SPECIAL ANTENNA ISSUE

QST

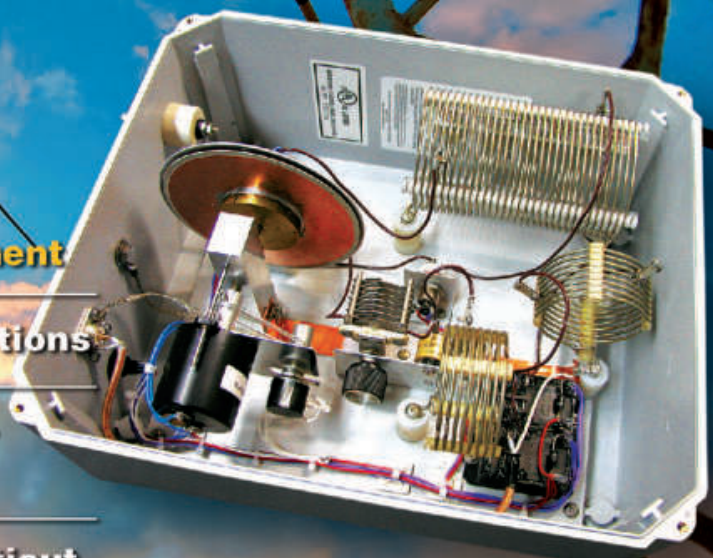
DEVOTED ENTIRELY TO AMATEUR RADIO

March 2012 WWW.ARRL.ORG

Antennas...

QST reviews:

Inside:



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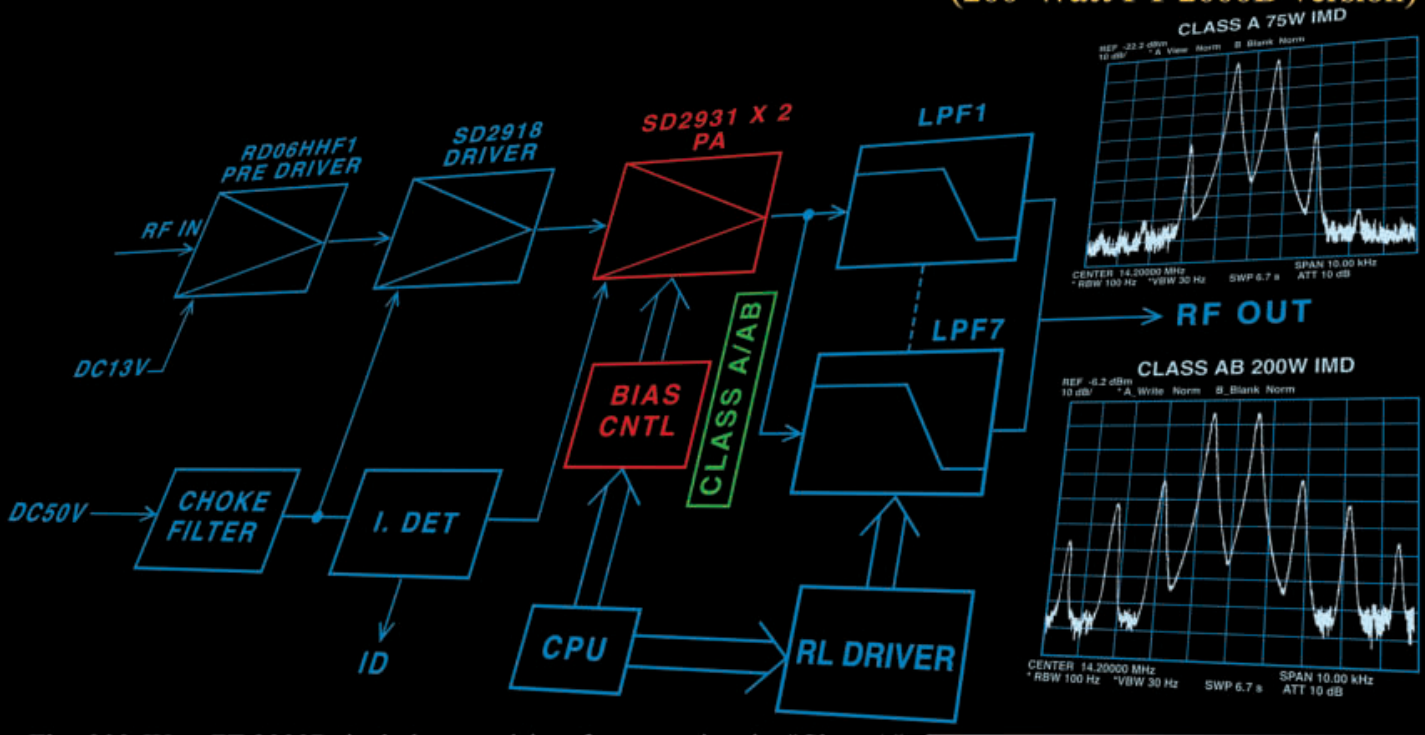
Official Journal of ARRL The national association for AMATEUR RADIO

The radio... YAESU
Choice of the World's top DX'ers

Ultra-low Distortion Class-A Final Amplifier

(200-Watt FT-2000D version)



The 200-Watt FT-2000D includes provision for operation in "Class-A" mode at 75 Watts of power output. It utilizes high bias current to produce very low transmitter Intermodulation products. The 3rd-order IMD products are typically suppressed 45 dB or better. The 5th and higher-order IMD is typically suppressed 70 dB or more. You may adjust the bias level between Classes A and AB to meet the demands of high ambient temperature in your station, and the long duty cycles associated with contest or DX-pedition use.

The FT-2000D (200-Watt version) utilizes push-pull SD2931 MOS FET devices, operating at 50 Volts. The user-adjustable bias control permits adjustment for optimum suppression of Intermodulation distortion products. The elaborate heat sink design includes a combination of aluminum and 3mm thick high-conductivity copper plate. The total heat sink capacity of 2720 ccm will ensure many years of reliable operation of this 200-Watt powerhouse.

HF/50 MHz Transceiver

FT-2000D 200 W Version (External Power Supply)

FT-2000 100 W Version (Internal Power Supply)

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The radio YAESU ...

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

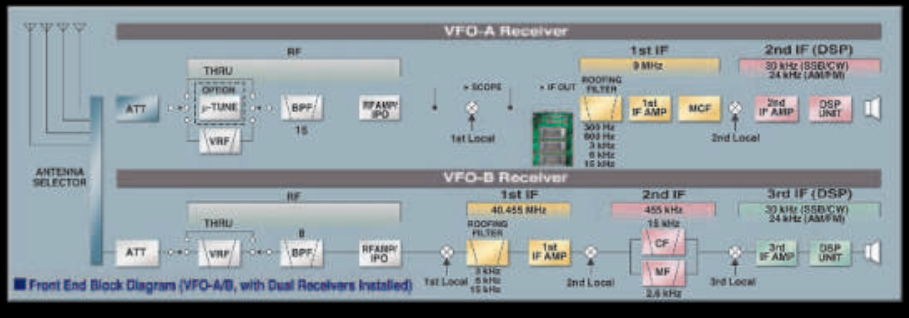
The New Premium HF/50 MHz Transceiver
FT DX 5000 Series

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

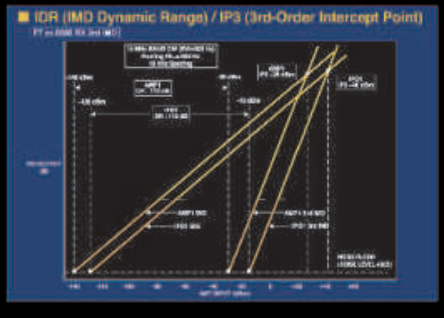
The tight shape factor 6 pole crystal filters and D Quad Double Balanced Mixer design afford incredible improvement in 3rd – Order dynamic range and IP3 performance

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)



Front End Block Diagram (VFO-A/B, with Dual Receivers Installed)



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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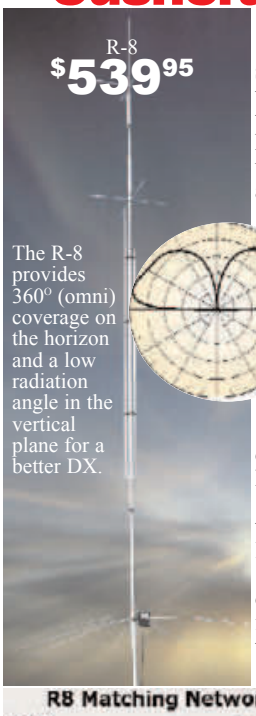
Cushcraft R8 *8-Band Vertical*



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!

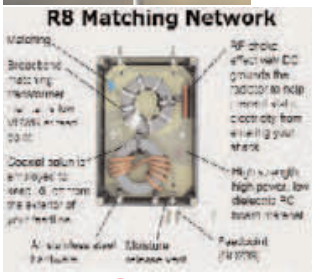
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

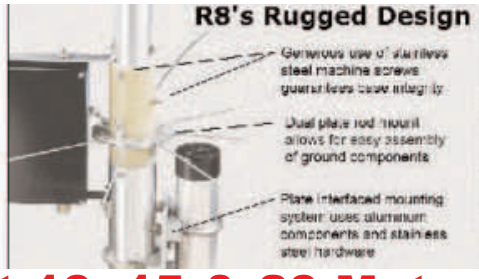
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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

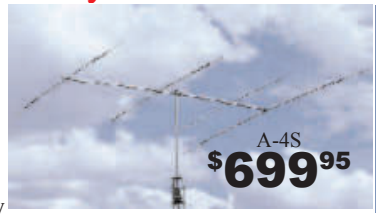
Small Footprint -- Big Signal

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.

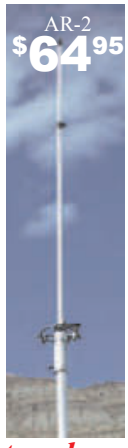
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

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!

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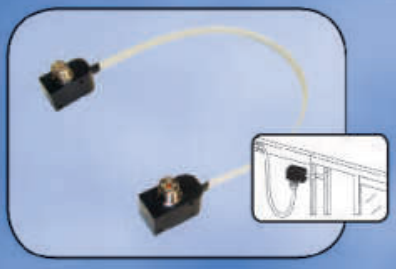
Life is a JOURNEY. Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

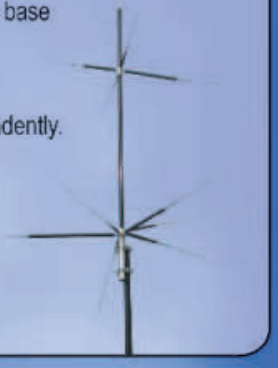
Max Power: HF 100W PEP
VHF: 60W FM
UHF: 40W FM
900MHz - 1.3GHz: 10W
VSWR: <500MHz 1.3:1
>500MHz 1.5:1
Impedance: 50Ohm
Length: 15.75"
Conn: 24k Gold Plated SO-239s

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



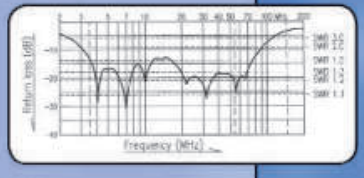
COMET CHA-250B
Broadband HF Vertical!

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.

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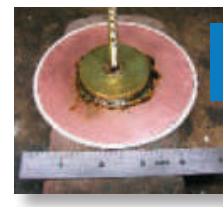
In This Issue

March 2012 Volume 96 Number 3

Technical

Page 46



Page 33

News and Features

Our Cover
Limassol Radio Club station 5B4MS on the island of Cyprus is located on property owned by the British East Mediterranean Relay Stations social club. Most 5B4MS club members are in the broadcasting business. The antennas, installed just a few yards from the sea, enjoy excellent take-off paths to Africa.

Sticking with the antenna theme, the inset photo shows the RF deck used to remotely tune a 43 foot vertical. The article begins on page 33.
[Background photo by Henryk Kotowski, SM0JHF; inset photo by Shef Robotham, WA1RHT]

Radiosport

Columns

Departments

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e-mail: qst@arrl.org

March 2012
Volume 96 Number 3

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

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- Foot Stand
- Classically Designed Main Dial and Knobs
- Dynamic Microphone MH-31 A8J Included

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-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

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

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

The King of Mobile

75 WATTS

NEW

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

*70 cm 45 W

FT-7900R

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

2 m/70 cm DUAL BAND

Best Selling, Reliable Mobile

55 WATTS

2 m MONO BAND

HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

FT-2900R

NEW

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

Commercial Grade Field Radio Submersible Construction

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

2 m MONO BAND

Size: 5.5" (W) x 1.5" (H) x 5.8" (D) / Weight: 2.2 lb

Compact Field Radio with Top Mounted LCD and Loud Audio

COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-270R

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

2 m MONO BAND

NEW

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

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

2 m MONO BAND

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NEW COMPACT HF TRANSCEIVER WITH IF DSP

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

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

HF/50 MHz 100 W All Mode Transceiver

FT-450D

With Built-in Automatic Antenna Tuner

- NEW Illuminated Key buttons
- NEW 300 Hz/500 Hz/2.4 kHz CW IF Filters
- NEW Foot stand
- NEW Classically Designed Main Dial and Knobs
- NEW Dynamic Microphone MH-31A8J Included

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

MOS FET RD100HHF1

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

Handy Front Panel Control of Important Features including:

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

More features to support your HF operation

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

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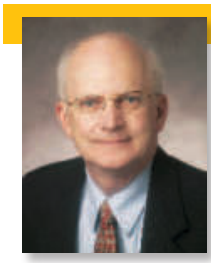

David Sumner, K1ZZ – dsumner@arrl.org
ARRL Chief Executive Officer

The FCC's Parallel Universe

"In the parallel universe that apparently exists just south of the corner of 12th and D Streets SW, Washington, DC, Broadband over Power Lines (BPL) is an 'important new technology option for delivery of broadband internet/ data services.' In the real world, BPL is a polluter of the radio spectrum and an expensive failure as a broadband delivery service."

On October 24, 2011 the Federal Communications Commission released its long-delayed Second Report and Order on rules for Access BPL systems. The 76-page document is rife with evidence that the FCC exists in a parallel universe, divorced from the one inhabited by the rest of us.

It took the FCC *3½ years* to complete its response to a remand by the United States Court of Appeals for the District of Columbia Circuit. The remand, ordered after the ARRL went to court to challenge the FCC's flawed rulemaking process, required that "the Commission shall afford a reasonable opportunity for public comment on the unredacted studies" that the Court found the FCC had unlawfully withheld and "provide a reasoned explanation of its choice of an extrapolation factor for Access BPL systems."

At the time we predicted that "the FCC's technical staff…will remain under heavy pressure to ignore the laws of physics and give preference to wishful thinking once again." And so it came to pass. The Second Report and Order repeatedly acknowledges that the ARRL's arguments are correct with regard to physics but erroneously claims that "ARRL asserts that there is only one scientifically correct and valid answer for an extrapolation factor." In fact we argued just the opposite.

In the Second Report and Order the Commission concluded that extrapolation "is far less important than the fact that *harmful interference must be corrected under any circumstances* [emphasis added]." This is a statement that would cause us to stand up and cheer but for one thing: the Commission's actions do not match its words.

On December 29, 2010 the ARRL filed a well-documented complaint of violations by BPL systems operated by IBEC. In the Second Report and Order released *nearly ten months later* the FCC had the nerve to say that this complaint was submitted "recently" and that it "is under investigation at this time." Can the evidence be any clearer that licensed radio services cannot rely on the FCC to take timely action to correct BPL interference after the fact, and that the only way to deal with BPL interference is to require that BPL systems not radiate at interference-producing levels to begin with?

We now know that in addition to being unable to supply BPL services to customers without violating the FCC's inadequate rules, IBEC had other problems. Never financially viable without grants and loans from the federal government, IBEC apparently ran out of money before it could make more than token installations in its target areas served by rural electric cooperatives. At the end of 2011 IBEC announced that it would close its doors and cease operations in January. Thus IBEC joins the list of BPL operators that were only able to resolve interference by shutting down.

The picture of Access BPL painted by the FCC's Second Report and Order is of an "important new technology" delivering broadband services to consumers in 125 ZIP codes across the United States while causing but one interference complaint. In fact BPL has left a trail of failed enterprises that have consumed many millions of dollars in the course of demonstrating that the principal product of BPL is interference. The "125 ZIP codes" statistic, which comes from a demonstrably defective industry source, was and is completely at odds with the FCC's own data that show there have never been as many as 6,000 BPL customers nationwide — and with IBEC shutting down, that number now has dropped dramatically.

The course of action available to the ARRL after the release of the Second Report and Order was to file a petition for reconsideration. This was done on December 21. Because petitions for reconsideration are limited to a certain length we focused on the one change that would accomplish the most: making it mandatory for BPL system operators to notch the amateur bands to a level at least 25 dB below that generally allowed between 1.7 and 30 MHz. If the FCC were to take this single step — and if BPL operators were to follow the rules — nearly all interference to amateur stations would be avoided. We would be reasonably satisfied with this outcome and the FCC would no longer have to make believe that ignoring interference complaints is the same as resolving them.

You may wonder why, if BPL has failed in the marketplace, the ARRL continues to worry about it. There are two reasons. First, while it is not a viable medium for delivering broadband service to consumers BPL is still getting some consideration for so-called "smart grid" applications. Second, bad rules tend to outlive the purposes for which they were created. Even if Access BPL disappears completely there is no guarantee that another noxious concept might not later rear its head, with its proponents arguing that the "success" of the BPL rules shows that their devices ought to be allowed to radiate the same way.

The radio spectrum is a precious natural resource. The tiny segment of spectrum in which signals propagate across thousands of miles by virtue of the remarkable properties of the ionosphere is especially precious. The laws of physics being universal, this must be true everywhere — even within the FCC's parallel universe.

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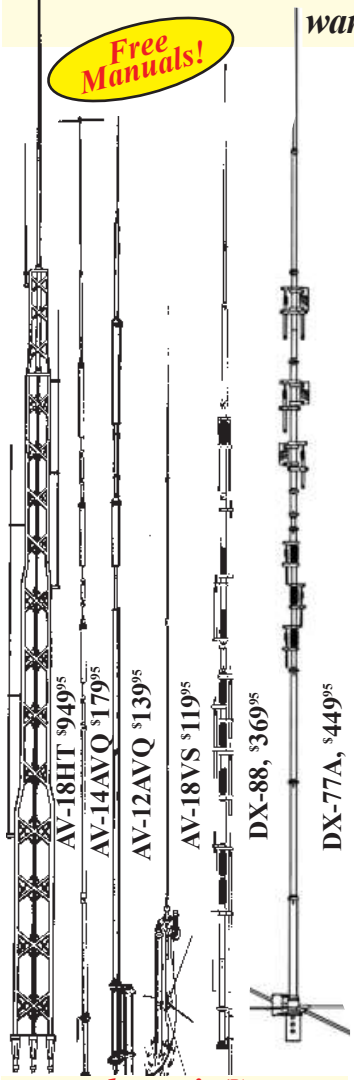

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AV-12AVQ, $139.95. (10, 15, 20 Meters). 13 ft., 9 lbs. **AV-12AVQ** also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with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

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AV-14AVQ	**$179.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$139.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$119.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 80 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 40 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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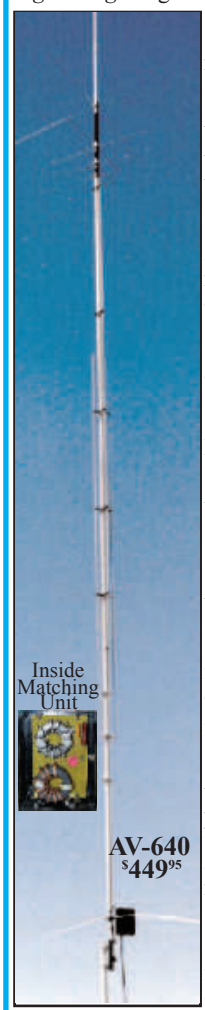

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Joel P. Kleinman, N1BKE – jkleinman@arrl.org

In Brief

- The ARRL Board of Directors held its 2012 Annual Meeting January 13-14. See page 73, this issue, for details.
- IBEC — one of the very few remaining operators of Access BPL systems — announced that it is closing down.
- ARRL rolled out its Diamond DXCC Challenge to commemorate the 75th anniversary of the ARRL's DXCC Award.
- On January 11, the FCC issued a *Memorandum Opinion and Order* denying an ARRL *Petition for Reconsideration* concerning vanity and club call signs.
- After four years under the Motorola umbrella, Yaesu has split from that company. The amateur division is known as Yaesu USA in the US.
- The FCC has granted Phil Williams, KA1GMN, a Special Temporary Authority (STA) to conduct specified Spread Spectrum experiments.
- The ARISSat-1 satellite re-entered Earth's atmosphere January 4.
- The ARRL Public Relations Department released the Do-It-Yourself (DIY) suite of promotional materials aimed at exposing the growing Do It Yourself/Maker community to Amateur Radio.
- The ARRL is asking for feedback to assist in crafting a proposed 5 MHz band plan.
- The winners of the *QST* Cover Plaque Award for December are Ashraf Abuelhaija and Klaus Solbach, DK3BA, for their article "An Inverted V Wire Yagi with Switchable Pattern Rotation for 14 MHz."

Media Hits

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

Before the release of the DIY materials on December 27, there were four main themes found in the media hits for the month: kids, helping hams, emergencies and victories.

- The *Rochester Democrat and Chronicle* happily told how "Kids dial into ham radio at Rochester Museum & Science Center" and the Rochester DX Association's display table. *Hawaii News Now* was proud of nine Sacred Heart Academy students who used the NASA Amateur Radio Ground Station on the Waialae campus to create the connection between the ISS and a school in Quebec. And Amateur Radio operators spread some Christmas cheer for younger children in the *Wisconsin Rapids Tribune* article "Kids can send message to Santa."
- Helping their communities is natural for hams, and was appreciated in the *Tri-City Herald* (WA) report of the special event at the National Weather Service office at the Pendleton Airport. Another one was "Amateur radio operators to be recognized" as volunteer operators were noticed for their service to the community in the *Jacksonville Daily News* (FL). The Royal Harbor Amateur Radio Club got another Florida hit as "Radio club takes part in Skywarn" in the *Daily Commercial.* But the most interesting helping ham appeared in *Chicago Tribune's* "Cook Islands: The glorious middle of nowhere." Asking for the island location, the reporter wrote, "No one nailed it until I spoke with a geography-crazed ham radio operator. "Oh, yeah," he said, rattling off the coordinates." The Cook Islands: They're basically in the middle — of the middle — of nowhere."
- Ham radio and emergencies always make news. But this month we had some major hits with a twist. Beginning with no less than the *New York Times* article "The World Is Ending, Please Update the Home Page." They wrote, "Ham radio was deemed to be the more durable and rugged platform, which is something to think about when everyone is focused on a different kind of wireless." 911.com, an important emergency management site added, "So, what makes Amateur Radio operators such a great resource? Simple: Have tech, innovative spirit, and will travel." This was proven out when "HAM radios come to the rescue during Utah wind storm" as reported on KSL.com. "Communications were tough for dispatchers during Thursday's massive wind storm. So to help get the word through faster, a special team of HAM radio operators was called in to help." But the best one of all had to be "Milwaukie seniors keep ham radio alive in case of emergency" in the *Oregonian*. "As a member of Willamette View Manor's ham radio club, she's ready to assist during floods, storms or other emergencies affecting communication. Louise Evans was an amateur radio operator in California for 15 years before moving to Oregon 22 years ago..." KE7LSF just got her A-1 Operator Award, is an active ham and an ARRL member — and she's 102 years old.
- Victories were celebrated in "Amateur radio operators at all-time high" in *The Dunkin Daily Democrat* (MO); "Amateur radio remains vital" in *New Times* (CA); "Local radio club going strong" in the *Green Valley News* (AZ); "You and your man shed," a *NY Times* blog by Jim Peterson; and "Amateur Radio Balloon Flies From California to Algeria" in *Popular Science*. "A weather balloon built and powered by amateur radio balloon enthusiasts made an epic three-day journey from California to the Mediterranean, splashing down after it apparently burst somewhere off the Algerian coast...."
- But the best was the DIY media hit "Ham creates bloodless scalpel in garage" about Dr Kim Manwaring, N7DFU, on KSL-TV (UT) and MSNBC. "From garage to operating room, surgeons using bloodless scalpel. I met Dr. Manwaring in a garage where he showed me a ham radio with a small piece of wire and he showed me how he could heat that piece of wire."

At the 2012 Annual Meeting of the ARRL Board: ARRL President Kay Craigie, N3KN, presided over the meeting. Details appear in the article beginning on page 73, this issue. [Harold Kramer, WJ1B]

Take Precautions, and They Will Survive

I purchased a Cubex quad antenna from the US three years ago and erected it on a 20 foot, 4 legged windmill tower with a 33 foot pole running through the center. I had asked for heavier gauge wire than is usually supplied with the antenna because of the strong winds in this area.

Recently, I erected another antenna — a multiband HF V Beam using 300 foot lengths of high tensile steel fencing wire for each leg. Not the most efficient RF radiator, but certainly robust.

Another antenna here is a multiband HF ground plane using the Hustler 6BTV vertical on a 20 foot steel pole with 10 radials around the base of the radiator. Because of the windy conditions here, I used high tensile steel fencing wire for the radials. The vertical itself is over 20 feet in length so I used Dacron rope to tie it to the ground in two places along the length of the vertical with a total of four ropes at each point.

In November of 2011, a "mini tornado" roared through, blowing roofs off of houses and knocking over TV antenna towers. Although many trees were uprooted on my property and windows were broken, my antennas survived. Fortunately, the quad was facing side on to the winds. The experience has taught me that you can never over-engineer ham antennas.
— *ARRL member Rob Norman, VK5SW, Paradise, South Australia*

Strong guys pay dividends: Robust guying and planning for a worst case scenario enabled VK5SW's antennas to survive a mini tornado.
[Rob Norman, VK5SW]

SEANET VE Session

An ARRL VE session was held at the 2011 SEANET (South East Asia Net) Convention in Brunei last November. Four VEs held the FCC exams for Steve Telenius-Lowe, 9M6DXX/KH0UN, who upgraded from General to Extra, and Johnny Tan, 9M8DB (whose daughter lives in Michigan). Johnny passed the Technician and General exams and now holds KD8RGH.
— *9M6DXX/KH0UN*

The four VEs and the two successful candidates at the SEANET Gala Banquet last November: (l-r) Eddie Valdez, DU1EV/N9EV; Tachio ("Tac") Yonemura, JA1BRK/W1BRK (in traditional Japanese kimono); Steve Telenius-Lowe, 9M6DXX/KH0UN; Johnny Tan, 9M8DB; Sungki Lee, HL1IWD/AH2Y (in traditional Korean bridegroom's costume), and Kazuo ("Kazu") Ogasawara, JA1RJU/KH2K.
[Courtesy Steve Telenius-Lowe, 9M6DXX]

Inside HQ

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

Changes are Coming to *QST*

Some FAQs about the upcoming digital edition

Welcome to our annual Antenna issue. Articles about antennas are the number one topic that our members request and want to learn about.

Our members are also looking for details about the upcoming digital edition. We will be publishing more detailed information in *QST*, but here are the answers to some of the questions I've received:

- *Will I have to pay extra for the digital edition?* No — it will be offered as a free membership benefit to all ARRL members.
- *How will I access the digital edition?* It will be available on the ARRL website. You will use the same username and password that you currently use to log into the ARRL website. If you do not have an ARRL website username and password, you will need to register on our website to obtain them.
- *How will I know when the digital edition will be available?* Provided that you have given us your e-mail address, you will receive a message from us notifying you that it is available.
- *Will I still receive the print edition?* Absolutely. You will still receive the print edition in the mail each month.
- *Will I be able to download the digital edition to my PC?* Yes, you can download your own copy.
- *Will the digital edition be different than the print edition?* Yes — there will be some slight differences in the beginning. For example, all URLs and e-mail addresses will become active in the digital edition. Instead of the QR codes here in the print edition, you will be able to view the video within the digital edition itself. As we learn more about what we can do with the digital edition, we will be adding more specific editorial and multimedia content.
- *What other features will the digital edition feature?* The digital edition will also have full text search capability. You will also be able to zoom in and zoom out as you prefer. You will also be able to navigate quickly from page to page.
- *Will I be able to view it on my smartphone or tablet computer?* Yes — you will be able to view it through your smartphone's or tablet's web browser. We plan to have dedicated apps for other platforms in the future.
- *When will it actually debut?* We are still projecting sometime around mid-year.

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

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

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

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

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

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

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

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Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
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50-Volt operation gives you highly linear operation with a superbly clean signal.

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Features Galore!

