Cajon
WA6BGS 393 2 51 2,018 SDG
Radio Assn of WNY
W2PE 584 2 20 1,984 WNY
West TN MARS
W4ODR 961 2 15 1,972 TN
Chesapeake ARS
W4CAR (+W4FOS)
499 2 25 1,962 VA
Kent Com Support Team
K7CST (+N7MU)
394 2 29 1,872 WWA
South TX ARC
N5C (+N5CRP)
255 2 32 1,866 STX
Tri-Co ARC
W3TCA 356 2 24 1,798 WPA
K7SI 172 5 10 1,770 ID
San Gorgonio Pass ARC
W6PRC 183 2 29 1,758 ORG
Kachina ARC
W7EH 246 2 22 1,684 AZ
Idaho DX Assn
NI7DX 248 2 20 1,670 EWA
South East Metro ARC
W0CGM 256 2 24 1,662 MN
Nortown ARC
VE3NAR 553 2 8 1,646 ONS
AC8IE 316 2 25 1,606 OH
Skyview ARS
WX3SKY 241 2 12 1,598 WPA
Outdoor Adventure USA
K6OAU 521 2 8 1,592 SJV
Somerset Co ARC
K3SMT 474 2 21 1,576 WPA
Allegheny Valley RA
W3RA 302 2 8 1,550 WPA
Kitchener-Waterloo ARC
VE3IC 380 2 25 1,530 ONS
Beaver Valley ARA
W3SGJ 349 2 26 1,462 WPA
Fulton Co ARC
K9ILS 295 2 21 1,448 IL
Black River ARC
K8BRC 316 2 20 1,444 MI
Kent ARS
K3ARS 127 2 9 1,428 MDC
RA of Erie
W3GV 469 2 12 1,418 WPA
WN4GM FD Group
WN4GM 790 1 4 1,417 SC
San Juan Co ARS
N7JN 218 2 24 1,406 WWA
HCARC/RARA
K5SST 166 2 20 1,402 NTX
K4WOC 225 2 10 1,376 GA
North Hills ARC
WV3E 149 2 34 1,372 WPA
Mercury NW
W7MNW (+K7YON)
132 2 35 1,368 WWA
Bear Bait RC
KC2ZZO 193 2 6 1,346 NNY
King George AR Op
K4GVA 174 2 22 1,344 VA
Sandoval Co ARES
W5SCA 165 2 5 1,336 NM
NBC ARC
N2EW 207 2 4 1,324 LAX
Edison AR Network
W6SCE 223 2 12 1,298 LAX
Susquehanna Co ARC
N3SRC 242 2 15 1,298 EPA
Detroit Lakes ARC
W0EMZ 220 2 11 1,296 MN
MS Coast ARA
W5SGL 215 2 29 1,290 MS
Sierra ARC of the High Desert
N6N 269 2 17 1,230 ORG
WA8RRA 182 2 17 1,162 MI
LARA
W2RUI 136 2 26 1,160 WNY
Bellevue ARC
W0WYV (+WB0CAP)
246 2 14 1,132 NE
Delaware Valley Ragchew Club
N2HQX 27 2 27 1,130 SNJ
Riverland ARC
WR9ARC 112 2 12 1,126 WI
W0EBE (+AC0SR)
195 2 12 1,120 MO
Jonestown Mountain Repeater Assn.
N3CSE 234 2 13 1,068 EPA
Jersey Shore ARS
NJ2AR 122 2 20 1,038 SNJ
Five Flags ARA
W4UC 93 2 39 1,036 NFL
Brush Prairie Hams
WB7RDE 193 2 5 1,036 WWA
Black Diamond RG
WI9BD 382 2 14 1,022 WI
Benton Co ARES
K7CVO 49 2 19 986 OR
Sequoia ARG
N6KRV 117 2 6 984 SJV
Miller Co. ARES
AF5AW 52 2 10 982 AR
Unallocated Space
W3UAS (+W3UAS)
141 2 12 932 MDC
South Central IA Comm Support Group
W9SCI 282 2 23 930 IN
Mile Highlanders Group
W4MHG 150 2 4 908 GA
Ojisantachi
AK6D 127 2 4 904 ORG
Bonner Co ARC
K7JEP 95 2 24 880 ID
335 World Wide ARG
KF7CIA 180 2 6 810 WWA
Bates ARC
K7BTC 65 2 13 782 WWA
The 220 Mhz Guys ARC
WM9W 124 2 9 758 IL
UCARS
KK4BUM 285 2 12 720 SC
AR Caravan Club / Albuquerque ARC
N5VA (+W5FHA)
110 2 30 630 NM
Trumbull Co ARES
W8TCA 252 2 15 554 OH
Coyote ARC
K5T 122 2 6 418 STX

5A

Loudoun ARG
K4LRG (+K5NOB)
5421 2 178 17,392 VA
599 DX Assn
NA5NN (+K5DXA)
5202 2 34 16,750 MS
Albuquerque DX Assn
W5UR 4053 2 16 13,492 NM
Palomar ARC
W6NWG (+KG6JEI)
2752 2 200 10,370 SDG
Cuyahoga Falls ARC
W8VPV 2572 2 28 9,240 OH
Ozaukee RC
W9LO (+AA9W)
2743 2 40 9,190 WI
Hampden Co RA
W1NY 2387 2 50 7,966 WMA
Durham Region QRO Club
VE3QDR 759 5 5 7,845 ONE
W3AI 1944 2 25 7,116 EPA
WA3COM (+KC3HW)
1781 2 14 6,940 WPA
Bergen ARA
K2BAR (+KD2CMS)
1878 2 54 6,826 NNJ
Lake Co ARA
N8BC 1669 2 20 6,220 OH
Hazel Park ARC
W8HP (+W8JXU)
1646 2 26 6,084 MI
Fountain Valley Am Comm / West Coast ARC
WA6FV 1540 2 18 5,602 ORG
Long Island Mobile ARC
W2VL 1456 2 107 5,504 NLI
Fort Smith Area ARC
W5ANR 1232 2 20 5,420 AR
Catalina RC & Rad Soc of Tucson
W7SA (+K7RST)
1398 2 77 5,146 AZ
K0KKV (+KC0WWR)
1350 2 50 5,000 NE
Iredell Co ARS
W4SNC 1399 2 30 4,780 NC
VE3YRA 1240 2 69 4,686 GTA
Pottstown Area ARC
W3T (+K3ZMC)
1084 2 61 4,640 EPA
Garrett Co ARES
K3EE 1057 2 23 4,534 MDC
Lorain Co Wireless Group
NW8S 1086 2 12 4,532 OH
W4OLB 905 2 28 4,486 TN
Columbia ARC
W4CAE (+W4RWL)
939 2 83 4,450 SC
Cuyahoga ARS
W8BM 1190 2 29 4,402 OH
Schenectady ARA
K2AE (+W2XAD)
943 2 20 4,346 ENY
L'Anse Creuse ARC
N8LC 1265 2 16 4,330 MI
Phil-Mont Mobile RC
W3EM (+W3PSH)
1216 2 40 4,302 EPA
VE3OW 1480 2 23 4,182 ONS
Cherryland ARC
W8TCM 1475 2 15 3,916 MI
LaGrange ARC
AB4KE (+AD4GS)
995 2 40 3,890 GA
K4W (+W4CBS)
760 2 30 3,672 WCF
Orange Co ARC
W2HO (+KC2ZFO)
875 2 75 3,670 ENY
Penn Wireless Assn
W3SK 841 2 20 3,522 EPA
Muskegon Area AR Council
W8ZHO 666 2 17 3,488 MI
Lancaster ARC
W2SO 867 2 19 3,458 WNY
Wayne Co ARA
W4HS 801 2 25 3,434 NC
Turlock ARC
W6BXN 934 2 33 3,228 SJV
Richland Co ARES Group
W8WE (+W8WER)
762 2 12 3,182 OH
Central NH ARC
W1JY (+W1CNH)
522 2 26 3,162 NH
Tryon AR
K2JJI (+KB2TJE)
531 2 30 3,104 NNY
W7IVM 679 2 70 3,054 UT
Radio Amateurs of Skagit Co
N7GDE 520 2 22 2,906 WWA
Mohave ARC
K7MPR (+KE7RC)
605 2 15 2,754 AZ
Wood Co Em Com
WC8EC 500 2 25 2,750 WV
K4CO (+KY4DH)
600 2 37 2,674 KY
San Diego Six Shooters
KI6BJN 635 2 76 2,668 SDG
Isothermal ARC
K4A 708 2 15 2,640 NC
Littleton Radio Amateurs
K0AE 539 2 10 2,548 CO
North Coast ARC
N8NC 280 5 23 2,450 OH
IRCMTW
KN9V 619 2 6 2,446 IN
Alexandria RC
W4HFH (+KK4JQQ)
607 2 30 2,424 VA
Pecos Valley ARC
W5ZU 386 2 15 2,320 NM
Northern OH ARS
K8KRG 506 2 23 2,276 OH
Forsyth ARC-Hobby Park
W4WS 512 2 7 2,252 NC
Queen Anne Co ARC
K3PG 301 2 12 2,248 MDC
W2FHA 318 2 12 2,086 WNY
Shiawassee ARA
W8QQQ 404 2 10 2,044 MI
W0TX 411 2 5 1,962 CO
N8IVE 500 2 12 1,938 OH
Meeker Co ARC
K0MCR 435 2 10 1,862 MN
Elk Co. ARA
N3NIA 381 2 15 1,862 WPA
South Waterloo ARC
VE3SWA 493 2 5 1,810 ON
Lodi ARC
N6SJV 320 2 32 1,724 SJV
TCARES
K6TUO 350 2 6 1,650 SJV
Saginaw Valley ARA
K8DAC 108 2 20 1,544 MI
Tri-County Hams
KC9OLF 182 2 20 1,530 IN

Jim Olsen, K7JEO, set up his 1B station on the "edge of the world" in the Utah desert. [Jim Olsen, K7JEO, photo]

Headwaters ARC
N3PC 314 2 9 1,486 WPA
Borderline ARC
W7BAR 130 2 40 1,476 UT
Chelsea ARC
WD8IEL 69 2 15 1,386 MI
Pilot Knob ARC
KSØLV 120 2 8 1,368 KS
Western Placer ARC
K6PAC 268 2 32 1,272 SV
Glenn ARS
KG6HCG 69 2 10 1,188 SV
W3YXE 223 2 25 1,126 WPA
Plateau ARA
WV8HF 338 2 14 926 WV
Centralia Wireless Assn
W9CWA 27 2 23 822 IL
Short Mtn Repeater Club
K4L 171 2 28 568 TN
Allegan Co ARC
AC8RC 45 2 15 260 MI

6A

Mike & Key ARC
K7LED (+AE7G)
4963 2 65 15,822 WWA
South Jersey RA
K2AA (+W2EA)
3815 2 50 13,224 SNJ
South Hill CC / W7PLU EOC Group
N7PP (+W7PLU)
3822 2 18 12,634 WWA
Utah DX Assn
K7UM (+AD7KG)
3589 2 35 11,122 UT
Raleigh ARS
W4DW (+W4RNC)
3909 2 35 10,948 NC
Fox River Radio League
W9NE (+W9CEQ)
2567 2 60 9,706 IL
Central KY ARS
AJ4A 2704 2 18 8,306 KY
Rappahannock Valley ARC
K4TS (+AA2FD)
1885 2 56 7,850 VA
Fort Wayne RC
W9TE (+W9BGJ)
1457 2 46 6,580 IN
DuPage ARC
W9DUP 1262 2 45 5,234 IL
Marple Newtown ARC & Mobile Sixers RC
N3NZ (+K3MN)
1012 2 41 4,454 EPA
Bellbrook ARC
W8DGN 917 2 51 4,300 OH
Radio Am Soc of Norwich
N1NW 847 2 45 4,192 CT
Maury ARC
W4GGM 912 2 40 4,096 TN
Holland ARC
K8DAA 942 2 15 4,030 MI
Kendall ARS
KB5TX (+N5SV)
983 2 25 3,962 STX
VE3TNC (+VE3BGD)
718 2 16 3,740 GTA
WI ARC
W9CQ (+KC9DPT)
1207 2 22 3,624 WI
W3CWC (+W3HAG)
626 2 30 3,484 MDC
W6PW 463 2 20 2,940 SF
South Bay ARS
K6QM 666 2 12 2,754 SDG
Whitman ARC, Inc.
W1N 720 2 43 2,742 EMA
Wilson ARC
WC4AR 486 2 13 2,718 TN
Bolingbrook ARS
K9BAR 590 2 30 2,708 IL
Kokomo ARC
W9GO 637 2 25 2,696 IN
Midland ARC
W8KEA 458 2 25 2,524 MI
Peak RA
W7PRA 551 2 15 2,522 OR
Sabine Valley ARA
K5GVL 373 2 18 2,506 NTX
Greater Wichita Area FD
WØN (+KØW)
781 1 45 2,465 KS
Fort Venango Mike & Key Club
W3ZIC (+WM3G)
479 2 10 2,458 WPA
Crawford Co ARC
W8BAE 709 2 18 2,414 OH
Sangamon Valley RC
W9DUA 439 2 50 2,280 IL
Antelope Valley ARC
K6OX (+K6A)
513 2 12 2,210 LAX
South Wake ARC
N4SWC 541 2 12 2,168 NC
Radio Amateurs of the Gorge
W7RAG 246 2 56 2,136 OR
K8BXQ 487 2 12 2,104 OH
Calaveras ARS
N6FRG (+KI6UTW)
295 2 10 2,072 SJV
Clarksville Operating Radio Enthusiasts
AA4TA (+W4CHM)
533 2 10 1,998 TN
Sylvan Springs ARC
KJ4SWD 270 2 27 1,910 AL
East River ARC
W8MOP 321 2 12 1,894 VA
Norfolk ARC
VE3SME 322 2 12 1,770 ONS
Orange Co ARC
KB9OHY 249 2 11 1,646 IN
Jackson Co ARA
N5OS (+W5WA)
259 2 12 1,552 MS
Conneaut ARC
W8BHZ (+W8BHZ)
225 2 21 1,380 OH
Unicoi Co ARA
W4T 32 2 10 314 TN

7A

Lake ARA
K4FC (+N4FLA)
4937 2 61 15,954 NFL
W1BIM (+WA1WTQ)
2178 2 37 8,204 WMA
Sierra Nevada ARS
W7TA (+VE7VSR)
1405 2 28 6,416 NV
W6TRW (+K6OUE)
1731 2 34 5,416 LAX
20/9 Radio Club Inc
K8TKA (+KD8JMO)
1139 2 65 5,126 OH
Kalamazoo ARC
W8VY 1183 2 20 4,392 MI
David Sarnoff ARC
N2RE 335 5 41 4,300 SNJ
Ak-Sar-Ben ARC
KØUSA 546 2 21 2,548 NE
AG6AU 520 2 34 2,532 SV
VE3LON 458 2 50 2,444 ONS
Big Bear ARC
K6BB 506 2 22 2,410 ORG
Benton Co Radio Ops
WX5BC 331 2 10 2,378 AR
Broken Arrow ARC
W5DRZ (+KF5TZM)
417 2 40 2,230 OK
KS2YL 336 2 19 2,230 WNY
Brantford ARC
VE3BA 415 2 11 1,738 ONS
Toledo Mobile Radio Assn
W8HHF (+KD8QBU)
234 2 45 1,528 OH
St Joseph Co ARES / RACES
WG8V 79 2 7 208 MI

8A

Gwinnett ARS
W4GR (+K4KME)
2781 2 136 10,108 GA
Carroll Co ARC
K3PZN 2231 2 22 7,460 MDC
Niagara Peninsula ARC, Inc.
VE3VM (+VA3ROW)
2359 2 48 7,394 ONS
MVARA
W8QLY (+KD8NZF)
1177 2 50 4,962 OH
Delta Amateur Radio Society
VE7SUN 703 2 17 3,480 BC
MGRA/CGARC
K4R (+AE4XO)
715 2 75 3,068 GA
Ogemaw Arenac ARS
K8OAR 513 2 26 2,630 MI
Ventura Co. ARC
K6MEP 300 2 10 1,836 SB

9A

Woodbridge Wireless
W4IY (+KJ4VHI)
5762 2 32 19,924 VA
West Valley ARA
K6EI (+W6ZZZ)
1988 5 30 18,885 SCV
Orange Co Radio Amateurs / Durham FM Assn
W4EZ 1832 5 47 17,675 NC
Brazos Valley ARC
KK5W 2409 2 60 10,164 STX
Wabash Valley ARA
W9UUU (+K9CAT)
941 2 40 4,618 IN
Everglades ARC
W4SVI (+K4JVA)
741 2 28 3,688 SFL
Four Lakes ARC
W9JZ 641 2 57 3,262 WI
Stanislaus ARA
W6ERE (+K6JRO)
410 2 29 2,528 SJV

10A

W3VPR 1577 2 104 6,688 MDC
Ventura Co ARS & Simi Settlers ARC
N6R 1533 2 19 5,328 SB
Barry ARA
K8BMI 560 2 37 3,070 MI
Hams On The Hill
N7V 314 2 76 2,428 NV
Western Reserve ARC
W8WRC 212 2 68 2,192 OH

11A

W2MMD 2937 2 35 11,638 SNJ
Hewlett Packard Boise ARC & Voice of Idaho ARC
AB7HP (+W7VOI)
486 2 55 3,192 ID

12A

W6ZE (+W6BAC)
6859 2 108 21,258 ORG
Mississauga ARC
VE3MIS (+VE3RCX)
1882 2 20 7,496 GTA

15A

Utica Shelby Em Com Assn
K8UO 1326 5 63 13,020 MI

16A

Conejo Valley ARC
AA6CV 871 2 70 4,900 SB

29A

Potomac Valley RC / Columbia ARA
W3AO (+KE3Q)
10275 2 113 33,724 MDC

36A

DCAR
KØDCA 36 2 16 594 MO

1A Battery

Niagara Frontier Radiosport
NF2RS 473 5 3 5,000 WNY
Reno Co. ARA
WØWR 110 5 10 770 KS
K5AWC 27 5 31 535 STX

2A Battery

Elliot Lake ARC
VA3TOP 154 5 11 2,305 ONN

4A Battery

Southern Michigan ARS
W8DF 440 5 46 3,525 MI

2A Commercial

Quad Co. ARC
N3QC (+K3HWJ)
679 2 20 1,970 WPA
Lewes ARS
W3LRS 208 2 7 946 DE
Arlington ARC
W4WVP 208 2 10 716 VA
Champaign Co. ARES
WB8UCD 116 2 5 492 OH
W4FAR 76 2 10 452 NC

3A Commercial

Macon Co. ARC
NØPR (+ABØC)
641 2 12 2,962 MO
Skyline Tower ARC
W7DTV 394 2 10 790 OR
Pottawatimi ARC
South East Oklahoma ARES
K5C 139 2 25 616 OK
Southeast Louisiana ARC
W5MT 44 2 5 88 LA

4A Commercial

Flagler Palm Coast ARC
W4FPC 299 2 8 1,104 NFL

1B-1 Op

WD5COV 2204 2 1 6,220 NM
N6RK 908 2 1 3,342 SV
AB9CA/4 739 2 1 3,206 AL
K8ER 596 2 1 2,634 MI
WW7D 607 2 1 2,494 EWA
WA9Z 536 2 1 2,394 IA
N5OE 501 2 1 2,254 NTX
N4UF 541 2 1 2,206 NFL
KM5VI 1884 1 1 2,034 STX
KA2OUO 530 2 1 1,964 MDC
VE7JKZ 396 2 1 1,734 BC
NØUY 321 2 1 1,434 MN
W9KHH 238 2 1 1,400 WI
WA9STI 333 2 1 1,218 SJV
AB6S 517 2 1 1,184 SJV
KØVK 508 2 1 1,116 CO
WAØACF 239 2 1 1,106 STX
NØFKC 129 2 1 1,038 MN
KB8UHN 279 2 1 862 OH
K3WGR 176 2 1 820 EPA
NO9C 115 2 1 810 WI
K7KHC 207 2 1 796 MT
W4EEE 345 2 1 740 GA
KU4MH 125 2 1 738 VA
K6PDQ 192 2 1 734 SB
VE3RCN 217 2 1 734 ONS
KC7O 224 2 1 698 ORG
WA3YLQ 155 2 1 670 EPA
K7JEO 207 2 1 664 UT
W7IWW 250 2 1 650 MT
K1ZZ 103 2 1 562 ME
K4JAZ 94 2 1 526 AL
K6KS 80 2 1 510 SV
KB3OZA 27 2 1 504 EPA
WB5LRP 83 2 1 504 STX
KA5VZG 130 2 1 498 TN
VA2NU 73 2 1 496 ON
AG6IP 111 2 1 488 SV
AC7CJ 18 2 1 486 EWA
N8MWS 79 2 1 462 OH
KD6WKY 92 2 1 448 EB
AK4OH 94 2 1 438 VA
AJ4BB 94 2 1 438 SC
AC2GD 42 2 1 434 NLI
N5DD 140 2 1 430 NTX
KBØYTO 13 2 1 376 NE
NØNNP 42 2 1 372 MO
N3GJ 66 2 1 356 WPA
KB3WIH 40 2 1 350 EPA
VE2AHH/VO1 32 2 1 328 NL
N1DN 41 2 1 314 CT
K3LGM 80 2 1 310 NTX
WA4UEA 36 2 1 294 AL
NY2EB 18 2 1 286 NLI
KD5DLZ 66 2 1 282 OK
W3FFZ 30 2 1 270 WPA

KD7ZQQ	8	2	1	266	NH
WY7KY	56	2	1	262	WY
NA3Z	4	2	1	258	VA
VE7USX	3	2	1	256	BC
K5HAL	52	2	1	254	EPA
N6OIM	28	2	1	206	SV
N7CFO	50	2	1	200	WWA
K7HXI	13	2	1	176	OR
K5NLX	21	2	1	142	AR
KF7ETX	15	2	1	130	OR
WA7TPB	14	2	1	128	WWA
AJ4UU	13	2	1	76	AZ
N1GNV	1	2	1	52	CT

1B-1 Op Battery

KW8N	750	5	1	7,835	OH
N7OU	716	5	1	7,410	WWA
N1KW	625	5	1	6,600	IL
W3TS	492	5	1	5,370	EPA
KXØR	426	5	1	4,610	WY
W7QC	408	5	1	4,530	EWA
KEØG	414	5	1	4,240	MN
AA5CK	260	5	1	2,870	OK
NZ5A	240	5	1	2,750	STX
K4RDU	257	5	1	2,670	VA
VE3SB	237	5	1	2,620	ON
N8BB	253	5	1	2,580	MI
VE2EZD	218	5	1	2,530	QC
NQ2W	221	5	1	2,460	ENY
KD2JC	207	5	1	2,320	NNJ
N3ZP	202	5	1	2,205	EPA
WVØH	173	5	1	2,180	CO
K8ZT	199	5	1	2,110	OH
KM5TY	159	5	1	2,040	CO
KE4PT	158	5	1	2,040	SFL
N7RVD	161	5	1	1,945	EWA
N2JR	157	5	1	1,920	VA
KIØII	146	5	1	1,910	CO
WD7Y	169	5	1	1,790	NV
K5CAO	164	5	1	1,690	SV
KØG	134	5	1	1,690	CO
W3WT	133	5	1	1,660	EPA
AA4JI	264	5	1	1,620	TN
WG5F	127	5	1	1,620	OK
N1BYT	136	5	1	1,610	EMA
AAØBQ	135	5	1	1,600	MN
WF2V	142	5	1	1,535	WNY
K1PDY	117	5	1	1,520	NH
AF4O	106	5	1	1,505	TN
K5AB	140	5	1	1,500	STX
AA1PL	136	5	1	1,500	RI
NC4RT	123	5	1	1,480	NC
VE3MGY	100	5	1	1,450	ON
W4LDA	129	5	1	1,440	GA
VE3EDX	116	5	1	1,410	ONN
NQ7R	133	5	1	1,375	AZ
WA7ZZB	68	5	1	1,240	EWA
AK4BH	107	5	1	1,215	SC
K8FC	106	5	1	1,210	WNY
WØQL	92	5	1	1,170	CO
WB3CEG	90	5	1	1,150	STX
WUØL	80	5	1	1,150	ND
VE3UZ	85	5	1	1,100	ONS
W6UB	102	5	1	1,070	TN
W7CD	53	5	1	1,060	WWA
K3TW	45	5	1	1,000	NFL
W6GF/7	158	5	1	990	WY
WØJRP	79	5	1	990	MO
AB3AP	79	5	1	940	EPA
AA8OY	68	5	1	930	OH
NE3R	146	5	1	880	WV
WA9PYH	72	5	1	870	IN
KØEWS	72	5	1	870	IA
K7NS	67	5	1	870	UT
KC0INP	69	5	1	820	MN
NA6MG	77	5	1	820	LAX
KK6YB	84	5	1	770	LAX
W7BBO	52	5	1	760	WWA
VE3WDM	50	5	1	750	ON
VE3AAQ	46	5	1	710	ON
WD5HNI	65	5	1	705	STX
KBØHQM	30	5	1	700	KS
K5KMS	109	5	1	695	NTX
K6CU	53	5	1	680	ORG
WA4MXF	48	5	1	680	TN
VE6ZC	55	5	1	655	AB
W9SRB	60	5	1	650	IL
WØCZ	35	5	1	650	ND
KFØXV	49	5	1	640	KS
AB3RU	48	5	1	630	WPA
W7JEX	51	5	1	610	UT
WB6AAJ	51	5	1	585	SCV
NUØT	68	5	1	565	CO
WB4JJJ	33	5	1	530	VA
KL7WP/7	46	5	1	510	OR
KI6SN	36	5	1	510	ORG
N8GU	25	5	1	500	OH
W2EB	25	5	1	500	WNY
WA4ZOF	34	5	1	490	MI
N3KCM	46	5	1	480	EPA
KBØQND	12	5	1	470	IA
K1MBO	32	5	1	470	RI
K6RHB	33	5	1	465	SB
KI6TPX	23	5	1	465	LAX
KI6FEN	31	5	1	460	SF
AC7QJ	39	5	1	445	UT
KB1ZBU	38	5	1	440	VT
WA6ARA	35	5	1	440	SV
W7SAG	49	5	1	440	ID
VE7BQO	19	5	1	435	BC
KL7/WA4DOX	28	5	1	430	AK
WDØFAA	28	5	1	420	EB
AC2HJ	26	5	1	410	WNY
AE5KA	24	5	1	390	OK
W6LPW	22	5	1	370	SCV
K5WI	12	5	1	370	NTX
VA3CME	21	5	1	355	ONE
VE5JZ	25	5	1	350	SK
N4IX	37	5	1	335	GA
K3ICH	35	5	1	325	VA
WA4HWT	44	5	1	320	GA
NKØE	17	5	1	320	CO
K2ULR	16	5	1	305	EPA
WX4USA	15	5	1	300	AL
AB8XX	5	5	1	290	OH
KDØSTU	8	5	1	290	NE
N1IVY	5	5	1	275	ME
K3BYU	34	5	1	270	WWA
YV5IAL	2	5	1	270	DX
N4HA	20	5	1	250	NC
WB6HVH	10	5	1	250	SJV
N6VNO	14	5	1	240	SCV
WA3TZH	9	5	1	240	EPA
KA6QWY	12	5	1	215	IN
W3MEO	11	5	1	210	MDC
KC7WZL	30	5	1	200	ID
NF8M	5	5	1	200	MI
W8WTS	4	5	1	190	OH
WB7ENX	6	5	1	180	AZ
W1LVT	12	5	1	170	VT
KB1WXC	2	5	1	170	EMA
AE7DW	3	5	1	165	AZ
KC7DM	6	5	1	160	OR
WD9EEK	13	5	1	115	IL
W4NBF	7	5	1	95	AR
VE7HLW	4	5	1	70	BC
W4TKB	1	5	1	55	WCF

