AUGUST 2012 QST Vol 96 No 8

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

August 2012 WWW.ARRL.ORG

Are You Ready for the ARRL EME Contest?

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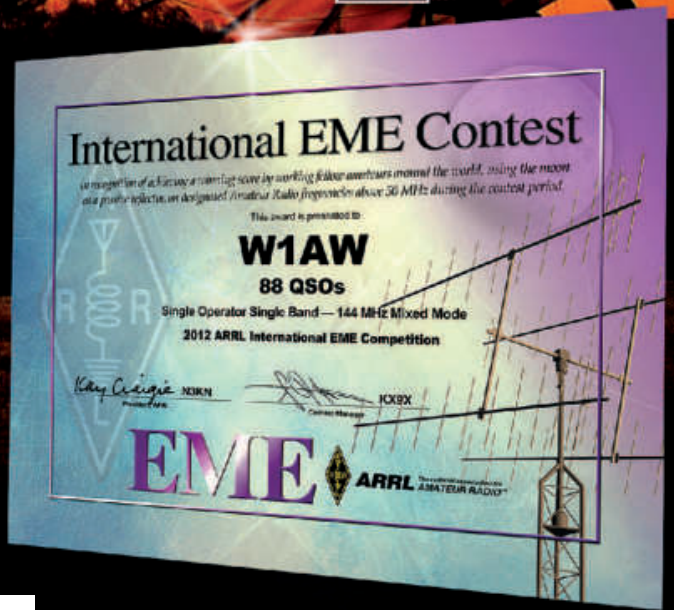

$4.99 US $6.99 Can.

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Official Journal of ARRL The national association for AMATEUR RADIO®

The radio... YAESU

HF/50 MHz 100 W Transceiver

FT DX 3000

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

The amazing Crystal Roofing Filter performance

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

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

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

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

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

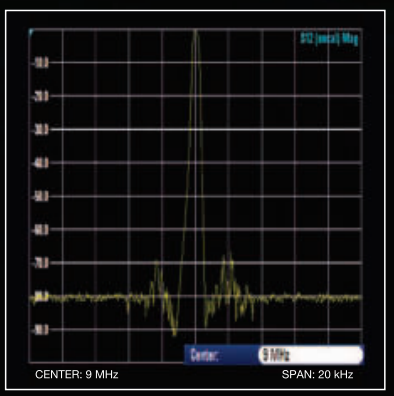
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

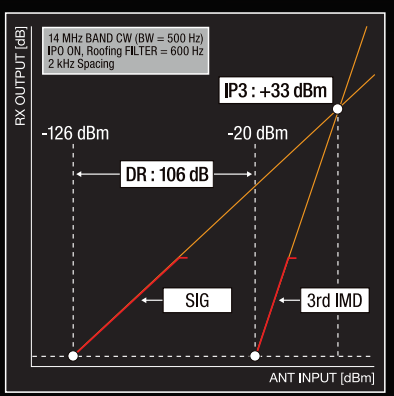
AF SCOPE display and RTTY/PSK encoder/decoder (optional)

Other features

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



Characteristics of the Crystal Roofing Filter (300 Hz)



3rd Order Dynamic Range / IP3

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The radio YAESU ...

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

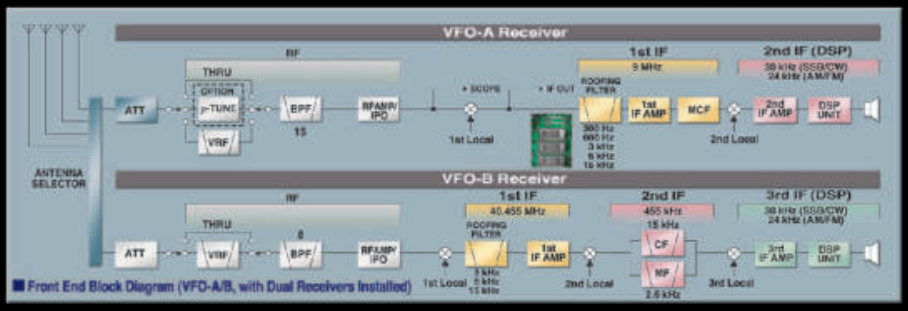
The New Premium HF/50 MHz Transceiver
FT DX 5000 Series

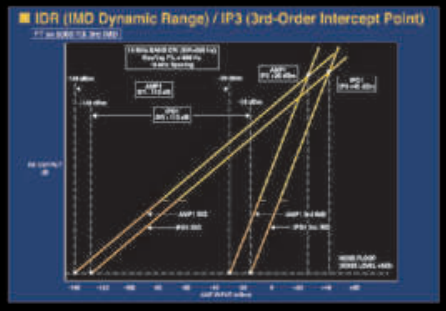
Two Totally Independent Receivers - The VFO-A/Main Receiver utilizes Super Sharp Roofing filters to give you the highest performance and best flexibility

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

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

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





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

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

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

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

HF/50 MHz 200 W Transceiver NEW
FT DX 5000

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

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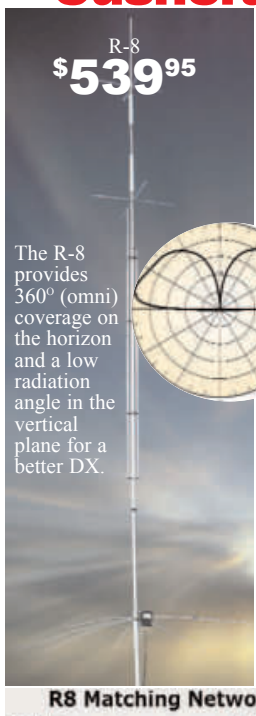
Cushcraft R8 *8-Band Vertical*

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



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

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

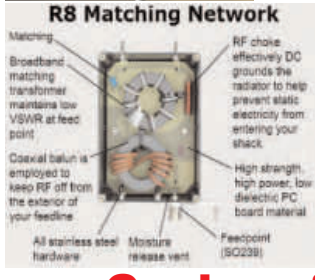
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

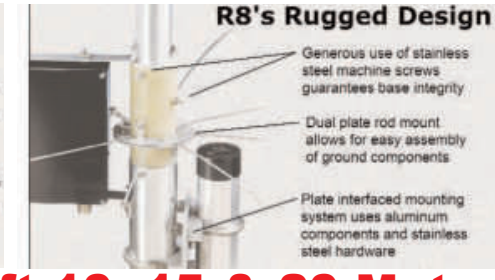
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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

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

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





MA-5B *5-Band* Beam

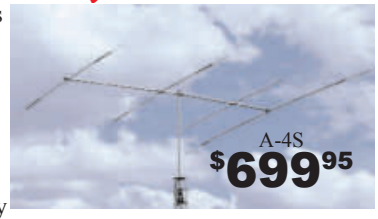
Small Footprint -- Big Signal

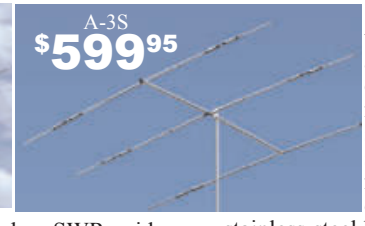
The MA-5B is one of Cushcraft's most popular HF antennas, delivering solid *signal-boosting directivity* in a bantam-weight package. Mounts on roof using standard TV hardware. Perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and full-sized array. Its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

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

Cushcraft 10, 15 & 20 Meter Tribander Beams

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



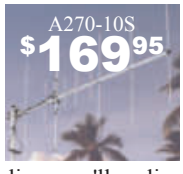


It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components, stainless-steel hardware, and aircraft-grade 6063 make all the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

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

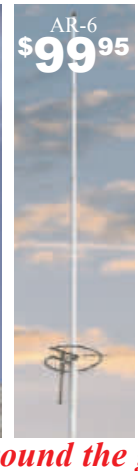
Cushcraft Dual Band Yagis

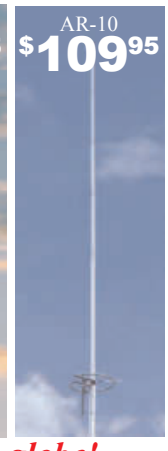
One Yagi for Dual-Band FM Radios



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

Cushcraft Famous *Ringo* Compact FM Verticals





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

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

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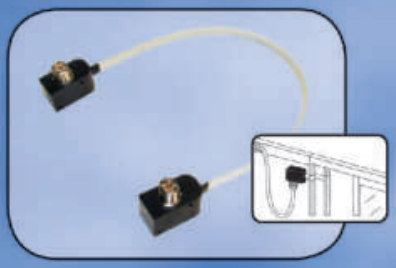
Life is a JOURNEY, Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

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

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

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

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

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

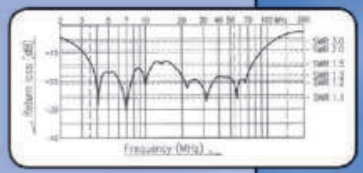
COMET CHA-250B
Broadband HF Vertical!

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

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

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

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



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

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

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

COMET and Maldol

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

Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
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Our mission: To promote and advance the art, science and enjoyment of Amateur Radio.

In This Issue

August 2012 Volume 96 Number 8

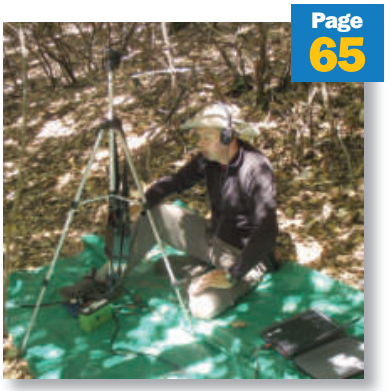
Technical

News and Features

Our Cover

With the advent of very sensitive receiving preamplifiers and commercially available high-gain Yagi antennas, many VHF operators are enjoying successful weak signal contacts. With a total path length of about 500,000 miles, EME is the ultimate DX! Our cover showcases the moon at sunrise over the 20 foot dish of Marc Franco, N2UO, of Summerfield, North Carolina [Marc Franco, N2UO, photo]. Find out more about EME and other fascinating modes at **www.arrl.org/weak-signal-vhf-dx-meteor-scatter-eme-moonbounce**.

Radiosport



Columns

Departments

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e-mail: qst@arrl.org

August 2012
Volume 96 Number 8

QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc, 225 Main Street, Newington, CT 06111-1494, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

POSTMASTER: Send address changes to: *QST*, 225 Main St, Newington, CT 06111-1494, USA. Canada Post: Publications Mail Agreement #40612608. Canada Returns to be sent to Bleuchip International, PO Box 25542, London, ON N6C 6B2.

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

- Large Backlit LCD Display for easy operation
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- 5 ppm Frequency Stability (-4° F to +140° F)
- 1000 Memory Channels for serious users
- Yaesu Unique Power Saving Circuit Design Minimizes Vehicle Battery Drain

Actual Size

NEW 2 m/70 cm DUAL BAND FM TRANSCEIVER

FT-7900R

2 m/70 cm DUAL BAND

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

• Separation Kit for Remote Mounting (optional separation kit YSK-7800 requires)

50 W 10 m/6 m/2 m/70 cm* Quad Band FM Mobile

FT-8900R

*70 cm 35 W

QUAD BAND DUAL RECEIVE

50 W 2 m/70 cm* Dual Band FM Mobile

FT-8800R

*70 cm 35 W

DUAL BAND DUAL RECEIVE

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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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Optimizing the merits of digital communications; ***12.5 kHz C4FM FDMA***

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DUAL BAND DIGITAL TRANSCEIVER

FT1D R/E*

- Water Spray Resistant, IPX5 Rating
- AF DUAL Monitor
- Large Dot Matrix LCD
- Wideband Receive Capability
- Built-in GPS Antenna
- Vibrate Alert Function
- Internal AM Bar Antenna

***GSM** (Group Short Message)*
***Snapshot Function** (Image data transfer)*
Digital ARTS
Data back up
USB connector
***E2O** (Easy to Operate)*
E-GPS, GPS data transferring function

ACTUAL SIZE

C4FM FDMA Digital Transceiver FT1D R/E

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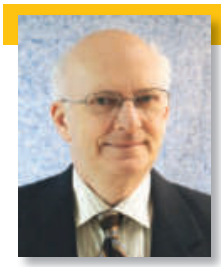
The FT1DR/E has not been approved by the FCC. This product may not be sold or leased, or offered for sale or lease until FCC approval has been obtained.

*E for European Version



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

Restrictive Covenants

"The problem with restrictive covenants is that in growing areas of the country there is no way to avoid them."

A radio station, amateur or otherwise, is only as effective as its antenna. From the days of the earliest experimenters right up to the present time, amateurs' desires for the best possible skyhook have not always been welcomed by our neighbors and our communities.

Most of us prefer to have a station — perhaps not our only station — in our home. There is ample case law establishing that an amateur station is a reasonable and normal accessory use of residential property. While land use is regulated at the local level, it is well established that the regulation of interstate and foreign communication by wire or radio is in the federal sphere.

At the request of the ARRL, in 1985 the FCC asserted limited federal preemption of state and local regulation of amateur station antenna structures. The principle, called "PRB-1" because at the time the Amateur Radio Service was in the purview of the Private Radio Bureau, is now written into §97.15(b) of the FCC Rules: "State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose."

PRB-1 has been of great assistance to countless amateurs in dealing with their local land use agencies. However, in 1985 the FCC was not persuaded that it had the authority to preempt private land use regulations such as covenants, conditions and restrictions (CC&Rs). In theory the purchaser of real estate that is subject to CC&Rs accepts them voluntarily; if you don't like them you don't have to buy the property. At that time it was still possible in most of the country to find housing that was not subject to CC&Rs, so it could be argued that their impact on Amateur Radio was not a federal issue.

Unfortunately, since then CC&Rs have spread like invasive species. For five years beginning in 1996 the ARRL went to the FCC with the argument that the effect of applying PRB-1 to government but not to private land use regulation was to deprive the residents of areas blighted by CC&Rs of adequate emergency communications facilities. Ultimately we were told that the FCC would take corrective action only if instructed to by Congress.

So we went to Congress. As we predicted on this page in September 2001, it wasn't easy — but after a decade of patient effort we achieved success on an important first step. A section of Public Law 112-96, signed by President Obama on February 22, 2012, required the FCC in consultation with the Office of Emergency Communications in the Department of Homeland Security to complete a study on the uses and capabilities of Amateur Radio communications in emergencies and disaster relief, including identifying "impediments to enhanced Amateur Radio Service communications and recommendations regarding the removal of such impediments." The statute specifically identifies "the effects of unreasonable or unnecessary private land use restrictions on residential antenna installations" as an example of such an impediment. A report on the findings of the study is due to be submitted to the House and Senate Commerce Committees by August 17.

On April 2 the FCC opened a proceeding to gather information for its study. The Commission posed 16 questions, ten dealing with the importance of amateur emergency communications and six with impediments to enhanced communications. In response the ARRL submitted a 128-page filing that documents the importance of what we do in providing communications relating to disasters, severe weather, and other threats to lives and property and discusses in great detail the impediments presented by private land use regulations. The filing includes 91 examples of restrictive covenants, most of which either prohibit Amateur Radio antennas or make them subject to the arbitrary whims of an Architectural Control Committee or some other body and many of which are illegal as written. Also included are 43 case studies that document the real-world experiences of amateurs in 21 states who have tried to live with CC&Rs but have ended up with unsatisfactory antennas or none at all. These examples were drawn from more than 870 responses to requests for input from ARRL members and other amateurs.

Citing estimates by the Community Associations Institute (CAI), the ARRL filing notes that in 2011 there were 314,200 association-governed communities with 62.3 million residents — figures that have more than doubled since 1990. In 2005 CAI concluded that "more than four in five housing starts during the past five to eight years have been built as part of an association-governed community." The result is that in the areas of the country with the fastest population growth it is virtually impossible to avoid restrictive covenants when purchasing a home. Clearly, what might have been regarded as a state or local issue in 1985 is a national issue today and requires a federal solution.

When the FCC reports to Congress we are hopeful that its recommendations will reflect the reality that is illustrated by the ARRL filing. We are also hopeful that — unless the FCC is persuaded to act on its own — the committees of jurisdiction will use the report to develop legislation along the lines of §207 of the Telecommunications Act of 1996, which instructed the FCC to prohibit restrictions on terrestrial and satellite television receiving antennas. The Commission later expanded the resulting provision to include antennas for fixed wireless broadband access.

The FCC has the authority as well as the obligation to see that all of its Amateur Radio licensees are treated equitably. The evidence is clear that with so many millions of Americans having no choice to do otherwise, it is sound public policy to extend the benefits of the Commission's time-tested PRB-1 limited preemption policy to those who must live subject to private land use regulations.

David Sumner, K1ZZ

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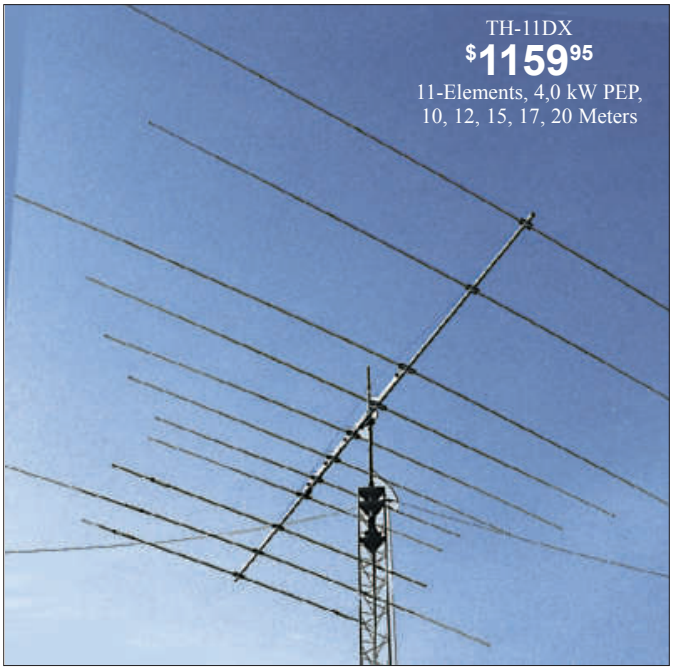

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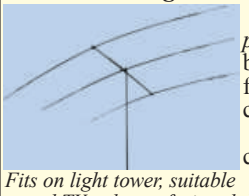

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TH-11DX	11	*For Gain and F/B ratio--See...*		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5	• www.hy-gain.com		1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**	• Hy-Gain catalog		**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
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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**
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Joel P. Kleinman, N1BKE – jkleinman@arrl.org

In Brief

- President Obama has announced that he will nominate Mignon Clyburn for a new five-year term as one of five FCC Commissioners.
- The FCC has decided to expand the Part 95 Personal Radio Service rules to allow medical devices to operate on a secondary basis in the 2360-2400 MHz band.
- The new Amateur Extra class (Element 4) question pool became effective July 1.
- The ARRL is seeking candidates for Director and Vice Director in five divisions. See page 74.
- The 31st Annual ARRL and TAPR Digital Communications Conference will be held September 21-23 at the Sheraton Gateway Airport Hotel in Atlanta, Georgia.
- The ARRL Board of Directors has unanimously voted to approve the 9 cm band plan, as presented by the ARRL UHF/Microwave Band Plan Committee.
- Former ARRL First Vice President Steve Mendelsohn, W2ML, of Dumont, New Jersey, died in May.
- Gene Zimmerman, W3ZZ, of Gaithersburg, Maryland, became a Silent Key in early June. Zimmerman wrote the popular *QST* column "The World Above 50 MHz" from 2002-2011.
- The winner of the May *QST* Cover Plaque award is Martin Huyett, KØBXB, for his article "An AFSK Interface for Android Smartphones."

Media Hits

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

Unusual

- When an unusual ham story comes up, it gets my attention. "Fire damages church, home at Franklin Crossroads" in the *News-Enterprise* (KY) was unusual in that Dave Riddle, WD4KBP, had to use his ham radio to call for help before escaping the house. When an unusual story is also right in my backyard, it's on my lists for sure. "Amateur sleuth helps stop National Archives thefts" told of J. David Goldin, WB1EZA, and his work with radio history. He spotted a recording he had donated to the National Archives long ago oddly being sold on eBay. His resultant investigation broke a major criminal's career — and got hits all over the country.
- In the first TV episode of *Touch* (FOX), a New York City taxi dispatcher, who is also a ham, saved the life of an ISS astronaut using an ancient Hallicrafters rig. While there were major technical gaffes galore, ham radio was depicted in a very positive light.
- Then there was the international incident that brought ARRL and Amateur Radio into the global news, as *China Daily* wrote, "Vessels navigate sea of troubles as wave of tension builds up." The recently renewed dispute over Huangyan Island first made global headlines in May 1997, when Philippine military forces harassed and cut short a DXpedition. "They said it was in their EEZ, but we were carrying maps from the Philippines that indicated that Huangyan is part of China," recalled Chen Ping, a member of the DX group. DX operators had been to the island before in 1994 and 1995. According to the report, Manila was outraged that BS7H has been used for Huangyan by "the influential American Amateur Radio Association." Ping noted, "Amateur Radio hobbyists around the world know that BS7H is a Chinese call sign for Huangyan Island."

  Who knew our "unique ability to enhance international goodwill" (and correct name) could be so difficult? [97.1(e)]

Promotional

In a more friendly manner, *Oklahoma Living* published "Retirement: Time to ham it up" with recent retiree Ben Joplin, WB5VST, reviewing his history with Amateur Radio — but he's now more involved than ever. Nice hits also came from both the Silver Springs Radio Club who released the names of the latest licensees with **Ocala.com** and the Clinton County Amateur Radio Association celebrating their 50th anniversary in the *Wilmington News Journal* (OH).

DIY Related

Many of you will remember the cancer work of John Kansius, K3TUP (SK). We were happy to see it continues in "Local man's invention & work continues to provide hope" on a segment broadcast by WINK-TV news. Brian Yee, W6BY, nailed it in "Not Your Grandpa's Ham Radio!" from the Bay Area Maker Faire 2012 — "What is a Spaceball?" as he described a microprocessor-controlled azimuth and elevation antenna positioning system. The *Santa Barbara Edhat* (CA) reported how Alex Carlson, KJ6UGF, along with Genevieve Hatfield, KJ6UGH, passed the exam for their Amateur Radio licenses to allow the Anacapa School Club to launch its second balloon and include telemetry and video options. Meanwhile, in Connecticut the seven members of the Norwich Free Academy Ham Radio Club (W1HLO) built an award-wining robot. The audio and video components fed into an amateur television transmitter (*Norwich Bulletin*).

Dayton

Amateur Radio operators from around the world made their pilgrimage to Hara Arena and "Hams return to Dayton for world event" was on WHIO Radio. "Techies in town for Hamvention" and "Dayton goes 'Radio Active' this weekend" was on WDTN while "Weather emergencies help fuel ham radio growth" was in the *Dayton Daily News*.

Last

Finally, we noted the sad media hits announcing "Steve Mendelsohn, Whose Radios Spread Word of City Marathons, Is Dead at 67" in the *New York Times* and other locations. He was a good friend of Amateur Radio.

Amateur Radio Week in Oklahoma: Oklahoma Governor Mary Fallin proclaims the week of June 17 "Amateur Radio Week" in honor of Field Day 2012. With the governor, from the left, are K5EMS, KC5FM and NØIRW. [Lloyd Colston, KC5FM, photo]

Club Activates North Carolina lighthouse: Paul Gawron, KI4SPO, and Joe Mazzei, KI4JM, operate inside the Bald Head Island Lighthouse. The Brunswick Shores Amateur Radio Club tries to put the historic lighthouse, known as Old Baldy, on the air at least once each year. The photo was taken in 2011 when the weather was bad and we were forced to operate and greet the public inside. [Ed Kuebert, K5EK, photo]

Transceiver Transfer

After Bruce Frahm, KØBJ, won a new transceiver during this year's Dayton Hamvention, he learned of the Kansas City Salvation Army SATERN's need for an HF rig for their emergency van. Bruce, who is the ARRL Second Vice President, promptly donated the rig to the Salvation Army. — *Cliff Ahrens, KØCA*

Bruce Frahm, KØBJ, accepts (temporarily) the transceiver he won at a Kansas City DX Club event during Hamvention from club President Bill Laux, NØAG. [Mike Crabtree, ABØX, photo]

Inside HQ

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

Advertising Sales

New gear and old — you'll find both in the ad section of *QST*.

Ads for Amateur Radio gear comprise about 45% of *QST*. We all enjoy learning about new rigs, antennas and other Amateur Radio products. In fact, our research surveys tell us that our members enjoy reading the advertising in *QST* almost as much as the editorial content!

Debra Jahnke, K1DAJ

The group responsible for *QST* Advertising is our Business Services Department, led by Debra Jahnke, K1DAJ. It is staffed by two account executives, an advertising graphics artist and an advertising scheduler. Along with selling ads in *QST*, this group sells advertising in *NCJ*, *QEX* and other print and electronic publications.

Many of our approximately 135 advertisers are small businesses that do not want to assume the responsibility or cost of producing their own ads. For this reason, we compose many of the ads that you see in *QST* for our advertisers. Our in-house artists, writers, photographers and designers have developed a high level of competency and skill in creating ads for Amateur Radio products. Producing these ads is not easy since they are packed full of complex images, technical information and specifications that must be represented clearly and accurately.

A lot of work goes into producing and publishing the *QST* ads each month. Ads are produced digitally using *Photoshop* and other sophisticated graphics software. The text, artwork and photography must all be completed well in advance of the issue date. Many *QST* advertisers publish coupons and specials each month. These need to be properly coordinated and often require last minute changes. An ad's exact position in *QST*, its size, color accuracy and layout are all thoroughly checked both before and after the ad is electronically transmitted to our printer.

Our members expect *QST* to be truthful about an advertiser's products and services. For that reason, the technical content of the ads that appear in *QST* is scrutinized for accuracy by the Business Services Department and the ARRL Lab. Since 1933, *QST* has strictly adhered to an Advertising Acceptance Policy. You can find it here: **www.arrl.org/advertising-opportunities#Acceptance_Policy**. This policy was created to assist our members in locating reputable suppliers of Amateur Radio equipment and to ensure that products work as advertised and meet FCC specifications. You can be confident that any product advertised in *QST* actually exists and meets the claims in the advertisement.

While we do not test antennas, antenna advertisements that specify gain, front-to-back ratio or beamwidth are acceptable only if the antenna has been tested in accordance with EIA Standard RS-329, Part 1 or has been modeled using an antenna modeling program that has been specified by the ARRL Lab.

The revenue derived from advertising helps subsidize the cost of producing *QST* itself and the cost of our general operations here at HQ, including critical areas such as W1AW, education and advocacy. I believe, and our members agree, that *QST* is a more valuable publication because of the great looking and informative advertising that we publish every month.

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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

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

Community

Radio Clubs (ARRL-affiliated clubs) – **www.arrl.org/clubs**
Hamfests and Conventions – **www.arrl.org/hamfests**
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Books, Software and Operating Resources – **www.arrl.org/shop**

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QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
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Typically 60-70 watts in gives full output. ON/OFF switch bypasses amplifier for "barefoot" operation. Extremely quiet fan

***New* ARI-500, $119.95**, *Amplifier Radio Interface* reads band data from your transceiver so you can *automatically bandswitch* your ALS-500M amplifier. *See right inset.*

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ALS-500M, $899, 500 Watt mobile amp.

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ARF-500K, $179.95, Remote kit for older ALS- 500M mobile amps with serial # below 13049. Includes filter/relay board for ALS-500M, AL-500RC Remote Head, cables, hardware, instructions.

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Let your rig *auto bandswitch* your ALS-500M Amplifier

ARI-500
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The Ameritron ARI-500 *Amplifier Radio Interface* reads band data from your Icom, Yaesu, Kenwood or Alinco transceiver so they can remotely and automatically bandswitch your ALS-500M amp. Lets you mount your ALS-500M out-of-the-way in your trunk. Works with serial numbers above 13049 (below 13049 requires the ARF-500K, *see above*). You can add the ALS-500RC for manual bandswitching and data monitoring, etc, *see left description*.

Programmable Screwdriver Antenna Controller

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Up/Down buttons let you manually move the antenna to any desired position. A 4-digit turns counter gives you precise antenna position -- you can see its *super bright LEDs* even in direct sunlight!

Returning to a position from memory is extremely accurate for three reasons . . .

A. The antenna always moves to its desired position from the bottom, insuring that the motor is always loaded the same.

B. Ameritron's exclusive *AutoPark*™ feature automatically bottoms your antenna for parking in your garage and *resets and calibrates* your counter each time to eliminate antenna slippage and turns count errors.

SDC-102
$129.95
Suggested Retail

C. The momentum of the moving antenna causes it to overshoot its stop point. Ameritron's exclusive *Dead-OnSTOP*™ feature automatically reverses the motor briefly just before it stops to eliminate overshoot and come to a precise stop.

Ameritron's exclusive *StallProtector*™ feature prevents your expensive motor from burning out. Automatically detects motor stall and completely shuts off power to motor.

Monitor motor current on LEDs for signs of trouble and to determine stall current.

If you wire the motor backwards, you can reverse its direction from the SDC-102 front panel so the UP button is always up and the DOWN button is always down.

Compatible with single and dual magnetic turns sensors. Requires 12 VDC.

3½Wx3¼Hx1¼D inches.

SRS-100, $29.95. Magnetic sensor kit for High Sierra antennas to use SDC-102.

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SDA-100 lets you operate 3.5 to 30 MHz continuous with six foot whip at full 1200 Watts PEP.

World's most rugged screwdriver antenna features . . . super heavy-duty commercial Pittman 12 Volt gear motor . . . stainless steel/ aircraft aluminum CNC machined components . . . 2-inch machine groove fiberglass coil form with 14-gauge wire wound at 8 turns per inch . . . built-in magnetic sensors . . . super durable Lexan cover . . .

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Saves $16.85! **SDA-110, $509.95.** Includes SDA-100, SDC-100, SWP-100.

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- SWR protection: automatic switching to STBY
- Tube: GU84b Ceramic tetrode
- Power supply: 240 V - single phase

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- Maximum output SWR: 3:1
- SWR protection: automatic switching to STBY
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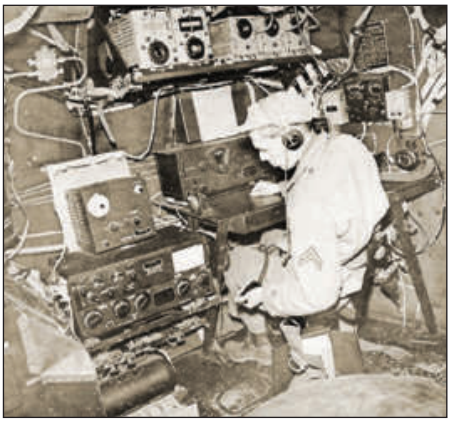
Joel P. Kleinman, N1BKE, upfront@arrl.org

Collins Radio and the B-29 Superfortress

Rod Blocksome, KØDAS

In 2004 the Rockwell Collins ARC created a working mock-up of the B-29 radio position for exhibit at The History Center in Cedar Rapids, Iowa. A photograph taken during WWII and published in the June 1945 issue of *The Collins Column* (a Collins Radio Company magazine) was our reference. The Collins AN/ART-13 auto-tune transmitter figured prominently, as all B-29s carried it for long range liaison communications. The museum exhibit ran for a full year before it was dismantled and the equipment stored for the next six years.

In the fall of 2011 we got the idea of offering it to the Commemorative Air Force (CAF) for possible use in FIFI — the last flying B-29 Superfortress in existence today. The CAF welcomed us with open arms and we quickly learned that FIFI was based in the old Collins Hangar at the Addison, Texas airport near the Rockwell Collins Plant in Richardson. Hams at the Richardson plant joined the project and a new B-29 Radio Position Restoration Project was born practically overnight.



WWII B-29 radio operator with the Collins AN/ART-13 to his left.

The Cedar Rapids team went into radio restoration mode while the Richardson folks became the aircraft integration and installation team. Our goal was to restore the radio operator's position on FIFI as close as possible to original and have it all operational on the ham bands. It was quickly discovered that FIFI did not have the original HF wire antenna so aircraft antenna engineers from Rockwell Collins joined the team to provide it. Many hams have donated additional WWII radio equipment as spares.

During the course of this project, team members not only dug deeply into the technical aspects but also the human experience and historical events associated with the B-29. The team has had the honor and privilege of meeting many veteran B-29 radiomen and listen to their amazing stories. FIFI is an educational experience for young and old alike. It regularly tours the country and now if you can't travel to see it, perhaps you can at least work it on the air. Go to **www.cafb29b24.org** for current information on tour schedules.

A pristine AN/ART-13 (actually the Navy version called an ATC).

Jonn Burke (BC-348 donor) visiting the restored radio position on FIFI, the last B-29 in flying condition.

Part of the FIFI radio restoration crew (from the left): Bryan McCoy, KAØYSQ; Rod Blocksome, KØDAS; Paul Veenstra, KCØTEG; Ross Terry, K5SRT; Bob Kirby, K3NT, and Loney Duncan, WØGZV.

SSTV via ARISSat-1

Just before it was launched from the International Space Station in August 2011, the ARISSat-1 transponder was found to be missing its 70 cm receive antenna. Numerous stations still managed short CW and voice contacts, but only three reported sending and receiving SSTV: Henk Hamen, PA3GUO, in the Netherlands; Ronald Zurmely, PY4ZBZ, of Minas Gerais, Brazil, and me.

For me it was a lot of hard earned fun, challenge and education to manage the extremely weak 2 meter return signals for an R36 (36 second) picture. After many tries, I teamed with my son Jeff, KB8VCO, to successfully receive a picture of my auto license plate. In December 2011 another experimental image was sent and was received by Doug Papay, KD8CAO, Zeeland, Michigan. — *Farrell Winder, W8ZCF*

The operators, Farrell, W8ZCF, and Jeff Winder, KB8VCO, and some of the key items used in the SSTV operation through ARISSat-1: two computers with *MSSTV* and *Nova Tracking* and two radios. Two antennas were manually controlled by observing *Nova for Windows*.

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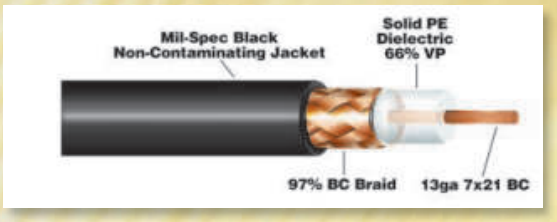

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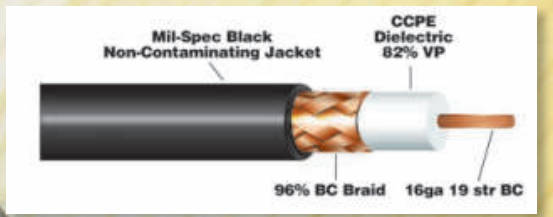
• 0.6dB @ 10MHz	3.43kW	87%
• 1.0dB @ 30MHz	1.95kW	79%
• 1.4dB @ 50MHz	1.5kW	73%

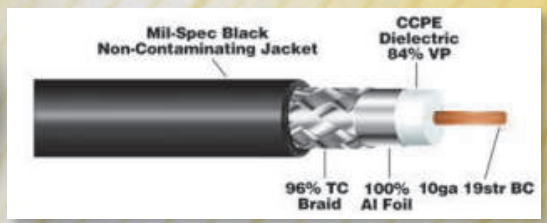
Part #	Length/Ft	Price/ea
2213A-PL-3	3	$11.95
2213A-PL-6	6	$14.95
2213A-PL-50	50	$57.95
2213A-PL-75	75	$80.95
2213A-PL-100	100	$99.95
2213A-PL-150	150	$144.95



218XA RG8X (240F)
Non-contaminating Direct-Burial Ultra-Violet Resistant Jacket.
W/SILVER-TEFLON PL259 & WEATHERPROOF HST each end.

Attenuation per 100ft	Power Rating	Efficiency%
• 0.9dB @ 10MHz	2.16kW	80%
• 1.4dB @ 30MHz	1.24kW	69%
• 2.1dB @ 50MHz	0.96kW	62%

Part #	Length/Ft	Price/ea
218XA-PL-3	3	$9.95
218XA-PL-6	6	$10.95
218XA-PL-18	18	$14.95
218XA-PL-50	50	$26.95
218XA-PL-75	75	$35.95
218XA-PL-100	100	$44.95
218XA-PL-150	150	$62.95



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Attenuation per 100ft	Power Rating	Efficiency%
• 0.8dB @ 30MH	2.77kW	83%
• 1.1dB @ 50MHz	2.14kW	78.5%
• 1.8dB @ 150MHz	1.22kW	65.4%
• 3.3dB @ 450MHz	0.69kW	47.3%

Part #	Length/Ft	Price/ea
25400F-PL-3	3	$11.95
25400F-PL-6	6	$14.95
25400F-PL-18	18	$26.95
25400F-PL-35	35	$43.95
25400F-PL-50	50	$58.95
25400F-PL-75	75	$83.95
25400F-PL-100	100	$100.95
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Letters from Our Members

Digital Delight

I think the new digital edition of *QST* is great. Now I can carry it with me and read it whenever I want, and it doesn't put wear and tear on my printed version. I collect them and I like to keep them in good condition. Thanks to everyone who helped put together this great member benefit.

James Jackson, KJ4IDJ
Auburn, Georgia

■ Good job ARRL!! I still prefer a print magazine, but the digital version of *QST* is well executed. The most valuable part of the digital is the video. The video evaluation and demonstration of inverter generators with their good, bad, and ugly attributes was outstanding! I will continue to look at the demonstration items as unique to the digital version, and I may eventually convert completely to digital. Thanks for bringing the online version to us!

Mark Jensen, KAØWTX
Fargo, North Dakota

Digital *QST* and DRM

When the ARRL announced a digital edition of *QST*, I was really excited: Less paper wasted, and no more pile of *QST*s to get rid of every year or two. So with great enthusiasm, I clicked the new link that appeared on the ARRL website to read the digital *QST*. And with equally great disappointment, I found that the so-called download version is horribly crippled with Digital Rights Management (DRM) restrictions.

Intended to lock down things like e-books so that copies can't be made of them, DRM — as embraced by the ARRL — is preventing members from giving digital copies of the new *QST* to our friends who may be thinking about becoming hams. Unlike paper *QST* subscribers, the new digital-only *QST* subscribers no longer have the "key" to decide what to do with their copy of *QST*.

QST has been the flagship of the ARRL for a long time, and has probably attracted more people into the hobby than any other publication. But as more hams pragmatically embrace the new DRM-restricted digital *QST*, fewer overall *QST*s are out there circulating and the spirit of freely sharing information seems to be fading into the past.

Matthew Steven, AI1P
Portland, Oregon

Stay In Line with Online

Thanks for the Product Review article on generators ["A Look at Gasoline Powered Inverter Generators," pages 49-56, Jun 2012]. The product reviews are one of my favorite sections with each *QST* edition, but there was one thing in this article that concerned me. There were several suggestions to see the ARRL website for more "in-depth" information. I understand that there is a need for this from time to time, and in this case, the reasons were clear. There are more graphs than can be included in the print edition.

I am concerned that this kind of thing will become more and more common since we now have a digital edition of *QST*. Please be cognizant of this and don't detract from the print edition content just because it's easier to put it all online. It's hard to imagine *QST* getting any better, but it's easy to see how things could go the other way. Keep up the good work.

Brad Cobo, N5WCO
Cedar Hill, Texas

■ QST *Managing Editor Joel Kleinman, N1BKE, responds*: We have actually been making some material available online for some time now. Some technical article material, such as software and circuit board patterns, has been posted to our QST-in-Depth website (**www.arrl.org/qst-in-depth**). We have made a conscious decision to avoid using the digital edition as a place to throw a large amount of additional content just because we can.

Traveling Hams

As Gary Pearce, KN4AQ, pointed out in his product review ["Kenwood TM-281A 2 Meter FM Transceiver," pages 45-53, May 2012], one rarely hears travelling hams on repeaters these days as it's impossible to safely program a frequency and CTCSS tone while driving. This also reduces local repeater use.

Pearce's suggestion that repeaters using CTCSS for input add the same tone to the repeater output is the first step. Next, we need the major radio manufacturers to reserve 10 or so memories for a "Travel Bank." These memories wouldn't be programmed by the user; when the user is traveling to a new area, he or she could optionally push a "Travel Scan" button to fill them. The radio would then scan the repeater sub-band for active repeater frequencies. When it hears one in use, it would stop and "Tone Scan" the output signal to determine the CTCSS tone. Once it determines the CTCSS tone, it would store the frequency, CTCSS tone and standard offset into the first memory slot.

Keying the microphone at this point would stop the scan and allow use of that memory just like any other memory. If the mic isn't keyed, the radio would keep scanning. If a new frequency is heard, it would determine the CTCSS tone and program everything into the second memory slot. This would make the 10 "Travel Memories" dynamic as you move from one area to another along your route.

Band Scanning, Tone Scanning, and Memory Copy already exist in many FM mobile transceivers. Simply coupling the existing features together with a one-button push could greatly add to a radio's usability for the traveling ham and the new rig owner, as well as those hams responding to or needing assistance in an emergency.

Gary Wilson, K2GW
ARRL Life Member
Hamilton Square, New Jersey

Unintended Consequences

The National Highway Traffic Safety Administration has expended many millions of taxpayer dollars studying vehicular crashes. The vast majority is caused by driver distraction, including those attributed to alcohol and illicit drugs. As a result of these studies, it was learned that distracted driving due to cell phone use has surpassed drunk driving as the number one cause of vehicle crashes and subsequent deaths. This has caused numerous governmental entities, both at the local and state levels, to pass laws aimed at curbing driver distracting activities. No one can argue the benefits of drunk driving laws, as countless of innocent lives have been saved. That's a good thing to be sure. But the knee-jerk passing of laws to curb other driver distracting activities has had an unintended outcome — it has intruded on our ability to operate Amateur Radio from our vehicles!

We need to be very diligent to make sure these well-intended laws don't become a scourge for us all. No one knows this better than the ARRL. Please read and familiarize yourself with the ARRL's Mobile Policy (see **www.arrl.org/files/file/MobileAmateurRadioPolicyStatement.pdf**). Actively promote this policy to your lawmakers when they attempt to limit our ability to react in times of disaster.

Alan Applegate, KØBG
Roswell, New Mexico

Send your letters to "Correspondence," ARRL, 225 Main St, Newington, CT 06111. You can also submit letters by fax at 860-594-0259, or via e-mail to qst@arrl.org. We read every letter received, but we can only publish a few each month. We reserve the right to edit your letter for clarity, and to fit the available page space. Letters published in "Correspondence" may also appear in other ARRL media. Of course, the publishers of *QST* assume no responsibility for statements made by correspondents.

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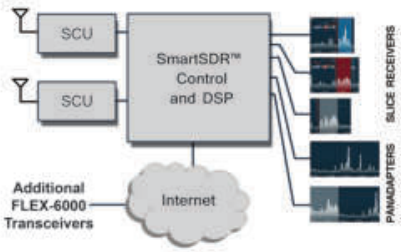

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This Month's Focus: Antennas for the Ham with Space Constraints or CC&R'S

Robert Fanfant, N7QT

BigIR Mark IV Vertical 40m-6m

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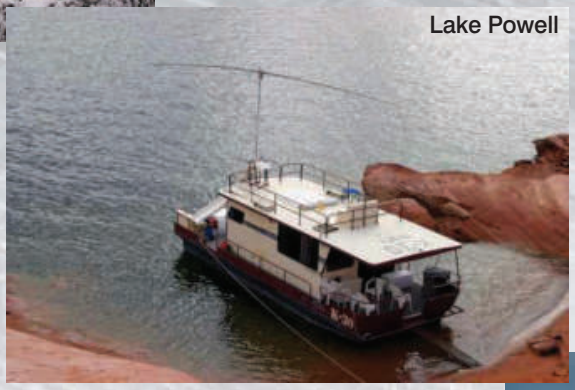
- Continuous coverage 6.9MHz – 54MHz
- 15 lb weight
- Optional 80m coil available
- Includes SDA100 basic controller, guy hardware kit and mounting post



Lake Powell

Dipole 20m-6m

Quick set up for portable operation

- Weight: 15 lb
- Longest element: 36 ft
- Power rating: 3 KW
- Wind load: 1.9 sq ft
- Turning radius: 18 ft
- Wind rating: 100 mph EIA-222-C
- Cable requirements: 4 conductor 22 ga shielded
- Tuning rate: 1.33 ft/sec - .4 m/sec

SmallIR Vertical 20m-6m

Our most portable antenna

- 1 x 18 ft adjustable element
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- includes SDA100 basic controller and mounting post

Peter I DXpedition

DB11

- 20m-6m
- Includes 3x 19 ft elements
- 11 ft boom
- 10.5 ft turning radius
- 63 lb
- 13.9Mhz – 54Mhz continuous frequency coverage
- Includes basic SDA100 electronic controller

2E Yagi 20m-6m

- 2 x 36 ft elements
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- 13.9Mhz – 54Mhz continous frequency coverage
- Includes basic SDA100 electronic controller

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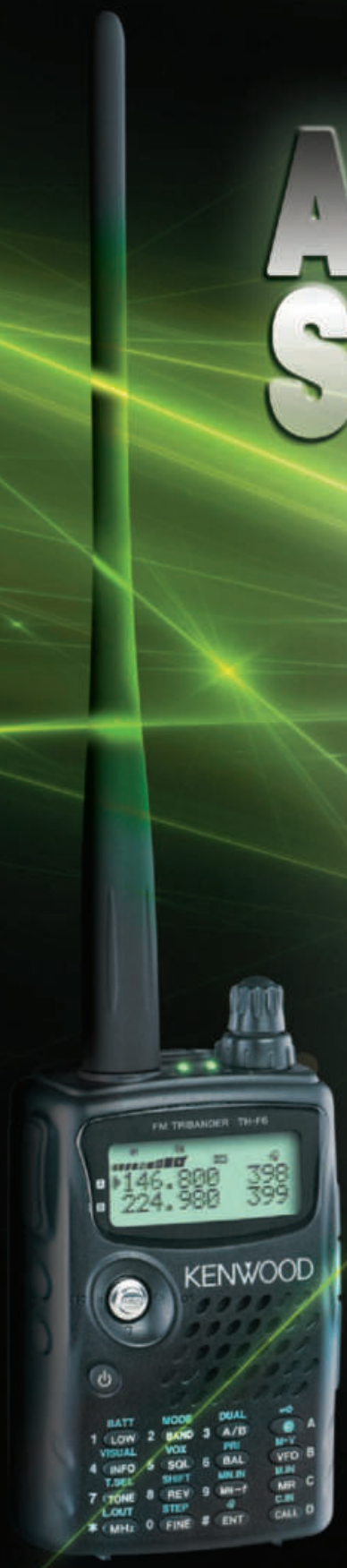
[1]Note that certain frequencies are unavailable. [2]5W output



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The DSP-610 Transceiver

This low cost transceiver won the latest ARRL Homebrew Challenge. It can put you on the air for less than $200 in parts.

Jim Veatch, WA2EUJ

I recently saw a *QST* QuickStats page that revealed that most ARRL members think that it's more difficult to homebrew Amateur Radio equipment now than it was in the past. Since I don't feel that way, I can only guess that most homebrewers are not yet comfortable with using surface-mount technology.

I've been involved with homebrew projects for more than 30 years. I think that it's easier than ever. The range of high quality components, sophisticated digital devices, low cost microprocessors and PCB fabrication services mean that hams can build in a level of sophistication into homebrew equipment that would not have been possible 5 years ago and not even imaginable 10 years ago.

The DSP-610

Enter the DSP-610 transceiver, designed for the third ARRL Homebrew Challenge.[1] The total price for all materials is under $200 but it includes:

- A digital signal processor (DSP) running 40,000,000 instructions per second (40 MIPS). This performs all functions from the second IF onward.
- A fractional-N synthesizer running in the microwave frequency spectrum, divided down with high speed digital dividers for an ultra low phase noise first local oscillator (LO).
- A direct digital synthesizer (DDS) for the second LO.
- A monolithic microwave integrated circuit (MMIC) amplifier in the transmit drive chain.
- Gallium arsenide RF integrated circuits (RFIC) for low level RF/IF switching.

All of this technology is available for a few dollars, fully integrated, so you don't need a Master's degree in engineering to use it. All you need is a good pair of tweezers and a magnifying glass.

Transceiver Specifications

The Homebrew Challenge III issued by the ARRL last year was to build a 25 W, SSB/CW transceiver that covers either the 10 meter band, the 6 meter band or both. The technical criteria are listed on the ARRL website and reproduced as Table 1.

The DSP-610 goes beyond these requirements in a few areas:

- The frequency coverage includes the 12 meter band as well as 6 and 10 meters. Actual coverage is 24.5 to 25.13, 28.0 to 28.63 and 50.0 to 50.63 MHz.
- A frequency synthesizer provides 10 Hz frequency resolution with 10 Hz, 100 Hz and 1 kHz tuning steps. In all cases, the operating frequency is displayed to a resolution of 10 Hz.
- A and B VFOs are provided on each band including memories that store operating mode and bandwidth.
- An IF digital signal processor with 0.4, 0.6, 0.8, 1.0, 1.8, 2.0, 2.2 and 2.4 kHz bandwidths, passband tuning and digitally controlled AGC.
- Receive S meter and transmit forward/reflected power meter.

Design

Figure 1 shows the block diagram of the DSP-610. The transceiver uses a dual conversion superheterodyne architecture with the first IF at 10.7 MHz and the second at 16 kHz. The first local oscillator (LO) signal, derived from a Silicon Labs SI-570 oscillator, is tuned 10.7 MHz above the RF signal on 10 and 12 meters and 10.7 MHz below the RF signal on 6 meters. An Analog Devices AD-9833 direct digital synthesizer generates the second LO. The BFO is a numerically controlled oscillator implemented in the DSP.

Receiver

In receive mode, the incoming signal is passed through the high power low-pass filter then switched into a low noise amplifier (LNA) using electromechanical reed relays. The LNA uses the BF-998 dual-gate metal oxide semiconductor field-effect transistor (MOSFET) in a design that dates back to the 1970s.

To keep the noise figure as low as possible, the main RF filtering comes after the LNAs with a three pole coupled resonator filter on 6 meters and a two pole filter for 10 and 12 meters. The signal is then converted to the 10.7 MHz first IF using the venerable Mini-Circuits SBL-1 double balanced mixer. The eight pole crystal roofing filter comes right after the mixer and is about 6 kHz wide. Another three BF-998s provide two IF gain stages and the second mixer, respectively. The automatic gain control (AGC) voltage is applied to the two amplifier stages.

After the second mixer an active operational amplifier (op-amp) filter is used for anti-aliasing and impedance matching for the input of the analog to digital converter (ADC). The ADC, which is integral to the Microchip DSP, samples the second IF 50,000 times per second with 12 bits of resolution. The DSP applies the input samples to one of eight, 127 tap finite impulse response (FIR) filters to set the IF bandwidth.

The DSP also detects the signal level, generates the automatic gain control (AGC) signal for the IF amplifiers, performs a product detection algorithm and filters the highs from the recovered audio. A separate digital to analog (DAC) is used to convert the signal to an audio signal that is filtered by an active op-amp low-pass filter. The audio signal is then amplified to speaker volume with a 0.75 W audio amplifier chip.

[1]Notes appear on page 32.

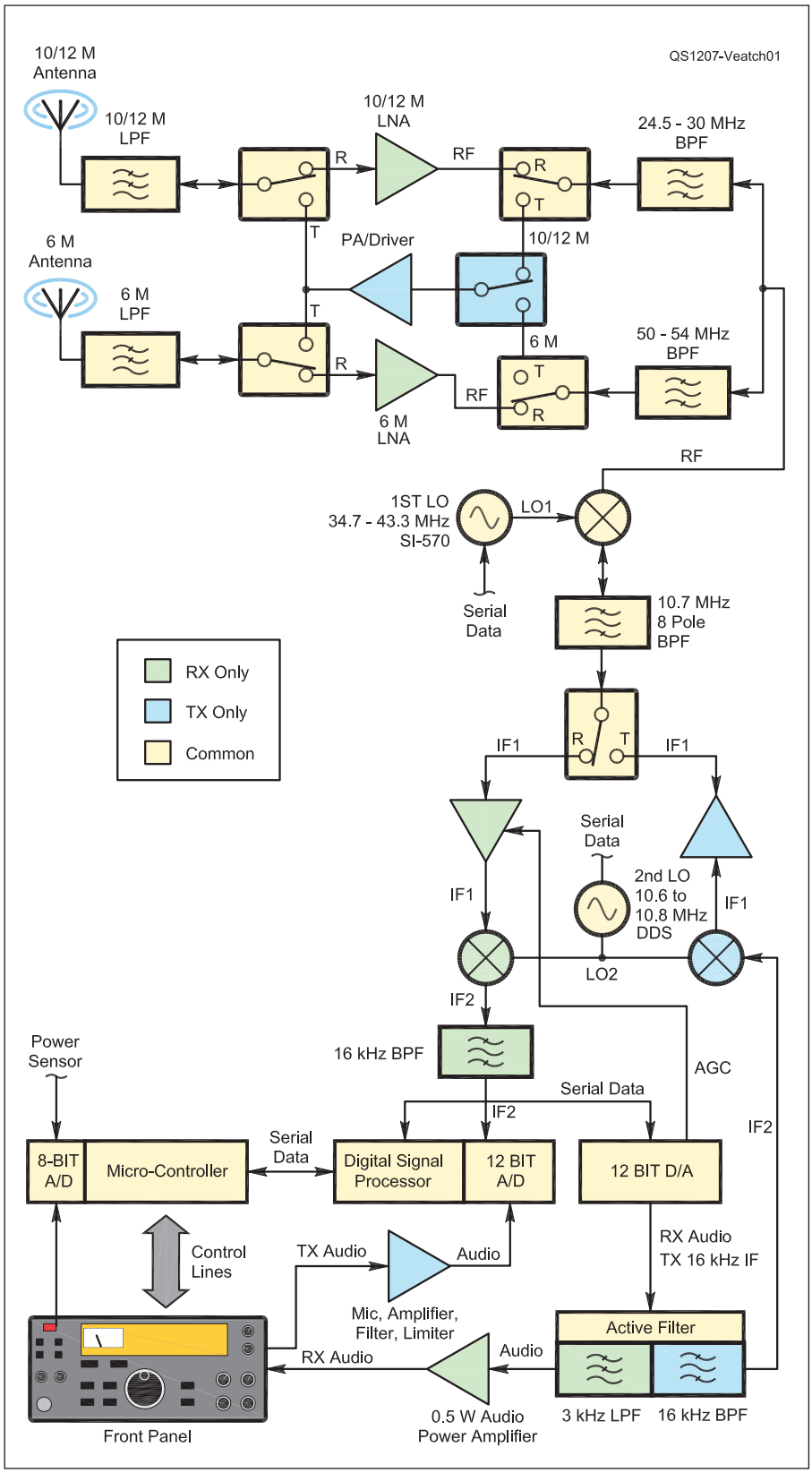

Figure 1 — DSP-610 block diagram. Note the color coding of the functions.

Transmitter

Audio from the microphone is amplified, filtered and limited in two op-amp stages. The audio is then presented to the ADC converter that produces 50,000 samples per second with 12 bit resolution. The audio level is adjusted digitally, hard limited, low-pass filtered and multiplied with the output of a numerically controlled oscillator (NCO) to produce a double sideband (DSB) suppressed carrier signal. The DSB signal is sent through a 2.2 kHz FIR filter then to the DAC. In CW mode the NCO generates the second IF signal directly and generates an adjustable sidetone signal.

The second IF signal is converted to the 10.7 MHz first IF using an SA604 mixer chip, amplified and passed through the eight pole roofing filter backwards. The SBL-1 then converts the first IF to the RF frequency. Four RF amplifier stages are used to bring the output to 25 W. The output stage is similar to the 50 W amplifier that I designed for HBC II, as is the directional coupler that is used to display the forward and reflected power. Two five pole low-pass filters, one for 10 and 12 meters and the other for 6 meters, reduce the harmonic level to meet FCC requirements.

Processing

The DSP-610 has two microprocessors, a general purpose processor (GPP) and a DSP. The GPP, a Microchip 18 series PIC, handles most of the housekeeping tasks, such as running the front panel, toggling signals between bands and operating modes, controlling the LOs and storing operating parameters in nonvolatile memory. The DSP, a Microchip 33 series dsPIC, handles the transmit and receive signal processing as described above. The DSP runs at 40 MIPS which translates to 800 instructions per sample at a 50 kHz sample rate.

The FIR filters are limited to 127 taps and, since the DSP can perform each tap in a single clock cycle, there's plenty of time left over for the NCO, AGC and other tasks. If I had it to do over I might have selected a dsPIC with more memory because 255 or 511 taps would provide more aggressive filtering. Initially, I was under the erroneous impression that the processor would run out of time first.

All of the processing elements derive their clocks from a single 25 MHz clock to help reduce internally generated spurious signals. The 25 MHz value was chosen because the fundamental (25 MHz) can be tuned in the 10/12 meter band and the second harmonic (50 MHz) can be tuned in the 6 meter band, thus creating a built-in signal generator for

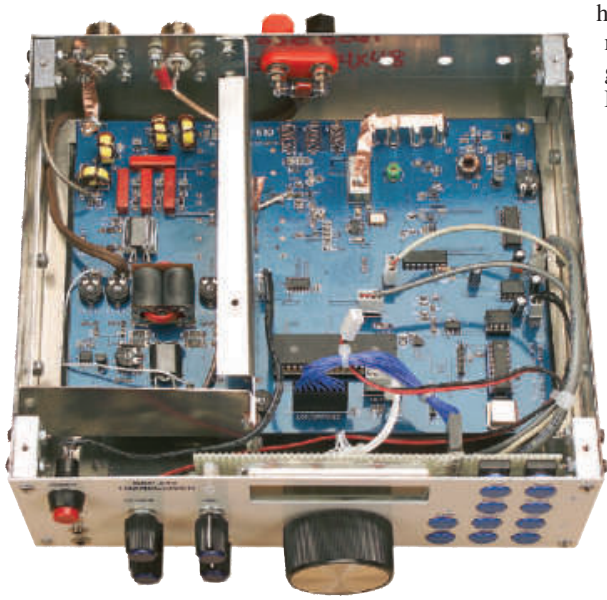

Figure 2 — Inside view of the DSP-610. Several improvements were made to the original version shown in April 2012 *QST*, including the additional shield that improved attenuation of spurious signals, a challenge in a single unit assembly.

adjusting the LNAs and IF interstage tuned circuits.

Construction

The DSP-610 is constructed with most of the components mounted on a double sided printed circuit board (PCB). There are services on the Internet that allow a circuit designer to buy prototype quantities of a PCB and the company will offer additional copies of the PCB for sale. The PCB for the DSP-610 was made by **HobbyPCB.com**. It is a high quality PCB with solder mask, silk screen and emersion gold plating for easy soldering. HobbyPCB sells the PCB for $20. The schematics, bill of materials (BOM), PCB design files, source code and other documentation are available for download from the QST-in-Depth website.[2]

There is a total of 494 parts on the BOM, almost half of which are capacitors. The majority of the components are surface mount and most of them are big enough that they are not too difficult to handle. There have been a number of articles in *QST* dealing with surface mount assembly techniques so assembling the DSP-610 should not be out of range of the intermediate to advanced homebrewer.[3,4] The BOM also includes the required chassis components to assemble a chassis similar to the one shown in Figure 2. The heat generating components are mounted on the back of the PCB and connected to the bottom of the chassis with an aluminum bracket made from pieces left over from the chassis.

Prior to producing the design files for the PCB, I constructed each individual stage separately using standard prototyping techniques with mainly through-hole components. Testing and fine tuning is much easier with this type of assembly. Once I got the entire radio working satisfactorily, I recorded the schematic and designed the PCB. I went section by section while assembling the PCB, starting with the microprocessors, then the receiver, then the transmitter and finally the power amplifier.

Careful observers will note that the layout in Figure 2 is somewhat different than that shown as Figure 1 of the announcement article in April 2012 *QST*.[5] The original version shown in the earlier photo passed all of the ARRL technical requirements, but some the spurious outputs were very close to the limits and I thought it was worth trying to make them better. I made some improvements in the DSP firmware, but the most improvement came from mechanical changes. The PA chain has more than 60 dB gain to get the –15 dBm signal from the mixer to the required +44 dBm signal at the antenna port. The output was feeding back into the input and every extraneous signal in the radio was amplified and sent out the antenna. Fortunately, with the help of ARRL Lab Engineer Bob Allison, WB1GCM, and some left over aluminum from the chassis, I was able to create an internal shield between the PA and the other circuitry that greatly reduced the spurious emissions and feedback. The ARRL Lab test data of the new version is shown in Table 2 on the QST-in-Depth Website.

Table 1
Homebrew Challenge III Requirements

Frequency coverage: 10 meters, 28.0 through 28.6 MHz or greater; 6 meters, 50.0 through 50.25 MHz or greater.
Frequency readout (mechanical or electronic) resolution: less than 1 kHz.
Receiver noise figure: 10 meters, less than 8 dB; 6 meters, less than 5 dB.
Receiver selectivity maximum: 3 kHz at 6 dB.
Receiver audio output: 0.5 W minimum with less than 10% distortion.
Transmitter must meet all FCC requirements.
TR switching; CW, semi or full break-in operation; Voice, VOX or push-to-talk.
Mic sensitivity; adjustable, with full 25 W output from standard low impedance dynamic mic or equivalent.
Output of 25 W into 50 Ω load with up to 2:1 SWR for at least 30 seconds. No damage driving open or short at antenna jack for 30 seconds.
Power required: either 120 V ac, 60 Hz mains or nominal 13.8 V dc supply.

Get the Iron Warmed Up

With today's components and assembly techniques, it is possible for the modern homebrewer to build equipment with all of the features of the commercial units. Best of all you can customize the unit any way you like: choose the layout of the controls, build it for different bands, reprogram the processors for additional features — anything goes.

Acknowledgments

I'd like to thank Curtis Pope and Mike Loebl at **HobbyPCB.com** for hosting the PCB, Chris Cockrum for ideas and test equipment, Jeff Nelson for *C* code help and my family who had to put up with another year of radio building.

Notes

[1]J. Hallas, W1ZR, "Homebrew Challenge III — And the Winner Is…," *QST*, Apr 2012, pp 32-33.
[2]**www.arrl.org/qst-in-depth**
[3]L. Wolfgang, WR1B, "Soldering Surface Mount Components," *QST*, Jan 2010, pp 32-33.
[4]R. Miller, KE6F, "Bob's Easy Assembly Surface-Mount Table (BEAST)," *QST*, Feb 2009, pp 37-38.
[5]See Note 1.

ARRL member and Extra class licensee Jim Veatch, WA2EUJ, received his first call sign in 1976. He is an avid kit builder and homebrewer and enjoys experimenting with applying new technology to Amateur Radio projects. Jim holds an Associate's Degree in Electronic Technology as well as a Bachelor's of Science in Electrical Engineering. He has spent his professional career engineering air-ground HF/VHF communications sites for Aeronautical Radio, direction finding systems for L3 Communications and lately software defined radios for Lockheed Martin.