An Operate/Standby switch lets you run "barefoot" and *instantly* switch to full power when you need it.

Fast 5 millisecond T/R relays (10 million operation lifetime specs) give you full QSK operation. The T/R relay sub-board is easily replaced if the relays ever fail.

Ameritron's *exclusive* front-panel ALC control prevents overdriving your transceiver.

The ALS-1300 can be keyed by any transceiver that can sink 15 mA at 12 VDC without requiring a special interface.

Super-clean modular construction makes service quick and easy.

Fully Protected!

The ALS-1300 is fully protected to prevent amplifier damage if you: switch to a band different from your transceiver, use the wrong antenna or have overly high SWR, if the heat sink temperature exceeds a safe level, if the dual 600 Watt modules are significantly RF unbalanced. Whenever the amplifier faults, it is automatically bypassed.

If output forward or reflected power exceeds a safe level, output power is automatically reduced to prevent amplifier damage by controlling ALC to the transmitter.

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The left meter continuously monitors DC current of both 600 watt amplifier modules.

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LEDs show which band is selected (manually bandswitched or automatically with optional ARI-500 Radio Interface) . . . ALC activity . . . when the amplifier is keyed . . . high SWR . . . power amplifier fault.

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Here's what they say . . .

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Inside the ALS-1300 Solid State Amplifier

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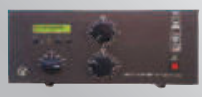

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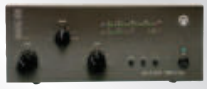

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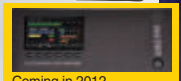

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Joel P. Kleinman, N1BKE, upfront@arrl.org

A Simple and Effective 10 Meter Radiator

John Reisenauer, HI3/KL7JR

Now that we have propagation on 10 meters back, it's time to get on the bandwagon homebrew style. A recent article in *QST* in which Bob Glorioso, W1IS, experimented with a 40 meter quarter wave vertical monopole antenna gave me the idea of building a similar antenna using mobile CB antennas.[1]

I had an old 24 inch Wilson FGT-2 vertical, so I decided to start with that and just add a couple of elevated radials to keep the antenna "low key" for my "no antennas allowed" patio in the Dominican Republic. I should point out that this antenna on a 5-foot-tall mast in the sand with three or four short radials yielded me a lot of DX a few years ago from KP2-land on 15, 17 and 20 meters.

Using just a pair of radials 180° apart yields omnidirectional coverage, which is what I sought for my small space antenna. The manufacturer advertises the antenna as ⅝ wavelength, so I knew I'd have to experiment with the radial lengths. The vertical radiator without a whip shows some good numbers when just used as a stand-alone vertical (27.6 MHz, SWR under 2 and an R of around 60). This just could turn out to be a good balcony antenna for those of us living in a restricted space environment. To avoid stray RF I'd recommend an air core inductor (6-8 coils of coax with a 6 inch diameter) at the feed point.

Note the old rum barrel on wheels that I used as my antenna test table. I bonded the first two metal barrel staves together and to the antenna connectors to broaden the ground plane. A metal electrical box on a camera tripod would also work fine as the connection point.

I started out with a pair of 102 inch long wire radials (¼ wavelength on 10 meters), then I started chopping and taking readings with my MFJ 259B analyzer (no whip tip was used on the FGT-2, nor did I use the ground strap). After a series of trimming adjustments I found that using wire hangers with a length of 34½ inches provided an excellent match in the 10 meter phone band.

On-the-air comparison with the monopole vs my loop really floored me — the monopole was an honest 2 S-units stronger on receive with all four stations (OH, IL, NJ and NC) I used for comparison.

[1]B. Glorioso, W1IS, "A Suspended Quarter Wave 40 Meter Wire Vertical Monopole," *QST*, Aug 2011, pp 34-36.

The CB and whiskey barrel 10 meter antenna, built for low visibility, is easy to put together and gives good results for a covert radiator.
[John Reisenauer, HI3/KL7JR]

Shuttle visit: Late last year I was given a rare opportunity to spend three hours inside the space shuttle *Atlantis*. I took a few photos of my and my dad's (AB4HQ) QSL cards in the orbiter's air lock and flight deck. I was also present for the shuttle's last launch and landing, STS-135. — *Bobby Lacey, KF4GTA*
[Courtesy Bobby Lacey, KF4GTA]

Somewhere a golf cart is missing some wheels: Sam Moore, NX5Z, of Sherman, Texas came up with a variation on a 5 band HF vertical using stackable 4 foot army fiberglass tent poles and plastic golf cart hubcaps.
[Sam Moore, NX5Z]

It's winter! My antenna farm and surrounding trees under the burden of the January 2009 ice storm that struck Northwest Arkansas. Note the tri-band Yagi, the collinear 2 m/70 cm vertical and the (then) drooping dipoles. The Yagi was ruined, but everything else is back in place. — *Bernie Skoch, K5XS*
[Bernie Skoch, K5XS]

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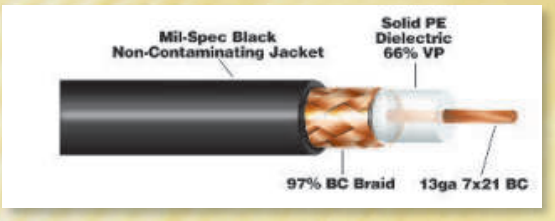

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• 0.6dB @ 10MHz	3.43kW	87%
• 1.0dB @ 30MHz	1.95kW	79%
• 1.4dB @ 50MHz	1.5kW	73%

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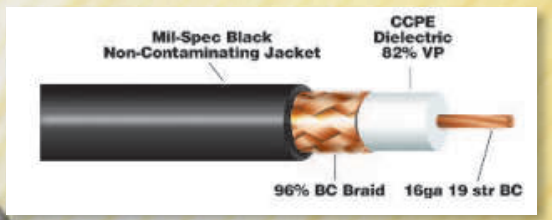
2213A-PL-6	6	$14.95
2213A-PL-50	50	$57.95
2213A-PL-75	75	$80.95
2213A-PL-100	100	$99.95
2213A-PL-150	150	$144.95



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• 0.9dB @ 10MHz	2.16kW	80%
• 1.4dB @ 30MHz	1.24kW	69%
• 2.1dB @ 50MHz	0.96kW	62%

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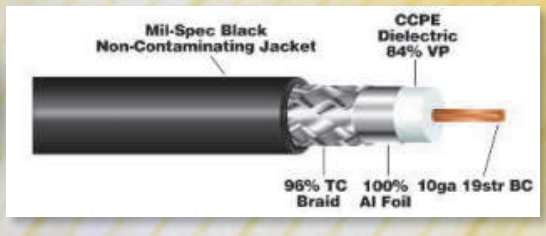
218XA-PL-6	6	$10.95
218XA-PL-18	18	$14.95
218XA-PL-50	50	$26.95
218XA-PL-75	75	$35.95
218XA-PL-100	100	$44.95
218XA-PL-150	150	$62.95



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• 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
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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
25400F-PL-150	150	$158.95

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Letters from Our Members

Pumped Up for Kids Day

ARRL Kids Day should, from my perspective, be one of the biggest events an Amateur Radio club holds each year. I'm the president of a small club in a rural county in Wisconsin. Last year, we held our first public Kids Day. Since I had never been responsible for a public event, we started planning in August. We looked for a location that was available on the date selected, within our club's budget and had good public access. We sent out e-mail to all of the local school districts, contacted local newspapers and home-school networks. Fifteen of our members showed up to help with setup, and to operate rigs they'd brought along. A few of the more seasoned members set up some Morse code practice oscillators. We had handouts for Morse code, standard phonetics and information on how to become a ham and join the ARRL.

The local noon start time arrived and we sat and hoped for a few people to show up. They came in small groups, but by the end of the day, we had 70 visitors, including a reporter from one of the local papers. In a town with a total population of 1638 (the entire county only has about 100,000 in an area of 576 square miles), this was quite impressive. It was quite a treat to see the kids getting excited about Amateur Radio. We had a few minor operating problems, but worked around them and we learned from the experience. We also got a nice full page write-up with pictures.

With the desire to bring young folks into Amateur Radio and show all that we have to offer from an educational perspective, I think it is imperative that more clubs organize larger and well-publicized Kids Day events. You might be surprised at the turn out and support of the local community!

Michel Bartolone, NX9A
Elkhorn, Wisconsin

What Makes a Good Emergency Coordinator?

I generally concur with the article by Rick Palm, K1CE ["Public Service: The EC — Where the Rubber Meets the Road," Jan 2012, pages 80-81]. The Emergency Coordinator position is certainly a critically important position and should be filled with one who demonstrates a high degree of maturity and exceptional people skills.

But Palm continues to define the EC as some sort of super hero who is a specimen of perfect health and void of vices of any sort — and wears khaki pants! Even if Superman or Wonder Woman is your ideal candidate, will he or she take the time that is required to perform the tasks of being an EC? Sometimes the only choice is the last one left who will accept the job.

I agree with Palm's closing remarks: "A good EC understands the need for tolerance, understanding and acceptance of other points of view." Mature decision-making capabilities and experience come with age, however, and with age comes a less-than-perfect image.

David C. Miller, K0RJL
Official Emergency Station,
ARRL Illinois Section
East Alton, Illinois

Wun, Too, Tree

The article by Steve Sant Andrea, AG1YK ["Sorry, Old Man, You're Not In the Log," Jan 2012, page 72] gave a good account of how and why radio amateurs should use the phonetic alphabet. Based on my personal experiences, I agree that they can help clarify communications, both when working DX, and when talking to native English speakers under stressful conditions, such as flying in a crowded pattern.

The same consideration for clarity is also needed for numerals. NATO's phonetic alphabet list slightly changes the sounds of most numbers (for example, "one" sounds more like "wun" and "three" is "tree"). Under good conditions these may not always be necessary, but others, such as "five" and "nine," with their soft similar endings, are. The recommendations are "fife" and "niner." Personally I always use the latter. It sounds a little odd, but works.

Richard Weil, KW0U
St Paul, Minnesota

Summing It Up Perfectly

I hope I'm not alone in my response to the letter from Cora Haefner, KK4ECV ["Correspondence: Keeping in Touch," Jan 2012, page 24]. This 10 year old ham makes a wonderful diplomat for the Amateur Radio community. Her zeal and pride in the hobby literally jumps off the page and she summed it up perfectly in her last sentence: "It was amazing to think that our one and only means of communication was the radio that most people think is now old-fashioned and long-gone, the radio made for amateurs, not professionals, who just want to build radios and make contacts and talk." Keep building, making contacts and enjoying your QSOs, Cora!

Jeff Louden, K7ZSA
Sedro Woolley, Washington

Earning Your Stripes

Even though it's been a while, I felt I had to respond to the letter from Randy Hamud, KJ6JAJ ["Correspondence: 75 Meters: Not for the Faint-Hearted," Dec 2010, page. 24]. Not for the faint-hearted? Or was the offended ham really the offending party? A lot of bad things are said about the old timers who hang out on 75 meters; it wasn't so long ago that I, too, was guilty of saying some of it. These are the folks who meet on the same frequency every night and talk about the same things.

When I was a new ham I had an experience that was similar to Hamud's. I came upon a group discussion, tried to join the group and it didn't work. I felt rejected and a little bitter, but it wasn't them, it was me — I was trying to fit in where I didn't belong. If I saw the same group of men chewing the fat at a local hardware store, I wouldn't have approached them the same way (if at all) as I did on the radio.

If approached humbly, these same people will try to help anyone who wants to become one of them do just that. For example, they want armchair copy, so to be one of them you have to run an amp. Think about it — they are older and can't hear as well. In the hardware store, they would be saying "speak up!" They more than likely run horizontal antennas because they are all close together, so NVIS is the mode of operation; vertical antennas just don't work for this.

I could go on with why these clashes occur, but now that I've been a ham longer, I can "visit" these groups without offense. I am careful about what I say and I am no longer offended that I don't really fit in, and that's okay. I understand now that their use of radio is just as valid as my own radio pursuits, and if I let them bother me, it's my problem.

Jim Brown, NY4JB
ARRL Life Member
Antioch, Tennessee

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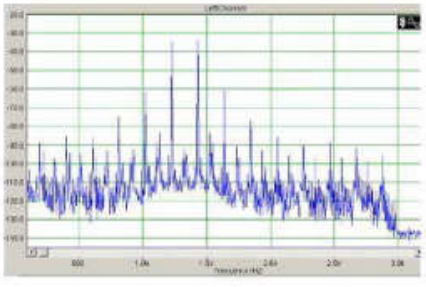
Noise Performance Characteristics of Direct Conversion Receivers

FlexRadio Systems PowerSDR™ Advantage

The Superheterodyne has been the staple of most receiver designs for the last 90 years due largely to challenges in implementing a direct conversion receiver. But today's technology can be used to exploit the advantages of a direct conversion design.

Superheterodyne Receivers

In a superheterodyne receiver, the desired RF signal is mixed together with local oscillators to create intermediate frequency stages (IF) before being demodulated to audio. Every mix creates both wanted and unwanted frequencies plus unwanted noise and distortion products. This outgoing noise can be seen in a two-tone intermodulation (IMD) test of a popular, respected amateur receiver shown in the figure below. Recently, expensive crystal "Roofing Filters" have been added to reduce IF noise but they too actually add to the overall distortion.

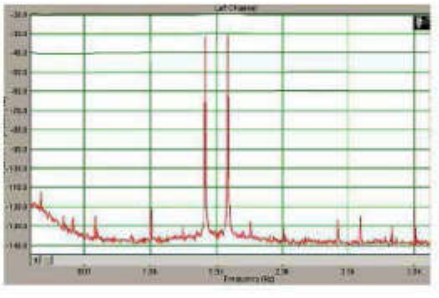


Direct Conversion Receivers

Direct conversion receivers avoid the cumulative non-linear effects that plague superheterodyne receivers by performing a single conversion from RF to baseband audio. No IF means no additional distortion from components and filters. It also means a wide range of signal levels must be handled in a single conversion stage. Previously this was a significant technical challenge, but the advent of HI-FI Analog to Digital Converters (ADCs) has made it possible to discern both strong and weak signals at the same time -- in other words, these ADCs have a very high dynamic range. The FLEX-5000 for example, uses a 192kHz 24-Bit sigma-delta ADC with a dynamic range of 123dB removing the need for roofing filters and the distortion they create.

The PowerSDR Advantage

Another difficult problem for direct conversion receivers is a conversion image that appears close to the desired frequency. FlexRadio solves this in three ways: First, an I/Q Quadrature Sampling Detector (QSD) is used instead of a traditional mixer or detector. The QSD acts like a mixer, but has natural image suppression better than -40dBc or 40dB below any carrier that would produce an image. Secondly, FlexRadio's PowerSDR™ software adjusts the QSD in real time resulting in image supression exceeding 100dB, moving images to the noise floor. Finally, PowerSDR employs a unique Automatic Gain Control Threshold (AGC-T) scheme that intelligently controls gain without amplifying unwanted noise. The results of a direct conversion receiver driven by PowerSDR can be seen in the IMD test on a FLEX-5000 receiver shown below. Notice how the distortion caused by the mixing of signals is significantly reduced as compared to the superheterodyne receiver shown in the first figure.



Summary

FlexRadio Systems QSD implementation provides superior noise performance to a superheterodyne receiver by reducing opportunities for mixing noise. Combined with the ability to easily lower the remaining background noise using the AGC Threshold (AGC-T) control, FlexRadio Systems receivers achieve a noise level that is significantly lower than that of the traditional superheterodyne resulting in less operator fatigue.

For more information or to download the full white paper on Direct Conversion Receivers, visit www.flexradio.com/DCRX

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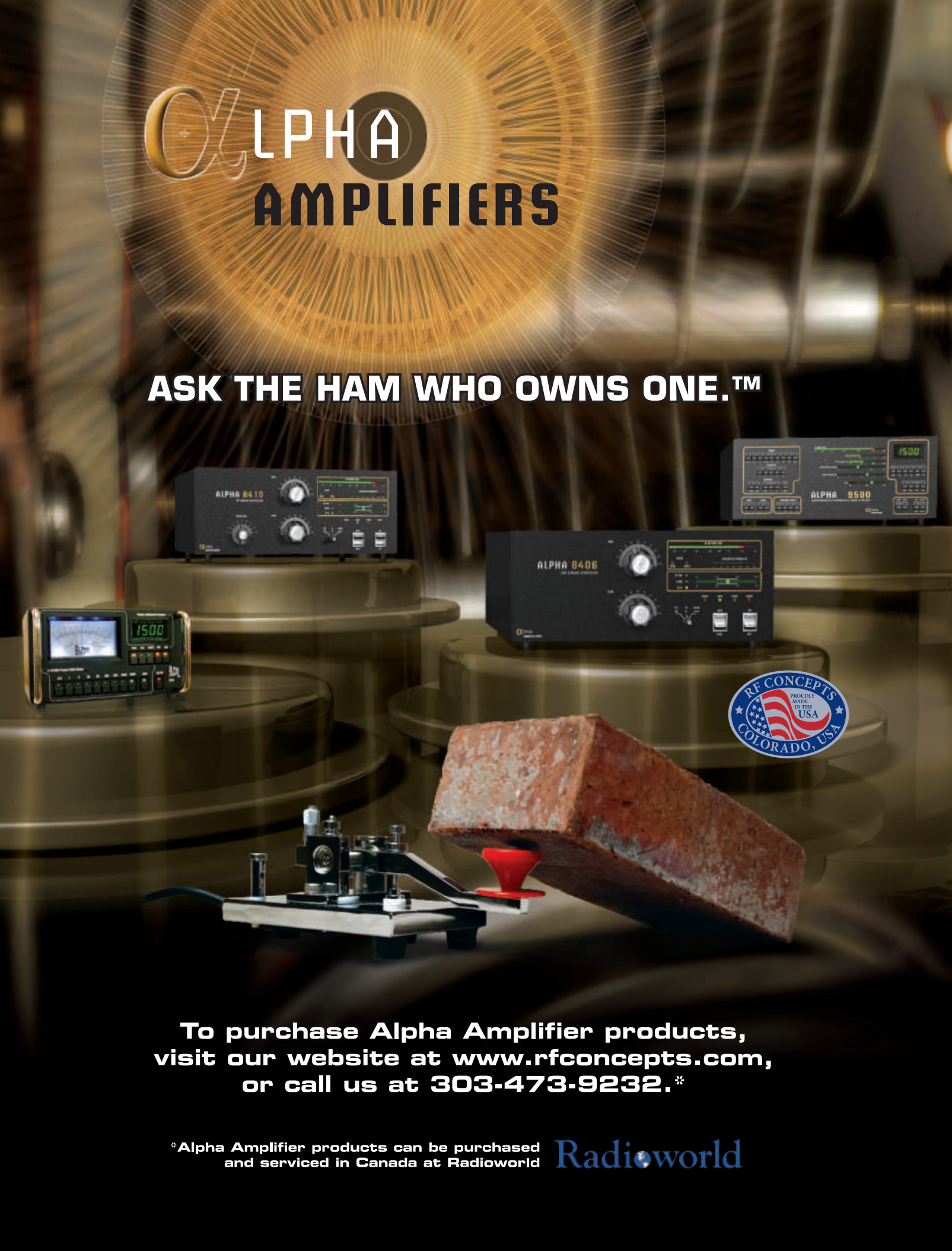
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A Coaxial Vertical for 160 and 80 Meters

By moving one clip lead at ground level easily change bands with this antenna.

Scott M. Harwood, K4VWK

I recently started working on a design for a new vertical antenna for 160 meters. I wanted the antenna to incorporate characteristics of the resonant feed line dipole (RFD) antenna for 80 meters.[1] I have used the RFD for many years at a secondary location. This unique configuration is physically end fed but has the balance of a center fed dipole. This allows me to feed the antenna at the ground level, run the coax leg up vertically and run the wire section off from the vertical leg at the top of the antenna back toward ground. This would move the high current point from the base of the antenna (as with a quarter wave monopole) to the top, making the antenna easier to match to a 50 Ω load, improve the radiation pattern and eliminate the losses associated with feeding the antenna against ground. After much experimentation and computer model analysis, I came up with the coaxial sleeve vertical described below.

[1]Notes appear on page 32.

Some RFD Antenna Theory

The RFD antenna is actually a form of a coaxial sleeve antenna.[2] One leg of the sleeve antenna consists of a quarter wave of the exposed inner conductor of the coax, and the other leg is a quarter wave metal sleeve placed over the coax and attached to the braid at the top or feed point. The RF travels up the inside of the braid and then makes a 180° turn and runs back down the outside of the metal sleeve. This is called the common mode current, and radiates in the same manner as one leg of a half wave dipole.

The RFD antenna has no exterior metal sleeve. Instead the common mode current runs back down the outside of the coax braid. A high impedance RF choke is placed ¼ wavelength down the coax. This stops most of the common mode current, and the antenna now performs exactly as a center fed dipole, except it is physically fed from the end. [Some common mode current will couple from the end of the antenna around the choke, so if there is RF in the shack, a second choke some distance from the first can be employed to reduce it. — *Ed.*]

The Coaxial Vertical

For the new vertical, the coax leg runs vertically up 65 feet and the center exposed wire runs down toward the ground at approximately a 45°. This yields an antenna with only a single high support. Computer models show the sloping wire portion did not drastically affect the radiation pattern. I also used four elevated radials for improved antenna performance. As an added bonus, moving one wire at the ground end of the antenna would make it work well on 80 or 75 meters. In addition, neither configuration of the antenna requires an external tuner.

Diagrams of the antenna configuration for each band are shown in Figures 1 and 2. A 6 foot ground rod is connected to the coax shield at the base. Four 100 foot elevated radials run out from the ground rod. The sloping section is a wire connected to the center conductor of the coax at the top (nothing is connected to the shield there). For 160 meters the base of the antenna is isolated with a high impedance ferrite choke or line isolator and coax is run from the choke to my transceiver in the shack. In this configuration the ground and radials are part of the antenna system.

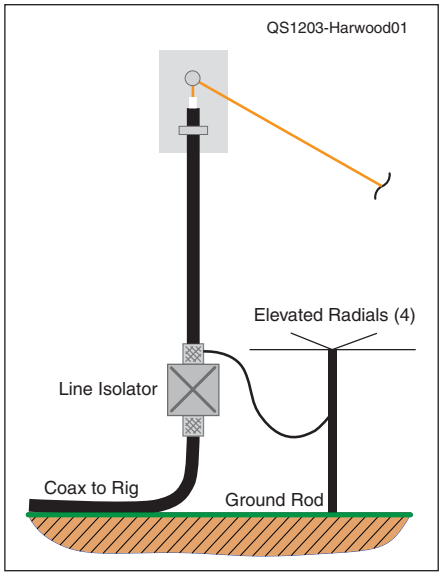

Figure 1 — The antenna in 160 meter configuration. Note that the radials are connected to the coax shield above the isolator.

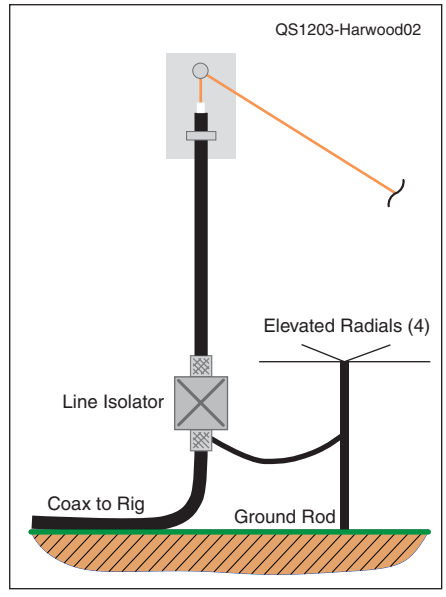

Figure 2 — The antenna in 80 meter configuration. In this case the radials are connected to the coax shield below the isolator.

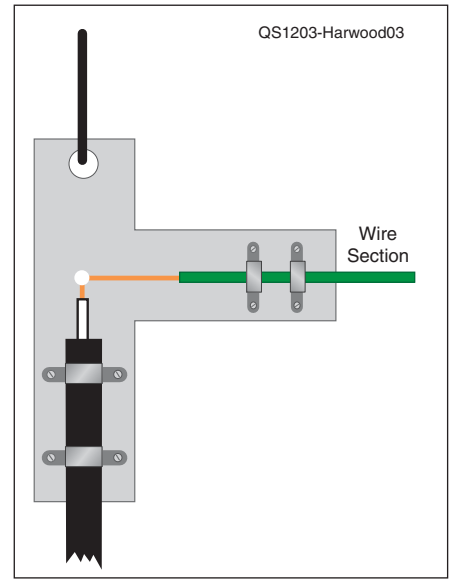

Figure 3 — The feed point support form made acrylic and fitted with stainless steel hardware.

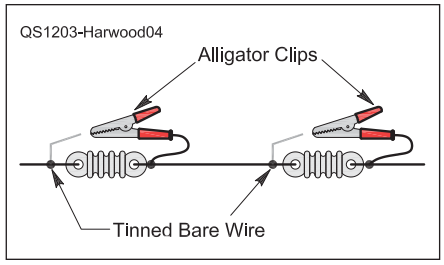

Figure 4 — Individual sections of wire were fabricated and attached to antenna insulators for resonant tuning of the antenna. The alligator clips allow easy changes in effective length.

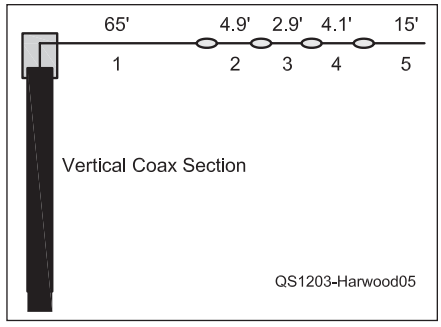

Figure 5 — Tuning lengths that I used. Experimentation may be needed to find the lengths that work best over your ground.

Section	*Length (')*	*Tuned Frequency (kHz)*
1	65.0	1910
2	4.9	1850
3	2.9	1800
4	4.1	1960
5	15	3580

For 80 meter operation, the elevated radials are removed from the vertical coax shield section of the antenna and connected to the feed-line shield on the other side of the choke. This in effect isolates the antenna into a true RFD type configuration with one leg vertical. In this case the antenna works against the separate ground system.

Actual Construction

The vertical section of the antenna was made out of a 65 foot section of good quality (100% shield) low loss RG-8X coax. At the top end, the shield was cut back about 3 inches and sealed with coax sealer and electrical tape. The center conductor was tinned and connected to the antenna sloping wire section. An acrylic support form was made and fitted with stainless steel hardware (see Figure 3).

The sloping section was made out of #14 AWG stranded copper wire. Individual sections of wire were fabricated and attached to antenna insulators for resonant tuning of the antenna (see Figure 4). The lengths of the sloping wire tuning sections are best determined by experimentation. Figure 5 shows lengths that I used as a guideline. The angle of slope and the height of the sections above ground will affect the resonant frequency. The elevated radials are 100 foot sections of #18 AWG stranded wire running out from the 6 foot ground rod. The far ends of the radials are 10 feet above ground.

RF Choke

For the choke, I used a commercial T-4 line isolator available from The Radio Works.[3] There were so many variables with the rest of the antenna that I didn't want to experiment with the choke. Other chokes are available commercially or one can be home-brewed.[4] From experience with my RFD antenna I know a coiled coax choke without a ferrite core will not work here, because they are frequency sensitive. One may work on 160 but not well on 80 and vice versa. A ferrite toroid with multiple turns of coax at the base should work as long as there are enough turns to have a high impedance on both 160 and 80 meters. A short wire is secured to the coax shield on each side of the RF choke, allowing for 160 or 80 meter operation.

Tuning the Antenna to Resonance

Attach section 1 of the tuning wires (see Figure 5) to the coax inner conductor at the top of the antenna and run a small rope from the end insulator to the antenna support on the ground. This way the angle will remain constant throughout the addition of extra sections. Make sure the antenna is in the 160 meter configuration (ground radials and ground rod attached *above* the RF choke) and measure resonance at the antenna base with a good quality antenna analyzer. Adjust section 1 to reso-nate at the highest frequency you want for 160 meters. Then add section 2 and adjust that for the mid range frequency and section 3 for the lowest range on 160.

Change the antenna configuration to 80 meters (ground radials and ground rod attached *below* the RF choke). Add section 4 and adjust for the highest operating range for 80 meters and section 5 for the lowest. You may want to include more sections after determining the band edge lengths to give more choices in frequency selection. There is some interaction between the elements, so you may want to go back and recheck the sections after all are installed.