1B-1 Op

N3JJT	200	2	1	1,100	OH
W3SFG	131	2	1	574	MDC
K5JJR	173	2	1	496	NTX
KP3ER	31	2	1	374	PR
WB5LAI	155	2	1	360	MS
KC9QPM	127	2	1	304	IL
N4NTO	50	2	1	250	NC
K7DNH	242	1	1	242	NV
VE6GD	85	2	1	184	AB
KC2RXS	25	2	1	150	ENY
AC5VF	3	2	1	56	NTX
N7LQK	1	2	1	2	AZ

1B-2 Op

WØAA	1160	2	2	5,256	MN
K7GGG	959	2	2	3,132	AZ
K7A	524	2	2	2,900	MT
WO9Z	821	2	2	1,792	IN
W8AWE	428	2	2	1,558	MI
K7RF	387	2	2	1,458	OR
W7WSV	220	2	2	1,130	AZ
K7VK	172	2	2	1,034	MT
K7YB	240	2	2	902	MT
W5WHN	64	2	2	852	NM
WA6RC (K6LMN,op)	112	2	2	824	LAX
W7CH	250	2	2	750	EWA
WA4KCO	176	2	2	622	NC
KU4UV	102	2	2	522	KY
KB1UJS	110	2	2	484	ME
KVØCO	150	2	2	454	CO
KDØWY	77	2	2	404	IA
KB1T (+KB1RWI)	110	2	2	390	NH
AD7BF	46	2	2	342	WWA
W4YS	93	2	2	336	SB
K4PMT	40	2	2	310	NFL
WA2EZG	60	2	2	270	NNJ
WØEM	55	2	2	252	CO
W7HBP	42	2	2	234	EWA
WB3IOS	31	2	2	172	EPA
N8ZKT	5	2	2	160	MDC
K2UNI	40	2	2	130	ENY

2B-2 Op

WD5F	996	2	2	4,014	NTX
W3SW	713	2	2	1,992	WNY
N2UC	379	2	2	1,866	WNY
WA2AEA	348	2	2	1,826	NNY
W7ZRC	276	2	2	1,252	ID
N9US	119	2	2	1,246	WCF
W7EAT	191	2	2	1,142	WWA
AD6Q	134	2	2	828	NC
AE6FD	176	2	2	702	SJV
K9MEV	7	2	2	364	IL
K7QFE (+W7NVR)	68	2	2	336	OR
KØREX (+ KB6FBD)	23	2	2	246	NV

1B-2 Op Battery

N4DD	736	5	2	7,610	VA
VA3DF	499	5	2	5,530	GTA
W9FHA	512	5	2	5,470	IN
N3CU	510	5	2	5,350	WPA
N4LG	447	5	2	4,820	KY
K8QWY	405	5	2	4,100	OH
W7EL	326	5	2	3,610	OR
VA3YV	367	5	2	3,515	ONS
W5ODS	297	5	2	3,305	OK
KØFTC	275	5	2	3,100	WY
K2WNY	257	5	2	3,060	WNY
N4RE	257	5	2	2,820	NC
W7RIN	250	5	2	2,540	AZ
W1M	426	5	2	2,325	ME
K6WC	125	5	2	1,755	SCV
W7JWT	185	5	2	1,275	EWA
N8WL	44	5	2	1,120	OH
NGØR	62	5	2	990	MN
K3TN	61	5	2	960	MDC
K7HZ	42	5	2	670	OR
KU7PDX	80	5	2	650	OR
WA5ZNU	7	5	2	515	SCV
AK4LZ	37	5	2	505	SFL
AC8GS	28	5	2	490	OH
NZ5G	25	5	2	485	STX
N6AE	42	5	2	460	SV
N8HM	11	5	2	340	MDC
N8FWY	10	5	2	300	OH
KC2JRQ	4	5	2	190	NLI
WA5DSS	17	5	2	160	STX
BØGUS	5	5	2	100	CT

2B-2 Op Battery

K3ZZ	835	5	2	6,970	MDC
KØNE	400	5	2	4,605	NE
WM4AA	282	5	2	3,260	SC
N4T	251	5	2	2,855	GA
N9F	47	5	2	905	WI
ADØCZ	23	5	2	670	MN
W9EWW	30	5	2	655	WI

1B-2 Op

N8KD	1041	2	2	4,136	MI
NFØT	169	2	2	682	IA
N8NOE	83	2	2	216	MI
N9IZ	64	2	2	178	IN

2B-2 Op

NE7D	724	2	2	2,946	OR
KB4CC	305	2	2	1,470	GA

The Nashoba Valley ARC set up their 1A effort near a bird-nesting sanctuary in Pepperell, MA — after receiving a permit from the Town Conservation Commission, of course! [Ralph Swick, KD1SM, photo]

Mobile Stations

1C

K4MTI/M	764	5	1	7,740	NFL
AA1K	390	5	1	4,050	DE
W1JCW	324	5	11	1,970	OK
N2CU	175	5	1	1,900	WNY
W5RE/MM	325	2	1	1,750	NFL
K7VO	731	2	1	1,712	WWA
WX7G	380	2	1	1,620	UT
K3ONW	368	2	1	1,522	EPA
K1GGI	319	2	1	1,426	EMA
WU3U	244	2	1	1,424	EPA
W9XS	270	2	1	1,288	IL
K4AEN	210	2	2	980	VA
NA1GB	173	2	2	734	EMA
W7CGA	99	2	1	646	NM
N3PV	121	2	1	534	SDG
W3AW	96	2	1	532	IL
W4ZPR	65	2	1	460	VA
N7DLV	44	2	1	438	WWA
WØAO	84	2	1	438	MT
W3AG	63	2	1	402	IL
W7VN/M	96	2	1	386	OR
AE5KJ	100	2	1	350	STX
KJ6RNN	68	2	1	286	SV
NR9EM	53	2	1	284	MI
K3GHH	55	2	1	270	MDC
K9JK	20	5	1	260	IL
K5VHH	68	2	1	236	STX
AD1N	40	2	1	230	AZ
KE4KE	19	2	1	226	MN
N8TFD	59	2	1	214	OH
AC2JO	29	2	1	208	NC
KØBRG	29	2	1	208	MN
KA3KSP	54	2	1	208	WPA
N3TG	19	2	1	188	VA
KC9KRB	16	2	1	182	IL
NØOMC	37	2	1	174	KS
WA4CHJ	12	2	1	174	VA
W1ZR/MM	5	2	2	160	CT
N6IGI	53	2	1	156	ORG
NØJK	1	5	1	155	KS
N4ERD	2	2	1	154	VA
AJØEB	1	2	1	152	NNY
K7RA	33	2	1	148	WWA
K1MAZ/M	21	2	1	142	NC
VE6AB	43	2	1	136	AB
KA1KNW	16	2	1	132	CT
KF7UXC	27	2	1	120	WWA
W8TR	33	2	2	116	MI
N5SQR	12	2	2	98	NM
KE7MPN	10	2	1	70	WWA
K5WL	9	2	1	68	NTX
AC8AI	9	2	1	68	IN
K9CEW	5	2	1	60	IL
N3AEA	5	2	1	60	MDC
NWØF	1	2	1	52	NTX

2C

W1AF/M	66	2	2	388	EMA

3C

K8LL	19	2	1	388	OH

Home Stations Commercial Power

1D

K8GG	956	2	2	3,974	MI
AA2BJ	1006	2	2	3,542	EPA
K8BTU	685	2	1	2,790	OH
KU8E	798	2	1	2,768	GA
N9CO	641	2	1	2,614	IL
W6SX	617	2	1	2,518	SJV
K9UQN	524	2	1	2,164	TN
KK9DX	469	2	1	1,926	IL
K3WW	469	2	1	1,926	EPA
KB3LIX	415	2	1	1,688	WPA
VA7ST	404	2	1	1,666	BC
KC3M	401	2	1	1,654	EPA
K5KDX	826	2	2	1,652	AR
N8BV	798	2	1	1,646	OH
WAØBJR	535	2	3	1,502	MO
N3KR	362	2	1	1,498	EPA
W4NHO	300	2	2	1,450	KY
N6JF	347	2	2	1,438	ID
WØUI	336	2	1	1,332	CO
WB3ESR	317	2	1	1,254	EPA
WA3AAN	571	1	1	1,192	EPA
VA7OM	600	1	1	1,180	BC
K3KU	314	2	8	1,144	MDC
N9OF	270	2	1	1,124	STX
NWØM	264	2	1	1,106	MO
NJ1K	1045	1	5	1,095	VA
W3CB	216	2	1	1,040	MDC
K2MK	500	1	1	1,037	SNJ
W8TM	269	2	1	1,032	OH
NX9P	260	2	2	1,022	IL
WB8RFB	239	2	1	984	IL
W9XB	465	2	1	980	IL
K6LRN	202	2	1	958	SV
NQ5K	450	1	1	950	STX
KK7XX	888	1	1	938	EB
K9PMV	223	2	1	920	IL
WR5O	326	2	4	902	WTX
K5SS	207	2	1	878	NTX
W7QN	205	2	1	870	WWA
K6SB	205	2	5	870	SB
N9NM	204	2	1	866	STX
WB5UDA	204	2	1	866	NTX
WX1S	237	2	1	860	NH
N8UR	224	2	1	850	MI
W4TFR	357	2	3	844	GA
WØVFW	830	1	6	830	KS
WAØGUD	211	2	1	812	IA
AI4QR	218	2	3	800	AL
WB4MJF	719	1	1	769	WNY
WB2FAU	381	2	1	762	SFL
K4DJ	178	2	1	762	NC
KB6PJU	705	1	1	755	SDG
KC4TVZ	685	1	1	735	GA
W5JBO	161	2	1	694	STX
KM4I	319	2	2	688	TN
AG6AN	296	2	1	662	LAX
K9NW	163	2	1	646	OH
KB6UNC	319	2	1	638	UT
K6CSL	146	2	1	634	SJV
KC3Q	145	2	1	630	EPA
KS4X	177	2	1	614	TN
N1DID	181	2	1	610	EB
K5EEE	221	2	1	592	SFL
VE3XAT	135	2	1	588	ON
NE2T	122	2	1	588	WNY
AA5VU	137	2	1	582	STX
KG8YT	133	2	1	582	MI
WAØRKQ	244	2	1	562	KS
K4AMQ	168	2	1	552	TN
K3UA	124	2	1	546	WPA
K9SG	468	1	1	541	IN
K4VV	123	2	2	522	VA
AAØA	506	1	1	506	MO
WA2JQK	180	2	1	504	ENY
VE7CA	125	2	1	500	BC
W9WXN	25	2	1	500	IN
KE5LQ	130	2	1	498	STX
K1WVO	172	2	1	494	NH
KE2WY	111	2	1	494	WNY
N3GGT	107	2	1	478	EPA
W4XK	104	2	1	466	TN
N5WW	116	2	1	464	STX
N8OC	123	2	1	464	MI
KØJJR	78	2	1	462	MN
WA3IVV	115	2	1	460	WPA
WIØS	102	2	1	458	MN
K7SEX	140	2	1	456	WWA
KJ4QAN	94	2	1	438	NFL
N3UA	108	2	1	432	VA
WA7YNU	105	2	2	430	MT
W3FME	140	2	4	430	DE
AA6EE	106	2	1	424	SDG
KC2MBV	116	2	1	422	NLI
W1WAB	76	2	1	422	WCF
W7KG	133	2	1	416	MT
K4FTO	104	2	1	406	VA
AL1G	205	1	1	405	AK
W3NCR	86	2	1	394	MDC
AA8IA	100	2	1	394	OH
KD7HHW	83	2	4	394	UT
K2CYE	86	2	1	392	ENY
KD7ADH	171	2	1	392	EWA
NØFIB	85	2	1	390	MO
WA8FRE	384	1	1	384	MI
W4BWQ	160	2	1	370	NFL
KB7YSY	110	2	1	370	AZ
K2TTM	91	2	1	364	NLI
W6AAJ	157	2	1	364	SDG
N5QO	156	2	1	362	AR
N4PCC	155	2	1	360	NFL
ABØOA	178	2	1	356	MO
WO8L/6	89	2	1	352	ORG
KB6A	75	2	1	350	ORG
KØUK	74	2	1	346	CO
KØTT	147	2	1	344	MN
NM4SH	73	2	1	342	VA
K3OQ	219	1	4	342	MDC
W4HDW	93	2	5	336	VA
N8LGQ	142	2	1	334	VA
WX9DX	282	1	5	332	IL
KB7HDX	139	2	1	328	EWA
WØBXR	27	2	30	324	IA
W1LIC	71	2	1	322	WCF
N6WN	72	2	1	318	OR
K7EIQ	65	2	1	310	EWA
N4NSS	65	2	1	310	WI
KQ6LV	125	1	1	300	ORG
KSØM	62	2	1	298	MO
KO6JF	149	2	2	298	EB
WB3CII	71	2	1	294	MDC
N1NN	60	2	1	290	EMA
W6CT	35	2	1	290	SCV
N6RLS	54	2	1	288	EB
AA1PR	144	2	1	288	VT
W4VHF	236	1	1	286	VA
K5DE	97	2	1	286	MS
W1AVK	116	2	1	282	CT
WA8HSB	58	2	1	282	AL
KO6OP	116	2	2	282	SJV
KC5YWN	115	2	1	280	AR
KJ4IZW	57	2	1	278	SC
NØNS	55	2	1	270	IA
N5ATM	105	2	1	268	NTX
NE4TN	134	2	1	268	TN
WA7BME	54	2	1	264	UT
NJ1Q	65	2	1	260	CT
K1BZ	194	1	1	258	MDC
AB2ZO	27	2	1	258	ENY
N1KRT	102	2	1	254	EMA
KØLAR	50	2	1	250	MN
KD4NEM	124	2	1	248	VA
N8BP	68	2	1	248	NTX
KD4YDC	99	2	1	248	GA
N4MBI	97	2	1	244	NC
WA6GFR	48	2	1	242	ORG
AD5XR	186	1	1	236	MS
WN4AFP	48	2	1	236	SC
WD4DC	116	2	1	232	WCF
WB6DIK	42	2	1	230	ORG
KAØEIC	45	2	1	230	KS
AD7MC	35	2	1	228	WWA
KJ4TUW	16	2	1	228	NFL
KI4SHR	89	2	1	228	AL
KD3SB	113	2	1	226	WPA
WØEB	44	2	1	226	KS
NC4MI	69	2	1	226	NC
KO7X	92	1	1	225	WY
N4NC	56	2	1	224	NC
W6RQR	18	2	1	222	SV
KK4DZP	54	2	1	220	NFL
KA7SPS	42	2	1	218	OR
WM9E	58	2	2	216	WI
KI5LR	80	2	1	210	STX
WB3CJU	105	2	1	210	EPA
N9WKW	108	1	1	206	IN
K4GOP	77	2	1	204	NFL
WB7OND	51	1	1	203	NC
N8PFK	76	2	1	202	MI
VE2KOT	50	2	1	200	QC
WE7H	52	2	1	196	AZ
N8LBF	72	2	1	194	MI
WØPAN	51	2	1	194	AZ
WE6EZ	86	2	1	194	STX
N3JNX	39	2	1	192	EPA
N6SL	95	1	1	190	NFL
N3GO	34	2	1	186	NC
WB9LRK	68	2	1	186	IN
KH6HME	36	2	2	186	PAC
W1WIU	152	1	1	185	RI
N4YHC	57	2	1	184	KY
W2PQG	16	2	2	182	NNJ
VE3RSA	33	2	1	182	GTA
KE5MO	65	2	1	180	NTX
PV8DX	10	2	1	178	DX
KA2IWK	13	2	1	176	WNY
NØYBC	123	1	1	173	GA
ND3R	36	2	1	168	WPA
K1NV	51	2	1	166	SV
VE2CEV	29	2	2	166	QC
KK4CIS/8	40	2	1	164	WV
W9II	56	2	1	162	IL
WA7HDZ	28	2	1	162	EWA
KJ4WD	55	2	1	160	NC
KC5HAV	79	2	1	158	STX
VE3CV	54	2	1	158	ONS
WB2KXC	78	2	1	156	LAX
KF6FIX	14	2	1	156	ORG
KØEQH	78	2	2	156	KS
WA7GNP	2	2	1	154	WWA
K6III	52	1	1	154	SV
AD5SR	52	2	1	154	OK
K1QW	26	2	1	154	STX
KF7VG	1	2	1	154	WWA
AC0E	26	2	1	154	KS
VA3FN	26	2	1	154	ONS
WC8Z	51	2	1	152	OH
W5TTY	51	2	1	152	STX
AC6TU	25	2	1	150	LAX
N6STA	25	2	1	150	LAX
VE3EEE	26	2	1	150	ON
N1IA	25	2	1	150	WNY
N6QEK	73	2	1	146	SDG
N5TOL	46	2	1	142	WTX
KF5OIO	25	2	1	140	OK
KU1Q	55	2	2	140	CT
KC8ACO	70	2	3	140	MI
KG6MXO	10	2	1	140	OK
KD8SPF	44	2	1	138	OH
AAØLV	44	2	1	138	KS
KB3INE	44	2	1	138	SC
KG7HR	43	2	1	136	ORG
KI6IHW	28	2	1	136	SF
KE4TVV	39	2	1	134	TN
KB3SJQ	21	2	1	134	EPA
VK4TT	33	2	1	132	DX
K3VED	65	2	1	130	WPA
K3TVC	40	2	1	130	EPA
N1MD	20	2	1	128	CT
N8EBN	38	2	1	126	AZ
WØNFS	38	2	1	126	MO
KF4USB	38	2	1	126	SC
K6SHS	62	2	4	124	SV
AA8N	37	2	1	124	MI
KD4QMY	37	2	1	124	GA
W5JEP	36	2	1	122	AR
K7JQ	50	1	1	121	AZ
WB5CCO	35	2	1	120	LA
NF9T	60	2	1	120	IL
KJ4LEN	21	2	1	118	NFL
KA1PPV	17	2	1	118	CT
N7TMS	34	2	1	118	ID
KB9O	17	2	1	118	IL
KC8KVA	33	2	1	116	WV
KC4IYD	23	2	2	116	OH
VE2XL	57	2	1	114	QC
VE2KY	31	2	1	112	QC
KØZFK	31	2	3	112	MO
KF7DX	50	1	1	111	WWA
KB4VC	15	2	1	110	WCF
K2DLS	30	2	1	110	NNY
AC2EV	30	2	1	110	WNY
KQ5M	54	2	1	108	NM
NN1AA	16	2	1	108	EMA
KE7SW	29	2	1	108	WWA
VA7HZ	18	2	1	106	BC
KC4QYG	20	2	1	104	VA
KB3ANZ	26	2	1	102	MDC
N8VNR	26	2	1	102	NC
WD4EXI	13	2	1	102	GA
N3IJW	13	2	1	102	VA
K6GRL	49	2	1	98	SCV
W7JSD	15	2	1	98	AZ
KM5ART	23	2	1	96	NTX
KF4IRC	18	2	1	96	AL
WJ3P	17	2	1	96	SNJ
K7UAZ	48	2	1	96	AZ
KK1MM	23	2	1	96	EMA
KD7WAE	23	2	1	96	MT
WO2N	14	2	1	96	NLI
AE2NG	22	2	1	94	WNY
KJ4OAS	22	2	1	94	VA
KA1RFD	11	2	1	94	ME
AA6TS	22	2	1	94	SDG
KC1EL	22	2	1	94	ME
K2DV	46	2	2	92	WNY
K9DVB	21	2	1	92	WI
KF5UTZ	21	2	1	92	NTX
KF6RXB	41	1	1	91	SF
KG6HXN	20	2	1	90	SCV
DL1QQ	90	1	1	90	DX
AD7GU	20	2	1	90	SJV
W2RR	20	1	1	90	WNY
W5QLF	10	2	1	90	STX
KE4QNO	19	2	1	88	MDC
K4IJK	19	2	1	88	RI
KI6DAR	19	2	1	88	SCV
KB2GD	19	2	1	88	WNY
KB4LHP	19	2	1	88	NFL
N8AGU	22	1	1	87	OH
KD8RBW	43	2	1	86	MI
W4CLQ	13	2	1	86	OH
K3MAF	18	2	1	86	VA
KB9UFG	43	2	1	86	IN
K1LHO	8	2	1	82	CT
KDØMGJ	16	2	1	82	KS
W4MDF	16	2	1	82	NC
VE3TW	40	1	1	80	ONE
N2GT	40	2	1	80	NNJ
KJ6UPL	15	2	1	80	SV
KA6MLE	15	2	1	80	SB
KK4IQD	14	2	1	78	NC
KJ4PXJ	7	2	1	78	SC
KJ6MSG	14	2	1	78	SJV
K6BSD	13	2	1	76	ORG
KK4RRX	13	2	1	76	WCF
N9NUZ	13	2	1	76	WI
NY7N	26	1	1	76	AZ
KO8S	13	2	1	76	MI
KJ6VX	13	2	1	76	SDG
KD2AMC	2	2	1	74	ENY
KE6PPE	12	2	1	74	SCV
N1OJW	12	2	1	74	WMA
KG7BFP	12	2	1	74	MT
KE5DNZ	12	2	1	74	NM
KT5QQ	11	2	2	72	NM
N6TWA	36	2	2	72	ORG
N4WPJ	10	1	1	70	SC
N1RLR	10	2	1	70	EMA
K7VBY	5	2	1	70	OR
WB7CLF	10	2	1	70	WWA
KJ4VD	10	2	1	70	TN
N6OIL	10	2	1	70	ORG
AE2MS	35	2	1	70	WNY
K6MUG	9	2	1	68	LAX
K7IP	8	2	1	68	WWA
KB3GJT	9	2	1	68	EPA
K1FUN	4	2	1	66	STX
JA3JM	4	2	1	66	DX
N2DMK	8	2	1	66	SNJ
KAØP	5	2	1	66	MO
VA7YJJ	8	2	1	66	BC
K6KR	8	1	1	66	WWA
N8KOJ	15	1	1	65	OH
KE9EX	32	2	1	64	IL
KDØLUM	6	2	1	62	KS
K7JKM	31	2	1	62	OR
NO8C	17	2	1	62	OH
KF7OVD	6	2	2	62	AZ
N1YIS	6	2	1	62	ME
K5JEF	11	1	1	61	AR
KA6AMB	5	2	1	60	SCV
N7XVQ	4	2	1	58	AZ
NØOII	29	2	1	58	SD
KD8OBW	26	2	1	52	OH
K8YXB	13	2	1	52	MI
K1GTK	26	2	1	52	MO
KF7MBM	1	2	1	52	WWA
WA5YNE	49	1	1	49	OK
KO6YG	23	2	1	46	SCV
N7NTM	23	2	1	46	AZ
W9SE	18	2	1	42	IL
N3BPB	21	2	1	42	WPA
K9IDQ	40	1	1	40	IL
KC7YE	10	2	1	40	WWA

WB9MMI	10	2	1	40	IL
AH6SZ	19	2	1	38	PAC
KJ6CWZ	19	2	1	38	EB
UX3MZ	33	1	1	33	DX
K2HVE	32	1	1	32	NNJ
N6TCZ	22	1	1	30	LAX
K9SQG	27	1	1	27	OH
KØRRP	13	2	1	26	NC
K2CMH	13	2	1	26	GA
AF5FH	8	2	1	26	NM
KF7UMW	12	2	1	24	OR
W2QYV	21	1	10	21	WNY
W2UIS	10	2	1	20	ENY
KI4WFJ	15	1	1	15	SC
K4PED	14	1	1	14	AZ
KC2WXZ	2	2	1	4	ENY

2D

N2BJ	2004	1	3	2,409	IL
N2XP	851	2	3	2,260	NNJ
W2BK	805	2	10	1,760	ENY
WA4T	269	2	13	1,436	WCF
K7ID	318	2	21	1,326	ID
W5TB	226	2	3	912	NTX
N1YF	215	2	3	900	ME
NK5G	191	2	1	814	STX
NØA	173	2	6	696	MO
AJ5Q	139	2	10	648	OK
VE3GBY	214	2	7	592	ON
W6CSA	258	2	1	566	MS
W2ZQ	56	2	15	562	SNJ
N9ZWY	166	2	5	422	WI
K2VK	63	2	4	292	NNJ
W6NAG	108	2	2	266	SCV
K4TAK	29	2	1	262	TN
WT3C	100	2	2	250	MDC
N4EMP	103	2	2	236	AL
K8RJW	82	2	2	214	OH
N9QID	65	2	3	180	MI
KK6DPE	61	2	2	172	ORG
W5DPT	41	1	3	111	STX
WØMI	55	1	11	105	KS
N6ISL	26	2	1	102	EB
W1VCM	66	1	5	67	CT