Jim can be reached at 1704 Bolton St, Baltimore, MD 21217 or at **wa2euj@arrl.net**.

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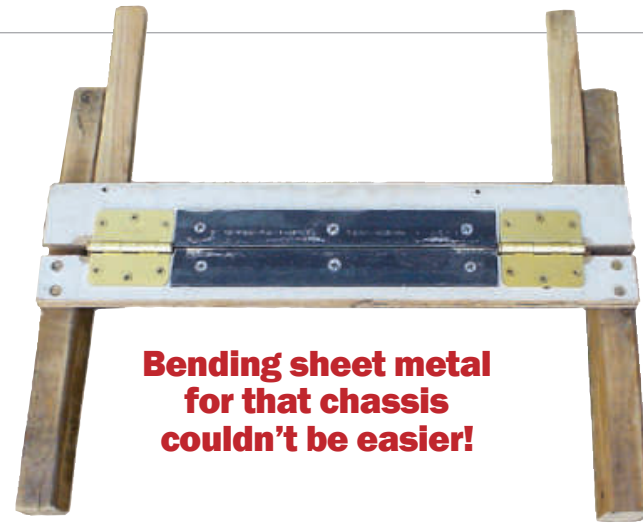
A Homebrew, Light Duty Metal Brake Revisited



Bending sheet metal for that chassis couldn't be easier!

George Averill, K4EOR

The October 1996 issue of *QST* included an interesting article by L. B. Cebik, W4RNL (SK), describing a light duty metal brake he had designed for bending sheet metal.[1] This article revisits that design in an attempt to simplify the construction even further, to describe how metal reacts to the stress of bending, and to add a pattern for constructing a metal box.

Why Build a Metal Brake

At some time or other, every ham needs a metal enclosure for that special homemade project. At one time, a ham could visit the local electronics store and make a purchase from a variety of enclosures. Not anymore. Most of these stores have closed, and those that remain in operation have a very limited selection of enclosures, usually plastic. That leaves one with the option of ordering an enclosure and waiting a week for it to arrive or using an enclosure that is not completely suited for the project.

Tools and Materials

Eureka! Why not build your own enclosure? This metal brake can be constructed with the simplest of tools. You will need a saw of some type to cut the wood, a hacksaw to cut the angle iron, a sharp pocket knife to shape the wood, an electric drill/screwdriver, drill bits and two C clamps. A small drill press will make drilling pilot holes easier, but it is not absolutely necessary. You will also need two 3 inch screen door hinges, one 9 inch metal mending plate, two 12 inch pieces of angle iron (I cut mine from a single piece, ⅛ × 1½ × 36 inches), and enough wood screws to attach things together. My scrap pile supplied me with everything except the mending plate, the screen door hinges and the angle iron. I purchased these at the local building supply store.

Building the Brake

The brake can be built in five easy steps as described below.

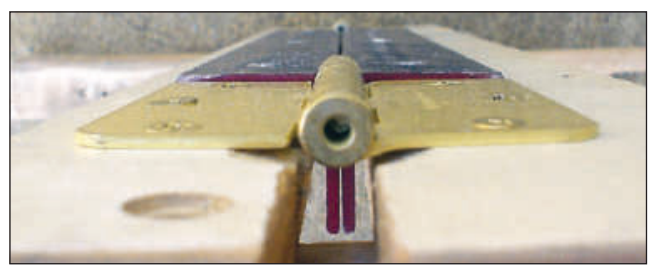


Figure 1 — For proper operation, it is important that the hinges be aligned as shown.

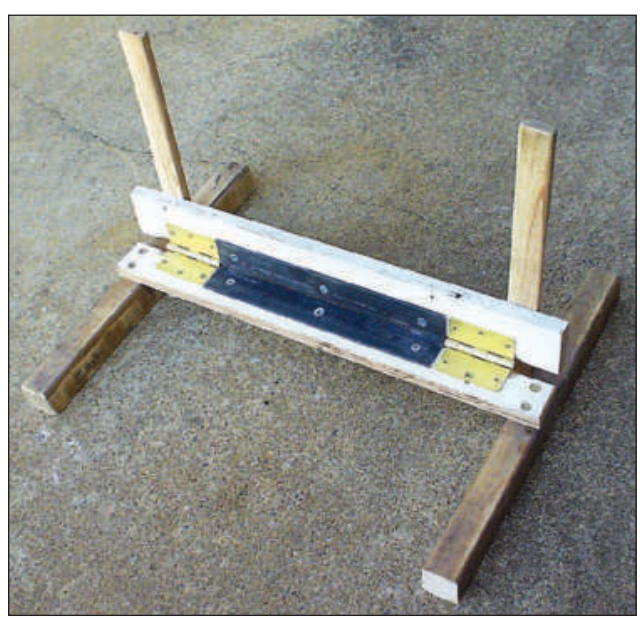


Figure 2 — Photo of the completed metal brake.

Cut the Wood

You will need to cut a total of six pieces of wood. Two pieces are flat cross boards for attaching the angle iron and the hinges, two are thicker boards on which the flat boards are attached, and two are handles for raising the side of the brake while bending metal. The dimensions of these boards aren't too critical. Just keep in mind that the stationary flat board will need to be narrow enough to allow clearance for attaching the clamps that hold down the material during bending.

Drill the Angle Iron

Drill three equally spaced holes in each of two 12 inch long angle iron brackets for attaching them with wood screws to the cross boards. You will need to counter sink these holes so that the wood screws will not protrude above the surface. This can be done using a drill bit slightly larger than the width of the head of the screws.

Attach the Angle Iron

Center each angle iron bracket against each of the flat boards, keeping their edges lined up with each other. Care must be taken to center the screws exactly in the center of the holes. This way the angle iron brackets will remain aligned after they are screwed down. If not aligned, the brackets may shift as the screws are tightened.

I found that the best way to do this was to first clamp the angle iron brackets to the boards, and then use a drill bit the same diameter of a hole to lightly mark

[1]Notes appear on page 35.

each hole for further drilling of the pilot screw holes. After the holes are marked, drill the pilot holes using a drill bit slightly smaller than the wood screws used to attach the angle iron plates. Use wood screws that are small enough so that their tops do not protrude above the surface of the iron. After securing the brackets with the wood screws, you should file down any portion of the screws that protrude above the surface of the angle iron brackets.

Attach the Hinges

The hinges are attached approximately ¼ inch from the ends of the angle iron brackets. The centers of most metal hinges are constructed so that the central hinge area protrudes slightly from the flat sides of the hinge. Wood must be removed to account for this bulge and allow each hinge to lie flat. A sharp pocket knife can be used to do this.

The objective of this procedure is to position the center point of the hinge pin with the top of the angle iron brackets. Attach the hinges, and take a look to see how well the center points of the hinges align with the angle iron brackets (see Figure 1). After removing some wood, the center of my hinges and the tops of the angle iron brackets aligned correctly, but you may need to place cardboard shims beneath your hinges if the center point of the hinge seems too low. If you have things aligned correctly, the two edges of the angle iron brackets should stay together as the rear one is raised while bending the metal.

Attach the Handles

Attach the two wooden handles with wood screws to the ends of the moveable flat board. You will have to drill pilot holes for the screws, and you may wish to use a large drill bit to countersink the holes. The completed brake is shown in Figure 2.

Bend Allowance

The following discussion is presented to help you understand why bending sheet metal changes its overall length.[2] You can basically ignore these calculations if you are constructing a box with dimensions that aren't critical. If you need more precision, just estimate how the change will affect your completed project.

When sheet metal is bent, the inside surface of the bend is compressed and the outer surface of the bend is stretched. Within the thickness of the metal lies its *neutral axis*, a line in the metal that is neither compressed nor stretched. What this means in practical terms is that if we want a work piece with a 90° bend in which one leg measures A, and the other measures B, then the total length of the flat piece is *not* A + B as one might first assume. To work out what the length of the flat piece of metal needs to be, we need to calculate the *bend allowance* or *bend deduction*. This will tell us how much we need to add or subtract to our leg lengths (A and B) to get exactly what we want (see Figure 3).

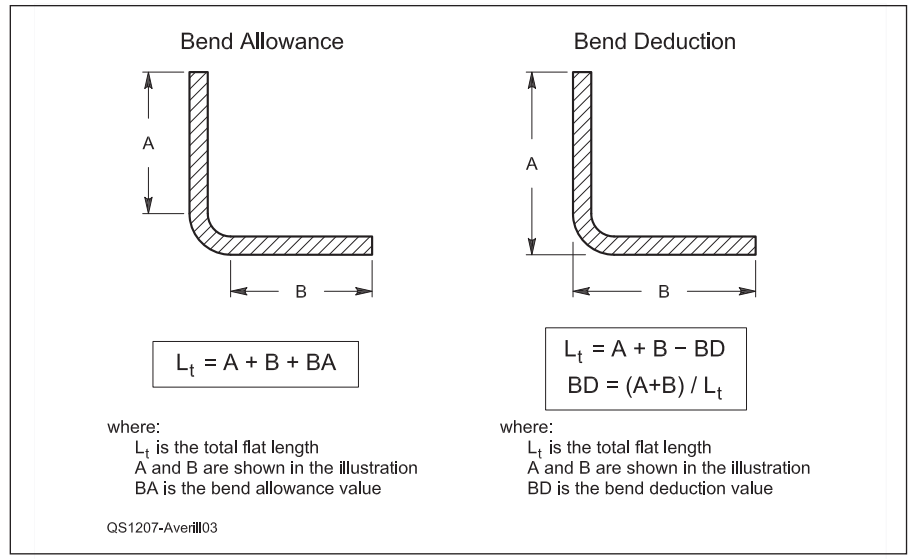


Figure 3 — Calculating total flat length.

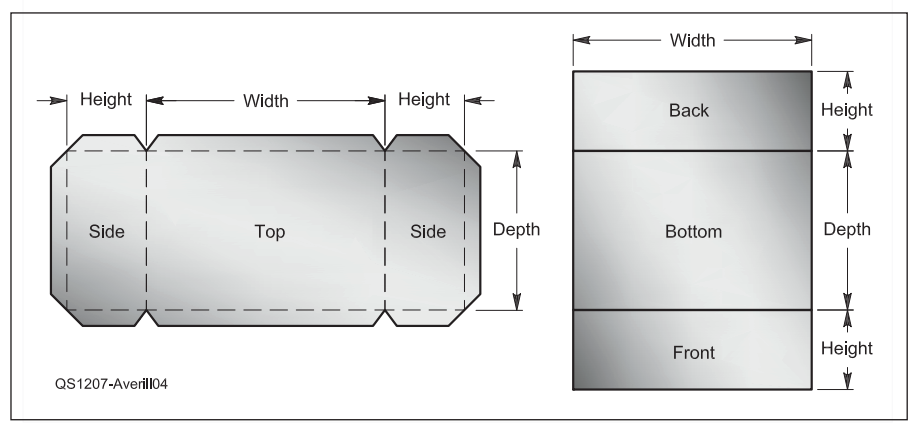


Figure 4 — A pattern for cutting metal for a simple box.

The only truly effective way of working out the correct bend allowance is to reverse-engineer a sheet metal part. Select a measured strip of scrap material, bend it and measure it. By noting the before and after dimensions, you will be able to determine the correct bend allowance for that thickness and type of stock. The width of the strip is not that critical but generally somewhere around 4 inches or so will work. Then, bend the strip to 90° and measure its Length A and Length B as shown in Figure 3. The bend allowance is added to pieces if the inside dimensions are important and subtracted from pieces if their outside dimensions are important.

Selecting Your Metal

The alloys of some metals are better suited for bending than others. Some may fracture rather than bend. A material's plasticity is determined by its ductility (ability to stretch), and its malleability (ability to compress).[3] Since this is different for different materials/alloys, including aluminum, it is best to try bending a sample of the material to determine its suitability for bending before starting your project.

The thickness of your metal will also be a factor when bending. Thinner metals bend more easy than thicker ones, and they are easier to clamp in place. So, again, you should make a test bend. I have bent aluminum sheeting up to 0.04 inches (1 mm) thick with no problem. If you wish to bend thick metals, you might want to purchase a commercial brake, but this one should be suitable for most of the electronic projects you will encounter.

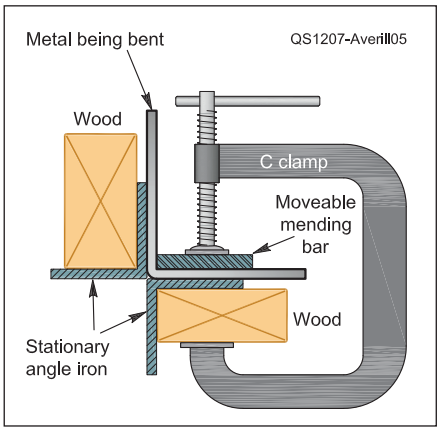


Figure 5 — Clamping the metal for bending.

Building a Box

Once you have your brake constructed, you are ready to start bending. You may want to take a close look at some of your commercial enclosures to see how they were made, and reverse-engineer your new enclosure. Several plans for building boxes can be found by searching the Internet. Figure 4 shows a simple plan for constructing a box. Again, the process breaks down into parts, four this time.

Design the Pattern

You should remember the rule of thumb to add the thickness of the metal when the resulting bend will be on the outside of the enclosure and to subtract the thickness of the metal when the resulting bend will be on the inside of the enclosure. The more accurate you are when measuring your pattern, the more accurate your box will be. You can just estimate this or you can follow the procedure mentioned above.

Cut the Metal

How you cut your metal sheet will depend on the tools you have at your disposal. The simplest way would be to use a pair of tin snips or a hacksaw. More accurate cuts can be made using a metal band saw, a jigsaw or reciprocating saw. Make sure that your metal sheet is cut perfectly square before you begin the first bend. This will improve the accuracy of your measurements. You may want to drill small holes at the junction of the corner bends (this makes a neater corner). The tabs at the corners should be slightly more than 45° to allow the metal to bend a little more than a right angle to allow for *spring back* during bending. I like to tape the metal plates to my drawing board, and then use drafting tools to facilitate marking the bend lines with a metal awl, but this isn't absolutely necessary. When making larger boxes, a T square can be used.

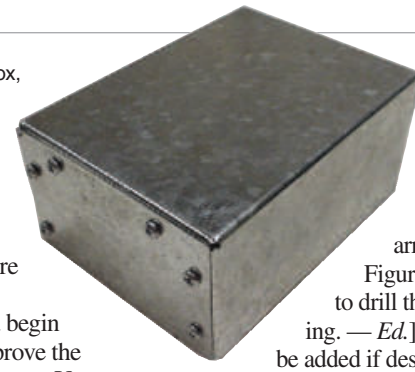


Figure 6 — Completed box, ready for that project.

Clamp the Cut Metal Sheet for Bending

Two clamps are required, as shown in Figure 5. When clamping a thick metal sheet, you should allow for the thickness of the metal at the bend. You will have to experiment to determine the order for making your bends. You will have to use different lengths of hardware store mending bars cut to fit the inside dimensions of your box in order to make some bends. These bars are used for clamping the material when making 90° bends. I have found that the best procedure is to bend the first section of the box, and then decide on the exact measurements of the second half.

Assemble the Box

The simplest method of securing the sides of your box is to drill holes and use self-tapping metal screws. First align the sections to be joined. Then drill through both thicknesses using a drill slightly smaller than the self-tapping screw. You may want to go back and enlarge the outside holes to allow the screws to pass freely. Once the box is completed you are ready to install your electronics and drill the requisite holes for switches, meters and other mounting arrangements (see Figure 6). [It may be easier to drill the holes before bending. — *Ed.*] Small plastic feet may be added if desired.

Summary

Your new metal brake will be a welcome addition to your ham tool set. You will find that designing and building your own enclosure will be as much fun as building your project itself.

Notes

[1]L. Cebik, W4RNL, "A Homebrew, Light Duty Metal Brake," *QST*, Oct 1996, pp 41-43.

[2]A. Rodriguez, "Sheet Metal Design: Beyond Bends and Flanges," A presentation to Autodesk University, Oct 2005, **www.widom-assoc.com/AU-MA31-2.pdf**.

[3]**en.wikipedia.org/wiki/Ductility**

ARRL member George Averill was first licensed as a Novice in 1955, at the age of 14 as KN4EOR. He currently holds a General class license. He holds a BS in Science from the University of Georgia, a MS and EdS from Columbus State University. He is a retired combat military engineer and secondary science teacher. His main ham interests are CW and QRP operating. In addition to Amateur Radio, he enjoys backpacking, gardening as a Master Gardner, swimming and operating a small business restoring antique chandeliers. His wife, Ellen, KE4MSQ, also a retired secondary science teacher, supports his various hobbies. You can reach George at **k4eor@arrl.net**.

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

New Products

PTC-IIIusb HF Radio Modem from SCS

Special Communications Systems (SCS) and North American distributor Farallon Electronics have released the PTC-IIIusb HF radio modem. The PTC-IIIusb is an updated version that replaces the PTC-IIusb introduced in 2005. The PTC-IIIusb comes standard with a USB interface, radio control port, GPS input and Bluetooth option. All units come with Pactor III mode enabled in addition to Pactor I and II. Price: $1148. For more information, or to order, see **www.farallon.us**.

Digital Interface for *Fldigi*

This easy to build interface includes a tone decoding PTT circuit.

David Spearing, KB9CSW

The Fldigi bug bit me (see the sidebar). It soon was apparent that that I needed an interface circuit between my computer and radio that that would electrically isolate the two and provide automated push to talk (PTT) like transmit-receive switching.[1]

For portability, I use my ASUS 1000 PC with the *Eeebuntu* operating system. ASUS, and many newer notebook computers have no serial port from which the PTT signal can be taken. The usual way around that problem is to take the audio from the computer output, rectify it and use that signal to switch the PTT on and off. While reading the Fdigi 3.2 manual, I discovered that a 1 kHz tone is available on the ring of the output jack for use as a PTT switch! Tone decoding — there's a chip for that!

Your computer sound card can put out a stereo signal to your headphones, or whatever. Since digital signals use only the left channel that leaves the right one unused. The designers of *Fldigi* took advantage of that and put a 1 kHz tone on the right channel whenever there is data on the left channel. This is a clever use of the card's capabilities that can be used to as a trigger for the PTT function. This can solve the problem of the vanishing serial ports on our computers without having to use the signal itself to trigger the PTT.

Using the tone avoids the potential problem of false triggering, which may occur from using the rectified signal for the PTT. That sounds good, but no one, at least to my knowledge, has published a circuit using the

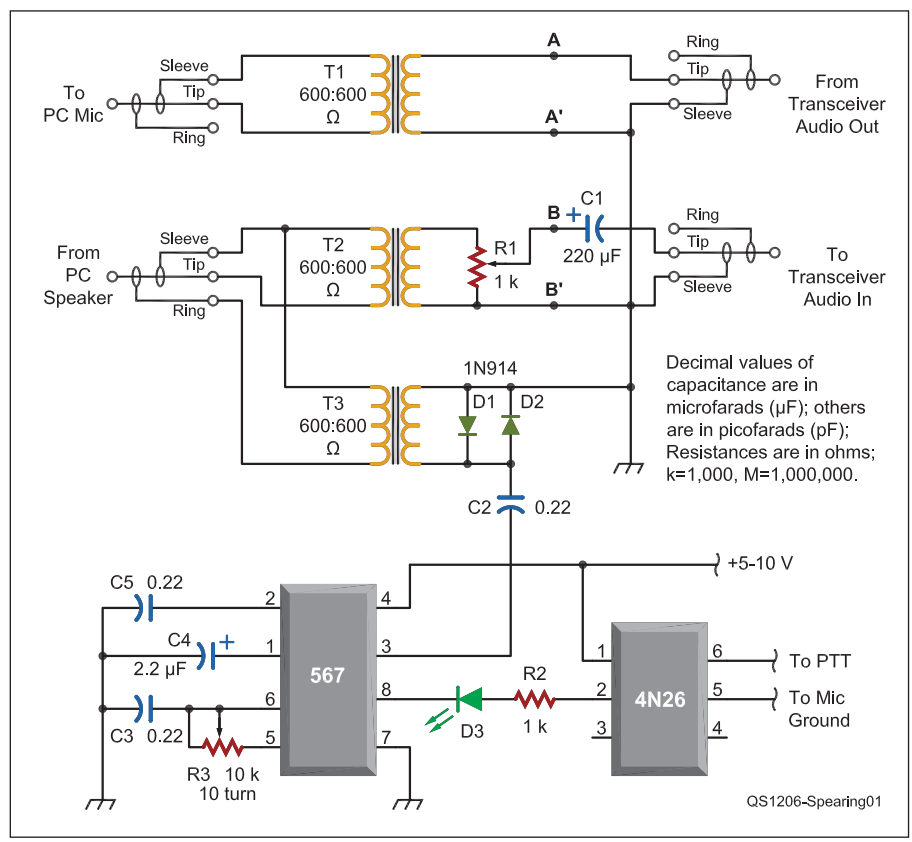


Figure 1 — Detailed schematic and parts list. All parts are available from one or more sources including your well stocked parts repository or RadioShack (**www.radioshack.com**), Ocean State Electronics (**www.oselectroniccs.com**), Digi-Key (**www.digikey.com**) or Mouser (**www.mouser.com**).

C1 — 220 µF, 25 V electrolytic capacitor.
C2, C3, C5 — 0.22 µF capacitor.
C4 — 2.2 µF capacitor.
D1, D2 — 1N914 general purpose diode.
D3 — Most any LED will work except the ultra bright ones.
R1 — 1 kΩ potentiometer.
R2 — 1 kΩ, ¼ W resistor.
R3 — 10 kΩ 10 turn potentiometer.
T1-T3 — Audio isolation transformers (RadioShack 237-1374 or similar).
U1 — 567 tone decoder IC. This was made by several manufacturers and the number may be preceded by letters such as LM or NE.
U2 — 4N26 optoisolator. If you find that you have a different 4Nxx chip, try it. There is a good chance that it will work.

[1]There are versions of *Fldigi* software for *Ubuntu*, *Puppy*, *OS X*, *Windows XP, Vista* and *7* operating systems. The latest version of the *Fldigi* software is V 3.31 and the manual is available on the Internet at **www.w1hkj.com**. For those who have PCs using the *Linux* operating systems, mixer controls are available. These amount to slide bar VOLUME controls on the left side of the RECEIVE and TRANSMIT windows of the main screen. They can be turned on by going to the *Fldigi* CONFIGURATION menu, clicking on AUDIO, then clicking on MIXER, then checking the MANAGE MIXER box. The *Fldigi 3.20 and Fldigi 3.21* manuals under the title "Rig Configuration" explain that you should go to the FLDIGI CONFIGURATION menu, click on RIG then on HARDWARE PTT, then check the PTT TONE ON RIGHT CHANNEL box to set the ring as a tone output.

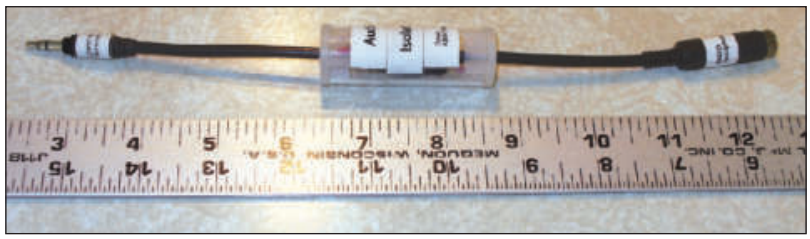


Figure 2 — A stand-alone audio isolator built into a cord.

tone for triggering the PTT. So, here is how I did it.

The Circuit

As with most digital interfaces, mine is made up of three circuits. The first is an isolated line from the phone jack of the radio or the ACC socket to the microphone of the computer. The second circuit is similar, though it runs from the headphone output of the computer to the microphone jack of the radio or the ACC socket. The final circuit switches the PTT on and off as needed (see Figure 1).

The first circuit is simply an isolation transformer in a line (shielded 2 wire audio cable) with appropriate ends for your application. It can be incorporated into a housing with the rest of the interface or be made as a stand-alone device for listening to digital signals or other needs requiring isolated audio (see Figure 2).

The second circuit is very similar to the first, with the addition of a 1 kΩ potentiometer for output VOLUME control and C1, which protects the power circuit of the electret microphones used in some radios.

The PTT circuit is isolated from the computer with the third isolation transformer. It connects between the ring and sleeve of the headphone jack of the computer rather than between the tip and sleeve as do the other two transformers. On the radio side of the transformer I built a clipping circuit using D1 and D2, to prevent any possible overvoltage from damaging the 567. When the 567 detects a tone, pin 8 goes to ground. C3 and R3 set the frequency to be detected, in this case 1 kHz. The LED is the ON light for the PTT. While searching for a transistor for the PTT switch I found a 4N26 optoisolator and used that instead of the transistor.

The 567 does not like a voltage above about 10 V, so I built a power supply to bring down the 13.8 V supply to 8 V using a 7808 regulator. A 9 V battery should work well for portable operation.

Between points A and A' I installed a simple audio amplifier to drive a small speaker. Since there are many ways to build an audio amplifier I do not include details, other than to say that I made mine with an LM386, a single chip audio amplifier. This addition is not necessary for the interface to work properly, but provides a check on operation.

Between points B and B' I installed a meter to keep track of the audio input to the radio. I again do not include details because I have no idea what kind of meters you have in your parts repository. In many cases a simple potentiometer, diode and capacitor network is all that you need to drive the meter. In my case I had to build an amplifier to accommodate the meter. This addition is also not necessary for the interface to work properly.

Construction

The construction technique used is not critical. I used perforated project board along with a scrap of board that I found hiding in my parts repository. I see no reason why other styles of construction

Fldigi — What's the Story?

Some years ago it came to me that I needed to upgrade my computer operating system from *Windows 2000*, but I did not care for the newer Microsoft systems so I turned to *Linux* and am happy I did, if for no other reason then not having to deal with viruses and other malware. *Unix* based systems are not susceptible to the malware associated with other operating systems. Also no one can beat the price, as most *Linux* software is free and open source (in most cases the source code is available for the asking). Yes, there is a learning curve and yes, not all Microsoft software can be made to run on *Linux* systems.

I needed digital mode software, so, like most, I turned to the Internet and found several programs which worked on *Linux* platforms to one degree or another. *Fldigi*, available at **www.w1hkj.com** caught my eye for two reasons.[A] First, it is a cross platform program, and second, it would do most of the common and even not so common digital modes. This means that anyone with almost any operating system can run most any digital mode. Several other noteworthy programs are also available from Dave Freese, W1HJK, and his crew.

One of the biggest problems with *Linux* operating systems is that it is sometimes hard to load an unusual, program such as *Fldigi*, a fact which turned off many would-be *Linux* users. It is now easy to load common programs such as word processors and browsers, which are often included in the package. *Fldigi* is really quite easy to load on *Ubuntu*, my present favorite flavor of *Linux*. If one can cut and paste instructions to the command line of a terminal, it is an easy download. Further instructions are on the website **www.w1hkj.com**.

The *Fldigi* program is easy to use and quite user friendly. One can poke around and make things work with little or no outside help. It is a good idea to download the manual and read it though. It is written in a rather straightforward step-by-step how-to way. The *Fldigi* program is full of features, some of which I have yet to try.

Among many other things it incorporates a logging program that is great for use with digital contacts. A stand-alone version is also available under the name of *Fllog*. It includes the actual operating frequency rather than just a band reference, a shortcoming of many otherwise good logging programs. It can output data in several formats, including Cabrillo, ADIF and CSV.

Fldigi supports operation in most digital modes, a great plus. I have been using mostly the PSK family of digital modes (PSK-31, PSK-63 and even PSK-125, which is very fast), with a bit of Olivia and Feld Hell thrown in just for fun, all of which are available on *Fldigi*.

Fldigi is my favorite program for digital modes because it works well on most modes on a *Linux* operating system, as well as others, and the price is right. It has many useful features, including a very good logging system.

A big thank you to W1HJK and his crew.

[A] *Fldigi* is pronounced eff ell digi.

Figure 3 — A front view of the completed project.

ARRL member David Spearing, KB9CSW, was first licensed in 1989. His interest in electronics began in the late 1950s while in junior high school. The interest continued leading him to VLF radio and eventually to ham radio. He earned his Amateur Extra class license in 2005. He is active in the Columbia County ARES®/ RACES group, for which he is the webmaster (see **www.aresraces.net**) and he is also active in the Yellow Thunder Amateur Radio Club and the Madison DX Club. David operates using local repeaters and on HF digital and USB, mostly 20 and 40 meters. You can reach him at 910 Prospect, Portage, WI 53901 or **kb9csw@arrl.net**.

would not work including dead bug or Manhattan style. I mounted the boards in an old CB radio housing that worked out very nicely because it fit my meter (see Figures 3 and 4).

Calibration and Setup

Only one adjustment is needed and that is the frequency setting on the 567. If you have a 1 kHz frequency generator simply hook it between the sleeve and ring and adjust R3 until the LED comes on when the tone is applied. If not, you will have to use the computer, which may take a bit of time. You can run the 10 turn potentiometer to one end and send a test message with the computer every half turn of the pot, as you back it out, until the LED comes on when you apply the tone.

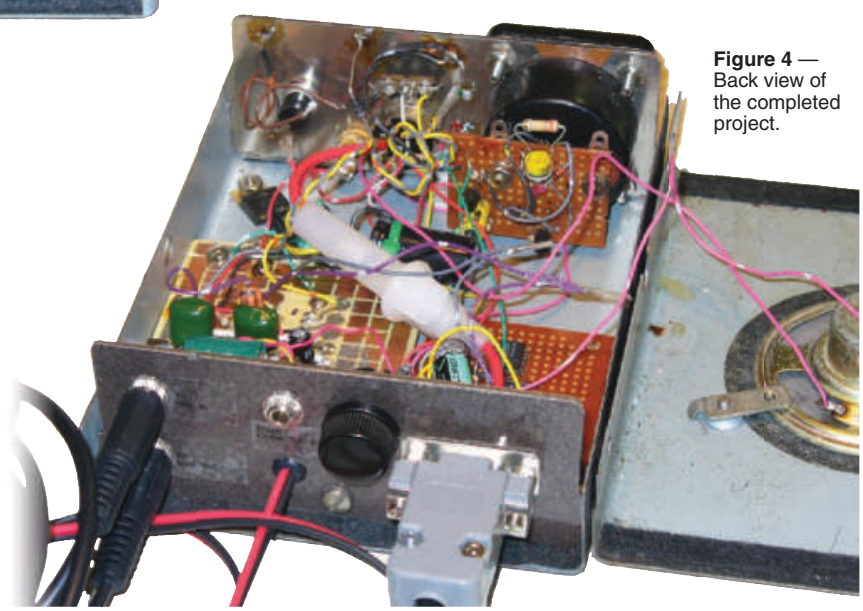


Figure 4 — Back view of the completed project.

New Products

QSL Card Scanner from DX Engineering

The DX Engineering QSL Scanning kit allows the user to store QSL cards and display them in rotation on an attractive, compact screen. The kit consists of one compact digital scanner, a seven-inch LCD digital picture frame screen, plug-in power supplies and a 2 GB SD card. To operate, feed QSL cards individually through the scanner. A slider guide adjusts easily to accommodate non-standard QSL sizes. The scanner accepts card sizes from 2 × 2 inches to a maximum of 4 × 6 inches, and images are saved in JPEG format. A PC is not required for the scanning process. To view the QSLs, plug the SD memory card into the digital picture frame. Up to 2000 QSL card images can be stored on the included SD card — more with larger capacity memory cards. Price: $89.95. For more information or to order, visit **www.dxengineering.com**.

Updated Features for N3FJP Logging and Contest Software

With N3FJP's *Amateur Contact Log* version 3.2, country files maintained by Jim Reisert, AD1C, can be downloaded from *AC Log*'s file menu options. The latest versions of N3FJP contesting software will check the same file download location first as well, eliminating the need to download the country files to the directory of each program separately. N3FJP software is compatible with *Windows 95* through *Windows 7*. The software is fully functional for 45 days after installation; registration is required for permanent use. Registration price: *Amateur Contact Log 3.2*, $24.95; contest-specific programs, $7 to $12 each; N3FJP Software Package and CD (all programs), $54.99. For more information, or to order, visit **www.n3fjp.com**.

Remote Radio Control Made Easy

If you're set up for sound card modes, you're almost there.

John Raydo, KØIZ

Why remote? In my case I have two homes, one in the mountains of Colorado (my station location) and another in Kansas City, Missouri. Unfortunately homeowner covenants prohibit antennas in my Kansas City subdivision. Other than trying some sort of stealth antenna, my operating was limited to Colorado. A remote setup gives me HF fun not only in Kansas City but from almost anywhere in the world.

Besides avoiding antenna restrictions, remote operation is great while traveling, dodging high noise levels, minimizing local RFI problems, avoiding grumpy landlords or while residing in a nursing home or other spot.

It Can Be Surprisingly Easy

Perhaps you thought the process was rather complicated, as I did. It doesn't have to be and can actually be surprisingly easy. If you are using digital modes such as PSK31, you already have almost everything you need. If you have a relatively new HF radio (that can be computer controlled) and a PC, you can set up a remote station in just a few hours. Then via software you can enjoy operating your station from anywhere that has a reasonably fast Internet connection.

Assuming you don't already have a digital mode setup, here's what you need: Connect two audio cables between your radio LINE IN and LINE OUT jacks and your PC sound card LINE OUT and LINE IN jacks. This gets the mic audio from the computer to your radio and receiver audio from the radio to your computer. Check your radio for type of connector(s) needed or better, use a radio-to-computer interface device that provides isolation and reduces the chance of hum.

It doesn't have to be complicated.

Next connect a control cable between your radio and PC serial port. The specific type of cable must match your radio (see "Setup Suggestions"). Many newer PCs do not have serial ports. If not, you can use a USB to RS232 adapter, or add an inexpensive PCI serial port board (which I think is the better option for a regular PC if it has room).

Software is the Key

You might already be using *Ham Radio Deluxe* (*HRD*) for digital modes.[1] Otherwise download and install *HRD* (version 5.11a or later) plus *LogMeIn* and *Skype* on your radio PC.[2] All three are free software products available on line. *HRD* allows control of the radio. *LogMeIn* is a remote PC access program so you can remotely run your PC, and *Skype* is a VoIP (Voice over Internet Protocol) program for audio. For CW and digital modes also install *DM780,* which comes with *HRD*. There are alternatives to these programs (I use *TRX Manager* rather than *HRD,*) but these are popular, free and great choices to start.

That's it for the radio end. Now set up a second *Skype* account and install it on your client (operator) PC or laptop. Lastly, plug in a PC headset and you are remote from anywhere!

Figure 1 shows a diagram of this setup. There is one potential downside to using *LogMeIn* or other PC access program. Internet traffic is relatively high, since screen updates on the radio PC are sent to the client PC. You may notice a little Internet delay as a result, but in most instances I have been quite satisfied with this type of setup. I strongly recommend at least initially using this method.

Setup Suggestions

You will need to check your radio documentation to determine the type of serial cable (and plug) to connect between radio and PC. Some use a standard DB9 RS232 serial cable (Elecraft K3 and Yaesu FT-2000, for example). ICOM radios and TEN-TEC Omni VI need a CI-V interface adapter or equivalent. The FT-847 uses a null modem cable but the FT-920 and FT-1000MP use a straight serial cable. Some older Kenwood and Yaesu transceivers require an adapter. In other words, you must use the proper adapter and/or cable. These are commonly available from a number of online sources. Older radios usually have some limitations on software control (some commands may not work).

HRD, *TRX Manager* and other radio control programs have built-in CW and digital generators and typically use the radio's internal keying. Switching to transmit uses the radio's break-in or VOX capabilities. Otherwise you will need an adapter that connects to a second serial (or USB) port on your radio PC and plugs into the KEY jack on your radio. There are several on the market.

While some have used external sound cards, I found the radio PC internal sound interface works just fine for the mic and speaker connections. You may experience RFI

[1]Notes appear on page 40.

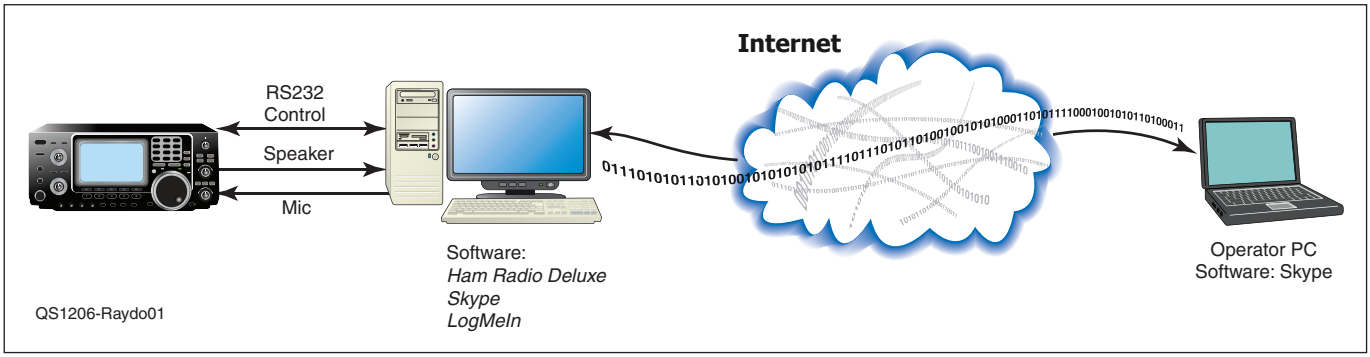


Figure 1 — Diagram of my first, and simplest, remote radio configuration using *LogMeIn* and a PC.

problems with *Skype*, as I did (but only if running 1500 W). If so, clamp-on ferrites on the audio cables (several turns each) will likely solve the problem. Setting mic and speaker/headphone levels will require some experimentation (adjustments in both PCs, both *Skypes* and the radio). Start with everything at mid points. I use a $10 LogiTech PC headset and get surprisingly good audio reports.

LogMeIn is only needed on the radio PC. The free version is entirely adequate for the remote radio purpose. For faster screen updates, while connected to the radio PC click COLOR QUALITY at the top of the screen and set to LOW. In the ADVANCE section, change IDLE TIME ALLOWED to an appropriate time such as 2 or 3 hours to keep from being inadvertently disconnected.

Set up both *Skype* and *LogMeIn* to load when the radio PC is turned on and *Skype* to auto-answer. Access the radio PC *LogMeIn* from the client PC via the Internet at **www.logmein.com**.

It's a good idea to turn off Microsoft *Automatic Updates* while running remote. Bogged down computers and reboots in the midst of a remote DX QSO can be mighty frustrating! Turn off *Windows* sounds to prevent unwanted beeps, etc from being transmitted. Change the SLEEP mode to NEVER otherwise you might not be able to remotely access that PC.

Other Ways To Go Remote

Another method of radio control uses a serial server. It is connected to your LAN via Ethernet and to the radio with a serial cable. A serial server is more efficient than a PC access program such as *LogMeIn*. Only commands are sent via Internet. Software is only on the client PC with fast screen updates. The popular RemoteRig and Glentek units are serial servers customized for ham radio with built-in codex for audio (thus no need for a PC or *Skype*). [The version of this article in the August 2012 digital *QST* includes a complete description of the author's implementation of a serial server, along with many helpful references. — *Ed.*]

A standard serial server also works well (but without audio). A PC at the radio would still be needed, but just for audio (*Skype*). The client (operator) PC has the software control program (*HRD*, for example) and *Skype*. A PC can also be used as a serial server to run *HRD* in a *remote* configuration (click REMOTE in the *HRD* toolbar).

Some radios (for example, the Kenwood TS-480) have removable front panels that can be set up remotely. The TEN-TEC Omni-VII is advertised as *net ready*. An Elecraft K3 can remotely control another K3. Other equipment options are appearing all the time. Many radios also have original equipment manufacturer (OEM)-supplied software as an alternative to *HRD* (the Kenwood ARCP series, TEN-TEC "One Plug," ICOM, Yaesu and perhaps others).

If you have existing control software running on your radio PC for amplifiers, antenna switching, rotator or other options, you can continue to use them via *LogMeIn*. Most radio control programs also have some built-in accessory control functionality. I use the Telepost LP Remote control board and software to control power to equipment and monitor station operation.[2]

Give It a Try

I was initially intimidated by the apparent complexity of remote radio. With the help of Lynn Kuluva, KØIMI, a member of my radio club, I was quickly up using *LogMeIn* and *Skype*. It worked surprisingly well. I later switched to the serial server method for more extensive control of my station. Remote operation adds a new dimension to HF operation from almost anyplace. I have even operated mobile using a cellular connection.

Much more information on this entire subject is available in a recent ARRL publication, *Remote Operating for Amateur Radio*.[4]

Notes
[1]**www.hrdsoftwarellc.com**
[2]**www.LogMeIn.com, www.skype.com**
[3]**www.telepostinc.com**
[4]S. Ford, WB8IMY, *Remote Operating for Amateur Radio*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0922. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

ARRL member and Amateur Extra class licensee John Raydo, KØIZ, has authored a number of articles for *QST* and *QEX*. He is an active member of the Johnson County (Kansas) Radio Amateur Club. He started his career working for TWA as an electrical engineer and later headed up their IT and purchasing departments. He subsequently retired from American Airlines and is now also retired from his second career as a principal and co-owner of a securities broker/dealer firm. John can be contacted at 4901 NW 79th St, Kansas City, MO 64151 or at **k0iz@kc.rr.com**.

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

Feedback

In the 2011 ARRL 10 Meter Contest Results [July 2012, pp 80-83], the DX winner of the Single Operator, Phone Only, High Power category was listed as LP1H (LU5HM, op). This is incorrect; the correct winner was KP2A (KW8N, op). The ARRL Contest Branch regrets the error.

Not surprisingly, electric power in the 21st century is quite different from that of the 19th.

Rethinking Electrical Power for the Ham

Bob Bruninga, WB4APR

Amateur Radio prides itself on portable operations under emergency conditions, still many still think in terms of decades old power systems. Modern electronics has transformed power in such a profound yet subtle way that many of us may not have noticed or taken advantage.

An example of how transformational technology can leap-frog progress is the cell phone industry. Pioneers in the US invented and developed the telephone and then wired the continent over the last century, but who would have guessed that now you don't need wires? Now the US is so far down the list of countries with phones per capita (72nd) that we are actually behind many third world countries.[1]

Beyond Thomas A. Edison

The same goes for electrical power. Ever since Edison wired New York City over a century ago, the local grid has changed little. Today, some countries in Africa have more renewable and survivable local solar energy systems than we do. They don't need a grid, just as they don't need phone lines.

Power Supplies

Now consider the transformational changes in electrical power for ham radio. In Figure 1, the 1980 linear supply on the left gives 9 A at 13.8 V, but the laptop supply in the middle provides nearly the same power (8 A) but in 7% of the space. The 18 A switcher on the right gives twice the power in 14% the space and weighs only 1/10 as much. The difference is the elimination of the bulky 60 Hz transformers in favor of dc switching circuitry.

Laptop power supplies up to 5 A (90 W) are very common and cheap at yard sales and flea markets. Most of them, however, will require external diodes or a regulator to drop the voltage down to 14 V to safely operate most ham gear as shown in Figure 2.

Even a 4 A laptop power supply can power a 100 W PEP HF station by having 10 AA size NiCd batteries floating across the 14 V output to provide peak transmit power (12 A or more) and then recharge during receive as shown in Figure 2. If your receive to transmit ratio is less than 8:1 you can operate indefinitely. A 4 A supply at 19 V should deliver 5 A at 14 V if you use the buck-switching regulator shown in Figure 2.

Lighting

Other dramatic changes in power are seen in lighting. Compact fluorescent lights (CFLs) and light emitting diodes (LED)s are gradually replacing the inefficient incandescent bulbs invented by Edison in 1879. CFL bulbs are now under $2 each, last 10,000 hours and draw only 25% of the

Figure 1 — Modern switching power supplies are smaller, lighter and more efficient. The linear 9 A supply on left weighs 10 times more and takes 16 times more volume per ampere than the 8 A laptop and 18 A switching supplies shown.

[1]Notes appear on page 43.

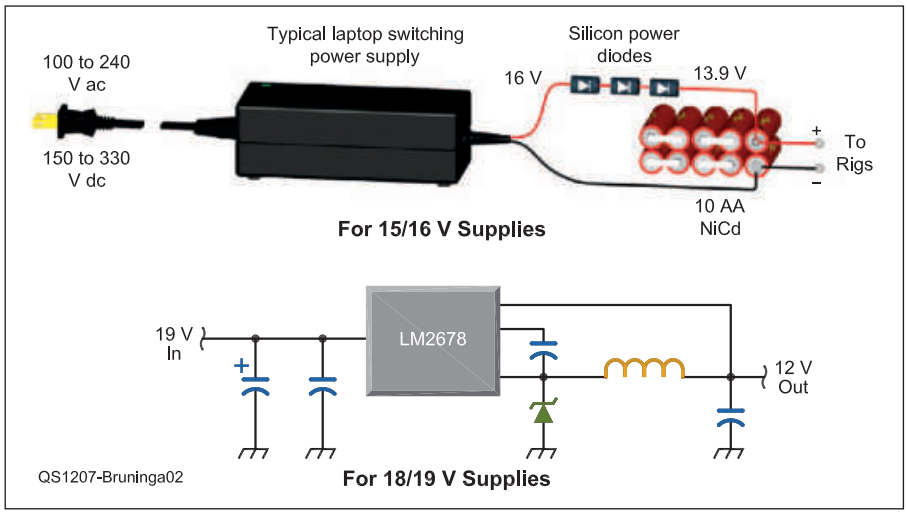


Figure 2 — A few series diodes (0.7 V drop) can reduce the laptop power supply to 14 V to power a station. For momentary peak currents of 8 to 20 A, add a small parallel battery of AA NiCds. Alternately, a 90% efficient switching regulator integrated circuit such as an LM2678 can also be used.

power of incandescents. Each CFL bulb can save $50 in power over its life.

Inverters

Changes have also been made in 12 V dc to 120 V ac modified or pure sine wave inverters. These are now available at above 90% efficiency. This makes it easy to provide emergency power from a 12 V car system or battery over significant distances by inverting to 115 V ac. If distant 12 V dc is needed, just use a switching supply back to 12 V. For any given wire, you can deliver the same power at 120 V over 100 times the distance as with 12 V since power loss is proportional to the square of current.

On the Road

With the high utility of having 120 V ac everywhere you go, hams should consider permanent inverters in their vehicles. Inverters of 1 kW or more go for $100 or less. Forget the backyard emergency generator that is rarely used, rarely starts when needed and requires routine maintenance. During blackouts, power your refrigerator, CFL lights and other electronics from your car inverter go-everywhere system. The car has a generator and a large gas tank, and is very reliable because it gets used every day. My 1200 W inverter can even run a small 5000 BTU window air conditioner.

Electrification of Transportation

The most transformational change in power systems, however, is just beginning. This year has begun with an explosion of new models of all-electric and hybrid vehicles. These vehicles have huge storage and generating capacity. Nissan even offers a whole-house power system that can power your house for a week from the 15 kWh vehicle battery in its Leaf automobile.

A Toyota Prius hybrid has a 220 V dc power system with a generator capable of 50 kW peak power. Drawing just 10 kW from the system could potentially power a half dozen houses during a blackout. Presently, of course, no EVs (except for the Leaf option) or hybrids give the consumer direct access to this power and there are no easy ways to use the high voltage dc directly at those power levels. But indirectly, using an added 1 kW inverter noted above, the Prius and some other hybrids can generate adequate power over long periods because the gas engine starts and stops automatically to maintain charge in its high voltage battery.

Figure 3 — The outlet on the rear of my Prius (on right) provides about 1 kW at 115 V ac from a 12 V inverter.

The Prius 220 V system uses a switching converter to provide up to 100 A for 12 V accessories. Through an add-on hobby inverter, this can supply about 1 kW of continuous 120 V ac power. (see Figure 3). Just leave the ignition on. At 1 kW, it runs about 3 minutes on and 4 minutes off. At a 200 W draw it is more like 3 on and 20 minutes off. Inside the house, draw whatever you need at any time, and the car will take care of itself. Gas efficiency is about 5 kWh per gallon, similar to most small generators.[2]

Solar Power Systems

Other new sources of high voltage dc are home and portable solar systems. Grid-tie inverters operate above 95% efficiency at high dc voltage and have 100% efficient grid storage (net metering). On the other hand, low voltage battery based systems are very inefficient due to 30% losses during charging and 100% losses on any day the batteries are fully charged and excess energy is lost. If you have not looked into solar recently, do not make the mistake this ham did by thinking in terms of battery systems. Batteries have no part to play in cost effective renewable energy if you have access to the grid.

It is very important to separate the economics of your 99.9% routine grid-tie energy maintenance-free system, from your extremely rare 0.1% power outage needs. For emergency power, forget whole-house batteries. Instead, use a generator or your vehicle energy system (see Figure 3).

The lead photograph shows an example of serious power to go. The solar panels on the car provide 200 W while those on the trailer (shown open) provide 300 W. Together they provide a clean noise free power source at ARRL Field Day or on a soccer field. The solar panels combined with 12 V batteries and inverters provide 2 kW of 115 V ac power peak and 500 W average, while the sun shines.

Two Dollars per Watt

Recently, solar grid-tie systems have become very cost effective, as low as $1/W on internet specials. In just the last few years, the doubling of electricity cost, the halving of solar panel cost, the 35% efficiency improvement of grid-tie compared to batteries and the 50% sum of county, state and federal cash or tax incentives make solar not only cheaper than the utility, but more than a guaranteed 10% return on your investment. You cannot match that in any bank.

Maximum efficiency of such a system requires the use of high voltage dc inverters.

Figure 4 — My home 8 kW grid-tie solar system also provides emergency power when the grid goes down by connecting to switching power supplies.

Check with your electrician and your local building codes to find out what can be legally used in your area and how you can make the best use of it.

In addition some utilities pay you over $200 per year per kW of capacity, just to count your system as part of their mandated renewable energy. Add this all up, and the incentive to go solar (without batteries) is more than 20 times what it was just a few years ago. If you have good sun exposure, and won't be moving again, it makes no sense not to invest in solar power for your home and lock in your energy supply at less than half what you will pay to the utility for the rest of your life.[3]

New Energy Thinking

Remember to separate the engineering and economics of your routine efficient energy system (solar) from your smaller rarely used home or ham radio emergency needs. Solar costs only 20% of what it did just 10 years ago. If you have good sun and a permanent home (see Figure 4), high voltage grid-tie solar is a great investment for the ham operator. For the few hours when the grid does go out, use short term Field Day techniques to keep the lights and rig running. Forget that dream 10 kW generator rust bucket in the backyard, too.

A $100 inverter in your car not only supplies these rare events but also gives you ac power wherever you drive. With more than 30 hybrid and electric cars on the market in 2012 with generators and high voltage battery capacity in the tens of kWh, there are more than ample sources of emergency backup power.[4]

It's not dad's power system any more. Our commuter car will be electric, our power will be solar or wind, we will consider efficiency in appliances and managing energy will be an important aspect in our daily lives. We will cherish the grid and not dream of living without it (unless we don't have access to it). Power supplies are becoming very efficient and flexible. There are now alternatives to the big ol' battery and backyard generator. Knowledgeable hams who keep up with the changing times will lead in their ability to operate under emergency conditions.

Notes

[1]**www.nationmaster.com/graph/med_tel_mob_cel_percap-telephones-mobile-cellular-per-capita**.
[2]Field Day power. See **aprs.org/FD-Prius-Power.html**.
[3]Alternative energy. See **aprs.org/alternative-energy.html**.
[4]Solar hybrid. See **aprs.org/APRS-SPHEV.html**.

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

New Products

Parabolic Dish Kit for 40 kHz Ultrasound Applications

The Xtal Set Society 12 inch clear plastic dish antenna for ultrasound applications can be used with the RX1 or RX2 ultrasound receivers as shown in the photo. Very narrow sensor beamwidths are desirable for applications such as locating radio interference caused by sparking of ac power distribution systems, separating multiple biological sources at a distance or amplifying a received signal. The 12 inch diameter dish has an 8 inch focal length and is designed to work with a 400SR16 or similar piezo transducer (PZT). It is rated to achieve a pressure gain over the sensor alone at 40 kHz of 20 to 25 dB Pa and narrow the field of view from 50° to less than 3°. The Parabolic Dish Kit includes the 12 inch clear plastic dish, a 400SR16 PZT, sensor PCB, three struts, instrumentation bracket, pistol grip and hardware. The kit manual includes assembly instructions, mounting techniques for the Ultra-RX1 or Ultra-RX2, a discussion on parabolic dish gain, and references. Assembly time is said to be about 1.5 hours for an experienced kit builder, requiring pliers, screw drivers, and soldering iron. Price: $129.95. For more information, or to order, visit **www.midnightscience.com**.

Quick Coax Test

Sometimes a high SWR can be good news.

Larry Jennings, WB5IZL

Have you ever been to an amateur flea market, seen a low price on some coax and wondered if it really is good? Have you and your club ever wondered if the coax running up to the repeater antenna is still up to snuff? Maybe you're wondering if that coax on your tower needs replacing.

I know that I have encountered each of these questions several times in over 40 years as a licensed amateur. I was scanning through *The ARRL Antenna Book* (15th Edition), and, right there on pages 24-14 and 15 was the answer I was looking for.[1] That section was about testing lossy transmission lines.

All Transmission Lines Have Loss

When we learn about transmission lines, we generally first learn about ideal or lossless transmission lines. We then learn that every transmission line can have loss. We understand that the line loss decreases the amount of power delivered to the antenna from the transmitter as well as the signal going to the receiver. Transmission line loss is why we measure the SWR of an antenna at the feed-point of that antenna, not at the transmitter, at which point the line losses reduce the measured SWR.

A set of three rules apply to transmission line loss, particularly coax. These are:

- At a given frequency, the longer the coax the greater the loss.
- At a given frequency and length, a larger diameter coax (such as RG-8 versus RG-58) made from the same materials as a thinner coax will have lower loss.
- For a given length and type of coax, the losses at higher frequencies will be higher than the losses at lower frequencies.

Testing Coax

Although we can test coax in many ways, for quick field tests of unknown coax we can start with simple ohmmeter tests of continuity. If it doesn't pass them, no further testing is necessary — on to the next candidate!

Quick Ohmmeter Tests

For our first test, we'll use an ordinary ohmmeter and a clip lead on the coax to determine if the coax is open or shorted somewhere in its length. Here's how you do it step by step. We first will check for physical shorts and opens. All we'll need is an ohmmeter and something to short the far end of the coax.

First, disconnect the coax to be measured at both ends. Make sure that there are no items such as duplexers, lightning arrestors or baluns between the ends you have disconnected. At the testing end, set up your ohmmeter to its highest resistance range (if you have one of the new digital types that autorange, just go on from here). Use the ohmmeter to measure the resistance between the center conductor and shield of the coax. The reading should be very high — higher than several megohms. If you get a lower reading, you may have a short or leakage between the center conductor and the shield. Such a short or leakage may be caused by corrosion, improperly installed connectors, or even water inside the coax. You may have to replace the coax if you can't find and fix the short.

If the coax has plugs, a matching socket with a wire from center conductor to shield or flange can be used to short the far end. If the cable does not have a far end connector, you can use a clip lead, a wire or even a knife blade to insert a short between the shield and center conductor at the far end of the coax. Now use the ohmmeter in its lowest range to measure the resistance between the center conductor and the shield.

Because the center conductor is smaller than

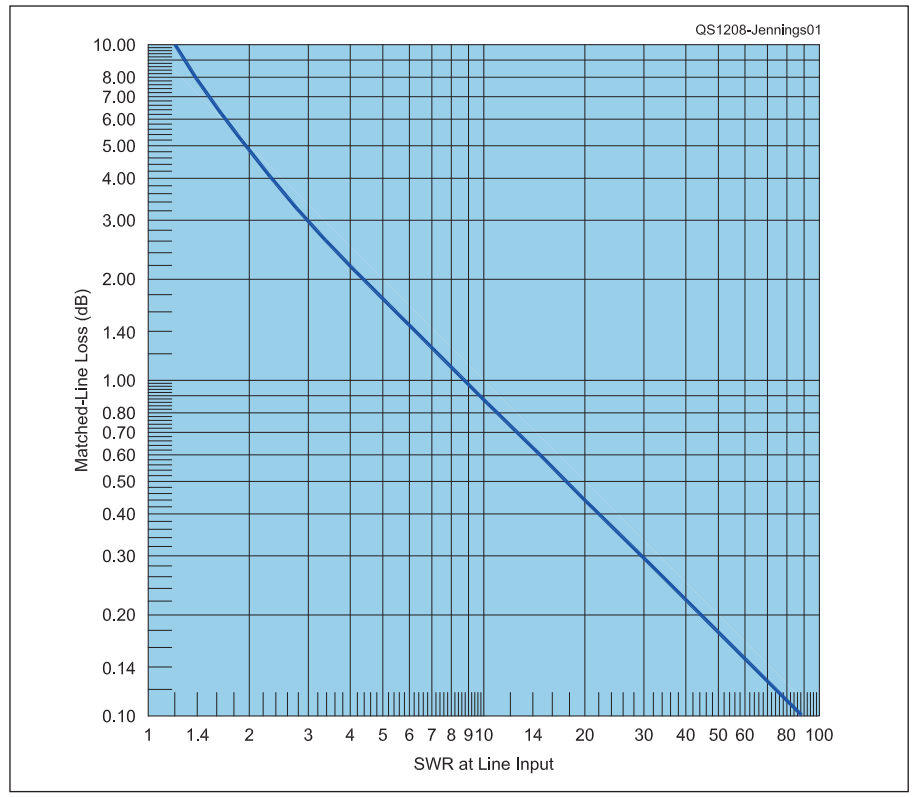

Figure 1 — Graph of the apparent SWR versus losses in a coax measured terminated in an open or short. Find the SWR value you measured on the horizontal axis and then go straight up and read the one way matched loss in dB on the vertical axis where the SWR reading crosses the diagonal line. Note that if the line is not matched, the loss can increase significantly.

[1]Notes appear on page 45.

the shield, the resistance should be close to that of the center conductor alone. This should range from just over 0.1 Ω for 100 feet of typical RG-8 to about 1 Ω for 100 feet of RG-58. The resistance will scale directly with length. If you get a reading much higher than that, your coax has a problem in the connectivity of the center conductor, the shield or possibly at the connectors. Be sure to check that your short on the other end of the coax is still making contact, since any resistance there will add to the result.

SWR Analyzer Loss Testing

Now that you've tested the coax for shorts and opens, you can use the antenna or SWR analyzer to determine the coax loss.

In order to test coax for loss, we can measure the SWR at the frequency of interest with the coax either open or shorted. If we had ideal lossless coax our measured SWR would be infinite since all the power would be reflected and would return to the source. With losses in the coax, something else happens. Whatever signal power we put into one end will arrive at the other end with the same power, less the amount of line loss. Because the short or open at the far end of the coax provides a total reflection, the signal then reverses its direction and returns to the source end. On the return trip, the power level at the far end of the coax will be again reduced by the losses in the coax.

The reduced reflected power will show up in real coax as an SWR that is less than infinite. The higher the loss in the coax, the lower the measured SWR will be as read at the test end. Carried to extremes, a very high loss in a length of coax (such as the losses at UHF for a 500 foot long piece of RG-58) will result in an SWR of nearly 1:1 with the far end of the coax open or shorted.

Figure 1 shows a graph from the 15th editon of *The ARRL Antenna Book* of the SWR versus matched loss in a coax measured in with a short or open at the far end. The section also provides an equation to determine the one-way matched loss from the measured SWR: L_M is the one-way matched line loss in decibels at the measurement frequency.

$$L_M = 10 \times \log_{10} \{(SWR + 1)/(SWR - 1)\}$$

In other words, if you measured an SWR of 3:1 with a length of open or shorted coax, either Figure 1 or the equation indicates that the cable loss will be 3 dB at the frequency of interest.

To make the measurement, first make sure the antenna end of the coax is not connected to anything, and that any shorts you placed there during the ohmmeter tests have been removed.

Following the instructions in the manual for the antenna analyzer, set the frequency of interest into the analyzer. Without changing the frequency, read the SWR on the analyzer and write it and the frequency down. Figure 2 shows the display on my MFJ-269 SWR analyzer while I was checking a 50 foot length of coax used on a 2 meter repeater:

Figure 2 — Display on my MFJ-269 SWR analyzer as I was checking a coax used on my local 2 meter repeater.

The upper line shows the test frequency in MHz and the measured SWR of 6.6:1. This indicates a loss of about 1.3 dB, compared to 1.4 dB predicted by *TLW* for 50 feet of RG-213 (Belden 8267). Not bad for a 50 foot long coax of RG-213. At 445 MHz, the SWR measured was 1.4, for a loss of 7.78 dB, much worse than the 2.6 dB predicted by *TLW*. Thus this coax, while useful on 2 meters, will not be very good on 70 cm and is probably in the process of degrading.

Now that you've confirmed that the coax is neither open nor shorted and have an approximate read on the losses in it at the frequencies of interest, you can make a better decision on whether to continue to use the coax or to replace it.

What if the Antenna is Up in the Air?

The tests described previously are great if you have access to both end of the coax, but sometimes you would like to find out about that coax going up the tower. While you don't have control over the far end, you likely know what's there if it's your antenna. For example, I have a 2 meter Yagi with a T matching section. While that provides a nice 50 Ω termination at 2 meters, it should look like a short at dc and the ohmmeter continuity test should show a very low resistance, almost as low as if it were a short. A split feed Yagi or dipole should look like an open at dc.

The SWR at 2 meters won't tell us much about loss; in fact, the lossier it is the better the SWR will look. On the other hand, it will look a lot like a short at 1/10 the frequency or at 20 meters. A measurement there should give us a good, but not precise, idea of the 14 MHz loss. If the cable is good there, chances are it is also good at 2 meters. Other types of antenna connections may be trickier to make use of, but if you measure the SWR on other frequencies when the cable is new, and store the data in your archives, any change in later years may mean either the antenna or transmission line has undergone a change that merits investigation. Another trick is to sweep your analyzer frequency looking for the worst SWR. That probably indicates either a very high or very low impedance and the loss at that frequency will be no better than that based on the noted indication.

A Cautionary Note

Note that all of the loss results are based on the data provided by the SWR analyzer. *The ARRL Antenna Book* notes: "The instruments available to most amateurs lose accuracy at SWR values greater than about 5:1, so this method is useful principally as a go/no go check on lines that are fairly long." That really is the only question you need answer — do we want to buy this coax, or if we have it, is it time for a replacement? These tests should give you enough information to make those decisions.

Notes

[1] *The ARRL Antenna Book,* 15th Edition.
[2] *TLW, Transmission Line for Windows*. Software is provided on a CD with *The ARRL Antenna Book*.
[3] *The ARRL Antenna Book,* 22nd Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

ARRL member Larry Jennings, WB5IZL, was first licensed as an Amateur Radio operator in 1962 as WNØCCH and continually licensed since then, currently holding an Amateur Extra class license. He operated as WB5IZL/KH6 between 1973 through 1977 while stationed in Hawaii with the US Air Force. He also holds an FCC commercial General Radio Telephone Operator License with Ship Radar Endorsement.