Antenna Performance

EZNEC computer models showed the antenna to have a good low angle radiation pattern on both 160 and 80 meters (see Figure 6).[5] The antenna also showed good SWR, bandwidth and impedance ranges as seen on my AIM 4170 antenna analyzer, with no matching problems.[6] No tuner is required if one uses the tuning sections to operate in their desired portion of the 160 and 80 meter bands as shown in Figures 7 and 8. A tuner could be used in the shack instead of changing wire lengths, but be aware that antenna performance drops off when the antenna is tuned outside of its resonant frequency area.

On the air reports have been extremely gratifying. On 75 meters the vertical antenna got identical signal reports to my large horizontal loop antenna and on 160 meters reports indicate it performs as the models predicted with good DX results.[7]

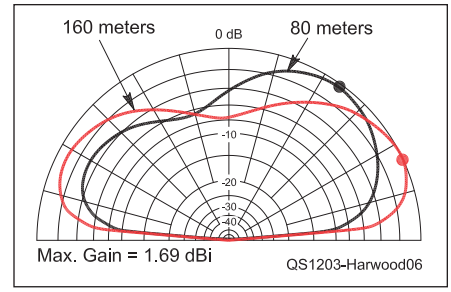

Figure 6 — *EZNEC* predicted 160 (red) and 80 meter (black) elevation pattern indicating low angle radiation.

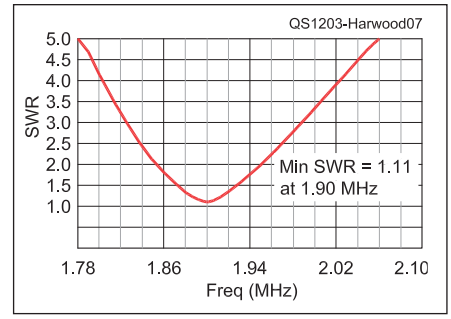

Figure 7 — Measured SWR across 160 meters. As shown, the 2:1 SWR with a single length is about 90 kHz.

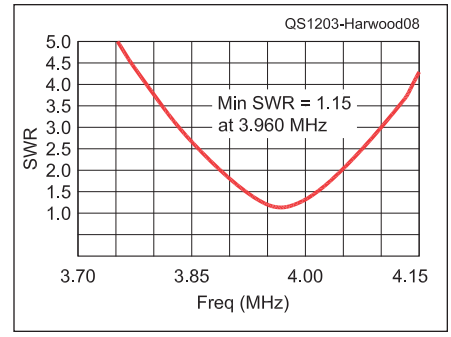

Figure 8 — Measured SWR across 75 meters. By adding the extension (see Figure 6) the resonance can be moved to the 80 meter CW portion of the band.

Hamspeak

RF choke — Inductor designed to have a high impedance to RF current and low impedance to dc. See **www.electronics-tutorials.com/basics/chokes.htm**.

Antenna Compromises

The design of this antenna is not cast in concrete. I worked with the real estate and trees that were available to me. Compromises are part of antenna design. Play around with it. Computer models show this antenna to be flexible in design. Altering the ground radials to fit one's real estate is certainly okay. Having the vertical section up less than 65 feet is feasible. It will affect the take-off elevation angle and resonance, but with experimentation it should still work well. Having the wire section horizontal will help with the shortened vertical section.

I have enjoyed building and using this antenna, and I hope you have fun with it also. A future project will be how to remotely switch all the sections and grounding wires so frequency changes can be done from the shack as opposed to running outside. Any suggestions would be appreciated.

Notes

[1]J. Taylor, W2OZH,. "RFD-1 and RFD-2: Resonant Feed-Line Dipoles," *QST*, Aug 1991, pp 24-27.
[2]The article in Note 1 contains an excellent description of the sleeve antenna.
[3]The Radio Works, **www.radioworks.com**.
[4]B. Palmer, K0WM, "Hints and Kinks — Ferrite Shield-Current Chokes Cure Stray RF on Vertical-Antenna Transmission Lines," *QST*, Jan 1994, p 78.
[5]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.
[6]The AIM 4170 Antenna Analyzer is available from Array Solutions at **www.arraysolutions.com**.
[7]S. Harwood, K4VWK, "The Horizontal Loop — An Effective Multipurpose Antenna," *QST*, Nov 2006, pp 42-44.

ARRL Life Member Scott M. Harwood, K4VWK, has been interested in radio since childhood. In the seventh grade he built a two tube regenerative receiver using #30 tubes as a science project. He obtained his original license in 1958 and has retained the same call ever since. He holds an Amateur Extra class license. An avid antenna experimenter, his main area of interest has been small portable antennas for 160 and 80 meters. He has given talks at local radio clubs on antennas, and has written articles for *QST*, *CQ* and *AntenneX* magazines. You can reach Scott at PO Box 523, Farmville, VA 23901 or at **scotthsr@earthlink.net**.

New Books

THE ROAD HOME

By Andrew Baze, AB8L
Published by Max Publications. Available from the ARRL Bookstore, ARRL Order No. 0427. Telephone 860-594-0355 or toll-free in the US 888-277-5289; ***www.arrl.org/shop***, ***pubsales@arrl.org****. $12.99.*

Reviewed by Sterling Coffey, N0SSC

I'm surprised as I hear and see how Amateur Radio has crept into movies and TV shows like *Frequency* and *Super 8* and the new acclaimed sitcom *Last Man Standing* featuring Tim Allen as a radio amateur. Despite the fact that they have pivotal roles featuring Amateur Radio, they do not present the true nature of Amateur Radio. While I was reading *The Road Home* by Andrew Baze, AB8L, I was pleased to see that it showed Amateur Radio as both enjoyable and practical in its vital role in emergency communication.

In the book, a young man and his father venture off to the Cascade Range for a weekend camping trip. During their hike through the woods, a disastrous earthquake rips through the ground, destroying much of their homeland. Robbie and Jeff begin a challenging trek home, while Robbie's mom and sister cross paths with a guileful delinquent looking to score free loot at the expense of others.

It was a short read and very young adult friendly. I was surprised at the amount of preparedness information packed into the book, complete with a comprehensive appendix containing a glossary and explanations of various concepts. It's also non-ham friendly and not overbearing about ham radio, yet provides detailed but brief explanations of repeaters, APRS, and even ARES® and CERT, to name a few. Basic preparedness information such as tying knots, administering first aid, having water, defending yourself and staying calm in emergencies, along with loads of other tactics, are cleverly weaved into the story.

I learned something from the book: always be prepared. In Missouri, we face the ever-present danger of the New Madrid fault line, ready to burst at any time. The location is also prone to damaging thunderstorms that spawn tornadoes, one of which carved a swath of destruction through Joplin last year. Although some may see modern survivalism and "preppers" as paranoid doomsdayers, this book shows that simple steps can be taken to ensure you are prepared to make the best of a bad situation.

Feedback

■ The article "A Transistor Tester in a Tin" [Jan 2012, pp 30-31] has three problems. In Figure 1, the sketch of the TO-92 transistor (the lower unit) has its emitter (E) and collector (C) leads reversed. BT1-3 should be AAA size batteries to fit in the Altoids can. The headphone connection, J1, is correct as shown for headphones with dc continuity, such as dynamic headsets. If a crystal earphone is used, the bottom of R7 should be grounded and the earphone connected between the top of R7, in parallel with the emitter, and ground. Note that with this change there will be current drawn from the battery at all times, so at least one battery should be removed when the unit is not being used, or a power switch should be added.

■ In "Product Review — Elecraft KPA500 HF/6 Meter Power Amplifier" [Feb 2012, p 55] the caption for Figure A in the sidebar should say "...break off pins 1, 6, 7 and 8..." (*not* pin 9). The drawing is correct.

■ In "Product Review — Four 25 A Switch Mode Power Supplies" [Feb 2012, pp 56-59] some updates were not made following Ten-Tec's replacement of the 941 supply with a current unit. On page 59, under "Lab Testing" in the first column, it should now say: "The supplies here all tested between 110 mV and 490 mV, most in line with the best of supplies reviewed previously." In the third column it should now say: "All of power supplies tested here passed Part 15 requirements for conducted emissions. Overall the QJE DX PS30SWII and Ten-Tec 941 were the quietest of the units tested, followed closely by the Jetstream JTPS30M."

■ In "Providing Power for Your Pet Project" [Jan 2012, pp 43-44] we described the characteristics of standard NiMH cells. Gary Fuchikami, WH6C, notes that unlike the standard cells that lose their charge fairly quickly while in storage, more expensive ones such as the Sanyo Eneloop will keep 80% or more of their charge for a full year.

■ Richard A. Lemme, K9FA, should not have been listed in Silent Keys [Feb 2012, p 105].

■ In "Op-Ed" [Feb 2012, p 90] Rick Lindquist, WW3DE, is the managing editor of *NCJ*, not the editor.

Remote Tuning for a 43 Foot Monopole

Here's another way to tame a 43 foot vertical for 160, 80 and 40 meters.

Shef Robotham, WA1RHT

I could not get a dipole high enough to achieve a low angle of radiation on 160, 80 and 40 meters. I tried a 43 foot vertical monopole instead because of its popularity and my fascination with HF verticals. I used a commercial product that included a "broad-band matching transformer." The impedance presented by the supplied transformer did not provide a very good match on any band, but was within the range of my built-in antenna tuner.

On the Air, But My Coax is Getting Warm!

While this was usable, the SWR on my coax line to the station resulted in lost power in the feed line. I remembered the *QST* article series by Phil Salas, AD5X, that described the need to match the antenna at its base to eliminate feed line losses. I extended his work to include a remote low loss tuning circuit that put as much power into the antenna as possible.[1] Figure 1 shows the result.

My vertical installation is of tapered aluminum tubing and includes 20 radials at 65 feet. My goal was to use this antenna on 160, 80 and 40 meters. While my ground system is not optimum, it should provide reasonable efficiency.[2] I live in a wooded area and consequently had to drop 4 trees to gain sky-access which resulted in an approximate 30 foot clear area around the antenna. The radials are laid on the leaves leaving the burying to Mother Nature in the fall.

Defining the Problem

I first modeled the 43 foot vertical in *NEC* using Arie's excellent *4NEC2,* yielding expected the antenna impedances.[3] I then measured the actual antenna impedance and compared my data against *NEC*'s predictions. A sample of the measured antenna impedance is shown in Figure 2. The real part of the impedance was higher than predicted, likely due to the additional ground loss, as discussed in the Salas articles. The imaginary part is very close to *NEC*'s calculations.

Figure 1 — Completed 43 foot vertical matching network.

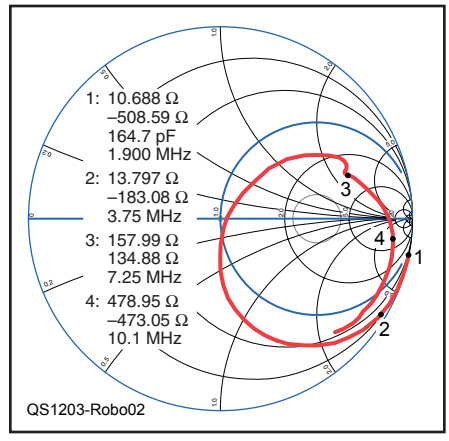

Figure 2 — Smith chart representation of measured antenna impedance from 1 to 15 MHz.

I used regression techniques to create three equations to calculate the real, imaginary and ground loss as a function of frequency. The equations allow *MathCad* to frequency sweep the antenna and have reasonable resistance and reactance to compute with. The accuracy of the equations is good, as long as the frequency is kept below the antenna's resonance, approximately 5 MHz.

MathCad predicted the system could be matched at different frequencies by inserting a tunable LC network from the antenna base to ground. The question was — could the antenna be resonated across a band and what would the resulting SWR be? This effort was strictly computational and based on the impedance data of my installation.

The Matching Network

The complete design was first evaluated using *MathCad* (**www.ptc.com**). It predicted the extremely high voltages under the condition that 1000 W is applied to the matching network and antenna. The high voltages mandated the use of vacuum relays and wide turn-to-turn inductor spacing. I have had comments from some amateur friends that I spend *way* too much time on the computer. I reply: "Nothing burns or arcs in computerland!"

The 160 meter band antenna and network was computationally matched at 2 MHz using a minimum additional shunt capacitance of 10 pF. A match could be achieved at 1.8 MHz by increasing the shunt capacitance to 47 pF. The SWR at 2 MHz was optimized by varying L1 and L2 with 10 pF, which resulted in an SWR of 1.0:1. The inductors are assumed to have Qs of 300.

The additional shunt capacitor was increased to 47 pF to achieve a match at 1.8 MHz with a resulting SWR of 1.04:1. The minimum capacitance of 10 pF was chosen as it is repeatable and not greatly dominated by stray capacitances. Applying 1000 W to the solved network yields 4.1 kV_{RMS} at the antenna base, 210 W radiated, 135 W lost in the inductors, Q defined as 300 and

[1]Notes appear on page 37.

Figure 3 — Rotating disk of the tuning capacitor made from high frequency PC board material.

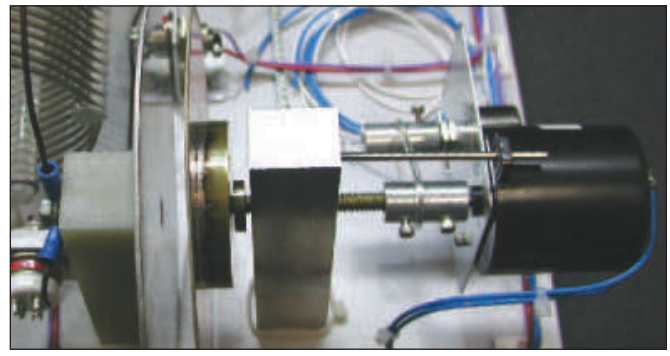

Figure 4 — Capacitor motor drive assembly.

655 W lost in the ground. 500 W yields 3 kV_{RMS} while 100 W produces 1.3 kV_{RMS}. The predicted 2:1 bandwidth is 40 kHz, based on the radiating resistance, ground loss and inductor Qs.

Likewise, the 80 meter band is computationally matched using a shunt tuning capacitor of 10 to 190 pF and an SWR of less than 2:1 at the band edges. The match was designed at 3.75 MHz with a nominal 100 pF tuning capacitance. This allowed adding 90 pF to produce an SWR of 1.7:1 at 3.5 MHz. Reducing the tuning capacitance to 10 pF yields an SWR of 1.97:1 SWR at 4 MHz. When matched at 3.8 MHz, SWR of 1.1:1 and 1000 W applied, the voltage at the antenna base is 1.2 kV_{RMS} with 760 W radiated. The predicted 2:1 bandwidth is 100 kHz, based on the radiating resistance, ground loss and inductor Qs. The big difference here is the higher antenna radiation resistance and the lower ground losses.

The 40 meter band measured impedance at 7.25 MHz is 157 + *j*138, which is a Q of less than 1 and therefore can be matched across the band. The measured impedance, 157 + *j*138, is quite different than the *NEC* prediction of 102 + *j*171. Experimentation inside *NEC* showed placing other grounded vertical elements in proximity to the radiating element increased the real part of the impedance. I simulated my surrounding trees by placing four, 43 foot grounded vertical elements 60 feet from the main radiator. These increased the antenna impedance to 125 + *j*171. Based on the *NE*C experiments, I am assuming that the departure of my measured impedance from the predicted value is due to the nearby trees.

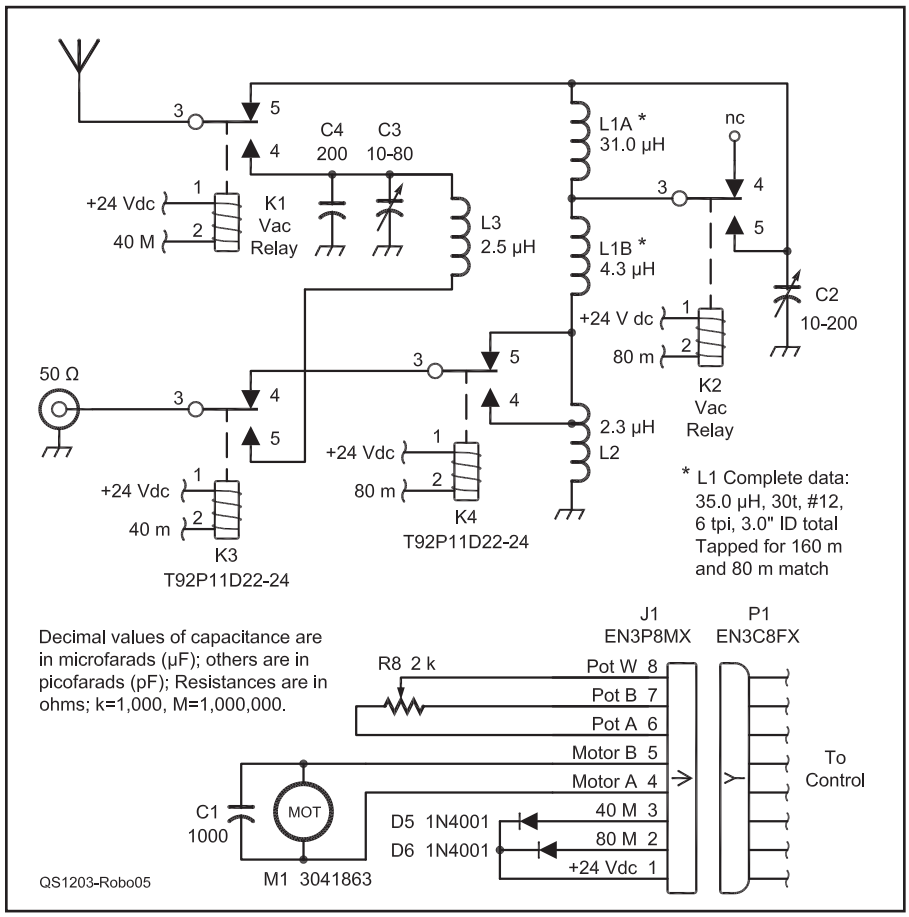

Figure 5 — Schematic and parts list of the RF deck. Automation Direct parts are available from www.automationdirect.com. Digi-Key parts are available from www.digikey.com.

C1 — 1000 pF, 50 V, ceramic capacitor.
C2 — 10-200 pF dual plate variable capacitor as described in text. [A surplus vacuum variable could be substittuted. — *Ed.*]
C3 — 10-80 pF to 100 pF, ⅛ inch spacing Hammarlund or equivalent variable capacitor.
C4 — 200 pF, 7.5 kV doorknob capacitor, as needed to match antenna on 40 meters.
D5, D6 — 1N4001 silicon diode.
J1 — Watertight male connector, 8-pin (Digi-Key SC268-ND).
K1, K2 — 24 V, DPDT vacuum relay.
K3, K4 — 24 V, DPDT relay (Digi-Key PB350-ND).
L1 (A) — Approx 35 µH inductor (30 turns, #12 AWG, 6 TPI, 3" ID), or as needed for 160 meter.
L1 (B) — Approx 4.3 µH inductor (7 turns tap on L1), or as needed for 80 meters.
L2 — Approx 3.5 µH inductor (7 turns, #12 AWG, 6 TPI, 2.5" ID), or as needed for 160 meter match and tapped for 80 meters.
L3 — Approx 2.5 µH (5 turns, #12 AWG, 6 TPI, 2.5" ID), or as needed for 40 meter match.
M1 — 12 V, 7 RPM, 12 oz stall torque dc motor (Edmund Scientific 3041863).
P1 — Watertight female connector, 8 pin (Digi-Key — SC259-ND).
R8 — 2 kΩ, 2 W, 10 turn potentiometer (Digi-Key SP534-2.0K-ND).
NEMA 10 × 12 × 6 inch waterproof enclosure (Automation Direct HW121006CHSC).
Fiberglass subpanel (Automation Direct HW-MP1210FG).
Mounting feet (Automation Direct HW-MGFTKIT).

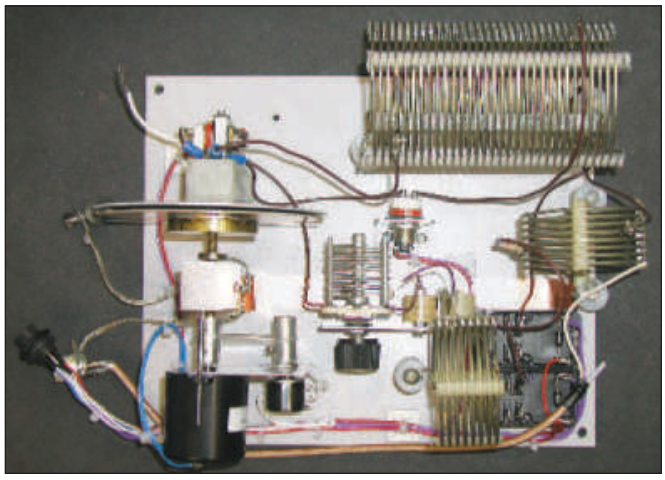

Figure 6 — Top view of the finished RF deck ready to deploy.

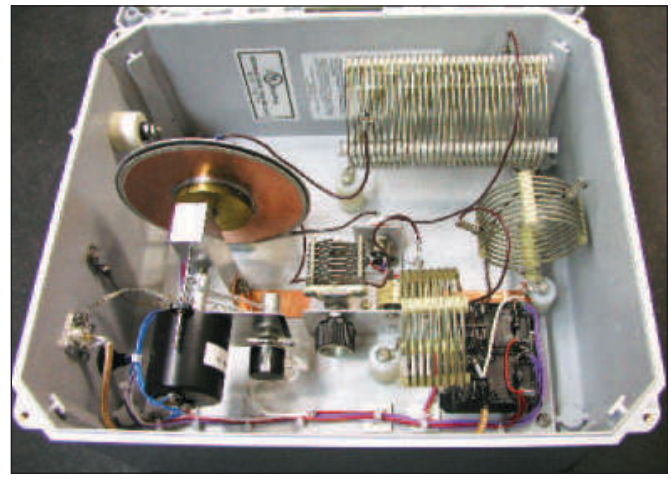

Figure 7 — The finished RF deck in its fiberglass watertight enclosure.

Building the Tuner

So much for the theory. Let's get to building the project and verifying all the calculations.

Inductors

I elected to make my inductors from 3 inch diameter premade coil stock offered by B&W (**www.bwantennas.com**). Their Miniductor line, although not really mini in this size, is easy to work with. I used this to construct the main resonating inductor for the lowest loss with reasonable cost. A toroid implementation is also possible, but will result in a compact inductor that is not as sensitive to its surrounding materials but has higher loss. The loss is primarily due to the ferrite material itself and shows up as heat in the inductor instead of radiated power from the antenna. I used vacuum relays to provide the needed high voltage isolation and normal power relays to handle the low voltage or low power switching.

Variable Capacitor

The tuning capacitor has a 20:1 range, 10 to 200 pF, and is made using a 5 inch disk of Rogers 4350B, 0.030 inch thick PCB material.[4] This is attached to a ¼-20 lead screw to adjust the plate's spacing from a fixed alu-

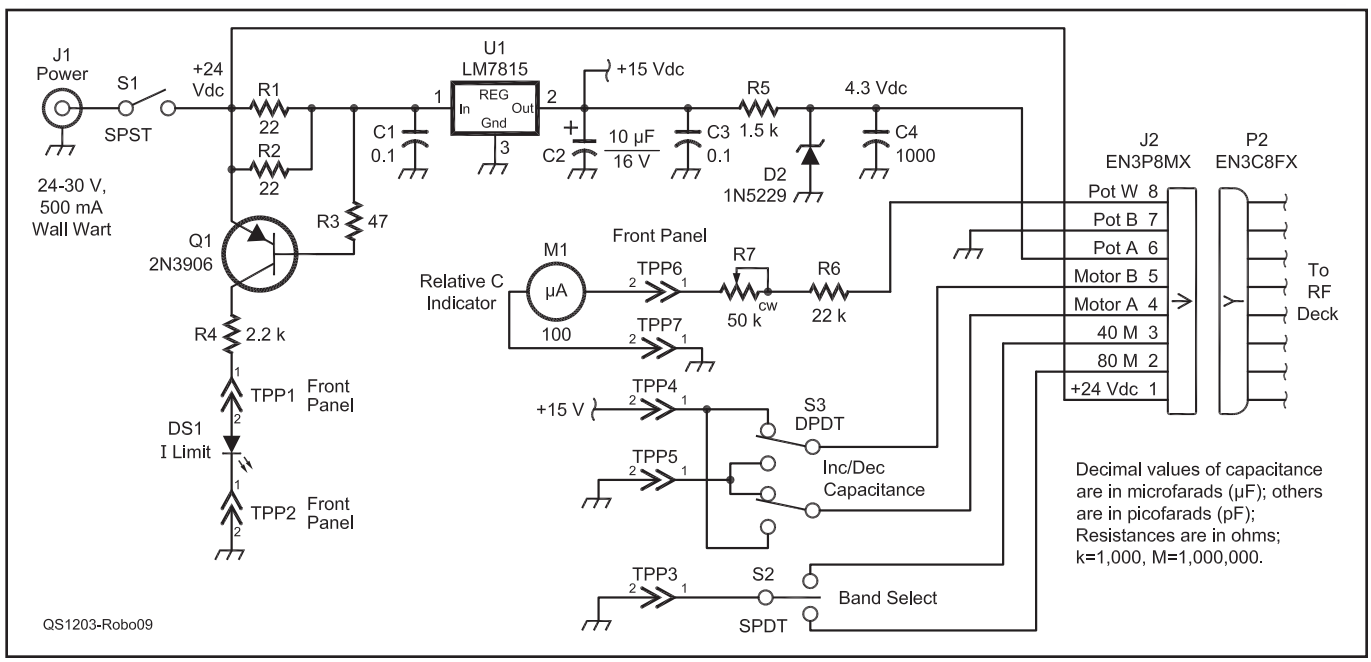

Figure 8 — Schematic and parts list of control box. Digi-Key parts are available from www.digikey.com.

C1, C2 — 0.1 µF, 50 V, ceramic capacitor.
C3 — 10 µF, 25 V, tantalum or equivalent electrolytic capacitor.
C4 — 1000 pF, 50 V ceramic capacitor.
D1 — General purpose LED.
D2 — 1N5229, 4.3 V Zener diode.
J1 — Power input connector as required.
J2 — EN3P8MX, 8 pin watertight male connector (Digi-Key SC268-ND).
M1 — 100 µA meter, Simpson or equivalent.
P2 — EN3C8FX 8 pin watertight male connector (Digi-Key SC259-ND).
Q1 — 2N3906 general purpose PNP transistor.
R1, R2 — 22 Ω, ¼ W carbon film resistor.
R3 — 47 Ω, ¼ W carbon film resistor.
R4 — 2.2 kΩ, ¼ W carbon film resistor.
R5 — 1.5 kΩ, ¼ W carbon film resistor.
R6 — 22 kΩ, ¼ W carbon film resistor.
R7 — 50 kΩ, 10 turn Trimpot potentiometer.
S1 — General purpose SPST toggle switch.
S2 — SPDT, center off toggle switch (Digi-Key CKN1027-ND).
S3 — DPDT, momentary contact, center off toggle switch (Digi-Key CKN1129-ND).
TP1-TP7 — Jumper point to front panel.
U1 — LM7815, TO-220 size, 15 V regulator IC.
Power supply — 24-30 V, 500 mA, wall wart supply or equivalent.

Figure 9 — Completed control subsystem.

Figure 10 — The finished RF deck and enclosure, mounted at the antenna base.

minum plate. The capacitance was designed using *MathCAD* based on the diameter, change in capacitance and loss. I chose the Rogers material because of its voltage standoff and dielectric properties. The dielectric is mostly air at wide spacings, and then the PC material predominates as the insulator for the capacitor as the plates move to close spacing.

The lead screw is run through a grounded, tapped aluminum block. The ground side of the Rogers disk has 0.25 inch removed from its outer perimeter to act as a voltage standoff. If this is not done, the 0.030 inch thick dielectric will not stand off the high voltage. The ground side of the Rogers disk is soldered to a brass disk that is threaded for the lead screw. Soldering the brass disk to the Rogers material must be done quickly to avoid warping the material, which would prevent close disk spacing. I applied torch heat to the brass disk and then immediately removed the heat when the solder started to flow.

Figure 3 shows the finished Rogers and brass disks and lead screw. To keep track of the spacing, a 10 turn potentiometer is coupled to the lead screw indicating the relative spacing. I do have some warping on my build so I used a small amount of Teflon tape to prevent the disks from touching while closely spaced. The goal is that the disks be exactly parallel and not bowed so that close spacing can be smoothly achieved.

Drive Motor

The 12 V, 7 RPM dc motor that turns the lead screw is held by its shaft coupling to the lead screw. The motor is available from Edmund Scientifics (**www.scientificsonline.com**) and was chosen for torque and rotation speed. The motor is prevented from rotating freely by a 0.100 inch stainless steel shaft routed through one of its mounting holes. The potentiometer is attached to the motor and thereby also floats. Figure 4 shows the motorized tuning capacitor assembly.