3D

N5KWN	694	2	5	2,744	STX
W8USA	777	2	7	2,712	MI
W5RTA	718	2	6	2,390	STX
N2OEF	64	2	3	178	SNJ
KK4OIU	10	2	3	70	VA

4D

W9HW	375	2	6	842	IL
W9GUS	114	2	12	768	IN

Home Stations Emergency Power

1E

NR5M	2925	2	2	9,020	STX
N4BP	2105	2	1	8,870	SFL
AA3B	2149	2	1	8,846	EPA
K9CT	1791	2	3	7,514	IL
N4PN	2402	2	1	6,448	GA
K6AM	1802	2	2	6,272	SDG
K1DW	1385	2	2	5,890	LA
N9TK	1122	2	3	4,838	IL
KF9D	1124	2	2	4,746	IL
W9TS	404	5	1	4,290	IL
K6LL	1000	2	2	4,150	AZ
AE5GT	978	2	1	4,062	STX
WZ2T	364	5	1	3,990	NNY
K7TD	939	2	2	3,906	CO
W4UT	344	5	1	3,555	TN
KT8K	873	2	3	3,534	MI
WW4B	325	5	1	3,500	NFL
W1ECH	335	5	1	3,405	VT
W3HGT	1351	2	6	3,360	WPA
NY4N	851	2	1	3,350	TN
K1EEE	1076	2	3	3,308	NH
K4WW	1000	2	1	3,250	KY
KY7M	1072	2	1	3,230	AZ
N5LZ	283	5	1	2,980	UT
K1MK	677	2	4	2,978	WMA
WA8REI	262	5	1	2,870	MI
WA1ENO	1289	2	2	2,828	EMA
NB4M	265	5	1	2,800	TN
NØEF	255	5	1	2,800	MT
WA2EQF	650	2	4	2,792	NNJ
K7IA	566	2	1	2,614	NM
N7ETC	230	5	1	2,500	WWA
NV4B	218	5	1	2,430	AL
VE7NI	205	5	1	2,400	BC
WØDZ	523	2	1	2,342	CO
WA1VKO	840	2	1	2,330	NH
KU4V	829	2	1	2,326	NC
W6AFA	1077	2	1	2,304	LAX
AF5B	222	5	1	2,285	NTX
N6TV	483	2	1	2,182	SCV
AG2J	533	2	1	2,182	SNJ
KDØQ	587	2	1	2,108	IA
N4CF	210	5	1	2,105	VA
W2DPT	171	5	1	2,055	NNJ
K4BSK	450	2	1	2,046	VA
NØFCD	765	2	1	1,890	IL
K2KGJ	161	5	1	1,860	ENY
K8ET	703	2	2	1,850	MI
VA3KAI	169	5	1	1,840	ON
K9FOH	159	5	1	1,730	IN
WA4FOM	163	5	1	1,720	NNJ
K7EA	382	2	1	1,678	UT
KYØQ	151	5	2	1,660	IL
WB2PEF	157	5	1	1,620	WNY
WR2G	330	2	1	1,588	NNJ
W8NNC	132	5	1	1,570	OH
AA4LR	363	2	1	1,496	GA
K6RB	358	2	1	1,482	SCV
AA4GA	136	5	1	1,460	GA
NK8O	130	5	1	1,450	KS
KU4A	150	5	1	1,450	KY
VE2AWR	356	2	1	1,430	QC
W7GB	280	2	1	1,420	EWA
N7NB	117	5	1	1,420	WWA
WG4FOC	105	5	1	1,400	NFL
KA2FHN	122	5	1	1,340	WNY
W7M	637	2	5	1,324	AZ
WA5TVO	268	2	1	1,322	SDG
K2OGT	264	2	1	1,306	EPA
NV9X	111	5	1	1,260	IL
N8OQ	201	5	1	1,255	VA
KB2MN	101	5	1	1,255	SNJ
KØRFD	348	2	2	1,250	CO
KC8UR	284	2	1	1,236	OH
AAØPO	1138	1	1	1,188	MO
NW3H	168	2	5	1,184	EPA
AD1L	443	2	1	1,154	WMA
NI7R	100	5	1	1,150	AZ
W6RKC	275	2	1	1,150	SV
N6NF	832	1	1	1,150	SCV
K6TY	160	2	3	1,090	LAX
K6KQV	246	2	1	1,070	SCV
KK5JY	232	2	1	1,048	OK
N1AGE	309	2	1	1,046	EMA
AA8V	210	2	1	1,040	MDC
N2KTV	100	5	1	1,020	ENY
KCØVEP	69	5	1	1,010	NE
AK4QU	248	2	1	992	TN
VE3PYG	179	2	1	988	ONE
KD7MSC	255	2	1	988	OR
W3KS	364	2	1	978	DE
VE6AO	814	1	12	964	AB
W8UE	91	5	1	960	MI
KB7EEG	399	2	1	956	UT
KG2R	377	2	2	954	SNJ
KC8SQC	78	5	1	930	MI
KJ4RSK	638	1	3	908	NFL
KB2URI	113	2	1	898	WNY
N7NEV	56	5	1	895	AZ
KB8U	267	2	1	892	MI
N6EF	213	2	1	888	SV
KB5EZ	148	2	1	886	AL
K7IOC	399	2	1	848	WWA
NR5ON	46	5	2	830	NM
WH7W	297	2	1	812	PAC
KEØCO	83	5	1	800	WWA
W9K	220	2	5	790	IL
AE5MM	151	2	1	754	OK
KG4RUE	301	2	1	752	SC
AA2JZ	150	2	1	750	NFL
W4EON	175	2	1	750	VA
WB6FDY	124	2	1	698	IL
N6KZ	165	2	1	690	AZ
K1TN	321	1	1	687	WI
W5UGD	197	2	4	664	SC
N1HO	127	2	1	658	SFL
K9OZ	151	2	1	654	IL
KØLUW	123	2	1	642	NE
KC9AOP	156	2	1	640	IL
N2MTG	241	2	1	632	ENY
W3EK	96	5	1	630	DE
W9CHD	126	2	1	604	WI
N5LH	125	2	1	600	AR
K7RFW	87	2	1	598	UT
KG6S	161	2	2	594	SV
KB5URQ	485	1	1	585	STX
K3ORS	167	2	1	584	TN
WA8YVF	154	2	1	582	OH
W9AV	121	2	1	570	WI
W1NV	44	5	1	570	SV
KU4WD	231	2	1	562	TN
KP4GC	40	5	1	550	PR
WØGXA	100	2	1	550	IA
WA7KLI	97	2	4	544	EWA
K7NEW	124	2	1	542	WWA
N1IH	42	2	7	534	CT
KX3M	119	2	1	532	EPA
WF1L	66	5	1	530	VA
KØMP	48	5	1	525	AZ
N4MUH	142	2	1	510	NFL
KB5JO	35	5	1	500	STX
WA4AAK	41	5	1	500	AL
W7DAU	50	5	1	500	OR
KE4UKX	112	2	7	498	VA
KG4IGC	173	2	1	496	SC
NX8G	93	2	1	490	OH
K5RWP	144	2	1	476	NTX
KL1JP	19	2	1	476	AK
KC3OQ	160	2	2	470	DE
ND9E	117	2	1	460	IL
K8PXR	179	2	1	458	OH
KI7N	102	2	1	456	OR
KQØJ	125	2	1	452	NE
WO3X	100	2	1	450	OH
KD8DKG	74	2	1	446	MI
W8BFX	76	5	1	445	WWA
WØWFX	94	2	1	426	MO
WB3LGC	10	5	1	425	DE
WD4IEC	136	2	1	422	KY
W2MRD	84	2	1	418	ENY
K1SD	79	2	1	408	RI
NBØO	100	2	1	406	SV
KG6LJO	101	2	1	402	NV
WBØOEW	25	5	1	400	AZ
KE3PL	173	2	1	396	GA
KC9SNI	122	2	1	394	IL
W5HLP	120	2	1	394	NTX
KB3LGO	24	5	1	390	WPA
N4REF	119	2	2	388	SC
K7TR	118	2	1	386	AZ
AJ4EY	68	2	1	386	VA
KG6HBF	64	2	1	378	SDG
W7RT	84	2	1	368	AZ
K6VDU	66	2	1	362	SV
KL7NC	27	2	1	358	AK
AC4RF	102	2	2	354	NC
W6KYF	24	2	1	346	SCV
KD7UIY	39	2	1	328	VA
K4RIV	88	2	1	326	VA
WØEA	18	5	1	325	IA
KE9SA	77	2	4	324	WI
N4LES	87	2	1	324	GA
WA4JA	85	2	1	320	TN
AAØW	55	2	1	320	NE
VE3MCF	20	2	1	314	ON
WB6RAB	81	2	1	312	SFL
KW7I	55	2	2	310	OR
W1VD	104	2	1	308	CT
NJ6A	78	2	1	306	ORG
KS4FE	99	2	1	298	KY
W8BS	24	2	1	298	WV
W9KVR	62	2	1	298	IL
K7JSC	21	2	1	292	UT
KC2PVM	68	2	1	286	NNJ
W4GHS	83	1	1	283	VA
W7JDB	116	2	2	282	NV
KD4CX	39	2	1	278	WCF
KI6CQ	111	2	1	272	TN
K5DCM	34	5	1	270	AR
WA7PTM	2	5	1	260	WWA
AD7MQ	53	2	1	260	MT
WD4HXG	50	2	1	250	NC
K1JCR	74	2	1	248	NH
KI4VLW	70	2	1	240	NC
WE8T	47	2	3	238	OH
K2AVI	43	2	1	236	WWA
NN7X	42	2	1	234	OR
VE3CQH	8	5	1	230	ONS
AE7WE	90	2	1	230	MS
W1AAT	39	2	1	228	VT
W7TAB	35	2	1	220	WWA
KC7CCL	32	2	3	218	EWA
KC2ELS	7	2	1	214	OR
W3WOT/4	56	2	1	212	NC
NT7MI	28	2	1	206	AZ
AF5BZ	105	1	1	205	AR
W5VDM	15	5	1	205	STX
VA2RIO	52	2	1	204	QC
KF7PCL	50	2	1	200	WWA
N8SK	21	2	1	192	OH
KI4EBD	20	2	1	190	NFL
KJ6ZNT	44	2	1	188	ORG
VE7TJL	18	2	1	186	BC
N2DD	17	2	1	184	WNY
N1KHL	8	2	1	182	EMA
KD8TVV	20	2	1	180	MI
WBØVYH	37	2	1	174	AZ
WB2TVB	4	5	1	170	LAX
XV4Y	5	2	1	170	DX
KE6TIM	32	2	1	164	SCV
WGØV	56	2	1	162	CO
VE3VID	29	2	1	158	ONE
WH7DX	56	1	1	156	PAC
KA1AMR	27	2	1	154	EMA
K7JSG/AG	1	2	1	152	WWA
AC8OE	19	5	1	145	WV
N1NAZ	8	2	1	116	NH
KK4FKF	32	2	1	114	VA
K7RQN/Ø	3	2	1	106	CO
W7EEI	28	2	1	106	OR
K1JNX	2	2	2	104	LA
KF6BRF	22	2	1	94	LAX
NU1H	20	2	1	90	ME
WE8U	18	2	1	86	ID
AD6AF	14	2	1	78	LAX
VA4CQD	13	2	1	76	MB
VE7MRP	12	2	1	74	BC
KD7JS	11	2	1	72	OR
W8DPK	10	2	1	70	OH
KI4CVU	8	2	1	66	TN
NØXOB	33	1	1	33	IA

2E

W5CT	3137	2	6	10,192	STX
AA2DC	2812	2	3	8,416	NLI
W5WZ	2384	2	6	6,028	LA
W4IT	451	5	3	5,035	SC
K9OM	1160	2	2	4,990	WI
VE3LC	516	5	3	4,875	ONE
W6QAR	1296	2	8	4,406	SDG
WR5P	1339	2	7	3,864	AR
WA4FC	1373	2	6	3,380	VA
WB2ELW	902	2	19	3,356	WNY
NAØPW	236	5	7	2,670	CO
W5ROK	395	2	5	2,130	NTX

Paul Graham, KC9YFL, is caught making his first-ever HF QSO as part of the Mobile Ohm Volunteer Examiners, N9OQU, Field Day in central Illinois. [Mary Twigg, W9MAP, photo]

VA7MM	367	2	3	1,980	BC
KØGEO	324	2	3	1,686	STX
AK7AT	274	2	2	1,510	ID
W4HOD	321	2	5	1,230	AL
W4K	358	2	6	1,226	NC
N9AKR	393	2	2	912	IL
W4ILB	244	2	2	838	SC
KC2ELX	182	2	11	734	NNY
W6BBL	160	2	3	690	ORG
WB5LVI	155	2	25	666	STX
K6PLU	155	2	6	658	SV
KNØBS	150	2	4	650	IA
W5NFL	122	2	22	494	NTX
W3HAC	50	2	10	468	MDC
KD7EJI	54	2	2	444	WWA
WU9Z	46	2	2	362	IN
W8WML	93	2	3	312	MI
ADØEN	13	2	3	276	IA

3E

W4NT	3969	2	7	12,212	GA
W4DXA	2862	2	15	9,738	SC
K5SAR	2328	2	32	6,438	LA
W3VPJ	1089	2	23	5,206	EPA
W5ROS	399	5	10	3,870	STX
W8CCI	886	2	14	3,782	OH
W6AB	710	2	19	3,454	SB
NO8N	753	2	5	3,392	OH
W4VLD	1160	2	3	2,770	GA
N5BL	746	2	23	2,100	NM
W3YA	961	1	6	1,855	WPA
W8DYY	875	1	20	1,700	OH
W5SSV	296	2	35	1,478	STX
N4PU	518	2	3	1,410	GA
W6DOJ	880	1	4	1,250	SV
KE4YVF	192	2	7	1,138	NC
KJ4ND	134	2	5	672	KY
W7YRC	31	2	6	620	AZ

4E

W4GJ	2463	2	6	9,936	NFL
K3MJW	1638	2	11	5,898	WPA
K5WPH	964	2	45	3,716	WTX
N8CV	1086	2	8	3,526	OH
N2MO	606	2	26	3,406	NNJ
W7DK	711	2	43	2,822	WWA
K7LWH	406	2	29	2,234	WWA
W5HVL	241	2	10	1,280	STX

5E

VE3YAA	1185	2	10	4,512	ONS
VE7RAC	649	2	9	2,508	BC

6E

W9EAU	2101	2	15	6,596	WI

7E

WGØD	236	2	7	1,546	MN

EOC Stations

1F

K1DFT	354	5	4	3,615	ME
W2EF	595	2	8	2,900	NNJ
K9WM	595	2	19	2,894	IL
W9PC	425	2	10	2,452	IN
W7QL	600	2	4	2,324	UT
NI2S	415	2	9	1,820	NNJ
WX5FWD	376	2	8	1,698	NTX
K8FAY	284	2	10	1,458	OH
W1QV	333	2	13	1,174	CT
W7RIM	216	2	10	1,138	AZ
KM4LS	165	2	4	980	GA
WR4MC	165	2	4	930	GA

NY1P	130	2	3	928	CT
N1NRA	184	2	4	918	VT
VE1AO	239	2	12	874	MAR
W5TQ	205	2	1	850	STX
WA4NZD	144	2	10	802	AL
KB5MAR	102	2	10	794	NTX
N7KQ	145	2	6	780	AZ
KC9VID	11	2	8	774	IL
KB1JJE	67	2	3	684	EMA
W8AV	177	2	5	604	OH
W6ABR	187	2	7	524	SF
W9EOC	64	2	10	478	IN
WD8KAF	142	2	5	476	MI
W1AW	225	1	1	470	CT
K5EPH	115	2	8	430	NTX
K5VFD	131	2	6	312	STX
W4OHH	65	2	5	300	GA
NP3M	35	2	4	290	PR
W5SAF	15	2	10	282	NM
W4DCG	27	2	10	220	NC
W7RDR	69	2	1	188	WWA

2F

KY4KY (+W4KBR)					
	1899	2	66	7,706	KY
AB5ER (+N5HU)					
	1795	2	51	7,430	AR
VE1FO (+VE1QD)					
	1873	2	30	7,396	MAR
N5EOC	1316	2	20	5,614	NTX
K9UW	1443	2	10	5,508	WI
W7ECA (+N7VJW)					
	910	2	34	4,104	MT
KS1R	773	2	28	4,076	ME
K4PJ	727	2	50	3,340	TN
W2GSA (+W2XYZ)					
	744	2	22	3,100	NNJ
W2ORC (+WA2DQL)					
	654	2	26	3,084	WNY
W5ECO	651	2	17	3,030	STX
K2DS (+KM0SI)					
	862	2	25	2,868	WCF
N5I (+KC5ZJY)					
	542	2	28	2,686	LA
N4THM (+N4IF)					
	527	2	22	2,678	AL
W4RYZ	471	2	26	2,564	NFL
W4CQ (+W4WBT)					
	569	2	17	2,564	NC
W1KOO	810	2	19	2,504	VT
W9AWE	576	2	20	2,328	IL
KB6EOC	548	2	12	2,318	EB
WF4Q (+KK4RMY)					
	414	2	38	2,196	TN
K2ZV (+KB2LAV)					
	487	2	12	2,166	NNJ
W5BMC	577	2	25	2,124	LA
K4WD	355	2	24	2,072	SC
KE8RV	600	2	12	2,060	OH
KE5LOT	369	2	21	2,026	STX
N4SER (+W2DEN)					
	365	2	8	2,000	WCF
KI4HUS (+N4STW)					
	317	2	20	1,950	KY
K1PQ (+WA1JMM)					
	314	2	11	1,900	ME
W9WIL	296	2	10	1,890	IL
W5BCR (+KF5WCA)					
	647	2	13	1,804	NTX
W0ECA	330	2	9	1,764	MO
N3TWT	907	1	18	1,741	EPA
W4PEM	178	2	7	1,732	WCF
K4TG (+KY4LAW)					
	326	2	22	1,718	KY
WC7EOC (+NJ7I)					
	177	2	14	1,680	OR
W7L (+W7FLO)					
	176	2	40	1,538	OR
W3EOC	334	2	15	1,538	EPA
W1LAS	605	2	11	1,466	CT
K2GE	189	2	14	1,422	NNJ
NP3PR (+KP4MB)					
	341	2	5	1,380	PR
AE5EE	32	5	2	1,370	AR
W2EOC (+KD2DO)					
	361	2	11	1,360	WNY
KE5OKT	211	2	5	1,352	OK
KP4FD	845	1	8	1,334	PR
W6CPD	270	2	15	1,262	ORG
N9XH	198	2	17	1,236	WI
KB1RDE	114	2	7	1,184	RI
W0RR	187	2	13	1,156	MO
W4MIN	241	2	8	1,088	WCF
KT9Y	385	2	15	1,024	IL
KB3HEV	241	2	5	1,000	DE
W1NPP (+N1OXA)					
	294	2	8	994	ME
K6CME	171	2	8	992	SJV
WX4PCA	51	2	8	970	GA
W5LOC	220	2	4	964	STX
W4BKM	446	2	25	942	GA
KW4DC (+KW4DC)					
	245	2	25	940	TN
KC8WIT	222	1	20	925	OH
WE4TT	239	2	8	828	WCF
KK1PMA	56	2	15	772	RI
W6PWT	259	2	4	748	ORG
K4GAR	73	2	32	740	GA
W0WWV	167	2	8	734	NE
KP4NM	25	2	19	700	PR
K7NKH	53	2	9	636	NV
W1IEM	43	2	10	636	EMA
K7DPS	141	2	7	590	AZ
KJ6LCP	40	2	3	550	ORG
W4LBT	50	1	3	522	NC
KB1MKZ	1	2	6	452	EMA
W4WFF	101	2	8	252	VA
KJ4MFT	10	2	2	70	KY

3F

K2NJ (+W2CG)					
	3970	2	21	14,500	NNJ
N4FR (+W4SQD)					
	2956	2	100	9,188	TN
WA5JRS (+WJ5E)					
	2870	2	24	7,970	NTX
K7RDG (+W7SVD)					
	1644	2	40	7,328	AZ
W4UCJ (+NY4D)					
	1818	2	46	6,906	GA
W0HF (+KT7AZ)					
	1460	2	50	6,036	AZ
K9IQP (+W9QL)					
	1409	2	32	5,758	IL
W4NC (+W4WS)					
	1574	2	24	5,722	NC
K9ESV (+N4DSW)					
	1056	2	25	4,634	IL
W4DFG (+W4DRH)					
	1802	2	25	4,456	SC
N4IV	755	2	24	3,628	NC
WC1SW	818	2	14	3,210	WMA
AB8I (+K8BRY)					
	685	2	17	3,032	MI
K2TD (+AK2S)					
	681	2	37	2,964	SNJ
K7NWS	593	2	24	2,824	WWA
W0HCA	691	2	10	2,792	MO
WA3NAN	728	2	13	2,668	MDC
N4DAB	418	2	9	2,620	NFL
K6CCR (+W1MJH)					
	495	2	43	2,614	LAX
KC4EM (+K4ARO)					
	431	2	43	2,542	TN
WE1CT	761	2	15	2,462	WMA
W3KGN	521	2	12	2,312	EPA
WV5D	762	2	21	2,234	MS
W4COV	676	2	8	2,068	VA
W8VVL	606	2	15	1,940	OH
W4ECA	450	2	13	1,906	GA
K8GQB	145	2	11	1,656	OH
W3OI (+W3GRD)					
	348	2	34	1,654	EPA
WC4DC (+NI4Y)					
	253	2	16	1,648	TN
K7MAR	178	2	13	1,602	OR
WB9EOC	367	2	8	1,576	IN
NC4AR	319	2	10	1,546	NC
W9VMW (+W9LVY)					
	310	2	10	1,480	IN
KA9FAJ	198	2	8	1,348	IL
K5LET	315	2	27	1,216	NTX
K5ABI (+KC5OLO)					
	526	1	38	1,205	WTX
KB5ARC	242	2	15	1,184	MS
K6KP (+WA2KDX)					
	90	2	19	1,170	SCV
WX0EK	119	2	5	1,128	KS
WD6RAT (+KW6GB)					
	165	2	25	1,052	ORG
W9VCF	327	2	23	818	IN
KF6NNM	184	2	5	800	SV
W7DG	339	2	8	728	WWA
W5SLA	133	2	22	684	LA
WR4CC	227	2	23	648	TN
K6MAN	221	2	15	604	SJV
WD8LC	167	2	12	388	WV

4F

W5NEM (+KE5LUX)					
	903	2	59	4,598	MS
W4F	1018	2	32	3,940	SFL
W8FY	1344	2	17	3,890	OH
W6WC (+KK6EZR)					
	696	2	6	3,506	ORG
WC5C (+WB5IDM)					
	735	2	15	2,862	NTX
VE7CVA	863	2	32	2,722	BC
W7S	410	2	45	1,774	WWA
W2MPX	185	2	30	1,620	NNJ
W9VT (+N9WDG)					
	291	2	15	1,598	IL
NF1Y	391	2	5	1,580	CT
W5WCR	321	2	5	1,566	STX
N6SSF	150	2	16	1,486	SCV
W4GS	375	2	40	1,440	SC
AJ4IR	565	2	13	1,344	SFL
ND5MS	138	2	9	1,070	OK
K5BAY	243	2	13	1,008	STX
KB3CVD	122	2	8	910	MDC

5F

W2GSB (+W2TOB)					
	1738	2	60	6,938	NLI
K2BR	1001	2	27	4,480	SNJ
N1EM	977	2	19	3,530	EMA
W4AAZ (+KI5FR)					
	770	2	14	2,946	NFL
AF2C	507	2	31	2,818	NFL
WA0QFJ (+W0DLK)					
	371	2	30	2,054	MO
N3EP	281	2	36	1,288	EPA
WA5CC	117	2	13	1,278	AR

6F

W4SHL (+KV4LQ)					
	1662	2	30	6,570	AL
K7CEM	561	2	31	2,692	WWA
K8GC (+KD8TXP)					
	522	2	15	2,596	MI
NC4CA	749	2	15	1,848	NC

7F

W8VA (+K8FER)					
	987	2	49	5,072	WV
K6SEE	456	2	40	2,754	SDG
N8SE	382	2	12	2,478	MI

9F

W6YX (+K6SU)					
	4685	2	51	16,074	SCV
K1AA	1062	2	51	4,788	NFL
W1BRS	988	2	18	4,278	CT
W1SAT	185	5	40	3,395	ORG

34F

KE5UES	34	2	3	618	NTX

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners according to the total number of ARRL exam sessions in which they have participated since their accreditations. Considering each session requires an average time commitment of 2 to 4 hours or more, the thousands of hours these VEs have invested represent extraordinary dedication! Whether you are one of our VE Teams that tests once a week, once a month, or once a year, we want to express our warmest appreciation to all volunteers for your generous contribution to the ARRL VEC program.

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

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

Examiner	*Sessions*	*Accreditation Date*
Harry Nordman, AB0SX	583	09-Jan-02
Sammy Neal, N5AF	524	20-Nov-84
David Bartholomew, AB0TO	474	22-Mar-02
Franz Laugermann, K3FL	456	01-Dec-91
Bill Martin, AI0D	454	01-Nov-84
Kevin Naumann, N0WDG	448	17-Nov-02
John Moore, III, KK5NU	413	21-May-95
Paul Maytan, AC2T	412	06-Sep-84
Jeanette Nordman, AB0YX	400	21-Aug-03
Karen Schultz, KA0CDN	392	06-Sep-84
Royal Metzger, K6VIP	368	29-Apr-85
Richard Morgan, KD7GIE	362	11-Aug-00
John Mackey, Jr, KS0F	359	01-Oct-90
Gerald Grant, WB5R	352	04-Jan-85
Victor Madera, KP4PQ	349	01-Mar-92
John Hauner, K0IH	335	11-Jan-85
David Fanelli, KB5PGY	329	01-Oct-91
Adolph Koehler, K5VCR	321	29-Sep-95
E. Drew Moore, W2OU	318	01-Aug-90
Roland Kramer, W0RL	313	21-Jun-01
Morris Jones, AD6ZH	307	27-Nov-01
Daniel Calabrese, AA2HX	304	01-Nov-91
Robert Hamilton, N0RN	303	19-May-87
Loren Hole, KK7M	301	06-Sep-84
Thomas DeGuire, KC0STQ	298	19-Jun-05

The 2014 ARRL January VHF Contest

1900 UTC Saturday, January 16 — 0359 UTC Monday, January 18

There will be plenty of activity on 6 meters and higher for this year's January VHF Contest. If you're new to VHF contesting, this may be the perfect event for getting your feet wet in that world.

- Home, mobile, or hilltop entries are all encouraged.
- SSB and CW will be the main modes; FM activity will be concentrated around high-population centers.
- Tropospheric ducting, aurora, and sporadic E propagation are all possible, allowing QSOs over distances of hundreds of miles.
- All logs must be received or postmarked no later than 30 days after the contest. E-mail Cabrillo-formatted electronic logs to **januaryvhf@arrl.org**. Paper logs should be mailed to ARRL, 225 Main St, Newington, CT 06111.

Full rules are available at
www.arrl.org/january-vhf

KJ6VZC and N6ZE enjoyed this view of the Malibu coastline from their effective rover setup in the 2013 January VHF Contest.

The 2014 ARRL RTTY Roundup

1800 UTC Saturday, January 4 —
2359 UTC Monday, January 5

The digital modes are growing in popularity, and it's time to get in on the fun! This year's ARRL RTTY Roundup promises high activity and excitement for everyone.

- W/VE send signal report and state; DX send signal report and consecutive serial number, starting with 001.
- Multipliers are US states (plus Washington, DC), Canadian provinces, and DXCC entities.
- All logs must be postmarked no later than 30 days after the contest. Cabrillo-formatted electronic logs should be e-mailed to **rttyru@arrl.org**; paper logs should be mailed to ARRL, 225 Main St, Newington, CT 06111, USA.

Full rules and paper forms are available at
www.arrl.org/rtty-roundup

KE2SX used a modest Buddipole antenna to work 37 multipliers in the 2013 ARRL RTTY Roundup.

The 2014 ARRL International DX Contest

_CW:_ 0000 UTC Saturday, February 15 — 2359 UTC Sunday, February 16

Phone: 0000 UTC Saturday, March 1 — 2359 UTC Sunday, March 2

How many different countries can you work? The ARRL International DX Contest — Amateur Radio's oldest contest — is the perfect chance to find out.

- E-mail Cabrillo-formatted electronic logs to **dxphone@arrl.org** or **dxcw@arrl.org**; send paper logs to ARRL, 225 Main St, Newington, CT 06111, USA. For assistance with converting your logs, the WA7BNM Cabrillo log converter can be found at **http://b4h.net/cabforms/**. All logs must be received no later than 30 days after the contest.
- W/VE stations send a signal report and their state or province; DX stations send a signal report and their transmit power.
- Soapbox submissions may be added by visiting **www.arrl.org/soapbox**.

Full rules and log information can be found at
www.arrl.org/arrl-dx

Goran, SMØDRD, and Don, N6DA, operate at the KH6LC multi-multi station in the 2013 ARRL International DX Contest. [Curtis Knight, AH6RE, photo]

KJ6PUO operates the 2013 Phone Rookie Roundup from the well-equipped Stanford Radio Club, W6YX. Will they be back for CW? [Photo: N6DB]

The 2013 ARRL December Rookie Roundup

Sunday, December 22, 1800 UTC — 2359 UTC

Have you been licensed three years or less? Use that to your advantage in the Rookie Roundup. This month's event is CW, so start practicing and get ready for fun!

- Rookies (licensed for three years or less) can work anyone; non-Rookies can work the Rookies. All Rookies earn a certificate of participation.
- Use the free online logger at **www.inthelog.com** to log, and the online submission form to enter. All entries must be received no later than 72 hours after the event.
- Non-Rookies should be prepared to send slowly and act as Elmers.

Complete rules, helpful tips, and the online score submission form can be found at
www.arrl.org/rookie-roundup

The 2014 ARRL Straight Key Night

0000 UTC — 2359 UTC January 1

Rod Bunn, KA6ROD, of Big Bear Lake, California returned to Amateur Radio after a 20 year absence. For SKN 2011, he used his childhood J-38 along with his reconditioned Heathkit HW-100 and had a blast!

Observe the New Year while celebrating the past! The ARRL Straight Key Night will have the bands full of J-38s and bugs as operators around the world participate in this fun event.

- Enjoy leisurely CW QSOs by hand and vie for the coveted "Best Fist" and "Most Interesting QSO" awards.
- This is the perfect opportunity to fire up your vintage gear, but newer rigs are also welcome.
- All reports must be received by January 31, 2014. E-mail reports to **straightkey@arrl.org**; mail paper reports to ARRL, 225 Main St, Newington, CT 06111, USA.