Larry earned BSEE and MSEE degrees as well as an MBA. He is now retired after an engineering career with the US Air Force, E-Systems and the Boeing Company. He also taught basic electronics, computer science and mathematics at North Central Texas College, a community college in Gainesville, Texas. You can reach him at 5005 Utah Dr, Greenville, TX 75402 or by e-mail at **jenninle@hbquik.com**.

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

My Tuner Tuned My Antenna — But Now it Doesn't!

We can only ask so much of our faithful tuner.

Joel R. Hallas, W1ZR

Antenna tuners seem to have gotten more popular than ever before among HF operators. This should come as no surprise — with more and more multiband awards, such as ARRL's Five Band DXCC, amateurs have reason to operate on more bands than ever before. The use of a tuner with a center fed Zepp, or vertical monopole is a popular way of obtaining multiband capability, especially for the real estate or budget constrained operator.

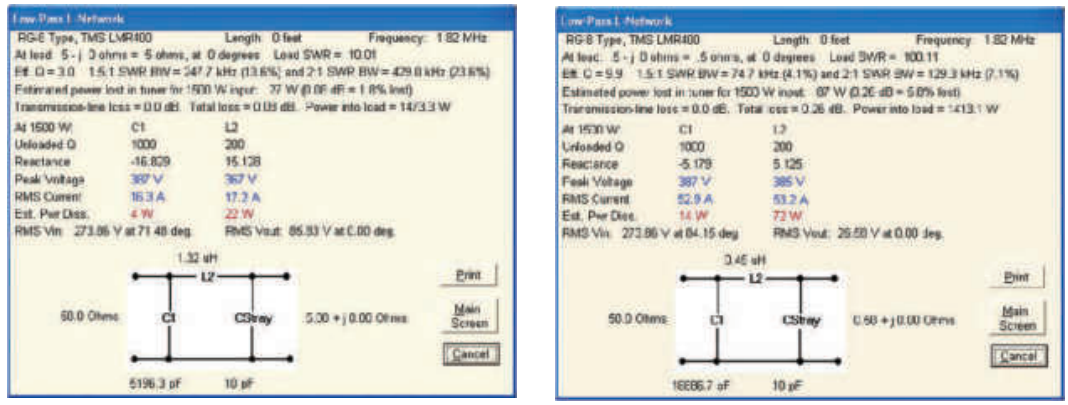

Figure 1 — The *EZNEC* TUNER output with input SWRs of 10:1 (left, within spec) and 100:1 (right, beyond spec) for 1500 W. Note the current values in each case to see why my switch likely melted.

There Are Limits

Antenna tuners seem to magically transform the impedance of almost any antenna to that needed by our radio on almost every band — but can they? All circuits have design parameters that result in values, and in this case more importantly component ratings. If we exceed the ratings, we have no right to expect the components to survive.

The typical antenna tuner has a maximum SWR specification, which is what defines both the component values and their ratings. In some cases, it is defined in terms of SWR — typically 3:1 for "trimming" tuners and often 10:1 for wide range tuners. Since the maximum voltage or current (depending on actual impedance) go up with the square root of the SWR, the stress on components should be less at lower SWR. Conversely, at higher than rated SWR, the stress on components can easily exceed the rating.

What Does it All Mean?

An antenna tuner is a relatively simple circuit. There are a couple of variations, but most are either L networks (two elements), or T or pi networks (three elements). The usual limits to tuning range are the maximum inductance or capacitance, usually the limits at the low frequency range, or parasitic capacitance of wires and components to the chassis, determining the high frequency range.

What this usually means is that a tuner that can tune a 10:1 SWR on its lowest range, typically 160 or 80 meters, can tune a much greater range on bands in the middle of its range, typically 40 or 20 meters. This sounds like great news! I can tune my "wet noodle" on 20 at full power and still get a good match. Maybe — but watch out! At a higher SWR than the rated 10:1, either the voltage or the current (depending on the actual impedance) *will* exceed component ratings.

How Do I Know This?

This became clear to me during a "learn the hard way" event at W1ZR. At the time, I was using a center fed 100 foot dipole fed by 100 feet of window line into the balun on the back of my commercial 1500 W T network antenna tuner. The arrangement worked well on all bands from 80 to 10 meters with my 500 W station. Always trying to push the envelope (just ask Nancy, W1NCY), I thought I'd try the 160 meter contest with this arrangement. My radio, amplifier and tuner could all cover 160, why not my antenna system?

Initially, I had trouble finding a match, but fortunately (or perhaps unfortunately) my tuner had a terminal that would allow inserting additional shunt capacitance to improve the match. Finally, I found enough capacitance to get a match and the system was tuned nicely at 1.8 MHz using my 100 W transceiver. So, flushed with success, I cranked up the 500 W final. I initially had a nice match, but very soon the match wasn't there. Further inspection indicated that a pair of gold plated contacts in the heavy rotary capacitor/impedance switch had vaporized.

What Did it All Mean?

I learned a powerful lesson. Just because I can make something work, doesn't mean it will keep working. Components do have limits — exceed them at your own risk. In my case, a very low impedance load resulted in excessive current. For a 50 Ω matched system, the RMS current would be just $(P/R)^{0.5}$ or about 5.5 A. With a 10:1 mismatch it goes up with $\sqrt{SWR}$ to 17 A, about light switch ratings. Increase the SWR to 100:1, as I might have, and we're at 55 A, quite a bit for a rotary switch to handle.

One way to find out what is happening is to use *TLW* software to determine stress on antenna tuner components.[1] You can either input the modeled antenna impedance from *EZNEC*, or your favorite antenna analysis program into the length of transmission line on *TLW*, or better if you have an antenna analyzer, measure the impedance at the station end and use that as an input to *TLW* with a zero length transmission line. Then press the TUNER button on *TLW* and select the tuner topology, put in your power and a few other parameters, and *TLW* will design you a tuner, including the voltages and currents everywhere, as shown in Figure 1. Compare these with your rated values and adjust your transmit power accordingly.

[1] *TLW, Transmission Line Program for Windows*, software provided on a CD with *The ARRL Antenna Book*.
[2] Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

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

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

MFJ-994BRT and MFJ-998RT Remote Automatic Antenna Tuners

These high power matching networks mount at the antenna.

Reviewed by Phil Salas, AD5X
Contributing Editor
ad5x@arrl.net

I previously reviewed several remote automatic antenna tuners specifically for use with a 43 foot vertical antenna.[1] Those remote tuners were limited to about 200 W maximum RF power, unsuitable for stations using power amplifiers. This has now changed with the introduction of the MFJ-994BRT (600 W) and MFJ-998RT (1500 W) remote auto tuners.

A remote antenna tuner must be weatherproof and remotely powered, and it must provide automatic tuning. For a given RF power handling and impedance matching specification, a remote antenna tuner will generally be more expensive than a desktop unit because of these requirements.

With many manual and automatic desktop models available, why use a remote antenna tuner? It's an efficient way to match an antenna that has a high SWR and is fed through a relatively long length of coaxial cable. SWR-related coax cable losses can be high when the antenna SWR is high — even if an in-shack tuner provides a 1:1 SWR for your equipment. You can easily demonstrate this with antenna modeling software simulations and a coax/SWR calculator.

Overview

The MFJ-994BRT and MFJ-998RT are remote versions of the current MFJ-994B (600 W) and MFJ-998 (1500 W) switched L-network desktop auto tuners.[2] Turning these into remote auto tuners involved mounting them in weatherproof boxes and removing some of the desktop features such as A/B antenna switching and multiple memory banks. A comparison of the MFJ-994BRT and MFJ-998RT auto tuners is given in Table 1.

In addition to the higher RF power ratings, the MFJ-994BRT and MFJ-998RT include some interesting features not found in other remote auto tuners. The first is an internal bias-T for those who may not have dc power available at the antenna. (A bias-T allows you to inject dc into the coax feed line so you don't have to run a separate power cable.) An MFJ-4117 bias-T for the station end of the feed line is included with both units and it includes an ON/OFF switch for convenient power control of the auto tuners.

The MFJ-994BRT and MFJ-998RT provide SO-239 connectors and random wire outputs (only one at a time can be used). The SO-239 connector has been tested to more than 2 kV to ensure there is no possibility of arcing under high SWR conditions.

These auto tuners include an LC limit feature that provides upper limits of inductance and capacitance according to frequency and maximum power rating. This feature limits the MFJ-994BRT maximum peak voltage to 1000 V and maximum peak current to 10 A across these components. For the MFJ-998RT the maximum limits are 2100 V peak and 13 A peak. If a match could be achieved, but with settings that would result in destructive voltages or currents, the auto tuners will not permit the match.

Both auto tuners will not tune if more than 75 W is applied and the SWR is greater than 3:1, or if more than 125 W is applied regardless of SWR. This effectively locks the tuner settings when high power is applied, protecting the tuner and your RF power amplifier from damage.

Finally, both the MFJ-994BRT and the MFJ-998RT can be forced to retune on any given frequency. When *Sticky Tune* is enabled (default) these auto tuners will always retune the first time you transmit after a power cycle. So if you want to try for a lower tuned SWR on a given frequency, simply cycle power and then transmit on that frequency. The MFJ-994BRT and MFJ-998RT will retune and store the new tuning data for that frequency only. All other previously stored memory locations will be unaffected.

Tuner Measurements

I performed resistive matching range and loss testing with a precision setup similar to that used in the ARRL Lab.[3] This is a good way to systematically check an auto tuner's ability to match a wide variety of loads.

While resistive matching tests are great for standard antenna tuner comparison testing, remote tuners will experience maximum inductance and highest RF current with short antennas, so antenna tuner losses can be higher under these conditions. To determine auto tuner losses in more real-world conditions, I built two antenna simulator circuits. One is based on the tuners' minimum antenna length specifications for 160 meters. The other simulates the popular 43 foot vertical on 80 meters.

Note that most auto tuners, the MFJ-994BRT and MFJ-998RT included, do not

Bottom Line

The MFJ-994BRT and MFJ-998RT provide reasonably priced remote auto tuner solutions for stations with high power amplifiers.

[1] P. Salas, AD5X, "Remote Automatic Antenna Tuners and the 43 Foot Vertical," Product Review, *QST*, Mar 2010, pp 47-52. Product Reviews mentioned here are available to ARRL members online at **www.arrl.org/product-review**.

[2] The MFJ-994, an earlier version of the MFJ-994B, was reviewed in the August 2006 *QST*.

[3] J. Parise, W1UK, "*QST* Reviews Five High-Power Antenna Tuners," Product Review, *QST*, Feb 2003, pp 69-75. See the sidebar, "Antenna Tuner Testing Methods vs Accuracy" by Michael Tracy, KC1SX, on p 75.

have enough internal inductance to tune a 43 foot vertical on 160 meters. MFJ offers the MFJ-2904 external inductor assembly that can be manually strapped in line at the auto tuner output to enable 160 meter tuning capability with a 43 foot vertical. In addition, I developed a remotely switched range extender for 160 meter operation and improved 80 meter operation that will be the subject of a future *QST* article.

For final testing, I connected each auto tuner to the base of my 43 foot vertical and recorded the tuned SWR on different bands. I measured the SWR in my shack with an Array Solutions PowerMaster. Seventy feet of Andrew FSJ4-50B ½ inch Heliax low loss coax connects my transceiver and amplifier in the shack to the auto tuners at the base of the 43 foot vertical. Three ground rods and approximately 20 radials provide RF and dc grounding at the antenna — certainly not a perfect ground, but probably not atypical. As a reference, I measured the resonant impedance of my 43 foot vertical on 60 meters as 48 – *j*0 Ω, which implies my ground loss is 12 Ω on that band.

Details of my test setup are available in the digital edition of *QST* and online at **www.arrl.org/qst-in-depth**.

MFJ-994BRT Remote Auto Tuner

The MFJ-994BRT, with its 600 W SSB/CW capability, is perfect for the many medium power amplifiers on the market. The photos accompanying Table 2 show the outside of the unit and the internal circuitry. Note that the inductors consist of a mix of toroidal and wide-spaced air-wound inductors.

ARRL Lab test results are given in Table 2. As you can see, the MFJ-994BRT matched all resistive loads presented to it that were within its specified tuning range. And while there were a few cases in which the SWR didn't reach the 1.5:1 target, in most cases the target specification was met.

I measured the MFJ-994BRT tuner losses using the 160 and 80 meter short antenna simulator circuits described earlier. Approximately 10 Ω of real resistance was added to simulate ground losses. The MFJ-994BRT was able to match a simulated 43 foot vertical for 80 meters and a simulated 100 foot antenna for 160 meters with power loss less than 10% and minimum SWR of 1.3:1 on 80 and 1.7:1 on 160.

MFJ-998RT Remote Auto Tuner

The MFJ-998RT handles a full 1500 W PEP on SSB or CW. Construction is similar to the MFJ-994BRT with a mix of toroidal and wide-spaced air-wound inductors.

Table 1
MFJ-994BRT and MFJ-998RT Specifications

	MFJ-994BRT	MFJ-998RT
Frequency range:	1.8-30 MHz	1.8-30 MHz
RF power capability:	600 W CW/SSB	1500 W CW/SSB
Resistive matching range:	12-800 Ω	12-1600 Ω
Capacitance range:	0-2950 pF	0-3900 pF (input side) 0-970 pF (output side)
Inductance range:	0-17 µH	0-24 µH
12-15 V dc current required:	850 mA max	1.4 A max
Size (HWD, approx):	2.8 × 10.1 × 9.2 in.	3.25 × 13.75 × 17 in.
Weight:	3.7 lb	9.5 lb
Price:	$400	$770

Table 3 shows the results of resistive load tuning range and loss measurements in the ARRL Lab. In most cases the 1.5:1 target specification was met. As with the MFJ-994BRT, the high impedance tuning range is significantly broader than the low impedance range. The low impedance limit is specified at 4:1 SWR.

I measured the MFJ-998RT tuner losses using the 160 and 80 meter short antenna simulator circuits described earlier, again with approximately 10 Ω of real resistance added to simulate ground losses. The MFJ-998RT was able to match a simulated 43 foot vertical for 80 meters and a simulated 90 foot antenna for 160 meters with power loss less than 10% and minimum SWR of 1.2:1 on 80 and 1.6:1 on 160.

Open/Short Circuit Testing

Ideally a tuner should not be able to match an open or short circuit load. If it does, this means that it is tuning into its own internal losses. However, no antenna tuner is lossless due to components with finite Q. From past experience I've found that most antenna tuners — manual and automatic — can find a match on one or more frequencies when connected to an open or a short.

In the ARRL Lab, neither tuner could find a match into an open circuit or a shorted PL-259 connector. At my station, I found some noteworthy short circuit match occurrences. With both the MFJ-994BRT and MFJ-998RT, on 20 meters I found a short circuit match with an SWR less than 2:1. If you have a shorted antenna feed line on 20 meters and the tuner finds a match, all your power will be dissipated within the tuner. You will probably damage the auto tuner if you transmit into it with full power. So if you don't hear any signals either before or after a tune-up, you might want to check your antenna system before you start transmitting.

It is probably a good idea to record your antenna's untuned SWR in your shack on your bands of interest so you can check that nothing changes over time. This is easily done by turning off auto tuner power, which bypasses the tuner.

43 Foot Vertical Antenna Testing

My final tests involved connecting both the MFJ-994BRT and MFJ-998RT antenna tuners to the base of my 43 foot vertical (Figure 1). Tuning was very fast, with initial tuning typically occurring in less than 2 seconds and tuning from memory essentially instantaneous. The results are shown in Table 4. I have two solid state

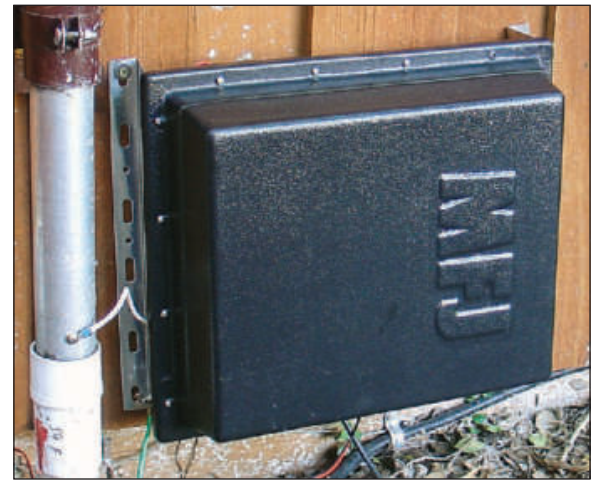


Figure 1 — The MFJ-998RT mounted at the base of the author's 43 foot vertical.

Table 2
MFJ-994BRT Resistive Load and Loss Testing

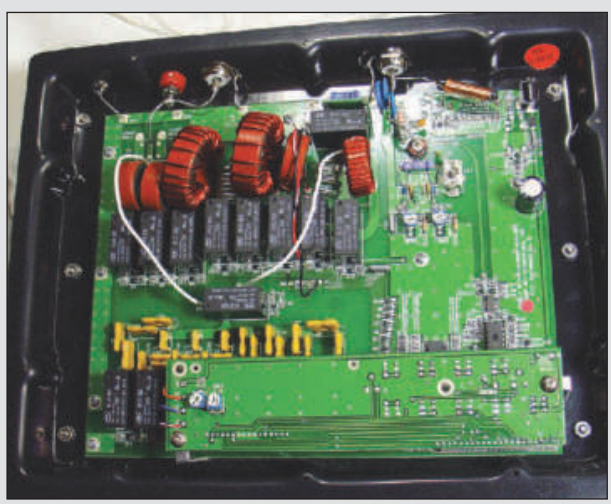
Manufacturer's Specifications

Matching range:	Up to 4:1 for <50 Ω, up to 16:1 for >50 Ω.
Minimum power for tuning:	2 W.
Maximum power for tuning:	20 W (100 W with foldback).
Target SWR:	1.5:1 (default) or 2:1 (selectable).
Tuning threshold:	0.5 to 1.5 above target SWR, 0.5 default.

ARRL Lab Testing

SWR	Load (Ω)		160 m	80 m	40 m	20 m	10 m
4.3:1	11.5	Power Loss (%)	*	*	*	*	*
		SWR	1.6	**	**	**	1.7
2:1	25	Power Loss (%)	*	*	*	*	*
		SWR	**	**	1.9	**	**
1:1	50	Power Loss (%)	*	*	*	*	*
		SWR	**	**	**	**	**
2:1	100	Power Loss (%)	*	*	*	*	*
		SWR	**	1.6	1.7	**	1.6
4:1	200	Power Loss (%)	*	*	*	*	14
		SWR	1.7	1.7	**	**	2.0
7.6:1	380	Power Loss (%)	*	*	*	*	20
		SWR	**	**	1.6	**	**
16:1	800	Power Loss (%)	11	12	*	*	28
		SWR	2.0	2.0	**	**	2.0

*Power loss less than or equal to 10%.
**Matched SWR less than or equal to 1.5:1.
Measured current usage: 2.4 A peak during tuning, 214 mA idle.



amplifiers — an Ameritron ALS-600 and an Elecraft KPA500. Both amplifiers put out full power into the tuned antenna system on all bands from 80 to 10 meters (I did, of course, limit power to 200 W on 30 meters).

As pointed out in both manuals, I found occurrences in which both auto tuners would not tune when changing bands. This can occur if the tuning solution for the previous band results in a very high SWR on the new band, and more often happens when going from a lower frequency band to a higher frequency band especially when using a highly reactive antenna. This very high SWR can reflect all input power from your transceiver, so the auto tuner cannot sense RF input power. The solution is to simply cycle power to the auto tuner when changing bands. This drops the auto tuner to bypass prior to tuning so some forward power is sensed thus permitting a tune to occur.

On the Air with the Remote Auto Tuners

Each auto tuner was installed on my 43 foot vertical for about one week. During this time I enjoyed numerous QSOs on 80 through 15 meters primarily using my Elecraft K3 transceiver and KPA500 amplifier. In all cases I would start anew on each band by pressing the TUNE button on my K3 (my K3 TUNE output is set for 15 W) with the amplifier off line. It was interesting to watch the PowerMaster SWR readout in the shack as the remote tuners did their thing. Once tuning stopped, usually less than 5 seconds on an initial tune, or instantaneously for a previously memorized tune, I would enable the amplifier and operate with no worries. Changing bands or making large frequency changes within a band required a trivial effort. And I never had an occurrence of either auto tuner trying to tune while operating at high power. It was a very pleasant experience indeed!

Summary

There are definite benefits to using a remote auto tuner with an untuned antenna. First, of course, is operating convenience. And second, the remote auto tuner will reduce SWR related coax losses. In the past, we have been limited to barefoot operation with the remote auto tuners available. Now, with the introduction of the MFJ-994BRT and MFJ-998RT high power remote auto tuners, we can realize these benefits when using a high power amplifier. The MFJ-994BRT works well with medium-power HF ampli-

Table 3
MFJ-998RT Resistive Load and Loss Testing

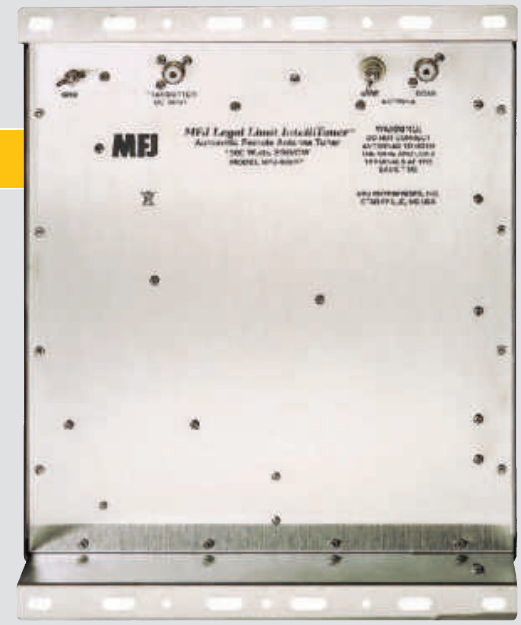
Manufacturer's Specifications

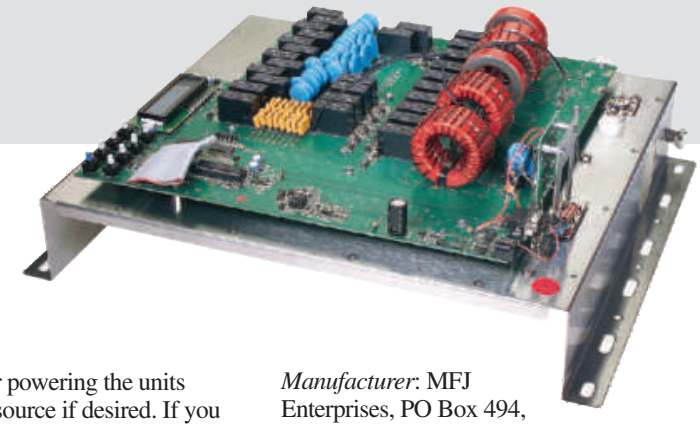
Matching range:	Up to 4:1 for <50 Ω, up to 32:1 for >50 Ω.
Minimum power for tuning:	5 W.
Maximum power for tuning:	20 W (100 W with foldback).
Target SWR:	1:1 to 2:1 selectable; 1.5:1 default.
Tuning threshold:	0.5 to 1.5 above target SWR, 0.5 default.

ARRL Lab Testing

SWR	Load (Ω)		160 m	80 m	40 m	20 m	10 m
4.3:1	11.5	Power Loss (%)	*	*	*	*	*
		SWR	**	1.8	1.6	1.7	1.6
2:1	25	Power Loss (%)	*	*	*	*	*
		SWR	**	1.6	**	**	1.9
1:1	50	Power Loss (%)	*	*	*	*	*
		SWR	**	**	**	**	**
2:1	100	Power Loss (%)	*	*	*	*	*
		SWR	1.9	1.8	**	1.6	2.0
4:1	200	Power Loss (%)	*	*	*	*	*
		SWR	1.7	**	2.0	1.6	1.6
7.6:1	380	Power Loss (%)	*	*	*	*	*
		SWR	**	**	1.6	**	**
16:1	800	Power Loss (%)	*	*	*	12	12
		SWR	1.6	**	1.6	1.6	1.6

*Power loss less than or equal to 10%.
**Matched SWR less than or equal to 1.5:1.
Measured current usage: 2.8 A peak during tuning, 277 mA idle.





fiers feeding less than perfect antenna systems. But if you are running more than 600 W or plan to do so in the future, the MFJ-998RT is the way to go.

Product Update

Since these review units were received, MFJ has improved the design by adding static and lightning protection to both the MFJ-994BRT and MFJ-998RT outputs, and an external dc jack for powering the units directly from a dc source if desired. If you have an early MFJ-994BRT or MFJ-998RT and wish these improvements, contact MFJ for pricing and availability of an upgrade kit.

Manufacturer: MFJ Enterprises, PO Box 494, Mississippi State, MS 39762, tel 800-647-1800; **www.mfjenterprises.com**.

Table 4
AD5X 43 Foot Vertical Testing

Band	Shack SWR untuned	Shack SWR with tuning MFJ-994BRT	Shack SWR with tuning MFJ-998RT
160	>20:1	NT	NT
80	11:1	1.53:1	1.12:1
60	2:1	1.38:1	1.14:1
40	3.8:1	1.21:1	1.32:1
30	6.7:1	1.47:1	1.61:1
20	5.4:1	1.59:1	1.55:1
17	2.5:1	1.39:1	1.42:1
15	4.3:1	1.35:1	1.64:1
12	3.1:1	1.32:1	1.35:1
10	2.3:1	1.06:1	1.27:1

NT = no tuning solution (as expected)

See your August digital *QST* for a video overview of these MFJ automatic antenna tuners.

ICOM ID-31A 70-cm Handheld Transceiver with D-STAR

Reviewed by Steve Ford, WB8IMY
QST Editor
wb8imy@arrl.org

The ICOM ID-31A is an analog FM *and* D-STAR digital transceiver that packs a 5 W punch on 440 MHz and offers several attractive features — all in an 8 ounce package that's less than 4 inches long (without antenna).

The ID-31A transmits from 420 to 450 MHz. It receives from 400 to 479 MHz, which gives you the ability to eavesdrop on the Family Radio Service and other activities outside the amateur band. If you'd prefer to adjust the RF output to maximize battery life, the ID-31A provides four power levels: 5, 2.5, 0.5 and 0.1 W. Speaking of the battery, the ID-31A comes with an 1150 mAh lithium ion battery pack. You can upgrade to an 1880 mAh pack, but I found the standard battery to be more than adequate. The higher capacity battery could be worthwhile if you use the ID-31A for extended operating, such as a public service activity.

Easiest D-STAR Ever?

D-STAR is a digital communication system based on a protocol developed by the Japan Amateur Radio League. To date, ICOM is the only commercial manufacturer that has brought D-STAR transceivers to market. Many amateurs refer to D-STAR as a digital *voice* system, but it actually does quite a bit more. In addition to voice information, D-STAR radios can simultaneously send other data on what amounts to an auxiliary data stream. This data can consist of position information, text messages and even static images (although at the relatively slow data rates used below 1.2 GHz, sizeable image files may take a while to arrive).

In the United States there are hundreds of D-STAR repeaters, primarily on 2 meters and 70 cm. Many of these repeaters are linked to the Internet, creating a global D-STAR network. Just like an analog FM rig, a D-STAR transceiver can communicate with other D-STAR transceivers directly (simplex), but D-STAR really shines when you tap into a repeater. Through a networked repeater you can do some pretty amazing stunts, such as enjoying chats with amateurs on the other side of the world or participating in national and international "round-table" conversations. If a friend is within range of a particular repeater, whether the repeater resides in the next state or on another continent, you can connect and communicate without jumping through complicated hoops; the D-STAR network handles all the routing automatically.

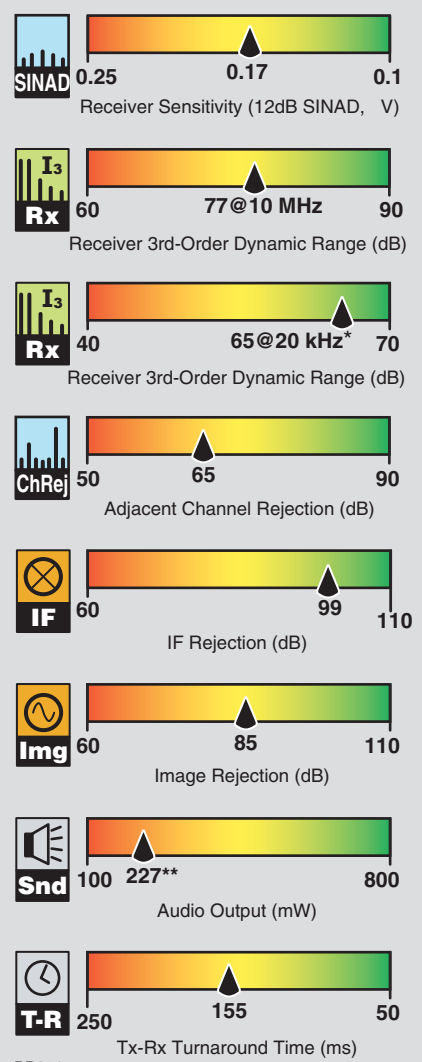
The only problem with D-STAR is that some amateurs find it difficult to understand at first, especially when compared to the relative simplicity of analog FM. With an analog rig you dial in a repeater frequency and press the transmit button — that's all there is to it. With D-STAR the learning curve is significantly steeper. Before a D-STAR repeater will even recognize and relay your signal, for example, you must configure your radio to include the repeater's call sign in the data stream. Obviously, this means that you must become acquainted with the call signs (and frequencies) of the D-STAR repeaters in your area, or wherever you're likely to find yourself.

The ID-31A levels the D-STAR learning curve in a remarkably clever way. The key element is the ID-31A's built-in Global Positioning System (GPS) receiver. When you power up the ID-31A, the GPS

Bottom Line

ICOM's ID-31A 70 cm handheld may be the most user friendly D-STAR transceiver available. It is also a high feature analog FM transceiver, includes a GPS receiver and works with a host of available options — a very flexible and useful package.

Key Measurements Summary



PR071

Key:
70 cm
* Noise Limited
** At external speaker jack; audio output is higher with internal speaker

Table 5
ICOM ID-31A, serial number 05001082

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive, 400-479 MHz; transmit, 420-450 MHz.	Receive and transmit, as specified.
Modes: FM, NFM, DV.	As specified.
Power requirements: 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) at 7.4 V dc.†	With 8.2 V dc battery power (full charge), FM mode: receive internal speaker, 185 mA (max volume, backlight on), 38 mA (standby), transmit,1.64 A (high), 1.1 A (med), 0.54 A (low), 0.35 A (s-low). With 13.8 V dc external power, FM mode: receive, 125 mA (max volume, backlight on), 67 mA (standby, backlight on).‡
Receiver	**Receiver Dynamic Testing**
Sensitivity: FM, <0.178 µV; DV, 0.282 µV.	FM, for 12 dB SINAD, 0.17 µV.*
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, 65 dB**; 10 MHz offset, 77 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	77 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset, 65 dB.
Spurious response: Not specified.	IF rejection, 99 dB; image rejection, 85 dB.
Squelch sensitivity: < 0.178 µV.	At threshold, 0.34 µV (min), 1.15 µV (max), 0.135 µV (auto).
Audio output: At 10% THD, >400 mW (16 Ω, internal speaker. >200 mW (8 Ω, ext spkr).	227 mW at 10% THD into 8 Ω, external speaker; THD at 1 V RMS, 1.8%
Transmitter	**Transmitter Dynamic Testing**
Power output: 5.0 W (high), 2.5 W (medium), 0.5 W (low), 0.1 W (s-low).	5.1 W (high), 2.6 W (medium), 0.51 W (low), 0.12 W (s-low).‡
Spurious signal and harmonic suppression: >60 dB (high, medium); 50 µW (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, 155 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	54 ms.
Size (height, width, depth): 3.7 × 2.3 × 1.0 inches (w/o protrusions); antenna, 7.0 inches. Weight: 8.0 ounces (with battery and antenna).	
Price: ID-31A, $380; 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.
‡Generally, using the DV mode in receive requires 125% more current than FM mode. With an external speaker, the current draw is about half that with the internal speaker. Transmit current and RF output were the same with battery or external 13.8 V dc.
*DV not tested; PN9/GMSK signal generator was not available.
**Measurement was noise limited at the level indicated.

receiver attempts to determine your location (Figure 2). The receiver is quite sensitive; I've seen it come up with a position solution even while sitting near a small window within the bowels of the ARRL Headquarters building.

Once the ID-31A *knows* where you are, the rest is easy. With push of a button the ID-31A will search through a built-in database of D-STAR repeaters. A second or two later you're presented with a list of nearby machines. Select the nearest one and transmit. The ID-31A takes care of the rest.

Of course, you still have to program your call sign into the ID-31A, but you only need to do that once. I punched in my call sign when I turned on the ID-31A for the first time and I used the search function to determine that the nearest machine was ARRL's own W1HQ D-STAR repeater. I squeezed the PTT button and said I was monitoring (just like analog FM in that respect). Joe Carcia, NJ1Q, the W1AW station manager, not only heard me, he saw my call sign displayed on his D-STAR transceiver along with my name, which I had programmed into the ID-31A as well. Joe responded and we were on our way.

With the ID-31A's 5 W output I was also able to quickly access more distant repeaters, even while using the flexible antenna indoors. The lookup table (Figure 3) includes the distances and bearings from your location. You may need glasses to read this information on the ID-31A's display (I did), but it is fairly crisp and bright, which helps considerably.

D-STAR operating does not get much easier than this and I have to commend ICOM for coming up with such an innovative approach. The GPS based D-STAR search is particularly convenient if you're a frequent traveler. Imagine getting off an airplane, turning on your ID-31A and immediately knowing which D-STAR repeaters were available in your vicinity.

Won't the list become outdated? Eventually, yes, although not quickly. The good news is that you can download the latest D-STAR repeater lists from the Internet and update the ID-31A yourself. That's where *CS-31* enters the picture.

Working with *CS-31*

On the CD-ROM that accompanies the ID-31A you'll find the *CS-31* for *Windows*. This is the software you'll use to update the D-STAR repeater list and modify many of the ID-31A's parameters — everything from audio equalization to display backlighting.

The D-STAR repeater database is available online as a set of comma-delimited files at **www.dstarinfo.com/downloads-for-icom-software.aspx**. This is a well maintained, easy to use website and you'll have little trouble finding the information you need. The trick is getting this information into the radio. There are two ways to go about it.

The first method is to use a memory card. At the time this review was written, ICOM was running a promotion in which each ID-31A included a 2 GB microSD card. With an inexpensive USB card reader, the *CS-31* software can read and write to the card just like a computer hard drive. When you're done, remove the card from the reader and insert it into the slot on the side of the ID-31A. If the ID-31A you purchased didn't include a card, you can buy one from just about any electronics or office supply store. The ID-31A can accommodate cards as large as 32 GB.

The second method is to use the *CS-31* software to communicate directly with the transceiver's firmware memory via ICOM's optional OPC-2218LU data cable. Ideally, *Windows* should recognize the OPC-2218LU the moment you plug it in and *Windows* should then install the proper driver to communicate with the radio. It didn't quite work out that way for me. Instead, my *Windows 7* system warned me that the driver it had attempted to install did not install correctly, for whatever reason. So, I went searching for a driver that *Windows 7* would tolerate.

The *CS-31* manual on CD-ROM tells you to

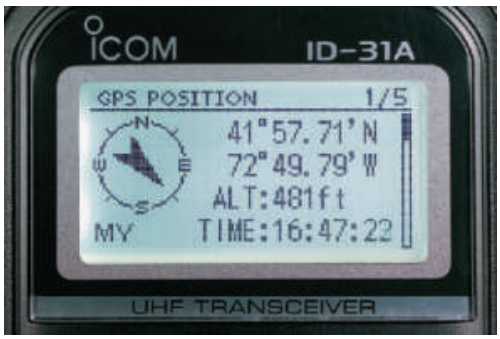


Figure 2 — The ID-31A features a built-in GPS receiver. The receiver is used to determine which D-STAR repeaters are closest to you. The ID-31A can also use the GPS receiver to track your position and share the information over the network.

Figure 3 — Based on your position as determined by the internal GPS receiver, the ID-31A will display a list of the nearest D-STAR repeaters. Simply highlight the repeater you wish to use, select it and you're all set.

download the driver "from the ICOM website," but it does not include the URL. I tried the ICOM USA site; no luck. I found the software on the ICOM Japan website at **www.icom.co.jp/world/support/download/firm/** (scroll to the bottom of the page under "Option").

The ICOM zip file includes *Windows XP, Vista* and *7* drivers. After some work, I successfully installed the new driver, plugged the OPC-2218LU back into my PC, and *Windows* recognized it without a hitch. *Windows* also popped up a flag to tell me that communication with the device would take place through virtual COM port 11. You have to make note of this because you'll need to select this COM port, which will likely have a different designation on your computer, when starting *CS-31* for the first time.

I was able to write the updated D-STAR list (and a few other bits of information) directly to the radio in a matter of seconds using *CS-31*. Once I was past the initial setup challenges, *CS-31* worked smoothly ever after.

Wait, There's More

While the ID-31A's D-STAR repeater locator may hog the Product Review spotlight, several other features deserve attention. For instance, the GPS function can also be used to transmit your position along with your voice. This is awfully handy for public service activities, among other things. If the D-STAR repeater you're using is connected to the Internet, it will likely relay your GPS data to APRS-IS, the Automatic Packet Reporting System-Internet Service, where it can be shared and displayed. The ID-31A's GPS can even function as a GPS logger, recording your movements and saving the information as a file on the memory card for later viewing in software such as *Google Earth*. To use the file with *Google Earth*, however, you have to convert it to *Google Earth's* KML format. The ID-31A manual doesn't tell you how to do this, but I made a successful conversion using the free *GPSBable* software at **www.gpsbabel.org**.

With a software package such as the popular *D-RATS* (**www.d-rats.com**) and the OPC-2218LU data cable you can put the ID-31A to work as a kind of RF modem, exploiting its auxiliary data stream to carry a variety of information (as I mentioned at the beginning of this review).

Audio can be a touchy topic among D-STAR fans with some complaining that voices sound flat or even a bit "robotic." I found the ID-31A's receive audio to be quite good and I received good reports about my transmit audio. That said, the ID-31A gives you the ability to tailor your receive and transmit audio equalization to achieve the result that sounds best to you (and to others). You can do this through the ID-31A's menu system or via the *CS-31* software.

While we're on the subject of audio, I should mention that the ID-31A gives you the ability to record conversations to the memory card and play them back. It can record not only received audio, but transmitted audio as well. The audio is recorded in WAV format and this tends to generate large files. That's yet another good reason to invest in a large capacity memory card.

Of course, the ID-31A also includes features that have become standard among many FM transceivers such as voice-activated transmit (VOX), CTCSS encoding and decoding, a variety of receiver scanning modes, hundreds of memory channels with alphanumeric labeling and a convenient band scope.

And should you fumble the ID-31A and launch it into a pond or puddle, you'll be pleased to know that it meets the IPX7 waterproofing standard. I don't doubt that the radio deserves the rating, but I couldn't summon the courage to toss mine into a bucket of water to make sure.

Conclusion

At a list price of $469, and an average street price hovering around $380, the ID-31A is a significant investment compared to single band analog handheld transceivers, but comparing the ID-31A to an analog only transceiver on the basis of cost alone is hardly fair. When you consider that the ID-31A offers D-STAR, a GPS receiver and all the other astonishing features *in addition to functioning as a powerful analog FM transceiver*, the radio may justify its price.

US distributor: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; **www.icomamerica.com**.

See your August digital *QST* for a video overview of the ICOM ID-31A transceiver.

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

Simple May be in the Eye of the Beholder

Q Dave, WB8ISZ asks: What are the relative benefits of a multiband vertical antenna with various tuned sections or other resonant arrangements, compared to a simple 43 foot vertical with an antenna tuner?

A The advantage of a trap, or other multiband vertical, is that they are designed to provide a direct match to 50 Ω coax without the need for a tuner, although particularly on the lower frequency bands, they will be unlikely to cover each complete band without use of a tuner. The 43 footer, to operate on different bands will need a matching network at the base to operate efficiently — depending on power, perhaps making the total cost similar. In many cases, it will be more involved than just an auto tuner, since the tuning range of the tuner may not be wide enough to cover 160 meters.

In terms of radiating performance, the multiband vertical will have a pattern looking about like a ¼ or ½ wave antenna (depending on design). The half-wave types have the advantage of not requiring a large radial field or ground system for efficient operation.

The 43 footer with a good ground system will generally provide 1 or 2 dB higher gain on 160 through 20 meters than the multiband vertical, while the multiband, may be slightly better on the higher frequency bands, but will certainly have a better pattern.[1]

Q Kevin, VA3OR, asks: I have a question about working the low-Earth orbit (LEO) FM satellites. I use a handheld 2 meter and 70 cm Yagi antenna and sometimes have a hard time making it into the bird. I twist the antenna to match the polarization of the signal on 2 meters. I then maintain this configuration for the duration of the pass, deviating slightly to compensate for the tumbling of the bird. On my antenna, the 2 meter and 70 cm Yagis are of opposite polarizations. There is another antenna in which the two bands are both of the same polarization.

I wonder if the two antennas on the satellite are of the same polarization, or are they orthogonal as well? If they are of the same polarization, should I be twisting my antenna 90° by hand between my receiving and transmitting times. What other options are feasible?

A I don't have experience working through LEOs, so asked *QST* Editor Steve Ford, WB8IMY, who provided the following:

Because ham satellites are usually not stabilized, they are forever tumbling and changing their antenna orientations. That's why some recommend circularly polarized ground station antennas — better to hedge one's bets, so to speak.

There is an ongoing debate about whether circular polarization is worth the trouble when attempting to work LEOs. The use of circular polarization can make a difference in weak signal conditions, but ham LEOs are usually not that weak. On the other hand, it did improve reception of AO-40 when the bird was hanging out at 48,000 kilometers, but AO-40 was also stabilized — it was always pointing at Earth.

I know that many times I have seen folks in the ARRL Headquarters parking lot with a handheld transceiver and antenna like yours working through the mode J satellites — they seem to do fine, and I think that's often the arrangement used. I would guess that much more important than antenna configuration would be selecting passes that are well above the horizon and then making sure you have figured the azimuth correctly.

Q John, K4TUG, had a question about my discussion about using a "single-wire" antenna tuner to tune antennas fed with balanced transmission lines (see Figure 1).[2] He notes that he has a similar arrangement but instead of my configuration, he has the lightning arrestor outside the house on the antenna side of the tuner, so much of the lightning-induced current will go directly to ground. He asks if that will work as well?

A You are quite correct that a lightning arrestor outside of the antenna entrance panel is the best spot in many respects. The configuration shown in the May column would thus be most appropriate for a remote tuner mounted near the antenna, although a balanced arrestor could also be added on the antenna side to help protect the tuner. For a tuner inside the house, a balanced arrestor should be installed at the grounded entrance panel. In fact, that's exactly how I have my station setup. There are, however, a number of considerations to be applied to arrestors for balanced feed lines.

[1] J. Hallas, W1ZR, "The 43 Foot Vertical Monopole — What's the Magic," *QST*, Jun 2012, pp 30-31.

[2] J. Hallas, W1ZR, "The Doctor is In," *QST*, May 2012, pp 54-55.

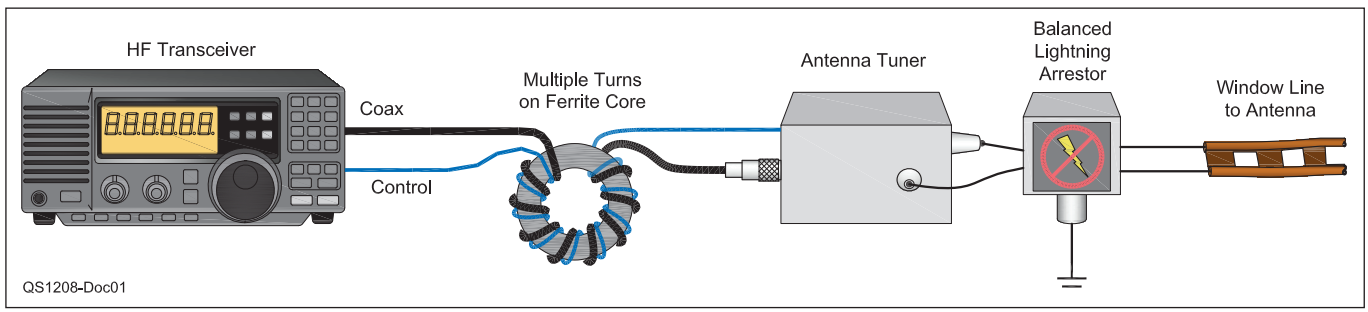


Figure 1 — Figure 1 from the May 2012 column modified with a balanced arrestor at the entrance panel, as suggested by K4TUG.

The first thing is that as shown in the May drawing, the choke in the coax makes the tuner and balanced line balanced. What the normally unbalanced tuner thinks is a ground terminal with the balanced line is at the same potential, but opposite sign, as the normal hot lead. Thus a standard coaxial lightning arrestor at that point will ground one lead, unbalancing the system and defeating the purpose of the common mode choke on the other side.

Thus, what is needed is a balanced lightning arrestor. These are hard to find, although ICE in Canada made the one I use, they no longer offer them. There have been some described for home construction in *QST*.[3]

The other issue is the operating voltage. With the arrestor where I located it in the May article, it is in a matched 50 Ω part of the system. Thus the RMS voltage on the arrestor will be $(P \times 50)^{0.5}$ corresponding to the power rating of the arrestor. For example, with 100 W, that would be 71 V_{RMS} or 99 V_{PEAK} with 1000 W, it would be 224 V_{RMS} or 314 V_{PEAK}.

With the high SWR on the usual unmatched balanced line, the corresponding voltages can be up to the square root of the SWR times the voltage if matched. Thus the voltage can easily be 5 to 10 times higher than an arrestor would expect, meaning that the arrestors could fire in normal operation, a serious potential problem for the transmitter. While the high voltage will exist somewhere on the mismatched transmission line, not necessarily at the arrestor, with the usual multiband application, there is a good chance that the high voltage will be near the arrestor on at least one band.

To be safe, check with the manufacturer to find the safe "no-fire" voltage (be sure to check whether they mean RMS or peak voltage, and adjust accordingly), or calculate what the matched voltage would be based on their power rating. Figure out what your maximum voltage could be and select an arrestor with a no-fire voltage well above that. I use a 2 kW rated balanced arrestor for my 500 W station and haven't (yet) had a problem.

Q Jim, W6JHB, asked: Several weeks ago I had asked about the 600 Ω open wire feeder that runs about 100 feet to an 88 foot long doublet that is 50 feet high. Initially The 600 Ω line was simply lying on the roof of the house. The roof at the time was made of wood shakes. I had mentioned that we were replacing the shake roof with a coated steel product and wondered what would happen with the feeder on the steel roof. You noted that it probably would not be a good idea to put the feeder on the new steel roof. So, I started looking at alternative ways to get my feeder over to that antenna, on the other side of the house.

Looks like there is no simple way to run the 600 Ω line. While I was looking I noticed a dealer that offered "parallel coax" that is said to be useful as a substitute for an open wire feed line. In fact, I had made about 15 feet of something very similar to this for my 600 Ω feeder system, running it from my window feed-through box up to the shake roof, and over the old steel gutter. The far end of this 15 foot long twin coax cable was connected to the 600 Ω open wire line. Each coax center conductor went to one side of the 600 Ω line, and the braids were tied together and grounded at the window feed-through point.

Is this parallel coax something that could be used in place of my open wire line and laid directly on the new metal roof? You noted that with the old 600 Ω feeder, there were RF fields present in the vicinity of the line — out several inches from the wire. Is that the case with parallel coax that has the braids tied together and grounded?

A Well, parallel balanced coax can be used as a balanced transmission line, and if (and only if) the shields of the two lines are connected together at both ends there are no fields outside, at least no more fields than leak through any other coax. That's the good news.

Unfortunately, the bad news is that the loss is the same as in comparable coax. This makes it fine for feeding a matched, or close to matched balanced antenna, if you wish to make a transformation to unbalanced at the radio end. In your multiband tuned feeder antenna system, the SWR will be quite high on most, if not all bands. This is not much of a problem with low loss open wire or window line, but a long run of parallel coax with a large mismatch will have very high loss. I have used parallel coax for runs of a few feet through unfriendly environments, but don't suggest using it for your kind of application.

This may be a time to consider multiband antenna arrangements that can be fed with a single coax. Trap dipoles can work quite well, although they are heavier than wire dipoles. The folded skeleton sleeve dipole I described in an article last year can give you two bands, three if the lowest band is 40 meters, and if it's the unfolded version.[4]

Jim, KB8QAQ, asks: I have a panel mount Simpson RF ammeter that I got from an estate. How would I install this meter so I can measure radio power output. This is an older meter that the Simpson Company has no information on.

RF ammeters were in common use over the years, and are still quite useful. Many were included in WW2 equipment as part of the antenna tuning circuitry. A good article by John Stanley, K4ERO, on the topic is available on the *QST* archive website.[5] I used to use them for tuning marine radiotelephones in the early 1960s before they moved from MF AM (around 2 MHz) to VHF FM.

Most RF ammeters are just what they say they are. Occasionally, however, you will find one that was removed from equipment that had a thermocouple elsewhere within the equipment and the meter was actually a dc milliameter. To be safe, set up a circuit that will have a current in the less than 1 mA range — perhaps a 12 V supply with a resistor of about 100 kΩ in series with the meter. If it is a dc milliameter, it should read a bit — if not, decrease to 10 k and then 1 k. If you don't get a reading it is probably a real RF ammeter.

If so, it can be put in a metal meter box with a coax socket (SO-239, for example) on each side with the flanges attached to the box and used to measure the RF current going down the coax, as described in many early ARRL Handbooks. If you know the load, and it's resistive, you can accurately determine the net power. As John notes in his article, it will also measure the current into a partly reactive load, and that doesn't necessarily indicate the actual power. If you have a 50 Ω SWR of 1:1, it is a resistive load of 50 Ω and the power delivered to the load is just $50 \times I^2$.

Another useful application is to use the RF ammeter to tune an antenna tuner. This was described in another *QST* article, also available in our archive.[6] In this case the impedance will be unknown and generally reactive, but as Eric points out, the tuning position with the highest current will be the one that puts the most power into the antenna.

[3]J. Hutchens, WJ5MH, "Hints and Kinks — Notes on Lightning Protection for Open-Wire Feed Lines," *QST*, Jun 2006, p 64.

[4]J. Hallas, W1ZR, "The Folded Skeleton Sleeve on Other Ham Bands," *QST,* Oct 2011, p 48.

[5]J. Stanley, K4ERO, "Revisiting the RF Ammeter," *QST,* Feb 1994, pp 35-37.

[6]E. Nichols, KL7AJ, "Keeping Current with Antenna Performance," *QST*, Feb 2009, pp 34-37.

Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to "The Doctor," ARRL, 225 Main St, Newington, CT 06111; **doctor@arrl.org**.

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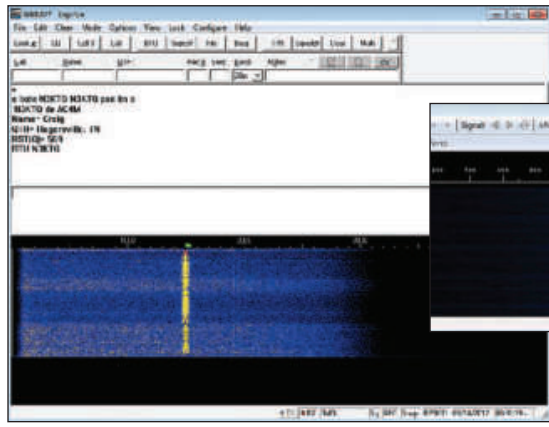
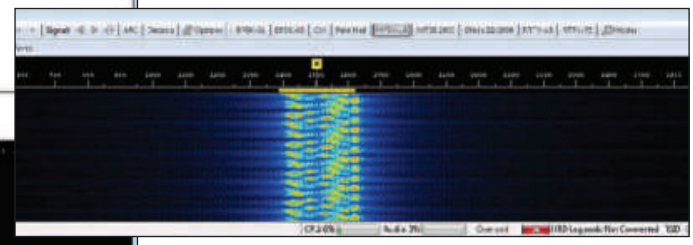
60 Meter PSK31



A PSK31 conversation on 60 meters centered 1500 Hz above the suppressed carrier frequency. The markers at the top of the waterfall represent audio tone frequencies.



Enjoying an MFSK16 conversation on 60 meters. Notice that the signal envelope is centered at the 1500 Hz mark on the waterfall display.

When our new 60 meter privileges came into effect last March, my initial impulse was to try PSK31. This operating mode has a reputation for decent performance in noisy conditions and I've had good luck with it on 80 meters. How would it fare on 60?

If you're unfamiliar with 60 meters, this band is an odd duck to say the least. Unlike all the other amateur frequency allocations, we're limited to five specific frequencies or "channels." The challenge for PSK31 operating, aside from noise and propagation, is that you must place the transmitted signal in the *center* of your chosen channel.

The channel-center requirement throws some hams for a loop, but it really isn't that difficult. When you operate your transceiver in the Upper Sideband mode, the frequency displayed is the *suppressed carrier frequency*. The 60 meter suppressed carrier channel frequencies are…

Channel 1: 5330.5 kHz

Channel 2: 5346.5 kHz

Channel 3: 5357.0 kHz

Channel 4: 5371.5 kHz

Channel 5: 5403.5 kHz

Each channel is 2.8 kHz wide. Simple math would tell you that the center of the channel would be 1.4 kHz up from the suppressed carrier frequency (2.8 / 2 = 1.4). However, the National Telecommunications and Information Administration, better known as the NTIA, controls how these frequencies are used and they, along with the FCC, have asked hams to operate CW and digital with our signals centered at a point *1.5* kHz above the suppressed carrier frequency.

Okay, so how do you go about generating a PSK31 signal at the 1.5 kHz point? Using the popular *DigiPan* software as my example (free for downloading at **www.digipan.net**), it is just a matter of clicking your mouse cursor at the proper spot on the waterfall display.

Like most digital software, *DigiPan* allows you to customize the markers that appear along the top of the waterfall. Click CONFIGURE and then BAND and you'll see the *Band Properties* window. Under *Spectrum Options* you can select *Tone*. This means that the numbers along the top of the waterfall will indicate audio tone frequencies. If you click your mouse on the 1500 mark in the waterfall and start sending CQ, your radio will generate PSK31-modulated RF 1500 Hz above the suppressed carrier frequency — smack dab in the middle of the channel, or at least at what the NTIA considers to be the middle.

Alternatively, you could select "USB" in *Spectrum Options* and enter the suppressed carrier frequency as the "Spectrum start." Now you'll see the corresponding RF frequencies when you view the waterfall display and you can select the proper channel center frequency. The channelized nature of 60 meters makes this approach somewhat problematic and more prone to error, which is why I prefer to display only the audio frequencies. To each his own.

With summer upon us, the noise on 60 meters is increasing substantially, but PSK31 still seems to hold up well. Earlier in the year I was enjoying keyboard chats with hams all over the country and well beyond, especially in the late evening.

I've also had fun trying MFSK16 and Olivia on 60 meters. The results have been impressive. As with PSK31, you need to make sure the signal envelope is centered on the 1500 Hz mark in your software waterfall display.

Low Energy Ions

Even though we've understood the nature of the ionosphere for decades, new discoveries are still being made.

Take so-called *low-energy ions*. According to researchers in Sweden, these particles are more abundant than anyone realized. The focus has always been on the high-energy variety, the kind that are churned up by solar activity. Mats André, a professor of space physics at the Swedish Institute of Space Physics in Uppsala, Sweden has found that low-energy ions abound in the distant reaches where Earth's atmosphere gives way to outer space. Researchers knew the ions were present at altitudes of about 100 kilometers (60 miles), but André and his colleague Chris Cully looked much higher, between 20,000 and 100,000 km (12,400 to 60,000 miles). It turns out that at those high altitudes the low-energy ions dominate the scene.

Finding so many relatively cool ions in those regions is surprising because there's so much energy blasting into Earth's high altitudes from the solar wind. The news has triggered some curiosity about a possible relationship between low-energy ions and the still-mysterious nature of Sporadic E propagation at VHF frequencies. Some have even wondered about a possible link to the very strange phenomena of Long Delayed Echoes.

The researchers' latest findings will be published in *Geophysical Research Letters*, a journal of the American Geophysical Union.

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Experiment 115

All About Tapers

What's the difference between a variable resistor, a trimmer or trimpot, a rheostat and a potentiometer or pot for short? Nothing! They are all the same basic device — a resistive structure (the element) made of wire or some conductive material that can be contacted anywhere along its length by a sliding contact or wiper. There are usually three terminals — one at each end of the element and one for the wiper (see Figure 1). The name used depends on the application.

The element can be straight, requiring the wiper to move back and forth in a straight line — those pots are often called *sliders*. Pots used for rotary controls on a front panel (or *panel* pots) have a circular element and a shaft moves the wiper as it turns. *Trimmers* or *trimpots* don't have a control shaft or knob and are adjusted with a screwdriver or tuning wand. They are very small and inexpensive — intended for tuning or bias adjustments that are made very rarely.

A *rheostat* needs only two terminals — one at the end of the element and one for the wiper — and it is used as a variable resistance in series with a circuit, usually a power circuit of some sort. Rheostats are generally made to dissipate large amounts of power (several watts and up) compared to the small pots used in most electronic circuits.

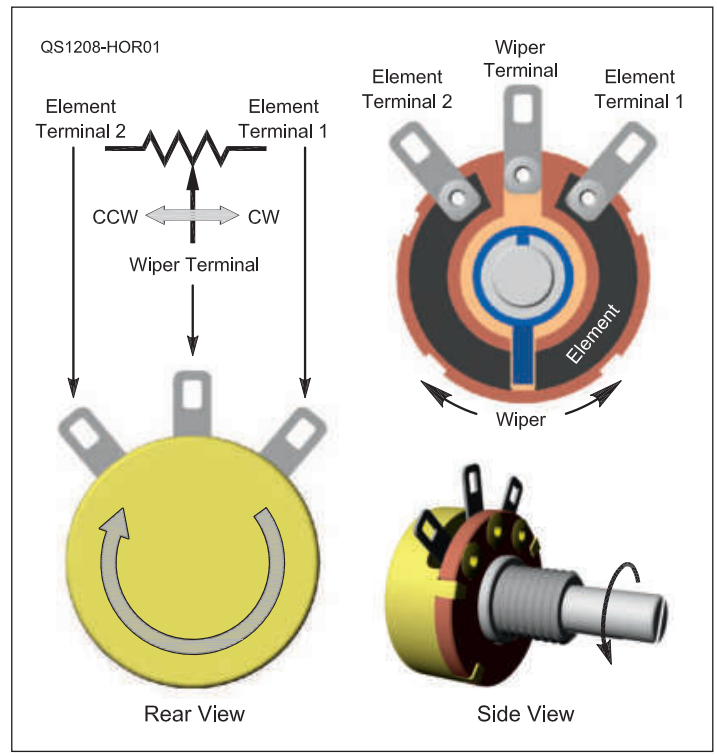


Figure 1 — Construction of a typical panel pot in which turning a shaft moves the sliding wiper contact along the resistive element.

Tracking the Wild Pot Taper

This month we'll take a pot shot at one of those ubiquitous but rarely discussed features all pots have whether the manufacturer says so or not — the taper. Not the pig-like animal from South America (spelled tapir), this type of taper tells you how the resistance of the pot changes with the setting of the wiper. Does it matter? Like the name, it depends on your application.

You might think that equal movements of the wiper would result in equal changes in resistance. Most of the time you'd be right — that's referred to as a *linear taper*. Unless the manufacturer says differently, it's a pretty good bet that a pot has a linear taper. Most of the time that works out just fine — for adjusting a voltage regulator or setting a bias point. Other applications are more sensitive to the relationship between the control position and the resistance from the wiper to each end of the element.

Audio Taper

If you look through the component catalogs you'll see something called *audio taper* or *log taper*. There are also reverse audio taper and reverse log taper pots. What are these? It all goes back to the human ear.

Named for Alexander Graham Bell in 1928, the decibel was a new name for what were previously called transmission units (TU). The TU was a replacement for the earlier MSC (Mile of Standard Cable) unit that represented the loss of one mile of standard telephone cable at a frequency of 795.8 Hz (5000 radians/s) such that 1.056 TU = 1 MSC.[1] The MSC represented the approximate minimum value of attenuation that could be detected by the average listener. (Now you know!)

Early telephone engineers quickly determined that the human ear responded roughly logarithmically to sound level. Thus, if the usual linear taper pot was used to control volume, all of the effective volume adjustment occurred at one end of the control. Listeners expected the perceived volume to

Watt's in a Name?

The word *potentiometer* comes from *potential*. A potentiometer is basically a variable voltage divider that is used to control the voltage or potential in a circuit, thus the name. There is also a potential or voltage measuring instrument with the same name.

[1] en.wikipedia.org/wiki/Decibel

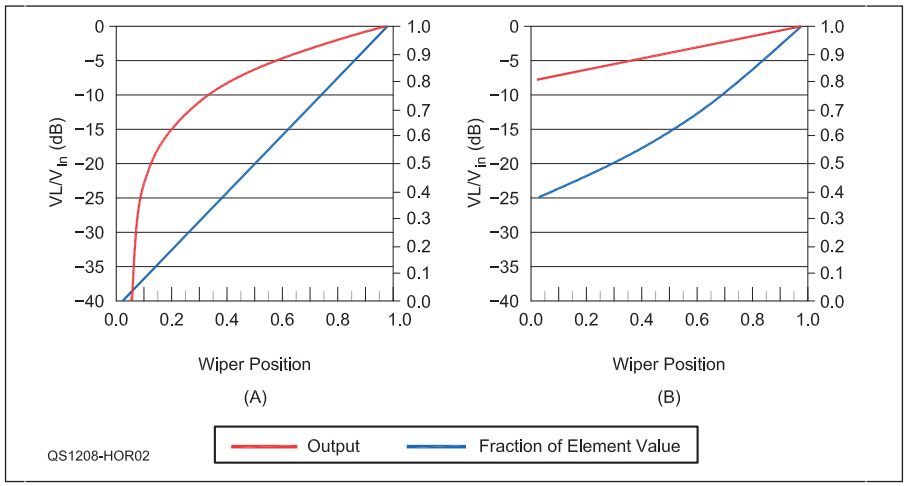


Figure 2 —The output from a linear taper pot (A) changes too rapidly at the bottom end of its range for a linear change in perceived output volume. The exponential change in resistance of a log taper pot (B) produces a linear perceived change in volume. The blue line represents the fraction of resistance between the wiper and common terminal of the pot element.

steadily increase throughout the control's adjustment range roughly linearly. For example, if the control was labeled 0 to 10, listeners expected a setting of 5 to be about one-half as loud as 10. (As fans of the band Spinal Tap know, a setting of 11 is even louder!)

The solution was to make the resistance of the element change logarithmically so that the voltage from the wiper would change in such a way as to create a linear perceived change in sound volume. Figure 2 illustrates the difference between a linear and a logarithmic taper along with the change in decibels of the output signal (red) from the wiper with the input signal connected across the pot element. A wiper position of 1.0 corresponds to a setting of 10 on a control calibrated from 0 to 10.