The calculated matching network for each band was built, and Figures 5, 6 and 7 show the schematic and pictures of the finished RF deck. The assembly is then mounted in a fiberglass NEMA 12 × 10 × 6 inch watertight enclosure. The subpanel, part of the NEMA enclosure, serves to hold the RF deck. The vacuum relays are from my junk box and are Kilovac HC-3 type rated at about 3 kV at 2 MHz. I did a HI-POT voltage test on them to greater than 6 kV to confirm their capability.

The inductor values were taken from the calculated values based on my antenna curve fit approximations. The number of turns for each inductor was then calculated using Wheeler's equation (see below) in *MathCAD* and served as the starting point. The 160 meter inductances were adjusted with the real antenna connected for minimum SWR at 2.0 MHz with minimum tuning capacitance (at the maximum spacing of 0.50 inches). The 80 meter inductances were adjusted for minimum SWR at 3.75 MHz with the tuning capacitor set at about100 pF or 0.025 inch spacing. The 40 meter matching system was designed using *WinSmith* and Wheeler's Inductance relationship built and tweaked in. The worst case 40 meter SWR over the 300 kHz is 1.5:1.

Wheelers Inductance equation:

$$L = (r^2 \times N^2) / [(9 \times r) + (10 \times l)]$$

where:

L is the inductance in μH,
r is the mean coil radius in inches,
N is the number of turns and l is the coil length in inches.

Control Console

The control subsystem is shown Figures 8 and 9. A current limit LED is provided to indicate when the capacitor is against the limit stops. The LM7815 regulator IC reduces the 24 V dc needed for the relays down to 15 V to run the dc motor. The 15 V is further reduced to 4.3 V for the meter circuit. The motor/pot/meter combination could be replaced with a stepper motor but that adds project complexity and cost. My first iteration used a 24 V dc universal ac input supply that created excessive switching noise. I found that a linear wall-wart could be used to keep power supply noise from blinding the receiver.

The control box front panel was made by designing a 1:1 size panel in a graphic design application, such as Microsoft *Visio*. Printing the resulting design onto paper and then saturating the paper with an acrylic spray, such as Krylon Crystal Clear results in an almost plastic escutcheon once the paper has dried. It can then be attached to the aluminum panel with contact cement.

The control cable is routed to the NEMA box using watertight connectors such as Switchcraft EN3C8F and EN3P8M, available from Digi-Key (**www.digikey.com**). CAT 5 Ethernet cable is more than capable of handling the 140 mA for the relays and motor.

Table 1

Measured Match at Band Edges

Band (Meters)	Frequency (MHz)	VSWR	Measurement Info
160	2.00	1.396:1	HP8753C data
	1.800	1.770:1	HP8753C data
80	3.999	3.00:1	On-air test
	3.94	2.00:1	On-air test
	3.86	1.446:1	HP8753C data
	3.54	1.249:1	HP8753C data
40	7.30	1.436:1	HP8753C data
	7.00	1.276:1	HP8753C data

Table 2

2:1 VSWR Matched Bandwidth

Band (Meters)	Frequency (MHz)	VSWR	ΔF (kHz)	Measurement
160	1.990	2.0:1		Autek VM1
	1.975	1.0:1	32	
	1.958	1.0:1		
	1.905	2.0:1		
	1.890	1.0:1	28	
	1.877	2.0:1		
	1.837	2.0:1		
	1.825	1.0:1	25	
	1.812	2.0:1		
80	3.940	2.0:1		
	3.860	1.2:1	148	
	3.792	2.0:1		
	3.841	2.0:1		
	3.775	1.1:1	129	
	3.712	2.0:1		
	3.629	2.0:1		
	3.568	1.0:1	118	
	3.511	2.0:1		

The Results

The network was installed at the base of the antenna and the input impedance and SWR measured (see Figure 10). The tuning sensitivity on the lower end of 80 meters was very fast and any tuning capacitor warpage results in a problem. A stepper motor solution might enable more consistent repeatability but is not within the scope of this project. I readjusted the 80 meter inductances to reduce tuning sensitivity so the minimum C matched frequency is 3.86 MHz, instead of 4.0 MHz. The result is a less than 2:1 match at the high end of the band.

The network performance was measured using a vector network analyzer and Autek VM1 computing SWR meter. The data, shown in Tables 1 and 2, indicates that all of 160, 80 and 40 meters can be matched. Additionally, the 2:1 SWR bandwidth was measured as that is an indication of loss and the useful bandwidth without network retuning.

I have used the antenna and this matching network on 160, 80 and 40 meters at 100 W with excellent results. The *MathCad* calculations indicate a 500 W limit on 160 meters while 1200 W should be within limits on 80 meters. I have tested the network on 160 meters at a 500 W level and 80 meters at a 1000 W level with good results — that is, I haven't set the woods on fire with the high voltage. Unfortunately, the house alarm system did not like the intense RF field and I had a visit from our local police force. I do have the wire, foam RG-8 center conductor and dielectric, connecting the output of the matching network to the antenna run through some PVC pipe for extra insulation where it runs close to ground.

The *MathCad* worksheets that were used to design this project are available on the QST-in-Depth website as are detailed construction drawings and additional photos and other details.[5] Thanks to my wife, Lee, for her continuing support and to Dave Rzewnicki and Jim Pheasant for their suggestions and machining help.

Notes

[1]P. Salas, AD5X, "160 and 80 Meter Matching for your 43 foot Vertical," *QST*, Part 1, Dec 2009, pp 30-32; Part 2, Jan 2010, pp 34-35.

[2]R. Severns, N6LF, "An Experimental Look at Ground Systems for HF Verticals," *QST*, Mar 2010, pp 30-33.

[3]*4Nec2*, by Arie, available from the NEC Archive at **www.si-list.net/swindex.html**.

[4]Rogers 4350B PC Board Material available from Rogers Corporation (**www.rogerscorp.com/acm/index.aspx**) or a PC Board Fabrication house that makes high performance RF PC boards.

[5]**www.arrl.org/qst-in-depth**

Photos by the author.

ARRL member and Amateur Extra class licensee Shef Robotham, WA1RHT, has been licensed since 1972, first as WN1RHT. He has always had a passion for electronics. Shef was a co-founder of DeMaria Electro-Optics Systems, an RF excited CO2 OEM laser manufacturer, and responsible for the design of the RF power systems, from 300 W to 3 kW, necessary to drive their lasers. He uses Amateur Radio as a experimenting and building outlet in various directions from radio astronomy to microprocessor-based projects. You can reach Shef at 14 Blueberry Ln, Burlington, CT 06013 or at **shefrobotham@comcast.net**.

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Webcam Microscope for the Radio Amateur

See those SMDs and tiny board traces with this handy tool.

Wayne Smith, WA4WZP

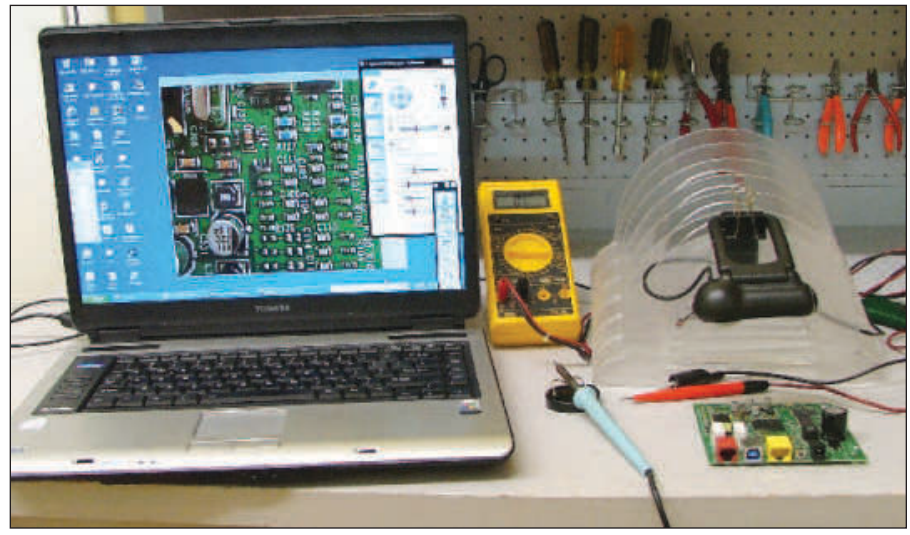

Figure 1 — Overview of the webcam microscope, PCB and laptop computer on the author's workbench.

Joe Koehler's *QST* article, "Reflow Soldering for the Radio Amateur" was enlightening.[1] Reading his article and biography caused me to undertake an interesting experiment.

I started tinkering with electronics when I was in the first grade (another story for another time), which led to a career in the consumer electronics industry. I started out mounting components on wooden boards then moved into punching holes in sheet metal to mount tube sockets, power transformers, electrolytic capacitors and other parts. As technology got faster and smaller, I learned about discrete semiconductors, integrated circuits and microprocessors.

As part of my electronics interest, I became a short wave listener, then Citizens Band operator and finally obtained my Amateur Radio license in 1965. Right away, I found that I liked homebrewing and experimenting more than communicating.

Time and Technology March On

This desire to build things with my own hands resulted in an introduction to surface mount technology. As a field representative for a test equipment company (in the late 1980s), we needed a few circuit boards that would be the heart of a teaching device. I volunteered to build these boards and right away found a challenge. Some of the parts could not be obtained with leads — they had to be surface mount!

Joe mentioned that he had access to a dissecting microscope. I didn't. At a local hardware store I found a large lighted magnifier that clamped to the workbench. This helped, but the *sweet spot*, the center of the lens with minimum distortion, was very small. Since the magnifier had to be close, within a couple of inches, to the printed circuit board it kept getting in the way.

Figure 2 — The laptop screen showing a portion of the PCB with the tiny surface mounted components.

Next, I obtained a jeweler's magnifier that can be worn on the head. I could see more clearly, but since I wear bifocals, the focal point was only 3 inches away from my nose. Yes, I breathed a lot of solder fumes and burned my nose several times. But, eventually, the project was successfully completed.

Then, as many have found, life got in the way and my ham radio tinkering was put on hold. But the flame never went completely out. Over the past couple of years, the flame has been in the process of being rekindled.

[1]J. Koehler, VE5FP," Reflow Soldering for the Radio Amateur," *QST*, Jan 2011, pp 32-34.

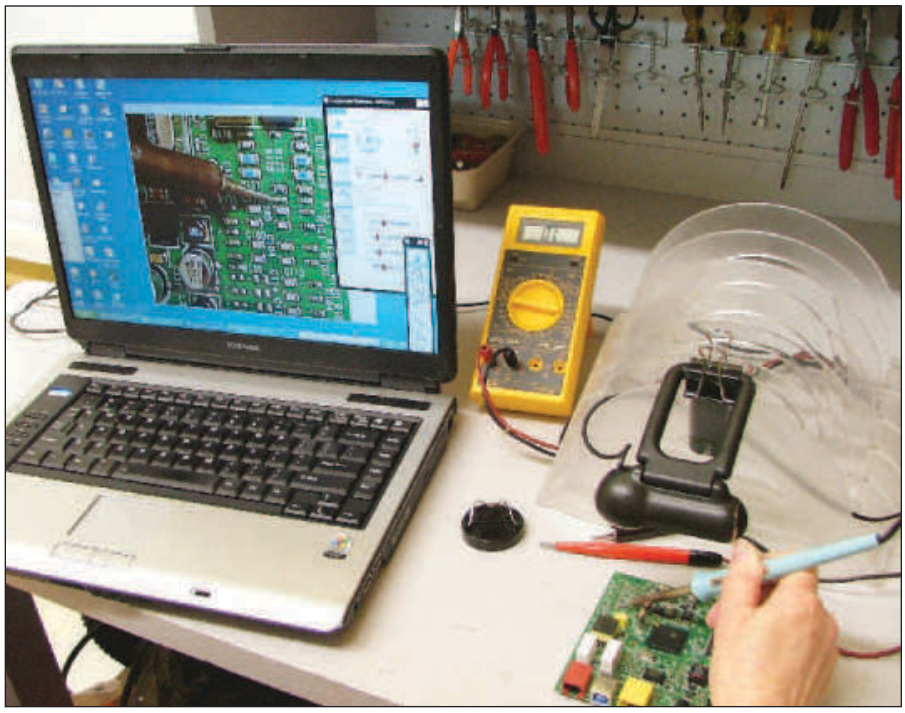

Figure 3 — My hand holding a soldering iron to one end of a component. On the laptop screen you can plainly see the tip of the iron against this tiny part.

As Joe mentioned, my desire is to experiment and build ham radio projects using the latest technology.

I still have the jeweler's magnifier, but my eyes are now 72 years old. How does an old man with bifocals see and work with these tiny parts? Joe mentioned the 0805 size parts. This is 0.08 × 0.05 inches length × width. Newer parts are now 0201 size, which is 0.02 × 0.01 inches length × width!

The Answer is Right in Front of My Eyes

While sitting in front of my computer monitor looking at the specs for a 20 meter PSK31 kit, I felt something looking back at me. It was the webcam that is clipped to the top of my monitor. A light went on and an idea formed. Could the webcam and computer monitor be used as an electronic dissecting microscope?

In my junk box was an old modem. With haste I disassembled the unit and removed the 4½ inch square printed circuit board. Sure enough it was manufactured using surface mount technology components — some of them were the 0201 size. I clicked on *Skype* to activate the webcam and put the board in front of the camera. The result was promising. I could read the tiny part numbers that couldn't be seen with my bifocal-assisted vision.

Encouraged, I unclipped the webcam from the desktop monitor and took it to the workbench. I clipped it on a support about 4 inches above a PCB that was on the workbench surface. I connected the camera to my laptop, activated *Skype* and the webcam control panel. I turned off the auto focus and by adjusting the zoom, white balance, color and brightness controls I had a decent image that I could see (see Figures 1 and 2).

Making it Even Better

Right then I knew that I had found a way that this old man could build with these tiny parts. Sitting back in my chair, the old experimenter syndrome kicked in. How to improve the system? First, how could I get the webcam image directly onto the monitor without activating *Skype*? Next, the *Skype* image is about 4 × 4 inches on monitor. Could I get it larger?

An Internet search found a free program called *Yawcam* (**www.yawcam.com**). A quick download and it worked. Start *Yawcam* and there is your webcam video that you can adjust to any size.

With shaky hands I picked up a soldering iron and without looking at the PCB (which I wanted to do because "that's the way we have always done it"), and just looking at the monitor, was able to bring the tip of the soldering iron directly to one end of a 0201size resistor (see Figure 3).

Let the experimenting begin. Have some fun. Reach over to the webcam control panel, push a button and *click* — you have an instant photo of your work. How about pushing the RECORD button to make an audio/video recording of your circuit board construction? Would better lighting make a difference? A better webcam (I am using a Logitech 9000)? A larger monitor with improved resolution?

Photos by the author.

Wayne Smith, WA4WZP, an ARRL member, earned his Technician class license in 1965 and is now an Amateur Extra class operator. Wayne is a graduate of DeVry University and enjoyed a long career in the consumer electronics industry until his retirement from Sencore Electronics. For years Wayne was very active on the VHF and UHF ham bands as well as in Air Force MARS. For several years, family duties have kept Wayne off the air, but he still enjoys tinkering with electronics and is looking forward to the day he can return to the ham bands using the digital modes. You can contact Wayne at 224 Saint Johns St, Arden, NC 28704 or at **wa4wzp@arrl.net**.

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Three Wrong Assumptions about the Ionosphere

Sometimes we need to step back and look at life with a different slant.

Eric P. Nichols, KL7AJ

My recent article, "Gimme an X, Gimme an O, What's that Spell? Radio" has generated a lot of feedback and interest.[1] It has also suggested a lot of new ideas for experimentation. That article was never intended to be the last word on the subject, but rather just the first word on the subject — at least in a very long time. If it generates interest and piques curiosity, it's really hard to ask for much more.

In any scientific endeavor, real progress is made when people acknowledge that some of their long cherished ideas might be incomplete or, perish the thought, actually wrong.

One of the most amazing things about radio is how well it works even if you do have a lot of misconceptions. You can do a lot of communicating with far less than optimum equipment and technique. This is the magic and romance of radio, and the last thing we would want to do is create an environment of "paralysis by analysis." The only correct answer to any ham's query, "Do you think this will work?" is, "Try it and see!" Any other answer is antithetical to the very concept of Amateur Radio. We need to be willing to go the next step, however. If what we observe by "trying and seeing" contradicts what we have been taught, or what we have always believed, we might have to make some adjustments to those beliefs. This is what "advancing the state of the radio art" is all about.

True progress in science (or any other field) begins with three magic words — I was wrong.

There is an amazing liberating effect when you utter these words. It opens up your mind to endless possibilities.

When it comes to radio propagation, particularly ionospheric radio propagation, there are three long standing doctrines that have pretty much served as mental straitjackets when it comes to understanding HF propagation. And it should go without saying that understanding is the key to any progress. As long as these doctrines evade scrutiny, our understanding and use of HF will be stagnant at best. And at worst, it will remain an intractable and confusing mystery.

Here are the three cardinal doctrines of HF propagation we need to call into question — and perhaps call on the carpet:

- The ionosphere is a spherical shell.
- The ionosphere is smooth.
- The ionosphere is reciprocal.

If you hold on to any of these three doctrines, you may find it helpful to apply the three magic words to each, in succession.

- The ionosphere is a sperical shell.
  I was wrong.
- The ionosphere is smooth. I was wrong.
- The ionosphere is reciprocal. I was wrong.

Good Company

If your operating enjoyment has been crippled by this tyrannical triumvirate of ionospheric misconceptions, it's not your fault. In fact, you're in good company. Decades of diagrams and scads of sketches have portrayed the ionosphere as something like an onion, with an array of smooth, reflective layers encircling the globe, just dying to convey our every tickling of the ether effortlessly to any spot on the planet. To add insult to injury, we now have ionospheric "propagation models" that merely reinforce this misconception. These propagation models do little more than allow us to be more precisely wrong. (I have an old sailor friend who says a GPS receiver just lets you get more precisely lost than a compass ever could. This is a great analogy to our situation with propagation models.)

You see, nearly every model you've ever seen of the ionosphere omits one significant factor: the Earth's magnetic field. If we didn't have a magnetic field, all our common conceptions of the ionosphere actually would be pretty good.

The Earth's magnetic field, however, is not

[1]Notes appear on page 42.

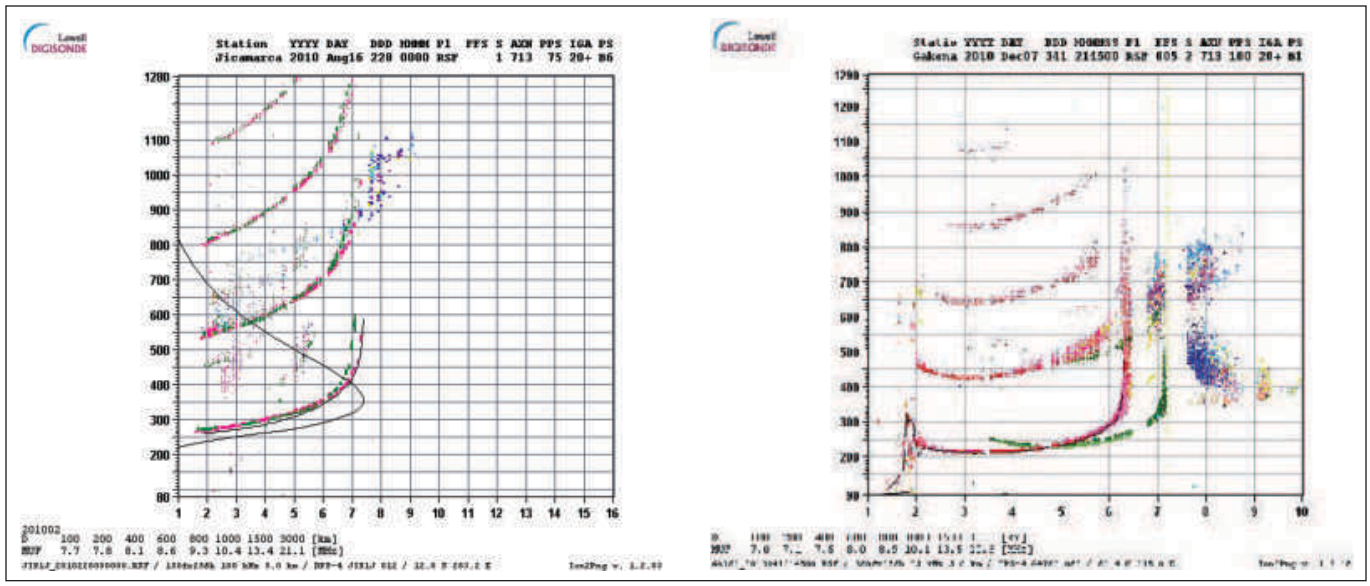


Figure 1 — Ionograms that show the profound difference that the Earth's magnetic field makes. At left, from Jicamarca, Peru, which is right near the magnetic equator. The horizontal axis of each is frequency (MHz), the vertical altitude (km). Notice that the O and X traces (red and green, respectively) lie almost on top of each other. At right, the Gakona ionogram in Interior Alaska shows the profound skewing between the X and O traces. (Absorption is very low in both cases — hence the multiple returns.)

a mere appendix, a curious footnote, a parenthetical comment in small print. It changes everything — profoundly.

As we demonstrated in "Gimme an X, Gimme an O" the magnetic field of the Earth splits every HF radio signal into either a right-hand circular O-mode wave or a left-hand circular X-mode wave. We learned that the Appleton-Hartree dispersion formula, the "Ohm's Law" of ionospheric propagation, actually forbids the propagation of linearly polarized signals. But this is only the beginning.

The magnetic field of the Earth warps, wrinkles and tilts the sky. It makes it misbehave. It pays no regard whatsoever to great circle paths (yet another cardinal doctrine that needs to be roundly smacked upside the head). Furthermore, all these warps, wrinkles and tilts affect the X and O waves differently.

Let's dissect each of the three major misconceptions and show how we might "do ham radio" a bit differently if we really understood the implications.

Leveling the Playing Field

One of the truisms of ham radio propagation is that if you want to work DX you want to launch low angle signals. This is based on the optical principle that the angle of incidence is equal to the angle of reflection (not a bad assumption), and that the ionospheric reflection layer is horizontal (not a good assumption). In this regard, having a less-than-ideal antenna actually helps. At HF frequencies, even the highest gain antennas have fairly wide lobes, and sometimes multiple wide lobes. It's difficult to talk about a launch angle, especially when you take into consideration ground reflections, both near and at surprisingly great distances.

What if the ionosphere is *not* spherical? Let's say it's tilted at a healthy 60°, as it often is in interior Alaska (see Figure 1). Why would it be tilted at 60° in interior Alaska? Because the north magnetic field lines up here make it tilt. Aren't we special? Let's say it tilts downward as you move north toward Fairbanks, so from the point of view of someone in a "normal" place like Ohio, it looks like a big drive-in movie screen. So, you aim your low angle beam toward Fairbanks, and hope for the best. Will I hear you? Quite likely. As long as I aim my beam straight up. Why? Because your carefully crafted low angle beam is bouncing off a tilted reflector in my bailiwick. Now, mind you, your signal might make a few "normal" low angle skips on the way up here, but once you're in my domain, all bets are off.

As I am so fond of saying, this isn't rocket science; it's just geometry. What if I want to talk to you? Well, if I aim my antenna toward you at a low angle, it's pretty obvious I'm going to miss the ionosphere entirely! (At least on the first potential hop or two.) If my signal somehow manages to make it to a more "normal" region of the ionosphere, one that's semi-horizontal, you might be able to hear me.

Since the ionosphere is marinated in magnetism, HF signals are refracted not only in the vertical plane, but in the azimuth, and actually the azimuth *skewing* is far more profound than what you see on any vertical incidence ionogram.

Reciprocity, What's That?

Now, most of you are probably saying, "Who gives a rip about Fairbanks, anyway? You're just an aberration up there."

Well, I admit I'm an aberration, but I'm an aberration you need to care about. Why? Because, like it or not, you have to go through me to get to Europe. (Well, not me personally, but through my "hood," so to speak.) But not only that, you have to go through another, nearly mirror image of my aberration just on the *other* side of the North Pole, where the sky is tilted just as much the other way.

And you aren't out of the woods if you go south. The south magnetic pole does the same thing, so even if you try long path so as to avoid me, you still have to deal with the tilted sky down there — probably twice.

Take Your Lumps

Not only can the ionosphere be profoundly tilted on the large scale, but it can also be very lumpy on much smaller scales. And you don't have to be near the magnetic poles to experience a lot of lumpiness. Some of the moderate latitude lumpiness is due to the magnetic field, but a lot of it is not. The ionosphere is soft and squishy — it's not a hemispherical mirror. It's also somewhat viscous so it can retain local structures for surprisingly long times. This is one of the truly remarkable properties of a plasma that is stranger than fiction. Lumps in the ionosphere can be caused by numerous things: solar wind, electron precipitation even weather events down below.

The fine folks at the EISCAT[2] facility in Tromso, Norway did some calculations not long ago. They determined that the mass of the entire ionosphere is about one metric ton. That's right. You could take every ion in existence around our planet and scoot it around on a one-man pallet truck. Everything that we know and use in the ionosphere could be

easily compressed and stashed in the corner of someone's garage!

Fortunately, there probably isn't too much danger of anyone stealing the ionosphere, precisely because it is spread so thin. (Not to mention the fact that it keeps regenerating itself.) In fact, the density of the atmosphere at altitudes where things just begin to be interesting from a radio standpoint is about one-quadrillionth of the density of the air we breathe. How can so little do so much?

I'm glad you asked, since this is the very key to the tenuous nature of the ionosphere. We shouldn't be surprised in the least that something as gossamer as a ghost's panty hose might be affected by magnetic fields and other influences to the degree that it is.

All the wrinkles and warps in the ionosphere serve to increase (on average) the local angle of arrival of incoming signals. In other words, low angle distant signals are converted into higher angle signals by virtue of the fact that so many reflecting surfaces are no longer horizontal. What this means is that, except for exceedingly quiescent conditions, NVIS (Near Vertical Incidence Skywave) antennas may be much more useful for effective DXing than we have previously thought. Most hams actually pay very little attention to incoming vertical angle of arrival from distant signals. I can only speak from personal experience here, but if I were a betting man, I'd guess that most HF signals arrive from much higher vertical angles than we expect. This is certainly something worth investigating, at the very least!

By the way, this would be something very easy to test by setting up a simple horizontal turnstile antenna that supports circular polarization from above. If you see a large difference in signal strength from a DX station as you switch between right-hand circular and left-hand circular polarization, you know the signal is arriving from nearly overhead. This is because a turnstile antenna does not show good "handedness" discrimination very far off axis. This, of course, makes the assumption that the incoming signal is itself circularly polarized, which is a valid cardinal doctrine. Appleton-Hartree has never been violated.

By the way, the Appleton-Hartree equation, as daunting as it is, has been rather effectively simplified in a *Communications Quarterly* article.[3]

In fact, this article is the only other recent reference to X and O modes I've seen in amateur literature. It is well worth the read. Although there are special implications of X and O propagation on 160, this affects all HF propagation to varying degrees.

Let's Reciprocate

It's an old axiom in ham radio that, "If you can't hear 'em, you can't work 'em." Actually, it's worse than that. A lot of the time, you can't work 'em even when you do hear 'em. (To be honest, this is the norm in Alaska. But for now, let's talk about where you live). If you're new to HF, you will discover there are many, many times that a DX station just will not hear you, no matter what you do. That's the bad news.

Here's the good news: It may not be your fault. Your transmitter might not be broken. Your antenna might not broken. The DX may not be avoiding you because you're a lid. The DX may not be avoiding you because you have a "new" call sign. They probably aren't ignoring you because there's too much interference.

There's a good chance they are not answering you because your signal is just not getting there. There is simply no path of propagation from you to them. Period. It doesn't matter if their signal is twisting your S-meter's needle three times around its pivot point. You are experiencing one-way propagation, which is something that can't exist according to normal ham radio "wisdom." True reciprocity needs to include not only the antenna radiation pattern, but all the intervening paths and processes, which may very well be nonreciprocal.

The truth is that Appleton-Hartree all but guarantees that true reciprocal HF paths will be excruciatingly rare. The only reason most of us never notice this is that most HF beams are very wide, even from the highest gain antennas available — and the beams get wider with every reflection. If you could generate a "laser beam" on 20 meters, you would probably never reach a DX station by aiming it in the same direction he's coming from.