Complete rules can be found at
www.arrl.org/straight-key-night

The 2014 ARRL Kids Day

1800 UTC — 2359 UTC January 5

Kids Day is an on-air activity focused on engaging the next generation of hams. Kids don't have to be licensed, so long as they are interested in having fun with ham radio and they have an Elmer to assist them.

- Suggested exchange: name, age, location, and favorite color. Be sure to call "CQ Kids Day," in order to draw attention to the event.
- A certificate for all participants is available online for free. Alternatively, you can send a 9 × 12 inch self-addressed, stamped envelope to Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009.
- The Kids Day e-mail reflector can be found at **lists.contesting.com/mailman/listinfo/kids**.

Kids Day offers fun for operators of all ages, whether it's children getting on the air and making contacts, or experienced hams guiding the way.

Share your experiences, submit photos, print certificates, and find the full rules at
www.arrl.org/kids-day

Bernie McClenny, W3UR, w3ur@arrl.org

Kimaam Island (OC-275)

Dr Stephanus J D Busono, W2FB, interviews the Kimaam Island IOTA DXpedition Team

Indonesia, with over 13,000 islands, is the largest archipelago in the world, but until recently there was no Indonesian Islands Award. In 2012 the Nusantara Indonesian Islands Award was launched, spawning many operations from YB land from different IOTA (Islands On The Air) activators since its inception.

By the time this column appears in print, two new IOTAs will have been activated: OC-275 and OC-276. Here is an interview with the three operators who activated OC-275 on September 10-16, 2013: Taufan, YBØAI; Budi, YF1AR, and Lucky, YD9RQX.

The conductor of the interview, Dr Stephanus J D Busono, W2FB, was first licensed in 1983 as YDØDBH. In 1984 his family moved to California and he was licensed as N2MAU, eventually becoming W2FB in 2001. He has been actively chasing YB islands since 1991. Together with Adhi, YB3MM, they founded the Indonesian Islands Hunter Group in 2012, which sponsors the Nusantara Award (Work Indonesian Islands Award). Steve is the QSL manager for Lucky's, YD9RQX/P, Kimaam Island operation.

Map of Kimaam Island (OC-275)

W2FB: How did the idea to activate OC-275 come about?

YBØAI: We were chatting casually at Budi's house and the idea came up to activate a brand new IOTA — there were two in YB9 and three in YB8. I did a search on these islands and decided on the coastal islands around South Papua near Merauke. There is a large island, Yos Sudarso, which has many other names, including Dolok and Kimaam. An important factor in the decision was the regional airport in the town of Kimaam. Merpati Airlines provides a 45 minute flight from Merauke on Mondays and Wednesdays. With this information, we decided to activate Kimaam Island, Part of the OC-275 Irian Jaya's Coastal Islands South group.

W2FB: How did you assemble the team?

YF1AR: Everything moved quickly, we recruited some operators. We did not want a big team; YB3MM, YB4IR, and YB9WZJ were not able to make it. By early August, we made an announcement to the IOTA community. I was placed in charge of fundraising. Because of the time constraint, it was decided to use individual call signs rather than to apply for a special one.

Figure 1 — Budi, YF1AR; Taufan, YBØAI, and Lucky, YD9RQX, outside the military post on Kimaam Island.

YBØAI: In the end we had only three operators, less than I wanted, but the show must go on.

YD9RQX: I joined 2 weeks before the expedition started and I was grateful that YBØAI welcomed me, a novice, to the team; I was very excited to be a part of the DXpedition.

W2FB: Can you tell me a little bit more about the preparation for getting to Kimaam?

YBØAI: I contacted other amateurs in Merauke and inquired how to get to Kimaam. I also asked Lucky, YD9RQX, to help because he lives in Papua.

YF1AR: For 2 weeks we tried to secure tickets to Kimaam but came up empty handed. The small plane can only take 16 passengers each way and only flies twice a week.

YD9RQX: Taufan and Budi asked me to contact Merpati Airlines in Merauke and book three tickets to Kimaam. I was not successful because of limited availability. I mustered up the courage to contact my friend from the local police department in Merauke and was promised three tickets.

Up until then, I had not met Budi and Taufan. We were aboard the same plane from Jayapura to Merauke on Monday morning September 8 but did not realize this until we arrived in Merauke.

YF1AR: We went to the Merpati ticket office and were met by the chief of police of the Merauke Airport who had secured three tickets for us to Kimaam. Best of all, the tickets cost almost half of what we had been quoted.

W2FB: What happened when you arrived at Kimaam? How did you decide on the operating site since you had not surveyed the island before?

YFØAR: In Merauke, we met some military personnel en route to Kepi, a community deep in the wilderness of Kimaam. They helped make arrangements for our transportation. At the airport we were picked up by a team in a military truck and were driven to a

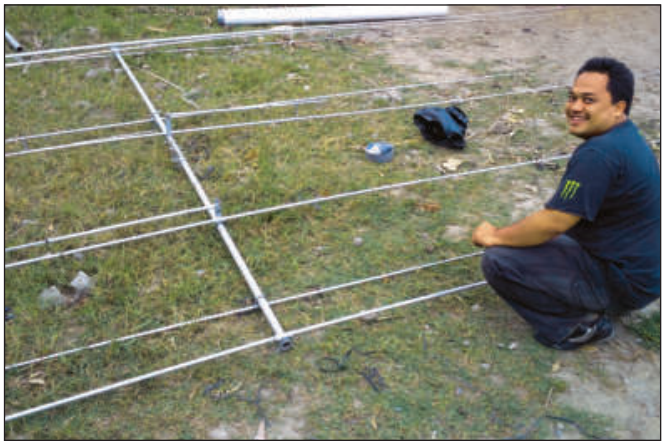


Figure 2 — Novice operator Lucky, YD9RQX, assembling one of the Yagi antennas.

Figure 3 — Taufan and Budi displaying their Kimaam Island OC-275 banner.

lighthouse approximately 10 kilometers from the airport. We stopped at the military post (see Figure 1) and met Mr Adam, the owner of the only general store in town, which is right by the lighthouse. We struck a deal with him to use his two 10 kilowatt generators during our stay.

YBØAI: We decided to set up camp at the base of the lighthouse. There is a tower about 30 meters high and we installed a vertical antenna on the top. Dipoles for 40 meters and 80 meters were installed at a height of 17 meters. The Yagis for 20, 17, and 12 meters were erected about 20 meters away from the lighthouse. YD9RQX helped assemble the antennas and we were done in an hour (see Figure 2).

W2FB: Finally, the moment we all had been waiting for — OC-275 on air for the first time. Who called CQ and who made it in the log first?

YF1AR: I called CQ on 15 meters on September 9 at 1201Z and logged Helmut, HSØZIV. YBØAI/9 was on 20 meters and logged Bert, YB1/PD1SA. We were immediately spotted on the DX clusters and the madness started. YD9RQX had trouble with his coax and couldn't get on the air until the next day. He finally got on 40 meter SSB and worked Andi, YC9XAV.

W2FB: How were the propagation and the pileups?

YBØAI: Early during the week, 15, 20, and 40 meters were very good. Initially I worked simplex but the pileup quickly went out of control and I had to listen up 5-10 kHz. My fingers were shaking as I typed the calls on my laptop, the adrenalin was rushing, and nothing could beat that feeling. I really enjoyed the pileups.

YD9RQX: As a novice I was extremely excited to work a pileup for the first time in my life. Unfortunately, I had to cut my participation short due to a family emergency that required me to return home to Jayapura.

W2FB: How did you divvy up the operating time?

YBØAI: After Lucky, YD9RQX, left, it was just the two of us. Budi would operate nonstop during daytime on 15 and 20 meters. Occasionally, when there was an opening, he would operate 10 meters, but propagation there was poor. During the nighttime, I operated 17 and 12 meter simplex because the pileup was manageable. I also operated 40 meters with good results to OC, AS, EU, and NA, but 80 meters was limited to AS and OC.

W2FB: Can you describe the logistics while you were on the island, such as electricity, food, sleeping quarters, hygienic needs?

YF1AR: There was no electricity at the operating site so we used the generator 24 hours a day. The base of the lighthouse served as our sleeping quarters. When there was no propagation, we put plywood on the ground and took naps in sleeping bags. For the first 2 days, Mrs Adam (the wife of the store owner) cooked for us, but then she left for Merauke on Wednesday. After that, we survived on instant noodles and fried eggs. On the last night, we had a farewell meal with our host Mr Adam and the local residents. We feasted on venison on a skewer and stew.

YBØAI: We did not shower for a week; there was a lack of fresh water on the island. We tried to brush our teeth every day though…HI... HI...

W2FB: Tell us about your last day on the island.

YBØAI: Budi made the last contact on 20 meters around 1600Z, or 1 AM local time. Then we packed our radios and disassembled our antennas.

YF1AR: At 3 AM local time it was pitch dark. With a flashlight, I climbed the 30 meter tower to take down all of our antennas because we had to be ready to leave at 7 AM. The military truck was due then to transport us to the airport. The total number of contacts made was 5147 with 150 DXCC entities across six continents. We operated 80-10 meters, all phone.

W2FB: Now that the DXpedition is over, how did you feel about your accomplishment?

YBØAI: Personally, since activating OC-275, I feel invigorated, especially to start DXing and contesting again. I have not been very active since completing 5BDXCC. I felt fatigued from constantly listening to high noise levels on 80 meters to attain DXCC on that band. It was draining.

YF1AR: Exhausted but very happy and satisfied, we activated a new IOTA OC-275, lighthouse ARLHS IDO-148, one of the Indonesian outer islands, and best of all; it was our gift to the YB Land DX Club for its second anniversary (see Figure 3).

YD9RQX: I wished I could have stayed longer but I was very proud to be a part of the OC-275 team. It was my first DXpedition and it will not be my last.

W2FB: Taufan, Budi, and Lucky, on behalf of the Indonesian Islands Hunter Group and IOTA community we want to convey our heartfelt thanks and gratitude for activating OC-275. Good luck with your next island activation.

All photos courtesy of Stephanus Busono, W2FB.

Jon Jones, NØJK, n0jk@arrl.org

50 MHz DX During a Solar Grand Minimum

Even if sunspots take a nosedive, there are still ways to keep your contact count rising.

Last month's column mentioned the Gleissberg solar cycle and that some solar scientists think we may be entering another solar minimum — an extended period of low solar activity. *Grand Minimum* is the general term for an extended period of low solar activity, of which the Maunder Minimum and Dalton Minimum are specific examples. During solar cycle peaks, F-layer propagation could be amazing on 6 meters. Stations with 10 W and a dipole could work Europe and Japan from North America. During Solar Cycle 21, a station in Kansas City running a 3 W Icom 502 radio and a three element Yagi on his chimney achieved Worked All Continents on a November afternoon in 1979.

With 100 W and a small Yagi, dedicated operators would work 100 countries on a regular basis. If a Grand Minimum were to occur — F_2 propagation such as appeared in recent Solar Cycles 22 and 23 on 6 meters would be all but gone in Cycle 25 and beyond. Even 10 meter F_2 DX may be rare. But don't tear down your 6 meter antenna — DX does not end on 6 meters in a Grand Minimum. So how can you work the foreign DX on 6 meters? How can you earn the DXCC award under these conditions? It will be possible using some modes you may be already familiar with.

Sporadic E

Propagation off of small ionized clouds in the E layer, or sporadic E (E_s), occurs throughout solar cycles. Its appearance seems independent of sunspots. Summertime E_s can reach thousands of kilometers in range. Single hop E_s is usually about 2200 km long. This can be easily worked with even with 10 W and a dipole. A double hop doubles the distance to 4400 km and occurs fairly often. Small stations can work it, but it is much easier with 100 to 1000 W and computer optimized Yagis. Three hops takes you out to 6600 km. Signals are weaker out here, and high power and a big antenna make the difference. This puts the eastern half of North America within range of western Africa, Europe, the Caribbean and northern South America.

Figure 1 — This photo shows the 6 meter antenna farm that Bill, KØHA (EN10), used to work BV2DQ. [William Hohnstein, KØHA, photo]

This is a treasure house for DXCC. Your location in North America greatly affects how many countries are workable via E_s. From VE1, VE2, VE3, W1, W2, W3, and the east part of the W4 call area — up to 75 or more countries may be possible via E_s alone. Even from the central USA, there are around 50 potential DXCC countries within a three hop E_s of Kansas City. Go out to four hops, and the air and the signals are getting thin. These openings may happen just a few days each summer and are most often very weak signals, or "EME quality." But a range of up to 9000 km puts much of the northern hemisphere in play.

Unfortunately, for those farther west, the E_s pond for DXCC dries up. There are not many countries even at three hops. But openings over the last couple of years from the Pacific Northwest to Europe at four and even five hops suggest that even the West Coast may have more countries available than previously thought.

Short-Path Summer Solstice Propagation

Another DX mode is short-path summer solstice propagation (SSSP). This theory was developed by Han, JE1BMJ, to explain the fairly frequent long-haul summertime openings from the Midwest and Eastern North America to Japan. Others consider the propagation mode to be multiple hop chordal E_s. In any case, contacts are possible on a number of days each summer from many parts of North America to Japan, China, Taiwan, Korea, and other Far East countries. This can potentially add 10-15 more countries on 6 meters. The stations that have had the best success on this mode are those with the state of the art equipment, including at least one long Yagi — some with large Yagi stacks and high power. Stations such as James Kesterson, KØGU (DN70), Colorado and William Hohnstein, KØHA (EN10), Nebraska (see Figure 1) have made some truly amazing contacts via this mode to China, Taiwan, and other Far Eastern countries.

Trans-Equatorial Propagation

Even in a Grand Minimum, Trans-equatorial Propagation (TEP) will still occur around the equinoxes across the geomagnetic equator. It is a very robust mode. But the zone for working TEP will move south and be smaller. As I write this column stations in South Florida and the Gulf Coast have been making TEP contacts to Argentina, Brazil, and Chile. But as the northern TEP zone moves south with

the decline in solar flux, stations in these states will need help from an E_s hop to reach it. Such contacts are still possible, but will be much less frequent. There is only a handful of countries workable — but for achieving a DXCC on 6 meters, every country counts!

Aurora and Aurora E_s

Aurora may permit stations in the Northeast to work FP, CY9, CYØ and those in the Pacific Northwest to contact Alaska. Aurora E_s has longer range, up to 5000 km. Stations in the Northeast have worked Greenland, Iceland, and Scotland via Aurora E_s. Auroras will be rare in a quiet solar cycle.

EME

This mode has the potential to help stations achieve DXCC on the 50 MHz band. This involves reflecting signals off the Moon and back to Earth. Joe Taylor's JT-65 digital mode has revolutionized EME communications, bringing what was an esoteric mode into the realm of a reliable propagation mode even for single Yagi stations. Stations running the legal power limit and a single Loop Fed Array (LFA) or M^2 long Yagis with 14 dBd gain (including ground gain) can work this mode on a regular basis.

Conditions for EME may be even better on 6 meters with the low solar activity, as high solar activity can increase ionospheric path loss and Faraday rotation of the signals. EME proponent Lance, W7GJ, has worked over 90 different countries on 6 meters via EME alone. Better results will be obtained with bigger and more antennas. A steerable four Yagi array such as used by W7GJ allows you to work many of the smaller DXpeditions with 6 meters. EME along with E_s and SSSP will be the workhorse DX modes if a Grand Minimum occurs. DXCC will still be possible, but to achieve it from North America will likely require a "state of the art" setup and EME.

F_2

You may ask why it's necessary to mention this mode. With no sunspots, F_2 on 6 meters is unlikely. But F_2 can occur even in a weak solar cycle on 6 meters. A huge solar flare such as the Carrington event can do it. On September 1, 1859 astronomer Richard Carrington observed a "white light" solar flare. This flare was so powerful it was visible against the bright surface of the sun. About 18 hours later, the Coronal Mass Ejection (CME) from the flare reached Earth, causing a monstrous geomagnetic storm. A storm this huge would boost the F layer and MUF, making F_2 possible on 6 meters. Events such as this are very rare. Data from ice cores in Greenland suggest they occur about every 500 years. Mini-Carrington flares occur more often, and they could spark F_2 as well. There may be one such event in each Grand Minimum.

What Does the Future Hold?

Solar activity prediction is an inexact science considerable uncertainty remains. In an article in *Solar Physics*, J. Feynman reviews what is known from 1500 years of proxy data about Maunder-type Grand Minima and the minima of the cyclic Centennial Gleissberg variations.[1] He and coauthor A. Ruzmaikin were able to generate criteria that distinguish between the two types of events.

> Applying these criteria to the observed solar terrestrial data, we conclude that the unexpected behavior began well before the solar cycle 23/24 minimum. *The data does not support the Maunder Minimum conjecture*. However, solar cycle behavior can be understood as a minimum of the Centennial Gleissberg Cycle that previously minimized in the beginning of the 20th century. We conclude that the Centennial Gleissberg Cycle is a persistent variation that has been present 80% of the time during the last 1500 years and should be explained by solar dynamo theory

If this is the case, then Solar Cycle 25 may be stronger than 24. Worldwide F layer skip may be just a cycle away on 6 meters. We can only wait and see.

On the Bands

50 MHz. The E layer seemed to shut down at the end of August. I noted only one North American E_s opening — and a brief one at that — on September 18 between Florida and W8 around 1430Z. There was an E_s opening to Central America from Texas spotted by N5DG on September 2 at 0110Z to Costa Rica (see Figure 2) and again on the 22nd at 0330Z also to TI.

Afternoon TEP and F_2 started the month off for stations in Florida and South Texas to South America September 1. N5DG spotted CE, HC, HK, and LU around 2325Z that day. Ed had South America in again on the 8th, 18th, 23rd and 27th in the late afternoons.

On September 23, Lefty, K1TOL, caught a surprise E_s–TEP link type opening to South America around 0200Z (see Figure 3). He found "most signals were at S-0 or S-1 but contacts were made. Heard at least 5-7 more but they never heard me over the TEP sigs at S9." He reported, "I park on 50.110 every day from 3 PM on in the fall months, just in case.

[1]J. Feynman; A. Ruzmaikin; "The Sun's Strange Behavior: Maunder Minimum or Gleissberg Cycle?," *Solar Physics*, Volume 272, Issue 2, pp 351-363.

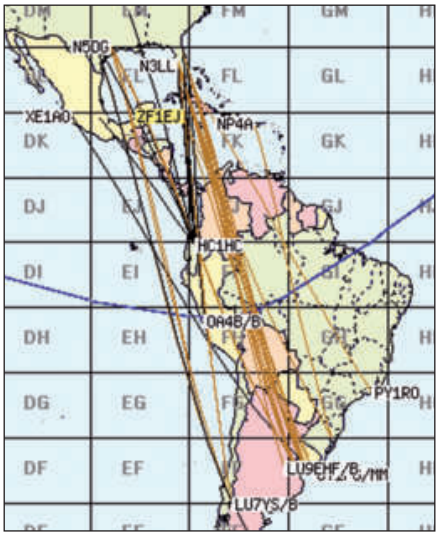


Figure 2 — Ed, N5DG, spotted this E_s opening to Central America on September 2. [**dxmaps.com**]

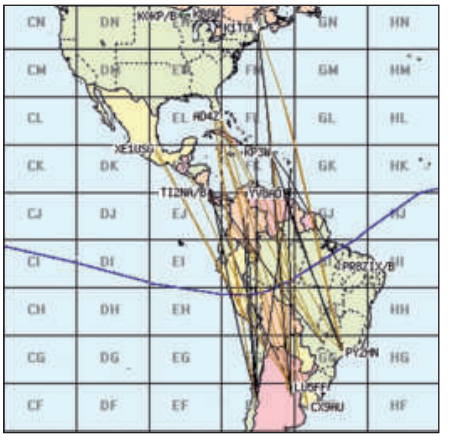


Figure 3 — Lefty, K1TOL, was surprised to catch this Es-TEP link to LU land. [**dxmaps.com**]

I heard a voice with a Spanish accent at 9:00 PM local but discounted it as impossible, so late at night. I got coffee, fed the cats, and sauntered back into the shack where I heard some LUs/PYs chatting on 50.110 at 9:30 PM or so, local time. I spit out my coffee in total surprise! I contacted LU5FF at 0148Z and LU1FP at 0208Z." This was the latest ever E_s–TEP contact for Lefty in 50 years of radio.

Fred, KH7Y, on "The Big Island" worked V73NS on the 27th for a "new one." Neil, V73NS, was using his HF fan dipole on 6 meters: "I'll tune up the fan dipole around 0840Z. I tuned the fan and called CQ. While the TX was happy it made the RX deaf. I left the tuner off and let the rig fold back. EZNEC say it has a 9.6:1 VSWR at 50.110 MHz. Not a DX antenna on 6 meters. HI HI. I figured I

Table 1
Two Meter Contacts by Jay, W9RM (EN52)

Call Sign	Grid	Distance
K5SW	EM25	570 miles
N1GC	EM95	589 miles
W4AMP	EM74	584 miles
N4ION	EM62	644 miles
NDØB	EM07	654 miles
KA2KQM	EM74	594 miles

was getting 20-30 W out of the rig, about 2 dB less than the beacon. If I could get a palm tree removed I'd put the beacon on from my home quarters. Maybe I could make a bracket and mount it to a palm. Either way I'd likely take some antenna damage when fronds fall. With the budget cuts, tree trimming was one of the reduced items."

144 MHz Tropo Is Back! There were a number of strong and fairly widespread tropospheric openings during September. Those who relied on various Internet "maps" and "spotting clusters" to alert them of tropo may have missed out. On the 3rd, Sam, K5SW (EM25), worked K8TQK (EM89) OH, WB8ART (EM79) OH, W8BYA (EN70) IN, KY4MRG (EM77), K9MRI (EN70) IN, W8MIL (EN74) MI, W9EWZ (EN52) WI, W8PU (EM89) OH, and WB9TFH (EN53) WI. September 4th was good for Jay, W9RM (EN52), to the Northwest and also to the southeast. Jay reported the 2 meter contacts listed in Table 1.

On September 5, JD, NØIRS (EM29), worked W3IP (FM19) over a thousand mile path on tropo. JD said W3IP popped up "on a dead band." He said of the instance, "I was on HF radio with some regulars when I heard W3IP calling CW on the Flex 5000. I thought I was dreaming. I had the lunar link amplifier on the Flex and it seemed like it took forever for it to warm up. I was just about ready to switch to the K3 and 1 kilowatt amplifier when the light finally came on and I started calling. I thought I had missed him but he came back and I confirmed his grid and state. Strange conditions, but you have to call CQ regardless of what the APRS map says, because it didn't show any activity nor did my local APRS Hepburn map."

Another station who worked tropo that was not "predicted by the APRS or William Hepburn's maps," is Terry, N4TWX (EL89 Florida): "This morning (September 9) Perry, W7PLS, alerted me to Doug, K4LY (EM85), in South Carolina being on 432.095 MHz. I went there and worked Doug on 432, 2, 222, and 1296 MHz. Signals were the best I have ever heard them from his location. I also heard W4DEX's beacon on 432.400 at S1.

Figure 4 — K4UHF/b is in operation from atop Johanna Bald Mountain. [Vic Woodling, Jr; WB4SLM, photo]

None of the Internet maps indicated any propagation. It just goes to prove that you can't rely totally on predictions."

Many stations found conditions flat in the September VHF contest, but there was some tropo DX for those who were persistent. Sam, K5SW (EM25), worked AA4ZZ (EM96) on 2 meters at 0400Z on the 15th. Todd, KØKAN (EM19), worked AA4ZZ on 144, 222 and 432 MHz in the contest at 0232Z September 15th. He said they were not loud but solid copy. Paul, AA4ZZ, from his end commented, "AA4ZZ team member Roger, W4MW, was predicting good tropo based on his study of the weather. Hepburn was not. Roger was the 2 meter operator who worked KØKAN and he passed him to me for the 432 and 222 contacts. This was my first time to work Kansas on 432 and the first time on tropo on 222 MHz! I wonder if the lack of big things on the Hepburn and APRS maps cut activity?"

Gedas, W8BYA (EN70), found great conditions in the contest: "I wanted to comment on the really nice opening we had on 2 meters from EN70 into 5-land, almost to the Gulf. The opening lasted over 4 hours starting at 1300Z Sunday morning (15th). It may have been open earlier but 8 AM is when I got on. K5QE (EN31), NE5BO (EM35), K5MRB (EM35), and K5OMC (EM44) were all worked on 2 meters Sunday morning. K5QE was heard almost continuously the entire morning calling on 144.200, and was at times S7 to S8!" Repeating the theme about Internet maps not helping to find tropo openings, Gedas said, "It was interesting once again that the APRS map did not correlate very well with what the actual conditions were. The map did show 5-6 discrete yellow and orange sections linked together between here and EN31 but never any red the whole morning. Temps here were quite cool, in the 50s, and with a nice breeze. Not what I would think are nice VHF tropo conditions." Jay, W9RM, caught a great tropo opening on September 24 UTC during the 2 meter sprint with many contacts over 500 miles. His best DX included W3IP (FM19) 658 miles, K3TUF (FN10) 658 miles, W4DXE (EM95) 645 miles, NT4RT (EM94) 639 miles, and WA2FGK (FN21) 664 miles. Jay notes he is moving to DM58 in Colorado by the end of the summer of 2014. Chris, K1KC (EM73), also had great Sprint conditions. He worked WØANH in rare EN47 at 1027 miles at 0402Z. NØIRS (EM29) worked W3IP (FM19) "again" in the Sprint.

222 MHz. W9RM worked NDØB (EN07), KN4OK (EM64), W4AMP (EM74), and KX4R (EN73) 592 miles on the 5th. AA4ZZ (EM96) worked KØKAN (EM19) September 15 at 0242 UTC.

432 MHz. Vic, WB4SLM, reports the K4UHF/b on 432 MHz is operational again (see Figure 4). The K4UHF/b site is on top of Johanna Bald (EM85cg). W9RM (EN52) worked KA2KQM (EM74) at 594 miles September 5th.

1296 MHz and Up. "Thanks to Russ, K2TXB/3, I was able to work Delaware for state number 13 on 10 GHz. Signals were very loud and contact was easy on SSB. We were tallying up states and realized another close state has not been worked yet, by us and others. Who would have guessed that it was New York!" Thanks Herb, K2LNS, the station manager at WA2FGK.

Here and There

Colin, KH9/WA2YUN, has a "POP3" e-mail account that may be used to alert him if you hear his beacon from Wake Island. Colin says, "If someone needs Wake on 6, have them send me an e-mail at **wa2yun@yahoo.com**. I have this account set up as a POP3 on *Outlook* and my computer should beep for an incoming e-mail."

Aves Island, YVØ. The 4M5DX Group's mostly Spanish web page for their DXpedition to Aves Island is now active at **www.avesislandinfo**. The group plans to be active as YWØA sometime between November 1, 2013, and February 28, 2014. Their page mentions 50.110-50.115 MHz CW and SSB.