As you can see from the graph of the linear taper (Figure 2A) the output changes nearly linearly as the position of the control is moved away from "full on." The output is down 3 dB (half volume) at a setting of 0.7 and down 6 dB (quarter volume) at the half-way mark. As the position approaches 0.3, however, the change in output accelerates dramatically, rapidly dropping to what the listener would perceive as *off*. About a third of the control's adjustment range is thus wasted.

Figure 2B, on the other hand, shows what happens if the resistance of the element changes more slowly at the bottom end of the adjustment range. This is an example of an audio taper that produces a linear change of nearly 10 dB across the control's range. Depending on the exact construction of the pot, the listener would find the setting of 1 produces about 1/10 the volume of a setting of 10.

This taper's function of resistance versus wiper position is actually exponential — the inverse function of logarithmic. The taper is called logarithmic because the exponential change in resistance produces a linear change of output volume in logarithmic terms.

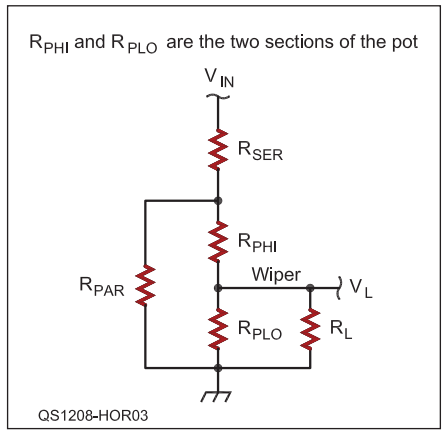


Figure 3 — A circuit that allows an experimenter to create a custom taper by varying the resistor values external to the pot. R_{PHI} and R_{PLO} represent the pot with the wiper connected to their junction.

There are also "reverse taper" pots that are used in applications such as BALANCE and BASS or TREBLE controls so that a common shaft causes the output signal from one pot to increase while the other decreases. Again, the changes are logarithmic so the listener perceives an even change in volume.

Custom Tapers

Of course, hams like to experiment and there are many instances in which the commercially available tapers aren't right for the job. In that case, you need to "roll your own" taper by combining a pot with some external resistors in series and parallel as in Figure 3. In that circuit, the pot is represented by the series combination of R_{PHI} and R_{PLO}. The wiper contact is at the junction of R_{PHI} and R_{PLO}. The sum of R_{PHI} + R_{PLO} = R_{POT} is constant and represents the value of the pot's element.

Input voltage, V_{IN}, is applied to the series resistor, R_{SER}. The resistor R_{PAR} is connected in parallel across the pot's element. Output voltage, V_L, is taken across the load resistor, R_L, which is connected between the wiper and circuit common.

By varying the resistor values, the experimenter can create an amazing variety of tapers suitable for just about any special need. (Dare I say, a whole herd of tapers…) The equations to do so, however, are an impenetrable symbolic thicket so I've provided a spreadsheet to let you solve the problem empirically, which is a fancy way of saying "cut and try." The *Excel* spreadsheet and the *LTSpice* schematic file, both available on the Hands-On Radio website, will allow you to enter any value for the resistors and pot.[2] You can also create custom functions for the element resistance versus wiper position.

As provided on the website, the spreadsheet is pre-loaded with one of the commonly available "two-piece approximation" functions for wiper resistance that simulates a log response. You'd think the abrupt change in output level would sound awful to the listener but it seems to be acceptable. Two piece tapers are common with several different varieties sold.

After loading the spreadsheet, enter values for R_{SER}, R_{PAR}, R_{POT} and R_L — those cells are highlighted in red. Select one of the functions for wiper setting versus resistance from the provided set (highlighted in green) by selecting the column of values, then using COPY followed by PASTE SPECIAL > VALUES (not PASTE) in the WIPER FUNCTION column of the spreadsheet. All other values and the chart will automatically update.

You can also create your own WIPER FUNCTION by using formulas based on the WIPER POSITION column or by just entering a set of 20 values by hand. Feel free to experiment and let your tapers run wild!

[2]All previous Hands-On Radio experiments are available to ARRL members at **www.arrl.org/hands-on-radio**. *LTSpice* was the subject of columns 83 through 86.

Steve Ford, WB8IMY, wb8imy@arrl.org

iDVM Wireless Multimeter

If you own an Apple iPhone or iPad, you know that there are apps for just about every purpose imaginable. When this review was written, the population of the iTunes app universe stood at more than 700,000. Among all those software packages there is the iDVM by Redfish Instruments — an app that can turn your Apple device into an auto-ranging digital voltmeter (DVM).

The iDVM app is free in the iTunes store, but you need an external unit to perform the actual measurements and wirelessly relay the results to your iPhone or iPad. That part of the iDVM package carries a $240 price tag.

So why would anyone invest $240 to turn their phone or tablet into a DVM? One part of the answer is that having the measurement hardware separate from the display unit is an attractive feature. The other part is that the iDVM is no ordinary bargain-basement device. This is a precision DVM that was selected by *Test & Measurement World* as the "Best In Test" among laboratory grade multimeters in February of this year, edging out another meter from Agilent Technologies for the award.

The iDVM Package

The iDVM arrives in a package complete with probes and documentation. The documentation is not as thorough as it could be, but it is enough to get the unit up and running.

The iDVM will measure the following:

AC voltage from 0 to 300 V

AC current from 0.1 to 4 A

DC voltage from 1 mV to 300 V

DC current from 0.1 to 4 A

Resistance from 0 to 4 MΩ

The iDVM also features a continuity alarm and a voice readout, which is particularly convenient when you're not in a position to glance at the phone or tablet display. During the review I ran into a problem that required me to make some voltage measurements in my car. Using the iDVM, I was able to rest my iPhone on the seat while I squeezed under the dashboard with the measurement module. With each touch of the probes the iDVM dutifully (and loudly) spoke the results. I deeply appreciated not having to contort myself or hold a flashlight between my teeth to read the display!

Up and Running

The first step is to download and install the free iDVM app from the iTunes store. When you start the app, it displays a nicely rendered "meter" on the screen and begins searching for the measurement module. The documentation doesn't detail what sort of wireless connection is being used. At first I thought it might be Bluetooth, but I was mistaken. Instead, the iDVM module features a 2.4 GHz transceiver that establishes an *ad-hoc* Wi-Fi connection. The range is specified to be 30 feet, although I was able to maintain the link at more than 50 feet in open terrain.

Part of what makes the iDVM special is that it not only performs measurements, it has a built-in data collection and graphing function. You can make a series of measurements over time, for example, and view the results on the iDVM display. I tested this feature by connecting the iDVM to a dc voltage source and deliberately varying the voltage level over a period of about 60 seconds. The result was the graph shown in Figure 1. After viewing the graph, you can tap the screen and share the information in an e-mail message. In fact, you can export the data in standard formats such as CSV or SQLite, or as a PDF or PNG image file.

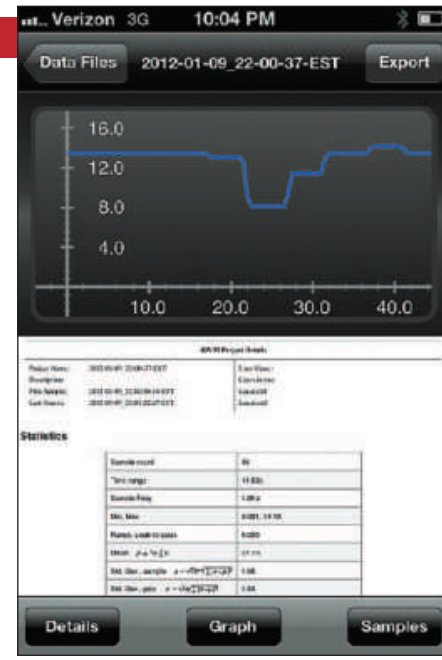


Figure 1 —The iDVM graphing function showing dc voltage variations over approximately 60 seconds.

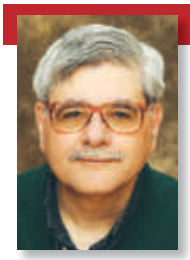
The iDVM display on an iPhone 4S.

The iDVM measurement module.

One Clever, Precise Device

Comparing the iDVM to my Fluke multimeter, the iDVM appeared to be every bit as accurate, if not more so in some instances. And having the ability to wirelessly separate the display from the measurement hardware is a big plus. Is the worth $240? If all you need is a basic multimeter, you're probably better off with a $15 model from RadioShack. On the other hand, if you require laboratory grade performance with graphing functions and more, the iDVM is definitely worth a look.

Manufacturer: Redfish Instruments, 303 Potrero St, Suite 42-304, Santa Cruz, CA 95060; tel 831-423-7400; **www.redfishinstruments.com**. *$240 from Amazon.com or directly from the manufacturer.*



Steve Sant Andrea, AG1YK, h&k@arrl.org

Toying Around, Rotary Repair and Banishing Bees

Leg o' Ham

New car — new puzzle. How do I install my mobile rig, which fit fine in my 1997 Taurus, in a 2011 Camry? As hard as I tried, I couldn't find a good place to mount the remote head for my IC-208H transceiver without it interfering with a vehicle control or being unreadable because of the viewing angle. I even tried a cup holder mount but found that the head still ended up "floating" in the wrong place (and I lost a cup holder).

I concluded that the only place to safely operate the head, keep it out of the way of the airbag system and clearly read it was just above the dashboard vent. Yet, there was no easy way to mount it because of the dashboard slope, which aimed the head toward the floor. After toying around with a few ideas, toying around became the actual solution — I noticed that the versatility of LEGO building bricks was just what I needed.

Out of the hundreds of brick shapes I'd seen, one of them had just the right angle to level the remote head. With the bricks mounted to one of the smaller LEGO baseplates (just flexible enough to contour to the dashboard curve), I could give the whole thing a stable base and plenty of mounting surface area (see Figure 1). Luckily, both gray and black bricks were available and matched the car's interior close enough.

Another consideration was not to damage the vinyl dashboard material while attaching the baseplate. For that, I used the leftover adhesive strips from a 3M coat hook. Hopefully, years from now all I will have to do is pull the tabs and the adhesive will come off clean. I secured the front end of the mounting baseplate to the plastic vent with a few small squares of hook and loop material, since I needed some rotational stability for button pushing and some height to fill the gap.

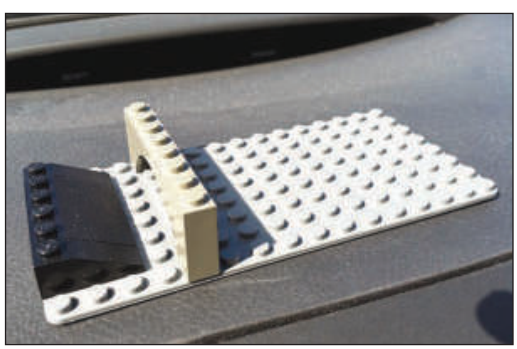


Figure 1 — Use these simple LEGO pieces to construct a mount for your transceiver's control head. [Mike Fesko, KB1LKH, photo]

As you can see in Figure 2, the design is simple — a baseplate with a few angled bricks, plus a support arch to take the load if I push too hard on the buttons. If the support pops off, I'll glue it down, but for now it seems to be holding strong. None of the bricks are glued. There's plenty of room for my fingers to push buttons and tune with and I lucked out with the remote head cable — it managed to fall right in line with a dashboard/control panel seam. Some coax sealant, which also matched the interior color quite well, did a nice job of keeping it in place. Since taking the photos, I colored the white adhesive tab strips with a black marker to eliminate reflection in the windshield.

Figure 2 — Here the completed mounting holds the control head where it doesn't interfere with driving but is accessible for easy operating. [Mike Fesko, KB1LKH, photo]

I'm not an electronics whiz so I'll never build much of a circuit, but with some imagination and playful experience, found I could whip a ham radio mounting problem. It was kid's play! — *73, Mike Fesko, KB1LKH*

Rebuilding a Broken Wafer Switch

Okay, we all know hams are cheap. I was facing a repair-or-replace decision involving a double-wafer ceramic band switch in a Tokyo Hy-Power HC-2000 antenna tuner I'd acquired (on the cheap) at a hamfest. Some contacts on the original switch had literally melted for some reason. A previous owner already had started rebuilding the damaged wafer and I completed the job by replacing the remaining burned contacts and securing them with scrounged machine hardware. I also polished away some burned spots on the rotor and replated that section in silver. [Replated areas should be inspected periodically for wear. — *Ed.*] As I was trying to install and rewire the switch, the second "good" wafer broke! Tokyo Hy-Power offered to sell me a new switch from its old stock for about $110. The original switch was rather flimsy so the decision to repair was a no-brainer.

As it so happened when I first opened the tuner's case I found a huskier two-wafer, multiposition ceramic wafer switch (I suspect the original owner didn't want to spend $110 either) and it provided the requisite raw material. I cannibalized that switch for its ceramic wafer and rotor disk, but I needed more very small machine hardware (the previous do-it-yourselfer had used some nice small brass screws I couldn't find locally). [A good source for unusual hardware is **www.amazonsupply.com** — *Ed.*]

The tuner switch had wipers on both sides of each wafer and was of the shorting variety. Tiny rivets would have been the preferable fastener, but these and the gear to install them were beyond the scope of my workshop and supply cabinet. A hardware store yielded some 1 mm stainless screws and nuts, although the pieces cost nearly 25 cents each! Even so, it was far less expensive than a new switch.

The switch wafer I was repurposing had more than enough contacts, but only on one side; it needed a double set to replicate the original switch wafer. Using a Dremel tool and a tiny grinding point or a cutting disk I salvaged individual contacts from the origi-

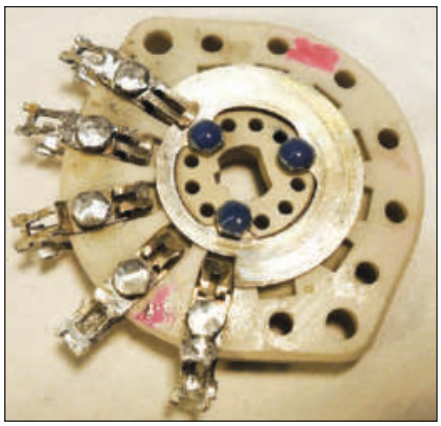


Figure 3 — The rebuilt wafer, with burnished solder "caps" on each of the nuts securing the contact lugs and a drop of thread-locking compound (still drying) on each of the nuts securing the rotor components. [Rick Lindquist, WW3DE, photo]

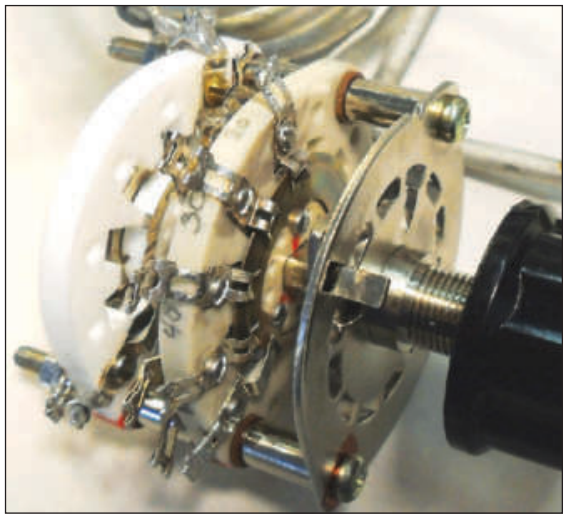


Figure 4 — The reassembled two-wafer band switch, prior to ultrasonic cleaning: The original (and flimsier) wafer is on the left, the entirely rebuilt wafer on the right. [Rick Lindquist, WW3DE, photo]

nal, broken wafer by *very carefully* removing the rivet heads (see Figure 3). After shaving down the flanged end of the rivets holding the new wafer's disks in place, I installed the salvaged lugs opposite each of the originals, using the 1 mm stainless hardware.

In addition, I had removed the rivets securing the two silver-plated pieces of the rotor, since that piece of ceramic also had cracked. I reattached these to the rotor disk from the new switch, using the 1 mm stainless hardware, making sure to align the rebuilt rotor on the common shaft with the original rotor, to maintain correct switching sequence (*you must install the rotor before the lugs*!). The cutting wheel trimmed the excess screw threads.

When all was done, I had a rebuilt switch wafer with five sets of contact lugs (see Figure 4). Drops of thread-locking compound secured the stainless nuts on the rotor; while solder held the nuts on each contact lug (soldering stainless can be a challenge). I swished some Tarn-X over the silver plated components, put the entire switch assembly back together and ran it through the ultrasonic cleaner to eliminate any grinding debris and dirt. Once it was clean, I replaced it in the tuner and the switch has performed flawlessly even at 600 W. — *73, Rick Lindquist, WW3DE, 25483 Jamie Ct, Seaford, DE 19973-8310,* **ww3de@arrl.net**

Repairing Stuck Pots

If you pick up used gear at hamfests or from the various online sites, you will eventually get one that has a potentiometer or rotary switch that King Kong leaning on a 36 inch Stillson wrench can't turn. The problem will not be the pot's wiper or the detent mechanism of a rotary switch, it will be where the shaft passes through the body that attaches it to the panel. I've tried several methods to free them up, but this one works the best.

The first step it to remove the stuck control or at least get it back from the panel. Looking closely at the mounting area of the control, you will see that just past the threaded mount, there will be a boss slightly bigger than the threads. This is the area that contacts the back of the panel so none of the stress of the tightened control nut is transferred to the body of the control, distorting it. Usually, there is a gap between this boss and the threads.

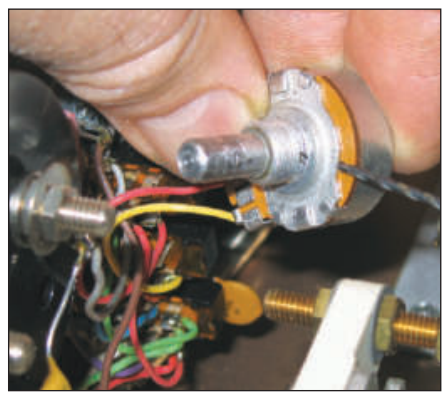


Figure 5 — To cure a stuck potentiometer drill a small hole at the base of the its mounting threads and apply a small amount of light oil or WD-40. [Charlie Liberto, W4MEC, photo]

Using a slow speed drill with a number 50 or smaller drill bit, drill a hole into the control (see Figure 5), just enough to break through to the shaft. If there is no gap between the threads and the boss, drill as close as you can. On a pot, you want to drill opposite from the terminal area so chips won't get into the pot. If you can rotate the control at all, you can verify you have drilled deep enough as you can see the shaft turn. If you can't rotate it, use your best judgment as to depth.

Use penetrating oil or WD-40 sparingly; don't get it on the contacts of a rotary switch or the innards of the pot. Begin working the shaft and it should slowly start to give way and turn like new. After it is free, use a light machine oil to lube the control, especially if you used WD-40. If you did get oil in the control or contacts, use a good contact cleaner like De-Ox-It, don't leave WD-40 on any important surface.

If the control is just too involved to remove, take off the mounting nut and any washers, then drill as close to the panel as you can. This will keep the area of the threads that are roughened up by the drill, in an area where the nut will not need to reach, or the nut will act as a die and clean the threads when you put it back on.

In the picture, I was able to drill the pot easily just by holding it in one hand and using a battery drill. You don't need much force, the smaller bits will really cut quickly without much effort. This procedure just may keep those log taper pots doing their job with silky smoothness. — *73, Charlie Liberto, W4MEC, 619 Hidaway Cove, Hendersonville, NC 28739*, **w4mec@arrl.net**

Digital QSL Display

Looking for a way to neatly display those hundred, or thousands of QSL cards you have acquired? In most radio rooms, maps and certificates cover the walls placing wall space at a premium. It wouldn't take long to run out of room with QSL cards filling the space. On the other hand, those neatly arranged shoe boxes full of QSL cards don't hint at the beauty of the gems enclosed in them. So, what is one left to do?

The world of high technology has arrived. I have a flat bed scanner and thought about scanning in those cards, but then you have to do many hours editing on the hundreds of images. Not bad if you only have a few, but I wanted to scan in about 300 cards, the best looking or most unique QSL cards from each state and country.

A quick search on eBay and I was on my way. Pandigital (and others) make business card scanners that will scan, in color, cards

4-5 inches wide, perfect for QSL cards. These stand alone scanners will scan a QSL card and store it directly to an SD memory card, which then can be inserted in a digital picture frame. A few bids on eBay and I got the scanner. A few more bids and I picked up a 7 inch digital frame.

Armed with the scanner, I went through those shoe boxes of QSL cards and picked out the ones I wanted and popped them through the scanner. The scanner works really well and automatically feeds the card through, no PC required. When I was finished, I looked at the card scans using a paint-type program on my PC and only needed to fix a few of them.

Once the minor editing was complete, I popped the SD card into the digital picture frame and *bingo*. One by one they cycle through, every couple of seconds a new card is shown making for a nice way to display the QSL cards for all to view.

I took the frame to work and have it on my desk. My co-workers are also Amateur Radio operators and the idea quickly caught on.

So, with a little bit of searching on eBay, I was able to get the card scanner for about $45 (recently the scanners have been selling for about $80). The 7 inch digital frame was another $30. Also, DX Engineering now sells a complete kit containing a scanner, frame and SD card for $89.95 under part number DXE-QSL-KIT. Now I can easily display those fantastic looking and unique QSL cards. Adding cards to the slide show is easy, just scan it in, copy and add to the SD card I use in the frame. — *73, Tom Parkinson, KB8UUZ, 9992 State Route 700, Mantua, OH 44255*, **kb8uuz@portcars.org**

Antenna Tube Talons

This method was inspired by Joel Hallas', W1ZR, article about adding 6 meters to a tribander.[1] Instead of the normal U-bolts and hardware to install the ½ inch element I used plastic copper pipe hangers called "Tube Talons." I found them at my local home improvement center for $1.98 a 10 pack.

The Talons come with a nail that must be removed. With the nail gone, drill out the nail hole with a 9/64 inch drill bit (for #6 hardware). Cut off the bottom to a length that is short enough, when installed, to make a tight fit. Place the cut talon on the element and it should hang off to the side a little bit. That way when you tighten down the screw it will hold the element tightly. Install with a 6-32 × 1¼ inch screw. You will need four

[1]J. R. Hallas, W1ZR, "Add 6 Meters to Your Triband Trap Yagi," *QST*, Sep 2011, pp 40-42.

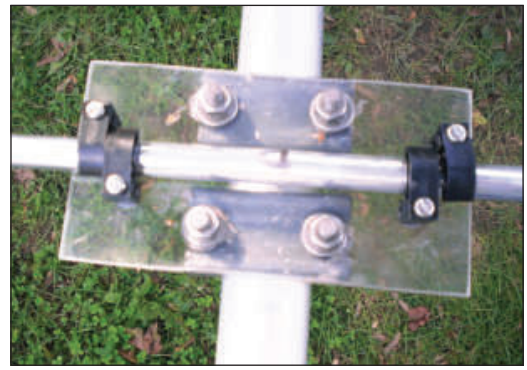


Figure 6 — Two Tube Talons, mounted in opposition make a secure anchor for an antenna element. [Walter Yatzook, W1ATV, photo]

Tube Talons for each element (see Figure 6). The two opposing talons help to lock the element in place.

The Talons do not slide or move. You may have to experiment when you cut the Talon to get the correct length so it will tighten down and clamp the element in place.

Another Use for Tube Talons

I was working on my next antenna project, a dual-band wire beam.[2] Two of the parts needed were ½ inch and ¾ inch ID Teflon donuts. I wasn't about to order them from a specialty catalog so, instead I used the Tube Talon clamps.

Both the ½ and ¾ inch Talons are cut the same way. A miter box used for cutting wood trim worked fine. You'll need two talons for one clamp, using only the tops. Cut the talon square with the hook end. This is your cutting guide. After removing the nail, drill out to 3/16 inch for a 3/16 inch eye hook. Assemble the two top halves together

[2]A. Baker, KG4JJH, "A Dual-Band Wire Beam for 17 and 12 Meters," *QST*, Aug 2005, pp 28-32.

Figure 7 — With their bottom fingers removed, two Talons mounted back-to-back can make a very effective clamp for tubing. [Walter Yatzook, W1ATV, photo]

with the eye hook using a flat washer on each end (see Figure 7).

The parts clamped well on the fiberglass tubes. The talons have a small dimple on the inside to help with clamping. — *73, Walter Yatzook, W1ATV, 77 Baker Ave, Meriden, CT 06451-5107*, **w1atv@arrl.net**

Boom Bee Protector

I would like to offer an addition to Ron Toynes, WAØAJF, article in Hints & Kinks.[3] While the downspout strainer makes an ideal method of keeping the critters out of the boom of a beam, it won't do much to keep out bees and wasps.

I used a piece of aluminum window screen large enough to cover the end of the boom and extend over the outside of the boom. I then used a stainless steel hose clamp to fasten the screen to the boom. Tighten the hose clamp loosely. Then cut off the extra screening and slide the clamp back to cover the edges of the screening before tightening it completely. I also like to spray almost everything outside with clear spray for additional protection. This is a simple and effective method for keeping bees and wasps from becoming unwelcome tenants in your antenna. — *73, Irvin Sanders, K3IUY, 100 N Larkspur Dr, Apt 119, Palmyra, PA 17078-9026*, **radioirv@comcast.net**

[3]R. Toynes, WAØAJF, "Keeping the Critters Out," *QST*, Feb 2011, p 68.

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

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **h&k@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether praising or criticizing an item, please send the author(s) a copy of your comments.

Strays

Have a *QST* Delivery Issue?

If your copy of *QST* does not arrive by the end of the month before the issue date, please contact the ARRL Circulation Department at **circulation@arrl.org**, tel 860-594-0200. Also contact them if your address changes or your copy of *QST* arrives in damaged condition.

Long Haul Radio

These hams have the biggest rigs!

Here's Kurt in his big rig's driver's seat with his little rigs at the ready. [photo courtesy Kurt Keilhofer, KC8RWD]

Diego Nicolas', EA5GTU, QSL card shows him standing in front of his cement truck. [Diego Nicolas, EA5GTU, photo]

Norm Fusaro, W3IZ

I have always been fascinated with big trucks and the open road. There was a time when the life of the American truck driver was considered to be one of a lone adventurer, a gear jamming cowboy fueled by strong truck stop coffee crisscrossing the country in a diesel powered boneshaker using his citizens band (CB) radio to avoid speed traps and weigh stations.

This fantasy works well in movies and television and it undoubtedly fuels American folklore and country music but in real life long haul truckers are professionals who operate some very sophisticated machinery. An 18 wheeler is more than 80,000 pounds of horsepower, torque and freight and the trucking industry is very big business.

It used to be that when a driver rolled out of the yard he was flying solo until he reached his destination. Today trucks packed full of technology are akin to remote offices in constant contact with corporate headquarters as if they were only down the hall from the accounting department. There are numerous systems at work in a big truck and through satellite connections managers at operation centers can monitor things like speed, location, fuel economy, tire pressure or mechanical efficiency all while the truck is in transit. Technology has helped the trucking industry improve safety and increase productivity.

A long haul truck driver can spend weeks or months away from home navigating a big tractor-trailer across the country. Often, a driver's diesel rig is a home away from home. The extended truck cabs on big trucks are called sleepers. These can have a bunk bed where a driver can catch 40 winks during required rest periods. Some of the larger sleepers can have such amenities as satellite television, microwave ovens, refrigerators and small sitting or eating areas. More elaborate rigs have showers and toilets. A truck equipped with such creature comforts can be a sanctuary for a road weary driver.

Rolling Rigs

A truck is many things — habitat, technology center and business office. For the hundreds of drivers who are also radio amateurs their truck is also a ham shack. These long hauling hams enjoy their Amateur Radio on the go or when they have some down time between loads. Over the years I have had the privilege to talk with several radio amateurs who are professional truck drivers and have found that on-the-air ham radio activity is as varied as the drivers.

Some like to work DX from the truck while others enjoy a ragchew on 40 or 80 meters and staying in touch with ham radio pals. Most of the drivers who I have talked with enjoy operating HF mobile because they can communicate over long distances while some others enjoy VHF/UHF simplex or repeaters. Automatic Packet Reporting System (APRS) is also very popular among the 18 wheeling hams. It's easy to spot a truck on your APRS display, just look for the truck icon or the number 14 next to a call sign (KC8RWD-14), which is used to identify trucks.

Lew Ridgeway, KD8UD, has retired from a trucking career and says that he enjoyed ham radio on the road for more than 15 years. His career started before the days of cell phones and other electronic gadgets so ham radio played a big part in his travels. To make sure that Lew would be safe and sound his ham friends would stay on the air with him until he found a secure place to park his rig for the night.

Lew operated HF and 2 meter SSB staying in touch with his family and friends via ham radio while on the road. Over the years he has used many different transceivers and all sorts of antennas including long wires on flatbed trailers.

Big Rig Radios — Safe and Secure

Installing ham radio equipment in a truck is not much different than installing a rig in the family vehicle. Professional drivers are

very safety conscious about everything on their trucks so it's not surprising they mount their transceivers to ensure easy access and visibility of controls while driving, solid electrical connections and, of course, a solid and safe mount to avoid shifting or flying components.

Antennas installed on big trucks have a clear advantage over antennas on four wheelers (cars) because trucks have a larger ground plane — or so you would think. Today's trucks are designed for fuel efficiency and better aerodynamics. In order to reduce weight and increase fuel economy truck bodies are made of fiberglass or carbon fiber. It may be necessary to run as much as 10 feet of 1 inch braided wire from the antenna to the truck frame to get a solid bond to ground. A ground is imperative for any mobile antenna whether on a big truck or the family sedan.

Just because a big truck can accommodate large antennas doesn't mean he can install whatever he wishes. Depending on where a driver travels there may be physical or safety considerations that limit antenna choices. Unfortunately, some drivers have to deliver their loads to some unsavory areas and an expensive looking ham radio antenna can make a truck very attractive to a crook. I met driver Frank Ardizzone, K1MHV, when he was delivering a trailer of groceries to a local supermarket. Frank enjoys ham radio from his truck but he only operates 2 meter FM and 10 meter SSB. He says that a typical VHF antenna has a low profile and a 10 meter antenna doesn't look much different than a CB antenna, so the thieves are not attracted to his truck.

On a visit to ARRL headquarters in Newington, Connecticut, driver Jack McComb, WØJMC, was explaining that he carries a portable mast to support a 25 foot vertical antenna above his trailer. When solidly bonded to the aluminum trailer, this antenna system allows Jack to put out a super signal at low angles for DXing or to reach his friends back home in Colorado.

Diesel DXing

Ham radio and trucking are both activities carried out around the world so it is not uncommon for a ham to contact another driving a truck in some DX land. On one occasion I contacted Diego Nicolas, EA5GTU, on 20 meters as he was driving his cement mixer around Cartagena, Spain. Diego has been driving trucks for 26 years and really enjoys operating SSB with his IC-7000 transceiver and multiband antenna. He related stories to me of several large mobile antennas that were destroyed after tangling with other equipment or structures on the construction sites where he delivers his concrete.

On one occasion I contacted Diego Nicolas, EA5GTU, on 20 meters as he was driving his cement mixer around Cartagena, Spain.

Diego has confirmed 237 DXCC countries, all from his truck. He got his start with radio at age 12 using CB radios to talk with friends. The DX bug got to him and he eventually got his *diploma de operador* and *licencia de estación* (operator permit and station license).

When talking about trucking it is impossible not to mention CB radio. Anyone who spends time behind a windshield will quickly notice the CB antennas on the big diesel rigs as they roll along the interstate highways. Cell phones and GPS have all but eliminated the need for truck drivers to use CB for directions or to call for roadside assistance but the CB radio can still be useful. Truckers use CB for help with traffic information, to get an "all clear" when changing lanes or when maneuvering through the depot or truck stop.

In the United States Federal regulations dictate the amount of time drivers can operate their vehicle between scheduled rest periods — 11 hours on, 10 hours off. Kurt Keilhofer, KC8RWD, is a special service hauler catering to trade shows and other unique customers. Kurt is often on the road for 2 months or more so these down times during his trips can be used to catch an opening on 6 meters or chat on a local 2 meter repeater or simplex frequency.

Kurt says that APRS is popular among truckers. While APRS has many other digital communications capabilities, most hams are familiar with the vehicle tracking element using GPS to spot the location of vehicles and other stations on a map on your computer screen. There have been times when Kurt would see the call sign of a buddy on the APRS map and be close enough for a simplex contact on 2 meters. Kurt has been driving for 19 years, a career that began after graduating from Penn State University. He enjoys running his own business without the confines of an office.

There have been times when Kurt would see the call sign of a buddy on the APRS map and be close enough for a simplex contact on 2 meters.

Having traveled the 48 contiguous states and Canada, Kurt has made lots of friends over the air.

Kurt is the 2011 United Van Lines Logistics Van Operator of the Year. You can see a short video about him, which includes a glimpse of his mobile rig at **www.youtube.com/watch?v=coLhInfwmZc.**

Home on the Road

One of Kurt's friends and fellow trucker is John McLendon, AB8JL, of Ohio. John is an owner operator and has been trucking 32 years, 13 of which he has been a licensed radio amateur. John uses APRS while on the road to show his location and he enjoys operating the HF bands with a 100 W transceiver and a motorized screwdriver type antenna. John uses compact transceivers with remote mounting systems that keep the cab of the truck neat with all controls safely accessible.

John says that being able to communicate over long distances is an attraction of ham radio regardless if it is done from home, on a mountain top or from the cab of a truck. When not on the road John spends time mentoring new Technician class licensees so that they may upgrade and enjoy the complete Amateur Radio experience.

While on the road John will check into nets, keep schedules with friends or just call CQ on the bands. Of the thousands of contacts he has made from his truck John recalls making a packet connection to the International Space Station as one of his most memorable contacts. John said he made this contact at a rest stop because, as he points out, using a laptop while driving is just as unsafe as texting while driving.

Amateur Radio is a fantastic hobby that mirrors our society and its many cultures. To me one of the greatest pleasures of Amateur Radio is getting to meet people from all walks of life. The men and women who drive the big diesel rigs hauling the cargo that makes our modern life possible are not solitary souls popularized in country music. Some of these drivers are hams just like you and I. They enjoy their hobby and stay connected with other radio amateurs while navigating the highways of the world.

Norm Fusaro, W3IZ, is Assistant Manager of the ARRL Membership and Volunteer Programs Department. He can be reached at **w3iz@arrl.org**.

Backpacking with Satellites

From the Lost Coast to outer space — activating CM79.

David Palmer, KB5WIA

I have to admit that in my 20 years of Amateur Radio, my favorite mode of operating is using the ham radio satellites. There's something almost magical about pointing antennas up into the sky and literally hearing a spacecraft as it flies by. Living in Northern California, I also love the outdoors and exploring new places. Combining satellites with heading outside can lead to some very fun and interesting portable radio adventures.

Ham Radio Satellites

There are more than half a dozen ham radio satellites orbiting the earth that can carry two-way voice conversations. AO-51, SO-50 and AO-27 carry onboard FM repeaters with a VHF uplink and a UHF downlink. VO-52, FO-29 and AO-7 carry linear transponders that can relay several conversations at once in SSB or CW. Using these six main satellites, I can easily talk to stations several thousand miles away using simple radios and just a few watts of power.[1]

Station Equipment

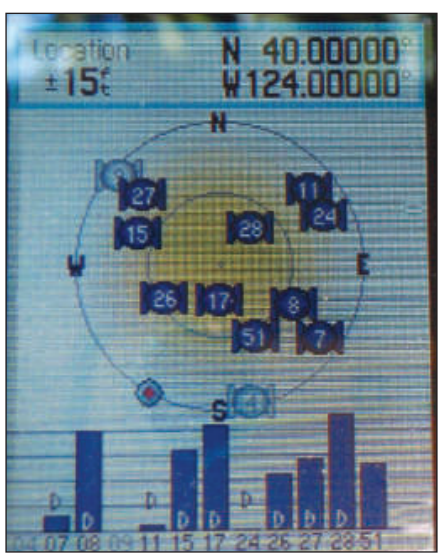
My home station consists of two Yaesu FT-817ND low-power radios driving a pair of Yagi antennas on a two-axis rotator in my backyard. One radio transmits my 5 W signal up to the satellite on one antenna, while the other receives the faint downlink signal on the second antenna.

Fortunately, these little radios are quite portable, so when I travel I can take the satellite station with me and, using a diplexer, connect both to a single Elk 2 meter/70 cm log periodic antenna (**elkantennas.com**). It still amazes me that a single small antenna can simultaneously send RF into space and receive the downlink signal from an orbiting satellite.

Backpacking equipment along the Lost Coast Trail.

I power the system with flexible PowerFilm solar panels (**powerfilmsolar.com**) and a lightweight K2 Energy (**k2battery.com**) battery. A small netbook handles the Doppler shift tuning and tells me where to steer the antenna. Using this simple setup I've been able to make numerous "portable" outdoor excursions.

[1]Notes appear on page 67.



The GPS receiver showing exactly 124° west, 40° north: the intersection of grids CM79, CM89, CN70 and CN80.

Grid Squares

Like other V/UHF operators, hams in the satellite community use the Maidenhead grid square designators to identify their locations. Each grid square represents an area 2° of longitude by 1° of latitude — about 120 × 60 miles. The typical grid square designator consists of two letters and two numbers. For example, my home is in grid CM88.

In some grid squares, it's easy to find ham operators but others are considered very "rare" being located away from population centers or in remote areas. There are 488 grid squares in the continental US; one of the rarest is CM79.

Lost Coast Grid

In October 2010, I read about Russell's, KB8U, trip to CM79 on the remote California "Lost Coast."[2] The grid is almost entirely in the Pacific Ocean, with less than a square mile on land extending into the coastal mountains. CM79 has no roads, houses, electricity or even trails. The entire grid square is thickly forested and slopes steeply over 2000 feet into the ocean. To make matters worse, it is on the west side of a steep ridge that blocks radio signals eastward. Fortunately, the ridge top is only 70 feet uphill from CM79's northeast corner. Also fortunately, there's a campground 2½ trail-miles away.

In 2010, Russell backpacked into this grid with portable 6 meter equipment. In doing so, he provided the last of the 488 grids needed for the Fred Fish Memorial Award (**www.arrl.org/ffma**). After reading Russell's story, I decided to activate CM79 for grid hunters in the ham radio satellite community.

...one of the rarest is CM79.

Plan A

My first plan was to operate directly from CM79's northeast corner, positioning my satellite station to be in four grids simultaneously (CM79, CM89, CN70 and CN80). Russell accomplished this in 2010 by having his transceiver directly at the grid intersection and running cables to a remote antenna 70 feet uphill on the ridge top.

One thing about working satellites is that you have to aim your antenna at the satellite

to be successful. You also need to be near your radios to tune them for Doppler shift and finding other stations. My plan was to have the radios and the antenna on the ridge, 70 feet uphill from the grid corner, where I could control them. To satisfy having the station in all four grids at once, I planned to have the solar panels and power source directly at the grid intersection. What could go wrong? I posted my plans on my ham radio blog and advertised the upcoming August trip on the AMSAT-BB mailing list.

Preparation and Practice Runs

In May of 2011, I took the system on a camping trip to Death Valley National Park and everything worked great. The ARRL June VHF QSO Party was a good chance to test the solar panels under heavy load and they worked well during the whole contest. In July I again used the system in Northern California and everything was working fine for all six of the SSB and FM satellites. I was ready for CM79.

Plans Can Change

Four days before leaving for CM-79, I received an e-mail from ARRL headquarters advising me that my plan wasn't sufficient for activating all four grids at once. It turns out that just having the power supply at the grid intersection wasn't enough and that I'd have to locate the transceivers directly at the grid boundary. How on earth could I accomplish this with satellites?! With the steep hill to the east, if I had my antenna by the transmitters my signal would never get through.

Then I realized that I could use the altitude of the satellites to my advantage. A ridgeline to the east would not affect the overhead or westerly satellite passes. Talking to East Coast hams would still be a problem since that ridgeline would block signals to satellites east of me.

I quickly got online and ordered 100 feet of LMR-400 coax. I then got out an unused Advanced Receiver SP432VDG UHF preamplifier (**www.advanced-receiver.com**). Plan B was to use a remote antenna setup for the easterly satellite passes. With my station directly over the grid intersection, I would run the signal to the hilltop through the LMR-400 to the Elk antenna. The preamplifier would boost the UHF signals on the downlink to help overcome cable loss. How would I steer the antenna? I'd simply run up and down the hill two or three times during the pass to re-orient the antenna. My wife laughed at me as I repeatedly ran through the house into the backyard, practicing aiming the Elk antenna on the end of a 100 foot run of coax.

CM79 has no roads, houses, electricity or even trails.

For overhead and westerly passes, I'd simply move the Elk antenna back to the station over the grid boundary. I e-mailed ARRL headquarters the revised plans and everything was now okay.

Putting the Plan into Practice

Saturday August 6 I drove the 6 hours to Wailaki Campground at the base of Chemise Mountain in the King Range National Conservation Area. I set up camp and loaded the backpack with the first load of equipment: 100 feet of LMR-400, 150 feet of power cable, solar panels, batteries, two tripods, tarp, camp chair, a Yaesu FT-857D radio for higher power (20 W on UHF) and a 5 pound battery. As I struggled to hoist the pack on, I questioned my decision to take so much stuff.

By early evening I was on the trail. The weather was beautiful, clear and calm, with temperatures in the 70s. The trail from the campsite climbed steeply through a thick forest, then switchbacked around the northeast side of Chemise Mountain. Once on top of the mountain, the trail opened up into a scrub forest with occasional nice views to the fog-shrouded ocean nearly 2500 feet below. Eventually the trail dropped down back into forest on the south side of the mountain.

After an hour and a half of hiking I was on the ridgeline just above CM79 and glimpsed more challenges! First, the ridge sloping down to CM79 was too steep to run up and down — so my plans to aim the antenna several times during a pass clearly weren't going to work. What was worse, the whole area was thickly forested, which meant the already weak UHF downlink signals were going to be even weaker. I dropped off the first load of equipment, stretched out the LMR-400 cable connecting the ridge top to the grid corner and then headed back to camp.

Sunday morning, I was back on the trail before sunup, carrying the two radios, the antenna, more cables and the computer. I also had to carry enough food, water and clothing for the day, as well as insect repellent, bear spray and a SPOT Messenger for tracking and emergency communication. An hour and a half later, I was back at the grid intersection with just enough time to set up the station and the antenna before the first satellite pass.

AMSAT-OSCAR 7 was the first satellite to come over. It was an easterly pass and I used the high-powered FT-857D radio on the uplink. I could barely hear anything. My downlink audio was very distorted, but by the end of the pass I was able to make a contact with Drew, KO4MA, in Florida. At that point, I realized that this wasn't going to be easy.

The next satellite to come over was AMSAT-OSCAR 51, which normally has a nice strong UHF downlink signal. It was a high westerly pass, so I moved the Elk antenna to my station on the grid boundary and then followed the satellite through the trees — and heard nothing! If I can't hear one of the strongest satellites through this forest cover, how am I going to make this work?

Grid square CM79 as viewed from the nearby Chinquapin Loop Trail. The entire grid is heavily forested and slopes steeply toward the Pacific Ocean.

Adapting to Conditions

Operating satellites gives you a lot of time to think because they cross the horizon in passes lasting only 5-20 minutes. As I was waiting for the next pass, I spent time thinking about how to improve the situation.

Looking around, I realized that on the ridge top I could see patches of sunlight through the trees to the east. And I had an extra 30 feet of the LMR-400 coiled up at the antenna on the ridge. Maybe I should use the extra cable and move the antenna to the clearest space in the trees I could find? If I aimed through the opening and waited until the satellite crossed into view, would that work?

I also realized that the preamplifier I had brought could be used for the overhead and westerly satellite passes. It might help overcome the signal loss from all the trees directly around the grid intersection. Moving the preamplifier along with the antenna was easy. It was worth a try.

I also decided to ditch the FT-857D. My biggest problem was being able to hear the satellites; sending higher power up to the satellite is of no use if you can't hear it.

Satellite Success

The next satellite passes confirmed that all three ideas worked. For the eastern satellite passes, I used the Elk antenna located just over the ridge top in the best "clearing" I could find. The preamplifier boosted the weak downlink signals right at the antenna and the low-loss LMR400 carried signals back to the radios. I was able to hear the satellites and make contacts.

Overhead and westerly passes were improved by having the preamplifier at the station. Even though the cable from the Elk to the radios was only 6 feet long, the GAsFET preamplifier is much more sensitive than the front-end of the FT-817ND, so it made a big improvement.

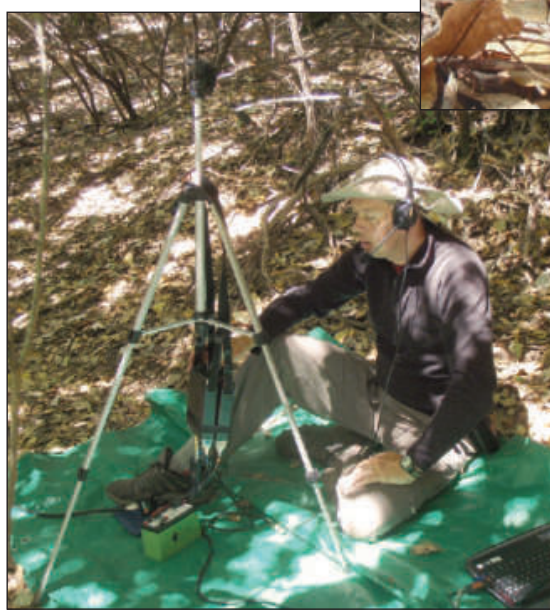
With these changes, I was able to make contacts on AO-7, VO-52, AO-27, FO-29, AO-51 and SO-50 over the course of the day. These contacts were all made from my mosquito-infested tarp on a sloping forested hillside. Twelve satellite passes in all and a few dozen nice contacts.

By 5:30 PM local time, it was time to hike back to camp. I left the main equipment up on the mountain and packed out the heavy lead acid battery and the FT-857D.

Monday morning I arrived at CM79 just before another AO-7 pass and started operating. Over the course of the day, I was able to work another nine satellite passes and make close to 20 more contacts.

None of the contacts came easy. Even with all of the improvements signal quality was still weak, but it was possible to make contacts. I'm really thankful for the patience of the other operators. By Monday evening I was ready to haul the remaining equipment off the mountain, pack up and get a nice (mosquito-free) motel room in nearby Shelter Cove.

When I arrived home I had a number of very nice messages from other satellite operators thanking me for making the effort to activate CM79 and the nearby grids. It was very nice to see the support from the community.



Dave, KB5WIA, at the operating location on the grid square boundary. A 100 foot run of LMR-400 connects the remote antenna to the station.

The Elk log periodic antenna in the heavily wooded "clearing." This was the best place available to reach the easterly satellites.

Lessons Learned

I learned a number of lessons on this trip:

- Let others know your plans before embarking on a DXpedition. I hadn't even thought of running my original idea by ARRL headquarters for validation. I'm quite glad that DXCC Manager Bill Moore, NC1L, let me know that my plan wasn't going to work. As uncomfortable as it was to change things at the last minute, it was much better to find out before than to find out after I got back.
- Be prepared to have your plans change during the DXpedition. I hadn't expected such a steep hill or thick forest cover.
- Have patience. Since I planned to operate for two full days, it was okay if a particular pass didn't work out — there were quite a few more to come.

Ham radio is fun! Even though it was hard work, the operating conditions were difficult and the technical challenges were many, it was still nice to do one of my favorite activities in a beautiful part of the country. It was quite an adventure! If you would like to share in my DXpedition adventure, have a look at my YouTube video at **www.youtube.com/watch?v=ef5_cYzwIZo**.

Notes

[1]As of February 2012, AO-51 is no longer operational and AO-7 is only partially operational. Go to **www.amsat.org/amsat-new/satellites/status.php** for current satellite statuses.

[2]R. Dwarshuis, KB8U, "A Backpack Grid DXpedition to CM79," *QST*, Oct 2010, pp 70-71.

Photos by Dave Palmer, KB5WIA.

A member of ARRL and AMSAT, Dave Palmer, KB5WIA, has been licensed since 1992 and holds an Advanced class license. He works in the biotechnology field and enjoys ham radio as a hobby. His main radio interests are satellites, low-power VHF and HF/VHF mobile. He can be reached at 4069 Shaker Run Cir, Fairfield, CA 94533, **kb5wia@amsat.org**.

100 Years of Amateur Radio Licensing

August 17, 2012 marks the 100th anniversary of President William Howard Taft signing into law the *Radio Act of 1912* — the first regulations affecting radio amateurs in the US.

S. Khrystyne Keane, K1SFA

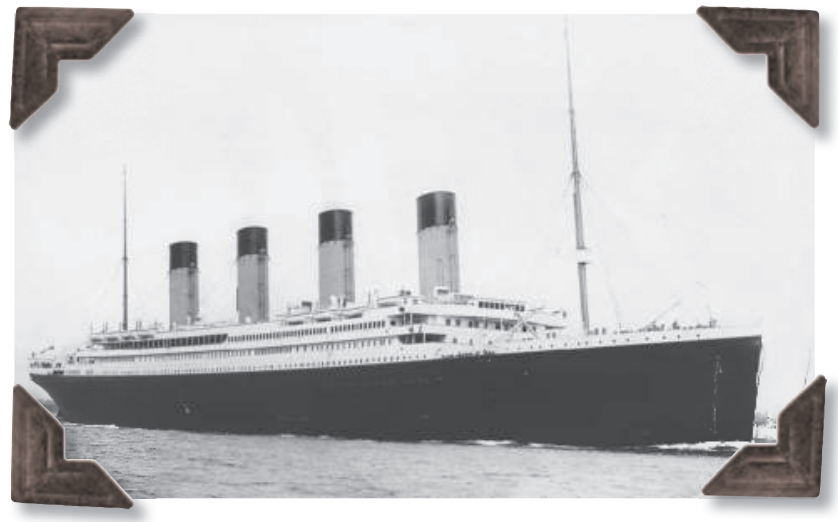
If you're like most radio amateurs, getting your "ticket" was a seminal point in your life. How did you feel when you passed your test, perhaps taken under the watchful eye of an FCC examiner? Or when you opened that envelope from the FCC — or checked the ULS online — and learned your new call sign? That excitement you felt is the same way amateurs felt 100 years ago.

Yes, you are not so different from the wireless experimenters who roamed the airwaves in the early 20th century. There is one big difference, however: You have a license to operate, as well as a call sign issued by the federal government and rules that must be followed. Prior to December 1912 — when the *Radio Act of 1912* went into effect — there were no Amateur Radio licenses; in fact, there were few governmental regulations of any kind for wireless operators. Anyone who wanted to could put a radio transmitter on the air. They didn't have to take a test. They could use any power, assign themselves a call sign of their own choosing, pick any wavelength at will and operate either as an amateur or commercial station when and as they pleased. Power was only limited by one's pocketbook, and some pocketbooks did not stop short of the 5 kW mark.[1]

As of 1911, there were only about 600 wireless stations in the US, and of those 600, about 150 were commercial or US Navy stations.[2] And of the 450 or so amateur stations, many operated at a higher power with bigger antennas than those used by the Navy or commercial stations. Before 1912, it was the radio amateur who dominated the airwaves.

You are not so different from the wireless experimenters who roamed the airwaves in the early 20th century. There is one big difference, however: You have a license to operate, as well as a call sign issued by the federal government and rules that must be followed.

With no rules in place, the airwaves were a lawless wasteland. Between 1902 and 1912, a total of 28 bills dealing with radio were introduced in Congress.[3] Only one of these, *The Wireless Ship Act of 1910*, made it mandatory for certain ocean steamers to have radio communications equipment on board — and operators trained to use it. But neither this act, nor its 1912 amendments (not to be confused with the *Radio Act of 1912*) had any bearing on Amateur Radio.



Just days before the sinking of the RMS *Titanic* the US ratified the Berlin International Wireless Convention of 1906 that spelled out international radio regulations. These international rules laid the groundwork for the *Radio Act of 1912,* the first rules governing Amateur Radio. [F.G.O. Stuart photo]

The Sinking of the RMS *Titanic* and the *Radio Act of 1912*

When the *Titanic* went down to its watery grave in April 1912, it was largely thanks to the two Marconi Company wireless operators — Jack Phillips and Harold Bride — that 712 people survived. Both operators were able to broadcast messages to other ships in the vicinity that the *Titanic* was in danger. Having wireless on board a ship was not the safety measure that it seems today. At the time, it was in place so passengers could check their stock portfolio or send private messages — and this service was available for a fee. With the advent of wireless, the White Star Line, under whose flag the *Titanic* sailed, did not feel that a full complement of lifeboats was needed on its ships,[4] believing that wireless could be used to send distress calls and other ships would respond in time.

On both sides of the Atlantic, hearings were held to determine ways to ensure that such a tragedy would never happen again. The day after the *Titanic* survivors arrived in New York City, William Alden Smith, a Republican senator from Michigan, convened the US hearings. Senators and spectators heard dramatic testimony from the surviving passengers and crew. On May 28, Smith's subcommittee issued a report that led to the *Radio Act of 1912*. Less than eight months after the hearings, President Taft signed the act into law.

The Berlin Convention of 1906[5] set into place international radio regulations, including the use of SOS as an international distress call, and required all land and ship radio stations to be staffed 24 hours a day, seven days a week. Ironically, it wasn't until April 3, 1912 that the US ratified these regulations — just before the *Titanic* disaster and just in time to incorporate them into what would become the *Radio Act of 1912*. But the US version had one major difference from the international version: Regulation 15, which specified that private (amateur) stations could not use wavelengths in excess of 200 meters (1.5 MHz), except by special permission. Specifically,

> No private or commercial station not engaged in the transaction of bona fide

[1]Notes appear on page 69.

commercial business by radio communication or in experimentation in connection with the development and manufacture of radio apparatus for commercial purposes shall use a transmitting wave length exceeding two hundred meters, or a transformer input exceeding one kilowatt, except by special authority of the Secretary of Commerce contained in the license of that station: Provided, That the owner or operator of a station of the character mentioned in this regulation shall not be liable for a violation of the requirements of the third or fourth regulations to the penalties of one hundred dollars or twenty-five dollars, respectively, provided in this section unless the person maintaining or operating such station shall have been notified in writing that the said transmitter has been found, upon tests conducted by the Government, to be so adjusted as to violate the said third and fourth regulations, and opportunity has been given to said owner or operator to adjust said transmitter in conformity with said regulations.[6]

A New Era for Radio Amateurs

With the *Radio Act of 1912* now the law of the land, Amateur Radio operators were put in their place, so to speak. The US Navy — still disconcerted by being unable to use Marconi equipment, as well as its disapproval of radio amateurs and their high-power equipment, no power limits and big antennas — effectively petitioned Congress to limit Amateur Radio privileges. Prior to 1912, amateurs were all over the band map, with the "little pistols" only able to transmit on 250 or 300 meters, while the "big guns" could range as high as 1000 meters.[7] Not anymore. Among other things, amateurs were limited to those frequencies "200 meters and down." In those days, it was the prevailing thought that radio waves increased in effectiveness directly in ratio to their length. This meant that it was believed that 700 meters was more powerful than 160 meters; wavelengths shorter than 250 meters were thought to be essentially worthless for anything but the most limited work. Lawmakers — and the US Navy — thought that by giving radio amateurs such a "worthless" portion of the spectrum, amateurs would become frustrated and would lose interest in operating.

William Alden Smith, a Republican senator from Michigan, chaired the hearings after the sinking of the RMS *Titanic* in April 1912. The report from the hearing later helped to form the *Radio Act of 1912*. [photo courtesy of the Library of Congress]

Put yourself in the shoes of the day: Amateurs, who had roamed the bands at will, would now be limited to what was considered to be a puny — and worthless — piece of radio spectrum. Such a brilliant theory on the part of the lawmakers, but by 1917, just five years after the *Radio Act of 1912* went into effect, there were more than 6000 amateurs on the air. Today, with more than 700,000 radio amateurs, it's clear that that theory back in 1912 didn't work out exactly as planned.

Not only were radio amateurs limited to those frequencies below 200 meters, traffic from commercial and US Navy stations now had priority over the amateurs. Those operators who had grown accustomed to using high power were now limited to a "paltry" 1 kilowatt. Amateurs were to be assigned permanent call signs, and they would have to use them when transmitting.

In the beginning, Amateur Radio was governed by the US Department of Commerce and Labor (in March 1913, it was split into the Department of Commerce and the Department of Labor), then by the Federal Radio Commission, and finally, in 1934, by the Federal Communications Commission.

The federal government's licensing of Amateur Radio experimenters and operators has evolved considerably over the past 100 years. Even so, many things are still the same. As radio amateurs, we still use call signs, we still have power limits and we still have to pass a test to become an Amateur Radio operator. But after 100 years, amateurs will no longer be limited to "200 meters and down" on a non-experimental basis: At the 2012 World Radiocommunication Conference in Geneva, Switzerland, WRC-12 delegates approved a 7-kilohertz-wide secondary allocation to the Amateur Radio Service between 472-479 kHz. This new 630 meter allocation will take effect when it is entered into the ITU's Radio Regulations and the US rules are revised.[8]

White Star Line Chairman J. Bruce Ismay — shown here testifying before Smith's subcommittee about the disaster — was one of the *Titanic*'s 712 survivors. More than 80 witnesses testified before the Senate subcommittee over the 18 day inquiry. A complete transcription from all the witnesses in both the American and British inquiries is available online at **www.titanicinquiry.org**. [Sketch by Louis F. Grant from *The Graphic*]

Notes

[1]*The 1932 Radio Amateur's Handbook* (published by ARRL), p 2.
[2]*The 1932 Radio Amateur's Handbook* (published by ARRL), p 2.
[3]C. DeSoto, *200 Meters and Down*, p 28, ISBN 978-0-87259-001-4, see **www.arrl.org/shop/200-Meters-and-Down**.
[4]See **www.titanicinquiry.org/BOTInq/BOTInq23Chalmers01.php** (#22875).
[5]See **earlyradiohistory.us/1906conv.htm**.
[6]See **earlyradiohistory.us/1914reg.htm#RA4-15**.
[7]*The 1932 Radio Amateur's Handbook* (published by ARRL), p 2.
[8]See **www.arrl.org/news/amateur-radio-gets-secondary-mf-allocation-at-wrc-12**.

S. Khrystyne Keane, K1SFA, is the ARRL News Editor. She can be reached via e-mail at **k1sfa@arrl.org**.

Beyond Our Bands

In public service, hams need to look beyond the Amateur Radio box.

Steve Sant Andrea, AG1YK

I felt stupid and a bit embarrassed.

As part of a Community Emergency Response Team (CERT) exercise, a "tornado" had ripped through our town, severely damaging the recreation center at a local condominium complex. There I was sitting at a folding table in incident command with a set of Family Radio Service (FRS) radios in front of me.

Our town emergency management director, who was orchestrating the exercise, had separated the CERT members into five teams and assigned them to various parts of the building for search and rescue operations.

As the "radio expert," my job was to deploy and retrieve the radios, monitor the radio traffic between the various search groups, and keep track of their reports and any requests for assistance. Easy, right? Well, the teams were ready, the damage and injury simulations were ready and there I was with three FRS radios that wouldn't talk to each other.

I had arrived a little late and the table with the FRS radios was already set up. I took a quick look at the radios. The batteries were okay and they were all on the primary channel. I distributed the radios to the teams and, lo and behold, three of the teams couldn't communicate.

The problem, of course, was simple: The FRS radios had a tone-coding feature. It hadn't even occurred to me that these "toys" would have something like that. After all, they didn't have multiband transmitters, 500 memories, a dozen memory groups, wideband receivers, scanning functions and the numerous other features found on our ham handhelds. They were designed so mom could keep track of little Johnny at the local park. What could go wrong?

But there I was fumbling with the FRS radios.

Yes, this story does emphasize the importance of proper preparation at the scene, but it also points to the need for hams to be familiar with the equipment used by other civilian radio services.

Civilian Services

This was only an exercise. There was no real damage and no real broken, bleeding people needing assistance. The delay wasn't long, but it was unnecessary and it was a wake-up call making me realize that being familiar with the radios of other services could be crucial.

Here in Connecticut many of the local CERT teams depend on FRS radios for communications. They are small, simple and inexpensive. There are also dozens of models, each with a different feature set. This means there are lots of radios with lots of menus containing lots of features. Not something you want to deal with in the heat of an actual event.

The civilian radio services you might have to work with are the FRS, General Mobile Radio Service (GMRS), Multi-Use Radio Service (MURS) and, of course, CB. The FRS radios have a range of a mile or less. GMRS radios have a range of 10-25 miles, while MURS radios usually cover 10 miles or so.

CBs, being HF radios, can cover very long distances. From a Public Service standpoint, you will probably run into them because they are standard equipment for truck drivers (see the article elsewhere in this issue).[1] You might encounter CBs at EOCs or any point of distribution (POD) where people, supplies or equipment are being delivered or picked up. Finally, those hams near forests or wilderness areas should be aware of the Personal Locator Beacon system.

Table 1
Civilian Service Channels (MHz)

CB (1-20)	CB (21-40)	FRS	GMRS	FRS/GMRS	MURS
26.965	27.215	467.5625	462.5500	462.5625	151.820
26.975	27.225	467.5875	462.5750	462.5875	151.880
26.985	27.255	467.6125	462.6000	462.6125	151.940
27.005	27.235	467.6375	462.6250	462.6375	154.570
27.015	27.245	467.6625	462.6500	462.6625	154.600
27.025	27.265	467.6875	462.6750	462.6875	
27.035	27.275	467.7125	462.7000	462.7125	
27.055	27.285		462.7250		
27.065*	27.295		467.5500		
27.075	27.305		467.5750		
27.085	27.315		467.6000		
27.105	27.325		467.6250		
27.115	27.335		467.6500		
27.125	27.345		467.6750		
27.135	27.355		467.7000		
27.155	27.365		467.7250		
27.165	27.375				
27.175	27.385				
27.185	27.395				
27.205	27.405				

*CB channel 9 is an emergency calling channel.

Get To Know the Radio

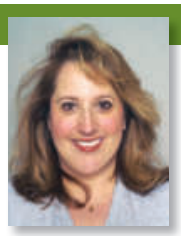
The trend for the future is for hams to be interacting more with other organizations when bad things happen. Find out what radios the groups you work with are using. Get hold of a manual for them and read it over. Most of the major manufacturers make these manuals available online. Download it, print it out and keep it in your "go-book" with the rest of your group's emergency-operations information. Become familiar with the features of those radios, so if the need arises you will not have to waste precious minutes digging through menus to reset a tone.

Your book should also include which channels your companion organizations are using, what type of traffic the different channels are designated for and any tactical names that have been assigned. While FCC regulations prohibit amateur transceivers from transmitting on FRS, GMRS, MURS or CB frequencies, most recent base, mobile and handheld transceivers have wideband receivers that can monitor these frequencies. Program the appropriate channels into your radios (see Table 1). Hearing what's going on is at least half the battle.