But let's disregard the steering differences for now. Let's say we've compensated our beam headings by whatever means so that our signals presumably would intersect the DX station. We still can have a profound difference in absorption going in one direction as opposed to the other, especially if perpendicular to magnetic field lines. We won't see this too much on O mode waves, but for X mode waves, the difference in absorption is very different depending on direction. That's why it can be really helpful to know whether you're dealing with your X wave or your O wave. You can't do much about the non-reciprocal absorption of the X wave, but you can choose to use the O wave instead, in many situations. This simply involves resteering your antenna (sometimes in elevation as well as azimuth) so your O-mode signal does get there.

Perhaps by now you're asking how we can apply all this new information. How would you "do radio" differently if you could smash these three idols of propagation? There are many answers, but here's the most profound one: We would use separate transmit and receive antennas a whole lot more frequently on the HF bands. The use of separate antennas can go a long way toward addressing all three issues.

Hamspeak

Turnstile antenna — An antenna consisting of two perpendicular horizontal dipoles in the same plane and fed through a 90° phasing line. While originally designed as an omnidirectional horizontal VHF antenna, it also provides circular polarization perpendicular to the plane of the elements.

Here's something you can start experimenting with right now, and I think you might be surprised at the results. Let's say you're a DXer and you have a fairly directional antenna, say on 20 meters. Your normal procedure is to probably steer your antenna for the strongest received signal and then assume that's the best orientation for the rest of the contact. But next time you do this, you may want to actually ask the DX station if this is really resulting in the strongest reception at his location. This may require a few iterations, but you may be truly surprised at how far off the steering is. Obviously, if you have to keep re-steering your antenna between transmit and receive, you'll get to appreciate separate antennas a lot more. Again, you may not see a 90° (or greater) difference as you may up here, but I can all but guarantee you that there will be some difference no matter where you are.

The second implication of this knowledge is that we'd also see a lot more experimenting with circular polarization and NVIS antennas as well. And finally, and by far most importantly, after a few successes with these new methods, we might be more willing to try even more new ways of doing things. And this is what ham radio is really about, isn't it?

Notes

[1]E. Nichols, KL7AJ, "Gimme an X, Gimme an O, What's that Spell? — Radio," *QST*, Dec 2010, pp 33-37.

[2]European Incoherent Scatter Scientific Association.

[3]R. Brown, NM7M (SK), "Power Coupling on 160 Meters," *Communications Quarterly*, Summer 1999.

ARRL member and Amateur Extra class licensee Eric P. Nichols, KL7AJ, has written numerous articles in just about every existent and defunct Amateur Radio and electronics experimenter publication over the past 30 years, with a strong emphasis on radio design and techniques. He worked as a broadcast engineer for a quarter century, later applying his radio experience to experiments conducted at HIPAS Observatory and HAARP, as well as designing instrumentation for the UCLA Plasma Physics department. His offbeat look at Amateur Radio, *The Opus of Amateur Radio Knowledge and Lore*, was published early in 2011 by CQ Communications.

You can reach Eric at PO Box 56235, North Pole, AK 99705-1235 or at **kl7aj@acsalaska.net**.

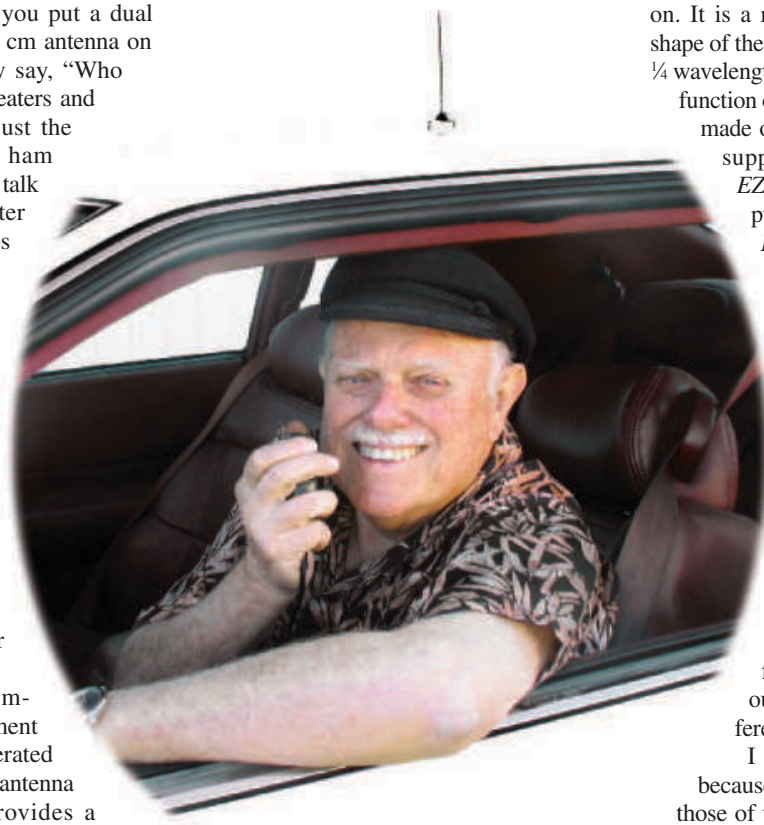
Your 2 Meter Mobile Antenna — What's the Best Mounting Location?

Where you mount that antenna makes a difference. Antenna modeling gives us some answers.

John Portune, W6NBC

Does it matter where you put a dual band 2 meter and 70 cm antenna on your car? Some may say, "Who cares, I only work local repeaters and rarely do simplex?" Well just the other day I heard a local ham bemoaning, "I wish I could talk to my regular repeater better from this location." Perhaps he could if he'd just move his antenna to a different spot on his car.

Perhaps you haven't thought about it because you have never seen a systematic technical comparison of the results of car antenna mounting positions. Hams normally just consider appearance and convenience. But there is a better method. This basic analysis may change your opinion.



This simple, yet systematic, look at antenna placement uses radiation patterns generated by *EZNEC*, a respected PC antenna modeling program that provides a friendly input/output language for the *Numerical Electromagnetic Code*.[1] It is a simple-to-use but powerful tool that has opened my eyes about many antennas over the years.

We'll model a typical 2 meter, 19 inch whip at five popular locations on a car:

1) roof top, center,
2) roof top, side,
3) rear window, top, center (glass mount),
4) trunk lid, center and
5) trunk lid, side, front.

The relative results are also valid for a higher-gain antenna or a dual band antenna while used on 2 meters.

To evaluate a VHF/UHF antenna on a car, we only need to look at the horizontal (azimuth) radiation patterns. *EZNEC* generates vertical (elevation) patterns as well, but in these cases they are all very similar, indicating little about the best mounting locations.

The Wire-Frame Model

The first step was to construct a wire-frame model of the vehicle to mount the antenna on. It is a rectangular grid of wires in the shape of the car, with wires spaced less than a ¼ wavelength apart. It was built in the WIRES function of *EZNEC*. Note that this model is made of far more than the 20 segments supported by the demo version of *EZNEC*. This requires either of two purchased versions of the program, *EZNEC+* or *EZNEC PRO*. These allow for the large number of wire segments used in the model.

A wire spacing of less than ¼ wavelength makes the wire-frame appear as a solid metal surface to the model. My first model was of a ¾ ton standard pickup truck with a metal toolbox. Here it's for an average sedan measuring 15 × 6 × 5 feet (LWH) and 6 inches off the ground. See Figure 2 (red outline). I simplified the car's shape as shown to make the wire-frame easier to construct (black outline). This causes only tiny differences in the radiation patterns.

I mention the pickup truck only because the patterns are quite similar to those of the sedan. This suggests that the results are valid for a wide variety of vehicles. Readers who are familiar with using *EZNEC* may find it enlightening to repeat the process for a van or an RV, either metal skinned or of partially synthetic construction. You may discover that some common antenna mounting maxims need another look.

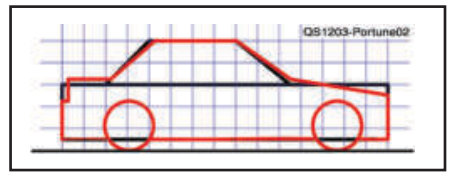


Figure 1 — Side view of *EZNEC* model of sedan. Details of the wire grid are shown in Figure 2.

Top Surfaces Only

While my first version of the sedan's wire-frame included both top and side surfaces, I later I found that the vertical surfaces have almost no effect on the radiation patterns. Therefore, I dropped them from wire frame. This allowed me to use my available segment count to define a closer wire spacing that provides improved accuracy.

The Radiation Patterns

Figure 3 shows the results — the horizontal (azimuth) patterns of a ¼ wave

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

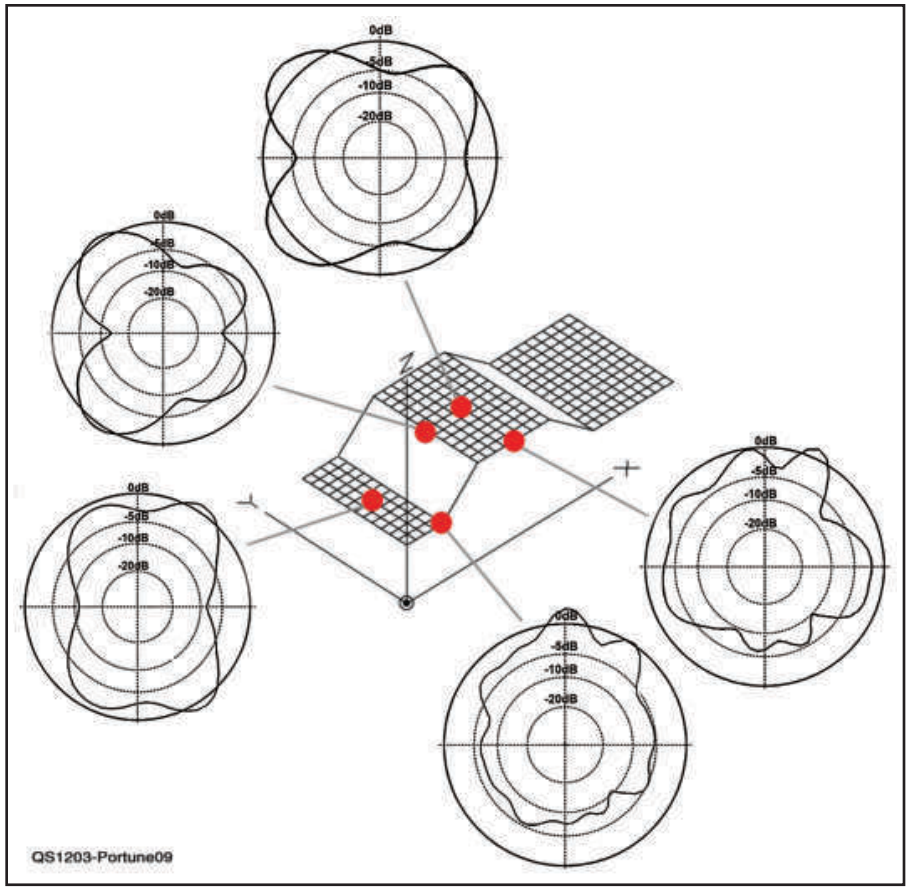


Figure 2 — *EZNEC* azimuth patterns of ¼ wave 2 meter whip antennas mounted at various locations on a wire grid model of the sedan shown in Figure 1. As shown, the center of the top provides the best pattern, followed by the center of the trunk lid.

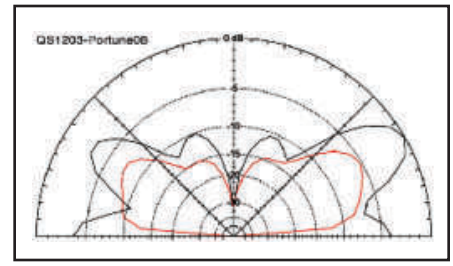


Figure 3 — Elevation plot of a 2 meter whip mounted at the center of the roof (red) over average soil, compared to the same configuration over a perfect ground plane (black). Note the loss of low angle radiation — more than a full S-unit.

2 meter whip at the five common locations. They are actual *EZNEC* plots just graphically simplified for clarity. In each plot I've also included a reference antenna. It too is a 19 inch long whip, but mounted over a perfect ground plane, not over the wire frame. As theory predicts, its pattern is omnidirectional (the outer circle). The dotted scales of each figure are in relative dB. (The front of the sedan is to the right.)

The dotted scales are dBi (*EZNEC*'s usual output), that is, gain compared to an isotropic radiator. I adjusted each plot to the same scale to provide a uniform comparison of all five and the reference antenna.

From these plots we can now derive some very useful guidelines for installing a mobile VHF/UHF antenna. Three seem evident to me. If readers see others, I would appreciate hearing from you.

Antenna Mounting Rules of Thumb

■ *There are always lobes*. Even though a car's body is large enough to provide an efficient ground plane for a VHF antenna, the azimuth pattern is never truly omnidirectional, as is evident from the plots. Note the lobes, and in particular notice the 2 S-unit (12 dB) field strength difference, direction to direction.

To give a practical use of this, in a weak signal area of a repeater's coverage, knowing where the gain and loss is relative to your car, can make a big difference. By simply moving your antenna, a troublesome dead spot on a regular commute may vanish without any significant compromise to repeater access in other areas. This is what the ham above needed to know.

■ *Center is better*. Figure 2 illustrates the disadvantage of mounting an antenna off the center line of the vehicle — either side to side or front to back. The reason? Off-center locations always create relative gain, diametrically across the vehicle, and also loss on the same side.

Transmitter hunters, for example, often use this pattern phenomenon. On HF transmitter hunts, directional antennas are much too large to mount on a car. But with only a simple HF whip mounted at an end of the rear bumper — normally the poorest mounting location — they can find the strongest signal direction by simply driving their cars in small circles. For this application, the pattern lobes are an advantage.

For the usual 2 meter/70 cm mobile installation, chose an on-center location if possible. This can be on any one of your vehicle's large horizontal surfaces, such as the trunk lid or the roof top. Notice the non-symmetry of the patterns from off-center locations. This to me is the most valuable rule of thumb of this little analysis.

■ *Higher is better*. The figures also demonstrate the value of a higher mounting position. Surprisingly, though, it isn't as much of a factor as some hams may believe. Therefore, also using the rule above, a lower on-center position is often better than a higher off-center location. I have not even bothered to show an end of the bumper mount, as the transmitter hunters use. The radiation pattern there has the largest irregularity.

My Own Preference

On my pickup truck, a work vehicle, I located the VHF/UHF antenna in the center of the roof top. Here, where appearance is not a big concern, it is the best choice. On my family sedan, I usually prefer center of the trunk lid. A magnetic roof mount in the middle of the roof is also good, though less attractive. Alternately on a pickup truck, the center of a metal toolbox is also a reasonable choice. It is similar to the center of the trunk lid on a car. Now that I have done these plots, however, I never mount a VHF/UHF antenna off-center, side to side or front to back.

Finally, here is an interesting observation that came out of this study. I have long known that low angle radiation from an HF mobile antenna is poor over average soil, but I did not expect to see the effect to any degree at VHF. I was therefore surprised to discover that the type of ground under a vehicle, even at VHF, does significantly still affect the radiation pattern for a 2 meter antenna at low angles. This is where we want our signals to be the strongest. Notice Figure 3, an elevation response plot.

What can you do about this? Nothing in most cases. Though if some day you are a long way away from a repeater and just barely making it in, try moving your car from dry ground to a moist green grassy area, or with such an area near the vehicle in the path to

the repeater. This may just make the difference between a satisfactory contact and the dreaded "no copy old man" report.

HF Mobile Antennas

After looking at antenna placement on VHF, I repeated this process for HF. Not surprisingly my additional modeling showed that location effects are proportionately less significant at lower frequency and small but measurable on the lowest HF bands. Therefore one of my new rules of thumb for a 75 or 40 meter whip is that location on a vehicle isn't a major issue. For 20 meters and up, however, there is more benefit to picking the best location.

My other rule of thumb for HF is, mount the antenna as high as possible. A bumper is still a poor choice, mostly because of nearby metal. Half way up the rear ladder on a smooth-sided fiberglass RV is generally the best, provided that the ladder is well grounded to the RV's metal frame with wide straps. Also, as much of the antenna as possible should be above the vehicle body. It is normally not a good idea to put an HF antenna on top of a fiberglass RV. The ground plane will be compromised too much. On a metal-skinned RV it's a great place, if you don't drive down many tree lined avenues, or eat at drive-through restaurants.

For 2 meters, however, top mounting on an RV is an excellent choice, as long as you provide an adequate ground plane. Remember, the same rules of thumb that apply to cars also apply to fiberglass RVs. A large metal surface or a wire grid of at least half a wavelength in extent is just as necessary here as it is on a car. A metal roof-top luggage rack is only a fair alternate. It has notable lobes.

Photo by the author.

ARRL member and Amateur Extra class licensee John Portune, W6NBC, received a BSc in physics from Oregon State University in 1960 and a BA in liberal arts and communications from Ambassador College in Pasadena, California in 1963. He earned an FCC Commercial General Radiotelephone license and an FCC Radiotelegraph license. John retired as a broadcast television engineer and technical instructor at KNBC in Burbank and then from Sony Electronics in San Jose, California. John received his Advanced class amateur license in 1965. He spent five years in England as G5AJH and upgraded to Amateur Extra class in 1987. John is active on many bands and modes, predominantly from his HF equipped RV mobile station. He has written various articles in ham radio and popular electronics magazines and remains active as a VE team leader, ham license teacher and website designer. You can reach John at 1095 W McCoy Ln #99, Santa Maria, CA 93455, or at **jportune@aol.com**.

At the Foundation

Mary M. Hobart, K1MMH, k1mmh@arrl.org

ARRL Rocky Mountain Division Scholarship Added!

The ARRL Rocky Mountain Division has added a $500 scholarship to the ARRL Foundation list of annual awards. The scholarship will be awarded to a resident of the ARRL Rocky Mountain Division (Colorado, New Mexico, Utah or Wyoming) who is a United States citizen. In addition the winner must be an active FCC-licensed Amateur Radio operator and enroll in a fully accredited US college or university. One very important qualification is on-air activity. Applicants must provide a letter from a sitting officer of an ARRL-affiliated Amateur Radio club attesting to the applicant's regular activity on the Amateur Radio spectrum and within the Amateur Radio community. In addition to the $500 award, the winner will receive one year of ARRL membership if the recipient is not already an ARRL member.

Remember — the application period for ARRL Foundation Scholarship awards opens October 1 and closes the following February 1. Winners are contacted by postal mail in mid-May.

Special note: Other ARRL Divisions, Amateur Radio clubs or individuals that are interested in establishing a scholarship award should contact the ARRL Foundation at **foundation@arrl.org** or by phone to 860-594-0397.

Strays

THE 2012 APPALACHIAN TRAIL HAM RADIO SURVEY

■Like to hike? Have a handheld transceiver? Then join the 2012 Appalachian Trail (AT) Ham Radio Survey and help determine ham radio coverage all along the AT. The survey will collect information to develop a list of usable repeaters and VOIP links along the AT from Georgia to Maine. Participants will also help to determine APRS tracking and texting reliability for hamming hikers along the trail. Ham hikers are asked to schedule a 1 or 2 day local hike while carrying an APRS handheld transceiver and GPS so that their track and coverage will be captured by the **aprs.fi** web page.

The survey hikes will begin in Georgia in mid-March, Tennessee and North Carolina in early April, Virginia in April and early May, then Maryland, Pennsylvania and New York in late May. After a month break, the survey will resume in Connecticut in July then on to Maine by the end of August. The timing is designed to coincide with the north bound trek of the hundreds of thru-hikers who attempt the 2180 mile hike each year. In this way, ham radio can also serve in a support role for any emergency assistance these through-hikers may need.

If interested, see the plan on **aprs.org/at.html** and contact **wb4apr@amsat.org**.

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.

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

A Look at Four Antenna Analyzers

Analyze these!

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

We've looked at antenna analyzers, along with other antenna measurement equipment, many times in the past, and we will continue to as new gear becomes available.[1] This is a very popular category — all active amateurs must deal with antennas, and an antenna analyzer can make it much easier to find out what's happening with them.

A number of devices can be used to characterize antenna systems, including the SWR metering capability in many HF transceivers. What sets an antenna analyzer apart from SWR and power meters is that the analyzer contains its own signal source. Having its own low level signal source allows measurements outside of amateur bands, often helpful during antenna development, without risk of causing harmful interference. These analyzers are compact and self contained. They include internal power sources, allowing their use on the roof or at the top of a tower.

Two of the units reviewed here, the MFJ and RigExpert are updates to analyzers in existing product lines, while the Comet and Ten-Tec are new entries. Although they are similar at first glance, significant differences among the units provide clear choices depending on your interests.

[1]For example, see J. Hallas, W1ZR, "Product Review — Two More Antenna System Measurement Devices," *QST*, Aug 2008, pp 43-47 and "Product Review — A Look at Some High-End Antenna Analyzers," *QST*, May 2005, pp 65-69. *QST* Product Reviews are available to ARRL members online at **www.arrl.org/product-review**.

COMET CAA-500 STANDING WAVE ANALYZER

Comet, a longtime antenna and accessory manufacturer, has joined the antenna analyzer marketplace with the CAA-500. This unit measures SWR and magnitude of impedance across the widest frequency range of the units in this test. Our unit covered 1.53 to 508 MHz in seven overlapping ranges except for a gap from 259.4 to 273.4 MHz. While the manufacturer indicates that the unit can measure SWR from 1:1 to ∞ (infinity), there are no numbers above 6:1, so readings above 6:1 are indications, but not quite measurements, in our view.

The frequency is adjusted using a thumbwheel knob that can be tuned by the same hand that holds the unit — very convenient if you are also hanging onto a tower or ladder, for example. The frequency is indicated on a seven digit frequency counter, while the SWR and impedance magnitude are shown on a large analog cross-needle analog meter with two scales. There are two coaxial connectors provided, a UHF (SO-239) type for the lower six bands and a Type N socket for 225 to 500 MHz.

The unit can be powered by six internal AA size alkaline batteries or an external 8 to 16 V dc power supply via a coaxial power connector. A power cable with matching plug and pigtail leads is provided as is a handy wrist strap.

On the Bench

We found that the unit had excellent frequency accuracy, within a few Hz, along with easy setability, especially on the lower bands. On the 225 to 500 MHz range it was difficult to set it within 50 kHz, but that shouldn't be a problem for most antenna work in that range. The frequency stability had similar results. It was quite steady in the lower ranges, but we observed drift of 250 kHz during 5 minutes at 440 MHz. The frequency counter on the unit follows the drift so you know the actual frequency as it moves.

The frequency counter has two positions, SLOW and FAST, set by a front panel button. In the FAST position, which easily follows tuning, at least on the lower bands, the counter resolution is 1 kHz. In the SLOW position, it reads to 100 Hz, dropping the hundreds of megahertz digit on the higher bands.

Bottom Line

This is an easy unit to like. Within the limits noted, it is easy to set and easy to read while making antenna or tuner adjustments. It doesn't offer all the measurement capabilities and other functionality of some of the other units, but it does what it does quite nicely.

Table 1
Antenna Analyzer Feature Comparison

Analyzer	Price	Range MHz	SWR	Z	X	Sign of X	AA Batt	External Power	Socket	PC I/O	Storage Locations
Comet CAA-500	$420	1.53-259 273-508	1-6	Yes	No	N/A	6	Yes	UHF/N*	No	No
MFJ-266	$320	1.5-71 85-185 300-490	1-9.9	Yes	Yes	No	8	Yes	N**	No	No
RigExpert AA-54	$320	0.1-54	1-10	Yes	Yes	Yes	2	Yes	UHF	Yes	100
Youkits FG-01	$249	1-60	1-9	Yes	No	No	3***	Yes	BNC	No	No

*Type N for top frequency range only.
**Type N to UHF adapter provided.
***Requires 3.6 V lithium batteries, type 14500.

The steady output level makes it a natural for use as an accurate signal generator for receiver alignment. The addition of a calibrated step attenuator would result in a test instrument that could be used for sensitivity measurement. When testing the receiver portion of a transceiver, be sure to disable the transmitter to heed Comet's warning about applying RF power to the unit. While we didn't test this analyzer as a dummy load, I can almost guarantee it won't make it.

The impedance meter can also be used to measure the reactance of a capacitor or inductor, as long as you know which it is. Change the frequency until you have the meter in an easy to read region and you will know the reactance at that frequency. Use the appropriate reactance formula and you will know the value of the capacitor or inductor.

Documentation

The CAA-500 comes with a clearly written four page *Instruction Manual* that includes specifications, identification of each connector and control and a short discussion of how to use it. There are also some frequently asked questions (FAQ) that may be helpful. While not a lot of information is provided, the operation of the analyzer will be intuitive to most amateurs who knew they wanted to buy one.

Manufacturer: NCG Companies, 15036 Sierra Bonita Ln, Chino, CA 91710; tel 800-962-2611, fax 909-393-6136; **www.cometantenna.com**.

MFJ-266 HF/VHF/UHF ANTENNA ANALYZER

MFJ arguably offers the widest selection of antenna analyzers known to man. They have models covering a wide price and capability range starting with their entry level HF analog tuning, SWR-only metering unit at under $100 and ranging up to the MFJ-269PRO HF/VHF/UHF multifunction digital display meter in the $400 range. A look at our Product Review archive (**www.arrl.org/product-review**) will find reviews of a number of representative models.

The MFJ-266 falls near the higher end of the product line. It includes many features of the MFJ-269 at a lower price and in an entirely new, more compact envelope with a different control layout. Features include the capability to measure not only SWR, but also the magnitude of impedance, as well as the rectangular resistive and reactive values. The two-line LCD simultaneously displays the frequency, tuning band, complex impedance, magnitude of impedance and SWR — no need to change settings, it's all there. Note that while a plus sign is shown with the reactive component, they describe it as a "place holder." You will need to determine the actual sign by other means such as changing the frequency slightly and noting the direction of reactance change.

Very useful features beyond the comprehensive SWR functionality mentioned above include the use of the '266 as a frequency counter. By selecting the appropriate buttons of the BAND button set and the DOWN button

Bottom Line

The MFJ-266 can serve as the "Swiss Army Knife" in your Amateur Radio tool kit. Either by itself or with available options it can perform many functions to keep your antennas and station equipment at peak performance.

Comet CAA-500 SWR/Impedance Analyzer	
Manufacturer's Specifications	**Measured in the ARRL Lab**
Frequency range: 1.5-500 MHz.	1.532-259.4 and 273.4-508 MHz.
SWR measurable range: 1.0-∞.	As specified, numerical indication to 6:1.
Impedance range: 12.5-300 Ω.	As specified.
Impedance accuracy: Not specified.	See Table 2.
Output power: 0 mW (0 dBm) max, load not specified.	0.5 mW (–3 dBm) into 50 Ω at 14 MHz. 0.44 mW (–3.5 dBm) to 50 Ω at 144 MHz. 0.59 mW (–2.3 dBm) to 50 Ω at 440 MHz.
Power requirements: 8-16 V, <180 mA.	165 mA at 13.8 V dc (external power); 167 mA at 9 V dc (internal batteries).
Size (HWD): 7.5 × 3.6 × 2.5 inches, weight 1.75 lb.	

MFJ-266 Antenna Analyzer	
Manufacturer's Specifications	**Measured in the ARRL Lab**
Frequency range: 1.5-71, 85-185, 300-490 MHz.	1.52-71.7, 85-185, 248-530 MHz.
SWR measurable range: 1.0-9.9:1	As specified.
Impedance range: Not specified.	5-200 Ω.
Impedance accuracy: Not specified.	See Table 2.
Output power: 1.6 mW (+2 dBm), load not specified.	2.3 mW (+3.6 dBm) into 50 Ω at 14 MHz; 1.6 mW (+2.0 dBm) into 50 Ω at 144 MHz; 0.8 mW (+0.7 dBm) into 50 Ω at 440 MHz.
Power requirements: 10.8-13 V dc (maximum), current, not specified.	Analyzer mode: backlight on, 152 mA, backlight off, 126 mA; field strength mode: backlight off, 41 mA; all at 12 V dc.
Size (HWD): 6.8 × 4 × 3.2 inches (including protrusions); weight, 1.3 lb.	

after power up you enter frequency counter mode. In addition to the observed frequency, the display shows the relative strength of the signal. This can be useful to identify a strong received signal that could interfere with antenna measurements.

By pressing the UP button at power on, the '266 will measure capacitance directly in picofarads. Similarly, pressing the DOWN button at power on switches to inductance measurement mode — both very handy features, calculator not required! Again, you need to know which type (inductance or capacitance) it is to get the correct answer.