Special Event Stations

Maty Weinberg, KB1EIB, events@arrl.org; www.arrl.org/special-event-stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Nov 11, 0900Z-1700Z, WØV, Sioux Falls, SD. USS *South Dakota* Wireless Association. **USS *South Dakota* Battleship Memorial, 5th Anniversary**. 28.315 21.315 14.315 7.215. QSL. Mark Carlson/WØV, 135 1st St, Ashton, IA 51232. **www.qrz.com/db/W0V**

Nov 15-Nov 20, 0000Z-2200Z, WP4CRG, Arecibo, PR. Caribbean Amateur Radio Group. **520 Years Puerto Rico Discovery**. 146.520 28.320 21.320 14.280. QSL. Caribbean Amateur Radio Group, HC 4 Box 43014, Hatillo, PR 00659. **wavilesjr@yahoo.com**

Nov 17-Nov 24, 0000Z-2359Z, W1G, East Berlin, PA. Area Amateurs. **150th Anniversary of the Gettysburg Address**. All bands, all modes, as propagation permits. Certificate & QSL. Robert Hess, WO4L, 74 Curtis Dr, East Berlin, PA 17316. **www.qrz.com/db/wo4l**

Nov 23, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. **Loss of the 5 Sullivan Brothers/Sinking of the Cruiser USS *Juneau* during the Battle of Guadalcanal**. 7.250 SSB 14.070 PSK 31 14.320 SSB DSTAR wide area reflectors. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Nov 23-Nov 24, 1500Z-0000Z, WA2XM, New York, NY. Columbia University Amateur Radio Club. **100th Anniversary of 2XM Call Sign to Wireless Telegraph Club of Columbia University, 103rd Anniversary of Columbia University**. Amateur Radio Club. 147.500 28.350 14.310 7.250. Certificate. Columbia University Amateur Radio Club, c/o Edward Miller, 3000 Broadway, MC 3136, New York, NY 10027. **www.w2aee.columbia.edu**

Nov 29, 1300Z-2100Z, W1P, East Falmouth, MA. Falmouth Amateur Radio Association. **Steamship *Portland* Special Event**. 14.260 7.260 3.997. QSL. Henry Brown, 19 Sao Paulo Dr, East Falmouth, MA 02536. **k1wcc@arrl.net**

Nov 30, 1700Z-2300Z, W9CAP, West Chicago, IL. Illinois Wing Civil Air Patrol. **72nd Anniversary of Civil Air Patrol**. 18.125 14.250 7.255. QSL. IIWG CAP Maj Ron Walerowics, IL WING CAP, PO Box 397, West Chicago, IL 60186. **w9cap.com**

Nov 30-Dec 1, 1300Z-1900Z daily, WA1NPO, Plymouth, MA. Whitman Amateur Radio Club. **The First Pilgrim Landing at Plymouth**. 18.160 14.260 7.240 3.860, EchoLink WA1NPO-R, IRLP:8691. Certificate & QSL. Whitman ARC, PO Box 48, Whitman, MA 02382. **www.wa1npo.org**

Nov 30-Dec 7, 1900Z-2300Z, KB9WQF, Mauston, WI. Juneau County Radio Amateur Club. **Boorman House Christmas Special**. 14.270 14.054 7.240. QSL. Howard Fischer, N2450 Scoville Rd, Mauston, WI 53948. **kc9ivj@gmail.com**

Jan 1-Dec 31, 0000Z-2359Z, EI13CLAN, Dublin, Ireland. Irish Radio Transmitters Society. **The Gathering**. 28.050 21.320 18.080 14.220. Certificate & QSL. David, O'Connor, Silver Howe, Sydenham Mews, Corrig Ave, Dunlaoghaire, Co Dublin, Ireland. **www.qrz.com/db/ei13clan** *or* **irts.ie**

Dec 5, 0900Z-1600Z, W4BUG, Pompano Beach, FL. Gold Coast Amateur Radio Association. **Flight 19 Memorial**. 14.325. QSL. Joey Jet, 4116 NW 1 St, Deerfield Beach, FL 33442. **w4bug.org**

Dec 6-Dec 7, 2300Z-2300Z, WX9LOT, Romeoville, IL. National Weather Service Amateur Radio Club. **SKYWARN Recognition Day**. 146.520 14.332 7.226 3.870. QSL. National Weather Service Amateur Radio Club, 333 West University Dr, Romeoville, IL 60446. **www.crh.noaa.gov/lot**

Dec 7, 1300Z-2100Z, W8VP, Cambridge, OH. Cambridge Amateur Radio Association. **100th Birthday Celebration**. 14.260 7.235. Certificate & QSL. Cambridge Amateur Radio Association, PO Box 1804, Cambridge, OH 43725. *12th and final Special Event in CARA's year-long 100th Birthday Celebration. QSL. Certificate available for anyone who works all 12 of CARA's monthly Special Events of 2013.* **www.w8vp.org**

Dec 7, 1600Z-2000Z, W5BMC, Morgan City, LA. Bayouland Emergency Amateur Radio Service. **Santa's Block Party Remembering Pearl Harbor**. 14.275 7.250. QSL. Jackie Price, KA5LMZ, 708 Front St, Morgan City, LA 70380.

Dec 7, 2100Z-2330Z, W2HO, Newburgh, NY. Orange County Amateur Radio Club. **Santa Net**. 7.190 3.920 146.94(-) repeater, PL 88.5. QSL. Orange County Amateur Radio Club, PO Box 624, Cornwall, NY 12518. **www.ocarc-ny.org**

Dec 7-Dec 8, 1000Z-1630Z, N4WIS, Virginia Beach, VA. USS *Wisconsin* Radio Club. **Pearl Harbor.** 14.264 7.264. QSL. N4WIS, USS *Wisconsin* Radio Club, PO Box 6682, Virginia Beach, VA 23456. **www.n4wis.org/n4wis/index.php**

Dec 7-Dec 8, 1300Z-2200Z daily, W2W, Baltimore, MD. National Electronics Museum Amateur Radio Club. **Pearl Harbor Commemoration**. 14.241 14.041 7.241 7.041. Certificate & QSL. W2W — Special Event Station, PO Box 1693, MS 4015, Baltimore, MD 21203.

Dec 7-Dec 8, 1600Z-0100Z, W3PIE, Uniontown, PA. Uniontown Amateur Radio Club Inc. **80th Anniversary Celebration**. 28.440 14.245 7.225 3.925. Certificate. Uniontown Amateur Radio Club, Special Event Station, 433 Old Pittsburgh Rd, Uniontown, PA 15401. **www.w3pie.org/year80**

Dec 7-Dec 9, 0000Z-0000Z, W7ORC, Okanogan, WA. Okanogan County Amateur Radio Club. **Grand Coulee Dam Special Event**. 14.270 7.260 3.860; PSK31 14.070 7.035 3.580. Certificate. Okanogan County Amateur Radio Club, 219 W Winesap St, Tonasket, WA 98855. *E-certificate via e-mail.* **www.w7orc.com**

Dec 13-Dec 14, 0001Z-0700Z, W1E, Burley, WA. Burley Amateur Radio Club. **Friday the 13th Special Event Operation**. 28.313 14.303 7.233. Certificate* & QSL. W1E BARC W7JQ, PO Box 639, Burley, WA 98322. **www.qrz.com/db/w7jq**

Dec 14, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. **Pearl Harbor Remembrance Day**. 14.320 7.250 SSB; 14.070 PSK31; D-STAR wide area reflectors. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Dec 14-Dec 15, 0100Z-2300Z, K7CCH, Coquille, OR. Coos County Radio Club. **Shore Acres Holiday Lights**. 28.325 14.325 7.235 3.935. QSL. Coos County Radio Club, K7CCH, PO Box 698, Coos Bay, OR 97420.

Dec 14-Dec 15, 1010Z-1000Z, W8ZQ, Wheeling, WV. Northern Panhandle Amateur Radio Club. **Wheeling Light Fest**. 14.250 7.232. Certificate. Joe Mccready, PO Box 192, Blaine, OH 43909. **j_t_mccready@yahoo.com**

Dec 15-Dec 16, 1400Z-2300Z daily, WX3MAS, Nazareth, PA. Christmas City Amateur Radio Club and Delaware/Lehigh Amateur Radio Club. **Christmas City Special Event**. 21.365 14.265 7.270 3.850 SSB CW and PSK31. Certificate. WX3MAS, 14 Gracedale Ave, Greystone Building, Nazareth, PA 18064. **cjfishing@rcn.com**

Dec 18-Dec 24, 1500Z-2300Z, KC5OUR, Belen, NM. Valencia County Amateur Radio Association. **Christmas in Bethlehem**. 28.483 21.283 14.283 7.283. QSL. Valencia County ARA, PO Box 268, Peralta, NM 87042. **www.kc5our.com**

Dec 21, 1400Z-2200Z, W3C, Bethlehem, MD. Easton Amateur Radio Society. **Christmas in Bethlehem**. 14.255 14.055 7.255 7.055. QSL. Easton Amateur Radio Society, PO Box 311, Easton, MD 21601.

Dec 28, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. **US Claims Midway Island in 1867**. SSB 14.320 7.250 SSB; PSK31 14.070; DSTAR wide area reflectors. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

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. Offline 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. ARRL reserves the right to exclude events of a commercial or political nature.

Special Events listed in this issue include current events received through Oct 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

Rick Lindquist, WW1ME, ww1me@arrl.org

IARU Region 2 Conference Charts Three-Year Course

The member-societies of IARU Region 2, the Americas, held their triennial General Assembly in Cancun, Mexico the week of September 23, 2013, with 18 national Amateur Radio associations represented. Representing the ARRL were President Kay Craigie, N3KN, as the voting delegate; First Vice President Rick Roderick, K5UR; Chief Executive Officer David Sumner, K1ZZ; and Technical Relations Specialist Jonathan Siverling, WB3ERA. The ARRL carried the proxy of Club de Radio Aficionados de El Salvador, whose president, José Arturo Molina, YS1MS, was present in his capacity as Vice President of Region 2 and could not also serve as a national delegate. ARRL International Affairs Vice President Jay Bellows, KØQB, participated in the conference as a member of the Region 2 Executive Committee. Also attending were most members of the IARU Administrative Council.

The delegates reviewed activity reports from member-societies throughout the region. Several reported increases in amateur licensing, however, several others reported declines in licensing and activity because of license fees and the growth of the Internet and mobile phones.

For the first time in Region 2, band plans for the VHF, UHF, and microwave bands were adopted to guide development of these bands. HF band plans were reviewed with the objective of improving terminology and aligning them more closely with those of the other regions, particularly Region 1 (Europe, Africa, the Middle East, and the former Soviet Union). The new and revised band plans will be posted on the Region 2 website, **www.iaru-r2.org**. In most countries, including the US, IARU band plans are voluntary guidelines and do not carry the same weight as regulations; the band plans may differ from national regulations, in which case the latter must be observed.

An important function of the conference was to adopt a budget for the upcoming three year period. Region 2 dues are assessed at $0.07 per licensed amateur in the country that the member-society represents. This amount has not been adjusted in many years but is still adequate to fund the activities of the region.

Another important function is to elect the members of the Region 2 Executive Committee, which manages the affairs between conferences. There are four officers and seven area directors, with two officers also serving as area directors. Members for 2013-2016 are: Reinaldo Leandro, YV5AM, President; Ramón Santoyo, XE1KK, Vice President and Director; José Arturo Molina, YS1MS, Secretary; Noel E. Donawa, 9Y4X, Treasurer and Director; and Directors George Gorsline, VE3YV, Jay Bellows, KØQB, Marco Tulio Gudiel, TG9AGD, Gustavo de Faria Franco, PT2ADM, and Galdino Besomi, CE3PG.

Chile will be the host country for the 19th General Assembly of Region 2, to be held in October 2016.

IARU: Administrative Council Studying Ways to Work with Non-IARU Organizations

The International Amateur Radio Union (IARU) Administrative Council (AC) is looking into ways to work with non-IARU Amateur Radio organizations in countries where the IARU member-society is failing to represent all of its radio amateurs. The issue came under discussion at the annual AC meeting September 21-22 in Cancun, Mexico.

Suggested solutions included establishing communication with the non-IARU societies to allow input from the country's amateur community on IARU and amateur-related issues or recommending QSL bureaus that will serve amateurs within a particular country.

In other business, the Administrative Council:

- Reviewed IARU positions for World Radiocommunication Conference 2015 agenda items and future WRC agenda items and discussed the strategy for achieving IARU objectives at WRC-15.
- Named David Wardlaw, VK3ADW, and Wojciech Nietyksza, SP5FM, joint recipients of the Michael J. Owen VK3KI Award, which recognizes individuals who exemplify the dedication and hard work of IARU volunteers.
- Adopted the theme "Amateur Radio: Your Gateway to Wireless Communications" for World Amateur Radio Day, April 18, 2014.

First IARU Region 2 Emergency Communications Workshop Stresses Awareness, Cooperation

The first IARU Region 2 Emergency Communications Workshop, held September 24-25 in Cancun, Mexico in conjunction with the IARU Region 2 XVIII General Assembly, explored international issues facing Amateur Radio's response to emergencies and disasters. Sponsored by IARU Region 2 and the ARRL, the event was co-chaired by ARRL Emergency Preparedness Manager Mike Corey, KI1U, and IARU Region 2 Emergency Coordinator Dr Cesar Pio Santos, HR2P.

Attendees heard presentations that covered ITU response to disasters, technical innovations in disaster response, the *IARU Emergency Communications Handbook* project, and organizational updates. Attendees and presenters also took part in a tabletop exercise. Discussion focused on several key points.

- The general public and served agencies need to be aware of what Amateur Radio can do.
- The IARU should consider approaching the ITU about developing partnerships with Amateur Radio equipment manufacturers to assist with communication responses to large international disasters.
- There should be more participation from young amateurs as presenters and attendees in international emergency communications workshops, and cross-border cooperation and coordination of amateurs should be encouraged. Amateurs also need to be aware of cultural differences that may arise in international responses.
- There is a greater need from served agencies for high-speed video, data, and high-resolution imagery.
- More input is needed for the *IARU Emergency Communications Handbook* project.

Presentations and material from this workshop will be made available at **www.iaru-r2.org**. Direct comments and questions to Mike Corey, KI1U, at **ki1u@arrl.org** (English), or Cesar Pio Santos, HR2P, at **psantos56@yahoo.com** (Español).

John Dilks, K2TQN, k2tqn@arrl.org

Earl Abbott's Massie Coherer

A mysterious piece of vintage brass has a surprising origin.

The earliest piece of radio gear I own is a coherer that dates to 1905 (see Figure 1). Coherers were one type of very early detectors. Mine was made by the Massie Wireless Telegraph Company in Rhode Island. I didn't always know it was a Massie coherer — in fact, I first thought it was just a signal bell for a telegraph with its bell missing.

The coherer came to me courtesy of Earl Abbott, W2FTT (SK). (See the September 2013 Vintage Radio column for his story.[1]) I remember the day I found it in Earl's cellar. It was located away from his other radios, on a small wooden shelf built into the wall of his shack. There were two or three other telegraph type relays with it. I recognized that they were special and old, so I carefully placed them in a box and carried them to my car.

With all the confusion at the time, bringing home so many things and going to hamfests, I almost sold it, not knowing its value. I put it aside and during the next couple of years I almost forgot about it. As it turned out, this procrastination paid off.

Serendipity

It was on a visit to my favorite wireless museum, the New England Wireless and Steam Museum (NEWSM) in Rhode Island (**www.newsm.org**) that I spotted what appeared to be a duplicate of my curious piece of equipment. At the museum was the historic 1907 Massie System Wireless Station, PJ (for Point Judith, RI). PJ had been relocated to the museum grounds in 1983 by Robert Merriam, W1NTE, and his museum volunteers, to avoid demolition. The original Massie equipment on display there was donated by the Massie family (see Figure 2). The Massie station's historic value is enormous and it is now listed in the National Register of Historic Places.

After spotting the duplicate, I rushed to ask Bob if he could tell me about it. He explained that it was a Massie coherer. When I told him I had one, he was astounded and asked me to bring it on my next visit. I did, and he verified that it was, in fact, a Massie coherer and

Figure 1 — This side view of the Massie coherer shows the glass tube of the coherer itself on the left and the de-coherer assembly that looks like a telegraph sounder.

Figure 2 — The inside of the Massie station at the New England Wireless and Steam Museum. The Massie coherer is on the far side of the table, behind the bell. [Stan Avery, WM3D, photo]

[1]J. Dilks, K2TQN, "Vintage Radio," *QST*, Sep 2013, pp 96-97.

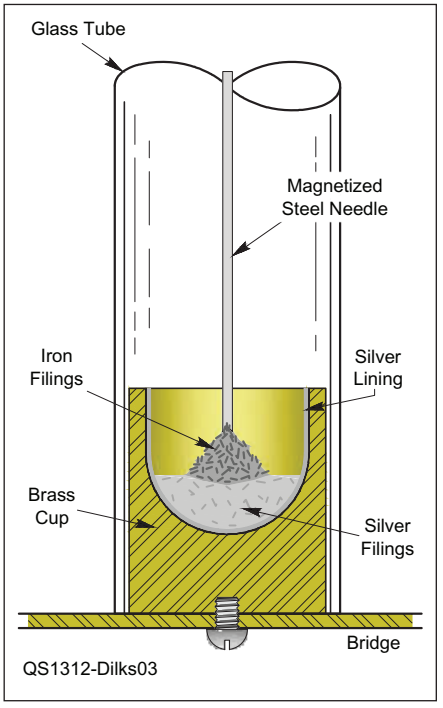


Figure 3 — Detail drawing of the Massie coherer.

provided me with copies of the patent documentation and a small French perfume bottle. The perfume bottle is what Walter Massie used as a cover, with the top and bottom cut out of it, for the silver cup and needle that formed the coherer. This piece was missing from mine.

I explained that I found it in New Jersey, in Earl's, W2FTT, ham station — we could only guess where he might have come across it. I believed that it may have come from the Massie station at Cape Henlopen in Delaware. It was probably rescued by one of the wireless operators when the station was closed, and later given to Earl. (Cape Henlopen is at the mouth of the Delaware River and some operators there may have lived in New Jersey, as similar surviving early wireless stations were located on both sides of the river.)

Bob Merriam explained that Massie was a strong competitor of Marconi. Marconi sued and closed Massie down after a very few years. Then Marconi destroyed all the Massie stations and replaced the equipment with Marconi gear. Due to this, Massie equipment is very rare, and I was lucky to find it.

How the Coherer Works

A wireless coherer in its simplest form is a mixture of metal filings in a confined space, usually a glass tube (see Figure 3). When excited by a radio wave, the filings cohere — that is, they stick together — forming an electrical circuit, just as if a switch had been turned on. This circuit operates a sounder of some kind and simultaneously triggers another device, called a "de-coherer" (see Figure 4). The de-coherer (the ball next to the glass cylinder) physically taps the coherer's brass support bridge. The vibrations generated loosen the filings to open the "switch." The coherer needs to be de-cohered many times during the dot time period and many more times during the dash time period. As long as RF is present the coherer stays cohered until the tap. If the RF is still present after the tap, it coheres again immediately, and gets tapped repeatedly. The buzzing sound comes from the tapper tapping. If no RF is present, nothing happens. In practice, fast CW would be difficult with a coherer set. Under good conditions, 10-15 WPM would be the limit.

My Massie coherer uses a mixture of silver and iron filings. These were missing, so I filed some particles off an old silver Liberty dime and an old iron nail. These filings were placed in the small silver-lined brass cup. Next, a magnetized steel needle was inserted into its carrier above the cup and pushed down into the cup. The filings jumped to the needle. One tap on the support bridge loosened the filings, which fell back into the cup (see Figure 5). The entire assembly was surrounded by a 1 inch long, 9 millimeter wide glass tube, which I cut from scrap instead of using the perfume bottle.

Because I intended this piece to be showcased, rather than used, that was as far as I was prepared to go. I wiped the coherer clean of 100 years of dust. The brass is still tarnished, as found. Wiping the wood with a light coating of WD-40 gave it a shiny appearance.

The Final Touch

I planned to display the coherer at radio contest meets and thought a display case would be a good idea. I found an excellent company with cases in an almost unlimited variety of sizes — Specialty Plastics Fabrications (**www.casesforcollectibles.com**). They carry cases in a wide range of styles and sizes, to accommodate almost any type of display.

I chose a 10 × 6 × 5 inch display case with a medium density fiberboard (MDF) base. Together with shipping, the cost was less than $60. The wood base came unfinished, and I spray painted it green to complete the exhibit.

For more information about coherers, search "wireless coherer" on the Internet. A brand new Marconi or Branley type coherer detector designed from an 1896 original is available from David Navone, N6SWX. See his website **www.davidnavone.com** or e-mail him at **dnavone@davidnavone.com**. He has additional coherer parts and items available.

The Massie station configuration, patent information and additional photos are on my website, **www.k2tqn.com**. Note: For more on the early Delaware River stations in New Jersey, see columns that ran in the September and October 2006 issues of *QST*.[2, 3]

All photos by John Dilks, K2TQN, except as noted.

Figure 4 — Close up of the Massie coherer and tapper. The coherer is the glass assembly on the left. It sits on a brass bridge. The ball on the right is the tapper part of the de-coherer.

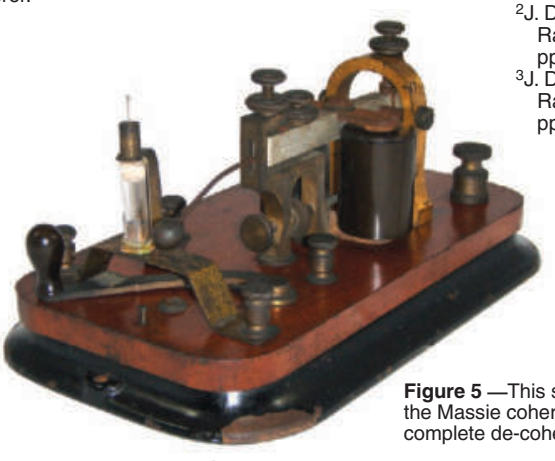


Figure 5 —This side view of the Massie coherer shows the complete de-coherer assembly.

[2]J. Dilks, K2TQN, "Old Radio," *QST*, Sep 2006, pp 80-81.
[3]J. Dilks, K2TQN, "Old Radio," *QST*, Oct 2006, pp 91-92.

Life Members

Elected October 5, 2013

Chris S. Aberle, KB7IAY
George T. Abouakl, KC6KBD
Jerry M. Agan, KJ4MBJ
Jeremy C. Allen, N1ZZZ
Orville F. Alwin, WL7BXJ
Sheron L. Ames, KC6ZSH
William R. Arcand, W1WRA
Carol L. Ashburn, N3STZ
James D. Atkinson, NO5L
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Donna J. Barker, WQ4M
D. Berrett, KC9FDL
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Jerry A. Boyd, WR5G
Ian M. Branson, NØIMB
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Elaine Chapin, KJ6YYP
Sherry A. Christiansen, K2SAC
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Larry R. Fravel, K8YYY
James M. Froncek, KA3RDA
Steven S. Gallion, W9SSG
Peter D. Gambee, K6TTD
Steve H. Gilmore, W4SHG
Gary D. Goeken, WA9RTI
James L. Goldman, W3JG
Maureen S. Gutowski, W1MSD
Brian S. Hall, K8TIY
Richard Hallman, N7TR
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Bruce N. Homer, NN7BH
Frank M. Howell, K4FMH
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Randall S. Pitchford, WW7ZZ
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Daniel G. Reimer, KØZL
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Charles Ristorcelli, NN3V
David R. Roberts, KB3UUW
Suzanne T. Robinson, KF5ECX
Jeffrey T. Satterfield, KD7ADI
Kathleen G. Savage, KB1LPW
Richard Savage, KB1LYJ
Micah T. Schmitt, AB9KK
David J. Schneider, AD4CC
Paul W. Shallbetter, NØYPS
Paul B. Shelton, KG5NP
Richard K. Sherman, K6AEN
Yin L. Shih, N9YS
Michael J. Shimp, KØEBH
N. Carol Shrader, WI4K
Thomas R. Sly, WB8LCD
Rick D. Smith, N6GSE
Robert Solberg, AC2KQ
James L. Spencer, WØSR
Marcus Stevenson, WB5LFS
William T. Strayhorn, K4WTS
Kenneth H. Stritzel, W9AEK
Arthur W. Strong, K2AWS
Chuck Stroud, KA8HDE
Chris A. Swartout, N6WCP
Cinthia Swartout, KD6ALN
Tirina Swartout, KG6HWK
William Taylor, KC9BNW
Dominic Theodore, K8HHL
John Thompson, N4JDT
Robert Thompson
Jerome M. Traynor, KC2SIE
Hector Trestini, K1HDT
Guy L. Tribble, N6SN
Winfield Wagner
Ronald J. Walerowicz, K9SX
Donnie Ward, KI4TXI
Jeffrey D. Waters, W4UWF
Jared A. Watson, KJ4IVC
Robert E. Whatley, KD5ZPB
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Christopher D. Wilson, ACØPP
Mark D. Winek, W3GN
Paul D. Wolf, AA5PW
Jake Wolfe, AE7KZ
John P. Wolterbeek, W6BCE
Forrest A. Woolley, N5RWE
Steven H. Wylde, KX6J
Nancy M. Yoshida, K9DIG
James F. Zuelow, KL2ZZ

Radio Tips

Shopping for an Antenna Tuner

If you determine that your station needs an antenna tuner, you'll find there are many available. Despite the bewildering number available to choose from, they can be reduced to just a few categories, according to how they function.

- **Manual Tuners:** As the name implies, you operate these antenna tuners by hand, twisting knobs and watching the SWR meter until you achieve the best match. These are among the least expensive models, but they are also the least convenient to operate. If you think you'll want to change bands and frequencies quickly, a manual tuner may not be the best choice.

- **Automatic Tuners:** These tuners have automated the tuning process. You simply apply RF and push a button — the tuner rapidly searches through combinations of inductance and capacitance until it finds the values that render the best match. Some models will respond as soon as they detect a signal from your radio — no button pushing required.

- **Remote Automatic Tuners:** These tuners are designed to be installed outdoors at the antenna. By achieving the best SWR at the antenna, remote tuners minimize RF loss in the cable between the antenna and the station. Remote automatic tuners will operate when they detect RF, or when they receive a command from the transceiver.

When shopping for a tuner, be sure to check its impedance range. The impedance range is critical to the tuner's ability to match a wide array of loads. Limited-range tuners can only handle mismatches that result in a maximum SWR of 3:1. In contrast, wide-range antenna tuners will handle SWRs of 10:1 or more.

Also pay attention to the tuner's RF power rating. For example, you may find a tuner rated for 150 W PEP — peak envelope power. This is an expression of RF power commonly used when we're talking about SSB signals. A 150 W PEP rating is fine for SSB, a signal with rapidly changing power levels, but what about a signal with a power level that is maintained continuously? A RTTY (radio teletype) signal is said to be "100% duty cycle," which is another way of saying that it is at maximum power continuously during the entire transmission. An antenna tuner rated for 150 W PEP may not be able to safely handle 150 W at a 100% duty cycle. Check the specifications carefully. Look for language such as, "150 W SSB, 80 W CW." In this example "CW" doesn't mean a Morse code transmission; it refers to "continuous wave" in the literal sense, meaning 100% duty cycle. If you plan to operate RTTY or other 100% duty cycle modes, be sure your antenna tuner is rated for the power.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Locust Fork) — Jan 4
D F 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. Chuck Walley, KF4TCU, 205-681-8354; **kf4tcu@bellsouth.net**; **freezefest.com**.

Florida (Ocala) — Dec 14 D T
7 AM-noon. *Spr:* Silver Springs RC. Green Clover Hall, 319 SE 26th Ter. *Tl:* 146.61 (123 Hz), 146.79 D-STAR REF037C. *Adm:* Free. Ed Biederwolf, W9CHA, 352-292-3135; **ed.w9cha@gmail.com**; **www.k4gso.us**.

Louisiana (Minden) — Dec 21
D F H R S V
8 AM-2 PM. *Spr:* Minden ARA. Minden Civic Center, 520 Broadway St. *Tl:* 147.3. *Adm:* $5. Dusty Collins, N5COL, 318-422-3159; **n5col@att.net**; **n5rd.org**.

Mississippi (Poplarville) — Dec 14
D F H Q R S V
8 AM-3 PM. *Spr:* Pearl River County ARC. Old National Guard Armory, SW corner of Hwy 26 and Hwy 11. *Tl:* 145.21 (136.5 Hz). *Adm:* $5. Roger Aubert, K5RDA, 601-795-4425; **k5rda@att.net**; **W5PMS.info**.