Ham radio's greatest asset in the Public Service arena is its flexibility. We can operate on-the-fly from anywhere and on a range of frequencies encompassing all the operating bands of the civilian and government services. FCC regulations that prohibit our amateur transceivers from transmitting on the civilian bands shouldn't keep us from listening to these bands and learning about their radios — what they can do and how to make them do it.

Steve Sant Andrea, AG1YK, is an assistant editor at *QST*. He can be reached at **ag1yk@arrl.org**.

[1] N. Fusaro, W3IZ, "Long Haul Radio," pp 63-64.



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

FCC Expands Part 95 MedRadio Rules to Allow Devices in 13 cm Band

While the Amateur Radio Service will retain its primary status in this portion of spectrum, the FCC has allowed medical devices to operate on a secondary basis from 2360-2400 MHz.

In a *First Report and Order* and a *Further Notice of Proposed Rulemaking* (ET 08-59) released on May 24, the FCC decided to expand the Part 95 Personal Radio Service rules to allow medical devices to operate on a secondary basis in the 2360-2400 MHz band. These devices — called Medical Body Area Networks (MBAN) — provide a way for health care facilities to monitor their patients via wireless networks. Because use of these frequencies will be on a secondary basis, MBAN stations will not be allowed to cause interference to — and must accept interference from — primary services, including radio amateurs who operate on a primary basis in the 2390-2395 MHz and 2395-2400 MHz bands.

In July 2006, the FCC released a *Notice of Proposed Rulemaking* and *Notice of Inquiry and Order* (*NOI*) regarding the use of the radio spectrum for advanced medical technologies. In December 2007, GE Healthcare filed *ex parte* comments in response, proposing that the band 2360-2400 MHz be allocated on a secondary basis for "Body Sensor Networks" (BSNs). In April 2008, the FCC put the proposal on Public Notice, and the ARRL submitted comments pointing out the potential incompatibility with amateur operations. Nevertheless, in June 2009, the FCC released a *Notice of Proposed Rulemaking* that also requested comments on possible alternatives, including 2300-2305 MHz. The ARRL followed up in October 2009 with additional comments.

"Even though the Amateur Radio Service retains its primary status at 2390-2400 MHz, it remains to be seen how the addition of a new secondary service in the band will work out in practice," noted ARRL Chief Executive Officer David Sumner, K1ZZ. "In the past, the FCC has declined the ARRL's request to raise the status of the Amateur Service at 2300-2305 MHz to primary, even though there is no other service to which this segment of the band is allocated. This is now the only portion of the 2300-2450 MHz band — which at one time was available in its entirety to amateurs — that is not encumbered by other spectrum occupants. We hope that in the future, the FCC will be receptive to making the Amateur Service primary in this narrow segment, in recognition of the reduced utility of the remainder of the band."

In making the decision to allow these devices in the 2360-2400 MHz band, the FCC noted that the costs of permitting MBAN operation "are limited to the risk of increased interference, which we minimize by adopting rules to protect other licensed operations in these bands. We find that the risk of increased interference is minimal and is greatly outweighed by the benefits of the MBAN rules we adopt today."

Sumner observed that with this decision, "the Commission has effectively taken 2360-2400 MHz off the table for consideration for commercial wireless broadband."

How Does this Affect Amateur Radio?

MBAN operators in the 2390-2400 MHz band will have to account for radio amateurs, who are authorized on a primary basis in this spectrum. "Both Philips and GE Health Care assert that interference from MBAN devices to Amateur Radio is unlikely, citing factors such as the low transmission power and low duty cycle proposed for MBAN devices, as well as geographic separation and the frequency agility of MBAN devices," the FCC pointed out in its comments. "The ARRL does not anticipate that an MBAN would cause 'a significant amount of harmful interference' to amateur users, but it cautions that some amateur operations — such as weak signal communications that occur on a 'completely unpredictable basis' — could receive interference."

The FCC said it believed that MBAN devices can "successfully share the band with the Amateur Service. These frequencies are part of the larger '13 cm band' in which Amateur Radio operators already share the adjacent 2400-2450 MHz portion of the band with low-powered equipment authorized under Part 15 of our rules. We expect that the Amateur Service will likewise be able to share the 2390-2400 MHz portion of the band with MBAN devices because the power limits for MBAN operations will be even lower than that allowed for the unlicensed equipment that operates in the 2400-2450 MHz range. We further believe that MBAN and amateur operations are highly unlikely to occur in close proximity to each other. An MBAN, which will use very low transmitted power levels compared to the Amateur Service, is not intended for mass market types of deployment, and instead will be used only under the direction of health care professionals."

According to the FCC, the majority of MBAN operations in the 2390-2400 MHz band will be located indoors: "We envision that the most likely outdoor use will occur in ambulances or while patients are otherwise in transit, thus we do not believe that prolonged outdoor use in a single location is likely. In such a situation, any interference that might occur would likely be transitory in nature and would not seriously degrade, obstruct or repeatedly interrupt amateur operations and thus would not be considered harmful under our definition of harmful interference."

The FCC also addressed the potential for interference from radio amateurs to the MBAN devices. The ARRL, in its October 2009 comments, stated that "amateur opera-

tion in the band is unpredictable" and that the "substantial power levels and exceptionally high antenna gain figures used by radio amateurs in the 2390-2400 MHz band will provide no reliability of MBANs in this segment whatsoever," calling the results of such interference "potentially disastrous." The FCC pointed out that MBAN proponents assert that "MBAN devices will have built-in capabilities, such as spectrum sensing techniques to detect in-band amateur signals and frequency agility capability to move MBAN transmissions to other available channels."

As to the ARRL's concerns about MBAN's reliability and the risk presented by interference caused by amateur operation, GE Health Care acknowledged that "medical device manufacturers seeking to develop equipment consistent with the MBAN rules would need to build robust products in order to satisfy FDA requirements and to ensure customer acceptance," but the FCC did not view that as a barrier to its efforts to develop and deploy MBAN devices.

"We find that factors such as the incorporation of established techniques to avoid interference into MBAN devices, the use of low duty cycles and the separation distances between MBAN devices and amateur operations that are likely to occur in real-world situations will minimize any potential for interference to MBAN devices from amateur users," it explained. "In the unlikely event that an atypical scenario occurs where amateur operators do receive harmful interference from MBAN operations, we note that amateur operators would be entitled to protection from MBAN interference. MBAN operations will occur on a secondary basis and MBAN operators will thus be required to accept any interference they receive from primary amateur licensees operating in accordance with the rules."

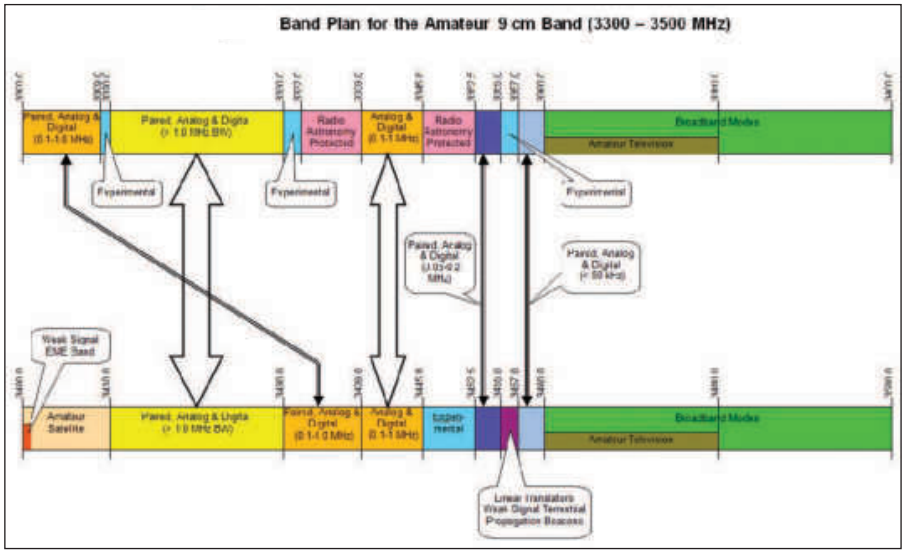
ARRL Board of Directors Approves 9 cm Band Plan

The ARRL Board of Directors has unanimously voted to approve the 9 cm (3300-3500 MHz) band plan, as presented by the ARRL UHF/Microwave Band Plan Committee. Earlier this year, the committee asked radio amateurs for comments on a proposed 9 cm band plan, explaining that the purpose of these band plans is to share information about how the amateur bands are being used and to suggest compatible frequency ranges for various types of application. The committee also recognized that local conditions or needs may necessitate deviations from a band plan, and that regional frequency coordinating bodies may recommend alternatives for use in their respective regions.

The new 9 cm band plan includes the following notations:

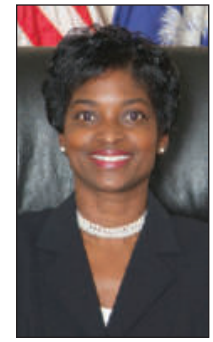
- This band plan includes all other emission modes authorized in the 9 cm amateur band whose necessary bandwidth does not exceed the suggested bandwidths listed.
- Weak Signal Terrestrial legacy users are encouraged to move to 3400.3-3401.0 MHz, as time and resources permit.
- Broadband segments may be used for any combination of high-speed data (such as 802.11 protocols), Amateur Television and other high-bandwidth activities. Division into channels and/or separation of uses within these segments may be done regionally, based on need and usage.
- Per ITU RR 5.149 from WRC-07, these band segments are also used for Radio Astronomy. Amateur use of these frequencies should be first coordinated with the National Science Foundation.

Find a link to an *Excel* file that provides details of the new band plan at **www.arrl.org/news/arrl-board-of-directors-approves-9-cm-band-plan**.



The new 9 cm band plan, as approved by the ARRL Board of Directors.

Clyburn Nominated for New Term as FCC Commissioner



FCC Commissioner Mignon Clyburn

On June 6, President Barack Obama announced that he will nominate Mignon Clyburn for a new term as one of five FCC Commissioners. Clyburn, a Democrat, came to the Commission in August 2009, filling the unexpired term of Republican Deborah Taylor Tate, whose tenure as a Commissioner came to a close in January 2009 when the Senate failed to confirm her nomination. Clyburn's current term expires June 30.

"In renominating Commissioner Clyburn, President Obama has made an outstanding choice for the Commission and for the American people," said FCC Chairman Julius Genachowski in a written statement. "As I know from working with her for the past several years, Commissioner Clyburn is a strong leader, focused on helping all Americans harness the benefits of broadband. I congratulate her."

For much of this year, the FCC has been operating with just three commissioners: Robert McDowell, Genachowski and Clyburn. Both Genachowski and Clyburn are Democrats; McDowell is a Republican. Last month, two new Commissioners — Democrat Jessica Rosenworcel and Republican Ajit Pai — were sworn in, bringing the Commission to full strength. Only three sitting Commissioners may be members of the same political party, and none can have a financial interest in any Commission-related business.

Former ARRL First Vice President Steve Mendelsohn, W2ML (SK)

After a courageous battle with pancreatic cancer, Steve Mendelsohn, W2ML, of Dumont, New Jersey, passed away May 23. He was 67. An ARRL Life Member, Mendelsohn began his time with ARRL in 1983 when he was elected as Vice Director of the Hudson Division. After two terms as Vice Director, he was elected as Hudson Division Director in 1987. In 1996, the ARRL Board of Directors elected Mendelsohn as its First Vice President, where he served until 2000. The next year, he was again elected as the Hudson Division Vice Director, serving through 2004.

Steve Mendelsohn, W2ML [S. Khrystyne Keane, K1SFA, photo]

Outside of his League activities, Mendelsohn was active both as the Communications Director of the New York City Marathon and, along with his wife Heidi, W2MLW, as the Game Day Frequency Coordinator for the New York Jets. Mendelsohn was inducted into the CQ Hall of Fame in May 2012 for his contributions to the ARRL, the New York City Marathon and the National Football League.

"Steve's passing is a great loss in the world of Amateur Radio," said ARRL Hudson Division Director Joyce Birmingham, KA2ANF. "I will always treasure the times I spent with Steve over the many years I knew him. To me, and to all of Amateur Radio, he was a strong leader, dedicated mentor and most importantly, a true friend to many of us throughout the entire Amateur Radio community. Most recently, as a courageous fighter, Steve battled pancreatic cancer, but still continued to serve the ham community until the end and enjoyed many hours on the air. Our prayers go out to his family and his beloved Heidi. Rest now, my friend, you are at peace. We will miss you."

Former "The World Above 50 MHz" Conductor Gene Zimmerman, W3ZZ (SK)

Gene Zimmerman, W3ZZ, of Gaithersburg, Maryland, passed away on Sunday, June 3. He was 71. Zimmerman wrote the popular *QST* column "The World Above 50 MHz" from 2002-2011. He also served on the ARRL Contest Advisory Committee, edited the VHF contesting column for *CQ Contest* magazine during its five-year lifespan and was director of the CQ VHF Contest from 2000-2002. An ARRL Life Member, Zimmerman earned VUCC on six bands: 50, 144, 222, 432, 903 and 1296 MHz, as well as DXCC, Worked All States and Worked All Continents on 6 meters. He was an early proponent of — and participant in — aggressive contest log checking.

Gene Zimmerman, W3ZZ

"Gene brought the same intensity and depth of knowledge of his career at the NIH to understanding propagation," said Ward Silver, NØAX. "His tenure as the conductor of *QST*'s 'The World Above 50 MHz' usually resulted in a sharp recounting and analysis of the month's unusual on-the-air events. I learned something from every single column. But what most will remember about Gene, though, will be his amazing capacity for storytelling and the twinkling of his eyes as he told of the undoing of scoundrels with obvious and undiluted glee. I've had the pleasure of being his roommate at Dayton and WRTC and I don't believe I've ever laughed harder or longer. Gene knew where all the bodies were buried and relished his role as sage and historian. Amateur Radio has had its share of characters but none were more colorful or more widely respected than Dr Gene Zimmerman. We will all miss Gene's presence greatly and it is a sad day for us all to learn of his passing."

Section Manager Nomination Notice

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

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at **www.arrl.org/section-terms-nomination-information**. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Membership and Volunteer Programs Manager, the original documents are received by the Manager within seven days of the request.

We suggest the following format:

(Place and Date)

Membership and Volunteer Programs Manager, ARRL
225 Main St
Newington, CT 06111

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

(Signature____ Call Sign____ City___ ZIP___)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on September 7, 2012. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before October 1, 2012, to full members of record as September 7, 2012, which is the closing date for nominations. Returns will be counted November 20, 2012. Section Managers elected as a result of the above procedure will take office January 1, 2013.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning January 1, 2013. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the January 2013 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager.
— David Patton, NN1N, Membership and Volunteer Programs Manager

Call for Nominations for ARRL Director and Vice Director

Attention: Full ARRL members in the Central, Hudson, New England, Northwestern, and Roanoke Divisions! You have the opportunity and duty to choose a director and a vice director to represent you for three-year terms beginning January 1, 2013.

The ARRL is governed by its Board of Directors. A voting director is chosen by ballot by the full (licensed) members in each of the 15 ARRL divisions. Vice directors, who serve in the absence of the director from a Board meeting and succeed to the position of director should a vacancy occur, are chosen at the same time. Elections are held in five divisions per year. It only takes 10 full members in a division to nominate a candidate for either office.

This year for the first time, ARRL members in divisions where there are contested elections **will be able to vote electronically**. Members with valid email addresses in their membership Profiles will be sent instructions on how to vote by email. Members without email addresses or whose emails bounce, or who request a paper ballot, will be sent a ballot by postal mail as in the past. Additional information will be provided later in *QST* and on the ARRL website.

Qualifications

The eligibility of nominees for the positions of ARRL director and vice director will be reviewed by the Ethics and Elections Committee, composed of three directors not subject to election this year: Greg Widin, K0GW (chair), Bob Vallio, W6RGG, and Bill Edgar, N3LLR. A nominee must be at least 21 years old and must have been licensed and a full member of the ARRL for a continuous term of at least four years immediately preceding nomination. Each nominee must provide information concerning his or her employment, ownership and investment interests, and other financial arrangements so the Committee can determine whether the nominee has a pervasive and continuing conflict of interest that would render him or her ineligible to serve (see Article 12 of the ARRL Articles of Association and Bylaw 45, available at **www.arrl.org/general-information**).

The qualifications for director and vice director are identical. All the powers of the director are transferred to the vice director in the event of the director's death, resignation, recall, removal outside the division or inability to serve.

Nomination Procedure

Step 1: Obtain official nominating petition forms. Any full member residing in a division where there is an election may request an official nominating petition package. The request must reach the ARRL Secretary *no later than noon EDT on Friday, August 10, 2012.* If you are seriously considering running or nominating someone to run, don't wait until the last minute to request the forms; the deadline for submitting a completed petition form is just one week later.

Step 2: Obtain signatures and complete questionnaire. Only the official form may be used. The petition form has two sides. To be valid, a nominating petition must name the candidate and must bear the signatures of 10 full members of the division. The candidate must complete the other side, providing the information required to determine eligibility, certifying its accuracy, and agreeing to assume the office if elected.

Step 3: Submit petition form. The completed form must reach the Secretary *no later than noon EDT on Friday, August 17, 2012.* The submission may be made by facsimile or electronic transmission of images (i.e. a PDF or JPEG attachment to an email) provided that upon request, the original documents are received by the Secretary within seven days of the request. A person who is nominated for both director and vice director may choose to decline the nomination for director; otherwise the nomination for director will stand and that for vice director will be void.

On Monday, August 20, 2012, the Secretary will notify each candidate of the name and call sign of each other candidate for the same office. Candidates then will have until Friday, August 31, 2012 to submit 300-word statements and photographs, if they desire these to accompany the ballot, in accordance with instructions that will be supplied.

Balloting

If there is only one eligible candidate for an office, he or she will be declared elected by the Ethics and Elections Committee. If there is more than one eligible candidate for an office, the full members in that division who are in good standing as of September 10, 2012 will have the opportunity to cast ballots. Balloting will begin no later than October 1, 2012 and will conclude at noon Eastern Time Friday, November 16, 2012. The candidate receiving the most votes will be declared the winner.

Members who are eligible to vote and for whom the ARRL has a valid email address will be sent instructions on how to vote electronically. All other members who are eligible to vote will receive ballots by USPS. The election will be conducted by Survey & Ballot Systems of Eden Prairie, MN, which has more than 20 years of experience with association elections. Whether cast electronically or on paper, all votes will be by secret ballot. A representative of the Ethics and Elections Committee will be present to observe the tabulation of results.

Absentee Ballots

A full member who is residing temporarily outside his or her home division, including overseas, may arrange to vote in the home division by notifying the Secretary prior to September 10, 2012, giving their current mailing address as reflected in the ARRL membership records (i.e. *QST* mailing address) and the reason why another division is considered home. Members with overseas military addresses should take special note of this provision; in the absence of information received to the contrary, ballots will be sent to them based on their postal addresses.

The Incumbents

The incumbent directors and vice directors, respectively, in the five divisions in which elections will be held this year are:

Central: George R. Isely, W9GIG and Kermit Carlson, W9XA

Hudson: Joyce Birmingham, KA2ANF and William Hudzik, W2UDT

New England: Tom Frenaye, K1KI and Mike Raisbeck, K1TWF

Northwestern: Jim Fenstermaker, K9JF and Grant Hopper, KB7WSD

Roanoke: Dennis Bodson, W4PWF and Dr. James Boehner, N2ZZ

For the Board of Directors:
May 11, 2012
David Sumner, K1ZZ
Secretary

Rick Palm, K1CE, k1ce@arrl.org

ARRL Partner: The National Communications System

Amateurs have proven themselves an essential part of our national communications plan.

"When all else fails" communications-wise for the Federal government, the National Communications System (NCS) stands up. Part of the Department of Homeland Security, its mission includes the "provision of national security and emergency preparedness communications . . . under all circumstances, including crisis or emergency, attack and recovery, and reconstitution." The ARRL® has a long-standing history of partnership with the NCS, including a formal memorandum of understanding (MOU) that can be found at **www.arrl.org/files/file/Public%2520Service/NCS%2520MOU.pdf**.

Veteran ARES® and NTS operators will recall the series of Night Tango exercises conducted by NCS in the '80s. In the June 1984 *QST*®, NCS Exercise Night Tango Coordinator Chuck Cavanaugh, K4VKU, described the exercises as testing whether amateur operators could serve as alternative communications resources during national crises.[1] The ARRL acted as a coordination point. Operators from ARES, NTS, Civil Air Patrol (CAP) and the three branches of the Military Auxiliary Radio System (MARS) all participated. The specific objective was to have their existing networks establish connectivity and pass critical messages between senior government officials at selected locations in a simulated post-attack scenario. Even in those days, the need for interoperability was recognized and tested. Cavanaugh concluded: "These exercises demonstrated that the volunteer radio systems could be used to support national emergency telecommunications requirements."

Building on the success of the Night Tango series, the NCS in 1988 launched the venerable SHARES — the Shared Resources High Frequency (HF) Radio program — as a national HF radio network using the combined HF radio assets of the Federal government on a shared basis. Using very basic operating protocols and a SHARES radio directory, messages could be sent among multiple departments and agencies around the country. Thanks to the Night Tango experiences, Amateur Radio (ARES/NTS), CAP and MARS became resources to be included in the SHARES concept.

Cuban Missile Crisis: Information Overload

After the Soviets placed nuclear warheads on Cuba in 1962, President Kennedy called for civilian and military input for mitigating the crisis, but what ensued was an information overload and lack of communications coordination among the various Federal departments because their telecommunications systems didn't "inter-operate." After the crisis was resolved, Kennedy sought to fix the problem with the National Communications System. Its original goal was to link together all Federal systems into one single integrated system, but that was untenable, given the labyrinth of systems in existence at the time. Thus, the goal evolved to make all of the agencies' systems interoperable, redundant and survivable.

"These exercises demonstrated that the volunteer radio systems could be used to support national emergency telecommunications requirements."

Responsibility: National Security/Emergency Preparedness Telecomms

The NCS is the government's entity responsible for the Federal government's national security and emergency preparedness communications. As we all know, the telecommunications system is incredibly complex, with multiple technologies and services having diverse ownership and modes such as wire, wireless, satellite, cable and broadcasting. They provide the foundation for the Internet and other key information systems. Protecting them is part of the NCS mission. The private sector owns most of the critical communications infrastructure, so this requires the NCS to work closely with its industry associations to assess and prioritize risks and develop protective programs.

SHARES and Other Services

SHARES has withstood the test of time. It still provides a "single, interagency emergency message handling system by bringing together existing HF radio resources of Federal, state and industry organizations when normal communications are destroyed or unavailable for the transmission of national security and emergency preparedness information." As of a couple of years ago, "over 1340 HF radio stations, representing 101 Federal, state, and industry entities were resource contributors to the SHARES HF Radio Program. SHARES stations are located in every state and at 20 overseas locations."

Technological advancements have made HF radio more efficient. Digital Signal Processing (DSP), computer control and Automatic Link Establishment (ALE) combine to simplify and enhance HF radio operation and frequency selection. New technologies also have enabled the transmission of high-resolution imagery via HF radio, thanks to new image compression and error correction algorithms.

GETS

The Government Emergency Telecommunications Service (GETS) is a White House-directed emergency phone service provided by the NCS. GETS provides emergency access and priority processing for calls on the Public Switched Telephone Network (PSTN), the fancy name for the public telephone system. It's used in an emergency or crisis when the phone system is congested and the probability of completing a call has significantly decreased. It's accessed through

[1]C. Cavanaugh, K4VKU, "NCS Update," *QST*, Jun 1984, p 94.

a universal access number using common telephone equipment. The call is then identified as a national security call and receives special treatment.

TSP

Telecommunications Service Priority (TSP) is a program that authorizes national security and emergency organizations to receive priority treatment for vital voice and data circuits. As a result of hurricanes, floods, earthquakes and other natural or man-made disasters, telecommunications service vendors frequently experience a surge in requests both for new service and to restore existing services. The TSP Program provides service vendors an FCC mandate to prioritize requests by identifying those requests that are of critical need. A TSP assignment ensures that it will receive priority attention by the service vendor before any non-TSP request.

Wireless Priority Service (WPS)

As we all know, during emergencies cellular networks can experience congestion due to increased call volumes and/or damage to network facilities, severely curtailing the ability of national security and emergency preparedness personnel to make emergency calls. With an increasing number of personnel relying on cell phones while performing their emergency duties, the NCS developed the Wireless Priority Service to provide priority for emergency calls made from cellular telephones. Wireless Priority Service is an easy-to-use, add-on feature subscribed to on a per-cell phone basis; no special phones are required.

The NCS's Route Diversity Project helps local, state and Federal agencies increase the availability of communications by employing diverse routing, defined as "communications routing between two points over more than one geographic or physical path, with no points in common."

Amateur Radio and SHARES

The participants in the SHARES network are Federal agencies, both military and non-military, and include the assets of federally controlled entities. Participants may include Amateur Radio operators who have access to Federal HF radio equipment and are authorized by a Federal entity.

Amateur Radio provides a means to augment SHARES during actual emergencies and sanctioned exercises. While the primary means of handling SHARES messages should be among Federal stations, Amateur Radio operators (using their facilities) can be considered for this purpose. SHARES message originators and radio operators may contact Amateur Radio operators by local means and request assistance in passing SHARES traffic. Further, SHARES radio operators holding valid Amateur Radio licenses may contact Amateur Radio operators in the Amateur Radio frequency bands and request assistance in radio relay of SHARES traffic.

On September 29, 2009, an 8.0 magnitude earthquake in the Pacific Ocean affected American Samoa with a tsunami that caused significant damage. FEMA activated ESF #2 (the Communications emergency support function) at both the national and regional levels. The NCS deployed personnel to the National Response Coordination Center in Washington and the Region IX Regional Response Coordination Center in Oakland, California. Given the direct impact on the telecommunications infrastructure, exacerbated by the indirect impact caused by power outages, responders experienced difficulty establishing contact with individuals on the island during response activities. They overcame this obstacle by using NCS' SHARES program to contact an Amateur Radio operator on the island, who passed information on to other emergency responders. [source: *2009 NCS Annual Report*; **www.ncs.gov/library.html**]

ARRL/NCS MOU

The Memorandum of Understanding signed in 1983 between ARRL and NCS established a close working relationship between the Federal government and volunteer radio amateurs for national emergency communications functions. The ARRL recognized that NCS is responsible for restoring Federal government communications and that, because commercial carriers provide more than 95 percent of the government's communications, there is a national and natural requirement for radio amateurs to assist in the transmission of critical messages.

The League and the NCS agreed to:

- participate in cooperative pre-emergency planning, exercise and training programs at all government levels
- cooperate in time of disaster or emergency to meet the needs of the government and of the agencies and organizations attempting to restore communications
- make its facilities, resources and capabilities accessible to the other in accordance with established plans and procedures.

ARRL Roanoke Division Director Dennis Bodson, W4PWF, was an administrator and engineer at the National Communications System Headquarters in Washington, serving as its Director of Office of Technology and Standards. Bodson, an electrical engineer, retired in 1998 after a 28 year career there. He said his office's job "was to develop and evaluate international, national and Federal standards in support of national security and emergency preparedness telecommunications." Bodson said that the SHARES program was the major tie-in to the NCS for Amateur Radio.

Illinois State Representative WV9C Visits Station at Illinois EMA Facility

Illinois State Representative Chuck Krezwick, WV9C (Orland Park, IL) the only amateur licensee in the state General Assembly, visited the RACES station (NC9IL) at the Illinois Emergency Management Agency facility at Springfield. The tour was arranged by ARRL Illinois legislative liaison Charlie Richey, K9DUE. Also on the tour was Emergency Coordinator and Deputy Illinois State RACES Officer Jim Pitchford, N9LQF, who had just returned from tornado-ravaged southern Illinois. — *Thanks, Ben Kiningham, K9IDQ, Petersburg, Illinois.*

From left to right, Illinois State Representative Chuck Krezwick, WV9C; Emergency Coordinator/Deputy Illinois State RACES Officer and professional emergency manager Jim Pitchford, N9LQF, and ARRL Illinois legislative liaison Charlie Richey, K9DUE, at the State RACES station, Springfield. [photo courtesy Ben Kiningham, K9IDQ]

Contest Corral – August 2012

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

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

Start - Finish Date-Time				Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
3	0200Z	3	0300Z	1.8-14 / -	SNS and NS Weekly Sprints	CW Dig	Serial, name, and S/P/C	www.ncccsprint.com
4	0000Z	5	2359Z	1.8-28 / -	Int'l Lighthouse-Lightship Contest	Ph CW Dig	Serial or ARLHS mbr/light nr and name, S/P/C	illw.org
4	0000Z	4	2359Z	1.8-28 / 50	TARA Grid Dip Shindig	Dig	Name and 4-char grid square	www.n2ty.org/seasons/tara_grid_rules.html
4	0001Z	5	2359Z	28 / -	10-10 Summer Phone QSO Party	Ph	Call, name, 10-10 number, S/P/C	www.ten-ten.org
4	1200Z	4	2359Z	1.8-28 / -	European HF Championship	Ph CW	RS(T), last two digits of 1st year licensed	lea.hamradio.si/~scc/euhf/euhfc.htm
4	1800Z	5	1800Z	- / 222+	ARRL UHF Contest	Ph CW Dig	4-char grid square	www.arrl.org/contests
4	1800Z	5	0600Z	1.8-28 / -	North American QSO Party	CW	Name and state	ncjweb.com
5	1300Z	5	1630Z	3.5-14 / -	South Africa DX SSB Contest	Ph	RS and serial	www.sarl.org.za
6	1600Z	6	See web	3.5 / 50, 144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
8	1300Z	9	See web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
11	0000Z	12	2359Z	3.5-28 / -	Worked All Europe	CW	RST and serial (see web for QTC rules)	www.waedc.de
11	1600Z	12	See web	1.8-28 / 50-440	Maryland-DC QSO Party	Ph CW Dig	Maryland county/city or S/P/C	mdcqsoparty.w3vpr.org
11	2000Z	11	2400Z	- / 50	Fall 6 Meter Sprint	Ph CW Dig	4-character grid square	www.svhfs.org
12	0000Z	12	2359Z	1.8-28 / 50	Straight Key Weekend Sprintathon	CW	RST, QTH, name, member nr if member	www.skccgroup.com
12	1700Z	12	2100Z	3.5-28 / -	NJQRP Skeeter Hunt	CW	RST, S/P/C, Skeeter number or power	w2lj.blogspot.com/p/njqrp-skeeter-hunt.html
12	2000Z	12	2200Z	1.8-28 / -	Feld-Hell Gridloc Sprint	Dig	RST, S/P/C, Feld-Hell nr, 4-char grid square	www.feldhellclub.org
15	0030Z	15	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
18	6 AM	19	12 AM	- / 10G+	ARRL 10 GHz and Up Contest	Ph CW Dig	6-character grid locator	www.arrl.org/contests
18	0000Z	19	2359Z	3.5-7 / -	Dominican Republic Contest	Ph	RS and serial	www.hi8ud.org
18	0000Z	19	See web	3.5-28 / -	SARTG WW RTTY Contest	Dig	RST and serial	www.sartg.com/contest/wwrules.htm
18	0800Z	19	0800Z	1.8-28 / -	Russian District Award Contest	Ph CW	RS(T), serial or Russian district	rdaward.org/rdac1.htm
18	1200Z	19	1200Z	1.8-28 / 50	Keymen's Club of Japan Contest	CW	RST and JA pref/dist or continent	www.kcj-cw.com
18	1800Z	19	0600Z	1.8-28 / -	North American QSO Party	Ph	Name and state	ncjweb.com
19	1300Z	19	1600Z	3.5-14 / -	SARL Digital Contest	Dig	RST and serial	www.sarl.org.za
19	1800Z	19	2359Z	3.5-28	ARRL Rookie Roundup	Dig	Both calls, name, check, S/P/XE or "DX"	www.arrl.org/contests
20	0100Z	20	0300Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
25	0400Z	25	See web	3.5-28 / 144,440	ALARA Contest	Ph CW	RS(T), serial, ALARA nr, name	alara.org.au
25	0400Z	27	0400Z	1.8-28 / -	Hawaii QSO Party	Ph CW Dig	RS(T) and HI county/island or S/P/C	www.hawaiiqsoparty.org
25	1200Z	26	1159Z	3.5-28 / -	SCC RTTY Championship	Dig	RST, 4-char year first licensed	lea.hamradio.si/~scc/rtty/rtty.htm
25	1200Z	26	1159Z	3.5-28 / -	YO DX Contest	Ph CW	RS(T), serial or YO district	www.hamradio.ro
25	1400Z	26	See web	3.5-28 / 50,144	Kansas QSO Party	Ph CW Dig	RS(T) and KS county or S/P/"DX"	www.ksqsoparty.org
25	1600Z	26	0400Z	3.5-28 / -	Ohio QSO Party	Ph CW	Serial and S/P or "DX"	www.ohqp.org
26	1400Z	26	1600Z	3.5-14 / -	South Africa DX CW Contest	CW	RST and serial	www.sarl.org.za

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

Strays

New Award for DXpeditions

The Cass Award encourages DXpeditions to maximize the number of DXers they work by annually presenting a $1000 prize to the single-operator DXpedition that works the most unique call signs within a 4 week interval. This award is named in honor of Hugh Cassidy, WA6AUD (SK), whose stories in the West Coast DX Bulletin taught a generation of DXers that DX IS! The winner of the 2012 Cass Award will be announced in March 2013.

An "unlimited" award category with a larger prize is under development for introduction in 2013. If you'd like to pledge a contribution, send e-mail to **Contribution@CassAward.com**. To learn more, visit the Cass Award website at **www.CassAward.com**. — *Dave Bernstein, AA6YQ*

2012 ARRL International DX Contest – CW Results

A shakedown cruise for the new sunspot cycle.

Nate Moreschi, N4YDU, n4ydu@yahoo.com

As the sun spits and sputters into Cycle 24, contesters continue to hope for improved conditions on the high bands. Although it is unpredictable, we are currently reaping the benefits of increased solar activity and the 2012 running of the ARRL DX CW contest offers proof.

This year's event offered more selection of usable frequencies during the daylight hours and even some interesting second-night polar openings on 10 meters. With the better propagation comes a potential change in strategy and maybe even hope of stations from the geographically challenged areas creeping closer to those geographically advantaged.

W/VE Single-Op, All Band (SOAB)

KØDQ continues to impress with his unbelievable results in SOAB-HP (High Power). Add another tally mark in the victory column for Scott and another trophy for his host, Woody, WW1WW (NH), who probably has more hardware than most small town hardware stores. Scott distanced himself from the pack with 6.58 million points, just shy of the 6.588M record set from the K5ZD station by W4PA in 2004. Alex, LZ4AX operating at K3CR (WPA) edged out Andy, N2NT (NNJ) for second place by less than 40k points (5.762 to 5.725 million).

This brings us to the topic of being competitive from the West Coast. N2IC (NM), Pat, N9RV (MT), and Dan, N6MJ operating at W6YI (SDG) all made the Top Ten in the W/VE standings; quite an accomplishment when factoring in the geographical advantage enjoyed on the East Coast.

N9RV said that it really doesn't matter for him where he is competing from because he is addicted to HF contesting and he's bound to have fun. "The competition this year within the west, between folks like myself and NK7U, W6YI, and N2IC is another animal completely," Barkey said.

In SOAB-LP (Low Power) Maury, W3EF (MD) soared to the top to take the title. Ed, N1UR (NH), who often dominates the category, battled sickness and still managed a strong second-place finish. Maury scored 3.25 million to Ed's 3.15 million. Despite serious jet lag, Maury was able to stay in the chair for 43 hours to Ed's 38.

Operating with just a handful of watts can be as fun as it is challenging. Bob, K3PH (PA) can often be found at the top of the SOAB-QRP results — 2012 was no different as he earned another top spot finish. He was able to edge out Sean, KX9X (CT, at W1HQ); Doug, W9WI (TN); Gary, N7IR (AZ), and Mike, K8CN (NH).

Scott, KØDQ operated from WW1WW to a first-place finish in the highly competitive SOAB-HP category. [WW1WW photo]

W/VE Single-Op Unlimited

Chas, K3WW and Bud, AA3B slugged it out from Pennsylvania in the popular Unlimited, High-Power category. In the end it was Chas getting the triumph with 6.8 million compared to Bud's nearly 6.2 million. It was a true iron-man experience for Chas who put 48 hours in the chair. Bud put in an impressive 43 hours. The biggest difference in the logs was that Chas had 330 more QSOs and 16 additional multipliers.

The ARRL now offers many awards for Unlimited, Low Power entries — a good incentive for the low power stalwarts to try the Unlimited category. This year Brad, W1NT (WMA) snared the top spot with 1.81 million, followed close by Dan, K2YWE operating as K3AU from Maryland. K3AU actually led the multiplier battle but Brad's 1651 contacts proved to be the difference.

W/VE Multioperator Roundup

The K1LZ superstation cruised to an impressive 8.68 million points to win the Multioperator, Single-Transmitter, High Power (MSHP) category by more than 2 million points and set a new record for W/VE. Operating from the Natick, MA station this year were W2GB, K3JO, N8BO and KB1WKF. In the MS Low Power (MSLP) category, it was the crew at W1TM winning with 1.06 million points. The Multi-operator, Two Transmitter (M2) category was dominated by the talented N3RS (EPA) team of N3RD, W8FJ, NG7M, NA3D, and N3RS with 10.8 million. K5GO (AR) was second with 8.77 million followed by 8.5 from the strong Virginia contingent at W4RM.

The annual Multioperator, Multitransmitter (MM) showdown was no yawner. In their 30th year as an MM entry W3LPL (MDC) edged out the K3LR (WPA) squad by just over 150k points — an incredibly close score considering both stellar teams approached 16 million points. KC1XX (NH) was third with 13.7 million.

Frank, W3LPL has been participating in the event since 1962 (50 years total) and even picked up wins as a single-op just two years in. Frank had this to say about the increasingly competitive MM category:

"The W3LPL team started multi-multi contesting in 1978. Our first USA #1 finish was exactly 30 years ago in the 1982 ARRL Phone DX Contest. I'm motivated by the technical, operating and teamwork challenges of successfully competing in the hyper-competitive multi-multi category. The K3LR and KC1XX teams can always be counted on to develop new and better ways to raise the competitive bar and you never know which of the three stations will finish on top.

"It's great to see the achievements of the K1RX, KM1W, W2FU, NQ4I, NR4M and NQ4I teams. I'm sure they're enjoying the challenges and rewards of multi-multi competition.

Top 10 Golden Logs*

Call	QSOs
K1HT	544
DL1NEO	471
NI1L	464
DL7UMK	420
WB4KDI	390
DJ8EW	373
W5KI	342
N5DY	313
G4HZV	297
ON4CAS	293

*Logs without errors

Sponsored Plaque Winners

Thanks to the generous sponsorship of numerous clubs and individuals, we are pleased to announce the winners of a sponsored ARRL DX CW plaque. The ARRL wishes to thank the plaque sponsors for their continued commitment to the ARRL Plaque Program. Without their support and dedication, the Plaque Program would not be possible. Unsponsored plaques may be purchased by the plaque winner. If you wish to purchase an unsponsored plaque or order a duplicate plaque, contact ARRL Contest Branch Manager Sean Kutzko, KX9X, at 860-594-0232 or by e-mail at **kx9x@arrl.org**. The cost for plaques is $75 (includes shipping).

Plaque Category	Plaque Sponsor	Winner
W/VE Single Operator High Power CW	Frankford Radio Club	KØDQ
W/VE 1.8 MHz CW	Jerry Rosalius, WB9Z	W1XX
W/VE 21 MHz CW	Carl Luetzelschwab, K9LA	N4ZZ
W/VE 28 MHz CW	Green River Valley, IL ARS	W4ZV
W/VE Single Operator Low Power CW	Andy Faber, AE6Y	W3EF
W/VE Single Operator QRP CW	Tod Olson, KØTO	K3PH
W/VE Single Operator Assisted, High Power CW	Harold Ritchey, W3WPG Memorial	K3WW
W/VE Multioperator Single Transmitter High Power CW	Ray Sokola, K9RS	K1LZ
World Single Operator High Power CW	North Jersey DX Association	ZF2AM (K6AM, op)
Europe Single Operator High Power CW	Jim George, N3BB	CR6K (CT1ILT, op)
North America Single Operator High Power CW	Potomac Valley Radio Club	ZF2AM (K6AM, op)
World 1.8 MHz CW	Fred Race, W8FR, In Memory of DL1FF	V31YN (DJ4KW, op)
World 14 MHz CW	Jeff Hartley, N8II	EF8S
World 21 MHz CW	Caribbean Contesting Consortium PJ2T	FY5KE (F6FVY, op)
World 28 MHz CW	W7EW / W7AT	CE1/K7CA
World Single Operator Low Power CW	Sanjay Vig, VA2OP	VP2MMM (N3AD, op)
World Single Operator QRP CW	Jerry Griffin, K6MD	KL7AC
World Multioperator Single Transmitter, High Power CW	John Patterson WCØW/V31TP	KP2M
Asia Single Operator QRP	Sean Kutzko, KX9X	JH1OGC
Asia Multioperator Single Transmitter High Power CW	Yankee Clipper Contest Club	RUØFM
World Multioperator Two Transmitters CW	Frankford Radio Club - K2TD Memorial	CR3L
World Multioperator Unlimited CW	H Stephen Miller NØSM	TI5W
Great Lakes Division Single Operator CW	North Coast Contesters	K8GL
Japan Single Operator Low Power CW	Western Washington DX Club	JI1RXQ
Seventh Call Area Single Operator High Power CW	Willamette Valley DX Club	N9RV
Canada Single Operator Low Power CW	Contest Club Ontario	VA7ST
Pacific Division Single Operator Low Power CW	Central California DX Club, Inc. W6MEL	K7ACZ
North America Single Operator Low Power CW	John Patterson WCØW/V31TP	VP2MMM (N3AD, op)
Hudson Division Single Operator High Power CW	HVCDX & AARA John Naberezny, WE2F Memorial	N2NT
Central Division Single Operator High Power CW	Northern Illinois DX Association	W9RE

W/VE Single-Banders

There may not be a better way to get a feel for a particular band than attacking a contest in a single-band category. Bill, W4ZV (NC) has spent the past few years duking it out on Top Band and owns records on 160 meters and 10 meters but even though this was not a record-breaking event for him, he easily took first place for W/VE with 257k points.

Don, N4ZZ (TN) muscled his way to gold on the 15 meter band with 486k points. He fought off Larry, N7DD from Arizona (477K) and Bill, KVØQ (473K). Brian, N2MF (WNY) cruised to a 20 meter title with 659k, as Doug, VE5MX operated VE6JY (AB) was second with 532k. Dave, NN1N (CT) captained his station to 612k for the convincing 40 meter Single-Band title and made a new benchmark for others to chase by setting a new W/VE record.

Jeff, VY2ZM tackled 80 meters from his impressive Prince Edward Island station for 280k. On 160 meters conditions were more difficult than in years past with a higher maximum usable frequency. That didn't stop John, W1XX (RI) from spending the weekend parked on the band. W1XX finished first among Top Band enthusiasts with 15k points to top Bob, W3GH's 10k points.

DX Single-Op All-Band

Aim the antennas at W/VE and fire away. That's the basic strategy for DX stations competing in any ARRL DX contest. A photo of John, K6AM's operation from ZF2AM clearly shows his Yagis pointed to the US. It certainly kept him busy in 2012 — so busy he tallied 6,493 contacts and 353 multipliers for the top prize and a new North American record in SOAB-HP. John, a regular to the Cayman Islands, nudged Yuri, VE3DZ who operated from 6Y2T.

Also of note was the effort of Andy, P49Y; Valery, RG5A operating TO5X, and CR3A operated by Tibi, OM3RM. Andy had another super performance from P49Y and even had an actual benefit from Mr Murphy who isn't always kind to contesters. Valery finished with 6.3 million from TO5X as Tibi guided the CR3A station to 4.86 million.

Operating with 100 watts on a small expedition has a big appeal. One doesn't have to worry about potential issues such as carrying an amplifier to another country, blowing up switches, etc. Although the tradeoff is a smaller signal it sure didn't seem to hinder the top finishers in the DX SOAB-LP category for 2012. VP2MMM (Alan, N3AD) edged out V31RR (Will, AA4NC) for first place. Alan scored 5.81 million points while Will registered at 4.59 million.

W/VE Region Leaders By Category

Tables list call sign, score and power (A = QRP, B = Low Power, C = High Power).

Northeast Region (New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)			Southeast Region (Delta, Roanoke and Southeastern Divisions)			Central Region (Central and Great Lakes Divisions; Ontario Section)			Midwest Region (Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)			West Coast Region (Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)		
KØDQ	6,581,169	C	K1TO	4,560,348	C	W9RE	4,647,513	C	N2IC	4,921,890	C	N9RV	4,776,480	C
K3CR (LZ4AX, op)	5,762,880	C	N5WR	3,948,846	C	VC3A (VE3AT, op)	4,353,804	C	KØRF (WØUA, op)	3,971,970	C	W6YI (N6MJ, op)	4,447,926	C
N2NT	5,725,440	C	K4RO	2,783,610	C	K8GL	2,717,832	C	KØSR	2,837,100	C	VE7CC	3,003,936	C
VY2TT (K6LA, op)	5,277,090	C	KØEJ	2,777,133	C	VE3TA	2,460,030	C	K5WA	2,549,376	C	K6XX	2,987,580	C
AA1K	4,360,524	C	K4AB	2,733,216	C	N8BJQ	1,915,584	C	N7VM	1,860,516	C	K6NA	1,961,982	C
W3EF	3,258,270	B	AD4Z	2,867,670	B	N4TZ	2,509,386	B	N5AW	2,490,540	B	N7ZG	1,387,386	B
N1UR	3,154,197	B	N4YDU	2,237,103	B	N8AA	2,086,224	B	WØUO	1,433,322	B	K2PO	1,380,744	B
KU2M	1,768,530	B	N2WN	1,433,250	B	NA8V	1,283,808	B	WØETT	511,500	B	WJ9B	833,721	B
K3NK	1,243,221	B	N4TB	1,075,248	B	N9CK	1,137,510	B	W5RYA	510,000	B	N6RV	679,320	B
W1JQ	1,198,218	B	NA4K	953,712	B	KV8Q	853,632	B	NAØN	509,355	B	VA7ST	662,112	B
K3PH	876,018	A	W9WI	766,290	A	K8ZT	337,041	A	KØOU	288,828	A	N7IR	602,712	A
KX9X	801,840	A	N3CZ	499,500	A	KT8K	248,976	A	NZ5A	105,792	A	W6JTI	452,904	A
K8CN	567,750	A	WB4MSG	298,143	A	VE3HG	229,917	A	WEØM	65,136	A	W6QU (W8QZA, op)	318,354	A
N1TM	413,028	A	NO4GA (W4QO, op)	221,781	A	VE3RSA	142,188	A	N5RZ	60,066	A	N6WG	84,900	A
K3RR	296,091	A	AA4GA	213,942	A	WA8REI	121,296	A	NDØC	41,796	A	K7GO	66,150	A

Top Ten by Category

W/VE

Single Operator, High Power

KØDQ	6,581,169
K3CR (LZ4AX, op)	5,762,880
N2NT	5,725,440
VY2TT (K6LA, op)	5,277,090
N2IC	4,921,890
N9RV	4,776,480
W9RE	4,647,513
K1TO	4,560,348
W6YI (N6MJ, op)	4,447,926
AA1K	4,360,524

Single Operator, Low Power

W3EF	3,258,270
N1UR	3,154,197
AD4Z	2,867,670
N4TZ	2,509,386
N5AW	2,490,540
N4YDU	2,237,103
N8AA	2,086,224
KU2M	1,768,530
WØUO	1,433,322
N2WN	1,433,250

Single Operator, QRP

K3PH	876,018
KX9X	801,840
W9WI	766,290
N7IR	602,712
K8CN	567,750
N3CZ	499,500
W6JTI	452,904
N1TM	413,028
K8ZT	337,041
W6QU (W8QZA, op)	318,354

Single Operator Unlimited, High Power

K3WW	6,844,572
AA3B	6,194,445
K5ZD	4,928,085
K2Z (K2NG, op)	4,405,305
K1AR	4,261,959
KI1G	4,241,466
N1EU	3,795,660
N3RR	3,470,445
N1IW	3,196,092
K7NV	3,134,934

Single Operator Unlimited, Low Power

W1NT	1,816,416
K3AU (K2YWE, op)	1,798,374
N4CJ	1,647,153
WD4AHZ	1,644,750
W3KB	1,485,249
N5DO	1,389,087
WW3S	1,368,252
K8JJC	1,301,760
W1MSW	1,009,971
N3QE	939,114

Single Operator, 10 Meters

W4ZV	257,355
NA4CW	99,102
W3EP	55,278
WF2W	46,575
KI6LZ	42,168
K1WHS	37,185
K2PS	34,974
WA9MAG	31,329
AA7DJ	31,320
K7HP	28,704

Single Operator, 15 Meters

N4ZZ	486,465
N7DD	477,276
KVØQ	473,070
WA3A	445,200
K3EL	435,978
WA7LT	256,662
KB7Q	242,424
K7ZA	241,392
W9ILY	229,500
W6AEA	216,216

Single Operator, 20 Meters

N2MF	659,880
VE6JY (VE5MX, op)	532,230
KT9T	364,635
W8TA	360,639
W3FW	330,321
W8WA	323,523
K9OM	302,091
N4IJ	280,500
N8AGU	231,345
KR2AA	140,976

Single Operator, 40 Meters

NN1N	612,054
W3UA	518,814
K9GS	158,496
N6MA	146,163
W2EG	141,450
VE6WQ	132,300
WAØUSA	112,560
K9FY	104,397
K6TA	96,048
K9CJ	62,331

Single Operator, 80 Meters

VY2ZM	280,800
W3NO	51,333
K4FJ	40,596
W4PK	38,454
K3JGJ	33,462
N3UM	23,265
K3TM	22,896
KØKT	20,250
K4YYL	20,130
VE3OSZ	16,128

Single Operator, 160 Meters

W1XX	15,792
W3GH	10,296
W2MF	6,552
W2VO	6,264
K4PI	5,883
K5RX	5,487
AG4W	4,770
K8FL	3,567
K4EJQ	2,730
NØTT	2,079

Multioperator, Single Transmitter, High Power

K1LZ	8,668,728
W2RE	6,625,872
K9RS	6,548,688
NY4A	5,813,280
K8AZ	5,608,440
W3BGN	5,553,735
K2QMF	4,984,122
W7RN	4,934,268
NK7U	4,842,708
NØNI	4,761,600

Multioperator, Single Transmitter, Low Power

W1TM	1,062,432
KU1CW	827,169
N4AU	404,766
VA7DZ	345,519
KØUK	146,880
W6YX	131,175
W3WN	97,785
N5FM	91,770
NØMA	37,026
VE3SAO	9,675

Multioperator, Two Transmitters

N3RS	10,820,976
K5GO	8,779,101
W4RM	8,526,060
KB1H	7,845,525
K9CT	7,290,756
N4GI	6,003,480
W8AV	5,274,414
W2XL	4,911,030
KØTV	4,873,416
W2YC	4,823,226

Multioperator, Multi-Transmitter

W3LPL	15,969,150
K3LR	15,747,228
KC1XX	13,724,835
NQ4I	13,606,920
NR4M	12,690,000
WE3C	12,371,742
W2FU	12,103,710
KM1W	11,343,312
K1RX	9,739,359
W2PV	8,969,268

DX

Single Operator, High Power

ZF2AM (K6AM, op)	6,805,134
6Y2T (VE3DZ, op)	6,736,863
P49Y	6,455,241
TO5X (R5GA, op)	6,342,756
CR3A (OM3RM, op)	4,864,113
HP1WW	4,736,034
CR6K (CT1ILT, op)	4,295,850
6V7S (RK4FF, op)	3,549,186
EF8USA (EA8AY, op)	2,912,904
9A6XX	2,859,480

Single Operator, Low Power

VP2MMM (N3AD, op)	4,819,806
V31RR (AA4NC, op)	4,596,600
VP9/W6PH	4,040,823
EF8R (EA8CAC, op)	3,792,096
J88DR (G3TBK, op)	3,599,730
V25AA (AA9A, op)	3,122,895
CQ3B (OM7JG, op)	2,724,300
J38A (K4LTA, op)	2,180,124
TG8/WØOR	1,292,544
CX9AU	1,219,671

Single Operator, QRP

KL7AC	292,572
LU7HZ	257,397
V31SG (KØUU, op)	230,175
HB9BMY	215,364
JH1OGC	180,621
OK3C (OK2ZC, op)	175,320
LZ2RS	119,547
IZ8JFL	116,064
UU2CW	102,111
JH1APZ	99,522

Single Operator Unlimited, High Power

E7DX (E77DX, op)	2,553,930
SN7Q	2,119,656
S52AW	1,953,744
S59ABC (S51DS, op)	1,837,725
OT2A (ON6CC, op)	1,832,424
HB9FAP	1,819,080
OQ5M (ON5ZO, op)	1,783,404
EF3A	1,591,500
JS3CTQ	1,580,652
S57DX	1,563,660

Single Operator Unlimited, Low Power

DF9ZP (DK8ZB, op)	1,858,080
EC4CBZ	811,647
GIØRQK	768,888
OL6T (OK1DCF, op)	572,670
ES6Q (ES5RY, op)	544,680
JW/LZ2HM	506,814
SP1NY	491,946
S52W	440,484
HA5BSW	438,729
SP5GRM	424,578

Single Operator, 10 Meters

CE1/K7CA	435,060
HK1R	434,478
PY2YU	378,540
LU5FC	356,301
KH7M (KH6ZM, op)	279,096
J39BS	277,713
LU6UO	227,976
LU8EOT	188,100
LW5EE	164,430
LU4VEW	131,670

Single Operator, 15 Meters

FY5KE (F6FVY, op)	478,077
ZD8Z (N6TJ, op)	463,209
CR2X (OH2PM, op)	356,655
CO8LY	298,776
E73W	222,489
EF7X (EA7KW, op)	220,365
S5ØK	210,276
9A5Y (9A3LG, op)	208,860
G5E (G3RAU, op)	202,842
WP3A	193,107

Single Operator, 20 Meters

EF8S	357,717
GM3POI	273,465
SO4M (SP4DEU, op)	224,259
OK7K (OK1GK, op)	209,214
HA7GN	201,492
YT9A	196,470
OL9Z	190,806
GW6W	174,876
LZ5R (LZ1UK, op)	168,858
DK3GI	156,468

Single Operator, 40 Meters

XE2S	249,747
HK3TU	238,596
YU1LA	224,694
CO2JD	186,876
E74IW	183,654
OK6W (OK1MU, op)	179,760
YT7A (YU7GW, op)	175,617
S57Z	175,446
S56X	161,205
9A2UZ	160,272

Single Operator, 80 Meters

CR2A	240,720
CO8ZZ	115,995
HF3R	81,549
CO6CAC	68,238
DJØMDR	55,566
G3P (G3WPH, op)	43,992
S57UN	42,720
YU7AV	41,040
DJ5EU	26,784
EA8ZS	25,830

Single Operator, 160 Meters

V31YN (DJ4KW, op)	49,539
KV4FZ	46,332
M5O (G3LET, op)	19,998
HB9LCW	11,880
OL9A (OK2ZAW, op)	8,712
KP2BH	1,767
JA8NFV	1,512
UU7J (UU1AZ, op)	1,248
SV3RF	975
OM7RU	936

Multioperator, Single Transmitter, High Power

KP2M	6,899,748
V31TP	6,358,680
PZ5RO	5,652,522
KH7X	5,252,742
CS2C	4,742,100
PS2T	4,583,700
C6AKQ	4,545,018
TM6M	4,405,734
CW5W	3,799,194
EE5E	3,480,885

Multioperator, Single Transmitter, Low Power

VP5OU	5,648,457
P49V	5,431,020
TI5N	4,426,392
HC2/W7SE	3,283,686
C6ANM	2,539,278
8P5Y	2,279,400
YU2A	386,136
SN9V	321,825
RK9CZO	54,168
GT8IOM	26,406

Multioperator, Two Transmitters

CR3L	6,788,880
M6T	3,805,620
OM7M	3,555,552
M5E	3,359,295
DM8D	2,637,180
HG7T	2,581,290
4U1ITU	2,376,297
LZ9W	2,265,219
7J1YAJ	2,121,483
RW0CWA	1,655,670

Multioperator, Multi-Transmitters

TI5W	11,504,976
PJ2T	11,070,786
PJ4X	11,035,200
KH6LC	6,962,670
9A1A	4,232,550
JA3YBK	3,624,960
JA1YPA	2,452,989
HG1S	2,442,645
JE1ZWT	2,311,458
RL3A	1,737,723

Andre, KL7AC pounded his way to 292k points for first place in the DX SOAB-QRP battle followed by 257k from Pedro, LU7HZ and 230k from V31SG (Jeff, KØUU). Finishing out the top five were Peter, HB9BMY with 215k and Kazuo, JH1OGC with 180k. KL7AC submitted a log that featured 129 multipliers and 766 contacts.

DX SOU

Braco, E77DX operated as E7DX and promptly secured the top spot in SOU-HP for DX entries. He found conditions to be a roller coaster ride with the high bands being a bit unpredictable on both days. Nonetheless, he persisted and tallied more than 800 QSOs on each of 15, 20 and 40 meters for his impressive final tally. His 2.55 million points was followed by 2.11 million from Kzrysztof, SN7Q and 1.95 million from Karl, S52AW.

Battling the assisted pileups with just 100 watts usually requires patience. DF9ZP (Barney, DK8ZB) was tops for 2012 in SOU-LP by a wide margin. His 1.85 million point total was followed by a distant 811k from Oscar, EC4CBZ.

DX Multiop

The crews at KP2M and V31TP had quite a duel this year. Multi-single efforts can require quite a bit of strategy with band changing limits an there's little doubt that played a role in the tight battle between two talented teams. In the end, KP2M gets to hoist the trophy with 6.89 million and be the proud

Continental Leaders By Category

Continent/Category Name	Call	Score
Africa		
Single Operator, High Power	CR3A (OM3RM, op)	4,864,113
Single Operator, Low Power	EF8R (EA8CAC, op)	3,792,096
Single Operator, QRP	EA8BVP	147
Single Operator Assisted, High Power	ZS6A	19,206
Single Operator Assisted, Low Power	CT3KY	11,214
Single Operator, 80 Meters	EA8ZS	25,830
Single Operator, 40 Meters	5H3EE	12,915
Single Operator, 20 Meters	EF8S	357,717
Single Operator, 15 Meters	ZD8Z (N6TJ, op)	463,209
Single Operator, 10 Meters	EA8AVK	24,030
Multioperator, Two Transmitter	CR3L	6,788,880
Asia		
Single Operator, High Power	JH4UYB	1,708,470
Single Operator, Low Power	JI1RXQ	709,716
Single Operator, QRP	JH1OGC	180,621
Single Operator Assisted, High Power	JS3CTQ	1,580,652
Single Operator Assisted, Low Power	JM1NKT	418,584
Single Operator, 160 Meters	JA8NFV	1,512
Single Operator, 80 Meters	JH1AEP	17,850
Single Operator, 40 Meters	JA6SHL	93,174
Single Operator, 20 Meters	RZØSR	90,312
Single Operator, 15 Meters	JA7FTR	184,509
Single Operator, 10 Meters	JA1BPA	62,769
Multioperator, Single Transmitter, High Power	RUØFM	2,093,976
Multioperator, Single Transmitter, High Power	RK9CZO	54,168
Multioperator, Two Transmitter	7J1YAJ	2,121,483
Multioperator, Multi-Transmitter	JA3YBK	3,624,960
Europe		
Single Operator, High Power	CR6K (CT1ILT, op)	4,295,850
Single Operator, Low Power	DL1QQ	849,930
Single Operator, QRP	HB9BMY	215,364
Single Operator Assisted, High Power	E7DX (E77DX, op)	2,553,930
Single Operator Assisted, Low Power	DF9ZP (DK8ZB, op)	1,858,080
Single Operator, 160 Meters	M5O (G3LET, op)	19,998
Single Operator, 80 Meters	CR2A (OH2BH, op)	240,720
Single Operator, 40 Meters	YU1LA	224,694
Single Operator, 20 Meters	GM3POI	273,465
Single Operator, 15 Meters	CR2X (OH2PM, op)	356,655
Single Operator, 10 Meters	EA4KD	51,552
Multioperator, Single Transmitter, High Power	CS2C	4,742,100
Multioperator, Single Transmitter, High Power	YU2A	386,136
Multioperator, Two Transmitter	M6T	3,805,620

Continent/Category Name	Call	Score
North America		
Single Operator, High Power	ZF2AM (K6AM, op)	6,805,134
Single Operator, Low Power	VP2MMM (N3AD, op)	4,819,806
Single Operator, QRP	KL7AC	292,572
Single Operator Assisted, High Power	XE2X (XE2WWW, op)	156,420
Single Operator Assisted, Low Power	KL1JP	42,558
Single Operator, 160 Meters	V31YN (DJ4KW, op)	49,539
Single Operator, 80 Meters	CO8ZZ	115,995
Single Operator, 40 Meters	XE2S	249,747
Single Operator, 20 Meters	KL8DX	141,588
Single Operator, 15 Meters	CO8LY	298,776
Single Operator, 10 Meters	J39BS	277,713
Multioperator, Single Transmitter, High Power	KP2M	6,899,748
Multioperator, Single Transmitter, High Power	VP5OU	5,648,457
Multioperator, Two Transmitter	KL7WV	1,100,358
Multioperator, Multi-Transmitter	TI5W	11,504,976
Oceania		
Single Operator, High Power	VK2IM	1,059,000
Single Operator, Low Power	KH6FP	117,720
Single Operator, QRP	N7ET/DU7	36,750
Single Operator Assisted, High Power	ZL3IO	1,485,384
Single Operator Assisted, Low Power	YB1ALL	102,414
Single Operator, 80 Meters	WB4JTT/KH6	18,720
Single Operator, 40 Meters	VK6HG	10,476
Single Operator, 20 Meters	4GØLD (DU1XX, op)	12
Single Operator, 15 Meters	KH6CW	135,744
Single Operator, 10 Meters	KH7M (KH6ZM, op)	279,096
Multioperator, Single Transmitter, High Power	KH7X	5,252,742
Multioperator, Single Transmitter, High Power	DU1HR	10,296
Multioperator, Multi-Transmitter	KH6LC	6,962,670
South America		
Single Operator, High Power	P49Y	6,455,241
Single Operator, Low Power	CX9AU	1,219,671
Single Operator, QRP	LU7HZ	257,397
Single Operator Assisted, High Power	PV8ADI	537,570
Single Operator Assisted, Low Power	PY1NX	417,945
Single Operator, 80 Meters	PS7DX	684
Single Operator, 40 Meters	HK3TU	238,596
Single Operator, 20 Meters	PR7AR	113,904
Single Operator, 15 Meters	FY5KE (F6FVY, op)	478,077
Single Operator, 10 Meters	CE1/K7CA	435,060
Multioperator, Single Transmitter, High Power	PZ5RO	5,652,522
Multioperator, Single Transmitter, High Power	P49V	5,431,020
Multioperator, Multi-Transmitter	PJ2T	11,070,786

owner of a new overall DX record for MS-HP. V31TP finished with 6.35 million as PZ5RO tallied 5.6 million. VP5OU could be easily found on the bands from the W/VE side of the event, cruising to the MS-LP triumph with 5.64 million points.