Setting Up the MFJ-266

When the '266 is powered up, the display prompts you, once you know the code, to tell it what you want, starting with the BAND-MODE SELECT buttons. If you press both the UP and DOWN buttons immediately on power up, it will turn on the backlight — the default is BACKLIGHT OFF to conserve battery power. The available dc voltage is shown, along with an indication that you should push UP to select frequency counter mode or DOWN to select antenna analyzer mode.

Frequency is selected from the eight bands by first using the A and B buttons to select HF, VHF, UHF or COUNTER as indicated in the table next to the buttons. While the VHF (85-185 MHz in their definition) and UHF (300-490 MHz) ranges are tuned in one band each, the HF range (1.5-65 MHz) is covered in six bands selected by the UP and DOWN buttons identified as BAND-MODE SELECT in the unit's center. Once you select the range, you tune the frequency using the TUNE knob. The TUNE knob is part of a 10-turn assembly that permits fine adjustment, but it is tricky to set the exact frequency you want especially on the higher bands. Interestingly, on the "HF" bands, turning the knob clockwise *decreases* the frequency, while on the VHF and UHF bands it works the other way. Note that all US amateur bands from 160 meters to 70 cm are covered, except 222 MHz. Even though the specifications (and band switch) allowed for a gap from 65 to 85 MHz, our unit covered up to 72 MHz, nicely extending through the UK 4 meter band (70-70.5 MHz).

Power Requirements

A somewhat surprising external power requirement is worth noting. The manual states that the external dc supply (plugged into a front panel coaxial jack) needs to be between 10.8 and 12.5 V and offers a warning that it can't be higher than 13 V without load. Since most amateur station dc power supplies deliver 13.8 V or more, this may be a problem for some applications unless special care is taken. The manual also notes that the usual rechargeable 1.2 V NiCd cells will not provide enough voltage for operation. Earlier units could operate from 11 to 18 V.

Table 2
Impedance and SWR Measurements

Load	Frequency	Comet CAA-500	MFJ-266	RigExpert AA-54	Youkits FG-01	Agilent 4291B (reference)[1]
50 Ω (1:1 SWR)	3.5 MHz	50 Ω (1.0:1)	50+*j*0 Ω (1.0:1)	49.8–*j*0 .2 Ω (1.0:1)	48 Ω (1.0:1)	50+*j*0 Ω
	14 MHz	50 Ω (1.0:1)	50+*j*0 Ω (1.0:1)	49.8+*j*1.1 Ω (1.0:1)	48 Ω (1.0:1)	50+*j*0 Ω
	28 MHz	50 Ω (1.0:1)	50.0+*j*0 Ω (1.0:1)	49.8+*j*2.2 Ω (1.0:1)	48 Ω (1.0:1)	50+*j*0 Ω
	50 MHz	50 Ω (1.0:1)	49+*j*0 Ω (1.0:1)	49.7–*j*4.0 Ω (1.1:1)	48 Ω (1.0:1)	50+*j*0 Ω
	144 MHz	50 Ω (1.0:1)	49–*j*0 Ω (1.0:1)	—	—	50+*j*0 Ω
	223 MHz	48 Ω (1.1:1)	—	—	—	50+*j*0 Ω
	440 MHz	50 Ω (1.1:1)	— (1.1:1)	—	—	50+*j*0 Ω
5 Ω (10:1 SWR)	3.5 MHz	—	4+*j*3 Ω (>9.9:1)	5.0+*j*0 .4 Ω (9.9:1)	4 Ω (8.5:1)	5.1+*j*0 .0 Ω
	14 MHz	—	2+*j*4 Ω (>9.9:1)	5.1+*j*1.7 Ω (9.9:1)	4 Ω (8.5:1)	5.1+*j*0 .2 Ω
	28 MHz	—	3+*j*4 Ω (>9.9:1)	5.1+*j*3.4 Ω (9.8:1)	6 Ω (8.7:1)	5.1+*j*0 .4 Ω
	50 MHz	—	6+*j*0 Ω (7.3:1)	5.1+*j*5.8 Ω (9.7:1)	11 Ω (8.2:1)	5.1+*j*0 .7 Ω
	144 MHz	—	3+*j*9 Ω (>9.9:1)	—	—	5.2+*j*1.9 Ω
	440 MHz	—	(>9.9:1)	—	—	—
25 Ω (2:1 SWR)	3.5 MHz	25 Ω (1.8:1)	25–*j*0 Ω (2.0:1)	25.1+*j*0 .1 Ω (2.0:1)	23 Ω (1.9:1)	25.1+*j*0 Ω
	14 MHz	25 Ω (1.8:1)	23+*j*12 Ω (2.2:1)	25.1+*j*0 .7 Ω (2.0:1)	24 Ω (1.9:1)	25.1+*j*0 .2 Ω
	28 MHz	26 Ω (1.8:1)	24+*j*10 Ω (2.1:1)	25.2+*j*1.3 Ω (2.0:1)	24 Ω (2.0:1)	25.1+*j*0 .4 Ω
	50 MHz	26 Ω (1.8:1)	26+*j*0 Ω (1.8:1)	25.2+*j*2.4 Ω (2.0:1)	25 Ω (1.9:1)	25.1+*j*0 .7 Ω
	144 MHz	24 Ω (1.7:1)	26+*j*10 Ω (2.0:1)	—	—	25.2+*j*2.0 Ω
	223 MHz	32 Ω (1.5:1)	—	—	—	—
	440 MHz	40 Ω (1.9:1)	— (1.5:1)	—	—	—
100 Ω (2:1 SWR)	3.5 MHz	110 Ω (1.9:1)	95–*j*19 Ω (2.0:1)	99.6+*j*1.7 Ω (2.0:1)	98 Ω (2.0:1)	100–*j*0 .2 Ω
	14 MHz	110 Ω (1.9:1)	90–*j*33 Ω (2.1:1)	99.0+*j*8.8 Ω (2.0:1)	98 Ω (2.0:1)	100–*j*0 .9 Ω
	28 MHz	105 Ω (1.9:1)	89–*j*33 Ω (2.1:1)	97.0+*j*16.8 Ω (2.0:1)	98 Ω (2.0:1)	100–*j*1.8 Ω
	50 MHz	100 Ω (1.9:1)	90–*j*27 Ω (2.0:1)	92.0+*j*28.6 Ω (2.1:1)	95 Ω (1.9:1)	99.9–*j*3.1 Ω
	144 MHz	92 Ω (2.1:1)	74–*j*41 Ω (2.1:1)	—	—	99–*j*8.9 Ω
	223 MHz	80 Ω (2.4:1)	—	—	—	—
	440 MHz	90 Ω (2.0:1)	— (2.1:1)	—	—	—

Documentation

The MFJ-266 comes with a 20 page instruction manual that includes not only instructions but application notes on how to perform the many tasks that this analyzer can accomplish. The instructions are well written, clear and will be needed to be able to make best use of the unit and all its capabilities.

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

Table 2
Impedance and SWR Measurements [continued]

Load	Frequency	Comet CAA-500	MFJ-266	RigExpert AA-54	Youkits FG-01	Agilent 4291B (reference)[1]
200 Ω (4:1 SWR)	3.5 MHz	225 Ω (3.8:1)	160–*j*94 Ω (4.4:1)	197.8–*j*1.7 Ω (4.0:1)	205 Ω (4.0:1)	201–*j*1.2 Ω
	14 MHz	225 Ω (3.8:1)	149–*j*107 Ω (4.6:1)	195.0–*j*26.1 Ω (4.0:1)	205 Ω (4.0:1)	201–*j*4.8 Ω
	28 MHz	220 Ω (3.8:1)	144–*j*104 Ω (4.5:1)	187.5–*j*50.3 Ω (4.0:1)	205 Ω (4.0:1)	200–*j*9.4 Ω
	50 MHz	210 Ω (3.7:1)	132–*j*100 Ω (4.3:1)	164.2–*j*83.4 Ω (4.2:1)	195 Ω (4.0:1)	199–*j*16 Ω
	144 MHz	175 Ω (4.1:1)	72–*j*93 Ω (4.3:1)	—	—	189–*j*45 Ω
	223 MHz	125 Ω (4.8:1)	—	—	—	—
	440 MHz	170 Ω (4.1:1)	— (3.8:1)	—	—	—
1000 Ω (20:1 SWR)	3.5 MHz	—	—	883–*j*184 Ω (18.7:1)	—	998–*j*33 Ω
	14 MHz	—	—	505–*j*471 Ω (18.6:1)	—	981–*j*127 Ω
	28 MHz	—	—	202–*j*471 Ω (∞)	—	935–*j*230 Ω
	50 MHz	—	—	53–*j*270 Ω (∞)	—	825–*j*373 Ω
50 – *j*50 Ω (2.62:1 SWR)	3.5 MHz	70 Ω (2.5:1)	34–*j*39 Ω (2.6:1)	49.0–*j*46.1 Ω (2.5:1)	83 Ω (2.5:1)	50–*j*47 Ω
	14 MHz	75 Ω (2.8:1)	33–*j*51 Ω (3.5:1)	45.5–*j*51.5 Ω (2.8:1)	89 Ω (2.7:1)	48–*j*52 Ω
	28 MHz	70 Ω (2.5:1)	36–*j*45 Ω (2.8:1)	45.8–*j*46.9 Ω (2.6:1)	78 Ω (2.4:1)	51–*j*48 Ω
50 + *j*50 Ω (2.62:1 SWR)	3.5 MHz	80 Ω (2.6:1)	65+*j*54 Ω (2.6:1)	52.0+*j*50 Ω (2.6:1)	92 Ω (2.5:1)	52+*j*50 Ω
	14 MHz	75 Ω (2.5:1)	51+*j*51 Ω (3.0:1)	55.8+*j*48.1 Ω (2.4:1)	92 Ω (2.5:1)	53+*j*48 Ω
	28 MHz	90 Ω (2.5:1)	54+*j*59 Ω (2.9:1)	72.2+*j*49.0 Ω (2.4:1)	100 Ω (2.5:1)	65+*j*51 Ω

[1]The SWR loads constructed in the ARRL Lab were measured on an Agilent 4291B Impedance Analyzer by ARRL Technical Advisor John Grebenkemper, KI6WX. An HP 11593A precision termination was used for the 50 Ω tests. This termination has a wide frequency range.

RIGEXPERT AA-54 ANTENNA ANALYZER

The AA-54 is very different from the other analyzers in this report, although there is a large functional overlap. It is similar to the AA-200 that we reviewed in August 2008, and which has been replaced by the AA-230. The AA-54 is part of a family of analyzers that cover different frequency ranges, the upper limit of each identified in the numerical portion of the model designator. Now included in the series are the AA-30, 54, 230, 230PRO and 520. As you might expect, the price increases, as do the features, as you move up the list. They are described and compared on the RigExpert website (**www.rigexpert.com**). While the AA-200 included a padded case and rechargeable batteries, the AA-54 is supplied with neither — part of the reduced price.

The first difference you would encounter between using the AA-54 and the other units in this review is that instead of a tuning knob to select frequency, there is a keypad. This is a mixed blessing — it takes a bit longer to fine tune frequencies, but the frequency you get is the one you actually want and it stays put until you change it. In addition, if you're not sure exactly what frequency you want to check, you can perform a sweep function to look at the SWR or impedance over a wide range of frequencies and then zero in on the frequency that needs the most attention.

On the Bench

Our AA-54 showed remarkable frequency accuracy and setability. At 10 MHz, we found the frequency accuracy to be within 800 Hz of the displayed frequency, quite appropriate for its 1 kHz resolution, expanding to be within 6.5 kHz at 54 MHz. It also stayed on frequency, exhibiting virtually no drift throughout our testing. The total output level was +12.3 dBm, ± 0.1 dBm, over the entire operation range, although there was high harmonic and spurious content in the output. The measured output level of just the *desired* signal ranged from +12.3 dBm at 100 kHz to +11.5 dBm at 10 MHz. From 15 to 30 MHz it ranges from +1.5 to +2.5 dBm, while from 35 to 54 MHz it is in the –2.0 to –2.5 dBm range. This did not seem to cause any problems with impedance measurements, perhaps due to internal processing, but could make for confusion if the AA-54 is used as a signal generator.

Rig Expert AA-54 HF Antenna Analyzer	
Manufacturer's Specifications	**Measured in the ARRL Lab**
Frequency range: 0.1-54 MHz.	1.5-54 MHz (usable range).
SWR measurable range: 1:1-10:1	As specified.
Impedance range: 0-1000 Ω.	As specified.
Impedance accuracy: Not specified.	See Table 2.
Output power: 20 mW (+13 dBm), 50 Ω load.	17 mW (+12.3 dBm) see text, 50 Ω (1.5-54 MHz).
Power requirements: Two 1.5 V alkaline AA batteries, two 1.2 V NiMH AA batteries, or external power via USB port.	Measurement mode: 244 mA backlight on, 169 mA backlight off; standby, 60 mA (backlight off); all at 3 V dc.
Size (HWD): 8.5 × 3.8 × 1.5 inches (including protrusions); weight, 14 oz with batteries.	

Bottom Line

The AA-54 is a very competent, accurate and easy to use analyzer providing single or multi-frequency pointed or plotted SWR and impedance data on a useful LCD display. In the shack or lab, it can also provide more advanced features while connected to a PC using the supplied software.

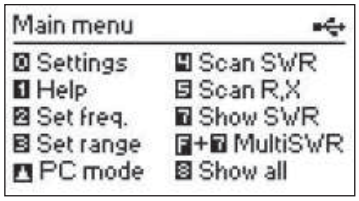


Figure 1 — Main menu screen of AA-54.

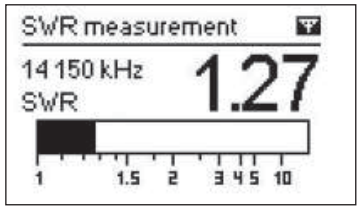


Figure 2 — Calibrated bar graph display in single frequency mode. The bars respond almost as quickly as an analog meter making them appropriate for adjusting the controls of an antenna tuner for minimum SWR.

Operator interaction is provided through a custom key pad and monochrome LCD screen. A single UHF connector on the top goes to the test sample, and a socket for a USB cable is provided for connection to a PC if desired. For most functions, the PC is not necessary. Note that the AA-54 is powered via the USB port when connected.

The AA-54 is menu driven (see Figure 1) and can provide bar type graphs or numerical SWR or Z data at one or more frequencies. It can also provide swept frequency data. In operation, I found the bar graphs best for making adjustments, since the display updates rapidly, while the swept data is most useful for a summary of results across a band following adjustment or repair.

In the Field

Standing wave ratio (SWR) is the meat and potatoes of such a device. Set for a single frequency, the LCD display shows a nice to tune with calibrated bar graph, a large font SWR readout, to three digits and the selected frequency, lest you forget. See Figure 2.

Selecting SHOW ALL on the menu provides

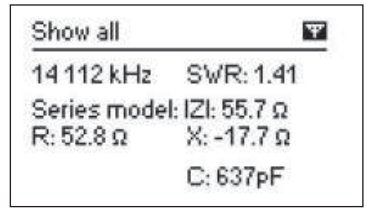


Figure 3 — Screen shot of SHOW ALL display in series equivalent mode. A parallel equivalent circuit model may also be selected. Note that the sign of the reactance is provided, along with the equivalent capacitance at the selected frequency.

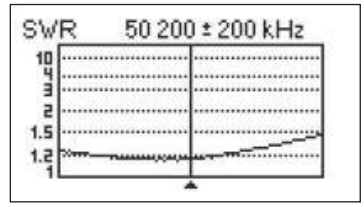


Figure 4 — Plot of SWR versus frequency.

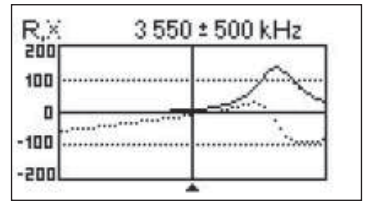


Figure 5 — Plot of R ± *j*X versus frequency. Note that the sign of the reactance is shown.

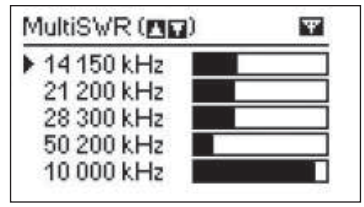


Figure 6 — Multi-frequency SWR plot with relative bar graph display. The five frequencies can be anywhere within the meter's range — very handy for adjusting multiband antennas, especially if they interact.

the details of the impedance being measured. This provides the measurement frequency, the SWR and also your choice of a series or parallel equivalent model of R and X, including sign and even the calculated equivalent capacitance or inductance value. See Figure 3. This is much more useful data than just SWR if you wish to design a network to match the load, for example.

Graphing Modes: A plot of SWR (Figure 4) or R ± *j*X (Figure 5) versus frequency can be easily arranged, again in either series or parallel equivalent model. Unlike many devices, the sign of the reactance is shown as well as its value.

MultiSWR Mode: A nice feature of all these units except the AA-30 is that data on multiple distinct frequencies can be observed simultaneously. This can be very useful while making adjustments on multiband antennas. In this case the display shows the frequency and a relative bar graph for each frequency (Figure 6) or the actual numerical SWR value. Without this feature, one often has to cycle through the interacting bands multiple times to get them all right. With the AA-54, you can observe the effects on five bands while you make adjustments.

The AA-54 includes a memory capability so that you can store up to 100 display screens. As you store each, you are prompted to tag them with an ID to make sorting them out later easier. They can also be shifted to a PC, great for "as built" or "as adjusted" records for later comparison to see degradation occurring, or to confirm it hasn't.

Computer Connection

The AA-54 comes with a CD that includes two auxiliary programs, described below. The software manual indicates that it can be installed in a PC running *Windows 2000, 2003, XP, Vista or 7* as well as *Mac OS* (version 10.6 recommended) or *Linux*. I tried it on *Windows XP* and *Windows 7* machines at my location, and each ran successfully.

The disc sets up two programs, *LCD2Clip*, which brings screen shots from the AA-54's display directly into the PC (push F and 6 simultaneously on the AA-54 keypad) at which point you can make screen shots to save the screen with your favorite photo program or *Windows Paint*. That is how Figures 1 through 6 were obtained for this review.

The other program is a more interesting tool for many applications. *AntScope* shows results on a full size PC screen, rather than on a copy of the AA-54's small native display. This allows viewing results in more detail, but it does take a few moments to display and transfer data. This program operates with the AA-54 in PC mode, so all definition and operation take place from the PC.

The major functions are similar to the AA-54's — all manner of impedance related data can be displayed — SWR, Z and R + *j*X (with sign of X, see Figure 7). The frequency limits can be set from the PC to display any portion of the range up to 54 MHz wide. By moving the curser with the mouse, all the details can be shown at any selected frequency.

A rather dramatic departure from the typical antenna analyzer is a time domain reflectom-

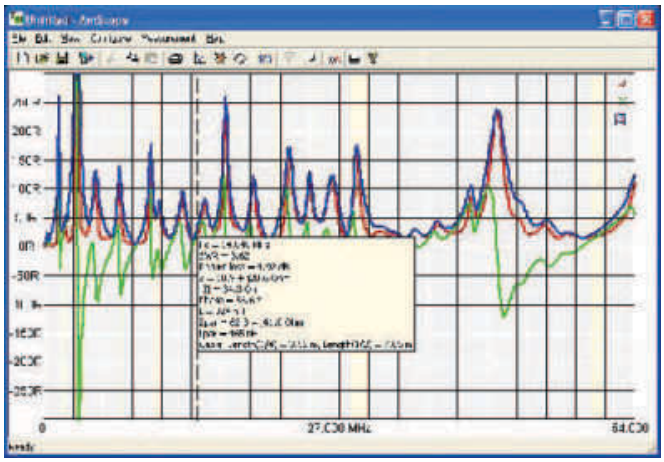


Figure 7 — *AntScope* view of the SWR of an antenna over the entire range. Note that European amateur bands are highlighted. Another view provides R, Z and X. The range can be reduced for more detail over a band, for example. Smith chart views are also provided.

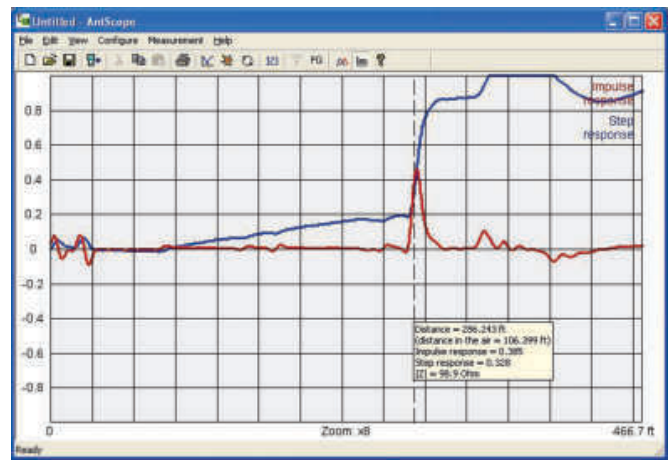


Figure 8 — *AntScope* in time domain reflectometer (TDR) mode. The TDR provides a radar-like view of cable discontinuities along the line. Here you see the 280 foot run of 0.82 relative velocity coax to the W1ZR 80 meter ground plane antenna. The early blips are the pulse partially reflecting from the impedance bumps going through my bypassed linear amplifier and antenna tuner. At almost three divisions (about 80 feet) out, the pulse encounters my dc grounded lightning arrestor at the entrance panel and then 200 feet of coax to the antenna. The details are shown by mousing the cursor to the discontinuity. Had there been a break, short or other cable problem, this would show you exactly where it was. This function is better described in the manual for the AA-230. That unit provides improved resolution.

eter (TDR) function. This sends a pulse down the line and graphically displays the reflected pulse from any discontinuity along the line. The discontinuity could be an antenna at the end of the line, but of even more interest are any discontinuities between the source and the antenna, likely indicating a cable fault. While the default display goes out to a distance of 900 meters (probably more useful for a telephone company than the typical amateur operator), it can be reduced to show closer indications as shown in Figure 8. In this view it has been changed to use US metrics. This feature is something usually found in much more expensive instruments and has the potential to be a great diagnostic tool.

Documentation

The AA-54 is provided with a 22 page *User's Manual*, also available on their website if you want to look it over before you buy. The manual does a good job of describing the basic functions of the device. In addition, the last eight pages are devoted to using the AA-54 in various applications. This section starts with antennas, but moves through measuring characteristics of cables, lumped inductors and capacitors and transformers. Use as an RF signal generator is also described, with some cautions as to waveform.

The AA-54 also comes with an 11 page *Software Manual* that describes how to load and run the programs discussed previously. While *LCD2Clip* is very simple to use, *AntScope* offers many features and adjustments. I had no trouble installing, running or using the supplied software, a much smoother experience than during the AA-200 review — thanks RigExpert!

Manufacturer: Rig Expert Ukraine Ltd, **www.rigexpert.com**. Available from Array Solutions, 2611 North Beltline Rd, Suite 109, Sunnyvale, TX 75182; tel 214-954-7140; **www.arraysolutions.com**, Rig Expert Canada, **www.rigexpert.net** or Yuri Onipko, VE3DZ/N2WCQ, PO Box 1403, Buffalo, NY 14225, tel 716-240-4597; **www.rigexpert.net**.

YOUKITS FG-01 ANTENNA ANALYZER

The Youkits FG-01 analyzer is the most compact of the bunch — not a lot bigger than a pack of cigarettes, if I remember them correctly. It is also the least expensive of this group, although it does require an optional battery pack to be self contained. It measures SWR and magnitude of impedance from 1 to 60 MHz, showing the numerical result of each at the chosen center frequency along with a display of the swept frequency results, all on a small but readable color display screen.

The FG-01 is very easy to operate. There is a

Youkits FG-01 SWR/Impedance Analyzer

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency range: 1-60 MHz.	As specified.
SWR measurable range: Not specified.	1.0-9.0:1
Impedance range: Not specified.	5-350 Ω.
Impedance accuracy: Not specified.	See Table 2.
Output power: 32 mW max (+15 dBm).	36 mW (+15.5 dBm) into 50 Ω at 14 MHz. 23 mW (+13.6 dBm) into 50 Ω at 50 MHz.
Power requirements: 400 mA at 10-12.8 V dc.	398 mA at 12.8 V dc (external power); 379 mA at 12.4 V dc (internal batteries).
Size (HWD): 4.4 × 2.3 × 2.2 inches (including protrusions); weight: 13.5 oz with internal battery.	

Bottom Line

The FG-01 shares the measurement capabilities of the Comet, but has a digital rather than analog display, and adds the handy sweep function. The frequency stability and accuracy are notable. It is easy to operate, easy to carry, compact and does what it does quite nicely.

single knob that by default sets the center frequency of the analysis (this is also the frequency to which the numerical data applies). The tuning is over a single continuous band with the tuning step size set from 1 MHz to 1 kHz in four steps. The steps are selected by pushing the knob for 1 second. The digit that will be changed flashes and the digit can be changed by turning the knob while holding it in. Once the step size is selected, the tuning will be at that step size until you change it. After it is set up the way you want it, pushing down the knob for 1 second will save your settings for the next time you power it up.

I found the color display easy to see with one exception. It was sometimes difficult for me to decide which of the two plots was which, since the colors don't seem that far apart. Fortunately, the manufacturer seems to have anticipated this. If you hold the TUNING knob in while you switch the unit on, it will just plot the SWR, the most useful information for most applications. The impedance is still shown in the numerical data portion of the display.

The other aspects of the display are easy to use. It simultaneously displays the center frequency, sweep width, SWR, impedance magnitude (no information on the complex impedance, as with the Comet) and battery voltage. The battery display turns red if the voltage drops below 9.5 V and the SWR changes to red for an SWR of greater than 3:1.

The real-time frequency sweep makes it easy to see the direction the resonance moves as you make adjustments, and can also aid in adjusting antennas with multiple resonances.

On the Bench

The detailed lab measurements reflect a very competent instrument. In addition it was noted that the frequency stayed unchanged once set. Of course, many of the others were quite stable over the frequency range of the FG-01 as well. The spectral purity was the best we saw.

Documentation

The unit is supplied with a five page instruction pamphlet that covers the basic operational details, along with many caution notices. The instructions seem to assume that if you buy one, you already know why you wanted it and what you can do with it. The instructions are available on the Ten-Tec website for a preview.

One caution relates to power sources. You are cautioned that the AA size battery holder provided is only for 3.6 V lithium cells, rather than the usual 1.5 V alkaline cells. It also notes that if an external supply is used, it must provide 10 to 12.8 V dc — so it is not compatible with most 13.8 V dc home station systems.

Manufacturer: Youkits (**www.youkits.com**). Sold in the US by TEN-TEC Inc, 1185 Dolly Parton Parkway, Sevierville, TN 37862; tel 800-833-7373; **www.tentec.com**.

Click for Video

Watch ARRL Laboratory Test Engineer Bob Allison, WB1GCM, as he describes some of the features of these antenna analyzers.

Bravo-7K Portable Vertical Dipole

Reviewed by H. Ward Silver, N0AX
ARRL Contributing Editor
n0ax@arrl.org

Planning a beach vacation this past summer created a need for a portable antenna. I had mobile whips and I could maybe string up a wire, but a stand-alone antenna would be more flexible to set up and could become part of my regular portable HF kit. The search was on!

My requirements:

- 40 through 10 meters, including 17 and 12 meters
- High efficiency without radial wires
- Light weight
- One-person assembly and adjustment
- Pieces sized 4 feet or smaller when disassembled
- No control boxes or power requirements

I found lots of antennas that met *some* of the requirements, even most, but I was beginning to think compromise was going to be necessary.

I recalled that Tom Schiller, N6BT (**www.n6bt.com**), along with the continuing expertise of Team Vertical, was returning to the antenna business and discovered to my delight that he was just finishing the Bravo-7K. It appeared to satisfy every one of my needs! I arranged to pick up a first-run model at the Dayton Hamvention in May and used it during Field Day at KO0A. It rapidly became clear that the antenna was effective on the air!

Figure 9 — The Bravo-7K set up on the north shore of Puerto Rico for a CW Sweepstakes contest expedition. The antenna is shown at the lengths specified for 12 meter operation. [H. Ward Silver, N0AX]

General Specs and Design

The Bravo-7K is 18 feet tall and a bit over 18 feet wide when all of the elements are fully extended for 40 meter operation. (Figure 9 shows the antenna set up for 12 meter operation.) The elements are made of telescoping aluminum tubing held in place with stainless steel hose clamps. The total weight is 13 pounds and the longest piece is 36 inches long.