Missouri (Brighton) — Jan 4 D F H R T V
8 AM-1 PM. *Spr:* Ozark Mountain AR Group. Brighton Assembly of God, 5403 Hwy F. *Tl:* 147.015 (162.2 Hz). *Adm:* $5. Mike Ballantyne, KC5MNP, 417-788-8882; **kc5mnp@gmail.com**; **www.w0omd.org**.

New Jersey (Bergenfield) — Dec 14
D F H R S V
8 AM-3 PM. *Spr:* Boy Scout Troup 139/Venture Crew 7373. St John the Evangelist's Conlon Hall, 19 N William St. *Tl:* 146.955 (141.3 Hz), 146.52. *Adm:* $3 (non-ham spouses and kids free). Gordon Beattie, W2TTT, 201-314-6964; **w2ttt@arrl.net**.

NEW YORK CITY/LONG ISLAND SECTION CONVENTION

January 5, Bethpage, NY
Q R S V
7:30 AM (doors open), 9 AM (forums start). *Spr:* Great South Bay ARC. Briarcliff College, 1055 Stewart Ave. Ham Radio University 2014, Special Event Station W2V. *Tl:* 146.85 (136.5 Hz). *Adm:* $3 (donation). Tom Carrubba, KA2D, 631-422-9594; **ka2d@arrl.net**; **hamradiouniversity.org/**.

Coming ARRL Conventions

November 16-17
Indiana State Convention,
Fort Wayne, IN*

December 6-7
West Central Florida Section Convention,
Plant City, FL*

January 5
New York City/Long Island Section
Convention, Bethpage, NY

January 17-18
North Texas Section Convention,
Fort Worth, TX

January 19-26
Quartzfest Convention,
Quartzsite, AZ

January 24-25
Mississippi State Convention,
Jackson, MS

January 25-26
Puerto Rico State Convention,
Hatillo, PR

January 31-February 1
Southern Florida Section Convention,
Miami, FL

February 7-9
Northern Florida Section Convention,
Orlando, FL

* See November *QST* for details.

Tennessee (White Pine) — Jan 4
D H R S T V
8 AM-2 PM. *Spr:* Lakeway ARC. Walter State CC Expo Center, 1615 Pavilion Dr. *Tl:* 147.03. *Adm:* $8. Gloria Pritikin, KJ4BHF, 865-674-7884; **GAPritikin4128@aol.com**; **www.lakewayarc.org**.

Wisconsin (Waukesha) — Jan 4
D F H R V
8 AM-1 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum Bldgs, 1000 Northview Rd (County Trunk FT). 42nd Annual Midwinter Swapfest. *Adm:* advance $4 (5 for $18 or 10 for $35 before Dec 20), door $5. Phil Gural, W9NAW, 414-425-3649; **janphil68@att.net**; **www.warac.org**.

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**.

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

Strays

Looking for Nautical QSLs

Horst Ballenberger, DL8NBM, is collecting QSL cards that feature a nautical theme (see his collection online at **www.qrz.com/db/dl8nbm**). He is looking for more cards and welcomes scanned image file sent to his e-mail address at **dl8nbm@darc.de**. You can also send originals by postal mail to: Lindenäckerweg 14, D - 90455 Nürnberg, Germany. Cards sent by postal mail will be returned; no return postage necessary.

December 2013 W1AW QUALIFYING RUNS

W1AW Qualifying Runs are held at 10 PM EST on Friday, December 6 (0300 UTC December 7) and at 9 AM EST on Tuesday, December 17 (1400 UTC). The West Coast Qualifying Runs will be transmitted by station K6KPH at 3581.5, 7047.5, 14047.5 18097.5 and 21067.5 kHz at 2 PM PST (2200 UTC) on Saturday, December 14. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

Building a Strong Future for Amateur Radio

Active promotion is the key. Here's how one group of Ohio hams approaches the task.

Devere "Dee" Logan, W1HEO

The recent growth in the numbers of licensed US radio amateurs is encouraging. But, as the saying goes: "Trend is not destiny." To ensure a bright future, we must continually spread the word about our radio service, and provide opportunities to prepare for license exams. This is up to us, and no one else.

We should recognize the major role the ARRL® has had in providing us with the support and materials for recruiting, educating, and training the many who have chosen to join our ranks. Yet the ARRL cannot reach into communities across the country and recruit new hams. That is up to each of us.

To ensure a bright future, we must continually spread the word about our radio service, and provide opportunities to prepare for license exams.

Many hams are not comfortable venturing into the community to "sell" ham radio. Yet, often it's an individual ham radio demonstration given to a friend or relative that creates the spark of interest. There are limits to this technique, which is why larger numbers are recruited by radio clubs that offer classes and volunteer examiner (VE) testing. It is such "radio-active" groups that hold great potential for building our numbers and our future.

Stepping Toward Greater Participation

Realizing the critical role of radio clubs, a group of radio amateurs (who would later become the foundation of the Ham Radio Promotion Project) assembled in 2005 to discuss how clubs could improve the effectiveness of their promotion and recruitment activities. They identified four steps to improve recruitment:

- Step 1: Raise awareness of Amateur Radio.
- Step 2: Identify prospects among those who appear interested in ham radio.
- Step 3: Focus training efforts on those who appear interested in obtaining a license.
- Step 4: Offer training classes, VE licensing sessions, and invitations to join a sponsoring radio club.

Conducting an effective promotion campaign requires a variety of tools. A number of promotional items are available from the ARRL, including printed materials and help from a public relations professional at headquarters. Training and educational materials developed by the League can be very helpful.

While developing the program, suggestions for how to conduct promotional campaigns came from local hams who were experienced public relations professionals and accredited members of the Public Relations Society of America.

Wireless Window to the World

Video is a powerful promotional medium. In order to assist in introducing the public to Amateur Radio, the group produced a video entitled *Amateur Radio: Wireless Window to the World*. Experienced television broadcasters on our team applied their talents to create the 15 minute DVD. To date, dozens of copies of this video have been provided to individual hams and radio clubs across the country for use in public showings, radio classes, and TV programs.

As for radio clubs, the group identified several ways to help with their promotion and recruitment efforts. Since few members are experienced in this field, a 50 page how-to handbook was developed; it contained sample news releases, display templates, press relations techniques and more. Other promotional tools were developed, including signs, banners, and a quarterly newsletter — *The Ham Radio Promoter* — containing practical tips and information on promotional techniques.

These steps became the foundation for what was designated "The Ham Radio Promotion Project." Since radio clubs are the logical place to build a local promotional campaign, invitations to join the project were extended to a number of groups in northeast Ohio. A website was established — **www.neoham.org** — presenting an overview of the project.

Financial support for the project was initially provided by the Hamfest Association of Cleveland and Chapter One of the Quarter Century Wireless Association along with several contributions from area amateurs. Invitations to join the effort were accepted by a number of northeast Ohio radio clubs. Today, more than 27 clubs are members of the project.

Our project has also provided support for individuals by supplying the promotional video for a modest $12 donation. The video has been used widely in training classes, presentations to civic clubs, scout troops, and other audiences.

We also encourage radio clubs to establish the objective of promoting ham radio on a continual basis. For example, regular club-sponsored licensing classes usually result in gaining new club members from among the students. This steady growth will help assure a bright future for your club and Amateur Radio itself.

Devere "Dee" Logan, W1HEO, an ARRL Life Member, received his Novice call, KN8WZJ, in 1961. An Amateur Extra class licensee, he has served as an Assistant Director of the ARRL Hudson and New England Divisions. He reached the top of the DXCC Honor Roll in 2007, holds nine-band DXCC, WAZ, and WAS, and authored the book, *Tips to the Top from DX Pros*. Dee lives with his wife Mary Elizabeth and can be reached at 9901 Cypress Cir, Mentor, OH 44060-7221, **deverelogan@gmail.com**.

Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to 900 words in length.

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

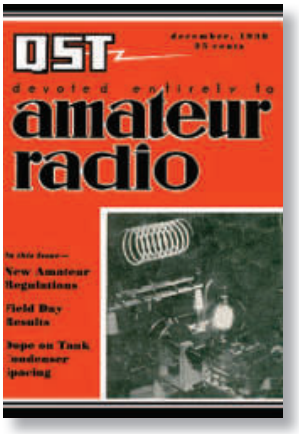
7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111 or via e-mail to **qst@arrl.org** (subject line Op-Ed).

75, 50 and 25 Years Ago

Al Brogdon, W1AB

December 1938



- The cover is an infrared photo of a large final tube and its glowing tank coil. There's no doubt that R.F. is present!
- The editorial addresses the recent panic that followed the famous "War of the Worlds" radio broadcasts reporting that Martians had invaded New Jersey. FCC Chairman McNinch commented, "Public reaction again demonstrates the force of radio and points out again the serious public responsibility of those who are licensed to operate stations."
- By Goodman, W1JPE, describes "A Simple Transmitter for Portable or Emergency Work," which was a crystal-controlled two-tube rig with single-control tuning.
- "Results, 1938 A.R.R.L. Field Day," reports that there were 1060 participants — an amazingly large number. Many fine photos of FD stations in action add to the excitement of the report.
- D. K. Oram, Chief Engineer for Hammarlund, tells how we can get "Full-Range Selectivity with 455-Kc. Quartz Crystals," complete with wide-range bandwidth control.

December 1963

- The cover shows some of the Aerojet RC gang working on a Field Day antenna.
- The editorial, "Field Day and Amateur Radio," discusses the great value of Field Day — for its technical training, operating training, and simulation of actual emergency conditions.
- Ernest Adolph, K8WYU, describes "A Medium-Power Band-Switching V.H.F. Transmitter" with v.f.o. or crystal control and 240 watts input on 2 and 6 meters.
- "The TOT" (Transistors on Two), by Robert Glorioso, W1EBW, is a hand portable for 144 Mc. that uses only three inexpensive transistors.
- "Harris's Theorem," by John Harris, VE3ON, describes a problem-filled Sweepstakes effort.
- "'63 Field Day Results — *the Biggest!*" by Ellen White, W1YYM, reports a FD record of 15,654 participants and 3815 transmitters CQFDing away.

December 1988

- The cover photo shows Santa, played by Kermit Broderseno-ho-ho!, who has visited the children's hospital in the ARRL HQ area for 30 years.
- Kevin Balmforth, NC6U, introduces "The Electronic Parrot," his voice-saving contest machine, a real cracker of an idea.
- Edward Ocarson, WA1TWX, describes "The CW6805 — An Inexpensive Morse Keyboard."
- Ken Goetz, NX7C, thinks outside the box and makes "The Case of a Portable Hand-Held Transceiver," using a plastic soldering-iron case to hold the H/T and using the case as an antenna base.
- In "The W6AM Rhombic Antenna Farm Dismantled," Jan Perkins, N6AW, tells the sweet but sad tale of W6AM's famous antenna farm and its finally coming to an end, following Don's death. A period photo in the article shows a young Don Wallace as the Chief Radio Officer aboard the USS *George Washington* at the Versailles Peace Conference.

Field Organization Reports

SEPTEMBER 2013

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 can be found at **www.arrl.org/public-service-honor-roll**.

512
W5KAV

375
KT2D

356
WM2C

340
WB8RCR

330
K8RDN

290
KB2RTZ

270
W5DY

265
KT5SR

260
K4BEH

249
WA7PTM

247
WB9FHP

235
KØIBS

231
N8JWM

230
KK4BVR

217
WB8R

210
W9BGJ
KC2LIX

209
W7FQQ

208
KC8QWH
KC5ZGG

200
WA4STO

199
KB1UAU

195
VE7GN

190
KB8QKC

188
KC8HPG

185
K9LGU

184
N8OSL

180
AE5VY
N9WLW
N8FVM

177
W1INC
KB8VXE

175
KC8YVF

171
WS6P

170
AD4BL
WD8USA

165
KE5HYW
K7OAH

160
K1PJS
KE4CB
KGØGG
N1UMJ

159
KF7PDV

158
KD5RQB

157
W9EEU

156
WB8YYS

155
N5TMC
W3YVQ
W4DNA
WB4ZIQ

154
KK7DEB

150
KK5NU
KK3F
WK4P

148
KB5SDU

147
WA4YWM

145
N9VC
N7CM
K7EAJ

144
N9EXM

141
K7GJT

140
K6FRG
WB2FTX
WA3EZN
WK4WC
NX8A

137
KB1YNE

136
W9WXN

132
KJ4JPE

130
WB9QPM
K6HTN
W4VX
WV8CH
K6JT
W8DJG
N2JBA

K4IWW
KW1U
K7BFL

129
KA8ZGY

125
WA1STU
NX9K
AG9G
WØLAW

124
KB2BAA
KC2QVT

123
KA9QWC

122
W9ILF
WE2G

120
KØVTT
NN7H
WB9WKQ
KA4FZI
KF5IOU
WO2H
NM1K
AA2SV
WA2NDA
K4GK
NA7G

119
KB1RGQ

118
N3RAY
N7IE

117
KB3GJT

116
W7JSW

115
KØPTK

114
W3CB

113
KB3GJT

110
WA1MXT
K5AXW
KC5OZT
N8IO
N8CJS
K7BDU
W7QM
WB6UZX
N7XG
N7YSS
KBØDTI
W2EAG
N1IQI
K1YCQ
KA1G
N9MN
KF7GC
W7GB
N7YRT

108
KB3MTW

105
KJ6IJJ
N9VT
N1TF

104
N7EIE

103
N5NVP
K4JUU

100
K6JGL
KJ6PCC
K4SCL
KB5KKT
W5CU
NØYR
N1JX
KA2GQQ
KB2QO
W8MAL
N8SY
WG8Z
WAØVKC
WD8Q
N3SW
KB1NMO
WB4FDT
KB3LNM
AA3SB
AJ4TH
WS4P
AK4RJ
W4TTO
WB8TQZ
KB8RCR
K8KV
WB8WKQ
W3GQJ

99
K7FLI

98
KC8UR
N1LKJ

97
NC3F

95
K9LOT
AB9ZA
WB8QLT
WAØCGZ

94
N3RB
N2RTF

93
WA2BSS

91
WØRJA
W2CC
KJ4G
NU8K

90
WA4BAM
KA5AZK
KF5TTN
WB8HJJ
WB8SIQ
N8IBR
K1HEJ
KC2EMW

KZ8Q
WB4BIK
K3IN
N3ZOC
N3KB
KC8BW
NS7K

89
W8IM
KJ4HGH

87
N2DW

85
WDØGUF

84
NA9L
KC2UMX

83
K6RAU

82
KB9KEG
WB4Y

81
K4VWK

80
KCØZDA
KØDEU
NØMHJ
KB1WXC
K8ED
WB4RJW
KB7RVF
W7YV

79
K9DUR

78
AB1AV

75
K7MQF
N2YJZ
WB3FTQ

74
AL7N
N5MBQ

73
KAØDBK

72
WA9QIB
KD7THV

71
K3KH
W5XX

70
AJ7B
KD7ZUP
KDØAYN
KDØNJK
KDØUSN
KØDLK
KØPTK
KØRXC
N3NTV
NØDUW
NØDUX
W0FUI
KA8IAF
N2VC

The following stations qualified for PSHR in previous months, but were not recognized in this column yet. (Aug) KD8EBY 463, KE5HYW 160, N5TMC 155, KD5RQB 135, K6JT 130, KC5OZT 110, KF5IOU 110, NC3F 108, KF5TTN 105, AJ4TH 100, WS4P 90, KA5AZK 90, KE5YTA 86, N5MBQ 86, KZ8Q 80. (Jul) KD8EBY 401. (Apr) VE7GN 208. (Feb) VE7GN 150. Note of correction to Aug report: KJ6PCC earned 197 points.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, GA, IA, ID, IN, KS, LA, LAX, MDC, ME, MI, MN, MS, NC, NE, NFL, NNJ, NTX, OH, OK, OR, ORG, SC, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WI, WCF, WMA, WPA, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: DE, ENY, GA, IA, IN, KS, KY, MDC, MI, MN, MO, NC, ND, NLI, NM, OH, STX, SV, WTX, WV, WWA.

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 3544, WA4STO 2493, KK3F 2434, WB9FHP 1413, K6HTN 1285, N1IQI 803, NS7K 774, KW1U 707, K7BDU 642, K6JT 563, WA1STU 561, W9WXN 534, K6FRG 522, N9VC 511.

The following stations qualified for BPL with Originations plus Deliveries: NM1K 106, K8LJG 102.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

KR1B **Snowman**, Robert L. Sr, Fremont, NH
W1BKT **Doughty**, Everett W., Windham, ME
KB1CWE **Bezak**, William J., Coventry, RI
KF1DX **Ferreira**, Kenneth M., North Providence, RI
WA1E **Klockars**, Frederick O., North Smithfield, RI
AA1FG **Hubel**, David H., Newton, MA
K1FU **Barter**, Jon E., Wetumpka, AL
W1HQM **Thomas**, Donald F. Jr, Torrington, CT
W1JIT **Richardson**, William F., Wayland, MA
ex-KK1G **Baker**, Mary C., Portsmouth, NH
K1OMJ **Mocker**, Joseph F. Jr, Schenectady, NY
KB1OYH **Kerr**, Gary L., Danbury, NH
♦WA1TLC **Bell**, Robert L., Spring Hill, FL
KB1VYR **Brooks**, Timothy C., Plainville, MA
WA1WMG **Pivero**, James V., Pittsfield, MA
WD2AID **Randel**, Harry M., Scotch Plains, NJ
N2ATJ **Jurrens**, Connie, Kingston, NJ
WB2BTE **Bach**, Robert W., Watertown, NY
KH2CV **Cavanagh**, Joseph A., New York, NY
W2DFS **Amdursky**, Ralph J., Fort Lauderdale, FL
K2GCN **Sayles**, Todd M., Missoula, MT
W2HYS **Mulvey**, Charles F., Fayetteville, NY
N2JTO **McCarty**, John H., Barnegat Light, NJ
WB2MDA **Johnson**, Nicholas C., Okeechobee, FL
W2MEP **Conlon**, Francis T., Brooklyn, NY
WA2MKB **Greetham**, Sadie K., Syracuse, NY
KB2MRA **D'Ambrosio**, Anthony J., Staatsburg, NY
W2NSD **Green**, Wayne S. II, Peterborough, NH
KG2QX **Seiboth**, William E., Bessemer City, NC
W2RWR **Petrus**, Philip P., White Plains, NY
WB2SBO **Williams**, Nelson O., Voorheesville, NY
W2TKB **Bristoll**, Truman K., South Kortright, NY
NY2V **Adsit**, Frederick V., Weedsport, NY
K2ZUT **Maha**, John P., Batavia, NY
W3ANS **Levisay**, Dale H., Charlottesville, VA
W3APR **Fuller**, Alan, Mars, PA
WA3BJS **Petrovich**, George E., Greensburg, PA
KB3CJS **Abbott**, Kris L., Hampstead, MD
♦K3CY **Gennaro**, Alfonso R., Ambler, PA
WA3ENM **Blackburn**, William J. III, Rockville, MD
W3JPS **Harclerode**, Richard C., Lancaster, PA
W3JTF **Herman**, Lawrence W., Edinboro, PA
KB3JTG **Barr**, Theodore R., Gouldsboro, PA
K3LKF **Newman**, Ira H., Lake Balboa, CA
KA3MLX **Macripo**, Peter D., Penndel, PA
W3NCC **Roxas**, Richard A., Pittsburgh, PA
W3NGO **Quiggle**, Richard B., Erie, PA
K3NLY **Brenneman**, Kay I., Carlisle, PA
W3NTL **Paul**, Boyd E., Snow Shoe, PA
K3NUZ **Baker**, Don C. Sr, York, PA
K3OLJ **Herner**, Raymond F., Towanda, PA
WR3R **Pritchard**, Jack C., Pasadena, MD
W3RPO **Mick**, Stanley P., Saint Clair, PA
KB3SIS **Tran**, Sonny, Salisbury, MD
K3SUY **Bell**, Eugene S., New Castle, DE
W3UCF **Greene**, William "Don," Fort Washington, MD
WA3UWT **Fedorko**, Joseph E., Bradford, PA
N4ABM **Olson**, Merritt W., Ashburn, VA
KK4AI **Bartholomew**, R. D., Huntsville, AL
WT4B **Burdick**, Tyler B., Lynchburg, VA
KQ4BQ **Petkiewicz**, Joseph, Saint Petersburg, FL
N4CEK **Loflin**, Arlen H., Virginia Beach, VA
WD4CMR **Hart**, Frederick W., Chattanooga, TN
N4CQU **Humphries**, Vander P., North Richland Hills, TX
KA4CTX **Whitney**, Lawrence D., Toano, VA
K4CWA **Stuchell**, Charles W., Bluff City, TN
AG4CY **Satterfield**, Mark A., Virginia Beach, VA
ex-KX4D **Gerhardt**, Richard Jr, Sandston, VA
AC4EC **Icenhour**, Wallace L., Chase City, VA
W4EKK **Brady**, E. Glen, Lakewood Ranch, FL
N4GBY **Munsey**, Bernard, Jacksonville, FL
W4GSF **Belyea**, Brinton, Newport News, VA
W4HZV **Titus**, L. Templar, Ellijay, GA
W4JBJ **Jones**, James Benjamin, Jacksonville, FL
KD4JYQ **Poston**, Samuel E., Marion, VA
KB4KEI **Brock**, Charles L., Ormond Beach, FL
KD4LFL **Saunders**, Carrie S., Montgomery, AL
KI4LM **Bostick**, Robert W., Wildwood, FL
W4LNT **Hillman**, Clay W., New Canton, VA
AE4LT **Krull**, Bernard A., Camden, NJ
KJ4NIF **Baker**, Ralph H. Jr, Shelby, AL
N4NNA **Harrald**, Tommy H., Watauga, TN
WB4OAC **Davidson**, Richard A. Sr, Wildwood, FL
♦W4OGG **Goggio**, David C., Memphis, TN
K4OJP **Johnson**, Douglas B., Greensboro, NC
KF4ORR **Byrd**, James E., Soddy-Daisy, TN
KF4OUB **Friar**, Gary R., Greenhill, AL
W4OUF **Davis**, James G., Fort Walton Beach, FL
WA4PMC **Clark**, Arthur S., Weber City, VA
N4PRA **Feimster**, Robert L., Statesville, NC
W4RUQ **Ray**, Thomas B., Atlanta, GA
KC4UA **Shults**, James C., Lenoir City, TN
W4UB **Lawrence**, Robert G., Myrtle Beach, SC
♦WB4UFB **Martin**, Ramah G., Millington, NJ
KF4UVI **Lathem**, Nancy J., Charlotte, NC
KJ4VJW **Wade**, James R., Cadiz, KY
WB4VOC **King**, George W. "Bill," Louisville, KY
W4VPZ **Vann**, James W., Lynchburg, TN
W4WOF **Overton**, H. B., Huntsville, AL
W4ZIM **Morris**, Ronald D., Lake Wylie, SC
KI4ZMK **Taylor**, Henry C. Jr, Louisville, TN
N4ZTX **Abernethy**, Paul M., Burlington, NC
WD5ACI **Dominick**, Pete Jr, Beaumont, TX
K5ACX **Malone**, Bernard L. Jr, Baton Rouge, LA
KA5AMP **O'Hara**, Daniel J., Dripping Springs, TX
ex-N5APD **Franklin**, Garlan R., Buna, TX
WD5BPH **Williamson**, Billy H., Pearland, TX
W5CJU **Pool**, Sam L., Nassau Bay, TX
WA5CKN **Clark**, Philip A. Jr, Clarksdale, MS
KC5CWY **Blum**, Edward H. Jr, New Orleans, LA
W5DAZ **Tolbert**, Ford, Glenpool, OK
♦W5EDZ **Wangler**, Raymond B., San Antonio, TX
K5FB **Sloughter**, William J., Houston, TX
♦K5FPJ **Hall**, Henry W. Jr, Beeville, TX
W5KFX **Groner**, Harold E., Sulphur Springs, TX
AC5KJ **Canaday**, Roy, Bartlesville, OK
WB5LSK **Inglis**, Curtis L., Fort Worth, TX
W5MFY **Mc Collum**, William E., Phoenix, AZ
WB5NCK **Anderson**, Archie N., Licking, MO
W5NCN **Salmon**, Robert R., Norman, OK
W5NRC **Cunningham**, Norton R., North Richland Hills, TX
N5QJE **Maulden**, Harris E., Rosharon, TX
W5QLQ **Anderson**, Leon, San Antonio, TX
KC5QMT **Dickey**, Don, Fort Worth, TX
KB5RCL **Sims**, Claude L., Apache, OK
KB5SFA **Hedgemon**, Helen C., Shreveport, LA
N5SI **Pickering**, Floyd R., Natchez, MS
♦WB5TAT **Sherwood**, Louis K., Waxahachie, TX
W5TXX **Lynch**, Thomas B., Commerce, TX
KC5VH **Tinsley**, Jon E., Milton, FL
W6BFH **Hanshaw**, Bayliss F. "Bud," Sun City, AZ
WA6EOA **Heyman**, Edward J., Beverly Hills, CA
KG6FFM **Owens**, Bruce J., Sun City, CA
KA6FKZ **Murphy**, Benjamin, Sutter, CA
KK6GCP **Shaffer**, William C., Fort Bragg, CA
KG6JY **Perrin**, Page T., Hat Creek, CA
WZ6K **Boeck**, Glenn M., Santee, CA
W6KTE **Krist**, Richard F., Vista, CA
K6NAU **Jones**, Robert W., West Sacramento, CA
K6NY **Althouse**, John E., San Diego, CA
ex-KB6ODK **Hoskins**, Virginia L., Lodi, CA
KD6POX **Du Bois**, David V. F., Coarsegold, CA
K6PPA **Allen**, Patricia P., Olympia, WA
KB6QFY **Peterschick**, Grace E., Richland, WA
W6TLH **Heaps**, Timothy L., Chatsworth, CA
KH6UY **Boehme**, Fred M., Juneau, AK
W6ZJE **Kohlenberger**, Charles W., Fullerton, CA
K7ASV **Stanton**, Harold F., Conner, MT
KF7DLQ **Schriver**, Anthony T., Newcastle, UT
KC7DN **Stevens**, Danny R., Roseburg, OR
KF7ECH **Gunness**, John P., Great Falls, MT
W7FJY **Packard**, Louise I., Portland, OR
♦KA7GJU **Rice**, James B., Walla Walla, WA
KL7H **Hopkins**, Bruce T., Rising Fawn, GA
KC7HIW **Roberts**, August D., Bullhead City, AZ
KE7K **Chambers**, Herbert I., Arcadia, CA
♦K7KR **Thurman**, Patrick A., Scottsdale, AZ
KB7PO **Cline**, Herbert L., McMinnville, OR
KC7TUY **Gill**, Donald A., McMinnville, OR
KD7UVZ **Wynkoop**, John N., Salem, OR
AB7XA **Geer**, D. Bruce, Yakima, WA
N7XRW **Hartman**, Richard E., Jackpot, NV
W8AAD **Teaford**, Myron G., Greenville, OH
WA8ATS **Saiter**, Arthur E., Columbus, OH
K8CIS **Hogan**, John B., Richland, MI
KA8CLD **Posthuma**, Calvin J., Coopersville, MI
WD8DWH **Barke**, Dennis S., Prudenville, MI
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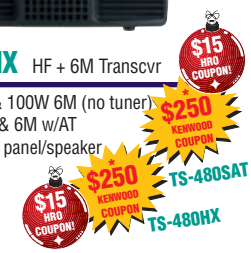

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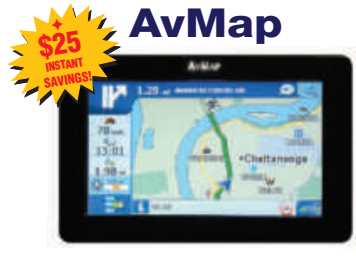

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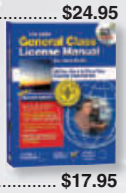

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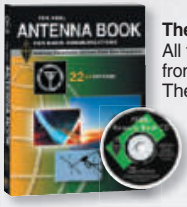

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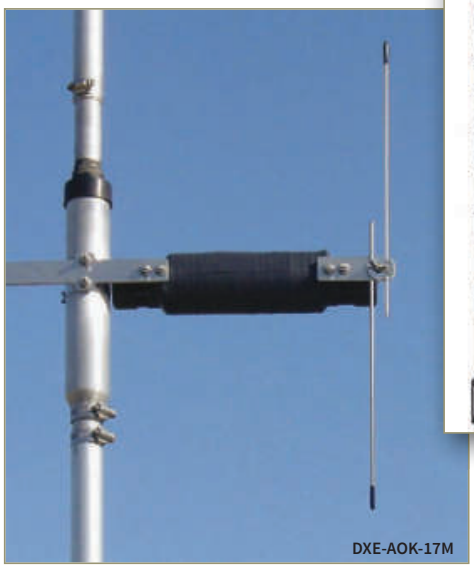

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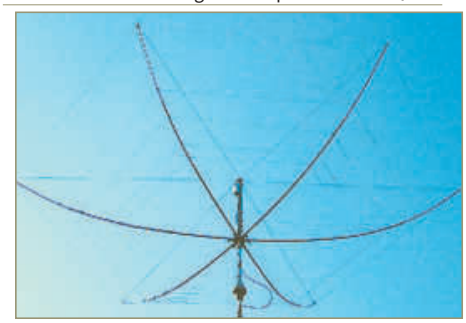

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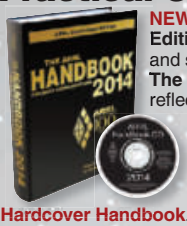

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DXE-SAD-075A	0.75"	1/4"-20	$5.65
DXE-SAD-100A	1.00"	1/4"-20	$6.05
DXE-SAD-125A	1.25"	1/4"-20	$6.85
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This aluminum and stainless steel antenna is durable, attractive and has a low profile to blend into its surroundings.