The race for second place in M2 proved to be tight but CR3L out-classed the field with 6.78 million points, nearly 3 million higher than the strong performance from M6T. OM7M was third with 3.55 million, followed by 3.35 million from M5E and 2.6 million from DM8D.

Of the DX multioperator categories, the MM showdown proved to be the closest for the top three participating teams. When the smoke cleared and amplifiers cooled it was the TI5W team earning the triumph and a new record for the category. The team did a hybrid Field Day-like operation taking advantage of an existing 80 foot tower with a 3-element all-band Yagi on top. The crew scored 11.5 million points to top PJ2T (11.07 million) and PJ4X (11.03 million).

DX Single-Band

Single-Band efforts for 2012 produced some real close battles. Starting with an ever improving 10-meter band, Al, CE1/K7CA edged out Jorge, HK1R by less than 500 points (435,060 to 434,078) for a new 10 meter DX record. While Al tallied less QSOs, (2433) he finished with two more mults for a total of 60 and had an impressive error rate of just 0.7%. Jorge had 2518 contacts and 58 mults with a solid error rate of 1.2%.

Fifteen meters was a solid band to bet on for consistently decent conditions to the U.S. from many parts of the world. Larry, F6FVY ventured to FY5KE again this year and mounted an impressive score of 478k for the top spot. He was followed closely by contesting legend Jim, N6TJ who powered ZD8Z to 463k. Both totals beat the old 15 meters DX record.

EF8S (op Mauri, OH2BYS) was a beacon on 20 meters, scoring 357k points for first place followed by 273k from Clive, GM3POI and 224k from SO4M (Piotr, SP4DEU). Despite only having one Yagi working, EF8S still managed more than 2k contacts and 59 mults.

Marco, XE2S took full advantage of being relatively close to the US in terms of geography to sail his station to 250k for the top 40 meter DX spot and was followed by 238k from Cam, HK3TU and 224k from Ivan, YU1LA.

World renowned contester and DXer Martti, OH2BH operated from the Azores as CR2A for a new 80 meter record and got it. His total of 240k was first place in the category followed by 115k from Raúl, CO8ZZ.

Top Band, like 80 meters, also takes a dedicated operator. Gerd, DJ4KW manned the V31YN station for 49k for first place and was followed by 160M enthusiast Herb, KV4FZ with 46k.

Closing

With WRTC 2014 not too far away, expect people jockeying for position for one of the precious team spots to put in big efforts in the ARRL DX CW contest on February 16-17, 2013 — one of the final qualifying events. Be sure to get on and experience the thrill of the event. The sunspots should be more plentiful and potentially at the peak — don't miss it!

Extended Version Online

For more extensive coverage including an explanation by K9LA of the "Saturday Night Special" opening to Asia on 10 meters and a great multiop saga by VE7FO, visit the ARRL website at **www.arrl.org/contest-results-articles**. If you own a smartphone, scan this QR code to go directly to the page.

2012 ARRL September VHF Contest

1800 UTC Saturday, September 8 – 0300 UTC Monday, September 10

Perennial Single Operator, Low Power winner Bob Striegl, K2DRH of Albany, IL will be QRV for another shot at top honors from his well-equipped QTH in EN41. [Bob Striegl, K2DRH, photo]

- Do you want to work stations hundreds of miles away on the VHF+ bands? Do you have a "DC-to daylight" radio with 6 meters, 2 meters or even 432 MHz? Have you ever used those bands? All amateurs, from experienced HF contesters and DXers to newly licensed Technicians, can get in on the fun during the ARRL September VHF Contest! *It's easy!*
- VHF antennas are smaller than their HF counterparts. They're ideal for setting up in the back yard, at a campsite or hilltop. You can even pack them in your vehicle and operate from multiple locations during the contest period. The contest exchange is simply your Maidenhead grid square; learn more about grid squares at **www.arrl.org/grid-squares**.
- If you want to learn more about VHF+ contesting, go to the ARRL's list of VHF clubs at **www.arrl.org/v-u-shf-clubs**. They'll be happy to help you!
- Don't sit on the sidelines this weekend in September… get in on the VHF fun!

Logs must be received by 1800 UTC Wednesday, October 10, 2012.

E-mail Cabrillo-formatted electronic logs to septembervhf@arrl.org.

For complete rules and entry forms scan this code with your smartphone or go online at www.arrl.org/september-vhf

August 2012 Rookie Roundup – RTTY

1800 UTC – 2359 UTC Sunday, August 19

- Digital modes come to the August Rookie Roundup, the contest aimed at amateurs licensed for three years or less. Old-timers work the Rookies and are encouraged to mentor the Rookies in person as well.
- It's easy and fun to get on RTTY; all it takes is a PC, a rig and an interface to connect your PC's sound card to your favorite HF transceiver. If you are new to RTTY, champion RTTY contester Don Hill, AA5AU, has a great beginner's guide on his website at **aa5au.com/rtty**.
- Rookies can compete as Single Operator, or get a bunch of Rookies together at the same station to enter as Multioperator. Up to five Single-Op entries can band together and participate in Team Competition. See the rules for complete details.
- Submit your score summary online using the Rookie Roundup Score submission form within 72 hours. All Rookie participants get a certificate via e-mail.
- Tell us how you did! Submit your story and high-resolution photos to the Rookie Roundup Soapbox page at **arrl.org/soapbox**.
- Complete rules and score reporting can be found at **www.arrl.org/rookie-roundup**.
- See you on the bands!

Joanna Dilley, K6YL, operating the 2011 RTTY Rookie Roundup from The Stanford ARC, W6YX in Stanford, CA. Licensed in 2009, Joanna has since "graduated" from the RR and is now participating in bigger contests. She's doing so well, she earned the Northern California Contest Club's "Most Improved Contester" award for 2011! [Larry "Rebar" Rebarchik, N6DB, photo]

For complete rules and entry forms scan this code with your smartphone or go online at www.arrl.org/rookie-roundup

2012 ARRL International EME Competition

Three weekends of activity and fun!

- Becoming active in EME has never been easier! Many stations are working DX on 2 meters and up with only 100 watts and a single long-boom Yagi. Using CW or digital modes, you too can bounce your signal off the lunar surface and work DX! Certificates awarded to all stations that submit a log with at least one QSO.
- Complete rules may be found at www.arrl.org/contests.
- Log must be received at ARRL HQ no later than 2359Z Wednesday, January 2, 2013. Send electronic logs to emecontest@arrl.org; paper logs to EME Contest, ARRL, 225 Main St, Newington, CT 06111, USA.

The moon at sunrise over the 20 foot dish of Marc Franco, N2UO, of Summerfield, North Carolina. [Marc, N2UO, photo]

Oct 6-7: 2.3+ GHz ■ Nov 3-4: 50-1296 MHz ■ Dec 1-2: 50-1296 MHz
0000 UTC Saturday – 2359 UTC Sunday each weekend

2012 ARRL 10 GHz and Up Contest

August 18-19 (first weekend) and September 15 and 16 (second weekend), 2012
6 AM local time Saturday through 12 Midnight local time Sunday

- One of the most challenging events on the contest calendar, the 10 GHz and Up Contest tests your ability to communicate over hundreds of miles on the microwave bands. Portable operation is not only allowed, it's encouraged! If you're an experimenter, this event is definitely for you! If you're interested, hook up with one of the regional microwave clubs and ask to tag along; there's a list of them at **www.arrl.org/v-u-shf-clubs**.
- E-mail logs to **10ghz@arrl.org**, or send paper logs to 10 GHz Contest, ARRL, 225 Main St, Newington, CT 06111. All logs must be received by 2359 UTC on Tuesday, October 16, 2012.
- Be sure to post your 10 GHz stories, photos and other interesting information about your contest experience at **www.arrl.org/soapbox**. Photos for *QST* consideration should be high-resolution.

Mark Casey, K1MAP, sets up his microwave gear on top of Mt Greylock in FN32 during the 2011 ARRL 10 GHz & Up Contest. [Tommy Sullivan, W1AUV, photo]

2011 DXCC Honor Roll

The DXCC Honor Roll is earned by DX Century Club members who submit confirmation for contacts reached within the numerical top 10 of the overall number of entities on The ARRL DXCC List. There were 341 entities on the DXCC list for this period with 332 being required for the Honor Roll. The period for this list is from January 1, 2011 through December 31, 2011. The boldface number indicates the total current DXCC credits. The number next to the call sign represents an individual's overall total.

Bill Moore, NC1L, ARRL Awards Branch Manager

Mixed

341

4X1FQ/383
4X4DK/394
4X6KA/350
9A2YM/361
9A4A/376
9A8A/349
AA1V/356
AA4H/354
AA4V/363
AA5AT/349
AA5AU/350
AA6G/357
AA6YQ/348
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AA8EY/366
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AB5C/354
AB9V/352
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AI0O/351
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EA4KD/349
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EA8AK/369
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EA8ZS/349
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K7ZD/349
K8AJR/348
K8AV/348
K8CX/356
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K8WWA/349
K8YSE/349
K8ZTT/350
K8ZZU/352
K9AJ/361
K9BWQ/362
K9CW/362
K9EL/354
K9EMG/356
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Why Are We Hams?

Pete Burokas, KL1HB

The gray light of the subarctic winter fell across the face of the tuner as I looked up and watched the needle settle. I live in a small 16×20 foot cabin on the edge of nowhere. But here in the loft I lovingly call my shack I felt truly at home. Daily I would repeat the process of tuning and listening for a signal, at times pondering the question why.

What is the nature of an Amateur Radio operator — a ham? What drives us to spend hours a day, week after week turning that knob that may connect us with a total stranger somewhere in the world? It is hard enough in these days of cell phones, tweets, Facebook, instant messaging and texting to explain to others the allure of Amateur Radio.

When someone asks about the antennas sprouting on your car, it usually takes only a minute to get them blank faced and wishing they had just passed on by. While I was raising my new antenna tower, neighbors stopped by to question why I would want a windmill in my backyard. My explanation would bring a similar response and a "why bother" shrug of their shoulders. At times like these I sometimes re-examine my love of Amateur Radio.

Staying in Touch

My personal story is 56 years in coming. Many fateful steps preceded my first contact and that story we will leave to another time. Suffice it to say I found myself in a remote cabin in Alaska with a 130 mile roundtrip to town where I would be able to call my children. My son Anthony, KB3DVS, was on me constantly to get my license so we could talk on a more regular basis. It took 6 years of his constant comments that if I had a license I could talk to him anytime. Besides, he said, you need it for emergencies.

His gentle prodding moved me to study and finally pass the first two exams and get on the air. Earlier in my life I had tried to balance raising two children, work and keeping my wife happy with studying for the code test — with no success. Here by myself in the wilderness it was still hard to absorb the code but it eventually came. My first contact, with my son in Philadelphia, happened on August 6, 2002. Looking at my log, I see we could barely hear each other with signal reports of 33. The next day we exchanged reports of 55 and had our first great contact.

Contacts and Conversation

I did this with a simple wire and a secondhand TEN-TEC radio running on battery power. With that contact, I was hooked. No more would I have to spend hours at a time on a snow-covered icy road. I just go up to my loft, reached out with my radio and my son or someone else is always there. Of course, at first, I got the bug of chasing down WAS and WAC, but soon found that this was not the driving force that had me returning day after day to the shack. It was the magic I felt after making a contact that led to a good conversation.

Pete's, KL1HB, shack in the Alaskan wilderness keeps him in touch with his family and a world of other hams who are wandering the airwaves. [Tricia Lynn Burokas photo]

So back to the question at hand: What is the nature of an Amateur Radio operator? I believe it is as varied as the number of operators. By its very nature, it is a personal communication between two operators. It is the *how* of the contact that is so varied. Whether it is CW, SSB or digital it is still the same, an exchange of information. One's interest could lie in SSB or digital modes on normal frequencies or one may want to try to bounce a signal off a satellite, meteor shower or, for that matter, the Moon. Others might have a passion for emergency communications, contesting, QSO parties, IOTA, DXpeditions or Field Day. Still others focus on certain bands they feel offer them a challenge, whether it is 6 meters or 160. As for myself, and I am sure more than a few others, it is the act of turning the dial and exploring the bands.

I live in isolation by choice but two or three times a day I climb up to my shack and reach out to the world. I never know what the conditions will be or if I will be able to copy someone. But there is no better feeling than that of finding someone out there who is a kindred spirit and having a great conversation. Later, while writing the entry into the log, I realize there are many more hams just like that one waiting to hear CQ CQ CQ.

Concerned that there is no phone service at his father's remote cabin, Anthony, KB3DVS, urged him to obtain an Amateur Radio license. Pete Burokas was licensed as KL1HB in January 2002 and is a member of the ARRL and the Arctic Amateurs Radio Club (AARC) in Fairbanks, Alaska. Ham radio plays a major role in his everyday activities. He can be reached at **kl1hbalaska@yahoo.com** or through his blog at **kl1hbalaska.wordpress.com**.

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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.

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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).

Bernie McClenny, W3UR, w3ur@arrl.org

DXing from VK/ZL

An Australian's view of down under DXing.

Ernie Walls, VK3FM/VK3CEW

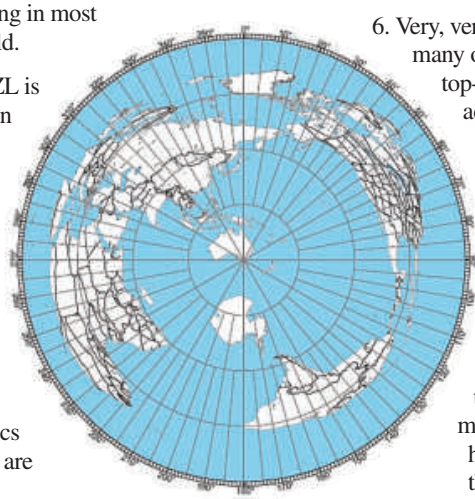
One of the subjects often talked about around the various Amateur Radio discussion groups is the function of DXing from VK/ZL. Sometimes the words spoken are sympathetic to the cause, sometimes critical, sometimes spoken from a point of complete ignorance or not from a point of significant knowledge.

The subject is a bewitching one, because it is quite different from DXing in most parts of the amateur world.

To be a DXer from VK/ZL is one of the toughest jobs in Amateur Radio. Why?

1. VK/ZL is so far from everyone that almost all contacts are, by default, true DX.

2. VK/ZL is not just one DXing area but four: VK2/4/8, ZL, VK3/5/7 and VK6. Propagation characteristics in any one of those areas are quite different from the other three.



Here is what the world looks like from the VK/ZL perspective. [Thomas Epperly, NS6T]

3. It is uncommon for more than two of the four areas to enjoy success in any given situation, as propagation on any given band will be different. Yet all VK/ZL operators are often visualized in the DX eye as "common." Not all DXers or DXpeditions operate with the understanding that to give VK/ZL DXers a chance they must often "return" to that part of the world two or even three times until all four areas have been appropriately worked.

4. There are three time zone changes. Each varies by 2 hours from the preceding area. Even if the DXer on the other end of the contact understands item 3 above, they must also realize that the timeframe to maximize possible success is different, as are some paths, in the four areas. The area encompassing VK/ZL is larger than the continental USA or Europe. It is a big place and understanding this is paramount to a good operational outcome for both ends of the contact.

5. The sum total of dedicated DXers in all four areas is, at a positive guesstimate, 300 hardy souls.[1] On a good day, sailing with the breeze, you may find a couple of hundred or so additional part-time DXers, but that's it for the VK/ZL DXing community. We are not going to be a real threat to any of the big three amateur population areas by taking a lot of the DX's time — if the DX knows the VK/ZL operating rules and "gets on with it."

6. Very, very few DXers, even many of the so-called top-class DXers, actually know much about VK/ZL. They know even less about the VK/ZL propagation vagaries, so they don't know how to "work" the place or how many VK/ZLs they are likely to meet. As an aside, I have lost count of the times I needed to point out to a DXer that VK is most definitely not OE or that we don't have kangaroos wandering around our cities and towns.

I have sat in my shack for hours listening to a DX station with a 59 (599) signal, who never called for or allowed in any VK/ZL. Finally, with his signal now at a miserable 33, he calls for the VK/ZL and may or may not work a handful of stations from one of the four areas.

7. It is interesting to experience how often either casual DX or sometimes big-time DXpeditions operating from Southeast Asia or the central Pacific try to ignore or limit VK/ZL calls on the basis that "they can always work this location so we will place them on hold and work them when we have time." They simply fail to understand that propagation does not always favor VK/ZLs working some of the nearby areas. As an example, it took the author almost 30 years to work T31 (East Kiribati) on 10 meters even though we are, almost, Pacific neighbors. When there were times I could have worked them, I wasn't in the shack and vice versa.

To be a DXer from VK/ZL is one of the toughest jobs in DXing.

8. Until very recently, legal power limits in both countries also disadvantaged the VK/ZL operator. The limit in ZL being 500 W and in VK 400 W. Fortunately, great work by the ZL amateur community ended with them being allowed a kW — embarrassing the VK government communications machine into sudden and somewhat unexpected action to follow suit and allow, on a trial basis, a similar power level.

DX Differences

Working DX broadly covers three methods: ragchewing, chasing DX casually and serious DXing, the latter specifically working the resident rare one, the casual rare one or serious DXpeditions.

Ragchewing is the easiest. It is truly a random and personal experience and not constrained by time or overburdened with demand. If you don't work each other today, you can do so tomorrow, or next week, or month, or whenever. You get to talk to those you can actually hear at the time and who you know are ready and happy to hear from you — or anyone — since they don't have a whole heap of folks calling them. They want to ragchew as well, so you have two parties who, at that point in time, have a common goal. You get to talk to hams who actually want to talk back to you. It is a mutually desirable situation. Sadly, it doesn't involve "rare" DX, except on "rare" occasions.

Chasing DX is harder because the DX doesn't necessarily want to talk to you. He really wants to talk to anybody, anywhere and there are always more of "them" than there are of "us." For most, if not all, times "they"

[1]The total number of licenses in VK/ZL is approximately 20,000. When you deduct multiple call signs, repeaters, beacons, the inactive and those not interested in DX, the result is about 300.

Most DXers around the world have worked Mike Bazley, VK6HD, from Western Australia. Over the years he has worked all 340 current DXCC countries for a grand total of 369 countries. On Topband he's got 260 confirmed at the DXCC Desk. [photo courtesy Mike Bazley, VK6HD]

are closer. If the DX is calling for specific areas, like NA, EU or JA, things just get a great deal harder. So you often do a lot of waiting because the DX station doesn't actually hear you.

The VK/ZL DXer is often left to the mercy of the operating habits of that particular DX station. Does he know when propagation is best toward a potential contact? Does he know which way to point, whether long path or short path? Will he stop occasionally and call for VK/ZLs? Will he try to run them if a VK/ZL should happen to bust the regular pile, on the basis that, if you can hear one VK/ZL, chances are you will hear more?

In this situation, breaking the pile is sometimes incredibly difficult. The DX station is, most times, a hardy individual. But he can only work one band and mode at a time. He is alone to battle the throng, just one set of ears with one radio; you know what I am trying to say. He is doing his best and very often his best is truly amazing. How often can he be expected to listen for VK/ZL stations that may be very far down in the mud? VK/ZL stations often don't have many colleagues calling to help alert the DX that they can play in the game and will work him, if given the chance.

DXpedition Difficulties

Working DXpeditions is the third of the DXing variants. They are there for a predetermined but always short period and are always rare to someone, somewhere. For these reasons, they always have a pile of DXers who want to work them and they must do so within the time constraints of the DXpedition. DXpeditions on the other hand usually call for specific areas regularly as a means of controlling the pile and treating everyone equally.

They call for EU, NA or JA, but rarely do they inquire if there may be a VK/ZL lurking in the group. When they do, it is surprising how often they don't realize the propagation is unsuitable. For example, calling VK/ZL at 0300 UTC is not a very productive idea but I have heard a lot of DX try.

One of the operating habits now regularly displayed by VK/ZL DXers is to call the DXpedition irrespective of whether he is calling for a specific area or not. Now, this may well be downright rudeness by the VK/ZL, and will certainly be seen as such by some DXers, but VK/ZL stations have found that if they wait for a specific VK/ZL "call to arms" they might wait a very long time, quite often until well after propagation has peaked. So, the ever increasing mode of DXing for the generally modest VK/ZL stations is — if you can hear 'em, call 'em.

Ernie, VK3FM, and his spouse Jan in the VK3FM shack. He has 329/334 (current/total) confirmed in the ARRL Mixed DXCC standings. [Ernie Walls, VK3FM, photo]

Now, I do feel somewhat embarrassed in admitting this frowned upon DXing tactic (generally employed en masse by the EU throng, to the detriment of almost everyone) but let me at least try to establish a defense here. I don't want to embarrass Martti Laine, OH2BH, who, in my opinion, is the best DXer I have personally come across, but on numerous occasions I have sat in my shack listening to Martti working the world or wherever at a hundred miles an hour when, without warning, he will call for "any VK/ZL." You don't get long to respond and if there is no response inside a minute, he will move on. But if there is even a trickle of VK/ZLs returning, he will often stay with them until the job is done.

What is my point? Well, usually the job is done and dusted by Martti in less than a few brief minutes. Then he moves on, until the next time. So there is never a big time investment in contacting VK/ZLs and they are a scant interruption to making contacts in the area that was being called.

Duncan McMahon, ZL3JT, of Christchurch, New Zealand has been active since March 1990 and is active on SSB, CW, PSK and RTTY on HF and 6 meters. He's a member of the DXCC Honor Roll #1 club with 340/345 (current/total) confirmed in the ARRL Mixed DXCC standings. [photo courtesy Duncan McMahon, ZL3JT]

The Silver Lining

You may think that the poor old DXer has all the problems of the DXing world on his shoulders and no advantages over others — not so. It is very rare for us to create the level of interference with each other as is normally generated by NA, EU or JA piles. We simply don't have that problem. There are times when propagation favors us against almost all others, often brief, often unreliable but always there — if only both ends of the potential contact were so aware. We are often a wanted DX, because there just aren't many VK/ZLs about and because many DXers realize that working us is almost the antipodes of DXing — we are farther away from them than most. Also, we are just plain nice folks. Well, I like to think so!

So, what is it that I am I trying to say? Well, that it is not very hard to work VK/ZL on most occasions and if you remember to try, and do so methodically, the exercise will take very little time out of your DXing schedule.

Finally, what is my advice to all DX operators and DXpeditions? Well, deciding to work VK/ZLs when you actually hear them is not a massive DXing impediment to an otherwise smooth operating process. Thus, it is highly recommended.

Ernie Walls, VK3FM, was licensed in 1979 and is a proud member of his national association the Wireless Institute of Australia (WIA), as well as the ARRL®, RSGB and NERG. Since retirement in 2001, he spends a good part of most days chasing DX from his modest station in suburban Melbourne. He chases all types of DX, but principally band and mode fills and IOTAs. He has 334 confirmed in the Mixed DXCC standings.

Ernie can be reached at 19 Ledbury Cres, Bundoora, Vic, 3083, Australia, **vk3fm@wallsy.com.au**.

Jon Jones, NØJK, n0jk@arrl.org

OH1VR/VP9 Makes First Bermuda to Finland 50 MHz Contacts

Seppo, OH1VR, and Zaba, OH1ZAA, tell the story of their early May DXpedition to VP9GE's home in Hamilton, Bermuda.

Seppo Sisatto, OH1VR

Our small scale Bermuda May 7-13 DXpedition (by OH1VR and OH1ZAA) evolved into an unexpected climax on May 10 — the 50 MHz band opened up for half an hour between VP9 and OH. As a result of this six OH stations got a new country in their logs. Here's how it happened.

We arrived in Bermuda on Monday evening, May 7 and quickly set up the stations at the spacious condominium provided by Ed's, VP9GE, ham-friendly rentals (**vp9ge.com**). We were on the bands 2 hours after arriving on the main island. Tuesday afternoon we also got a 5 element 50 MHz antenna set up and commenced a keen activation of the band in question, which turned out to produce solely the familiar hiss on the listening breaks. Zaba, OH1ZAA, got a few contacts to the US East Coast but that was about all (apart from spots by FG4NN and KP2HC on the back of the beam). We kept the antenna mainly on Europe, but results were nil there and for South America, which we thought would be an easier "reach out."

On the HF bands the pileups were almost continuous, though things calmed down somewhat after a vivid start. Thursday May 10 arrived, the third full day of our DXpedition. Ed, VP9GE, and Zaba, OH1ZAA, went off to Hamilton and I kept monitoring the bands, having already visited the city on previous VP9 trips. The HF bands were kind of "lazy," so I decided to lay an eye onto 6 meters. I spotted myself on the cluster at 1527 UTC while mentioning my calling to Europe on 50.103 MHz.

Things Get Hot

A couple of calls went out and then things started to happen. The signal of Reijo, OH3XA, emerged suddenly out of the noise and we quickly exchanged reports. After him came OH2ZH, OH3UU, OH3BYZ, OH2ZZ and then quiet following the string of five initial contacts, 20 minutes later OH3FK was worked. At that point, the flags were flying high in Bermuda.

My rig was an Elecraft K3 with a PR6 preamplifier. The beam was a 5 element Yagi [M^2 6M5X that I had left at Ed's — *NØJK*] 10 meters over ground (see Figure 1). It was a very modest setup. What about the other side of the path? How did the worked stations experience the opening? Let them speak for themselves. Reijo, OH3XA, had the honor of making the first OH-VP9 contact from Finland on 50 MHz.

Reijo, OH3XA: Based on the cluster spot I turned my antenna westward and I heard you immediately with a good signal at 1529 UTC. The contact was established on the first call. Soon the other OH's started to call, whoever happened to be on the spot. The opening stretched to 1602 UTC. The OY-beacon was strong then. Rigs: ICOM 756PRO2 + PA and 2 x 8-el Yagis at 42 m height.

...Reijo, OH3XA, emerged suddenly out of the noise and we quickly exchanged reports.

Figure 1 — Here are Ed's, VP9GE, 6 and 2 meter beams against the Bermuda sky. [Ed Kelly, VP9GE, photo]

Timo, OH2ZH: I got the info from the cluster, and when I tuned the rig on the frequency, there you were! My rig: ICOM 756PRO3, power 70 watts, antenna DK7ZB / 6-el/ 7 m boom (its height is 27 m over ground). In Finland it seemed as if all the worked stations were East of Tampere, as for example Reiska OH1TN did not hear even a single peep.

Risto, OH3UU: Thanks for the blast! I was on 3699 kHz when Timo reported about the opportunity to work VP9. I moved very skeptically to 50 MHz, but surprise, surprise: OH1VR/VP9 came in Q5. The S-meter rose to S5 on an empty band. The signal was readable at least during 20 minutes, while I was listening to the action. Only when the signal started to decline, I hit my forehead and lamented that I had not recorded my QSO. So finally I recorded OH1VR/VP9's weakening transmission. Rig: Elecraft K3 100W, 4-el SteppIR at 37 m.

Veke, OH3BYZ: Hello Seppo. By the way: nice contact! Here a FT-847 as the rig, and a 5-el Tonna as the antenna, 18 m over ground. Output power was about 30 watts. I tried many times before Risto OH3UU but the QSO did not materialize. However, during Risto's QSO the meter jumped to 559 - 569 and then I knew that it was going to work out well!

Vili, OH2ZZ: I heard on 3699 about others hearing you, and I moved to 50 MHz. There you came in fine. I have an FT-2000D, 150W, 2 x 5-el Yagis.

Pekka, OH3FK: It was an unbelievable happening! Thanks very much! The signal was solid and first I accidentally tried to manage it on the rear of the antenna. It was nerve-breaking to wait for the

slow turning of the antenna. It took 3 minutes to get to the right direction, but fortunately the opening lasted. You came in nicely with 559 on a totally interference-free band. The antenna is a 6-el on a 7.3 m boom and the IC-706 is fed by a battery. Due to the low voltage the power output was 60 watts, but thanks to your sharp ears it was enough. The height of the antenna is 13 meters and the QTH right in the middle of Vanajavesi.

Another story is the facial expression and comments of Zaba, OH1ZAA, when he returned after a couple of hours from the Hamilton tour. Initially he did not believe that I had just worked OHs on 50 MHz.

It has been proven again: 6 meters — The Magic Band!

[This opening was likely multihop E_s, as the distance is around 6700 km. The footprint was very small in Finland. The 6M5X Yagi at VP9GE has a clear over the ocean path toward Finland at 34° azimuth. — *NØJK*]

T6MO Afghanistan Update

Eric, K9GY/T6MO (MM21) heard the SV1SIX/b on May 30 at 0837 UTC. Initial RST was 439, which improved. The distance is around 3700 km and likely multihop E_s. He also worked A92IO at 1533 km on May 1 at 1253 UTC on 50.110 MHz SSB with a 55 report followed by CW at 1300 UTC receiving a 599.

On the Bands

50 MHz. "Goodbye TEP, hello E_s" — *Bob, N6RW*. May was a transition month in the northern hemisphere, with propagation going from Transequatorial Propagation (TEP) and sporatic E (E_s)-TEP to seasonal mid-latitude E_s as the days got longer. TEP declines as the sun moves farther north from the geomagnetic equator, but E_s increases with a peak around the Summer Solstice. Dave, N3DB, started May 1 with "E_s to J6, FG, FM, HI & one E_s link/TEP to LU6QI." NWØW (EM47) and NØJK/m (EM28) logged XE2NBW (DL95) around 1600 UTC. VP9GE (FM72) noted strong single-hop E_s to Florida and eastern Canada the evening of May 2. On May 3 E_s from N3DB to CO, 8P and 9Y, and E_s-TEP with four LUs and three CEs. Tim, NWØW (EM47) worked 9Y4D at 1855 UTC via multihop E_s. CE3RR (FF46) went into KØGU's log at 2340 UTC, E_s-TEP. May 4-7 Peter, PP5XX, was at PYØFM (thanks W9VA).

Wake Island. Fred, KH7Y (BK29) heard the WA2YUN/KH9 (RK39) beacon on 50.014 MHz 599 for 3 hours on May 7. The following evening, May 8, Fred worked WA2YUN/KH9 at 0523 UTC for his 6 meter country number 78! He also worked JA1BK and a few other JAs. The Wake Island beacon was in again to KH7Y May 9 from 0315-0515 UTC.

"6 Meters Open to Europe and North America at the Same Time!" — *JL8GFB*

May ended with a remarkable opening from W6 and W7 to Japan, and Japan to Europe. K6QXY worked JL8GFB, at 0605 UTC. JL8GFB then worked SM5CEU and W6BX at 1730 UTC. That morning there was a long lasting opening between Europe and North America. Tim, NWØW (EM47) worked LZ2WO (8909 km), LZ2HM, F8DBF, F8DZY, F8GGD, SV8MQP, SV1DH, YO3DDZ (8865 km), UXØUN, UT3UA, YT3DX and ISØGQX between 1404-1703 UTC. Tim said most were 559-579 and he was running only 200 W.

LZ2WO was worked by KØAZ (EM37), W5KI (EM36), K9IL (EM56), N5DG (EM20) and the East Coast. It is unusual to have a deep European opening this early in the season.

May 15 W9FF (EN40) caught an E_s-TEP link to Argentina. Roger worked LU9DO and LU8EML at 2014 UTC. "They just jumped out of my speaker. I was sitting here and there they were. KA9CFD (EN40) worked four of them, I could only hear the first faintly and we are only 30 miles apart. It was a very brief opening."

A transatlantic E_s opening was noted by K1TOL, ME; K1SIX, NH; N3DB, MD, and VE1SKY to CT1FFU, CT8/KØRUI, CU1CB, CU1EZ, CU3EQ and the CN8IG/b, CS5BLG/b around 2100 UTC May 18. AA1VL worked CU1EZ with "a 6 Meter loop tossed up in a tree."

May 19 was one of the best (and last) E_s-TEP openings to South America from the Midwest (see Figure 2). LUs were worked by KF6A (EN73) and stations in W2, W3 and W9. The WZ8D/b (EM89) was spotted by LW3EX at 2008 UTC 599! Bill, KØHA (EN10) worked LU1DMA (GF05) at 2008 UTC.

Figure 2 — North America, South America and the Caribbean all got in on the May 19 6 meter action. [DXSHERLOCK]

After seeing Bill's spot, I went out portable with my 2 element Yagi in EM28. Initially I heard no signals other than the WBØRMO/b (EN10). I was about ready to quit when at 2105 UTC, faint SSB appeared on 50.110 MHz. It was LU8YD, who came up and gave me a 5×5 report at 2108 UTC. LU8YD is in grid FF51 western Argentina near Chile, 9022 km away. Alex, LU8YD, e-mailed he was running just 10 W and a 5 element Yagi! About 15 minutes after I worked Alex, strong single-hop E_s appeared to Florida, W3 and W7. The E_s opening continued well after dark. Rick, WØRT (EM27) worked a busy KCØW in rare DN86, VE4EAR (EN19) and VE5MX (DN89). WW3ZZ (FM18) reports E_s contacts May 21 with stations in KS and NE.

A strong, stable E_s opening from Hawaii to California occurred on May 22. Bob, K6QXY, "first spotted the KH6HI/B at 2157Z and I finally woke Bert up. It was quite strong at first then went into a fade. Conditions seemed better to the south and north of me. Then ~2300 UTC the KH6HI/b was back to 599. I worked both Bert, KH6HI (BL01) and Doug, KH6U (BL11) on SSB. We talked for over 15 minutes. Then a few other locals worked them. The KH6HME and NH6P beacons were not in." The footprint of this opening in Hawaii was small as KH7Y (BK29) heard nothing.

May 23-24 brought more single-hop E_s openings. Louis, W5DPT, worked into Florida from Texas as W5DPT/m on CW. He uses a 2 meter ⅝ wave whip for the antenna. It is about ¼ wavelength on 6 meters and a quick way to operate mobile on 6. Also on the 24th, Lefty, K1TOL, worked ZD7VC on 50.110 MHz SSB at 1829 UTC. Lefty heard the ZD7 and ZD8 beacons May 22 and e-mailed Bruce, ZD7VC, to look toward North America. "I was getting coffee and feeding the two cats (with the radio on 50.110 and beamed 117 degrees as soon as I got

home from work), I heard a weak 'voice' on .110. It did not sound 'British,' so I slowly sipped my coffee and ambled into the shack to see who it might be. As I walked in, I heard 'CQ, CQ from ZD7VC, ZD7VC.'

Gulp!

"I grabbed the mic. and dropped in my call — but still thinking I must be 'imagining' things!

"Bruce came right back in a 'ho-hum' manner and said 'Oh, hi Lefty. Nice to hear you today.'

"We chatted for a while as he peaked near S-9....nobody broke in. My 6M DXCC #184.

ZD7VC e-mailed Lefty "WOW...in 12 years you're the first stateside station that I have worked (on 6M), perhaps you haven't made any really juicy history but it counts for something I reckon."

The Saly Radio Club station, 6V7SIX, in Mbour, Senegal popped in to North America Saturday afternoon May 27. They worked as far west as KØGU (DN70) at 1933 UTC and were heard by WØWOI (EN22) and NØJK (EM28). KØGU notes he had an EN61 beacon in loud when he worked 6V7SIX. Tony, N8WAC, was one of the lucky stations to make a contact. "My contact took place with 6V7SIX at 20:24 UTC on 50.115 USB. Signal reports were 5×1 both ways."

May 28 NWØW heard ON4IQ at 1740 UTC. Ed, VP9GE, logged J69MV and PV8AZ. Dave, N6AN, at the Cal-Tech club station W6UE worked PV8ADI at 7000 km. On May 30 there was a major European opening from Florida, Texas and the East Coast. Dave, N9HF, in EL99 logged MM, CT and an ISØ. From Bermuda, Ed, VP9GE, worked CT1, CU2, EA, I, ISØ, IWØ, MW and S5 around 1530 UTC. Ken, N4UK (EM92) reports working 58 grids, 23 states and 8 countries from May 20-31. He runs 100 W and a halo at 20 feet.

144 MHz "Rare Midwest Tropo Opening to Colorado and Wyoming."

A rare tropo opening occurred on Saturday morning May 5 permitting contacts from IA, KS, MO, OK to CO, western NE and WY. Driving to work I heard the NØYK beacon (DM98) at 144.288 MHz 599 (see Figure 3). AB5UB (EM26) chatted with NØYK (DM98). JD, NØIRS (EM29) was pleased to log WA7KYM (DN71) for his state #43; WFØN (EM28) also worked the rare Wyoming station. KFØM (EM17) said WA7KYM was "very loud" and KØGU was even stronger on 432 MHz than 144. John worked WDØBQM (DN81) at 1528 UTC. K5SW (EM25) found WA7KYM for his best DX. From Colorado, Jay, KØGU (DN70) worked:

Figure 3 — A view from the top of the NØYK beacon (DM98) looking out across the western Kansas plains. [Chad Wasinger, NØYK, photo]

1522 UTC	KFØM	EM17io	744 km
1523 UTC	NØMST	EM27qa	982 km
1526 UTC	KB5MR	EM25av	948 km
1559 UTC	W6ZI	EM26bi	925 km
1602 UTC	K5SW	EM25hr	1001 km

Jay observed, "Tropo almost always stops just short of the Colorado border. I can only remember three other openings since 1995 and I missed two of those. Just wish I had gotten up earlier. Got up a little after 1500 UTC (9 AM) and noticed the NØLL/b very loud on 6M. It took me a few minutes to add 2+2 as I've never seen that effect on it. When I first got on I was heard in EN22/32 but too much local interference to even realize I had callers." Tropo is rare in Colorado and Wyoming due to most inversions being around 3000-5000 feet ASL. Colorado hams are often above the inversion.

From Duane, WA7KYM, Wyoming: "My QTH is at 6373 feet ASL. I check the beacons from Kansas most mornings around 1400 UTC. On Saturday May 5, NØLL's beacon on two meters was extremely strong. I knew at that point the band should be open."

Another unusual aspect of the May 5 opening was it "crossed a dry line" in western Kansas, which usually blocks tropo. At the time the tropo opening was in progress, the Eta Aquarids meteor shower gave 1-2 minute "blue whizzers" to many on 2 meters. This shower is dust from Halley's Comet. N4QWZ (EM66) worked W6OAL (DM79), WA7KYM (DN71), KØOJ (DN70) and KØRI (DM78) on random SSB meteor scatter. (Thanks *205MorningReport*)

May 25 tropo from old Mexico across the southern states. KX4R (EM73) worked XE2OR (DL98), over 1000 miles away at 1345 UTC. Todd, N4QWZ (EM66) logged XE2OR at 1401 UTC. On May 26 at 0800 UTC Jeff, K1MOD (EN40) received analog TV from Monterrey, Mexico at 1861 km. The morning of May 27, a strong narrow duct formed from KS, MO, OK to IL and WI. KDØR (EM18), K5SW (EM25), NØIRS (EM29) and NØJK/m (EM28) worked K2DRH (EN41). NØJK heard the WD9BGA/b (EN53) for over 4 hours on a whip.

222 MHz. WA7KYM (DN71) worked NØIRS (EM29) with 5×2 reports May 5. W3UUM (EL29) logged W6ZI (EM26) and K5SW (EM25).

432 MHz. NØIRS (EM29) worked WA7KYM (DN71) on May 5 with 5×5 signals. KFØM (EM17) put KØGU (DN70) in his log. On May 24 Sam, K5SW (EM25) worked XE2OR (DL98) on tropo at 1402 UTC for his first "Mexico on 70 cm."

1296 MHz. WA7KYM (DN71) worked WØLGQ (EN21) on May 5 and K5SW worked WBØJQQ (EM39) for his grid #64. On May 25, Vic, WB4SLM (EM82) worked N4TUT (EL98). W3UUM (EL29) worked K5SW and W6ZI May 26 and 27 NØIRS (EM29) worked K2DRH (EN41).

EME. On May 1, NDØB in ND gave G4IGO his state number 50 on 6 meters. W5UWB (EL17) worked W7MEM on his moonset May 13 on 222 MHz. "I am using a single M^2 17 el (5wl) and Mark has four 17 el. I was his first Texas contact on 222." On May 29, Fred, KH7Y, gave Howard, AE3T, his state #50 on 144 MHz EME. Howard relates, "Thanks for a wonderful experience and all of your efforts to get back on 2M EME to help a few of us out with #50. My birthday is on Thursday and this was a great gift. It has taken me 47 years on and off to complete WAS on 2M. What a thrill for me!" N9HF also worked KH7Y for his state #50 on 2 meters.

Here and There

The "6 Meter First List" and VHF/UHF standings are managed by Sean Kutzko, KX9X. Sean posts updates "on or about the first of every month" on the ARRL® website. You may e-mail updates to **standings@arrl.org**.

I was saddened to learn that Gene Zimmerman, W3ZZ, passed away June 3. Almost exactly a year ago, Gene asked me to become editor of this column. He was a good friend and mentor. More next month about Gene's life and his contributions to "The World Above 50 MHz."

Special Events

Maty Weinberg, KB1EIB, events@arrl.org, www.arrl.org/special-event-stations

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jul 21-Jul 22, 1019Z-1322Z, KA3RKW, Halifax, PA. Halifax Radio Club. Halifax on The Air (All Halifax Towns). 14.260 14.200 7.260. QSL. Halifax Radio Club, Terry Snyder, PO Box 355, Halifax, PA 17032. Contact Halifax cities and towns in the USA, England, and Canada. For QSL info see our web site **www.HalifaxPaRadioClub.org**, or KA3RKW on QRZ.com You may add your Halifax by contacting Terry at **HalifaxOnTheAir@gmail.com; www.HalifaxPaRadioClub.org**

Jul 24-Aug 6, 1509Z-1509Z, WØN, Ashland, NE. 3905 Century Club WAS/DX Nets. 3905 Century Club Net 2012 Eyeball. 7.188 7.046 3.902. QSL. Ray Myers, 204 Turf Ct, Saint Louis, MO 63119. **www.3905ccn.com**

Jul 26-Jul 31, 0000Z-2359Z, K8D, Midland, MI. Art Peters. 75th Anniversary of DCECU. 14.275 14.070 14.035. QSL. Art Peters / K8D, 139 Ashman St #500, Midland, MI 48640. All QSOs will be QSL'd via LoTW. Paper QSLs will also be mailed for every contact. At this time operations are planned for CW, PSK, RTTY, and SSB on 80-10 m. **www.dcecu.org**

Jul 27-Aug 4, 0000Z-2359Z, KB3WBE, Summit Station, OH. Shooters Amateur Radio Club. Camp Perry National Match. 14.261 7.213. QSL.* SARC, PO Box 147, Summit Station, OH 43073. *Scheduled frequencies 14.261: 1600Z-2200Z, 7.213:2200Z- 0400Z, or until the band drops out. QSL requests must be received on or before Sep 30, 2012.* **piccolo834@gmail.com**

Jul 28-Jul 29, 1200Z-2200Z, KC2YYL, Sanborn, NY. Niagara County Amateur Radio Events Services Station. Niagara County Community College's 50th Anniversary Celebration. 40 m. QSL. John Titta, 1460 Staley Rd, Grand Island, NY 14072. **kc2yyl.net**

Aug 3-Aug 5, 0000Z-2359Z, W9I, Cloverdale, IN. Indy Hams. Ernie Pyle 112th Birthday. 21.060 14.060 7.030; HF on weekend. Certificate & QSL. Brian Murrey, 47 Grassy Dr, Whiteland, IN 46184.

Aug 3-Aug 5, 1400Z-2300Z, K7K, Beaver, UT. Cove Fort Amateur Radio Club. Cove Fort Days. 14.250 7.272 3.987 146.52. Certificate. Alan Bryner, KK7UD, 4021 North 500 West, Ogden, UT 84414. **nu7x@arrl.net**

Aug 3-Aug 5, 2300Z-2200Z, XL31812, Amherstburg, ON. Amherstburg Amateur Radio Club. War of 1812 200th Anniversary. 14.150 7.200 3.760. QSL. David Beckett, 52 County Rd 10 (Middle Sideroad N), Amherstburg, ON N9V2R9, Canada. **va3arg.arcservice.ca**

Aug 3-Aug 6, 2000Z-1500Z, W1T, Gloucester, MA. Cape Ann Amateur Radio Association. Thacher Island Activation. 21.040-21.065 14.030-14.035 7.040-7.065 28.400 14.250 14.070 7.185 7.035. QSL. Cape Ann Amateur Radio Association, 6 Stanwood St, Gloucester, MA 01930. **caara.net**

Aug 4, 1400Z-2330Z, KE7NO, Bonner, MT. Potomac School and Community. Potomac School/Pioneer Days. 21.340 14.305 7.210 7.055. QSL. KE7NO, 5330 Twin Creek Rd, Bonner, MT 59823. 100th year of education within the school and of the community of Potomac, Montana. **www.potomacschoolmt.us**

Aug 4, 1700Z-2130Z, WØIKE, Red Wing, MN. Hiawatha Valley Radio Club. River City Days. 147.300 21.300 7.200. QSL. Bill Eichenlaub, 1966 Launa Ave, Red Wing, MN 55066.

Aug 4-Aug 5, 1200Z-1900Z, KC2YYL, Youngstown, NY. Niagara County Amateur Radio Events Services Station. International Lighthouse-Lightship Weekend. 40 m. QSL. John Titta, 1460 Staley Rd, Grand Island, NY 14072. *From Fort Niagara Lighthouse.* **illw.co.uk** *or* **kc2yyl.net**

Aug 4-Aug 5, 1200Z-2359Z, W8AL, Canton, OH. Canton Amateur Radio Club. Annual Pro Foot Ball Hall of Fame Festival. 28.365 21.365 14.265 7.265. Certificate.* Roger Gray, W8VE, 3506 21st St NW, Canton, OH 44708. **www.w8al.org**

Aug 4-Aug 5, 1300Z-1800Z, VE3WCD, Port Colborne, ON. Niagara Peninsula Amateur Radio Club. Canal Days Marine Heritage Festival. 28.250 21.250 14.250 7.250. QSL. Niagara Peninsula ARC, PO Box 20036, Grantham Postal Outlet, St Catharines, ON L2M 7W7, Canada. **www.nparc.on.ca**

Aug 4-Aug 5, 1400Z-0400Z, K1CG, Port Angeles, WA. Coast Guard CW Operators Association. US Coast Guard 222 Birthday. 21.327 21.052 14.327 14.052 7.227 7.052 3.827 3.552. QSL. Fred Goodwin, 424 N Bagley Ck Rd, Port Angeles, WA 98362. *K1CG will be operated by several different stations across the country starting on the East Coast and moving west.*

Aug 4-Aug 5, 1400Z-2000Z, W9B, Sheboygan, WI. Sheboygan County Amateur Radio Club. Sheboygan Brat Days. 21.350 14.275 7.275. Certificate. Robert Durfee, 924 Lincoln Ave, Sheboygan, WI 53081. **www.w9vcl.com**

Aug 7-Aug 8, 1000Z-0100Z, W2H, Wildwood, NJ. Southern Counties Emergency Radio Network and the 1900 Contest Club. National Lighthouse Day. 14.260 7.190. QSL. Hal Fisher, 247 Palatine Rd, Elmer, NJ 08318. *From Herford Inlet Lighthouse.* **www.scernet.org**

Aug 8-Aug 12, 1200Z-1200Z, AC7II, Logan, UT. Bridgerland Amateur Radio Club. Cache County Fair. 7.200. QSL. Ted McArthur, 8730 South 200 West, PO Box 71, Paradise, UT 84328. **www.barconline.org**

Aug 10-Aug 13, 0000Z-2300Z, AO1TSR, A Coruña, Spain. Radio Club Hércules. Tall Ships Races 2012 - A Coruña. 21 14 18 7. QSL. AO1TSR, P Box nº 6060, A Coruña 15011, Spain. **www.ea1hnp.es/ao1tsr.php**

Aug 12-Aug 14, 1400Z-1400Z, N7C, Window Rock, AZ. Navajo Amateur Radio Club. The Navajo Code Talker. 14.265 7.240. QSL. Herbert Goodluck, PO Box 3611, Window Rock, AZ 86515.

Aug 11, 1600Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. US Coast Guard Birthday. 14.320 7.250 PSK 14.070 D-STAR 012C. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Aug 13-Aug 18, 0001Z-2359Z, N8C, Flint, MI. Noobz Contest Club. Corvette Reunion and Back to the Bricks. 14.240 14.070 7.240 7.035. QSL. Noobz Contest Club, 4318 Greenbrook Ln, Flint, MI 48507. **www.noobzcontestclub.org**

Aug 13-Aug 19, 2200Z-2000Z, W9IMS, Indianapolis, IN. Indianapolis Motor Speedway Amateur Radio Club. Indianapolis MotoGP. 21.350 14.240 7.240 3.840. Certificate & QSL. Indianapolis Motor Speedway Amateur Radio Club, PO Box 30954, Indianapolis, IN 46230. **w9ims.org**

Aug 17-Aug 19, 1400Z-2000Z, W3GV, Erie, PA. Radio Association of Erie. Bayfront Marine Center Small Boat Festival. 28.410 21.280 14.280 7.280. Certificate. Rich Eisenberg , 40 Holland St, East Canal Basin, Erie, PA 16501. **w3gv.org**

Aug 18, 1400Z-2000Z, W4K, Hopkinsville, KY. Christian County ARES. Anniversary of the "Kelly Little Green Men," Kelly, Kentucky. 21.300 14.260 7.250 147.030. Certificate. Jerry Holt, 7585 Hopkinsville-Mt Zoar Rd, Hopkinsville, KY 42240.

Aug 18, 1400Z-2100Z, W8LKY, Alliance, OH. Alliance Amateur Radio Club. Ohio Carnation Days Festival and Alliance Amateur Radio Club 25th Anniversary. 14.240 14.045 7.045 7.240. Certificate & QSL. Alliance Amateur Radio Club, W8LKY, PO Box 3344, Alliance, OH 44601. **www.w8lky.org**

Aug 18, 1600Z-2200Z, WA5ZOV/WBØWXN, Sherburn, MN. Aldrich Bryant Colfax Avenue Group. ABC Reunion, Fox Lake, MN. 14.280. QSL. John Popple, 1 Spyglass Ct, Park City, UT 84060. **jpopple@comcast.net**

Aug 18-Aug 19, 0000Z-2359Z, W1S, Georgetown, ME. Friends of Seguin Island. Lighthouse and Lightship Weekend. 14.025. QSL. John Brewster, 8 Shenecossett Ln, Pinehurst, NC 28374. **jbrew@nc.rr.com**

Aug 18-Aug 19, 0001Z-2359Z, W6A, San Pedro, CA. US Coast Guard Auxiliary-Pt Fermin Lighthouse. International Lighthouse and Lightship Weekend. 14.265 7.250. Certificate & QSL. Roy Lay, 219 Beal Ave, Placentia, CA 92870.

Aug 18-Aug 19, 1200Z-1900Z, KC2YYL, Youngstown, NY. Niagara County Amateur Radio Events Services Station. International Lighthouse Lightship Weekend. 40 m. QSL. John Titta, 1460 Staley Rd, Grand Island, NY 14072. *From Fort Niagara Lighthouse.* **illw.net** *or* **kc2yyl.net**

Aug 18-Aug 19, 1300Z-0100Z, N7UW, Laramie, WY. University Amateur Radio Club. Centennial Ridge, Queen Mine. 28.450 21.350 14.250. Certificate. William Wright, 1856 N 13th, Laramie, WY 82072. **n7uw@uwyo.edu**

Aug 18-Aug 19, 1600Z-2359Z, N6P, Point Reyes, CA. Valley of the Moon Radio Club. Point Reyes Lighthouse Activation. 14.270 14.070 7.270 7.035. QSL. Ken McTaggart, 402 4th St E, Sonoma, CA 95476. **www.vomarc.org**

Aug 23-Aug 27, 0000Z-0000Z, W1A, Boxborough, MA. FEMARA. Boxboro/ARRL New England Convention. 14.227 14.027 7.227 7.027. QSL. BARS, PO Box 832, Nutting Lake, MA 01865. **boxboro.org**

Aug 24-Aug 25, 1009Z-1009Z, W8CDZ, Hancock, MI. Copper Country Radio Amateur Association. 61st Houghton County Fair. 14.261. QSL. **www.eqsl.cc** or direct to W8CDZ 61st

Houghton County Fair Event, PO Box 217, Dollar Bay, MI 49922. **ccraa.net**

Aug 25-Aug 26, 1400Z-2000Z, KØL, Olathe, KS. Boeing Employees Amateur Radio Society of Kansas & Santa Fe Trail ARC. Kansas QSO Party. 14.240 7.240. QSL. Calvin Lewandowski, PO Box 483, Olathe, KS 66051. Will be mobile working the Kansas QSO Party. **www.ksqsoparty.org**

Aug 25, 1500Z-2359Z, W7SVD, Coronado National Memorial, AZ. Sierra Vista Contesting Club. National Park Service Anniversary. SSB 28.350, 21.285 14.275 CW 28.050, 21.050 14.050 PSK31 28.120, 21.070 14.070. QSL. Sierra Vista Contesting Club, 3707 Elder Ct, Sierra Vista, AZ 85650.

Aug 25-Aug 26, 1400Z-2130Z, KØH, Homer, IA. Webster County Auxiliary Communications Service. Threshing Bee Special Event Station. 146.550 446.000 28.450 14.325. Certificate. Ronald J. Vought, KØRJV (COML), Webster County Auxiliary Communications Service, 1923 4th Ave S, Fort Dodge, IA 50501. **k0rjv@arrl.net**

Aug 26, 1400Z-2100Z, KØASA, Hanover, KS. Crown Amateur Radio Association. Hollenberg Pony Express Station Festival. 18.085 14.245 14.045 7.045. Certificate & QSL. Crown Amateur Radio Association, 11551 W 176th Tr, Olathe, KS 66062. Commemorating the 152nd anniversary of the Pony Express and the Important role the telegraph played in its operation. **www.arrlmidwest.org/ponyexpress.html**

Aug 31-Sep 3, 0800Z-1800Z, W7R, Fort Bridger, WY. Local Hams. Fort Bridger Wyoming Mountain Man Rendezvous. 14.280 14.070 7.190 7.070. QSL. W7R c/o Clayton Lowther, PO Box 201, Fort Bridger, WY 82933. **www.kf7elu.info/w7r**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Oct** *QST* would have to be received by **Aug 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through June 10. You can view all received Special Events at **www.arrl.org/special-event-stations.**

Sean's Picks

Sean Kutzko, KX9X
ARRL Contest Manager

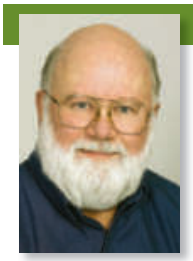
- **State QSO Parties this month:** Hawaii, Kansas, Maryland-DC, Ohio
- **QRP contests this month**: ARS Spartan Sprint (August 7), NJQRP's Skeeter Hunt (August 12), NAQCC Straight Key/Bug Sprint (August 15), Flying Pigs' Run for the Bacon (August 20), QRP-ARCI's "Welcome to QRP" Contest (August 25)
- **ARRL UHF Contest (August 4-5):** 220 MHz and up is where the QSOS will be made for this event. Exchange is simply your grid square. Operate from home, portable in a rare grid or from multiple grid squares as a Rover. A fun event — don't miss it!
- **10-10 International Summer Contest, SSB (August 4-5):** 48 hours of fun on 10 meters! Collect as many 10-10 numbers as you can. If you don't have one, submit an application with 10 numbers and get your own. A great way to focus time on 10 meters near the end of the Sporadic-E season.
- **North American QSO Party, CW (August 4-5):** This contest focused on North America is perfect for many ops. It's only 12 hours long, meaning there's lots of time to do other things on the weekend. The exchange is simply your name and state/province or country.
- NEW! **NJQRP's Skeeter Hunt (August 12):** Here's a brand new QRP contest I'm really excited about! The New Jersey QRP Club has started the Skeeter Hunt. It's a 4 hour sprint focused on field QRP operating. You can register in advance to be a "Skeeter," which means you agree to operate QRP in the field and not connected to a commercial power source. Work as many Skeeters as you can. I'll be on the air for this one for sure! For more info, visit Larry, W2LJ's blog at **w2lj.blogspot.com/p/njqrp-skeeter-hunt.html**. Open to non-portable stations, too!
- **Worked All Europe, CW (August 11-12):** Sponsored by DARC, this is the biggest European DX Contest of all. European stations can ask for part of your log ("QTC") for extra points, making this a unique event.
- **ARRL 10 GHz & Up Contest (August 18-19):** Microwaves aren't just for cooking! A few watts of power with a small dish atop a high hill and you're a Big Gun! New to the microwave bands? There' a link to VHF/UHF clubs at **www.arrl.org/v-u-shf-clubs** to help you get started.
- **North American QSO Party, SSB (August 18-19):** The SSB portion of the NAQP CW contest mentioned above. Same exchange and rules apply.

August 2012 W1AW Qualifying Runs

W1AW Qualifying Runs are 10 PM EDT Wednesday, August 8 (0200Z August 9) and 4 PM EDT (2000Z) Thursday, August 23. The West Coast Qualifying Runs will be transmitted by station K9JM on 3590 and 7047.5 kHz at 9 PM PDT Wednesday, August 15 (0400Z August 16). Unless indicated otherwise, speeds are from 10-35 WPM.

Strays

Mike Hankins, KI5M, presents a check for $2000 from the Temple (TX) Amateur Radio Club to Temple College. Each year since his passing, the radio club has been sponsoring the Charles R. Schlieper Scholarship Fund to assist students in a technical course as selected by the college. From the left: Kay Schlieper, KB5DC; Jennifer Graham of the Temple College Foundation; Carl Schlieper, N5KLP, and KI5M. [photo by Sherie Garrett of Temple College]



John Dilks, K2TQN, k2tqn@arrl.org

Making AM a Bit Better

Radio pioneer's school project leads to a major modulation breakthrough.

This month's column is written by my friend James E. O'Neal, K4XAR, who wrote about Mary Day Lee last September.[1] *Besides being a historian, James is an avid AM operator. He is building a Collins station consisting of a 75S-3 receiver, 20V-2 1 kW AM transmitter and a 212-B broadcast audio console used as a microphone preamp and to initiate transmit/receive switching. James can be contacted at* **crm114j@verizon.net**.

Who was Loy Edgar Barton? His name is not exactly a household or ham shack word. Yet, he had a significant impact on the design and performance of radio transmitters.

Barton's contribution has its roots in a 1924-25 thesis project for what then amounted to a master's degree in electrical engineering at the University of Arkansas. The project involved designing and constructing a 500 W commercially licensed radio station for the school — something of a challenge at that time.

Nevertheless, Barton overcame the many hurdles involved, constructing a speech amplifier, transmitter, power supplies and a large flattop antenna strung between the north and south towers of the University's iconic "Old Main" building.

Barton, who was born in 1897, first enrolled at the University of Arkansas upon completing high school, but had his studies interrupted by WWI. He eventually completed requirements for an engineering degree. Upon graduation, he remained as an engineering instructor and continued his studies in an advanced degree program. The spring of 1925 found the 28 year-old Barton ready to depart northwestern Arkansas and seek his fortune in the rapidly expanding world of radio engineering. Before that, he had to get the station — KUOA — on the air and write his thesis.

The thesis described in detail his work in designing and constructing the station, along with solutions to various problems encountered in moving from theory to practice. The 27 page document indicates that Barton was more interested in modulation methodology than other aspects of the station, as this was the first element discussed.

[1]J. E. O'Neil, AG4DH, "Vintage Radio," *QST*, Sep 2011, pp 96-97.

Constant Current Modulation

The conventional method for sound modulation at that time came from Bell Labs scientist Raymond Heising.[2,3] His invention was termed "constant current" modulation, because one of its circuit elements, a large iron-core choke (X_{L1} in Figure 1) didn't like to see current fluctuations, and resisted such changes when the current flowing through it moved away from a steady-state value. In Heising's circuit, the choke sources plate voltage for both an audio amplifier and RF amplifier. When the audio tube's grid is driven toward the positive, it conducts more heavily and draws more plate current. The choke opposes this by developing a counter voltage, thus dropping the plate potential. This reduction causes a drop in the output of the RF amplifier. When the input audio level dips toward the negative, the RF amplifier plate voltage rises and the power output increases.

In the 1920s, Heising's approach was the best available method to achieve amplitude modulation at the power level Barton wanted. He incorporated it into his design even though he didn't really like it. The biggest problem is that the circuit can never deliver a 100% modulated signal, as it can't pull the RF output down to zero due to the hysteresis of the choke. It never really lets the RF tube open up all the way either. Heising's real deal-breaker is that both modulator and RF tubes have to have equal power delivering capability (if you want a kW of RF, you need a 1 kW audio amplifier). To top it all off, the audio tube has to operate in Class A mode, with miserable efficiency.

A Better Modulator

Barton, in a stroke of genius, observed in his thesis that this poor modulator performance "… has suggested to the writer the use of a transformer instead of the choke X_{L1} with the modulator plate circuit [passing] through the primary [winding] and the oscillator plate through the secondary [winding]."

Barton realized that by using a transformer to superimpose audio on the plate supply of the RF tube, he could do much better than the approximately 60% Heising depth of modulation limit. Further, the Class A amplifier could be replaced with a push-pull pair operating in Class B. Unfortunately, at that point his priorities were focused on getting the degree and an engineering job. He noted:

"The writer will not have the time to try the idea for this paper."

That could have ended it, as the station took to the air successfully and Barton was

[2]R. A. Heising, "Modulation in Radio Telephony," *QST*, Jul 1921, pp 7-12.
[3]R. A. Heising, "Modulation in Radio Telephony," *QST*, Aug 1921, pp 9-15.

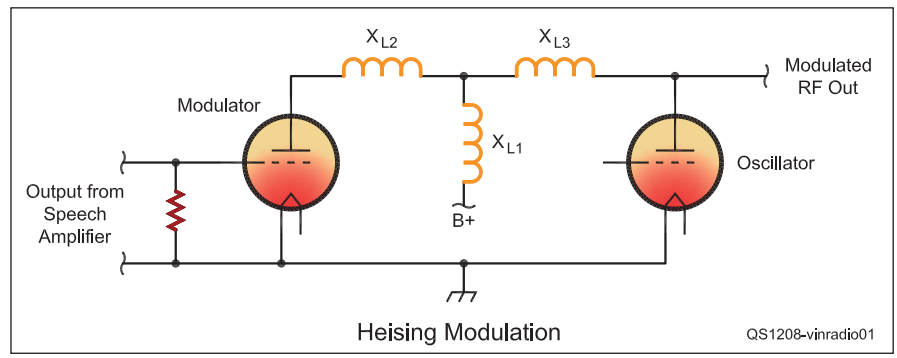


Figure 1 — Heising modulation depended on the constant current characteristics of the iron core choke that supplied plate voltage to both modulator and RF amplifier tube plates.