The antenna has a single vertical element and two "radial" sections. The antenna is not a typical ground-plane and the "radials" aren't ground-plane radials in the usual sense. An evolution of N6BT's previous vertical dipoles, it is an off-center-fed configuration with the lower half split into two radials. Loading coils at the feed point are inserted into both elements and the total amount of inductance is changed for each band. Even with all loading coils inserted, the claimed efficiency exceeds 87% (0.59 dB loss) on 40 meters.

Tuning the antenna for the different bands is done manually by changing the element lengths and moving a shorting jumper on the tuning coils. Figure 10 shows the inside of the coil enclosure. The two coils on the right are inserted between the feed point and vertical element on 40 and 30 meters. The four coils at the left are inserted between the feed point and the radials on 40 through 15 meters. No coils are used on 12 and 10 meters. Changing the element lengths entails loosening the hose clamps and adjusting the telescoping tubing lengths. The available remote-tuned version (Bravo-7KR) switches the coils in and out with the element lengths unchanged.

Figure 10 — Loading inductors are added in series with the vertical and radial elements on different bands. No inductance is required on 10 and 12 meters. Mounting screws have been turned around from the stock configuration.
[H. Ward Silver, N0AX]

First Impressions and Performance

My primary first impression was that the antenna is simple and sturdy. The supporting tripod is welded. Mounting and assembly hardware is stainless steel and big enough to do the job. The coil enclosure of thick plastic comes with an O-ring if you want to seal the box although that's not necessary. The antenna is rated for use with legal limit power and it appears to be built to handle the voltages and currents involved. (I tested it with a maximum of 100 W.)

Assembling the antenna is straightforward and the instructions are clear. Following the element section length table and setting the jumpers requires very little head-scratching. The antenna has a very low FAF (fiddling around factor — thanks to Steve Morris, K7LXC, for that metric). No tweaking is required once the antenna is configured for a particular band.

The antenna is specified for a minimum SWR of 1.3:1 at resonance on all bands and I found that to be true except on 40 meters where resonance was below the band. N6BT reports that is not uncommon because of different ground types or mounting farther away from ground and includes an alternate set of 40 meter coils with the antenna.

Changing the coils resulted in the expected performance on 40 meters after stretching the 40 meter coil a small amount to obtain minimum SWR. The only band that required tweaking to get specified performance was 40 meters. I also found the antenna performed well on 20 through 10 meters while set for 17 meters and using an auto-tuner to take care of the resulting impedance mismatch.

Band changes take a couple of minutes. Starting with the radials, adjust each section to the proper length. Change the jumper position by loosening a nut and moving the terminal. Tip the antenna over and adjust each vertical section for the proper length. Return the antenna to vertical and you are back on the air.

On the air, the Bravo 7-K plays like a full-size ground-plane antenna with a decent field of radials. The Bravo 7-K was our "run" antenna at NP4DX for the CW Sweepstakes with a leading Multi-operator, Low Power submission. It plays well at the beach and in the back yard — I even put it on the roof for some evaluation. One of these days I would very much like to perform a "shootout" comparison to a full-size quarter-wave monopole.

Bottom Line

N6BT's Bravo-7K vertical dipole offers good performance on 40 through 10 meters in a compact, stand-alone package that's easy to transport and assemble.

Likes and Dislikes and Mods — Oh My!

As with all antennas there are strong and weak points. The strongest point is performance similar to what I'd expect from a full-size antenna but in a reduced-size package. The second strong point is the extreme ease of transportation and setup. I am completely unpacked and on the air within 30 minutes of arriving at a portable location. My entire station, including the antenna and feed line, can fit comfortably within a hard-shell golf bag and still meet a weight limit of 50 pounds. (I recommend carrying radios by hand, though, if you are flying.) This makes it quite easy to "grab and go" for a quick afternoon of operating.

What I don't like: Although sturdy, the antenna will tip over in a strong wind if not tethered. A tent peg and a short length of guy rope holding from the wind's direction are sufficient to solve the problem.

Measuring section lengths gets old, so I used an engraving tool to mark lengths and band names on each section. The feed point requires a pigtail, so I made a short adapter section for attachment to a PL-259 coax connector. Next to the tripod in Figure 9 you can make out a coiled-coax choke balun wound on a plastic water bottle — this helps isolate the feed line's outer shield surface from the antenna's radiated field. I also turned the coil mounting screws around to extend outside the coil enclosure and replaced the standard hex nuts with stainless steel wing nuts — this speeds up the band change process. In fact, I can now assemble the antenna using only a miniature pocket multi-tool.

Summary

I have used mobile whips, ground-planes, sloping dipoles and inverted V antennas in portable operation and this one is by far the best I've encountered to date. It's in the portable station kit to stay!

Manufacturer: N6BT Antennas, PO Box 1859, Paso Robles, CA 93447; **www.n6bt.com**. *Price*: $289.

Technical Correspondence

Larry D. Wolfgang, WR1B, tc@arrl.org

AN ANTENNA IDEA FOR ANTENNA RESTRICTED COMMUNITIES (NOV 2011)

The loop antenna article by Cristian Paun, WV6N, in the Nov 2011 issue of *QST*, "An Antenna Ideal for Restricted Communities," can have serious RF safety issues when operated at high power levels. If just 100 to 150 W is applied, then the compliance distance from Table 17, p 8.77 in ARRL's *RF Exposure and You* (also in FCC Bulletin OT-65) is close enough.[1] WV6N talks about applying up to 1500 W to his loop, however. When I generated Table 17 for *RF Exposure and You*, it did not occur to me that someone would drive a small tuned loop with more than 150 W, let alone with over a kilowatt of RF power. Since WV6N indicates the possibility of using 1500 W with his loops, we need additional RF compliance calculations to accommodate the legal limit power level. Table 1 shows the compliance distances I calculated for 1500 W to a one meter diameter loop on the 40, 20, 15 and 10 m bands.

Additionally, WV6N talks about a 6.6 ft diameter tuned loop for use in the 80 m band. Table 2 shows the compliance distances at 1500 W for the 6.6 ft diameter loop.

The lead photo in the article shows a two-turn loop, and the text describes the rationale for using a two-turn, 3.3 ft diameter loop for 80 m instead of the larger one-turn loop. I don't have an analysis that handles multi-turn loops. The two turn loop is interesting, and maybe *NEC* code can handle it, maybe not. *NEC* results are not always reliable or correct for wires that are too close together. Such calculations need validation by measurements or by independent analysis. I don't have that capability at the moment. The best I can state now is "Multiturn loops will require further analysis and evaluation for RF Safety."

[1]E. Hare, W1RFI, Ed, *RF Exposure and You*, ARRL, 2004, ISBN: 978-0-87259-662-1, ARRL Order No. 6621. ARRL publications are available from your local ARRL dealer, or from the ARRL Bookstore. Telephone toll free in the US 888-277-5289 or call 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

Table 1
Compliance Distances for 1500 W Supplied to a 1 m Diameter Tuned Loop

Frequency (MHz)	Controlled (ft)	Uncontrolled (ft)	Reactive Power (kWr)
7	9.9	17.4	286
14	12.2	21.4	155
21	15.5	31.2	57
28	19.4	42.4	19

Table 2
Compliance Distances for 1500 W Supplied to a 6.6 ft Diameter Tuned Loop For 80 m

Frequency (MHz)	Controlled (ft)	Uncontrolled (ft)	Reactive Power (kWr)
3.5	16.2	21.6	349

In the last column of the Tables, I report the enormous stored reactive power around the loop. The reactive power drops off as the cube of distance, whereas radiated power drops off with the square of distance.

The total *stored reactive power* equals (*transmitter power* × *Q*)/(2 π). Because the *Q* of these loops is so large, then so is the stored reactive power in the not-so-immediate vicinity of the loop. The diminutive physical size of these loops belies the real danger posed by the stored reactive fields. Another way to state the danger is that, at 28 MHz for example, the compliance distance is 13 times the diameter of the loop!

I used a purely analytical approach, solving for the current shapes on a tuned small fat HF loop made from copper tubing, and I included a ground factor for the fields of 1.6. The method compares with NEC results, but is slightly more accurate for fat wire loops because the analysis accounts for current variation around the cross section circumference of the loop wire surface, as well as the variation in the loop circumference. Because of the feeding arrangement and the tuning capacitor, the fields are not uniform around the loop, so I computed fields in both directions along the three principal axes of the loop. I then compared the magnitudes of the combined electric field,

$$\sqrt{E_x^2 + E_y^2 + E_z^2}$$

and combined magnetic field

$$\sqrt{H_x^2 + H_y^2 + H_z^2}$$

against the FCC compliance limits. The distance for the maximum of the two fields in each of the six directions is shown in the Tables. Sometimes the electric fields determined the compliance distance, and sometimes it was the magnetic fields. That depends on the frequency and power level.

When using loops in a pedestrian mobile or back pack configuration, the user's head can be in line with the huge toroidal magnetic fields that pass through the center of the loop. Remember, every bit of the magnetic field that appears in the entire far-field first squeezes through the loop itself! Because this is not a case of "whole body" exposure to a plane wave field, we would need to measure the SAR (specific absorption rate) to determine compliance. As a matter of interest, however, if the head is 10 cm in front of, and in line with, the loop conductor, power levels of just 7.6 mW, 7.2 mW, 14 mW and 27 mW at 7, 14, 21, and 28 MHz respectively will immerse the whole head, neck and upper torso in magnetic field at a level that exceeds the far-field whole body limit. Backpack or pedestrian portable with a small loop? Be careful! — *73, Kai Siwiak, KE4PT, 10988 NW 14th St, Coral Springs, FL 33071, ARRL RF Exposure Committee*; **k.siwiak@ieee.org**

Cristian Paun Responds:

Thanks for the additional information, Kai. For my loop installations at WV6N, the distances between my antennas and humans are more than adequate, since they are greater than the distances shown in the tables, for all cases. — *73, Cristian Paun, WV6N, 904 Aster Ln, Lompoc, CA 93436*; **wv6n@arrl.net**

HANDS-ON RADIO EXPERIMENT 101: ROTARY ENCODERS (JUN 2011)

I really enjoyed reading the "Hands-On Radio Experiment 101" about rotary encoders by Ward Silver, N0AX. These are

wonderful devices that amateurs can use in their own projects, but there is not enough written in the Amateur Radio literature about the details of using them. I would like to bring up an important concept that was not addressed in the article: detents. Rotary encoders are often manufactured with detents; indeed, the model specified in the article has twelve detents. The confusing part comes in the relationship between the number of detents and the number of pulses per revolution.

For the encoder used in Ward's experiment, there are 12 pulses to go with the 12 detents, and, of course, the logic outlined in the article works perfectly. Some encoders, however, produce an output only ¼ of a pulse with each detent. This means that if a user rotates the knob just one click, only one signal will change state, not both. The procedures detailed in the article will not work with this type of encoder, and the results could be quite frustrating for anyone who just happens to pick one to experiment with out of their junk box. I have used both types of these incremental encoders with microcontroller circuits, and in some cases the ¼ cycle version can produce clearer signals with its slower pulses. I believe that either style can be used, but the software code written to interpret the signals is quite different.

I would also like to note that there are differences in quality that can be reflected in price. I once had to replace an encoder in a brand new project with one from a different manufacturer because the signals were not clean.

I enjoy designing and building devices using PIC microcontrollers. I always try to use quality components. If I am going to invest tens of hours of my time building a project, I want it to last, and I don't mind paying extra for quality. I purchase almost everything by brand name, and to figure out what I like, I buy a variety of a certain component and test them. That is what I did with rotary encoders in 2010.

There are encoders built that do not have detents in the rotation, but I don't have any experience with those devices. In my applications I want the clicks, so I have never researched any encoders without them. Similarly, I have no experience with absolute (binary and gray code) rotary encoders.

Readers might be wondering, "How can I tell whether I have an encoder that gives one pulse per detent or ¼ of a pulse?" There are four ways:

1) Look on the manufacturer's datasheet. The CPR (cycles per rotation), or PPR (pulses per rotation) will be equal to the number of detents for a one-pulse-per-click encoder, or will be a fraction like ¼.

2) Find your part in a retail catalog like Mouser or DigiKey and look for the same information.

3) Connect the encoder to a simple circuit and an oscilloscope. A dual channel scope does a good job of graphically showing the two square waves being output by the encoder.

4) Connect the encoder to one or two ohm meters or continuity meters. A "¼" encoder will turn one channel on with one click, and stay that way. A "1 pulse per detent" encoder will just show a brief blip.

Figure 1 is a piece of a schematic from one of my projects. The encoder connects directly to the PIC chip. No limiting or pull-up resistors are necessary, because the PIC chip has internal weak pull-ups. The rotary encoder is used to set the correct time on a clock. This encoder has an integral pushbutton switch. The knob is pressed to begin setting, twisted in either direction to alter the time, and then pressed again to store the data.

Now I will discuss nine specific encoders. To the best of my knowledge, each encoder mentioned is currently in production and available from Mouser. The four manufacturers are Alpha, Alps, Electroswitch, and Bourns. The part numbers are from the Mouser catalog.

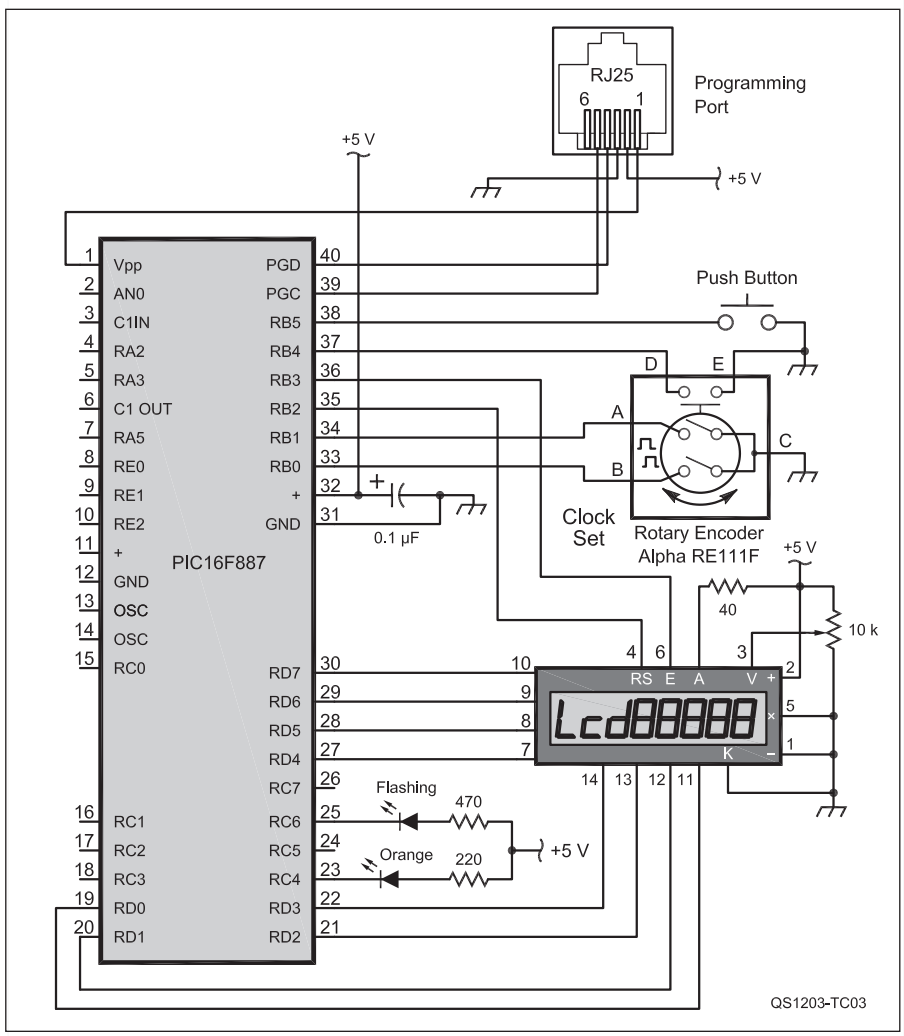


Figure 1 — This schematic diagram shows how a rotary encoder can be used as an input to a microprocessor. In this circuit, the encoder is used to set a clock. This encoder includes a pushbutton switch, which is pressed once to enter the clock set mode of the program. Then the encoder is rotated in either direction to set the correct time on the clock. When the pushbutton switch is pressed again, the set mode is exited.

Electroswitch

I have tested encoders from both their 700 and 701 series. Electroswitch's datasheet documentation is good. The quality of the parts seems to be above average in both series.

Part no. 690-700-24-24: This encoder has 24 detents with one full pulse per detent. The shaft takes a much higher rotational torque to turn it than any other model. Without a knob on it, it is actually difficult to rotate.

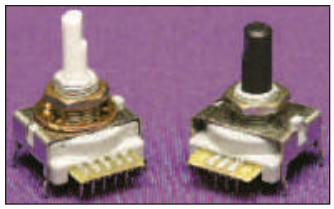


Figure 2 — Two Electroswitch rotary encoders. The 701 series encoder is on the left and the 700 series encoder is on the right.

Part no. 690-701-06-24 and part no. 690-701-04-16: These two models emit ¼ pulse per detent. They have 24 and 16 detents respectively. They have an integral pushbutton switch built into them, therefore they have five circuit board pins instead of three. Their shaft diameter is a very odd 0.198 inches. You would likely have to construct your own knob, which can be accomplished with wooden dowel stock.

Alps

Part no. 688-EC12E24204A9: This encoder has 24 detents with a full pulse per detent, but I was not pleased with this product. In my opinion, Alps' documentation is poor. There are no threads for a nut on the bushing, which may be desired for mounting in the enclosure. Worst of all, instead of lining up the detent before and after the completed pulse, it sits directly on the pulse point. Electrically, it can fluctuate at a light touch, without being rotated! This rotary encoder is inexpensively priced.

Alpha

I have tested series ENC160 and ENC111. I believe Alpha's documentation is also poor. I would say the quality of the ENC160 is average and the ENC111 is above average. Their shafts are 6 mm in diameter; knobs are available through Mouser but probably not in your junk box.

Part no. 318-ENC160F-24P: This one has 24 detents with a full pulse per detent.

Part no. 318-ENC111F-20PS: This encoder has 20 detents with a full pulse per detent. It also has an integral pushbutton switch, and is a compact size compared to others. This is one of my favorites.

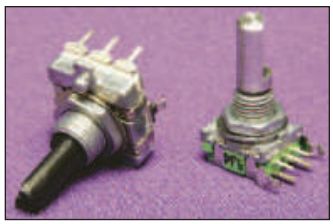


Figure 3 — Here are two Alpha rotary encoders. The ENC160 encoder is on the left and ENC111 encoder is on the right.

Bourns

I have tested encoders from both their ECW and their PEC11 series. The Bourns datasheet documentation is good.

Part no. 652-ECW0J-C24-BC0006: This rotary encoder is of the highest quality, and is actually rated for the longest usable life. It is the most expensive that I have purchased, at around $5 each. It has 24 detents at ¼ pulse per detent. Take note that this part does not come with a nut to go on its threaded bushing. Unfortunately, the thread size is a metric M9×0.75; I could not find a nut to fit from my collection. Mouser can sell you a nut if you ask for it. This encoder is a great choice if you do not need an integral pushbutton switch.

Part no. 652-PEC11-4220F-S12: This one is different. 24 detents, but it gives ½ pulse per detent. I figured I could make it work with a little different software coding, but since I saw no advantage to it, I chose not to bother.

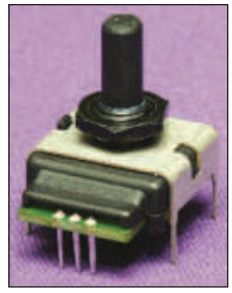


Figure 4 — This photo shows the Bourns ECW series encoder.

Part no. 652-PEC11-4225F-S24: This is another encoder with 24 detents and a full pulse per detent. It has an integral pushbutton switch. These encoders are very inexpensive. This is an example of "You get what you pay for," though. I actually selected this part to be used in a project. Soldering done, in the testing phase I kept seeing errors in operation. It turned out that the signals from the rotary encoder were so sloppy I had to remove it and substitute a competitor's model. I would recommend avoiding encoders from the PEC11 series.

This discussion has been timely for me. I just started planning my next project using a rotary encoder. It's a fancy alarm clock, and the encoder will again be used to set the time. *— 73, Greg May, W2ORO, PO Box 495, Union, KY 41091*; **tykeastro@yahoo.com**

A 2 W LOGIC CHIP TRANSMITTER (DEC 2011)

Thanks to Lew Smith, N7KSB, for his interesting article. Here is my suggestion for a modification of the frequency setting circuit, L1-Y1-C2.

I prefer to tune the coil impedance of L1 with a ferrite core moving in and out of the coil, and use a fixed capacitor, C2. There is less mechanical work. For my little 14 MHz transceiver, shown in Figure 5, I used an M4 T-nut, a 6 mm OD piece of plastic tubing from a liquid soap dispenser, a part of an M4 bolt and a ferrite core. I fixed the core to the bolt with a piece of heat-shrink tubing. The coil has 28 turns of 0.3 mm enameled wire. With a 14.06 MHz quartz crystal, I get a tuning range of 14.045 to 14.060 MHz. *— 73 Willy Schwarz, HB9WI, Heerenweg 6, Ch-8476 Unterstammheim, Switzerland*; **willyschwarz@swissmail.com**

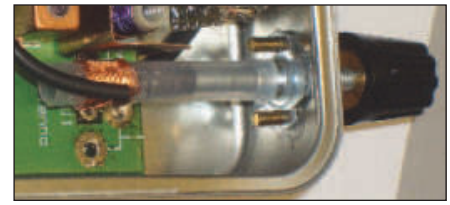


Figure 5 — Here is the mechanical arrangement HB9WI uses to tune the frequency of a small 14 MHz transmitter. The knob turns a piece of machine screw, which threads a piece of ferrite core material into and out of the tuning coil.

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

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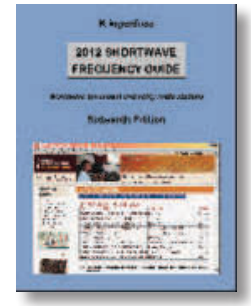
New Products

2012 KLINGENFUSS RADIO MONITORING PRODUCTS

◊ Klingenfuss has published new editions of its popular line of frequency guides and products for shortwave listening and monitoring enthusiasts. Now available are: 2012 *Super Frequency List on CD*; 2012 *Shortwave Frequency Guide*; January 2012 supplement to the 2011/2012 *Guide to Utility Radio Stations*; 2012 *Frequency Database for the Perseus Software-Defined Receiver*; and 1997-2012 *Digital Data Decoder Screenshots on CD*. For more information visit **www.klingenfuss.org**. Available from the ARRL at **www.arrl.org/shop**: 2012 *Super Frequency List on CD* ($44.95, order no. 1233) and the 2012 *Shortwave Frequency Guide* ($59.95, order no. 2615).



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

A bunch of antenna questions.

Q Stan, W8NNX, asks: Late last night I pondered why, with 10 meters so hot, I was not working any DX stations in the Asia Pacific region. My first thought was that the competition was too great. I still use the three element trap Yagi that was on my tower in the 1980s when I had much better luck. Thanks to my power company, I have a far field noise source that allows a pretty good check of antenna pattern, F/B and the ability to determine if there is a gain compared to my other antennas. With a pretty good SWR, and greater than 20 dB F/B, I believe that the tribander has survived three hurricanes and two decades of use very well. That led to another possibility.

I seem to recall a *QST* article that noted that the elevation angle of maximum radiation was largely determined by the antenna's height.[1] I wonder if this might be a factor in my lack of success. Since my antenna is limited to 24 feet by homeowners and county rules, the installation has not changed in 32 years. Only the results have deteriorated. The decline in the rainfall over the two decades here at my location (I maintain two rain gauges in the back yard) may have changed the apparent ground.

The ground beneath my house and antenna is what the locals call "sugar sand." It is one step up from beach sand. Its ability to provide a good ground is akin to pure distilled water. I read some time ago about the relationship of soil fertility, carbon and soil conductivity. Will improving my ground conductivity improve my radiation elevation pattern? Your thoughts would be appreciated.

A Well, a better ground will certainly change the elevation contour of your antennas due to reflections — in phase for vertical antennas (reinforcing the low angle radiation) and out of phase with horizontal (tending to cancel the lowest angles). The major impact will occur at some distance from the antenna, however.

The exception is for vertical antennas that use the earth as part of their ground system — their efficiency will improve with better conductivity near the base — independent of the reflection part of the equation.

Your height of 24 feet is interesting for a tribander. That is about 0.35 wavelengths on 20, just above 0.5 wavelengths on 15 and about 0.7 wavelengths on 10 meters. Over *EZNEC*'s "Typical ground" (0.005 S/m conductivity, dielectric constant of 13), that gives the results in Case 1 of Table 1 on the 10 and 20 meter bands based on my model of a similar tribander.

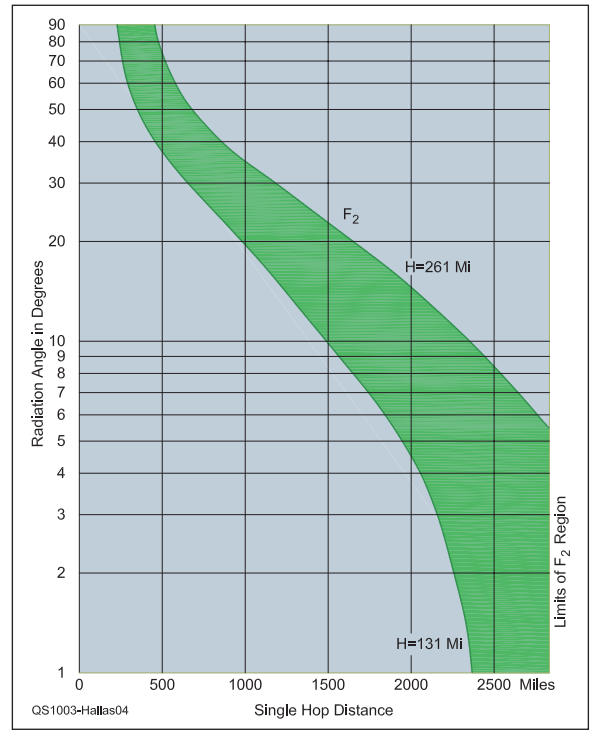


Figure 1 — The required elevation angle for a small number of F layer hops to the Pacific region is quite small.

The results for 15 meters will be in between. If your ground is less conductive, it will actually be better (less cancellation at low angles). You will not get as much reinforcement at the peak angle at which the reflection is in phase, however. The extreme would be the "free space" case in which there is no ground at all. There the peak is at the horizon and you have the results shown as Case 2 in Table 1.

Thus, with a low horizontal antenna, the long haul performance will be better with a poor ground than with one of high conductivity. This will change as the antenna gets high enough so that the angle of peak gain gets close to the optimum angle for the distance you want to work. This angle will be quite small for few hops to the Pacific — typically a 6000 to 10,000 mile path. As

Table 1
Peak Gain and Gain at Elevation Angles for a 24 Foot High Yagi

Case 1, Over EZNEC "Typical" Ground				
Band (Meters)	*Peak El (°)*	*Gain at Peak (dBi)*	*Gain at 5° (dBi)*	*Gain at 10° (dBi)*
20	35	8.2	–3.9	1.7
10	20	11.9	4.2	9.3
Case 2, In Free Space				
Band (Meters)	*Peak El (°)*	*Gain at Peak (dBi)*	*Gain at 5° (dBi)*	*Gain at 10° (dBi)*
20	0	4.7	4.6	4.7
10	0	6.9	6.9	6.9

[1] J. Hallas, W1ZR, "The Antenna Elevation Pattern — What's the Big Deal?" *QST*, Mar 2010, pp 39-40.

seen in Figure 1, even at 5° elevation, it will take two to four hops to get there. Again, this is not the ground directly under the antenna, but the ground from which the reflection takes place, some distance away. The higher the antenna is, the farther the distance to the ground that will reinforce the peak of the elevation pattern.

Q Jeff, KA8ZAW, asks: Several months ago I purchased an HF transceiver with an internal tuner. I erected a 144 foot wire loop using #12 AWG stranded copper wire. I used the tuner to match it from 40 to 10 meters inclusive. I noticed the antenna is stretching in places. Should I replace the stranded copper with solid to ensure a better and more stable antenna, or will the tuner clean up this situation as the antenna gets longer?

A Well, copper wire does stretch, even if it's solid. I much prefer stranded wire for unsupported runs, since the solid is more likely to break from metal fatigue. If you want to reduce the stretching on long unsupported runs, consider stranded copperweld wire. It consists of strands of copper plated steel so has the strength and stretch resistance of steel with the RF conductivity of copper. The insulated type avoids corrosion and lasts very nicely.

If your current wire gets too loose, you could shorten it a bit, although having sag reduces the tension on the wire and makes it less likely to stretch more or break. If it works, and doesn't bother anything, I'd just let it be and consider it a feature.