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DXE-40VE-2.....$219.95

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Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads. They feature an A356-T6 cast aluminum saddle, with rough, as-cast finish for a secure grip. The clamps include a cast stainless reinforcement plate; armor coated bolt sets are available separately.

Part Number	Tube O.D.	Price
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Securely mount tubing to any flat surface. These blocks have an insulated mount between the tubing and plates, ideal for antenna construction and electrical applications.

See the entire selection at DXEngineering.com.

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The saddles feature serrated edges to grip hard pipe surfaces. These clamps include stainless steel V-bolts, and can be ordered with a tab and 1/4" hardware for grounding applications.

V-Bolt Stainless Saddle	Pipe Size	Ground Lug	Price
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DXE-SSVC-1PG	1/2"-3/4"	Yes	$7.95
DXE-SSVC-150P	1"-1 1/2"	No	$9.95
DXE-SSVC-150PG	1"-1 1/2"	Yes	$10.95
DXE-SSVC-2P	1"-2"	No	$11.95
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These stainless steel brackets have two holes for chassis- or bulkhead-mount connectors (not included). Each bracket comes with a stainless steel V-bolt and hardware.

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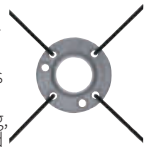
Guy Rings



Use DX Engineering's Guy Rings to secure your rope guys and stabilize your aluminum vertical antenna. They work with three- and four-way guying systems and are a great complement to our tubing kits. These guy rings are super strong, virtually impervious to the elements and fit 0.75", 1.0", 1.25", 1.50" and 2.0" O.D. tubing.

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Available in either fiberglass or aluminum, these kits contain several tapered sections of DX Engineering tubing and stainless steel band camps, allowing you to build your own vertical antenna. You can design, experiment and create an adjustable setup tailored specifically to your specs. The tubing telescopes smoothly and comes in larger sizes and wall thicknesses.

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The Best Aluminum Tubing Available

Just Add Clamps and Slide It Together for a Complete Antenna Element!

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- Better than the other guys, same price
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- Smoothly telescoping pre-slit or un-slit lengths
- Custom made just for DX Engineering

3' lengths .058" wall - 3/8" to 2 1/8" O.D.

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Perfect for Most Elements

6061-T8 .120" wall - 1.5" to 3" O.D. un-slit

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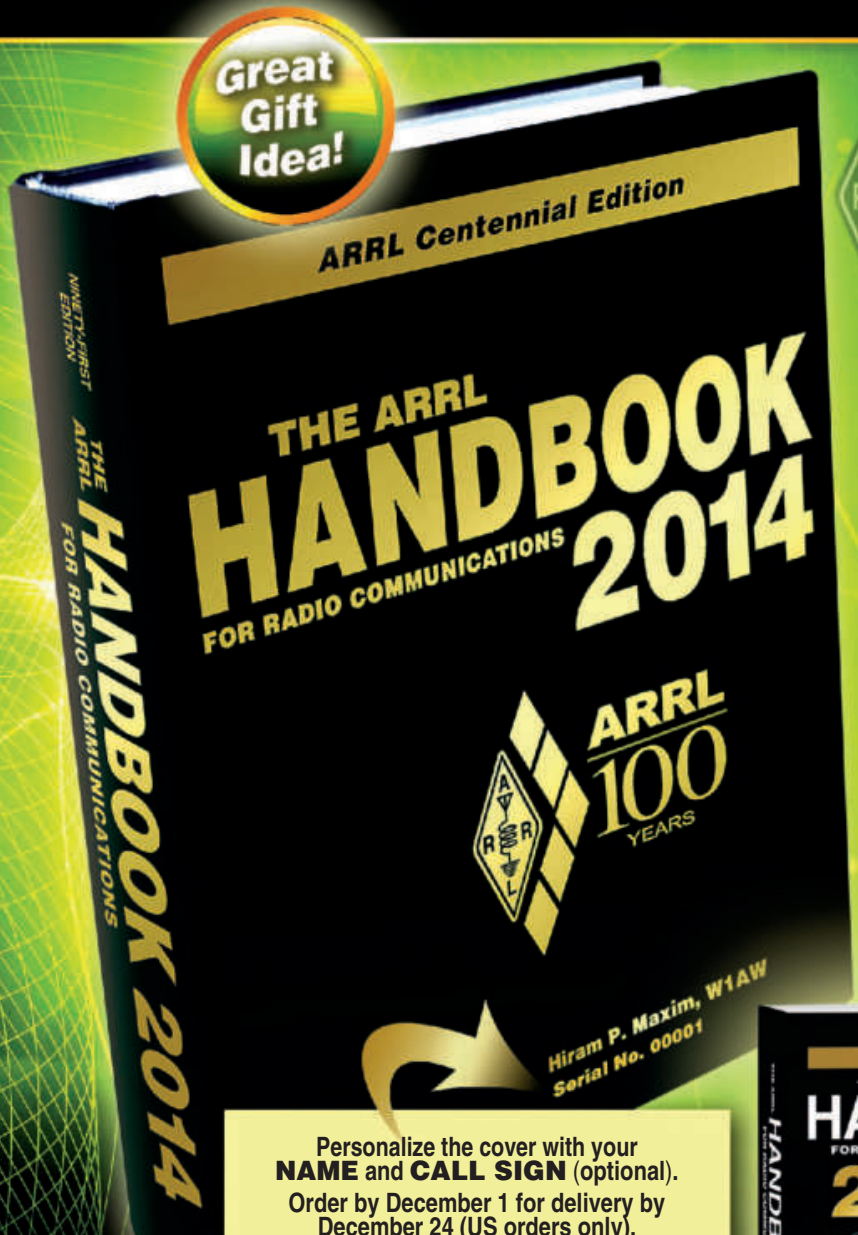

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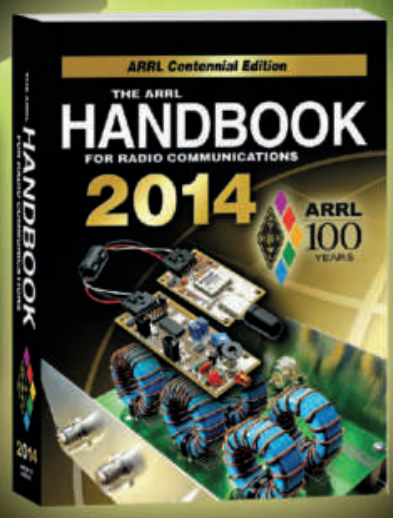

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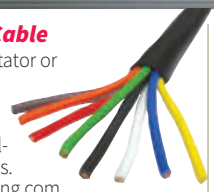
Bulk Cable	Impedance	Length	Price
Low-Loss Mini-8 Cable			
DXE-8X	50 Ω	per foot	**$0.31**
DXE-8X-1000	50 Ω	1,000'	**$259.99**
Low-Loss Cable			
DXE-213U	50 Ω	per foot	**$0.89**
DXE-213U-500	50 Ω	500'	**$409.99**
DXE-11U	75 Ω	per foot	**$0.52**
Premium Low-Loss Cable			
DXE-400MAX	50 Ω	per foot	**$0.82**
DXE-400MAX-500	50 Ω	500'	**$364.99**
Low-Loss Foam Cable			
DXE-8U	50 Ω	per foot	**$0.79**
DXE-8U-500	50 Ω	500'	**$359.99**
Highly Flexible Cable			
DXE-58AU	50 Ω	per foot	**$0.29**
Flooded Jacket Cable			
DXE-F6-CTL	75 Ω	per foot	**$0.19**
DXE-F6-1000	75 Ω	1,000'	**$149.95**

Multi-Conductor Control Cable



The ideal cable to control your rotator or antenna switch, this color-coded stranded copper cable is reliable and flexible. A vinyl jacket shields it from the elements and it is available by the foot and in bulk spools. Find all the details at DXEngineering.com.

Part Number	Conductors (Gauge)	Description	Price/ Foot
COM-CW3	3 (20 AWG)	Standard	**$0.25**
COM-CW4	4 (20 AWG)	Standard	**$0.28**
DXE-CW8	2 (18 AWG) 6 (22 AWG)	Standard	**$0.48**
DXE-CW8-HD	2 (16 AWG) 6 (18 AWG)	Heavy Duty	**$0.89**
DXE-CW9	9 (24 AWG)	CAT5e	**$0.32**
DXE-CW9S	9 (24 AWG)	Shielded	**$0.36**

DXE-8X BNC Jumper Cables

These male BNC jumper cables use secure, crimped connectors and weatherproof shrink tube strain relief. They are Hi-Pot and high voltage tested. In addition to these 50 Ω assemblies, 75 Ω cables are available as well.

DXE-8XDB002 2' Length.....**$14.25**
DXE-8XDB003 3' Length.....**$14.75**
DXE-8XDB006 6' Length.....**$15.75**
DXE-8XDB012 12' Length.....**$17.75**
DXE-8XDB025 25' Length.....**$21.75**
DXE-8XDB050 50' Length.....**$32.75**

Phasing Cables

DX Engineering provides precision, electrically-tuned phasing lines for your 50 or 75 Ω applications. Choose from pre-manufactured four-square and two-antenna array cables or contact us with your custom application.

Multi-Conductor Heavy Duty Tinned Copper Flat Braid

A critical part of any grounding system, this Flat Braid is made with terminals for quick, easy installation. See more sizes and grounding solutions at DXEngineering.com.

Part Number	Length	Price
7 AWG Braid Rated at 85 Amps 1" Wide, for a 1/4" Stud		
DXE-TCB10-RT01	1'	**$5.75**
DXE-TCB10-RT03	3'	**$8.75**
DXE-TCB10-RT05	5'	**$12.75**
DXE-TCB10-RT10	10'	**$18.75**
10 AWG Braid Rated at 53 Amps 1/2" Wide, for a #10 Stud		
DXE-TCB05-RT01	1'	**$4.75**
DXE-TCB05-RT03	3'	**$5.75**
DXE-TCB05-RT05	5'	**$6.75**
DXE-TCB05-RT10	10'	**$9.75**

DX Engineering is the Best Place to Get Coax, Here's Why:

- 100% High Voltage (Hi-Pot) Tested
- Weatherproof: Adhesive Shrink Tubing Seals Connections
- Silver-plated PTFE-insulated Connectors
- Hand Crafted by Top Techs

See DXEngineering.com for more connector options.

Black PVC Jacket

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket

Attenuation per 100 feet	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%

Pre-cut Cable with Connectors Part Number	Length	Price
DXE-8UDU002	2'	**$18.95**
DXE-8UDU003	3'	**$19.45**
DXE-8UDU006	6'	**$22.45**
DXE-8UDU025	25'	**$42.45**
DXE-8UDU050	50'	**$67.75**
DXE-8UDU100	100'	**$117.45**

UV-Resistant, Non-Contaminating, Black PVC Jacket

DXE-213U MIL-Spec Cable

- .405" Type II UV-resistant jacket is non-contaminating and suitable for outdoor use

Attenuation per 100 feet	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%

Pre-cut Cable with Connectors Part Number	Length	Price
DXE-213UDU003	3'	**$19.95**
DXE-213UDU006	6'	**$22.95**
DXE-213UDU012	12'	**$27.95**
DXE-213UDU025	25'	**$42.95**
DXE-213UDU050	50'	**$67.95**
DXE-213UDU075	75'	**$95.95**
DXE-213UDU100	100'	**$117.95**
DXE-213UDU150	150'	**$177.95**

UV-Resistant, Black PE Jacket

DXE-8X Low-Loss Foam Dielectric Cable

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 per 100 feet	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%

Pre-cut Cable with Connectors Part Number	Length	Price
DXE-8XDU003	3'	**$17.95**
DXE-8XDU006	6'	**$18.95**
DXE-8XDU012	12'	**$23.95**
DXE-8XDU025	25'	**$28.95**
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DXE-8XDU075	75'	**$43.95**
DXE-8XDU100	100'	**$53.95**
DXE-8XDU150	150'	**$78.95**

UV-Resistant, Non-Contaminating, Black PVC Jacket

DXE-400MAX Low-Loss Cable

- Gas-injected foam, polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density UV-resistant polyethylene jacket is ideal for outdoors
- Direct-bury

Attenuation per 100 feet	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	0.7kW	47%

Pre-cut Cable with Connectors Part Number	Length	Price
DXE-400MAXDU003	3'	**$20.95**
DXE-400MAXDU006	6'	**$23.95**
DXE-400MAXDU018	18'	**$30.95**
DXE-400MAXDU025	25'	**$43.95**
DXE-400MAXDU050	50'	**$68.95**
DXE-400MAXDU075	75'	**$96.95**
DXE-400MAXDU100	100'	**$118.95**
DXE-400MAXDU150	150'	**$178.95**

The #1 Line of Autotuners!

AT-1000ProII

LDG Electronics' 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

NEW! AL-100

The AL-100 is compatible with all Alinco radios including the new DX-SR8T. Includes Alinco interface cable.

The AL-100 is the definitive low cost automatic antenna tuner for the definitive low cost Amateur transceiver! It has been designed from the ground up to provide the power handling you asked for, in a small, lightweight package that is perfect for portable as well as sitting on your desk in your shack!

Suggested Price $149.99

NEW! USB-100

The USB-100 provides serial communication for the AT-1000 and AT-600 over a USB port to your computer. Third party software will be available to provide communication including Army MARS.

Suggested Price $49.99

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***

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

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***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-100ProII

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

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*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***

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***

NEW! RT-100

A Technological Breakthrough in Remote Tuning!

The RT-100 is a coax in / coax out tuner designed to be placed near the feedpoint of the antenna. If you're worried about power loss due to SWR in your feedline, the RT-100 is the answer. Place the RT-100 near the feedpoint and virtually eliminate all feed line loss due to SWR.

The RT-100 is DC powered over the coax, so add your own DC injection circuit or use the LDG RC-100 to power and control the tuner from your shack. The RC-100 will provide DC power over the coax as well as control for Auto mode, Lock, and Tune.

Suggested Price $199.99

Optional RC-100 $49.99

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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HAM-IV

The most popular rotator in the world!

HAM-IV **$649.95**

For medium communications arrays up to 15 square feet wind load area.*Has* 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast $2^{1}/_{16}$".

HAM-VI **$749.95** with DCU-2

HAM-VII **$799.95** *with DCU-3*

TAILTWISTER SERIES II

T-2X **$799.95**

T-2XD2 **$899.95** with DCU-2

T-2XD3 **$949.95** with DCU-3

For large medium antenna arrays up to 20 sq. ft. wind load. Has 5-second brake delay, Test/Calibrate functions. Low temp 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, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" max mast. **MSHD, $109.95.** Above tower heavy duty mast support. T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

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-3 Digital Rotator Controller

6 Programmable Beam Headings . . .

Gives you fully automatic and manual control of your hy-gain rotators

New!

DCU-3 **$449.95**

New DCU-3 Digital Controller lets you program 6 beam headings! Gives you fully automatic or manual control of your hy-gain HAM or Tailtwister Rotators.

Push a memory button or dial in your beam heading or let *Ham Radio Deluxe* (or other) control your DCU-3. Your antenna automatically rotates precisely and safely to your desired direction.

DCU-3 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. Greatly reduces potentially damaging overshoot.

Fine tuning and full manual control is effortless with *automated* Left and Right direction buttons - - no more worrying about releasing and relocking the brake. Brake *automatically* releases before fine tuning begins and relocks after fine tuning.

Bright blue LCD displays actual, dial-in and computer controlled beam headings in one degree increments and your call.

AutoBrake Release - no need to remember to release brake -- release time is automatic and adjustable 0 to 8 seconds.

***Coast* feature** allows antenna to gently stop before 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 antenna before turning -- great for older rotators with "sticky" brakes. It jogs the rotator backwards slightly to ease brake pressure enough to release.

Offset feature allows you to calibrate display to show actual beam heading. USB/RS-232 ports. Adjustable LCD sleep time. Field upgradeable. 8.5Wx4.3H x9D". 110 VAC. **DCU-3X** for 220 VAC.

DCU-2, $399.95. **Digital** Rotator Controller, like DCU-3, but no programmable memories. 110 VAC. Order **DCU-2X**, for 220 VAC.

HAM-VI & HAM-VII

New!* HAM-VII, $799.95.** Like HAM-IV but with ***DCU-3 digital controller with *six programmable memories*. For medium antennas up to 15 sq. ft. wind load.

New!

HAM-VII **$799.95** *with DCU-3*

HAM-VI **$749.95** *with DCU-2*

HAM-VI, $749.95. Like HAM-VII but with ***DCU-2*** digital controller.

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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TH-F6A Triband FM HT

- 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

$25 INSTANT Coupon

TH-D72A 2M/440 FM HT with 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 • 200 Memories

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TM-D710A

Dualband FM Mobile with 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 • EchoLink® ready

$40 INSTANT Coupon

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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 • Optional RC-D710 can replace the TM-V71A control panel to enable all the features of the TM-D710A

$15 INSTANT Coupon

TS-480HX 200W HF/6M Mobile

- TX: HF/6M • RX: 0.5-60 MHz • Power: 10-200W (with two optional 22A PS's) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band

$250 INSTANT Coupon

TS-480SAT 100W with auto antenna tuner.

$250 INSTANT Coupon

TS-2000 HF/VHF/UHF Transceiver

- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- 99 Memories • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

$200 INSTANT Coupon

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

$250 INSTANT Coupon

TS-590S 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz MHz • Power: 5-100W
- 110 Memories + 10 Quick Channels • Auto Antenna Tuner • USB for PC and remote control • Down conversion receiver • Narrow first roofing filter • More!

TS-990S HF/6M Flagship Transceiver

- TX: HF/6M • RX: 0.13-60 MHz • Power: 2-200W
- Built-in Auto Antenna Tuner and AC Supply • Dual TFT Display • Dual receivers Narrow-band roofing filters
- Triple DSP • Serial port, USB ports and Ethernet port

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• Power: 5.5/2.5/0.5W • Memories: 207
• Comes with NiMH Battery and Wall Charger

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• No NiMH Battery or Charger • Has AA Battery Case which accepts standard or alkaline batteries

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• TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
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• TX: 144-148 MHz • RX: 118-174 MHz • Tested to the latest MIL-STD 810G Specifications • Heavy Duty Power: 65/25/10/5W • 4.5W Audio Output • 207 Memories • CTCSS and CTCSS encoder/decoder

ID-880H 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blocked) • Power: 50/15/5W • 1052 Memories • D-Star built-in, ready to go!

IC-7000 Multimode HF/VHF/UHF Mobile

• TX: HF/6M/2M/440 MHz • RX: 0.03-199, 400-470 MHz
• Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
• 503 Memories • 41 selectable band-widths
• Selectable sharp or soft filter shapes

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IC-7100 HF/VHF/UHF All Mode Transceiver

• TX: HF/6M/2M/440MHz • RX: 0.03-199.999, 400-470 MHz MHz • Power: 2-100W/2-50W (2M)/2-35W (440) • Memories: 495, 900 D-Star Repeater Channels • Remote Head • Intuitive Touch Screen Interface • D-Star DV Mode • Detachable Angled Screen • SD Memory Card Slot • USB Port • Optional RS-BA1 Remote Control Software • Optional RC-28 USB Remote Encoder

IC-7200 HF/6M Portable Transceiver

• 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 and 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
• Much faster DSP unit compared to the IC-746PRO
• Automatic antenna tuner • USB connector for PC control

IC-7600 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
• Memories: 101 • 5.8 inch color screen • High-resolution real spectrum scope • Automatic antenna tuner

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
• +30dBm class third-order intercept point • Optional 3 kHz & 6 kHz Roofing Filters (first IF) • USB Port for PC Control • Optional Remote Control Software • Optional RC-28 USB Remote Encoder • Much More!

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- 200 Memories • Extra large LCD display & speaker

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- TX: 144-148, 430-450 • RX: 0.5-999 (cell blocked)
- Power: 1.5W (2M), 1W (440 MHz) • 1000 Memories
- Ultra Small - Only 1.9" x 3.2" x 0.9" and 4.6 ounces!

FREE AES MT-4 Mount

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- TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
- Power: 5/2.5/1/0.3W (1.5W on 220) • 900 Memories

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VX-8DR 4-Band FM HT

- TX: 50-54, 144-148, 222-225, 430-450 MHz
- RX: 0.5-999 MHz (cell blocked) •1200+ Memories
- Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
- Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand microphone provides APRS® data

$80 Mail-In REBATE

FT-2900R Heavy Duty Wide/Narrow Deviation Selection 2M FM Mobile

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FT-8800R 2M/440 FM Mobile

- 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) •1000 Memories • Crossband repeat • YSK-8900 Remote Kit included!

$100 Mail-In REBATE

FT-8900R Quad-Band FM Mobile

- Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 Rem. Kit included!

$100 Mail-In REBATE

FT-450D HF/6M Compact Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 500 • Built-in Automatic Antenna Tuner • IF DSP • Same as the original FT-450AT with new features: Key illumination, Foot stand, Selectable 300 Hz/500 Hz/2.4 kHz CW IF Filters, Classically designed main dial and knobs, dynamic microphone

FTDX-1200 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Triple Conversion with 32-bit floating point DSP • Power: 100W • Built-in Automatic Antenna Tuner • 40 MHz IF with selectable 3 kHz, 6kHz & 15 kHz Roofing Filters • FM & AM Wide and Narrow modes included • Optional built-in FFT UNIT supports advanced functionality - AF-FFT Scope RTTY/PSK31 Encode/Decode, CW Decode and CW Auto Zero-in • Full Color 4.3 inch TFT Color Display • USB

FTDX-3000D HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 5-100W
- Large TFT color display with high-speed spectrum scope
- High end receiver based off of the FTDX-5000 • IPO
- Built-in USB interface • Remote Control Capability
- High-speed auto antenna tuner • RTTY/PSK31 encode/decode included • 5 Digital voice messages

FTDX-5000MP HF/6M Transceiver

- TX: 1.8-29.7, 50-54 MHz Power: 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz
- 99 Memories • Agressive 112dB range • +40dBm IP3 or 3rd-order Intercept Range • High stability ±0.05ppm OCXO • 32-bit Floating Point DSP • Variable CW Audio Peak Filter, and High/Low-Cut DSP filtering • 300 Hz, 600Hz, 3 kHz, 6kHz and 15 kHz Roofing Filters
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- Fully Automatic bandswitching and tune up
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AT-615

Full legal limit tuners, for coax-fed low band verticals and balanced wire fed systems

NEW!

Fully Automatic Remote Antenna Tuners

Exclusively from "RF Communication Electronics" in Germany, fully-automatic remote tuners for both balanced and unbalanced loads. Full legal limit power capability.

Visit our Webpage for more information!

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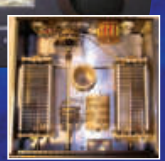

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New coaxial and balanced tuners available in **800w**, **1500w** and **3000w** versions.

See the Array Solutions website for more details.

ACOM 1500 Linear Amplifier

- Frequency coverage: All amateur bands 1.8 – 54 MHz
- Power output: 1500W PEP SSB, 1200W all other modes
- Manual band switching and tune up
- 3 antenna outputs
- Maximum output SWR: 3:1
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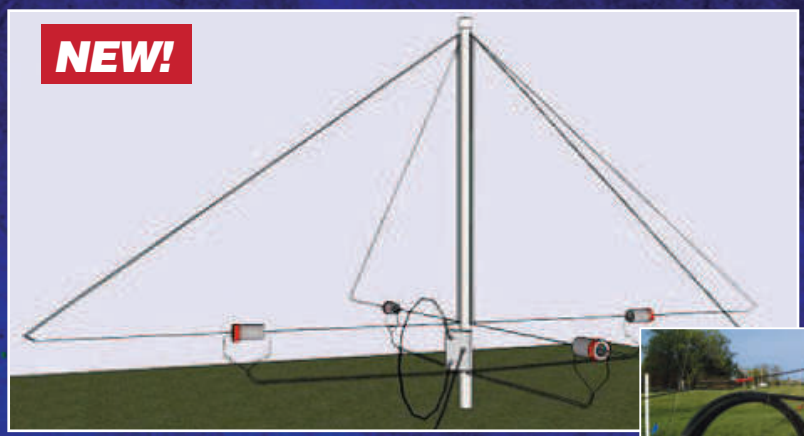

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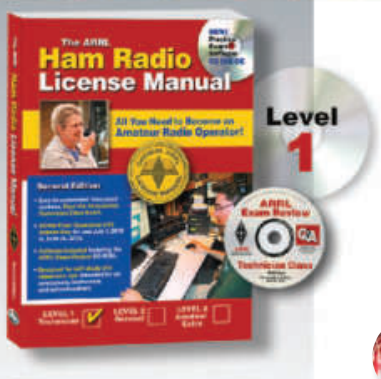

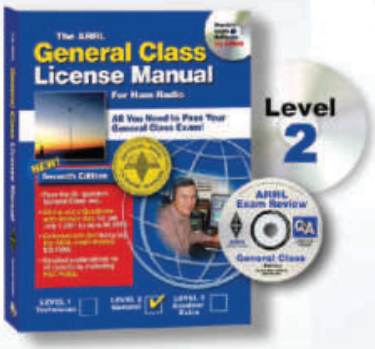

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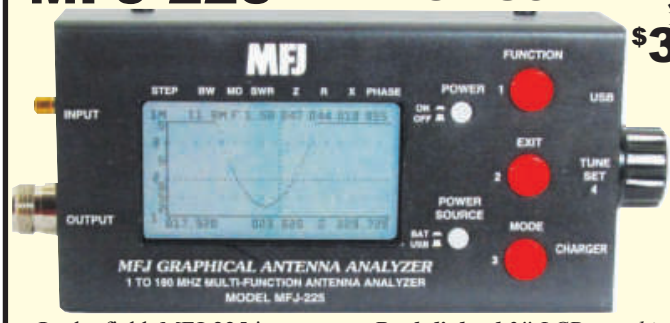
MFJ ANALYZERS

MFJ-225 . . . 1.5-180 MHz, Two-Port Graphic Analyzer



MFJ-225 **$399.95**

In the field, MFJ-225 is a completely *self-contained hand-held analyzer*. On the bench it becomes a two-port (S21) desk-top machine teamed with your PC. Use powerful IG-miniVNA freeware, run data analysis and print out stunning color-graphic plots to document your work!