Figure 2 — While a graduate student at the University of Arkansas in the 1920s, Barton designed and constructed this 500 W transmitter. It would become the world's first high-level class B plate modulated rig. [James O'Neal, K4XAR, photo]

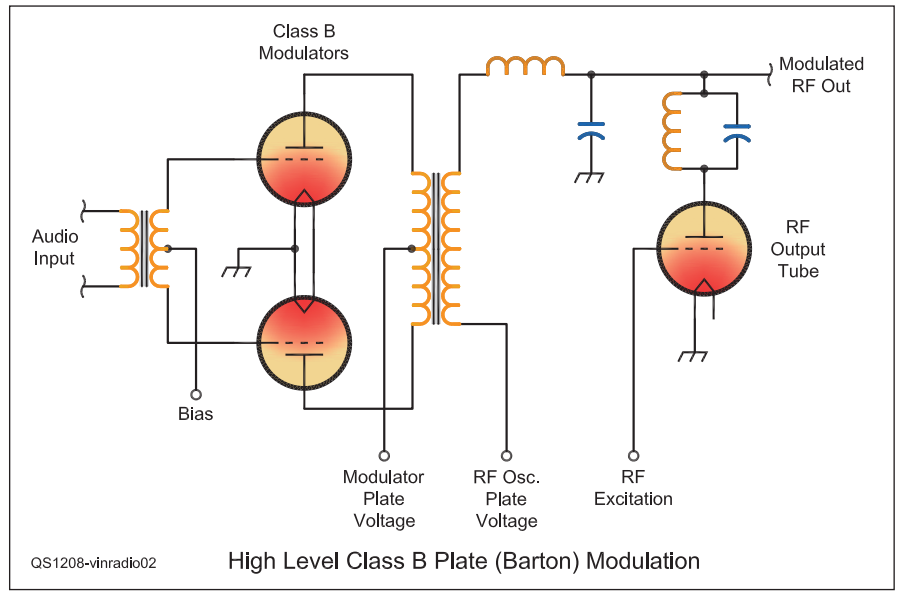


Figure 3 — Barton reasoned that better and more efficient amplitude modulation could be achieved by replacing Heising's choke arrangement with a transformer.

awarded the advanced degree (see Figure 2). Soon Barton, his wife and small daughter were on their way to Schenectady and a job with General Electric.

Fast forward 4 years to 1929 — Barton, unhappy with the Schenectady electronics giant and Hudson Valley winters returned to the UofA as an associate engineering professor. After settling in, he dusted off his thesis to see if he'd been correct about a better way to modulate. Everything came together just as Barton predicted and by 1930 he had stripped out KUOA's Heising circuit and replaced it with his new high-efficiency design, making the station the first to use high-level Class B modulation (see Figure 3).

RCA Steals the Credit

Barton published his findings in a rather obscure school engineering leaflet.[4] The Camden, New Jersey folks must have been reading everything in the country then and soon came upon Barton's report. In short order, RCA paid him a visit and apparently made him an offer he couldn't refuse — a career in radio engineering.

The devil in the detail was that Barton had to assign his patent (he'd already applied for one) to the Radio Corporation of America. With the Great Depression beginning, Barton really wanted to work in Mr Sarnoff's empire. This patent assignment more or less guaranteed that Loy Barton would not be remembered for pulling us out of amplitude modulation's dark ages. (It was sold and licensed to others as RCA technology.)

Nor is Barton remembered for another important patent (again assigned to RCA). This came some 20 years later during RCA's crash program to develop compatible color TV. Barton and co-worker Peter Werenfels came up with the idea of synchronizing transmitted color information with a subcarrier "burst" sent during horizontal blanking. This principle was still being used to sync NTSC color transmissions until mid-2009 when broadcasters dropped their analog signals for digital emissions.

Figure 4 — Loy Barton was an early proponent of solid-state technology, designing some of RCA's first prototype transistor receivers. [Helen Solomon photo]

Barton was also on the leading edge of technology when the transistor was first introduced, designing and constructing some of RCA's first prototype solid-state consumer radios (see Figure 4).

He was never a ham, but almost certainly had a hand in the UofA's amateur station, 9YM and later 5YM. (Today the station is K5YM.) Also, not long after he was hired by RCA, Barton prepared an article for *QST* that provided information on using his modulator circuit in ham rigs.[5] The author would like to suggest that in describing high-level Class B plate modulation the term "Barton modulation" be used to honor this forgotten inventor.

AWA 2012 World Convention

K2TQN and his Collins desk, shown in last month's column, will be at the Antique Wireless Association (AWA) meet in Rochester, New York, August 21-25. The AWA themes this year are *Collins Radio* and *A Tribute to the Titanic*. K2TQN will be making presentations in both areas. For AWA meet information visit **www.awamuseum.org**. I hope to see you there.

[4]Barton, Loy E., "A Plate Modulation Transformer for Broadcast Stations," University of Arkansas Bulletin; Vol. 23, No. 20; May 1930.

[5]L. E. Barton, "The Class B Push-Pull Modulator," *QST*, Nov 1931, pp 8-13.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

SOUTHEASTERN DIVISION CONVENTION

August 18-19, Huntsville, AL
D F H Q R S V

The Southeastern Division Convention, sponsored by the Huntsville ARC, will be held at the Von Braun Center (South Hall), 700 Monroe St. Doors are open Saturday 9 AM-5 PM, Sunday 9 AM-3 PM. Features include all indoor, air-conditioned event with giant new dealer/manufacturer show; huge flea market (Dave Givens, K5RSI, 256-883-2760; **dagivens@yahoo.com**); exhibitors; vendors; wide selection of forums (Johnny Winter, KR4F, 256-534-6785; or Chuck Lewis, N4NM, 256-539-8950); VE sessions (10 AM sharp, both days; $15 test fee); Youth Lounge; Foxhunts; Kit Building; Hospitality Suites (Friday and Saturday eves at the Holiday Inn, located across the street from the VBC); DXCC card checking; convenient parking ($5); limited RV parking. Talk-in on 146.94, 147.3. Admission is $7 (under 12 free). Tables are $30 (electricity $10 extra). Contact Charlie Emerson, N4OKL, 8003 Craigmont Rd, Huntsville, AL 35802; 256-882-9137; **n4okl@arrl.net**; **www.hamfest.org**.

Arkansas (Mena) — Sep 7-8 D F H T V
7 AM-5 PM (both days). *Spr:* Queen Wilhelmina Hamfest Assn. Queen Wilhelmina State Park, 3877 Hwy 88 W. 43rd Annual Hamfest. *Tl:* 146.79 (100 Hz). *Adm:* Free. Tables: Check web site for details. Mike Gathright, KC5ZJV, 464 Provo Rd, Lockesburg, AR 71846; 870-289-6335; **mdgathright@gmail.com**; **menahamfest.org**.

California (Goleta) — Aug 12 D F H R T V
8 AM-3 PM. *Spr:* Santa Barbara ARC. Santa Barbara Elks Picnic Grounds, 150 N Kellogg Ave. Contests, BBQ Lunch, Demos, ARRL Booth. *Tl:* 146.79 (131.8 Hz). *Adm:* $5 (includes credit to BBQ). Tables: $10. Tom Saunders, N6YX, c/o SBARC, Box 3907, Santa Barbara, CA 93130; 805-967-7351; fax 805-308-0347; **hamfest@sbarc.org**; **www.sbarc.org**.

California (Lincoln) — Sep 8 D F H R T V
5:30 AM-12:30 PM. *Spr:* Western Placer ARC. McBean Park, McBean Dr. *Tl:* 147.36 (179.9 Hz). *Adm:* Free. Tables: No tables available. Harvey Ulijohn, KD6LND, 1190 Tarapin Ln, Lincoln, CA 95648; 916-543-9286; **hulijohn@ssctv.net**; **wparc.org**.

Colorado (Golden) — Aug 19 D F H R S V
8:30 AM-1 PM. *Spr:* Denver Radio Club. Jefferson County Fairgrounds, 15200 W 6th Ave. *Tl:* 145.49, 448.625 (100 Hz). *Adm:* $5. Tables: advance $12, door $15. Bryan Steinberg, KBØA, 1011 S Foothill Dr, Lakewood, CO 80228; 303-987-9596; **drcfest@w0tx.org**; **www.w0tx.org**.

Connecticut (Newtown) — Sep 9
D F H R S T
8:30 AM-12:30 PM. *Spr:* Candlewood ARA. Edmond Town Hall, 45 Main St. Western CT Hamfest, batteries. *Tl:* 147.3 (100 Hz). *Adm:* $6. Tables: $15 indoor ($10 per tailgate space; includes 1 admission). Joe de Groot, AB1DO, 30 Sunnyview Dr, Redding, CT 06896; 203-938-4880; **ab1do@arrl.net**; **www.danbury.org/cara/hamfest.html**.

Florida (Orlando) — Aug 4 D F H R T V
6 AM-noon. *Spr:* AES Orlando. Amateur Electronic Supply, 621 Commonwealth Ave. *Tl:* 147.12, 444.125 (103.5 Hz). *Adm:* Free. Tables: Bring your own tables, chairs, and shade. Jim Stout, W9QC, 621 Commonwealth Ave, Orlando, FL 32803; 800-327-1917; fax 407-894-7553; **w9qc@arrl.net**; **aesham.com**.

Florida (Fort Pierce) — Aug 11
F H Q R S V
8 AM-2 PM. *Spr:* Fort Pierce ARC. Indian River State College (KSU Bldg), 3209 Virginia Ave. *Tl:* 147.345 (107.2 Hz). *Adm:* $5. Tables: $10. Pete Amar, KD4SPW, PO Box 10286, Ft Pierce, FL 34979; 772-465-5204; **kd4spw@aol.com**; **www.qsl.net/w4akh/**.

Florida (Tampa) — Aug 18 D F H Q R T V
8 AM-1 PM. *Spr:* Tampa ARC. Tampa ARC Clubhouse, 7801 N 22nd St. TARCFest XXVIII. *Tl:* 147.105 (146.2 Hz). *Adm:* $3. Tables: $15. William Bode, N4WEB, 14302 Capitol Dr, Tampa, FL 33613; 813-382-9262; **n4web@hamclub.org**; **www.hamclub.org**.

Illinois (Oakwood) — Aug 18 D F R T V
8 AM-1 PM. *Spr:* Vermilion County ARA. Vermilion County Fairgrounds, 11798 County Rd 1720 N. *Tl:* 146.82 (88.5 Hz). *Adm:* $5. Tables: $5. Tuck Miller, NF9T, 807 Franklin St, Danville, IL 61832; 217-497-4166; **nf9t@arrl.net**; **vcara-hamfest.info**.

Illinois (Peotone) — Aug 5 D F H R S T V
6 AM-4 PM. *Spr:* Hamfesters RC. Will County Fairgrounds, 701 S West St. 78th Annual Hamfest. *Tl:* 146.52. *Adm:* advance $8 (with double-stub tickets), door $10 (with single-stub tickets). Tables: $15. Kerry Nelson, AA9SB, 3404 Hazel Ln, Hazel Crest, IL 60429; 708-335-4574; **kw_nelson@earthlink.net**; **hamfesters.org**.

Illinois (Quincy) — Aug 11 D F H Q R T V
8 AM-2 PM. *Spr:* Western Illinois ARC. Eagles Alps, 3737 N 5th St. *Tl:* 147.03 (103.5 Hz). *Adm:* advance $4, door $5. Tables: $10. Danny Pease, NG9R, 306 S Illinois, Camp Point, IL 62320; 217-430-2046; **dpease@adams.net**; **www.w9awe.org/Swapfest2012.pdf**.

Indiana (LaPorte) — Aug 18 D F R T
Set up 8 AM; public 9 AM. *Spr:* Porter County ARC. Concrete Tower, US Rte 35 and Schultz Rd. *Tl:* 146.775 (131.8 Hz). *Adm:* Free. Tables: Free. Matt Lasayko, KC9KUD, PO Box 1782, Valparaiso, IN 46384; 219-916-4907; **mlasayko@comcast.net**; **pc-arc.net**.

Indiana (Spencer) — Aug 25 D F H R S T V
7 AM to 2 PM. *Sprs:* Owen County ARA and Bloomington ARC. Owen County Fairgrounds, 100 S East St. *Tl:* 146.985 (136.5 Hz). *Adm:* $5. Tables: First table free. Bob Poortinga, K9SQL, 5930 N Maple Grove Rd, Bloomington, IN 47404; 812-876-6174; fax 812-323-4060; **k9sql@arrl.net**; **www.owencountyara.org/**.

Iowa (Emerson) — Sep 8 D F R
8 AM-1 PM. *Spr:* Heartland Hams ARC. Indian Creek Historical Society and Museum, 59256 380th St. *Tl:* 145.29. *Adm:* $3. Tables: $5. Donald Brown, ACØTS, 53243 260th St, Glenwood, IA 51534; 712-526-2080; **don_jean_2000@yahoo.com**; **www.heartlandhams.org**.

Kansas (Gardner) — Sep 1 D F H R S
8 AM-5 PM. *Spr:* Santa Fe Trail ARC. Johnson County Fairgrounds, 136 E Washington St. *Tl:* 147.24 (151.4 Hz). *Adm:* $5. Tables: $10. Mike Costello, KBØISQ, 1501 E Harold, Olathe, KS 66061; 913-764-0702; **kb0isq@gmail.com**.

KANSAS STATE CONVENTION

August 19, Salina
D F H R S V

The Kansas State Convention, sponsored by the Central Kansas ARC, will be held at the Salina Bicentennial Center, 800 The Midway. Doors are open 8 AM-4 PM. Features include large indoor air-conditioned flea market; major vendors; forums; meetings (ARRL, Kansas Section, MARS, RACES, SKYWARN, Kansas Weathernet); VE sessions (8:30-10:30 AM); DXCC, WAS, and VUCC card checking; special

Coming ARRL Conventions

July 20-22
Montana State, East Glacier*

July 26-28
Central States VHF, Cedar Rapids, IA*

July 27-29
Rocky Mountain Division, Bryce Canyon, UT*

August 3-4
Texas State, Austin*

August 3-5
Pacific Northwest DX, Clackamas (Portland), OR*

August 11
Ohio State, Columbus

August 18
West Virginia State, Weston

August 18-19
Southeastern Division, Huntsville, AL

August 19
Kansas State, Salina

August 24-26
New England Division, Boxborough, MA

August 25
DXCC East, Frederick, MD

August 26
Western Pennsylvania Section, New Kensington

September 10-14
RV Radio Network Fall Rally, St Cloud, MN

September 14-15
W9DXCC, Elk Grove Village, IL

September 15
Virginia Section, Virginia Beach

September 22
EmComm East, Rochester, NY
Washington State, Spokane Valley

September 22-23
Illinois State, Peoria

September 28-29
SEDCO/W4DXCC, Pigeon Forge, TN

*See July *QST* for details.

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

guest from ARRL HQ Chuck Skolaut, KØBOG, Field and Regulatory Correspondent; handicapped accessible; refreshments. Talk-in on 147.03, 443.9 (both 118.8 Hz). Admission is $5. Tables are $15 (commercial or flea market, includes electricity if requested and 1 admission ticket per table). Contact Ron Tremblay, WAØPSF, 112 N Douglas Dr, Salina, KS 67401; 785-827-8149; **rtremblay@cox.net**; **www.centralksarc.com**.

Kentucky (Lawrenceburg) — Aug 12
D F H R S T V
8 AM-3 PM. *Spr:* Bluegrass ARS. American Legion Post #34, 745 W Broadway. Special Event MARS Station, State Emergency Communications Vehicle. *Tl:* 145.39 (107.2 Hz), 146.76. *Adm:* advance $5, door $6. Tables: advance $15, door $25. Jeanie Dalton, KB8QLC, Box 24188, Lexington, KY 40524; 859-619-8164; **jeanie@insightbb.com**; **www.BluegrassARS.org**.

Kentucky (Shepherdsville) — Sep 8
D F H R S T V
8 AM-2 PM. *Spr:* Greater Louisville Hamfest Assn. Paroquet Springs Conference Center, 395 Paroquet Springs Dr. *Tl:* 146.7 (79.7 Hz). *Adm:* advance $6, door $7. Tables: $10. Bob Myers, K4RVM, 3601 Dorset Rd, Louisville, KY 40214; 502-935-6710; **GLH-2012@LouisvilleHamfest.com**; **louisvillehamfest.com**.

Louisiana (Leesville) — Aug 11
D F H Q R S T V
7:30 AM-2 PM. *Spr:* West Central Louisiana ARC. First United Methodist Church of Leesville, 202 N 5th St. 36th Annual Hamfest. *Tl:* 145.31 (203.5 Hz). *Adm:* $5. Tables: $10. Lonnie Jacobs, W5LPJ, 12326 Lake Charles Hwy, Leesville, LA 71446; 337-239-0734; **w5lpj@cebridge.net**; **www.wclarc.com**.

Maine (Milo) — Aug 11 D F H Q R S T V
8 AM-noon. *Spr:* Piscataquis ARC. American Legion Post 41, 18 W Main St. Foxhunt. *Tl:* 147.21 (71.9 Hz). *Adm:* $5. George Dean, WA1JMM, 39 Railroad Ave, Brownville, ME 04414; 207-441-6112; **wa1jmm@roadrunner.com**; **k1pq.org**.

DXCC EAST CONVENTION

August 25, Frederick, MD
D H Q R S V

The DXCC East Convention, sponsored by the National Capitol DX Assn, will be held at the Holiday Inn and Conference Center at FSK Mall, 5400 Holiday Dr. Doors are open 8:15 AM-9 PM. Features include vendor booths; guest speakers including Dave Patton, NN1N, ARRL MVP Manager; presentations by well-known DXers; VE sessions (1-3:30 PM; 703-280-2637; **secretary@ncdxa.org**; $15 fee); QSL card checking; N3C HF/2 M station; dinner banquet (6-9 PM, special guest speaker Dr Hrane Milosevic, YT1AD); awards presentations. Talk-in on 146.48. Registration is $70 (includes banquet); $40 (convention only). Tables are $30 (8-ft, includes 2 chairs). Contact Mike Cizek, W3MC, Box 239, Severn, MD 21144; 410-562-3010; **convention@ncdxa.org**; **www.dxcceast.com**.

Maryland (Westminster) — Aug 19
D F H R T
8 AM-noon. *Spr:* Carroll County ARC. Carroll County Agricultural Center, 700 Agriculture Center Dr. 13th Annual Tailgate Fest. *Tl:* 145.41 (114.8 Hz). *Adm:* $5. Steve Beckman, N3SB, 2145 Bethel Rd, Finksburg, MD 21048; 410-876-1482; **n3sb@qis.net**; **www.qis.net/~k3pzn**.

Massachusetts (Adams) — Aug 12
D F H R T V
9 AM-2 PM. *Spr:* Northern Berkshire ARC. Adams Agricultural Fairgrounds (Bowe Field), Rte 8. Several ham demonstrations, NoBARC's 40th Anniversary will be celebrated with a Special Event Station on site. *Tl:* 146.91 (162.2 Hz). *Adm:* $5. Tables: $10. Tim Ertl, KE3HT, 128 Hale St Ext, Dalton, MA 01226; 413-822-7075; **hamfest@nobarc.org**; **www.nobarc.org/hamfest.htm**.

NEW ENGLAND DIVISION CONVENTION

August 24-26, Boxborough, MA
D F H Q R S T V

The New England Division Convention, sponsored by FEMARA, will be held at the Holiday Inn Boxborough, 242 Adams Pl. Doors are open Friday afternoon, all day Saturday, and Sunday until 2 PM. Features include flea market; exhibitors; dealers; vendors; forums and seminars; demos and workshops; QSL card checking; VE sessions; Special Event Station W1A; DXCC Banquet (Friday eve, $35; special guest speaker Don Greenbaum, N1DG); Saturday eve banquet with special guest speaker well-known CT television meteorologist Geoff Fox, K1GF ($40); Wouff Hong ceremony; RV parking; handicapped accessible. Talk-in on 147.27 (146.2 Hz), 224.88 (103.5 Hz), 449.925 (88.5 Hz), 53.81 (71.9 Hz). Admission is $15 (covers all 3 days); under 16 free. Tables are $10. Contact Mike Raisbeck, K1TWF, 85 High St, Chelmsford, MA 01824; 978-250-1235; **k1twf@arrl.org**; **www.boxboro.org**.

Massachusetts (Cambridge) — Aug 19. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Lapeer) — Aug 19 D F H R V
8-11:30 AM. *Spr:* Lapeer County ARA. Lapeer West Community High School, 170 Millville Rd. 13th Annual Swap and Shop. *Tl:* 146.62 (100 Hz). *Adm:* $5. Tables: $10. Bill Miller, KD8VP, 3605 Pratt Rd, Metamora, MI 48455; 810-797-5329; **kd8vp@arrl.net**; **w8lap.com**.

Michigan (Owosso) — Aug 25 D F H R T V
8 AM-noon. *Spr:* Shiawassee ARA. Baker College Welcome Center, 1309 South M-52. *Tl:* 147.02 (100 Hz). *Adm:* $3. Tables: $4. Don Warner, WB8GUS, 10008 Lehring Rd, Byron, MI 48418; 810-599-0729; **wb8gus@arrl.net**; **www.w8qqq.org/**.

Michigan (Wyoming) — Sep 8 D F H R T V
8 AM-1 PM. *Spr:* Grand Rapids ARA. Home School Bldg, 5625 Burlingame Ave SW. *Tl:* 147.26 (94.8 Hz). *Adm:* advance $5, door $6. Tables: $10. John Streyle, W8QZ, 1487 Maderia Ave SW, Grand Rapids, MI 49534; 616-791-9411; **streyle.j@comcast.net**; **www.grahamfest.org**.

Minnesota (Rush City) — Sep 8 F H R T
9 AM-noon. *Spr:* East Central Minnesota ARC. Rush City High School, 51001 Fairfield Ave. 20th Annual ECMARC Radio Rendezvous. *Tl:* 145.33 (146.2 Hz). *Adm:* Free. Tables: Free. Larry Jilek, KAØMEN, 51835 Belle Isle Dr, Rush City, MN 55069; 320-358-4205; **lj@ecenet.com**; **ecmarc.org**.

Minnesota (Worthington) — Sep 8
D F H R S V
9 AM-2 PM. *Sprs:* Worthington ARC, Iowa Great Lakes ARC, Northwest Iowa ARC. Hickory Lodge, 2015 N Humiston Ave. Northern Plains Regional Radio Council Hamfest. *Tl:* 146.67. *Adm:* Free. Tables: $5. Rick Hansen, KDØBJY, 201 Hagge St, Worthington, MN 56187; 507-372-7113; **nprrc@yahoo.com**; **www.nprrc.org**.

Missouri (Joplin) — Aug 24-25
D F H Q R S V
Friday 4-9 PM; Saturday 8 AM-2 PM. *Spr:* Joplin ARC. Holiday Inn Convention Center, 3615 Hammons Blvd. 23rd Annual Hamfest. *Tl:* 147.21. *Adm:* advance $6, door $8. Tables: non-commercial $10, commercial $30 (includes 2 admissions). Jim Johannes, NØZSQ, c/o JARC, Box 2983, Joplin, MO 64803; 417-437-9547; fax 417-347-9412; **jimjohannes@sbcglobal.net**; **www.joplin-arc.org**.

Missouri (O'Fallon) — Aug 12
D F H R S T V
8 AM-1 PM. *Spr:* St Charles ARC. Elks Lodge 2587, 1163 Tom Ginnever Ave. *Tl:* 146.67. *Adm:* $3. Tables: $12. Ben Barnett, K4BEZ, 22 Shadow Creek Dr, St Peters, MO 63376; 636-922-4027; **k4bez@arrl.net**; **wb0hsi.org**.

Montana (Belgrade) — Aug 25
D F H R S T V
8 AM-4 PM. *Spr:* Gallatin Ham Radio Club. National Guard Armory, 451 Tower Rd. Transmitter hunt. *Tl:* 146.88, (100 Hz). *Adm:* Free (donations welcomed). Tables: Free (donations welcomed). Norm Reger, KD7TQM, 816 Goldenwest Dr, Belgrade, MT 59714; 406-599-5310; **kd7tqm@yahoo.com**; **www.w7ed.com**.

Nebraska (Springfield) — Sep 8 D F H R
8 AM-1 PM. *Spr:* Ak-Sar-Ben ARC. Sarpy County Fairgrounds 4-H Building, Main St. *Tl:* 146.94. *Adm:* $4. Tables: $8. Patrick Joseph, KØCTU, 1821 Robertson Dr, Omaha, NE 68114; 402-492-9156; **k0ctu@cox.net**; **www.aksarbenarc.org/main/**.

New Jersey (Bergenfield) — Aug 11
D H R S V
Set up 6-8 AM; public 8 AM-3 PM. *Spr:* Boy Scout Troop 139/Venture Crew 7373. St John the Evangelist's Conlon Hall, 19 N William St. Di's Kitchen open for hot breakfast and lunch. *Tl:* 146.955 (141.3 Hz), 146.52. *Adm:* $5 (nonham spouses and kids free). Tables: $20 for 1, $35 for 2, $5 for each additional. Gordon Beattie, W2TTT, 29 N Washington Ave, Bergenfield, NJ 07621; 201-314-6964; fax 201-387-8896; **w2ttt@arrl.net**.

New Jersey (Haledon) — Aug 18
D F H R T V
Set up 6 AM; public 8 AM. *Spr:* Ramapo Mountain ARC. Camp Veritans, 225 Pompton Rd. 36th Annual Ham Radio and Computer Flea Market. *Tl:* 146.49 (107.2 Hz). *Adm:* $7. Tables: $20 (inside; extra tables $15 each); $15 per tailgate space. Dave Schwartz, W2DIS, 225 Pompton Rd, Haledon, NJ 07508; 201-891-8060 ext 101; **dischwartz@optonline.net**; **www.qsl.net/rmarc**.

New Jersey (Toms River) — Aug 19
D F H R T V
8 AM-1 PM. *Spr:* Jersey Shore ARS. Riverwood Park, Riverwood Dr. *Tl:* 146.91 (127.3 Hz). *Adm:* $5. Tables: $15 (table or tailgate). Don McGlaughlin, K2HCW, Box 811, Ocean Gate, NJ 08740; 732-237-9448; **k2hcw@comcast.net**; **jsars.org**.

New York (Ballston Spa) — Sep 8
D F H R T V
7 AM-2 PM. *Spr:* Saratoga County RACES Assn. Saratoga County Fairgrounds, Prospect Ave. 27th Annual Hamfest. *Tl:* 147.0. *Adm:* $5. Tables: $5. Darlene Lake, N2XQG, 314 Loudon Rd #84, Saratoga Springs, NY 12866; 518-587-2385; **dar@saratogaspringsny.us**; **wa2umx.net**.

New York (Howard) — Aug 18 D F H T V
8 AM-noon. *Spr:* Keuka Lake ARA. Howard

Community Building, 7481 Hopkins Rd. Free overnight camping. *Tl:* 145.19 (110.9 Hz). *Adm:* $5. Tables: Free tailgate with admission. Roy Koehler, KB2WXV, 37 Carrington St, Avoca, NY 14809; 607-566-3688; **hamfest@xdrcertified.com**; **klara.us**.

New York (Lancaster) — Sep 9 D F H R T

6 AM. *Spr:* Lancaster ARC. Bowen Road Grove – Como Park, 3845 Bowen Rd. *Tl:* 147.255 (107.2 Hz). *Adm:* $5. Tables: Free tailgating. Luke Calianno, N2GDU, 1105 Ransom Rd, Lancaster, NY 14086; 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net**.

New York (Medina) — Aug 11 F H R S T V

Set up 6 AM; public 8 AM. *Spr:* Orleans County ARC. Ridgeway Fire Hall, 11392 Ridge Rd. *Tl:* 145.27 (141.3 Hz). *Adm:* $5. Tables: $5. Terry Cook, KC2JKU, 14069 W County House Rd, Albion, NY 14411; 585-589-6362; **kc2jku@ocarc.us**; **www.ocarc.us**.

New York (Trumansburg) — Aug 4. Bill Klinko, KC2OYN, 607-738-4694; **whk2@cornell.edu**; **tcarc-ny.org/hamfest.htm**.

North Carolina (Dallas) — Sep 1-2

D F H Q R S T V

Saturday 8 AM-5 PM, Sunday 8 AM-2 PM. *Spr:* Shelby ARC. Dallas (Biggerstaff) Park, 144 Leisure Ln. 56th Shelby Hamfest. *Tl:* 146.88, 147.12. *Adm:* advance $6, door $8. Tables: $70. Ben Melvin, KM4C, 902 Henry St, Kings Mountain, NC 28086; 704-734-5116; **ben@kmse.com**; **shelbyhamfest.com**.

OHIO STATE CONVENTION

August 11, Columbus

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The Ohio State Convention, sponsored by the ARRL Ohio Section, will be held at the Aladdin Shrine Center, 3850 Stelzer Rd. Doors are open 8:30 AM-2:30 PM. Features include forums and seminars; special guest ARRL President Kay Craigie, N3KN; Wouff Hong ceremony; OSSBN Semi-Annual Meeting; Section Awards Ceremony; information booths by local ham clubs. Talk-in on 146.97 (123 Hz). Contact Scott Yonally, N8SY, 258 Valley Hi Dr, Mansfield, OH 44904; 419-884-5105; **n8sy@arrl.net**; **www.arrl-ohio.org**.

Ohio (Columbus) — Aug 11 D F H R S T V

8 AM-2 PM. *Spr:* Voice of Aladdin ARC. Aladdin Shrine Center, 3850 Stelzer Rd. *Tl:* 146.97 (123 Hz). *Adm:* $5. Tables: Free. James Morton, KB8KPJ, 6070 Northgap Dr, Columbus, OH 43229; 614-846-7790; fax 614-846-2074; **kb8kpj@arrl.net**; **www.aladdinshrine.com/hamfest.htm**.

Ohio (Cortland) — Aug 19 D F H R T V

8 AM-2 PM. *Spr:* Warren ARA. Trumbull County Fairgrounds, 899 Everett Hull Rd. 56th Annual Hamfest. *Tl:* 146.97. *Adm:* $6. Tables: $10. Jacqueline Clay, KD8DNE, 14770 Hillcrest Ave, Middlefield, OH 44062; 440-636-2806; **kd8dne@gmail.com**; **www.w8vtd.org**.

Ohio (Findlay) — Sep 9 D F H R S T

8 AM-2 PM. *Spr:* Findlay RC. Hancock County Fairgrounds, 1017 E Sandusky St. *Tl:* 147.15. *Adm:* $6. Tables: $20 (first table; $15 for each additional table). Bill Kelsey, N8ET, 3521 Spring Lake Dr, Findlay, OH 45840; 419-423-3402; **hamfest@kangaus.com**; **w8ft.org**.

Ohio (Stow) — Aug 12 D F H R T

Set up 7 AM; public 8 AM-noon. *Spr:* Cuyahoga Falls ARC. Robert Pinn Armory, 4630 Allen Rd. *Tl:* 147.27 (110.9 Hz). *Adm:* $5 per vehicle (regardless of number of occupants; vendors get two spaces, buyers get one). Tables: Bring your own. Frank Tompkins, W8EZT, 124 Chart Rd, Cuyahoga Falls, OH 44223; 330-928-4048; **tailfest2012@cfarc.org**; **cfarc.org/tailgate2012.html**.

Pennsylvania (Matamoras) — Aug 12

D F H R T

7 AM-noon. *Spr:* Tri-State ARA. Matamoras Airport Park, 9th St Extension. *Tl:* 145.35 *Adm:* $5. Tables: $15. Tom Olver, W2TAO, Box 711, Sparrowbush, NY 12780; 570-486-6773; **tristateara@gmail.com**; **www.k3tsa.com**.

WESTERN PENNSYLVANIA SECTION CONVENTION

August 26, New Kensington

D F H Q R S T

The Western Pennsylvania Section Convention, sponsored by the Skyview Radio Society, will be held at the Skyview Radio Society Clubhouse and Grounds, 2335 Turkey Ridge Rd. Doors are open 8 AM-2 PM. Features include 52nd Annual Swap 'n Shop; tailgating; VUCC/WAS card checking; WPA ARES meeting; special guest from ARRL HQ Allen Pitts, W1AGP, Media and PR Manager; breakfast and lunch served; "Skyview Jam" (musicians bring your instruments); bring your high performance or antique cars for the Skyview Car Show. Talk-in on 146.64 (131.8 Hz). Admission is $3. Tables are $5. Contact Pat Cancro, NK3P, 3525 Milligantown Rd, New Kensington, PA 15068; 724-339-4945; **jpc2@psu.edu**; **www.skyviewradio.net**.

Pennsylvania (Sinking Spring) — Aug 11

D F H R T V

Set up 7 AM; public 8 AM. *Spr:* Reading RC. Heritage Park, Clematis St. Auction (11 AM; for unsold items that attendees wish to auction off). *Tl:* 146.91 (131.8 Hz). *Adm:* $1 (nonham spouses and under 18 free, or VE exam only). Tables: $2 per seller plus admission (tailgate or bring your own tables). Harry Hoffman, W3VBY, 104 Evans Ave, Sinking Spring, PA 19608; 610-678-8976; **harryhoffmanjr@juno.com**; **readingradioclub.org**.

Texas (Gainesville) — Aug 25 D F H R T V

7 AM-1 PM. *Spr:* Cooke County ARC. Gainesville Civic Center, 311 S Weaver St. 20th Annual Hamfest, RV parking adjacent to Civic Center ($15 with full hookup; 940-668-4530). *Tl:* 147.34, 442.775 (both 100 Hz). *Adm:* advance $6 (by Aug 15), door $8. Tables: advance $8 (by Aug 15), door $10 (electrical hookup $5 extra). James K Floyd, N5ZPU, 1704 E California St, Gainesville, TX 76240; 940-668-7511; **jfloyd54@swbell.net**; **www.gainesvillehamfest.org**.

Vermont (St Albans) — Aug 11

D F H R T V

8 AM-1 PM. *Spr:* St Albans ARC. VFW Post #758, 353 Lake St. *Tl:* 145.23 (100 Hz). *Adm:* $5. Tables: $5. Arnold Benjamin, N1ARN, 1420 Rice Hill Rd, Franklin, VT 05457; 802-309-0666; **n1arn@yahoo.com**; **www.starc.org**.

Washington (Des Moines) — Aug 25 H R T

9 AM-1 PM. *Spr:* Highline ARC. Des Moines Senior Activity Center, 2045 S 216th St. *Tl:* 146.66 (103.5 Hz). *Adm:* $2. Tables: $10. Dennis Reanier, W7UBA, 204 S Normandy Rd, Burien, WA 98148; 206-241-6812; **w7uba@comcast.net**; **www.highlinearc.org/swapfest.html**.

Washington (Spanaway) — Aug 11

D F H R V

9 AM-1:30 PM. *Spr:* Radio Club of Tacoma. Bethel Junior High School, 22001 38th Ave. *Tl:* 147.28 (103.5 Hz), 147.5. *Adm:* $5. Tables: $20 (non-commercial), $30 (commercial). Larry Watson, KD4VOM, 2708 295th St S, Roy, WA 98580; 253-843-2190; **royretreat@mailcan.com**; **www.w7dk.org**.

Washington (Vancouver) — Aug 25

D F H R S

9 AM-4:30 PM. *Spr:* Clark County ARC. Clark County Square Dance Center, 10713 NE 117th Ave. *Tl:* 147.24, 443.925 (94.8 Hz). *Adm:* advance $6, door $8. Tables: $15. Wade Kight, WB7RDE, 4209 NE Morrow Rd, Vancouver, WA 98682; 360-232-4601; **wb7rde@yahoo.com**; **www.w7aia.org**.

West Virginia (Huntington) — Aug 11

D F H Q R S V

8:30 AM-1:30 PM. *Spr:* Tri-State ARA. Christ Temple Church Life Center, 2400 Johnstown Rd. 50th Anniversary Hamfest. *Tl:* 146.76 (131.8 Hz). *Adm:* $6. Tables: advance $10 (by Aug 1), $12 (after Aug 1); free electricity. Judy Taylor, WD8EOP, Box 4120, Huntington, WV 25729; 304-525-4237; **W8VA@arrl.net**; **www.orgsites.com/wv/taraclub**.

WEST VIRGINIA STATE CONVENTION

August 18, Weston

D F H Q R S T V

The West Virginia State Convention (54th Annual Event), sponsored by the West Virginia State Amateur Radio Council, will be held at the WVU Convention Center – Jackson's Mill 4-H Conference Center, 160 Jackson's Mill Rd. Doors are open 8 AM-midnight. Features include flea market; vendors; auction; forums (ARRL, DX, technical); talk-in station; special guest from ARRL HQ Dan Henderson, N1ND, Regulatory Information Manager; ARES; MARS; QCWA; SKYWARN; NTS Net Meetings; VE sessions; Wouff Hong ceremony. Talk-in on 145.39, 147.88. Admission is $5. Contact Bob West, WA8YCD, 883 Goshen Rd, Morgantown, WV 26508; 304-291-0418 (home), 304-672-6381 (cell); **wa8ycd@hotmail.com**; **www.qsl.net/wvsarc**.

Wisconsin (Baraboo) — Aug 25 D F H R V

8 AM-1 PM. *Spr:* Yellow Thunder ARC. Elks Club Lodge, 623 Broadway St. 16th Annual Circus City Swapfest. *Tl:* 147.315 (123 Hz). *Adm:* $5. Tables: $10. Thomas Harrison, N9PQJ, E7983 E Lake Virginia Rd, Reedsburg, WI 53959; 608-963-0762; **n9pqj@arrl.net**; **www.yellowthunder.org**.

Wisconsin (Lyons) — Aug 11 F H R V

7-11 AM. *Spr:* Lakes Area ARC. Lyons Town Hall, 6339 Hospital Rd. 2nd Annual LAARC Freefest. *Tl:* 146.865 (127.3 Hz). Admission and tables are free for buyers and sellers. Michel Bartolone, NX9A, 733 Foxtrail Cir, Burlington, WI 53105; 262-210-8652; **NX9A@arrl.net**; **sites.google.com/site/laarcradioclub/**.

Wisconsin (Sturtevant) — Aug 11 D F H R

7 AM-1 PM. *Spr:* Racine Megacycle Club. Fireman's Park, 9600 Charles St. 5th Annual Racine Megacycle Freefest. *Tl:* 147.27 (127.3 Hz). Admission and tables are free for buyers and sellers. Paul Giannoni, KC9PG, 9228 Millstone Dr, Mt Pleasant, WI 53406; 708-269-1074; **kc9pg@yahoo.com**; **www.w9udu.org**.

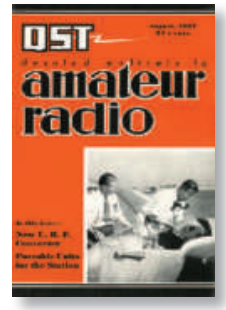
To All Event Sponsors

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.

75, 50 and 25 Years Ago

Al Brogdon, W1AB

August 1937

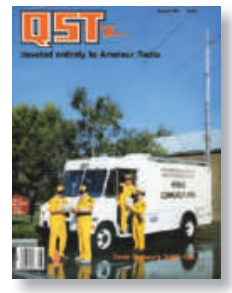


- The cover photo shows two hams installing a rig in a sailplane.
- The editorial points out that the 28 Mc. Band often seems dead because everyone is listening and no one is making calls, and notes that "Ya gotta make calls if ya wanta get results."
- "CQ PITC," by Alan Eurich, WCFT (radio operator on the ship *Yankee*), is the fascinating story of Alan visiting Pitcairn Island, its spark station PITC, and PITC's operator Andrew Young.
- "1936 Hiram Percy Maxim Award Goes to W6KFC" reports that Vic Clark, W6KFC, of Phoenix, Arizona, was chosen by the hams at HQ for the prestigious award. Even though Vic is still young, he has a strong history of traffic work, low-power success, DXing, and hidden-transmitter hunting.
- George Grammer, W1DF, tells us how to get "Battery Performance from the R.A.C. Power Supply," which can be adjusted for output between 160 and 250 volts at 70 ma.
- In "A Unit Style Portable Station," Clinton B. DeSoto, W1CBD, and By Goodman, W1JPE, describe the genemotor-powered set that features a 35-watt 6L6 transmitter and a superhet receiver.
- By, W1JPE, also presents "A 56-Mc. Converter of High Stability," whose output can be tuned on an H.F. receiver.
- George, W1DF, also does double-duty in this issue, presenting "Operating Data on the New Beam Power Tubes."
- S. L. Baraf and Frank Edmonds, W2DIY, tell about their recent project, "A DeLuxe 'Phone Transmitter with Grouped Controls and Cable Tuning.

August 1962

- The intricate cover cartoon, by Gil, W1CJD, shows hams arriving by all sorts of transportation modes for the 12th ARRL National Convention, coming up next month.
- The editorial advises us to follow common sense about using the appropriate frequency band for our contacts; e.g., don't use a DX band for a local ragchew.
- Kline Mengel, W3CT, tells us how to modifying the popular Heath SB-10 by adding a driver and a 90-watt P.E.P final, to make a "Complete Transmitter from an SB-10 Adapter."
- Harry Neben, W9YVZ, tells about his "Handy 12-Volt D.C. to 110-Volt A.C. Inverter."
- "Three-Band Crystal-Controlled Converter," by Lew McCoy, W1ICP, describes a simple converter for the Novice bands.
- William Deane, W6RET, tells us about his mobile rig that produces "Four Watts for Six Meters."
- Apartment-dweller Terry Griner, W3DEA, presents his "'Retrievable' Antennas" — a "flag-pole" and a wire antenna.
- Roy Brougher, W5HPB, describes "A Novel Key for Use with Electronic Keyers," made from a two-pole relay. The key is operated with two fingers moving in the vertical direction, one for dits and one for dahs.
- "4U1ITU Opens" reports on the grand opening of the international ham station in Geneva.

August 1987



- The cover photo shows the Santa Barbara ARC's ARES mobile communications van.
- The editorial discusses World Administrative Radio Conferences (WARCs), and how the League is already gearing up for the next one.
- Doug DeMaw, W1FB, puts our fears to rest, with "Homemade Circuit Boards — Don't Fear Them!"
- In "RF Path Selection," Jon VanDonkelaar, WB8EAF, discusses how to calculate the minimum power required for paths at VHF and higher frequencies.
- John Reed, W6IOJ, tells us how to build "A UHF Amplifier — from Scratch" that produces 45 watts output at 435 MHz.
- "The Lunchbox," by George Murphy, VE3ERP, is a nice package that includes a 12 V gel-cell battery, with charging and metering circuits built in.
- John Hobson, N6EGY, describes "The Robert N. Dyruff Van," the communications van shown on the cover, and how it was put together by Santa Barbara hams.
- Rod Newkirk, W9BRD, tells the funny tale of his being involved in an unofficial ham station in the Pacific, immediately following the end of WW II, in "Lieutenant Bigswitch Stayed for Dinner."

Field Organization Reports

MAY 2012

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this web page: **www.arrl.org/public-service-honor-roll**.

537 WB8RCR
510 W5KAV
500 W7FQQ
435 KØIBS
404 N8OSL
365 KT2D K8OLY
260 K8RDN
254 WB8R
248 KD8EBY
335 N9VC
326 KI4KWR
300 KA2ZNZ KA4IZN
297 W2MTA
295 NX9K
285 K9LGU
270 WA9LFO
267 KC5ZGG
265 K2DYB
250 WE2G
240 KB2ETO
232 KT5SR
220 VE7DXD
210 WD9FLJ W5DY
207 WB9FHP
205 KB2KOJ
202 WD8USA
200 WB9WKO
196 AE5VY
192 KB9GNB
182 WA2BSS
180 KE5YTA KB2BAA
176 KC2SFU
175 KB1RGQ
170 N8IO WB9JSR
166 KC8QWH
165 KB1NMO KB5PGY K2HAT KB8RCR
162 W7JSW
161 KJ4JPE
160 WK4P KE5HYW KGØGG NX8A
158 K2ABX
156 N9WLW
155 KD1LE
150 KK3F
145 NM1K W4DNA N9VT KK5NU K6HTN
140 KJ7NO AG9G K7BFL
135 N8CJS W3YVQ
131 W9WXN
130 K4IWW KØVTT N7CM K7EAJ
K6JT WB2FTX WØLAW KW1U
127 W3CB
126 KA8ZGY KD8HPG
125 N2JBA
123 K1PJS W2DWR
122 K4VWK K4LXG
120 WI2G NA7G KA4FZI W8UL WA2NDA KF5IOU WA3EZN K4BG K4GK WA4UJC KB3LNM WB8WKQ
119 KK7DEB
118 WB8YYS
115 N7IE K6FRG
114 K4BEH
110 W9BGJ WA5LOU W7QM W2EAG WB4ZIQ N7XG N7YSS KE4CB W7GB N9MN K7BDU W7QM WB8HHZ N8SY KA1G AA2SV KC2UMX N1IQI NØMEA
106 NA9L KC5OZT N8FVM
105 KF7GC K4JUU W4TTO KC5MMH W8DJG
104 N2RTF WM2C
100 N7EIE K7OAH WB6OTS N3SW W3TWV WA4BAM N5OUJ N1JX KI4AAN NU8K WB8SIQ WG8Z KA8IAF KC2EMW K4SCL K3IN AA3SB WB4FDT WØCLS WAØVKC K8VFZ
99 W8CPG
98 KØLQB
97 KC8RTW
95 K5AXW W8IM
94 N3RB
93 KB9KEG
91 N2VC
90 N2WKT W5CU NC3F N5RL AA5VZ N4ELI W3GQJ KJ4HGH KZ8Q N8DD KB8HJJ N1TF K1YCQ N3ZOC
88 KD8QPF
87 WØRJA
86 N2GS N2DW
85 KD2AMW W2DER W9OV N1LKJ KD8LZB
82 KD7OED KK7TN W2CC KD2AXP N2VQA W8QZ
81 KT4YA KB8VXE
80 K7MQF KB7RVF KJ4RUD WA1STU KB5KKT K8KV WB4RJW W8MAL WB3FTQ KØDEU NIØI NØMHJ KFØXO KCØZDA N5ASU
79 K4MSG
77 K7FLI
76 KD8GLN
75 KJ6IJJ NN7H
74 KD8AAD
72 WDØGUF KBØDTI
70 AL7N N2YJZ KB2RTZ W1PLK KDØAYN KØDLK NØDUW NØDUX WØFUI N3NTV KØPTK KØRXC KD7ZUP

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AR, AZ, CO, CT, EMA, ENY, EPA, GA, IL, IN, KS, LAX, MDC, ME, MI, MN, NFL, NNJ, NTX, OK, OR, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WNY, WV, WWA, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, DE, EWA, GA, IA, ID, MI, MT, MO, NLI, NM, OK, STX, SV, WTX, WV.

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 2977, KK3F 1923, N1IQI 1489, WB9FHP 1310, WB9JSR 1088, WB8WKQ 1023, W8UL 840, KW1U 826, NX9K 737, KZ8Q 731, K7BDU 707, N9VC 690, KB8RCR 587, K6HTN 566, W9WXN 508, W9OV 503.

The following stations qualified for BPL with Originations plus Deliveries: NM1K 116, K8LJG 251.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

N1DCE **Wirth**, Theodore J., Quaker Hill, CT
ex-KK1F **Baker**, William R., Portsmouth, NH
W1GBS **Lanning**, Bruce E., Winter Harbor, ME
N1GFG **Harrison**, Omer D., Tiverton, RI
W1GMP **Bupivi**, Joseph P., Brookfield, CT
W1HBZ **Ecenbarger**, Gale R., Jenison, MI
W1HS **Watts**, Edward B., Port Richey, FL
W1HYH **Mac Gown**, Richard H., Pittsfield, ME
N1IKM **Johnson**, Roy E., Bristol, CT
N1JJT **Perkins**, Edward W., Guilford, CT
W1NYR **Collins**, John F., Sandwich, MA
W1PHW **White**, James E., Orange City, FL
♦ K1PQV **Cheney**, Sidney L., Thornton, NH
K1SIE **Latour**, Michael R., Dover, NH
KA1VRP **Firth**, Clifford S., Natick, MA
♦ W2BCH **Mozley**, James M., Camillus, NY
K2BJG **Anderson**, Robert R., Oakland, NJ
N2CZZ **La Rocca**, Phillip R., Egg Harbor Twp, NJ
KC2FEP **Petzon**, Merillyn M., Depew, NY
WA2FSX **Ciccone**, Emidio, Belmar, NJ
WA2FVL **Keating**, John J., Union Beach, NJ
W2GDC **Zemanovic**, George, Hillside, NJ
ex-K2GXX **Irvine**, John, Old Tappan, NJ
K2HD **Barr**, Edwin A., Spring Hill, FL
K2HUX **Coates**, Jack G., Niskayuna, NY
WA2IMX **Lambrinos**, Harry P., Liverpool, NY
WA2IOR **Halpern**, Dorothy, Peabody, MA
KC2JJS **Elliott**, David R., Williamstown, NJ
ex-WB2KTW **Brandiff**, David E. Jr, Salem, NJ
NX2L **Schienberg**, Joseph, Green Valley, AZ
ex-KF2M **King**, Reno C. Jr, Douglaston, NY
W2ND **Campbell**, Douglas W., Ridgefield Pk, NJ
W2QFQ **Schreibman**, Bernard I., Tinton Falls, NJ
KC2TJ **Stark**, John H. Jr, Morganville, NJ
W2TKG **Dreher**, Joseph W., Baldwinsville, NY
N3BYT **Kohl**, Annis J., Littlestown, PA
KB3DRM **Danner**, Donald E. Sr, New Oxford, PA
K3GKY **Taucher**, Louis R., Eagleville, PA
KA3GQN **Wurzel**, William J., New Brighton, PA
W3HEZ **Colby**, Lauren A., Frederick, MD
♦ N3HNQ **Keyser**, Thomas S., North Wales, PA
K3IBE **Kissel**, Patricia H., Bethel Park, PA
KA3LAM **Morganelli**, Thomas J., Bethlehem, PA
W3MHY **Brosky**, Stanley A., Bethel Park, PA
W3NJZ **Ryan**, Frederick M., New Alexandri, PA
KB3NR **Wilson**, Clarence W., Ocala, FL
W3PKL **Stamps**, Henry B., Forest, VA
ex-W3QOV **Jones**, Carroll E., DuBois, PA
W3SBU **Palmer**, Burtis E., Allentown, PA
N3VAR **Grant**, Stephen E., Annapolis, MD
W3VOG **Zito**, Charles, Middletown, PA
W3VPF **Sell**, Byron S., Altoona, PA
K3WAJ **Walls**, Gisele B., Secane, PA
KA4APZ **Smith**, Linda R., Gastonia, NC
KF4BEP **Faircloth**, Joseph A., Daytona Bch Shrs, FL
KJ4CMR **Crowson**, Joe, Keystone, AL
KK4DHS **Edmondson**, Charles Sr, Pleasant Gap, PA
♦ WA4DXO **McKean**, William J., Silver Spring, MD
K4EDR **Martin**, Alfred L., Smyrna, TN
WD4EWK **Wright**, Henry J., Minnie, KY
K4ICD **Cowan**, John G., Panama City, FL
KK4JT **Terry**, James L., Port St Lucie, FL
KI4KKW **Wright**, Jesse P., Morristown, TN
KD4L **Blair**, Howard W., Valdese, NC
N4LLU **Gallemore**, Lorrence S., Spring Hill, FL
K4MAK **Nelms**, Mark A., Fultondale, AL
W4OBT **Poteete**, Lillian R., Madison, TN
K4OKA **Abernethy**, John A., Hickory, NC
KC4OQF **McGill**, Ronnie W., Lexington, KY
♦ WA4PEE **Fleming**, Robert W., Springville, AL
KI4QFI **Hill**, Gilbert R., Florence, AL
AA4SU **Edwards**, John A. Jr, Newnan, GA
WB4TLO **Carr**, James O. II, Hickory, NC
WA4TNW **Brown**, William L., Sullivans Island, SC
N4USB **Moore**, Robert A., Grifton, NC
W4VVG **Neal**, Leroy W., Jackson, TN
W4WEL **Laasch**, Wesley E., Lansing, NC
W4WMD **Hood**, Henry H. Jr, Saint Stephen, SC
WA4YEM **Hammons**, Charles E., Ponte Vedra Beach, FL
WB4ZOD **Baker**, James F., Jasper, AL
K5LID **Wakefield**, Troy K., Columbus, GA
W5NTC **Nagel**, Sidney, Shreveport, LA
KE5PFW **Still**, Daniel C., Albuquerque, NM
W5QIB **La Bry**, Eucharist J., Kaplan, LA
W5RAU **Arvidson**, Raymond E., Albuquerque, NM
W5TAB **Benners**, Timothy A., McKinney, TX
KD5TEU **Patterson**, Kerry R., Atlanta, TX
W5THU **Cole**, Ralph N., San Antonio, TX
KD5TQD **Wyatt**, James, Artesia, NM
♦ K5VY **Meredith**, Garland, Bryan, TX
KC5XC **Jones**, Walter A., Denham Springs, LA
KK5YZ **Gilstrap**, Marcus D., San Angelo, TX
N6BA **McCullough**, Leo F., Lake Havasu City, AZ
N6BAR **Johnson**, Jerry R., Bakersfield, CA
AA6EQ **Brown**, Wallace J., Camarillo, CA
W6JXZ **De Muth**, John J., Fort Wayne, IN
W6KEQ **Cannella**, Albert J., N Hollywood, CA
K6KQT **Mueller**, Bruce E., Fullerton, CA
N6LFD **Baginski**, Mark E., Martinez, CA
K6OF **Gumpertz**, Donald G., Toluca Lake, CA
W6PSC **Buffenbarger**, Vinton A., San Juan Capistrano, CA
KA6RZR **Johnson**, Julia S., Long Beach, CA
K6VBH **Hallacy**, Viola B., Idyllwild, CA
KC6VCR **Weese**, Jennie P., Pacific Palisades, CA
♦ N7ARY **Carle**, George H., Olympia, WA
K7CRE **Dotson**, Loren A., Electric City, WA
KC7EQC **Bills**, Reed J., Murray, UT
KC7FOG **Conrad**, Eugene L., Otis Orchards, WA
W7FYU **Rasmussen**, Louis "Larry" M., Spokane, WA
WH7G **Griffin**, Troy D. Jr, Mililani, HI
♦ KA7HJN **Souter**, Charles R., Seattle, WA
N7IOK **Sakir**, Clyde M., Tucson, AZ
KA7ITE **Mollan**, Edith P., Tumwater, WA
WA7IXK **Blanchard**, Dale R., Henderson, NV
K7JUT **Callender**, Charles W., Pueblo, CO
W7KCU **Huff**, George W. Jr, Bridgeport, WA
N7MOM **Allison**, Richard H., Creswell, OR
KE7NGQ **Hedgpeth**, Charles V., Bedford, TX
KB7RMO **Cole**, Edward J., Mesa, AZ
WB7SBD **Bixby**, Eddie G., Sun City West, AZ
WB7SDR **Hagius**, C. "Fred", Pocatello, ID
K7UAL **Ohlson**, Bruce H., Reno, NV
AB7WJ **Jonez**, William A., Gig Harbor, WA
W7WJK **Kruse**, Kermit O., Spokane, WA
♦ WA7ZTC **Hanson**, Jaakko, Taipalsaari, FINLAND
AA7ZY **Halverson**, Francis A., Tillamook, OR
WB8AGB **Phillips**, Charles E., Durand, MI
♦ K8AUH **Stahley**, David M., Cleveland, OH
KB8DMP **Johnson**, Alan B., Jackson, MI
WA8EWW **Kachenmeister**, Merle G., Toledo, OH
W8GNV **Callahan**, Harold R., Franklin, OH
ex-WB8GZH **Edwards**, James A.,Durand, MI
♦ W8HR **Travis**, Joseph D., La Center, KY
N8IIX **Jones**, Judith B., Yellow Springs, OH
W8IO **Allen**, Robert E., Macedonia, OH
N8KVY **Dundon**, Jacqueline A., Traverse City, MI
W8KXS **Lever**, Charles E. Jr, Toledo, OH
WD8LJF **Williams**, Charles O., Battle Creek, MI
WA8LRB **Van Nocker**, Walter J., Battle Creek, MI
WA8OBJ **Rakaska**, Charles S. Sr, Heath, OH
KA8SKP **Horton**, Harlan "Lee", Clarkston, MI
K8SVV **McClain**, Harold J., Steubenville, OH
KG8TD **Doak**, George H., Saginaw, MI
W8TGG **Jakab**, Joseph J. Sr, Toledo, OH
K8UA **Medendorp**, Norman K., Muskegon, MI
KC8UPR **Rutherford**, Frank H., Traverse City, MI
♦ WA8ZNV **Barnes**, Frederick J., Benton Harbor, MI
WB9DBR **Shepard**, Rolland "Gene" E., Elwood, IN
KD9DD **Delano**, Richard L., Charlotte, NC
KR9F **Wolf**, Neil J., Sheboygan, WI
N9HNQ **Czajka**, John J., Berwyn, IL
KF9LG **Wilhelm**, John D., Brookfield, WI
K9MFQ **Harting**, Glen R., Lake Summerset, IL
W9NAP **Nap**, Kimbel, Grafton, WI
W9RSL **Warble**, Jack, Shelbyville, IN
WA9SPT **Bartholomew**, Charles W., Marion, IN
KB9WGE **Imboden**, Edward "Doug," Decatur, IL
K9WXD **Bowman**, Doyle L., Franklin, IN
N9XBY **Sukalich**, Paul E., Hartford, WI
K9ZUM **Grady**, Michael G., Little Chute, WI
KØAQQ **Sprout**, William C., Elgin, NE
NØBLO **Lewis**, Myron L., Mason City, IA
NØBXJ **Navis**, Lucille, North Platte, NE
♦ WØHLR **Barnard**, Eugene R., Melcher, IA
WØHPD **Swisher**, James C., Coon Rapids, MN
WØJSG **Wright**, Joe D., Olathe, KS
WØJVB **Parish**, Plinn C., Orono, ME
KBØJWE **Lynch**, Patrick G., Kansas City, MO
WØMIE **Haldeman**, John C., Shenandoah, IA
NØMYP **Berger**, Russell G., Roseau, MN
AAØOJ **Martin**, Daniel E., Cedar Rapids, IA
KØOJR **Kovell**, Frederic G., Champaign, IL
ex-KAØTDN **Roberts**, Glen A., Prosser, NE
KGØWJ **Thomas**, Kendall, Kinsley, KS
VE3SY **Cassel**, Paul H., Petersburg, ON, Canada

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111.

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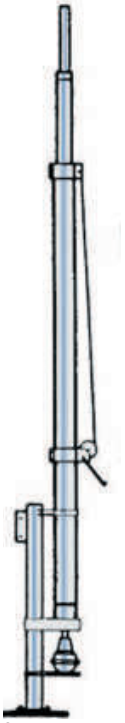

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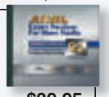

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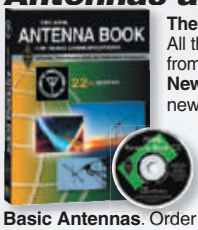

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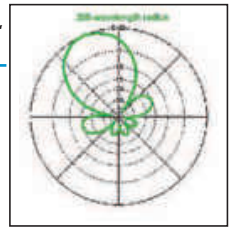

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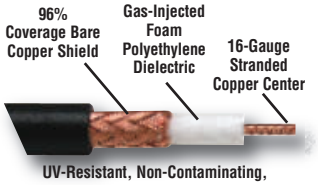
- Weatherproof, adhesive shrink tube seals connections

Complete information is available at DXEngineering.com. Contact DX Engineering Customer Support for your application.



UV-Resistant, Non-Contaminating, Black PVC Jacket

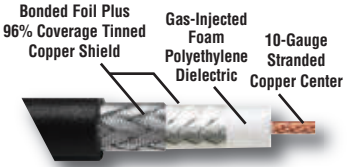
DXE-8X Low-Loss Foam Dielectric Cable (also known as RG-8X or Mini-8)

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

Cable Only		
DXE-8X	By the foot	$.31/ft.
DXE-8X-1000	1,000 ft.	$259.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft	Price
DXE-8XDU003	3	$9.88
DXE-8XDU006	6	$10.88
DXE-8XDU012	12	$12.88
DXE-8XDU025	25	$17.88
DXE-8XDU050	50	$26.88
DXE-8XDU075	75	$35.88
DXE-8XDU100	100	$44.88
DXE-8XDU150	150	$62.88



UV-Resistant, Black PE Jacket

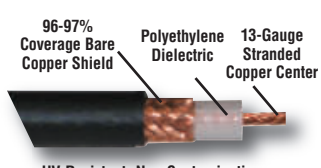
DXE-400MAX Low-Loss Cable

- Low-loss, gas-injected foam polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density polyethylene jacket is UV resistant, ideal for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	6.9 kW	93%
0.5 dB @ 10 MHz	4.8 kW	90%
0.8 dB @ 30 MHZ	2.8 kW	83%
1.1 dB @ 50 MHz	2.1 kW	79%
1.8 dB @ 150 MHz	1.2 kW	65%
3.3 dB @ 450 MHz	0.7 kW	47%

Cable Only		
DXE-400MAX	By the foot	$.82/ft.
DXE-400MAX-500	500 ft.	$364.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft	Price
DXE-400MAXDU003	3	$11.88
DXE-400MAXDU006	6	$14.88
DXE-400MAXDU018	18	$26.88
DXE-400MAXDU025	25	$33.88
DXE-400MAXDU050	50	$58.88
DXE-400MAXDU075	75	$83.88
DXE-400MAXDU100	100	$100.88
DXE-400MAXDU150	150	$158.88



UV-Resistant, Non-Contaminating, Black PVC Jacket

Gas-Injected Foam Won't Absorb Water.

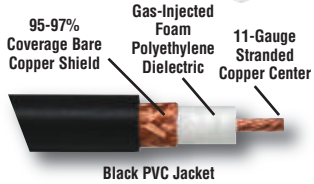
DXE-213U MIL-Spec Cable

- .405" Type II jacket is non-contaminating and UV-resistant, suitable for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

Cable Only		
DXE-213U	By the foot	$.89/ft.
DXE-213U-500	500 ft.	$409.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft	Price
DXE-213UDU003	3	$11.88
DXE-213UDU006	6	$14.88
DXE-213UDU012	12	$20.88
DXE-213UDU025	25	$33.88
DXE-213UDU050	50	$57.88
DXE-213UDU075	75	$80.88
DXE-213UDU100	100	$99.88
DXE-213UDU150	150	$144.88



Black PVC Jacket

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket
- Low-loss foam dielectric

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.4 dB @ 5 MHz	5.1 kW	91%
0.9 dB @ 10 MHz	3.1 kW	81%
1.3 dB @ 30 MHZ	1.8 kW	74%
1.4 dB @ 50 MHz	1.6 kW	72%
2.2 dB @ 150 MHz	1.0 kW	60%

Cable Only		
DXE-8UDU	By the foot	$.79/ft.
DXE-8UDU-500	500 ft.	$359.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft	Price
DXE-8UDU002	2	$10.48
DXE-8UDU003	3	$11.48
DXE-8UDU006	6	$14.48
DXE-8UDU025	25	$30.48
DXE-8UDU050	50	$50.48
DXE-8UDU100	100	$90.48

Coax Prep Tools, see DXEngineering.com for Details.

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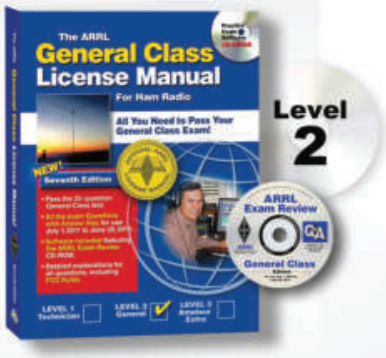

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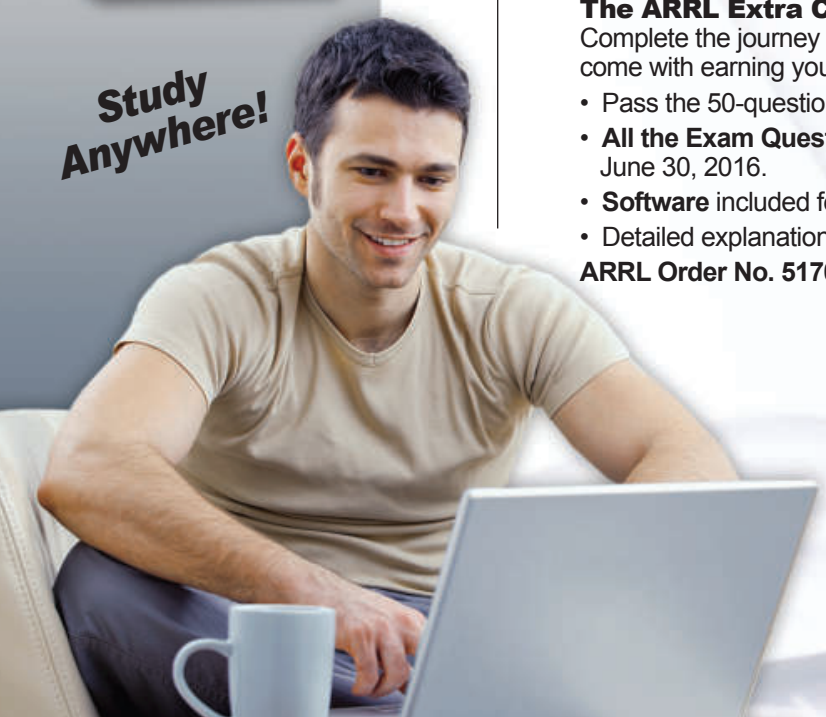

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Strong, High-Quality, Corrosion-Resistant, Unique, Purpose-Designed Clamps

Our Clamps are Specified by Scientific, Military & Government Designers! Used by Antenna Builders: Both Commercial & Amateur!

Saddle Clamps with Cast Saddles

- Stainless steel flat washers, lock washers, nuts and bolts
- Corrosion-resistant aluminum saddles with as-cast rough finish for secure grip

U-Bolt Style, designed and sized to fit tubing

- Full 360° grip for specified tubing size

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-SAD-050A	0.50	1/4-20	**$4.95**
DXE-SAD-075A	0.75	1/4-20	**$5.35**
DXE-SAD-100A	1.00	1/4-20	**$5.70**
DXE-SAD-125A	1.25	1/4-20	**$6.55**
DXE-SAD-150A	1.50	1/4-20	**$7.40**
DXE-SAD-175A	1.75	1/4-20	**$8.55**
DXE-SAD-200A	2.00	5/16-18	**$9.75**
DXE-SAD-200B	2.00	3/8-16	**$10.95**
DXE-SAD-250A	2.50	5/16-18	**$11.75**
DXE-SAD-250B	2.50	3/8-16	**$13.25**
DXE-SAD-300A	3.00	5/16-18	**$13.30**
DXE-SAD-300B	3.00	3/8-16	**$14.90**
DXE-SAD-400A	4.00	3/8-18	**$34.40**
DXE-SAD-450A	4.50	3/8-16	**$39.90**

Dimensions in Inches.

V-Bolt Style, sized to accommodate ranges of tubing sizes

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-CAVS-1P	0.50 to 1.75	1/4-20	**$9.95**
DXE-CAVS-11P	0.50 to 1.75	5/16-18	**$10.45**
DXE-CAVS-2P	1.00 to 2.00	5/16-18	**$11.95**
DXE-CAVS-3P	2.00 to 3.00	3/8-16	**$14.95**

Dimensions in Inches.

Clamps with black powdercoated saddles are also available in U-Bolt and V-Bolt styles, designed and sized to fit ½" to 2" tubing.

Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads.

- A356-T6 cast aluminum saddle, with rough, as-cast finish for high-torque grip on masts, etc
- Cast stainless reinforcement plate included
- Armor coated bolt sets sold separately

Part Number	Tube O.D.	Price
DXE-SDS-200P	2.00	**$32.00**
DXE-SDS-250P	2.50	**$39.00**
DXE-SDS-300P	3.00	**$49.00**

Dimensions in Inches.

Resin Support Blocks

Securely mount tubing to any flat surface. An insulated mount between tubing and plates, ideal for antenna construction and electrical applications.

- Optional stainless steel reinforcement plates available

Part Number	Tube O.D.	Price
DXE-RSB-I02500	0.250	**$2.65**
DXE-RSB-I03125	0.3125	**$2.65**
DXE-RSB-I03750	0.375	**$2.65**
DXE-RSB-I05000	0.500	**$2.90**
DXE-RSB-I06250	0.625	**$2.90**
DXE-RSB-I03400	0.750	**$3.05**
DXE-RSB-I10000	1.000	**$3.05**
DXE-RSB-I11250	1.125	**$4.70**
DXE-RSB-I12500	1.250	**$4.70**
DXE-RSB-I11500	1.500	**$4.70**
DXE-RSB-I13400	1.750	**$7.15**
DXE-RSB-I20000	2.000	**$7.15**
DXE-RSB-I22500	2.250	**$7.95**

Dimensions in Inches.

Cushioned P-Clamps

- Provides strain relief of coaxial cable connections
- Grips the cable jacket without nicking or cutting

DXE-CPC-250 For RG-8X, RG-6, RG-59 cable.....pack of 10 **$14.95**

DXE-CPC-375 For RG-213, RG-8, RG-11 cable.....pack of 10 **$14.95**

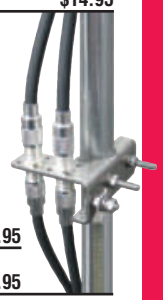
V-Bolt Style Saddle Clamps with Stainless Steel Saddles

- Stainless Steel Saddles, serrated to secure hard pipe surfaces
- Stainless steel V-bolts and hardware

Part number	Nominal Size	Price
DXE-SSVC-1P	.50 to .75	**$6.95**
DXE-SSVC-150P	1.00 to 1.50	**$9.95**
DXE-SSVC-2P	1.00 to 2.00	**$11.95**
DXE-SSVC-3P	2.00 to 3.00	**$14.95**

Dimensions in Inches.
Also available with a tab and 1/4" hardware for grounding as shown.

Coaxial Cable Grounding Brackets



- Stainless steel bracket supplied with stainless steel V-Bolt and hardware

DXE-CGB-150 Fits .50" to 1.50" O.D. tube **$15.95**

DXE-CGB-200 Fits 1.00" to 2.00" O.D. tube **$15.95**

Stainless Steel, Studded Band Clamps

- Welded 10-24 stud
- Easy connection to aluminum elements
- Useful for mounting items to round or irregularly shaped structures

Part Number	Nominal Size	Price/Pack of 2
DXE-ECLS-050	0.500	**$9.99**
DXE-ECLS-062	0.625	**$9.99**
DXE-ECLS-075	0.750	**$9.99**
DXE-ECLS-087	0.875	**$10.99**
DXE-ECLS-100	1.000	**$10.99**
DXE-ECLS-125	1.250	**$11.49**
DXE-ECLS-150	1.500	**$11.49**
DXE-ECLS-175	1.750	**$11.49**
DXE-ECLS-200	2.000	**$11.49**
DXE-ECLS-225	2.250	**$11.49**
DXE-ECLS-250	2.500	**$11.99**
DXE-ECLS-275	2.750	**$11.99**
DXE-ECLS-300	3.000	**$11.99**
DXE-ECLS-325	3.250	**$11.99**

Dimensions in Inches.

Tell us how you used DX Engineering clamps. The best design will win 200 DX Bucks! One winner every month. Details at DXEngineering.com!

This month's winner: a magnetic loop antenna made by Dick, AL7B. Dick says the DXE RSB-series insulated Resin Support Blocks worked very well to support the 1" copper tubing element attached to all the other DXE hardware. See it on DX Engineering's Customer Showcase at DXEngineering.com.

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- *1.8 to 54 MHz range*
- *6 to 800 ohm range (15 to 150 on 6M)*

M-600 Meter sold separately

NEW! AT-600Proll

Building on the success of the AT-600Pro, LDG Electronics has refined and expanded the model with an optional external 4.5" analog meter. The new AT-600Proll 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-11Proll

Meet the Z-11Proll, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" × 7.7" × 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 through 6 meters. The Z-11Proll 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! 2,000 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

We have a tuner that will work for you!

We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the ***Tuner Comparison Chart*** *on our web site for more selection help!*

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, 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***

M-1000 Meter sold separately

AT-1000Proll

LDG Electronics' new flagship 1KW tuner features: 5 to 1,000 Watts 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

Z-100Plus

Small and simple to use, the Z-100Plus sports 2,000 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

LDG Electronics, Inc. 1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

NEW! Z-817H

The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal alkaline batteries (not included). 2,000 memories cover 160 through 6 meters.

Suggested Price $159.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-100Proll

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-100Proll requires just 1 watt for operation, but will handle up to 125 watts. Includes six-foot DC power cable.

Suggested Price $229.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-200Proll

The AT-200Proll now includes LEDs to show antenna position and if the tuner is in bypass. A two-position antenna switch stores 2,000 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

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 2,000 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. 2,000 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

FREE!

RBA-1:1 Balun or RU-4:1 Unun

When You Buy A S9V 43', 31' or 18' Multiband Antenna

Purchase an S9V 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!

Antennas!

S9V 43' $199.99

80-6 meters *Fixed Operation*

The S9V 43' is a high-performance, lightweight, telescoping fiberglass vertical. The best value in high-performance "tall" verticals!

S9V 31' $99.99

40-6 meters *Fixed or Portable Operation*

S9V 18' $49.99

20-6 meters *Fixed or Portable Operation*

The S9V 31' and 18' are tapered, ultra-lightweight, fiberglass, vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

S9RP $39.99

Aluminum Radial Plate

Includes 20 sets of stainless steel nuts & bolts.

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HAM-VI
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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.**

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with DCU-2
See more info below

For large medium antenna arrays up to 20 square feet wind load. Has 5-second brake delay and Test/Calibrate functions. Low temperature grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch maximum mast size.

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II
$449.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

hy-gain® DCU-2 Digital Rotator Controller

. . . gives you full automatic and manual control of hy-gain rotators

DCU-2
$399.95

New!

New hy-gain DCU-2 Digital Controller gives you fully automatic or manual control of your *hy-gain HAM or Tailtwister Rotators*. Just dial in your beam heading and press the rotate button or let *Ham Radio Deluxe* (or other program) control your DCU-2. Your antenna automatically rotates to your desired direction precisely and safely.

First, the DCU-2 makes sure your antenna is free and safely unlocked before turning begins and then turns off your motor before your antenna reaches its final destination. Your antenna gently coasts to a stop before the brake locks. This greatly reduces potentially damaging overshoot.

Fine tuning and full manual control is effortless with *automated* Left and Right direction buttons - - no more worrying about manually releasing and relocking the brake. Brake automatically releases before fine tuning begins and relocks after fine tuning is completed.

Bright blue LCD displays actual heading, dial-in beam heading, computer controlled beam heading in one degree increments and your call sign.

Advanced Features

AutoBrake *Release* - no need to remember to release brake or release too soon - release time is automatic and settable 0-8 seconds.

Coast feature allows antenna to gently stop before the brake locks. Adjustable coast delay (*0-10 degrees*) turns off motor before antenna reaches its final destination to reduce potentially damaging overshoot.

AutoJog unlocks and frees your antenna before turning begins. Great for older rotators with "sticky" brakes. It jogs your rotator backwards slightly to ease brake pressure enough to release.

Offset feature allows you to calibrate your display to show actual beam heading.

USB and RS-232 ports for computer control. Compatible with *Ham Radio Deluxe* and other programs. Adjustable LCD sleep time. Field upgradeable Firmware. 8.5W x 4.3H x 9D inches. 110 VAC. **Order** DCU-2X for 220 VAC.

HAM-VI

HAM-VI
$749.95
with DCU-2

New!

New HAM-VI, $749.95, like HAM-IV but with DCU-2 digital controller. For medium antennas up to 15 square feet wind load.

Rotator Options

MSHD, $109.95. Above tower heavy duty mast support. For T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$ to $2^{5}/_{8}$ inch OD. Centers on 2 ½ inches.

TSP-1, $34.95. Lower spacer plate for HAM-IV, HAM-V and HAM-VI.

AR-40

AR-40
$349.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

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ID-31A 440 FM & D-STAR HT w/GPS

• TX: 420-450 MHz • RX: 400-479 MHz • Power: 5/2.5/0.5/0.1W • Memories: 1252
• D-Star Digital Voice and GPS receiver is built-in • Large Dot Matrix Display and Directional Keypad makes the radio easy to navigate through the menus

IC-80AD 2M/440 D-Star & FM HT

• TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
• Power: 5/2.5/0.5/0.1W • Improved User Interface
• Optional HM-189GPS Speaker Mic adds GPS capabilities

IC-92AD 2M/440 D-Star & FM HT

• TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
• Power: 5/2.5/0.5/0.1W • Dual RX
• Optional HM-175GPS Speaker Mic adds GPS capabilities

GPS Speaker Microphones

• Shows your position data on the display and offers a position reporting function in DV mode
• HM-189GPS for IC-80AD and HM-175GPS for IC-92AD

ID-880H 2M/440 FM Analog & D-Star Digital Dual Bander Mobile

• TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W
• Memories: 1052

ID-1 1.2 GHz D-Star & FM Mobile

• TX: 1240-1300 MHz • RX: 1240-1300 MHz
• Power: 10/1W • Memories: 105
• D-Star 128 kbps Data & 4.8 kbps Voice

IC-718 HF Transceiver

• TX: HF (except 60M) • RX: 0.03-30 MHz
• Power: 5-100W • Memories: 101 • DSP built-in
• SSB, CW, RTTY and AM (2-40W)

IC-7000 HF/6/2M/440 MHz Mobile

• TX: HF/6/2M/440 MHz • RX: 0.03-199, 400-470 MHz
• Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
• Memories: 503 • 41 band-widths with sharp or soft filter shape

IC-7200 HF/6M Portable

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
• Memories: 201 • Rugged design for outdoor use
• 32-bit IF-DSPs + 24-bit AD/DA Converters
• USB Port for CI-V Format PC Control & Audio In/Out

IC-7410 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
• 15kHz 1st IF filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
• Much faster DSP unit compared to the IC-746PRO
• Automatic antenna tuner • USB connector for PC control

IC-9100 HF/6/2M/440 MHz All Mode

• TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
• Power: 2-100W HF/6/2M & 2-75W 440 MHz
• Memories: 297 • Optional D-Star Board • Auto Tuner
• USB Port for CI-V Format PC Control & Audio In/Out

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FT-250R 2M FM HT

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 5/2/0.5W • Memories: 209

FT-60R 2M/440 FM HT

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 5/2/0.5W • Memories: 1000

VX-8DR Quad-band FM HT

• TX: 50-54, 144-148, 222-225, 430-450 MHz
• RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
• 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 mic provides you with APRS® data

FT-2900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 75/30/10/5W • Memories: 221

FT-7900R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blocked)
• Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
• Memories: 1055 • YSK-7800 included!

FTM-350AR 2M/440 FM Mobile

• TX: 144-148, 430-450 at 50/20/5W & 222-225 at 1W
• RX: 0.5-1.8, 76-250 & 300-1000 MHz (cell blocked)
• Memories: 500 + 500 • Optional internal GPS FGPS-1 or external FGPS-2 & CT-136 adds GPS and APRS® features
• Same as the older FTM-350R but includes a new suction cup bracket for the control head and new APRS® features with the installed V1.2 firmware

FT-857D 100W HF/VHF/UHF Mobile

• TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200

FT-897D 100W HF/VHF/UHF Portable

• Similar to the FT-857D but can also operate 20W using optional FNB-78 13.2V @ 4.5 Ah NiMH battery packs

FT-950 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 100 • Auto Antenna Tuner
• 32-bit Floating Point DSP • Built-in high stability TCXO

FT-2000 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
• Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive • Internal Power Supply
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000D RF output is 200W, PS is external

FTDX-5000MP

FTDX-5000 Series – Covers HF and 6M; Three different configurations all running 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" also comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000 - Basic Model & ±0.5ppm TCXO
FTDX-5000D - With Station Monitor & ±0.5ppm TCXO
FTDX-5000MP - With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

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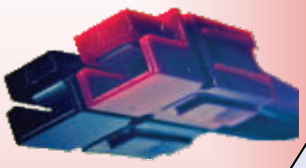

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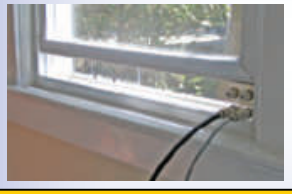

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- Power: 5.5/2/1W • Memories: 200

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

TH-D72A 2M/440 FM HT Built-in GPS
- TX: 144-148, 430-450 • RX: 118-174, 320-524 MHz
- Power: 5/0.5/0.05W • Memories: 1000 • USB Port
- 1200/9600 bps packet TNC • SkyCommand and APRS
- Stand-alone Digipeater • Built-in High Performance GPS
- GPS logging - stores up to 5,000 points of track data
- Echolink® ready • KISS mode protocol

TM-281A 2M FM Mobile
- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 65W • Memories: 200

TM-D710A
Dualband FM Mobile w/TNC
- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G6 & EchoLink® ready

Green Light Labs GPS-710
- Plug-and-play adds GPS for TM-D710A & RC-D710
- Acquires GPS lock from cold start in under 60 seconds
- Quick and easy install typically in less then 5 minutes
- Longer cable sold separately to mount on vehicle's glass

TM-V71A Dualband FM Mobile
- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready
- The optional RC-D710 can replace the TM-V71A control panel to enable all the features of the TM-D710A.

TS-480HX 200W HF/6M Mobile
- TX: HF/6M • RX: 0.5-60 MHz • Power: 10-200W (with two optional 22A power supplies) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-480SAT 100W version with built-in automatic antenna tuner.

TS-2000 100W HF/VHF/UHF Transceiver
- TX: HF/6/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz) • Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

TS-590S 100W HF/6M Transceiver
- TX: HF/6M • RX: 0.03-60 MHz
- Power: 5-100W (5-25W on AM)
- Memories: 110 + 10 Quick Channels
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- Full/semi break-in CW • 10 Hz Dual VFO Display
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MFJ-259B
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The MFJ-259B is the world's most popular Antenna Analyzer and the easiest to use! Just select a band and mode. Set frequency. Your measurements are instantly displayed!

Handheld Antenna Lab

Owning the MFJ-259B is like having an entire antenna lab in the palm of your hand!

Measure SWR quickly or make sophisticated measurements such as Return Loss, Reflection Coefficient, Resonance, Complex Impedance (R+jX), Impedance Magnitude (Z) plus Phase in degrees. Covers 1.8 to 170 MHz -- no gaps.

Coax Analyzer

Determine coax cable velocity factor (Vf), loss in dB, coax length, distance to open or short plus detect wrong coax impedance.

Frequency Counter

Measure frequency of external signals using the separate BNC counter input.

Signal Generator

Use as a signal source 1.8-170 MHz with digital dial accuracy for testing and alignment.

Inductance and Capacitance

Measure Inductance (uH) and Capacitance (pF) at RF frequencies not at audio frequencies used by most L/C meters.

Digital and *Analog* Meters

A high-contrast backlit LCD gives precision readings and *two* side-by-side *analog meters* make antenna adjustments intuitive.

Smooth, Stable Tuning

Velvet-smooth reduction drive tuning and precision *air-variable capacitor* makes setting frequency easy and stable.

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Here's What You Can Do

Find true antenna resonant frequency
Tune *antenna quickly for minimum SWR*
Match complex loads to your feedline
Adjust *mobile whips without stressing finals*
Determine safe 2:1-SWR operating windows
Adjust *tuners without generating QRM*
Find exact location of shorts and opens
Cut *stubs and phasing lines accurately*
Check cable for loss and contamination
Find *value of unknown coils and caps*
Test RF transformers and baluns
Troubleshoot *filters and networks*
Find self-resonance and relative Q
Check *patterns and compare gain*
MFJ-259B does all this and more!

MFJ Analyzer Accessories

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Special foam-filled fabric cushions blows, deflects scrapes and protects knobs and meters from harm. **MFJ-39C, $24.95.** Like MFJ-29C, but for MFJ-269.

MFJ-66, $24.95. Plug-in coils turns any MFJ Antenna Analyzer into a sensitive and accurate *band switched* dip meter. 2 coils.

MFJ-92AA10, $29.95. Ten MFJ *SuperCell*™ Ni-MH AA rechargeable batteries.

MFJ-99B, $88.90. ***Save $7!*** MFJ-259B Deluxe Accessory Pack: MFJ-29C Pouch, 10 Ni-MH batteries, dip coils, AC adapter. **MFJ-98B, $88.90.** Like MFJ-99B but for MFJ-269.

MFJ-99, $60.85. ***Save $5!*** Like MFJ-99B, less batteries, for MFJ-259B. **MFJ-98, $60.85.** Like MFJ-99 but for MFJ-269.

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MFJ-917, $29.95. Current balun lets you make balanced line antenna measurements on HF with your MFJ Analyzer. **MFJ-7702, $3.95.** MFJ-917 to MFJ Analyzer adapter.

MFJ-731, $99.95. Tunable RF filter allows accurate Antenna Analyzer measurements in presence of strong RF fields. 1.8-30 MHz.

MFJ-5510, $9.95. Cigarette lighter cord.

MFJ-269 ...1.8-170 MHz and 415-470 MHz plus 12-bit A/D!

The MFJ-269 does everything the MFJ-259B does - and much more!

Expanded Frequency Coverage

MFJ-269 adds UHF coverage from 415 to 470 MHz -- right up into the commercial band. With it, you can adjust UHF dipoles, verticals, Yagis, quads and repeater collinear arrays with ease -- plus construct accurate phasing harnesses and timed cables. Also use it as a signal source to check UHF duplexers, diplexers, IMD filters and antenna patterns.

Much Better Accuracy

New *12-bit* A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads *parallel* equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

MFJ-269
$389.95

CoaxCalculator™

Lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and coax loss with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Logarithmic Bar Graph

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Uses instrumentation grade N-connector to ensure minimum mismatch on all frequencies. Includes N to SO-239 adapter.

MFJ-269*PRO*™ Analyzer

Like MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

MFJ-269PRO
$419.95

MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3$^{3}/_{4}$Wx6$^{1}/_{2}$Hx2$^{3}/_{4}$D inches. 1.3 lbs.

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New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

***New TrueActive*™** peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D **$389.95**

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New crank knob lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-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. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$179.95**

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E **$139.95**

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M *mobile* Tuner

MFJ-945E **$129.95**

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$119.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$99.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

MFJ-902 **$99.95**

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

MFJ-16010 **$69.95**

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$99.95**

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 **$89.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 *artificial* RF Ground

MFJ-931 **$109.95**

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

Dealer/Catalog/Manuals

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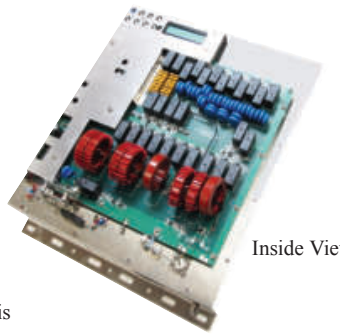
MFJ 1500 Watt *Remote* Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes -- greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$769.95

Bottom Chassis



Inside View

Tune your antenna AT your antenna!

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and *prevent tuning* caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive *StickyTune™ always* tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has *ceramic* feed-through insulator for wire antennas. 2 kV *Teflon*® insulated SO-239 -- prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at *full* 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ *InstantRecall*™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ *Intelli-Tune*™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ *AdaptiveSearch*™ searches *only* the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional MFJ-1316, $21.95. Weighs 9.5 lbs. 13¼Wx6¾Hx17½D inches.

600W *Remote IntelliTuner™*

MFJ-994BRT
$399.95

MFJ-994BRT -- perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for outdoor use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet, 9¼Wx3Hx 14¼D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

300W *Remote IntelliTuner™*

MFJ-993BRT
$299.95

MFJ-993BRT handles 300 Watts SSB/CW and matches an *extra-wide* 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for remote outdoor or marine use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet measures 9¼Wx3Hx14¼D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

200W *Remote IntelliTuner™*

MFJ-926B
$279.95

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

200W *Remote Econo Tuner™*

MFJ-927
$259.95

MFJ-927, 200 Watts SSB/CW, 6-1600 Ohms, Coax/Wire antennas, 1.8-30 MHz. Weather-sealed, BiasTee. 7½Wx5¼Hx8½D in.

MFJ-2990
$359.95

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide-range *MFJ automatic tuners* at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you *simply put it up!* Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $34.95.** All band ground radial system.

Free MFJ Catalog

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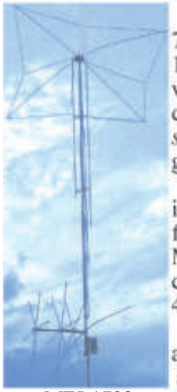
http://www.mfjenterprises.com

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .



MFJ-1798
$349.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter *Rotatable* Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 M as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

Dealer/Catalog/Manuals

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MFJ . . . the world leader in ham radio accessories!

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.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5½Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 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

www.mfjenterprises.com . . . World's largest selection of HF/VHF/UHF SWR Wattmeters!

MFJ-822
$59.95

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862
$69.95

Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864
$99.95

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C
$89.95

Lighted 3" C/N Meter, SWR/Watts, 1.8 -30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B
$39.95

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B
$149.95

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403
$119.95

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

MFJ-1164B
$79.95

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

MFJ-655B
$219.95

Free MFJ Catalog

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MFJ . . . The World Leader in Amateur Radio!

MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack*. Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like

MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$279.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

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http://www.mfjenterprises.com *for instruction manuals, catalog, info*

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver – it instantly displays CW in English! Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . . More!

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW. Digs out weak signals. Phase-Lock-Loop even tracks slightly drifting signals.

MFJ-461
$89.95

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable. A battery saving feature puts the MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery. Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 inches. 5½ ounces.

Super easy-to-use! Just turn it on -- it starts copying instantly!

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $16.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ Morse Code *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-464
$199.95
(Keyboard, paddle not included.)

MFJ-551, $39.95. RFI suppressed keyboard, a must to avoid RFI problems.

MFJ Iambic Paddles

MFJ-564 Chrome
MFJ-564B Black
$69.95

MFJ *Deluxe Iambic Paddles*™ feature a full range of adjustments in tension and contact spacing. Self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. Works with all MFJ and other electronic keyers.

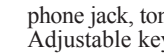
***Miniature* Travel Iambic Paddle**

MFJ-561, $24.95. 1¾Wx1¾D x¾H inches. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

MFJ Code Oscillator

MFJ-557
$39.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ inches.



MFJ-550, $14.95. Telegraph Key Only with adjustable contacts. Handsome black.

MFJ *Pocket* Morse Tutor

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ-418
$89.95

MFJ Deluxe CW Keyer

Deluxe MFJ Keyer has all controls on front panel for easy access -- speed, weight, tone, volume knobs, and tune, semi/auto, on/off push-buttons. You get all keyer modes, dot-dash memories, self completing dots/dashes, jam- proof spacing, sidetone, built-in speaker, type A /B keying. RF proof. Solid state keying. 7x2x6 inches.

MFJ-407D
$79.95

MFJ-401D, $69.95. Econo Keyer II has front-panel volume/speed controls (8-50 wpm), tune switch. Internal adjust weight, tone. Solid state keying. Tiny 4x2x3½ inches.

Keyer/Paddle Combo

MFJ-422D
$189.95

Best of all CW worlds -- a *deluxe MFJ Curtis*™ *keyer* that fits right on *Bencher paddle*! Adjustable weight and tone, front panel volume and speed controls (8-50 WPM), built-in dot-dash memories, speaker, sidetone, semi-automatic/tune or automatic modes. Use 9V battery or 110 VAC with MFJ-1312D, $15.95. 4⅛x2⅝x5¼ in.

MFJ-422DX, $99.95.

MFJ *Curtis*™ Keyer only, fits on your Bencher paddle or MFJ-564 (chrome) or MFJ-564B (black) paddles above.

MFJ *ClearTone*™ Speaker

MFJ-281, $12.95. Makes copying easier, enhances speech, improves intelligibility, reduces noise, static, hum. 3" speaker, 8 Watts, 8 Ohms.

MFJ 24/12 Hour Station Clock

MFJ-108B, $21.95. Dual 24/12 hour clock. Read UTC *and* local time *at-a-glance*. High-contrast 5/8" LCD, brushed aluminum frame. Batteries included. 4½Wx1Dx2H in.

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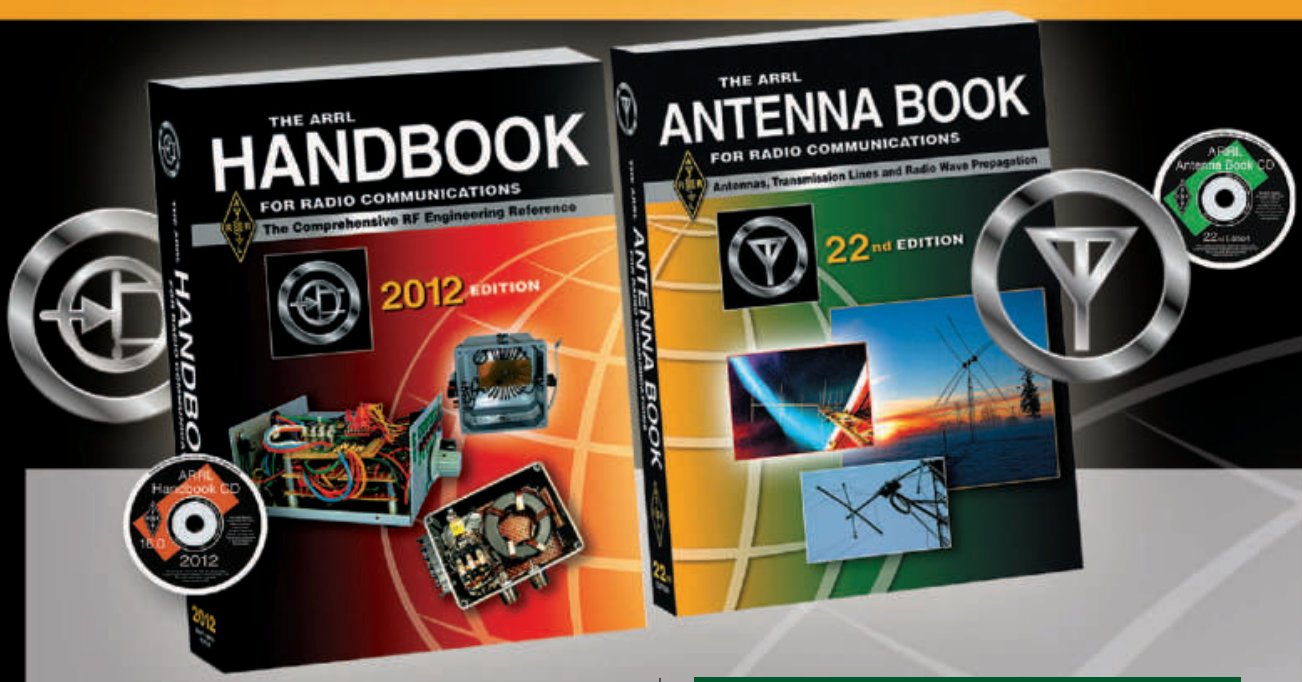

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QST 3/2012

MFJ Dummy Load/Wattmeter

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

MFJ-267
$159.95

World's most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

High accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

RF tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with **MFJ-1312D, $15.95.**

MFJ HF/VHF/UHF Dummy Loads

Dry 300 Watt *HF /VHF* Dummy Load

MFJ-260C
$39.95

Air-cooled, non-inductive resistor in a perforated metal housing; Has SO-239 connector. Full load for 30 seconds. Silk-screened derating curve to 5 minutes. Handles 300 Watts. SWR is below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz. Compact 2¼x2¼x7 inches. **MFJ-260CN, $49.95.** With type "N" connector.

Dry 1.5 kW *HF/VHF/UHF* Dummy Load

MFJ-264
$74.95

Ham radio's most versatile 50 ohm *dry* dummy load. Works with all radios from 160 Meters through 650 MHz. SWR below 1.3 to 650 MHz and below 1.1 at 30 MHz. Handles 100 watts for ten minutes, 1500 Watts for 10 seconds. 3Wx3H x9D inches. Has SO-239 connector. **MFJ-264N, $84.95.** With type "N" connector.

Oil-Cooled 1 KW CW, 2 KW SSB VersaLoad ™

MFJ-250X
$49.95

Run 1KW CW or 2 KW PEP for 10 minutes. Run *continuous duty* with 200 Watts CW or 400 watts PEP. Transformer oil not included. Low VSWR to 400 MHz. Under 1.2:1 to 30 MHz. SO-239 connector. Safety vent with cap, carrying handle. 7½Hx6⅝D inches. **MFJ-250, $69.95.** Includes transformer oil (no PCB).

3 GHz, 300 Watts Dry Dummy Load

MFJ-263
$99.95

New high-tech metal film resistor gives low SWR up to 3 GHz at 300 Watts! Mounted on large heavy-duty air-cooled heatsink. SWR is less than 1.1 DC to 1 GHz, 1.2 at 1.5 GHz and 1.5 at 3 GHz. Handles 125 Watts *continuous* and 300 Watts for ten seconds. High quality *Teflon*(R) N connector. 10¾Wx2¼Hx5¼D in. **New!**

MFJ Frequency Counters

MFJ-886
$129.95

MFJ-886 covers 1 MHz to 3 GHz with 300 MHz direct count, 0.1 Hz resolution. 4 gate times. 10-digit high-contrast 3/4 inch LCD display. Lock display button. Bargraph shows RF field strength. Includes rechargeable Ni-Cad batteries, charger, telescopic antenna. Black anodized aluminum. 2¾x2¼x1¼ inches.

MFJ-888
$199.95

MFJ-888, like MFJ-886, but covers *10 Hz*-3 GHz. Measures frequency/ period, has 50/1M Ohm input, auto hold, LED backlight, beeper. 2¾x4¼x1¼ inches

Field Strength Meters

MFJ-802
$49.95

MFJ-802 shows relative antenna field strength. Use to determine radiation pattern. Has large 3 inch meter. Telescoping *dipole* reduces influence of surrounding objects and is more reliable and repeatable than monopole. Sensitivity control. Jack for remote sensor. **MFJ-802R, $34.95.**

MFJ-801
$29.95

MFJ-801 has 1¾ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

Find Power Line Noise fast!

MFJ-852
$119.95
with dipole

MFJ-856
$159.95
with 3 el.Yagi

Choose 3 element Yagi or compact telescoping dipole to quickly pinpoint noise. Walk or drive with these handheld, directional noise finders to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise directly to pole, transformer, insulator or others. Has field-strength meter, headphone jack to listen or record. Operates in optimum 135 MHz region. Sensitive .3uV receiver, 70 dB AGC.

81 dB Step Attenuator

MFJ-762
$89.95

81 dB Attenuator in 1 dB steps. 50 Ohms. Usable to 500 MHz. 250 milliwatt maximum input. BNC connectors. Shielded stages. Connect between receiver and antenna and use S-meter as a precision calibrated field strength meter. Prevent receiver blocking, cross-modulation. Determine gain/loss, ideal for fox hunting. Evaluate linearity. Isolate circuits. Extend range of sensitive equipment. Measure input/output level differences.

Compact Cross-Needle SWR/Wattmeters

MFJ-822
$59.95

MFJ-822, $59.95. Large 3-inch *lighted* Cross-Needle meter covers 1.8-200 MHz in 2 power ranges: 30/300 Watts. Read forward, reflected power, SWR *simultaneously*. Compact 3¼Wx3¼Hx3¼D inches takes little space. Perfect for home, mobile or portable use. SO-239 connectors. Use 12 VDC for lamp (cable included). **MFJ-842, $59.95.** Like MFJ-822, but covers 140-525 MHz, 15/150 Watt ranges.

25-1300 MHz Discone Antenna

MFJ-1868
$59.95

Ultra wide-band antenna receives 25-1300 MHz. Perfect for scanners. Transmit 50-1300 MHz. Handles 200 Watts. Ideal for 6/2/1¼Meters, 70/33/23 CM ham bands. Excellent for testing various transmitters on single coax. SO-239, 50 feet coax, stainless steel elements.

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300 Watt Antenna Tuner

VC-300DLP
$179.95

VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and 1000 Volt variable capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

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VC-300M
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The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna, any HF transceiver and fits in the smallest car. It can also be used at home with any coax fed antennas -- dipoles, vees, verticals, beams or quads.

Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. 3.4 pounds.

SWR/Power Meters

PM-30
$89.95
PM-30UV
$99.95

PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.

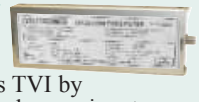
144/220/440 MHz, 30/300 SWR/Wattmeters
PM-30UV, $99.95, SO-239 connectors.
PM-30UVN, $99.95, N connectors.
PM-30UVB, $99.95, BNC connectors.

1.5 kW *dry* Dummy Load

DL-650M, $79.95
100 Watts continuous 1500 W/10 seconds to 650 MHz. *Ceramic* resistor. SWR less than 1.3. SO-239s. **DL-650MN, $84.95** has N connectors.

Low Pass TVI Filter

LP-30, $89.95
Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. Handles 1.5 kW.



High Pass TVI Filter

HPF-2, $34.95
Installs between VCR/TV and cable TV/antenna cable. Eliminates or reduces interference caused by nearby HF transmitters.

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MIRAGE. . .160 Watts on 2 Meters!

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	--	--
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base*. **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $299**, 60W out/2W in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount,$199.95*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Repeater Amps

11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

Accurate SWR/Wattmeters

Read SWR directly and Forward/ Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

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- Radio City
- R&L Electronics

New! - PK-232SC with Sound Card, Rig Control, USB - All built-in!

PK-232SC Multimode Data Controller*

Sound Card, Rig Control, USB, Pactor, RTTY, CW Packet & more!

100,000 sold - All-time top selling data controller!

New PK-232SC Now shipping!

- Single USB connection to computer
- USB Sound Card built-in
- 3-Way Rig Control built-in - logic level, RS-232 & USB!
- Computer isolated from radio

As Always- Upgrade any PK-232 ever made to the PK-232SC!

Customize your PK-232 with our complete line of upgrades and accessories.

The incredible PK-232SC again expands its role in your radio station. Now it 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 new logic level and RS-232 rig control is optically isolated for your Icom CI-V, Yaesu CAT, Kenwood and other radios. You never have enough downstream USB ports so we even added a pair for that new radio with USB rig control and other accessories.

Need Software? Get the new Ham Radio Deluxe & Radio Operating Center bundle for $99.95!
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Signal Processing, Antenna Analysis, Data & Remote Control

DSP-599zx Audio Signal Processor*

Noise Reduction, precision highpass, lowpass, bandpass & notch filtering for audio, CW & data.

Now shipping with new bigger & brighter display!

TZ-900 Antenna Analyzer

Once you use the TZ-900 - you'll never want to use any other!

Sweep and analyze antennas in seconds. Zoom, Compare & Store Data. Sunlight-visible color graphics, handheld, rechargable batteries, no computer required.

ANC-4 Antenna Noise Canceller

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Kill Noise before it reaches your receiver! Great for supressing power line noise, plasma TV noise & many other local electrical noises.

DSP-232+ Multimode Data Controller*

Sound card interface, USB, Pactor, 1200/9600 Packet

PK-96/100 TNC - 1200/9600 Packet*

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HamLinkUSB™ Rig Control Plus

C-IV, CAT, RTS (PTT, FSK or CW) for sound card software

PK-232 RS-232-to-USB Adapter*

HamLinkBT-BTH+™ Bluetooth® Adaptor

Use a standard cellphone Bluetooth® headset to keep your hands free for driving and operating. Includes USB rig control for your station. Audio, VOX & PTT - Fixed & Mobile.

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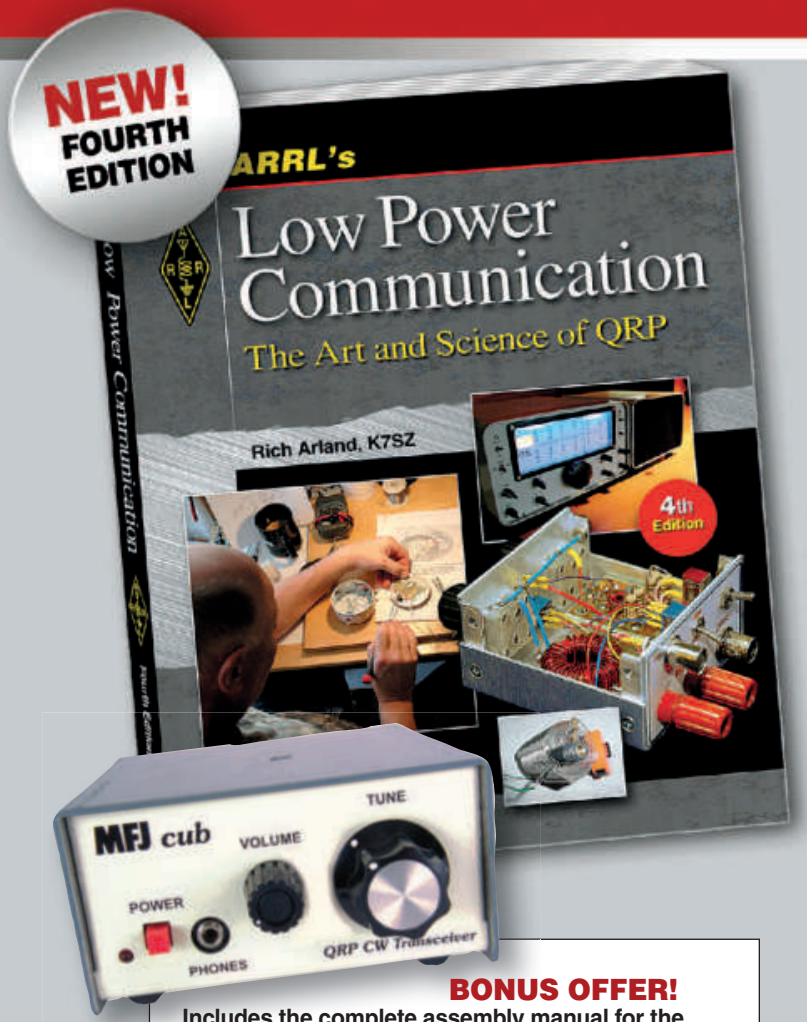
A Little RF Power Goes a Long Way!



BONUS OFFER!
Includes the complete assembly manual for the **MFJ Cub Transceiver Kit** (sold separately). **Build this tiny high-performance radio in just a few hours and get countless hours of enjoyment working the world with QRP!**

ARRL's Low Power Communication
The Art and Science of QRP

by Rich Arland, K7SZ

The fourth edition of *ARRL's Low Power Communication* is your guidebook to the fascinating world of low power QRP operating. With only 5 W or less—sometimes much less—you can enjoy conversations over hundreds and even thousands of miles.

Highlights include:

- **Tips to Get You Started the Right Way**
  An introduction to QRP operating, FAQs for newbies and tips that even experienced amateurs will appreciate.
- **Equipment and Station Accessories**
  Off-the-shelf commercial gear, kit building and homebrew, including an all-new homebrew photo gallery.
- **Antennas for QRP—Updated and Expanded!**
  Wire beams, loops, dipoles, portable antennas and alook at the author's new stealth antenna design.
- **Operating Strategies**
  Contesting, awards and advanced techniques for becoming a successful QRP operator.
- **Emergency Communication**
  Training, planning and other factors for utilizing low-power gear during an emergency.
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Special ARRL Member Price—Only $24.95*
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QST 8/2012

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NEW IC-2300H 2M

Powerful, smaller and simple to use. Tough and built to last!

- 65/25/10/5 Watt Output
- RX: 136–174MHz*
- 207 Alphanumeric Memory Channels
- 4.5W Audio Output
- Built-in CTCSS/DTCS Encode/Decode
- MIL-STD 810 G Specifications

IC-2820H 2M + 70CM

Feature-rich mobile with optional GPS receiver.

D-STAR Optional

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Your ultimate 2m mobile experience.

- 75 Watt Output
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Classic analog operation, updated for today's ham

Durable construction, built to military standards

Impressive loud audio, even in noisy environments

Powerful, long-lasting battery and recharger

Also available:

V80 SPORT & T70A SPORT

Comes with a AA alkaline battery case. Costs less, longer storage!

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

digital HFDSP

Icom's pioneering work in Digital Signal Processing lets today's ham isolate weak signals without needing to buy expensive optional filters.

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IC-7800

200 Watt Output (50W AM),
Built-in Power Supply

RX: 0.030–60.000MHz*

Four 32 Bit IF-DSPs + 24 Bit
AD/DA Converters

2 Independent Receivers

+40dBm 3rd Order Intercept Point

3 Roofing Filters

Selectable, "Build Your Own"
IF Filter Shapes

IC-7700

200 Watt Output (50W AM),
Built-in Power Supply

RX: 0.030–60.000MHz*

Two 32 Bit IF-DSPs + 24 Bit
AD/DA Converters

Single Receive

+40dBm 3rd Order Intercept Point

3 Roofing Filters

Selectable, "Build Your Own"
IF Filter Shapes

IC-7600

USB Control Audio

100 Watt Output (30W AM),
Optional PS-126

RX: 0.030–60.000MHz*

USB Port for CI-V Format
PC Control and Audio In/Out

Dual Receive

+30 dBm 3rd Order Intercept Point

3 Roofing Filters

Selectable, "Build Your Own"
IF Filter Shapes

you can't work 'em if you can't hear 'em

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

QST QuickStats

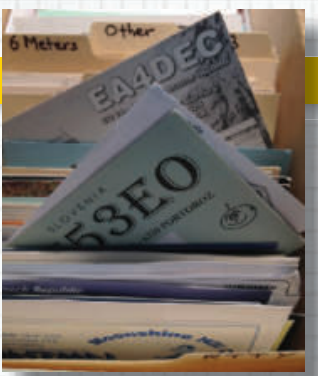
sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for May 6 through June 6.
Get on the web and vote today at **www.arrl.org/quickstats**!

Do you suffer interference from your vehicle's electronics when you operate mobile?

- Yes, it is so bad I can't operate mobile at all 2%
- Yes, but although it is strong it's isolated to certain bands and frequencies 4%
- Yes, but it is weak enough that I can still operate 17%
- No 50%
- I don't operate mobile 27%

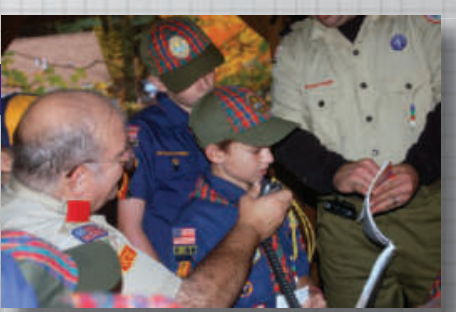


Where do you store your QSL cards?

- In boxes 35%
- In a file drawer 10%
- In a desk or cabinet 14%
- In a book or binder 16%
- Other 12%
- I don't collect QSL cards 13%

How do you participate in Field Day?

- By myself 17%
- With a small group of friends or family 7%
- With a club 52%
- I don't participate in Field Day 24%



How were you introduced to Amateur Radio?

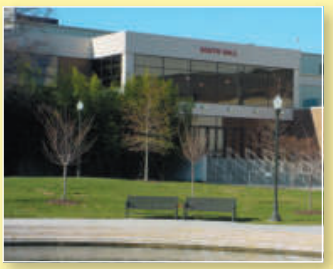
- Through a family member 18%
- Through a friend 32%
- By seeing hams operating at a public event 3%
- Through a website 1%
- Through social media such as Facebook 1%
- Through a radio, TV or newspaper advertisement 1%
- By listening to a scanner or shortwave receiver 23%
- Other 21%

www.hamfest.org www.hamfest.org www.hamfest.org

Huntsville Hamfest and ARRL Southeastern Division Convention

August 18-19, 2012

South Hall, Von Braun Center, Huntsville, Alabama



Program Highlights

- **Huntsville Hamfest:** Featuring a huge new equipment dealer show, many major manufacturers, giant flea market. Huge forum slate including ARRL, public service, DX, technical and contesting topics.
- **DX Card Checking:** Representatives will be available to field check your DX cards for DXCC credit. Visit the NADXC booth for information.
- **Hospitality Suites:** Huntsville Hamfest will host Hospitality Rooms at the Holiday Inn across the street from the VBC on Friday and Saturday nights.
- **2011 YHOTY (Young Ham of the Year):** An award intended to recognize a young ham who has demonstrated his or her dedication to Amateur Radio through his or her activities.
- **Talk-in station:** Our always welcoming and always helpful talk-in crew (they haven't lost a visitor yet) will be operating as K4BFT on the 146.94 repeater for complete talk-in information. Back-up frequency is 147.30. No PL required during the hamfest weekend.
- **HAYLARC YL Breakfast:** The Huntsville Area Young Ladies Amateur Radio Club (HAYLARC) invites all YLs attending the Huntsville Hamfest to join them for a Dutch breakfast Sunday, 7:00 AM at Mullins Drive In.

- **DX Banquet** – Saturday evening sponsored by the North Alabama DX Club, featuring Bob Allphin, K4UEE speaking on 2012 HKØNA DXpedition to Malpelo Island. Ticket info: Bob DePierre, K8KI@comcast.net. The DX Banquet is held at the Holiday Inn across from the Von Braun Center.
- **License Exams:** Exams will begin at 10:00 sharp Saturday and Sunday in the curtained area outside the South Hall. Bring your original license, copy of same, any CSCE's you want to present, some means of personal identification and the $15 test fee.

Hotels

Holiday Inn Downtown
Huntsville Hamfest Official Hotel
Right across the street from the hamfest site, is the Holiday Inn, Huntsville Downtown. Call them at (256) 533-1400 (Huntsville) or 1-877-320-8455 (Corporate). Mention the Group/Convention code "**SHF**" to get the special Hamfest rate of $82. **www.holidayinn.com/hunsvilleal**

Embassy Suites, Huntsville, AL
You may also want to consider reservations at the Embassy Suites adjacent to the Von Braun Center. Call (256) 539-7373 (Huntsville) or 1-800-362-2779 (Corporate) and mention the Group/Convention code "**HMF**" for the special Hamfest rate of $109 (single or double).
www.embassysuiteshuntsville.com

Nearby Points of Interest

- ✓ U.S. Space & Rocket Center and U.S. Space Camp
- ✓ Bridge Street Centre – Upscale Shopping Mall
- ✓ Huntsville Botanical Garden
- ✓ Huntsville Museum of Art
- ✓ Cathedral Caverns State Park
- ✓ Historic Huntsville Depot Museum and Alabama's Constitution Village

Parking: The parking garage across the street from the VBC will be open with a parking fee of $5. The South Hall where the Hamfest is located has a 500 space ground level garage with a parking fee of $5. Elevators carry you up to the hamfest.

ARRL The national association for AMATEUR RADIO®

Huntsville Hamfest Association
The World's Friendliest Hamfest
www.hamfest.org

The ARRL National Convention
hosted by Pacificon and the Mt. Diablo Amateur Radio Club

October 12, 13 & 14 at the
Marriott Hotel • Santa Clara, California
www.arrl.org/expo www.pacificon.org

PROGRAM HIGHLIGHTS

Pacificon—This premier west coast Amateur Radio convention features over 80 forums and presentations, plus a huge exhibit hall with commercial dealers and manufacturers, flea market and outdoor swap meet. Enjoy dozens of programs for QRP, DX, kit building, transmitter hunts, and demonstrations of Amateur Television (ATV/DATV), satellite, and more!

ARRL EXPO 2012—A large exhibit area featuring ARRL program representatives, activities and a huge ARRL bookstore.

All-Day Antenna Seminar (Fri.)

Law Forum (Saturday morning)

DXCC Card Checking—and other ARRL operating awards

Saturday Banquet

Licensing Class and Exam Sessions

W1AW/6 Special Event Station

International Space Station—scheduled ARISS radio contact

ARRL Wouff Hong Ceremony

Youth and Scouting Programs

...and much more!

Online Registration is OPEN!
www.pacificon.org

TICKETS

www.pacificon.org

Purchase advance tickets online by October 1.

General admission
in advance $23
at the door $28

Youth 17 and under are **FREE** (registration and Youth Convention Badge is required).

See www.pacificon.org for more information including lodging options and travel information.

NEARBY

California's Great America theme park (next door!)

Intel Museum

The Tech Museum of Innovation (downtown San Jose)

Computer History Museum

Winchester Mystery House

Triton Museum of Art

NASA Ames Exploration Center

Shopping and restaurants galore: Mercado Santa Clara, Santana Row, Westfield Valley Fair.

San Francisco and wineries are just a short drive away.

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$139.95

MASTRANT

Synthetic guy ropes & accessories

Mastrant-P

New type of guy wire optimized for guying with respect to maximized "performance/price" rate. This excellent rope offers very good strength, low elongation, high UV and humidity resistance. It has low weight, great abrasion resistance, great durability and is electrically insulating. Moreover, in contrast to ropes made from aramid fibres (Kevlar, Vectran, Technora, Twaron), it has knot strength almost 60 %! Due to these properties, MASTRANT-P is exceptionally suitable for all kinds of guying.

Model	Diameter	Length	Price
MP02100	2mm	100m/328ft	$17.00
MP03100	2mm	100m/328ft	$25.00
MP04100	4mm	100m/328ft	$37.00
MP04100	5mm	100m/328ft	$54.00
MP06100	6mm	100m/328ft	$90.00
MP08100	8mm	100m/328ft	$114.00

ICOM

IC718

The HF bands allow you to communicate over long distances covering many km even to the other side of the world. With the superior performance found in the IC-718 such as wide dynamic range, high C/N ratio, and full duty operation you will find making these contacts easy. Experience the combination of the latest RF and digital technology, along with the size and simplified operation. You will see the IC-718 will be the most practical rig you will ever own.

AH4 Auto Tuner 319.95
CT17 Level Converter 142.95
FL52A 500Hz CW filter 204.95
MB23 Carrying Handle 16.95
UT102 Voice Synthesizer 71.95

IC2820H

Wideband receiver with simultaneous receive capability, Diversity receive capability, 50W on VHF and UHF, Separate controller from main unit, 522 memory channels, Band scope function, Optional D-Star operation.

CS2820 Programming Software 38.95
MB65 Mounting Base 35.95
OPC478UC USB Cloning Cable 52.95
OPC589 8 pin modular adapter 36.95
OPC1663 Separation Cable 11.2ft 15.95
UT123 Digital/GPS Unit ..... CALL

IC7000

IF DSP, AGC Loop Management, Digital IF filter, 2 point manual notch filter, Digital noise reduction, Digital noise blanker, 35W output on 70cm band, High stability crystal unit, Direct digital synthesizer circuit, Compact, all in one package, User friendly key allocation, Digital voice recorder, Built-in RTTY demodulator, 2.5 inch color TFT display.

AT180 Auto Tuner 499.95
CT17 Level Converter 142.95
OPC589 Modular 8 pin mic adapter 36.95
RMK7000 Remote Kit 74.95
SM20 Desk Mic 209.95

IC92AD

Rugged submersible protection, Optional GPS speaker microphone, Wideband receiver with dualwatch capability, 5 watt output, Simple bandscope, Built in voice recorder, Large dot matix display, One touch reply button, Keypad navigation, Optional PC remote control capability,

BC177 Rapid Charger 68.95
BP256 7.4V @ 1620mAh Li-Ion 86.95
BP257 AA Battery Case 36.95
HM175GPS Wtrprf spkr mc w/GPS 229.95
HM75A Speaker Mic w/Remote 71.95
HS85 Headset w/VOX, PTT 109.95
LC168 Carrying Case 29.95
RS92 Remote control software 82.95

ICT70A

Rugged 2m/70cm HT, 700mW loud audio, Long Lasting Battery Life, External DC Power Jack, 302 Memory Channels, CTCSS Built-in, Internal VOX function, PC Programmable with Optional CST70

BC193 Rapid Charger 50.95
BP263 AA Battery Case 26.95
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TYT TH-UVF1A Dual Band HT
144-148 MHz VHF(TX), 430-450 MHz UHF(TX), 136-174 & 400-470MHz plus FM broadcast (RX) FCC 2013 narrow band compliant, 128 memory channels, alpha numeric display, standard SMA antenna connector
FCC Certified

NEW! Wouxun KG-UV6D Dual Band
Frequency Range: VHF/UHF
Memory Channels: 199 channels
2.5KHz VFO steps, FCC 2013 narrowband compliant, Frequency Stability: ±2.5ppm
Operating Voltage: 7.4V
Waterproof: IP 55, Standard SMA antenna connector
FCC Certified

Wouxun KG-UVD1P Dual Band HT
Dual Frequency, Dual Display
144-148 MHz, VHF(TX)
430-450 MHz, UHF(TX)
136-174 & 400-480MHz plus FM broadcast(RX)
FCC Certified

NEW! – Now In Stock!
Baofeng UV-5R Dual Band HT

- Frequency: 136-174 / 400-480MHz
- Output Power: 4 /1Watts
- 128 Channels
- Built-in VOX Function
- 1750Hz Brust Tone
- FM Radio (65.0MHz-108.0MHz)
- LED Flashlight
- Large LCD Display
- High/Low RF Power Switchable
- 25KHz/12.5KHz Switchable
- Emergency Alert
- Battery Saver
- Keypad Lock
- Monitor Channel
- Channel Step: 2.5/5/6.25/10/12.5/25KHz

FCC Certified

Baofeng UV-3R
Ultra-Compact HT
136-174 MHz TX/RX
400-470 MHz TX/RX
2 watts
FCC Certified

Surmen Antennas

Experience SURMEN® Quality

Surmen's unique quality control provides maximum conformity while reducing cost. Each product is 100 percent tested before packaging to assure compliance with their rigid standards. Look for yourself. See and feel the difference. 304 Stainless for mounts, using zinc alloy castings and 304 steel and 631 steel tapered wire for antenna whips provides durability, strength and flexibility.

SURMEN COMMUNICATION CO., LTD. Not available at all locations

Surmen Max-1 Antenna Black SO-239 Now in Black and Natural
Frequency (MHz): 144/430
Max.Power(W): 60
V.S.W.R: <1.5
Length (M): 0.92
Weight(g): 135
Connector: PL-259

PRESENTING the Surmen NEW Max-1 NMO in Black!
Frequency (MHz): 144/430
Max.Power(W): 60
V.S.W.R: <1.5
Length (M): 0.92
Weight(g): 135
Connector: PL-259

KY-66 Trunk Lid/Hatch Back Door Mount
Color: Chrome
Weight: 168g

P-800 External Speaker
Speaker Max Power: 5 Watts
Cord: 4M
Plug: 3.5mm mono
Size: 90x85x35MM

S-850B Antenna
Frequency (MHz): 144/430
Max.Power(W): 150
V.S.W.R: <1.5
Length (M): 1.04
Weight(g): 350
Connector: PL-259

WP-115
Frequency(MHz): 144/430 MHz
Z (ohms): 50
Max Power: 10W
Length (mm): 400
Weight: 42g
Connector: SMA or BNC

Princeton Antennas

Princeton Antenna
80M Windom
131' overall length, black jacketed wire, 200 watts

Princeton Antenna
40/80D-Black, 109' overall length, black jacketed wire, 1500 watts

Princeton Antenna
G5RV, 102' overall length, 34' of 450 ladderline, 1500 watts

Power Supplies from QJE

QJE PS30SWIV
30 amps Max (10% duty cycle), 20 amps continuous 110/220 VAC.

Voltage is adjustable from 9-15 Volts or can be a fixed out-put of 13.8 VDC via a control located on the front panel.

QJE PS50SWIII
Switching Power Supply
13.8 VDC at 40 amps continuous, Adjustable output voltage from 9 to 15 VDC

QJE PS30SWI
DC Power Supply
Output voltage: DC13.8+0. 3V
Output current: 0-30A, 20A cont.

QJE PS30SWII
DC Power Supply
DC 13.8V Output: (9-15V adjustable)
Output current: 0-30A, 25A cont.
Ripple & Noise: <15m Vp-p
See February 2012 *QST* Product Review, Page 57

QJE PS30SWIII
DC Power Supply
Output DC 13.8V (9-15V adjustable) Output current 0-30A, 20A cont.

TigerTronics SignaLink USB Digital Mode PC Interface
Optimum performance while eliminating the need to attach to your computer's existing sound card.

Comet CHA-250B
The Comet CHA-250B is a newly designed broadband vertical with no ground radials. This antenna is very easy to assemble.

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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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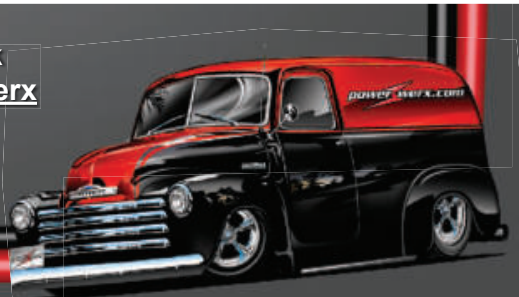

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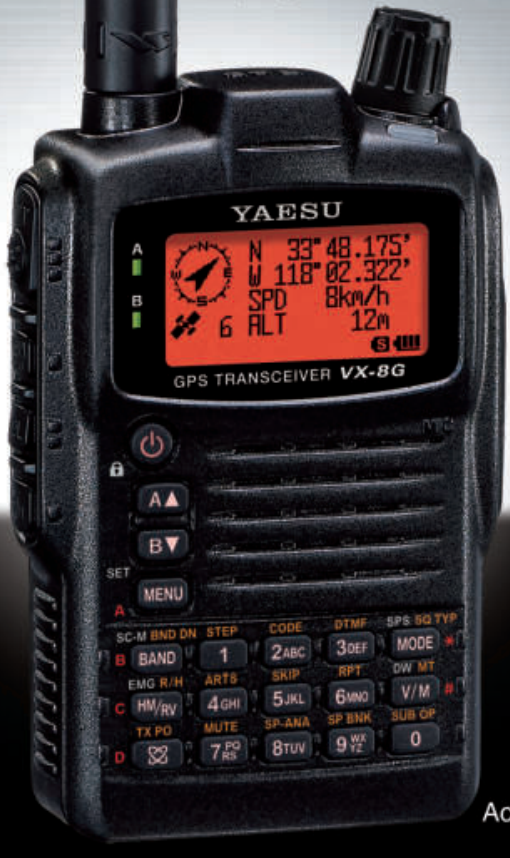

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