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DDS stimulus generator gives leveled -5 dBm signal source for driving mixers, low-power amps, filters, networks, diplexers, and antennas with *over -50 dBc* of harmonic and spur suppression.

Measures SWR 1:1 to 9.9:1, complex impedance (R+jX), impedance magnitude (Z), return loss (0-30dB), phase, capacitance, inductance , cable length and cable loss (0-30dB).

Requires 3 NiMh AAA cells or optional 12VDC/110VAC with **MFJ-1312D, $15.95.** Interface requires a USB Type-B cable. $3^{3}/_{32}$Wx$6^{1}/_{8}$Hx$1^{1}/_{2}$D inches.

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MFJ-213, $199.95. Reads SWR, complex impedance, impedance magnitude. Measures capacitance, inductance, field strength, frequency, generate test signals. Tune stubs, analyze coax, test baluns, RF transformers, more.

More hams use MFJ analyzers than all others in the world!

MFJ-259B 1.8-170 MHz . . . World's most popular analyzer

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World's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz. Super easy-to-use -- Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to short or open in feet. Read inductance in uH, capacitance in pF at RF frequencies. Large easy-to-see two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning. *More!*

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MFJ-266C 1.5-65, 105-230 300-490 MHz -- *all* Ham Bands

MFJ-266C **$359.95**

MFJ-266C *new* compact *wide-range* analyzer covers HF (1.5-65 MHz), VHF (105-230 MHz, including 220 MHz band) and UHF (300-490 MHz). Antenna Analyzer mode reads frequency, SWR, complex impedance *simultaneously*. 500 MHz freq. counter mode has 100 Hz resolution, measures relative field strength/frequency for tracking interference. Signal Generator mode, solid-state switching, and electronic tuning. Backlight, N-connector.

MFJ-249B *Analyzer*

MFJ-249B, $269.95.
If digital display is all you need MFJ-249B does everything MFJ-259B does without analog meters.

MFJ-269*PRO*™ *Analyzer*

MFJ-269Pro, $419.95.
Like MFJ-269, but UHF range covers *430 to 520 MHz* to include commercial and industrial frequencies. Rugged protective shell protects knobs, switches, meters, digital display for commercial, industrial and lab work.

HF/VHF/UHF SWR Analyzer™

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Has all the features of MFJ-266C but MFJ-266B covers 1.5-65 MHz, 85-185 MHz and 300-490 MHz. Does not cover 220 MHz band.

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B. MFJ-92AA10, $29.95. 10-Pack 2500 mAh Ni-MH Supercells.
C. MFJ-66, $24.95. Dip coils, set of two covers 1.8-170 MHz.
D. MFJ-731, $99.95. Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.
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F. MFJ-5510, $9.95. 12VDC cigarette lighter adapter.
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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!

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More hams use MFJ tuners than all other tuners in the world!

MFJ-989D *Legal Limit* Tuner

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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**

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MFJ-971 *portable/QRP* Tuner

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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.

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MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

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MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

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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.

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Small, Ant Switch, 20K VA Memories

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High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

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No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

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200W...Weather-sealed

for Remote/Outdoor/Marine

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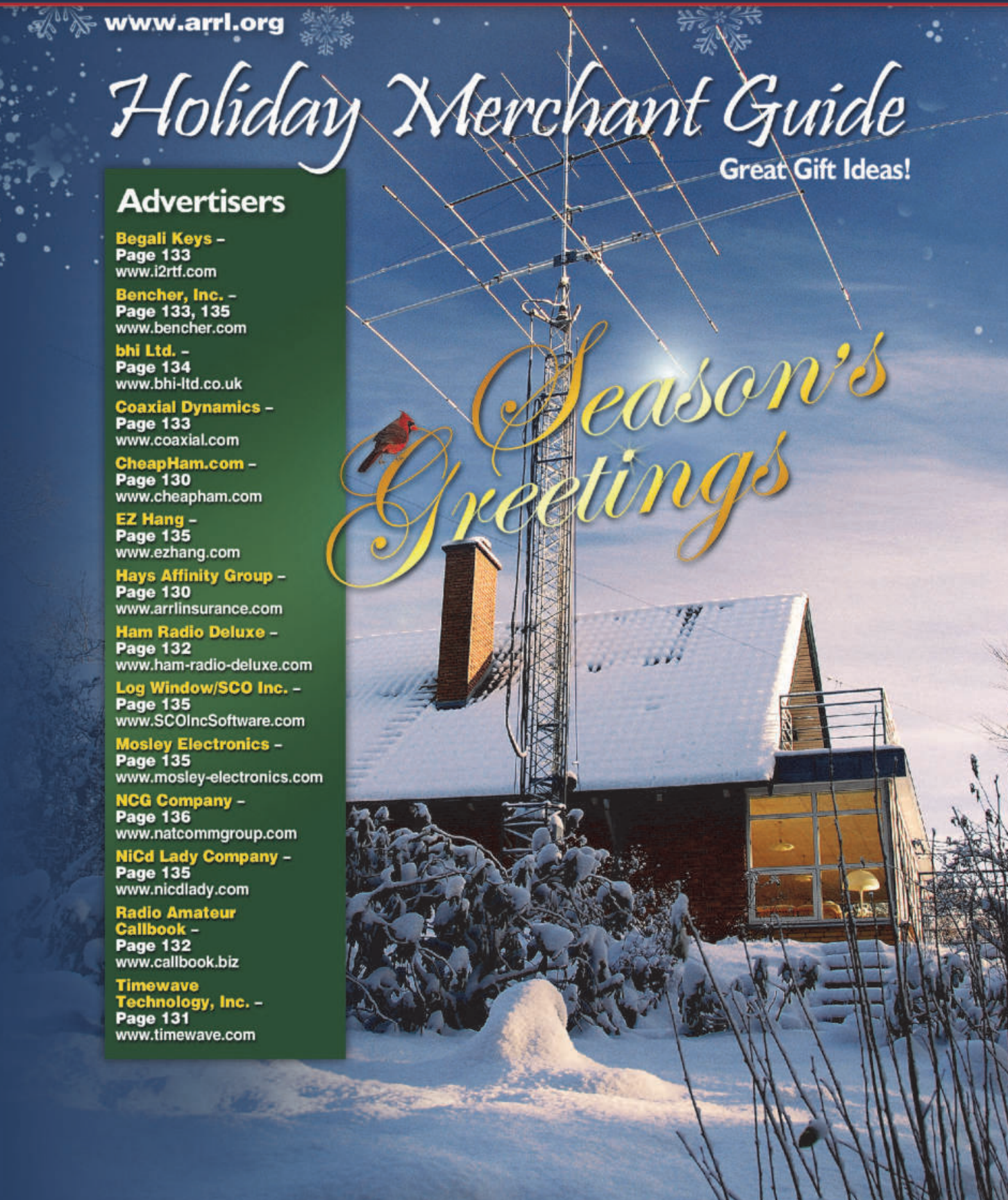

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The *Navigator* joins the PK-232SC+ Multimode Data Controller in Timewave's versatile line of data controllers, TNCs and and sound card modems.

The *Navigator* is a complete USB sound card modem featuring a proven USB audio sound card chip, six FTDI USB serial COM ports, a K1EL WinKey keyer, True FSK and rig control connections for every radio. It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. A second audio input lets you use both receivers in a dual receiver radio. The logic level and RS-232 rig control ports support your Icom CI-V, Yaesu CAT, Kenwood and other radios. Front panel controls set both RX audio levels, TX audio ouput level, audio monitor level and the CW speed. There are no internal configuration jumpers - just conveniently set the software-controlled configuration settings from your PC.

Need Software? Check the new Ham Radio Deluxe & Radio Operating Center bundle!
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PK-232SC+ with New Dual Port Option!

PK-232SC+ Multimode Data Controller*

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- Computer isolated from radio
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For the first time in 23 years, we tweaked the PK-232's main PC board! Now with a dual port option, the incredible PK-232SC+ again expands its role in your radio station. The new PK-232SC+ can operate legacy modes on one port and sound card modes on the other - simultaneously! The SC+ connects to your computer with a single USB cable - no audio cables, no RS-232 cables! It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. The logic level and RS-232 rig control is optically isolated for your Icom CI-V, Yaesu CAT, Kenwood and other radios. A new optically isolated DTR PTT option works with legacy sound card software and radios. We even added a pair of USB ports for that new radio with USB rig control and other accessories.

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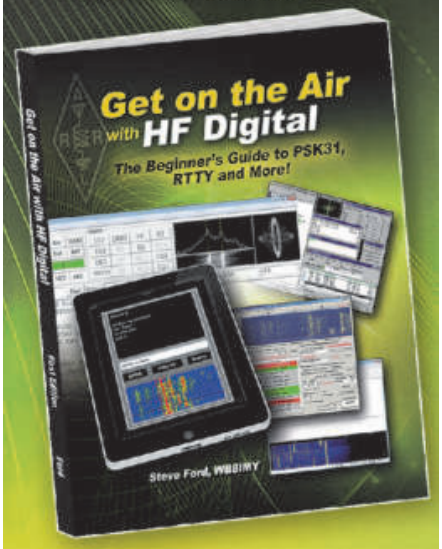

By Steve Ford, WB8IMY

Get on the Air with HF Digital is a step-by-step guide that'll get you started in the fascinating world of HF digital technology. Written in an easy to understand, conversational style, this book will show you how to set up and operate your own HF digital station. It's a fun and easy way for beginners to *get on the air*!

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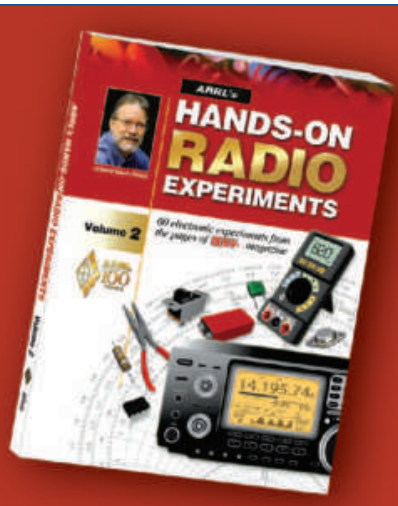

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QST's **monthly *Hands-On Radio* column, written by Ward Silver, NØAX, is one of the most-read sections of the magazine. Wireless technology continues to develop rapidly and radio experimenters are eager to discover what makes their radios work. As long as we keep putting our hands on radios, there will be techniques to learn and circuits and components to try. The second volume gathers all of the columns over the past five years, from 2008 through 2012. Once again, Silver expertly leads you through 60 short electronics experiments, designed to increase your understanding of basic radio fundamentals, components, circuits and design.** ***Includes a complete parts list from all experiments in Volumes 1 and 2!***

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MFJ 160-6 Meter Antenna

Self-supporting 43 foot vertical -- no guy wires required . . . 1500 Watts . . . exceptional performance . . . low-profile . . . includes base mount and legal limit balun . . . assembles in an hour . . .

MFJ-2990
$359.95

New!

Operate all bands 160 through 6 Meters at full 1500 Watt with this self-supporting, 43 feet high performance vertical! It assembles in less than an hour and its low-profile blends in with the sky and trees -- you can barely see it from across the street.

Exceptional Performance

The entire length radiates to provide exceptional low angle DX performance on 160 through 20 meters and very good performance on 17 through 6 Meters. You can shorten it by telescoping it down for more effective low angle radiation on higher bands if desired.

With an automatic antenna tuner there's no fuss -- just talk!

A wide-range automatic or manual antenna tuner *at your rig* easily matches this antenna for all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up!

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than 1/2 dB 60-6 Meters and less than 1 dB 160-80 M with good quality, low-loss coax).

Fully self-supporting, Extremely low wind loading, Very low visibility . . .

With just 2 square feet wind load, the fully self-supporting MFJ-2990 -- *no guy wires needed* -- has the lowest wind-loading and lowest visibility of any vertical antenna! The key is a six foot section of tapering diameter *stainless steel* whip that flexes in strong wind instead of stressing the bottom sections. Its 2-inch O.D. and .120 inch thick walled tubing bottom section makes it incredibly strong -- it'll stay up!

Weighs just 20 pounds -- you can easily put it up by yourself because its corrosion resistant *6063 aircraft aluminum* tubing and stainless steel construction make it light *and* super-strong.

Assembles in an hour

You can easily assemble it in an hour! Ground mounting lets you completely hide its antenna base in shrubbery. Includes ATB-65 high-strength antenna mount. Requires ground system -- at least one radial. More extensive ground system will give much better performance.

Great for Stealth Operation in antenna restricted areas

This very low-profile antenna is perfect for stealth operation in antenna restricted areas. Hide it behind trees, fences, buildings, bushes. Use it as a flagpole. Telescope it down during the day. Put it up at night and take it down in the morning before the neighbors even notice!

Quick and easy installation makes it great for DXpeditions, field day and other portable and temporary operations.

MFJ *Automatic* Tuners

MFJ-998
$699.95

For legal limit 1500 Watt SSB/CW amplifiers. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, amp bypass, matches 12-1600 Ohms, 1.8-30 MHz.

MFJ-993B
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Dual power range -- 300 Watt range matches 6-1600 Ohms. 150 Watt/6-3200 Ohms. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, 1.8-30 MHz.

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1500 Watts SSB/CW, 1.8-30 MHz. Active peak-reading Cross-Needle SWR/Wattmeter, balun, dummy load, antenna switch, aircore roller inductor.

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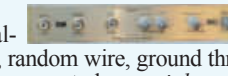

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22 Amp Continuous

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22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

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22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

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40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

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75 Amps maximum and 70 Amps continuously. Adjustable voltage 4.0-16 VDC. Short circuit, overload and over-temperature protection, 10.5 lbs. 9¾Wx5½Hx9½D". Great for Ameritron's ALS-500M mobile amplifier!

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High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a* single *DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

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MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

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MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

MFJ-1128 **$104.95**

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx1¼Hx2¾D".

MFJ-1126 **$84.95**

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®*, *extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

MFJ-1129 **$114.95**

PowerPoles™ *AND 5-Way Binding Posts*

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, 12½Wx1¼Hx2¾D inches.

MFJ-1124 **$64.95**

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost.*

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. 1½ lbs. Tiny 3¾Wx2¼Hx3¾D inches fits easily in an overnight bag.

MFJ-4115 **$59.95**

30 Amps Continuous

Linear with 19.2 lb.Transformer

No RF Hash!

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. 9½Wx6Hx9¾D in.

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MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

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$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.

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MFJ *giant* 6.5 inch SWR/Wattmeter

World's *largest HF SWR/Wattmeter has giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

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.

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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. 7¼Wx4½Hx4½D in.

MFJ-891
$109.95

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. 6½Wx2⅝Hx6D inches.

MFJ-826B
$179.95

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MFJ-4416B
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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. 7¾Wx4Hx2⅛D inches.

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MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

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34 feet Radiators
Covers 7-55 MHz

MFJ-2289
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Whether you're relaxing in the mountains or beach or at your antenna restricted neighborhood, MFJ's BigEAR™ portable HF dipole puts out a strong full-size dipole signal!

Full Size Performance

BigEAR's™ whopping 34-feet stainless steel radiator -- *twice the length* of other portables -- gives you *full-size dipole* performance on 20-6 Meters. An *ultra low loss*, high-Q adjustable *air-wound* loading coil gives you highly efficient loaded dipole performance on 30/40 Meters.

Full-size and ultra low loss loading coil is a winning combination that stands head and shoulders above shorter backpack antennas. All your power is radiated, not wasted in loading coils.

Rotatable Dipole Directivity

BigEAR's™ dipole pattern lets you aim a strong main lobe toward your QSO or null out QRM by simply rotating your tripod or mount.

True General Coverage

You can tune it up with exceptionally low SWR on any frequency between 7.0 and 55 MHz. Handles QRP to a full killowatt PEP.

Element Tips High In-the-Air

Distinctive V-shaped elements are set 45 degrees from the horizon to keep element tips high in the air. This maximizes radiation, minimizes ground loss and prevents hazardous contact.

Built-in Guanella Current Balun

Current Balun gives you consistent high-performance. Kills feedline radiation, pattern distortion, SWR shifts, RFI, noise pickup.

True Backpack Portability

Antenna is over 34 feet long fully extended, but disassembles and collapses to 27 inches in seconds. Fits most backpacks or suitcases! Just 2 pounds -- you'll hardly know you are packing it!

Goes Up Fast

Fewer parts to assemble. Much faster tune-up procedure. Heavy-duty aluminum center block instantly mounts on any mast/tripod up to 7/8 inches with MFJ's heavy-duty *NoTool*™ mast lock. SO-239. For confined spaces, shorten whips and use loading coil to resonate.

BigStick™ 18-foot Portable Vertical

For the Ham on-the-go!

Carry a BigStick™ for strongest, loudest portable signal on the band!

MFJ-2286
$99.95

MFJ's extra long 17 foot stainless-steel telescoping whip gives you *full-size antenna* for full size performance 20 to 6 Meters but collapses to just 28 inches.

An ultra low loss, high-Q adjustable *air-wound* loading coil gives you highly efficient operation on 30/40 Meters.

This extra long radiator and ultra low loss loading coil is a winning combination that stands head and shoulders above shorter backpack antennas.

Antenna is 18 ft. fully extended. Disassembles and collapses to 28" in seconds. Fits most packs or suitcases! Just 2 pounds, you'll hardly know you are packing it!

Tapped loading coil covers 7-55 MHz without gaps. Great for Ham Bands and outstanding for image-free shortwave broadcast!

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Counterpoise kit included. Ensures low SWR, high efficiency.

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18 foot Telescopic Fiberglass Mast with Tripod

MFJ-1919EX, $139.95.

***Put your antennas anywhere and get them up high with this super-strong* 18 foot telescoping fiberglass mast and heavy-duty steel MFJ-1919 tripod.**

QuickClamps™ easily collapses mast to 5 feet. Mast has thick 1/8 inch wall, .75 inch diameter top, 1.5 inch bottom. 15 lbs.

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Tripods Only

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MFJ-1918, $49.95, *Smaller tripod*. Supports 66 lbs. 1 inch diameter mast extends 6 foot. Collapses to 3.2Hx.3D feet. Triangle base spreads to 2.75 feet. Weighs 6.75 lbs.

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MFJ-1979, $59.95. Super-strong, super long *17 foot stainless steel* telescoping whip. 27 in. collapsed. 10 sections. 3/8-24 threaded base.
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160-6 meters, Noise Reduction, Keypad Entry, Roofing Filters, HF and 6M Antenna Jacks

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Affordable all-mode HF/VHF/UHF mobile

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Selectable roofing filters at 3kHz, 6kHz and 15kHz, IF-DSP technology

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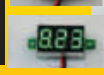

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SX-5 144/430 Base Station Antenna
Frequency (MHz): 144/430
Zo(Ω): 50
V.S.W.R: <1.5
Power(W): 200
Length(m): 1.7
Weigh(g): 900
Connector: UHF

SX-3 144/430 Base Station Antenna
Frequency(MHz): 144/430
Zo(Ω): 50
V.S.W.R: <1.5
Power(W): 150
Length(m): 1.3
Weigth(g): 800
Connector: UHF

Priced from $69.95

S-850B Antenna
Frequency (MHz): 144/430
Max. Power(W): 150
V.S.W.R: <1.5
Length (M): 1.04
Connector: PL-259

Surmen K-505 (3D)
PL or NMO
Strong Magnet

SX-20 144/430 Base Station Antenna
Frequency(MHz): 144/430
Zo(Ω): 50
V.S.W.R: <1.5
Power(W): 200
Length(m): 2.5
Weight(Kg): 1.20
Connector: UHF

UL-01 Hatchback Door Trunk Lid Mount
Color: Black
Weight: 202g

Priced from $19.95

RB-90 Trunk Mount
Tilt angle adjust-able mount

Holiday Combo Special!

SC-ECH PL/NMO Mobile Antenna Cable
Color: Black
Cable: RG-58
Length: 4M
Connector: UHF Male to NMO Male

PRESENTING the Surmen NEW Max-1 PL/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

Combo Price $39.95

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P-800 Small External Speaker
Speaker Max Power: 5 watts
Cord Length: 4 Meters
Plug: 3.5mm Mono
Size: 90 x 85 x 35mm

KY-66B Trunk Lid/Hatchback Mount
Door Mount
Weight:168g

WP-115
Frequency (MHz): 144/430 MHz
Z (ohms): 50
Max Power: 10W
Length (mm): 400
Weight: 42g
Connector: SMA or BNC

FT-252
2M

FT-257
440MHz
5 Watts FM
HT's, Large
Display
200 Channels

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30 amps Max
(10% duty cycle),
20 amps
continuous
110/220 VAC.

QST QuickStats

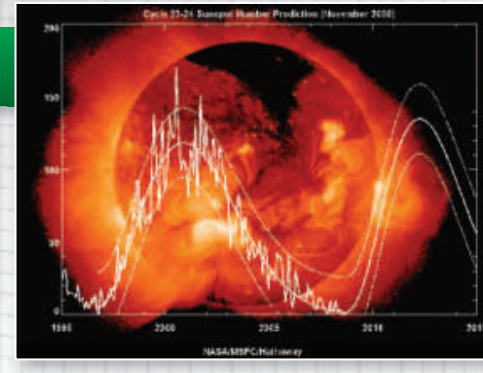
sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for September 4 through October 4, 2013.

Get on the web and vote today at **www.arrl.org/quickstats**!

If you read a grim HF propagation forecast on the Internet, do you...



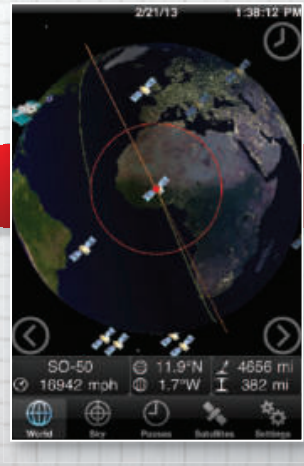
- Turn on the radio and check the bands anyway **68%**
- Find something else to do that day **9%**
- I never read propagation forecasts **19%**
- I don't operate HF **4%**

Have you ever operated 10 Meter FM?

- Yes, recently **12%**
- Yes, but it has been a long time **43%**
- No **45%**

Do you use the extended frequency coverage and AM reception features in your FM transceiver to listen for aeronautical activity?

- Yes **48%**
- No **40%**
- My FM transceiver doesn't have those features **9%**
- I don't own an FM transceiver **3%**



Have you ever made a contact through SO-50, the FM repeater satellite?

- Yes, recently **9%**
- Yes, but it has been a long time **7%**
- No **84%**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Includes Grab-N-Go bag; 7AH rechargeable gel cell battery; charger with Powerpoles; and fused cable with Powerpoles, battery terminals, & lighter socket.

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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.

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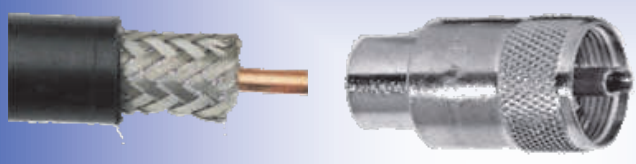
Cheap Coax Is No Bargain!

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.

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, old and new.

Yes!

We have Red/Black Zip Cord for all of your DC wiring needs. #18 through #6 are in stock.

Santa Shops Here!

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4-6-8-10-12 Way
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The Ultimate Powerpole *and* Coax Prep, Strip & Crimp Kit

Full-cycle ratchet crimper with Andy-Crimp Pro™ dies, two coax dies, coax and wire strippers, and coax cutter in a sturdy ABS case. Crimps 15-30-45-50-75A Powerpoles, LMR-400, RG-8, RG-8X, RG-58, RG-316, more. High quality connectors are always in stock.

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Free **Powerpole Assortment with purchase of kit**

Valid 11/15/13—1/15/14

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15-30-45-50-75 Amp Powerpoles
And **Many Other Connectors**

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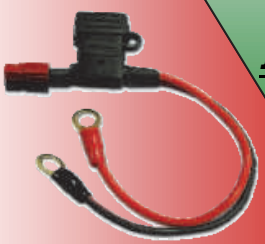

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Many Types Available

Santa Checks His List Here!

New Items On Sale

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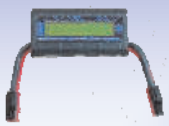

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Designed specifically to suit radio amateur needs, the RigExpert AA-170 is a rugged, lightweight, and self-contained instrument for the field and lab use with continuous bandwidth coverage from 100 kHz to 170 MHz.

Check or tune your antenna literally in seconds!

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The AA-170 is capable to display everything you might want to know:

- **SWR;**
- **Magnitude of impedance (|Z|);**
- **Complex impedance (R+jX) for series and parallel models (needless to say, the AA-170 is able to measure the sign of reactance!);**
- **Capacitance (C) or inductance (L) or reactive loads.**

Surprisingly, you do not need any calibration to maintain the highest level of accuracy. No need to run a periodic "self-calibration" either.

You will have even more joy in the lab by using the powerful AntScope software supplied free of charge. Windows, Mac OS and Linux operating systems are supported. Print your graphs, email your data to friends, use it in Word or Excel documents or export S11 files to other programs.

With the AntScope, you will be able to have: Smith chart, return loss, phase and time domain display modes, as well as many other functions, usually available only in professional-grade instruments. With the AA-170, all of these features come at no additional cost to you.

User and Software Manuals contain detailed description of all functions of the analyzer and AntScope software, as well as many examples of practical applications.

The AA-170 complies with FCC and CE requirements.

There are five more antenna analyzers in our extended product line.

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3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

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5. No Ham-Ad may use more than 200 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

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7. AN IMPORTANT NOTICE TO ALL HAM AD POSTERS AND RESPONDERS, FROM THE ARRL ADVERTISING DEPARTMENT Greetings from ARRL HQ! Please note that we have received reports from many ARRL members who have placed classified ads in these listings, and have received responses from individuals proposing "creative" payment schemes. These particular instances involved offers of overpayments for goods by bank check, followed by instructions to deduct the cost of your item from the overpayment, and to transfer the overage back or to another individual. This is a well-known scam. Unfortunately, we have no control over this and other scams of this type. Once your email address is posted, you are vulnerable to those individuals seeking to provide you with questionable information.

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January 2014	Wednesday, November 13, 2013	Friday, November 15, 2013
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A270-6S/A270-10S	$119/159
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AT-100PROII	$209
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2MCP14/2MCP22	$259/359
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432-12EME/440-18	$145/159
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1.375"	.058"	$1.40
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1.625"	.058"	$1.65
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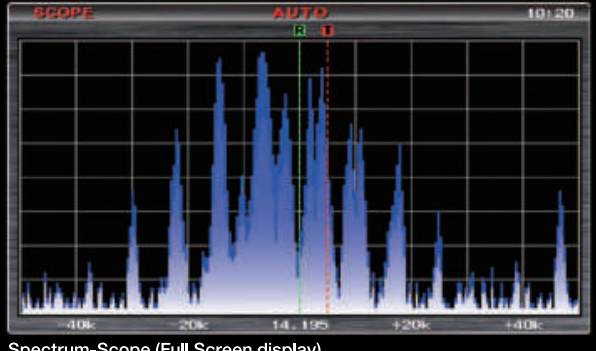

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