Q Nico, PA0MIR, asks: I have a question about my antenna feed system. I am using an HF/VHF/UHF transceiver that has a combined antenna connection port for the 144 and 430 MHz bands. On my tower I have separate beam antennas for each band, so if I want to use one or the other I need to unscrew the plug and put the other feeder in the place. I wonder how I can make this work better?

Will it work to just connect the feed line from the 430 MHz antenna, some feet above the 144 MHz antenna, and connect it to the 144 MHz feed line using a T connector? I note that the 144 MHz antenna has a reasonable SWR on 430. So the question is what length of coax will work best for this interconnection? This would be similar to what I do at HF with my 160, 80 and 40 meter dipoles fed in parallel.

I know I could also use a diplexer, but I do not wish to have equipment that can corrode on top of the tower. If a simple solution is practical I want to use that.

A Your parallel 160, 80 and 40 meter dipoles work because the impedances of the dipoles not on the bands used are higher than the impedance of the active one. Thus, the power goes into the one for the band that is intended. If some goes into another dipole, it doesn't really matter, since it will still be radiated.

That would not be the case with your antennas for 144 and 430 MHz. There is probably a length of coax that would keep your 430 MHz antenna from interfering with the 144, but we would need to know the impedance at the 430 MHz antenna feed on 144 MHz to figure it out. If it is a gamma or T matched Yagi, it probably has a very low impedance on 144, and thus an odd number of electrical ¼ wavelengths at 144 MHz should make it a high impedance, which should not take much power from the 144 MHz system.

The other way is more complicated. Because the 2 meter Yagi is close to a match on 430 MHz, any length of standard coax will also provide close to a match on 430 MHz. That means you will end up with the power split between the two antennas on 430. The parallel impedance would be around 25 Ω, and the resulting 2:1 SWR would increase your coax loss. In addition, around half your 430 MHz power will go to the 2 meter antenna, which will likely not send it where you want it.

I would thus recommend either a diplexer or a remote controlled coax switch. You could use bias Ts to put the switching dc over your coax to avoid added wire. Or just use two coax runs and switch at the station end.

Q Lloyd, K8DIO, asks: I have a question on the inverted L antenna. I have used one for several years on 160 meters. I never gave much thought as to how it actually works until a young fellow stopped by my house the other day. He has had his license for a few months and finally got up enough nerve to stop by and talk with me. He saw my tower with VHF and UHF antennas on it and we talked a bit about those bands. He then asked me about the wire I had hanging from the tower.

I told him that it was called an inverted L antenna. Then, he asked me how a wire so close to the tower worked. The vertical part of my inverted L is about 3 feet from my tower going up to the top at 60 feet. He thought that a wire so close to the tower would have all sorts of interaction. I was stumped. I couldn't give him a good answer.

He also asked if it could be used on other bands. I said yes, I can get it to resonate on several bands by using my antenna tuner. The other day, he stopped by the house again and I gave him a demo of the 10 meter band. It has been so good that I have been able to work all around the world with 100 W and the inverted L. So perhaps you can answer my young friend's question about how the inverted L works with the wire so close to the tower.

Is it possible that the vertical part of the inverted L is actually inducing current into the tower? I would also like your opinion on what kind of peak elevation angle I am seeing on 10 meters. It can't be too high or I wouldn't think I would be able to work any DX.

A The short answer is that it does interact and distort the pattern to a certain extent. On the other hand, it doesn't absorb or dissipate significant power so it all goes out somewhere. Because it is less than ¼ wave on 80 and 160 meters, the effect is not too significant on those bands. I modeled your antenna, assuming that the folded portion was about 60 feet long and went off in a horizontal direction from the top.

On 10 meters, the antenna has multiple elevation lobes. The strongest and widest is at 44° elevation, at an amplitude of about 10 dBi — good for satellite work. It is not uniform and falls off in the direction perpendicular to the horizontal wire. The tower reduces the signal in its direction by about 6 dB.

There are significant but narrow lobes at 7 and 23°. The 7° lobe has a peak intensity of about 6 dBi — not shabby — but is down in the direction of the tower. It has four "petals" in azimuth. So if the DX is in the direction of a petal, it should work well.

At 23° — perhaps good for medium distances — it has about 5 dBi gain, down a bit toward the tower. So, if you put 100 W into the antenna, most will come out somewhere and some may even come out where you want it.

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**.

H. Ward Silver, N0AX, n0ax@arrl.org

Experiment 110

PCB Layout — *Part 4*

It's time for the rubber to meet the road — the boards designed previously have been delivered and so have all the components.[1] Let's build the circuit and compare it to our requirements and expectations. It's time for *Incoming Quality Inspection*.

Collect the parts and boards as shown in Figure 1. The PC boards are delivered individually shrink-wrapped so cut one out of its package and verify that it's the right size and that the traces and silk screen are oriented correctly. Go through your parts and confirm that all of them are the correct value or part number by placing them on the schematic as in Figure 2.

Check the fit of the relay into the holes on the board. This is where we find out if our new component was created properly. Next, check the pushbutton switch and make sure the contact closures connect to the expected pairs of pads. Because the exact part number was listed in the *ExpressPCB* components I was confident of proper fit but generic components may vary.

Now perform a visual and electronic check against the printed schematic — called *buzzing out* the board. This simple board can be checked manually by using your voltmeter's continuity test function. If everything is ready, you're ready to start building.

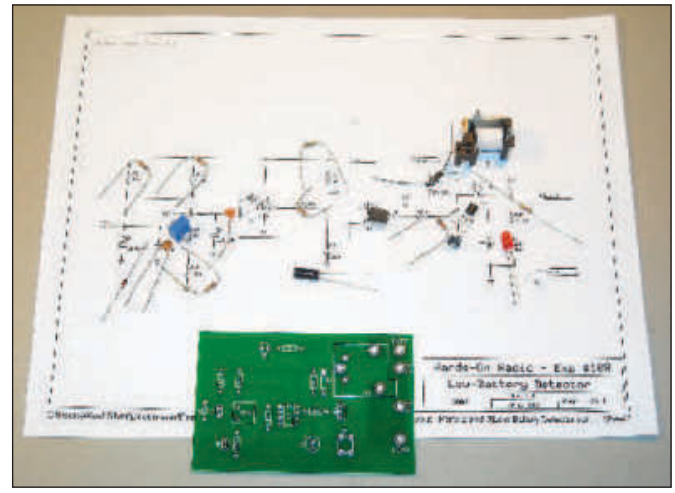


Figure 2 — The easiest way to confirm that you have all of the parts and that they have the right value is to place them on the schematic.

Testing the Board

Even for simple circuits, it's important to perform the initial prototype testing in a step-by-step fashion, building each part of the circuit independently. In this way, you can find and correct problems while they are isolated. If everything is assembled before testing it can be much harder to find problems because they often affect the entire circuit.

Figure 1 — Before beginning assembly make a thorough inspection of all parts and the finished PC boards. Be sure custom components fit their hole pattern properly.

Before you start working with the board, if you live in a dry location consider taking steps to minimize electrostatic discharge (ESD) by working on a grounded metal surface or using a static-discharge mat or cuff. (I use a cuff connected to the workbench safety ground.) None of the parts in this circuit are particularly sensitive but a finger-to-IC spark can damage the LM393.

Until the relay is installed, use the LOAD and GND terminals for power connection. The power supply should be adjustable. Remove power from the board between each step.

Step 1, Voltage Reference — Place and solder R1, D1 and C1. Apply 12 V and use a voltmeter to verify that the voltage at U1-3 (pin 3 of U1) is 6.2 V ±5%.

Step 2, Battery Voltage Sensing — Place and solder R2, R3, R7 and C2. Apply 12 V and adjust R7 through its range to verify that voltage at U1-2 varies from approximately 10.1 to 11.8 V. Now set the power supply voltage to the threshold voltage at which you want to disconnect the battery. Verify that you can set the voltage at U1-2 to 6.2 V by adjusting R7. Leave R7 set at this position.

Step 3, Comparator Switching and Timing — Place and solder U1 (be sure to get pin 1 oriented correctly), R4, R5, R6 and C3 (pay attention to the marking of the capacitor's negative lead). Apply 12 V and verify that the output of both comparators (U1-1 and U1-7) is LOW (near 0 V). This indicates that the power supply voltage is above the minimum so that the relay would be supplying power to the load. Now reduce the power supply voltage until the minimum threshold is reached to verify that C3 begins charging. The voltage at U1-5 will begin to increase slowly. Verify that it takes approximately 30 seconds for the voltage at U1-5 to reach

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

6.2 V and that U1-7 goes HIGH when that voltage is reached.

Step 4, Relay Drive — Place and solder K1, Q1, D2, D3, R8 and SW1. Use a rubber band or two to hold K1 securely against the board while it's being soldered. Play close attention to the cathode markings or package shapes of Q1, D2 and D3. Apply 12 V to the board — now to the BATT terminal. The relay should remain de-energized and the LED should stay OFF.

Press SW1 — the relay contacts should close and the LED should light up. Reduce power supply voltage until U1-1 goes HIGH and C3 begins charging toward 6.2 V. After 30 seconds, verify that the relay contacts open and the LED goes out. Return power supply voltage to 12 V. Verify that the relay stays de-energized until you press SW1 again.

Troubleshooting

I tested the board using an adjustable power supply as in Figure 3. First, I tested with a resistive load (12 Ω, 1 A draw) and then with mobile rigs. On a couple of the rigs, I was greatly dismayed to hear the unmistakable buzz of rapid relay cycling when low voltage was detected! The voltage reference and voltage at U1-5 both looked stable and clean — on a voltmeter. Connecting an oscilloscope to U1-5 and U1-7 quickly showed the problem. As power was removed from the LOAD circuit, the comparator output turned back ON just long enough to close the relay for a few milliseconds before turning OFF again and creating an oscillating cycle.

To make a long story short, this problem turned out to be caused by filter capacitors inside the radio. If sufficiently large capacitors are present on the LOAD circuit, enough voltage remains to keep the comparator circuit alive for several milliseconds after opening the relay contacts instead of voltage being removed abruptly. As V_{CC} dropped, the comparator output switched back ON very briefly — long enough to energize the relay and cause the cycling.

After several attempts at modifying the comparator circuit, it became clear that the easiest solution was to operate the comparator circuit from the BATT circuit instead of the LOAD circuit. This kept the comparator in control at all times and eliminated the cycling. To make this modification on the PC board, use a razor blade or hobby knife to cut the trace connecting U1-8 to the LOAD circuit. Use a short piece of insulated wire such as wire-wrap or light hookup wire to connect U1-8 to the BATT circuit connection on the relay.

Figure 3 — The completed board being tested on the workbench. Anderson Powerpole connections were used to connect to the adjustable power supply and the ICOM IC-207H mobile rig serving as a test load.

Does this violate the "no OFF power" requirement by allowing battery current to flow after the load is disconnected? To a degree, yes, although the LM393 does not draw more than 0.4 mA of supply current according to the datasheet. This is less current drain than most batteries experience from self-discharge and other vehicle loads so I consider it an acceptable trade-off. I'll be experimenting with using another transistor to switch power to the comparator. Updates to the circuit will be posted on the Hands-On Radio website.

This problem illustrates an important lesson about simulation — it rarely includes all of the system in which the circuit must operate. In this case, a slower than expected removal of power from the LM393 circuit resulted in unexpected behavior. Perhaps a more complete simulation would have picked this up but my experiences in product development tell me that there is almost always at least one SDT (Some Darned Thing) that the computer or designer doesn't know about. Plan for your initial testing to turn up behavior that will require some adjustment to the design. This is why the fourth part of the design cycle in Experiment #83 must always be "compare": Design, Simulate, Build, Compare.

Final Testing and Improvements

The final test was to connect the board to a portable VHF/UHF radio powered by a lawn tractor lead-acid battery. I inserted the low battery detector in the radio's power supply line and spent the day listening to and talking on the repeater while keeping an eye on the voltmeter. Late in the afternoon during a contact…click! The voltage had dropped low enough for long enough to trigger the disconnect. Even though the battery voltage recovered as predicted, the relay contacts stayed open until I pressed the RESET switch.

Obviously, it will take more testing before the detector can be considered "finished" but it is now working as expected. I'll mount it in an enclosure and take it on the road to see how it performs in a real vehicle. Watch the Hands-On Radio website for updates about testing and circuit changes.

What kind of improvements would I make to the board layout? There is lots of space, so I would add a grid of isolated pads to support additional prototyping and circuit changes. I would also add test points (isolated pads) for connecting voltmeters and 'scope probes, including ground points. Once I've used the circuit for a while, I may find that I need transient suppressors or additional filtering capacitors. An updated schematic and layout are available on the Hands-On Radio website.

I hope you've enjoyed this foray into laying out your own circuit boards. With the inexpensive software tools and the ability to submit designs directly to fabricators, it is easier than ever to build professional, reliable projects for your shack.

Steve Ford, WB8IMY, wb8imy@arrl.org

MP Super-M Classic Mobile Antenna

Last April I reviewed the MP Antenna Super-M Classic base antenna in this column. This unusual-looking antenna is designed to cover 25 to 1300 MHz with low SWR on the 144, 222 and 440 MHz amateur bands. With its tilted elements it creates a radiation pattern that is somewhat crossed-polarized between horizontal and vertical, giving you some of the best of both worlds, so to speak. At the time I wondered if the same arrangement might be effective in a mobile environment, especially as a means to reduce mobile "flutter." Well …

Figure 1 — A Slow Scan TV image received from the ARISSat-1 satellite with the Super-M Classic mobile antenna.

Behold the Super-M Classic Mobile

If you don't mind attracting stares with your vehicle, there is a mobile version of the Super-M Classic antenna to consider. The radiating portion of the antenna is virtually identical to the Super-M Classic base. There are three stainless steel elements ranging from 15 to 20 inches in length and all are tilted about 30 degrees from vertical. As with the base version, the Super-M mobile boasts a receive frequency range spanning 25 to 1300 MHz (good for mobile scanners) with low SWR segments at 144, 222 and 440 MHz for transmitting.

Three radiating elements attach to the Super-M base.

The difference between the designs begins at the base of the antenna. The Super-M Classic mobile is designed to fit a standard NMO antenna mount. For the purpose of this review, I purchased a Larsen NMO magnetic mount. Assembling the Super-M was straightforward and took all of 10 minutes. You simply secure the Super-M radiating elements with the Allen wrench provided and then screw the base onto the NMO mount.

On the Road

The Larsen mount instantly grabbed the roof of my SUV with a mighty *thump*. I snaked the RG-58 coaxial cable to my antenna analyzer and began taking measurements. The SWR on 2 meters bottomed out at 2:1. It dropped to 1.5:1 and 1.6:1 on 222 and 440 MHz respectively.

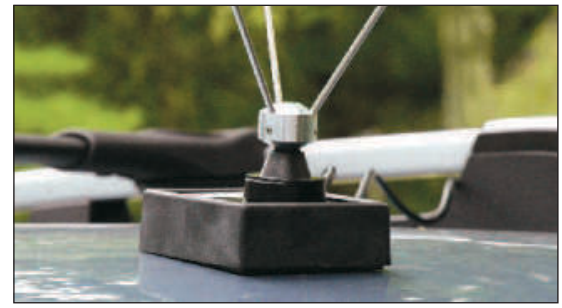
While a 2:1 SWR on 2 meters may seem high, keep in mind that the cable was only about 12 feet in length, so the loss due to SWR (about 0.7 dB) was well within acceptable limits. Even so, I disconnected my trusty dual-band mobile antenna, which is secured to the vehicle with a trunk lid mount, and substituted the Super-M to test whether a better ground would improve the result. Sure enough, the 2 meter SWR dropped all the way to 1.2:1.

With the Super-M back on the magnetic mount, I connected a multiband transceiver and took to the highway. Despite the porcupine element design, the Super-M had no problem sticking with the Larsen mount, even at 65 MPH. With my daughter's assistance, we switched between the Super-M and my dual-band vertical while checking for signal reports on a distant 2 meter repeater. According to the reports, the Super-M appeared to have a definite advantage when it came to reduced mobile flutter. In one instance, the flutter disappeared completely when we switched from the dual-band vertical to the Super-M. Signal reports on simplex were similar with the Super-M occasionally coming out the winner when it came to overall strength.

Since the ARISSat-1 satellite was predicted to put in an appearance during our test, I packed a laptop computer and used it to capture a Slow Scan TV image from the bird on 2 meters with the Super-M while racing down Interstate 91. You can see the result in Figure 1. Noise and fading effects are present in the image, but it isn't bad considering the fact that we were receiving a weak FM signal from a couple of hundred miles away.

Odd Appearance, Good Performance

I was quite pleased with the Super-M Classic mobile antenna. Yes, it certainly drew some curious glances, but so do many ham antennas. Its performance rivaled, and often bested, my dual-band mobile vertical, especially in terms of reducing annoying flutter.



The Super-M attached to a Larsen magnetic mount.

Manufacturer: *MP Antenna, 147 Eady Ct, Elyria, OH 44035; tel 877-678-3243;* **www.mpantenna.com**. *Suggested list price: $89.95. Available from Universal Radio,* **www.universal-radio.com**; *tel 800-431-3939.*

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

DIY Open-Wire Line

Antenna experts prefer open wire transmission line is to coax. At one extreme is the 6-inch-wide line using 6-inch-long wooden dowels boiled in paraffin as spreaders for 600 Ω line for a doublet.[1] It was low loss but pesky to make and rather ugly. At the other extreme William Parmley, KR6L, used #22 AWG zip cord as a close-together pair.[2] Very portable, but 198 Ω in impedance and higher in loss because of small conductors and between-wire insulation. The de facto open-wire standard of today is window line with a nominal impedance of 450 Ω. Not bad and acceptable looking but you can do better at less expense. Here are three such lines that differ only in the spacers used.

All lines use # 16 AWG insulated stranded speaker wire (RadioShack P/N 278-1267). This wire is all copper and more flexible than steel core ladder line wire. It will not break under moderate flexing. The wire's soft and the thick insulation is the key to the spacers staying in place.

Line A uses squares cut from plastic milk containers. A half gallon container yields up to twenty 1⅜ × 1⅜ inch squares. Make holes with an ice pick, going first down and then back up. Space holes 20 mm apart both ways. Taper the wire end to make insertion easier. Set the squares about 6 inches apart. The spacer will not move along the wire by itself but you can move it by squeezing it then sliding it into position (see Figure 1A).

Line B uses Styrofoam plastic as spacers. You need a thickness greater than the wire diameter. Many grocery meat trays have extra thick sides or bottoms. Cut the Styrofoam spacers 1⅛ inch wide × 1 inch long. Wrap a length of ¾ inch vinyl electrical tape around with the wire and insulator to hold them in place (see Figure 1B). [This method should be limited to short-term portable operations. — *Ed.*]

For Line C the spacers are rectangular pieces cut from Coroplast, a plastic sign board material that is made with rectangular channels running through it (**www.coroplast.com**). Try your local sign company and purchase a piece that is 2 × 3 square feet. The side-to-side thickness is 4 mm and the core-to-core spacing is 5 mm. It slits easily lengthwise with an X-acto knife and cuts easily in width with scissors. Slit every sixth core to leave five full cores and cut that strip into ¾ inch lengths. The square core has only a loose grip on the wire so you will need a filler made of vinyl tape cut into ¾ inch squares and wrapped around each wire (see Figure 1C). [In the sample Willard provided, there was some slippage of the wire using the Coroplast insulator and tape filler. The use of glue is recommended. — *Ed.*]

Neither impedance, velocity factor nor loss was measured for these lines, but here are some estimates. The *ARRL Antenna Book* calculated impedance using 0.0508 inch wire size at 20 mm spacing as 412 Ω. Since there is so little insulation between the wires, it should be very nearly that. If you need a different impedance, change spacing as calculated by the *Antenna Book* equation.[3] Velocity factor should be 0.91 or greater. Loss should be less than window line since there is less insulation between wires and near the 0.08 dB/100 ft @ 10 MHz as given for 600 Ω line.

Running any open line around and over supports and changing direction is always a bit of a problem, but my previous Hints & Kinks hint about using PVC end caps as standoffs will be of help.[4] Standoffs essentially eliminate losses. Of course, the Coroplast can be extended sideways to make a standoff of any shape or length. — *73, Willard Monahan, K6KH, 817 Pacific Ave, Manhattan Beach, CA 90266-5849*, **k6kh@aol.com**

[1]B. Shackleford, W6YE "Custom Open Wire Line — It's a Snap," *QST*, July 2011, pp 33-36.

[2]W. Parmley, KR8L, "Zip Cord Antennas and Feed Lines For Portable Applications," *QST*, Mar 2009, pp 34-36.

[3]H. W. Silver, N0AX, Ed., *The ARRL Antenna Book* (Newington: 2011), pp 23-17–23-18.

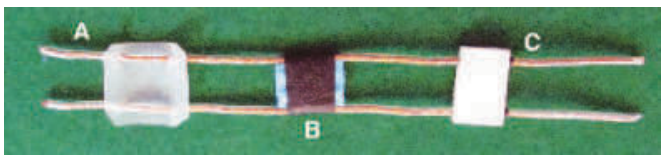


Figure 1 — Here are all three methods on one section of ladder line. At A is the "milk-container" spacer; at B is the "grocery tray" spacer, and at C is the Coroplast spacer. [Willard Monahan, K6KH]

Measuring Unknown Coaxial Traps

I found a couple of coaxial traps I had built some time ago and thought I might use them to build an 80-40 meter dipole. In order to model the antenna to determine the dimensions necessary and the expected performance, I needed to know the L/C ratio, as this will affect the length of wire beyond the trap for resonance on 80 meters. It is possible to determine these values with two relatively simple measurements.

I have an old grid-dip meter, to which I have added a BNC connection to the oscillator tank to connect to my homebrew counter for a more accurate frequency readout. If I made one measurement of the trap's resonant frequency, then a second measurement with a known capacitor soldered in parallel, I should be able to calculate the trap capacitance, and from that, the inductance.

The familiar formula for a resonant LC circuit is:

$$f_1 = \frac{1}{2\pi\sqrt{LC}} \qquad \text{[Eq 1]}$$

If we add a capacitor (C_P) in parallel, the formula becomes:

$$f_2 = \frac{1}{2\pi\sqrt{L(C+C_P)}} \qquad \text{[Eq 2]}$$

After dividing one formula by the other, performing a bit of algebra and dividing out like terms, we obtain the following relationship:

$$C = \frac{C_P}{\left(\frac{f_1}{f_2}\right)^2 - 1} \qquad \text{[Eq 3]}$$

[4]W. Monahan, K6KH, "A Window Line Support," *QST*, Jan 2004, pp 63-64.

where C = trap capacitance, C_P = parallel capacitance, f_1 = trap resonant frequency without the added capacitor and f_2 = resonance with the added capacitor. Because of the ratios taken, if C_P is in pF, C will also be in pF.

With the value of C found, we can rearrange Eq 1 to find the value of L. The added factor 10^6 yields L in µH if C is in pF and f is in MHz:

$$L = \frac{10^6}{(2\pi f_1)^2 C} \qquad \text{[Eq 4]}$$

Using these three pieces of information, f_1, f_2 and C_p, and the formulas presented here you can learn the truth about those mystery traps lurking in your junk box. — *73, Ted Bergstrom, W1IQW, 50 Bayshore Dr, Mashpee, MA 02649-3967*, **w1iqw@arrl.net**

Ladder Line Standoff

I read a hint in the October 2010 Hints and Kinks regarding a coaxial cable standoff and would like to suggest a standoff for ladder lines.[5]

After erecting a new inverted V antenna up about 30 feet and using 450 Ω ladder line, I noticed that my SWR was poor for certain bands due to the proximity of the line to the vertical metal pole.

To remedy this, I glued a PVC T at the end of an 18 inch long PVC pipe and cut a thin slot big enough to insert the ladder line into the T. I then glued another ¾ inch T at the other end of the 18 inch tube, cut half of the perpendicular side to produce a semicircular seat that fits against the vertical pole (see Figure 2). I then used two hose clamps to attach the cut T to the pole. Following my standoff installation, my SWR dropped nicely.

This is a very versatile and cheap method to make a standoff. The loose ladder line in the PVC T can move up and down with any gusts of wind. I also experimented with the length of the PVC and found 18 inches acceptable for both the SWR and the physical length of the standoff. — *73, Jim Wheeler, KJ6VX, PO Box 6564, San Diego, CA 92166-6564*, **wheeler513@cox.net**

[5]E. Kampe, KB0LSX, "Coax Cable Standoff," *QST*, Oct 2010, p 63.

Figure 2 — Here is the PVC standoff holding the ladder line away from the metal mast. Note the modified T connector that is held to the mast using hose clamps.
[Jim Wheeler, KJ6VX]

Giving Your Radials an Edge

In our sandy soil here in Orlando, Florida, I needed to run at least eight radials in such a way that I could mow over them when the grass began to grow in earnest. I used an electric edger to cut slots into the lawn. I was then able to press #12 AWG insulated wire into the slots. The #12 wire was so stiff it would not lie in the slots so I used small hooks of wire to hold it in place and added a little topsoil to hold the wire and encourage the grass to grow over it.

I cut a wider slot to place an 8 foot length of PVC, sealed at both ends, that protects the RG-8 that is running to my Hustler 4BTV vertical antenna (**www.new-tronics.com**). — *73, Clinton Wills, WB4WMY, 17 Capehart Dr, Orlando, FL 32807*, **wb4wmy@bellsouth.net**

Fixing Shorted Connectors

There is nothing more frustrating than soldering a PL-259 connector and then finding that it is shorted. This has happened to me on many occasions when using an adapter to allow the use of smaller RG-58 type coax. The reason for this has to do with the way many PL-259 connectors are made. Looking at Figure 3 you can see that the center pin is swaged to the plastic insulator in a way that exposes a small ring. This ring can come into contact with the coax shield when the adapter is screwed in place.

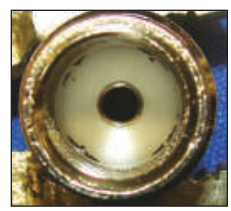


Figure 3 — Look closely inside this connector and you can see the small metal rim of the center pin. The RG-58 adapter can sometimes push the shield up against this rim, shorting the connector.
[Jerry Semones, K4FJK]

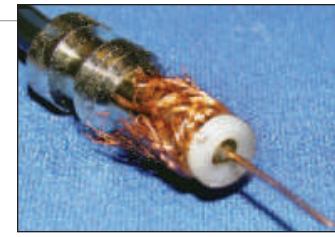


Figure 4 — Placing a plastic washer or other insulator on the end of the cable before inserting it into the connector body will prevent the shield from shorting against the center-pin rim.
[Jerry Semones, K4FJK]

To prevent this, add a small nylon washer (or other suitable insulator) over the center conductor before assembling the adapter. This added washer prevents the coax shield from contacting the center pin. The one shown in Figure 4 is 5/16 inch diameter with a 1/8 inch hole and is 1/16 inch thick. I found them at a local hardware store. — *73, Jerry Semones, K4FJK, 9700 Forestwood Dr, Louisville, KY 40299*, **grandham@insightbb.com**

Tower Horses

In the middle of an antenna building project I found I had used all my saw horses in the process — some of the horses were holding completed antennas off the ground and others were holding up various "works-in-progress." As I was looking around for something else to use to support another project, I spied a couple of halves of a section of Rohn 45G. The tower sections proved to be the best antenna work platforms I have used. The vertical legs keep tubing from rolling off and one could work on different parts of an antenna on two or three levels of the tower pieces.

So, if you have an old tower section, or find one cheap at a flea market, buy it and cut in half and it will work better for less money than even the least expensive commercial saw horses. — *73, Dave Patton, NN1N*, **nn1n@arrl.org**

"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.

Mercy Ships — 9L5MS Sierra Leone 2011 DXpedition

"Expect the unexpected"

Arie Kleingeld, PA3A

Sierra Leone is one of the five poorest countries in the world. It was devastated by a 12 year civil war that lasted until 2002. It is a country where one of every five children will not make it to the age of 5 and where 75% of the people live on a budget of under $2 per day.

The Mercy Ships hospital ship *Africa Mercy* visited Sierra Leone in 2011 to perform free life saving surgery for the poor.[1] To witness the good work of Mercy Ships, four Dutch radio amateurs went on a DXpedition in the spring of 2011. Our goal was beyond communicating worldwide by ham radio — we were trying to find sponsors for a charity project. We decided to adopt the Mercy Ships Vision Project in Sierra Leone. This project addresses many of the surgical and medical eye needs of the Sierra Leonean people. The primary emphasis of surgical intervention is the removal of cataracts and a reduction in the prevalence of blindness throughout the country.

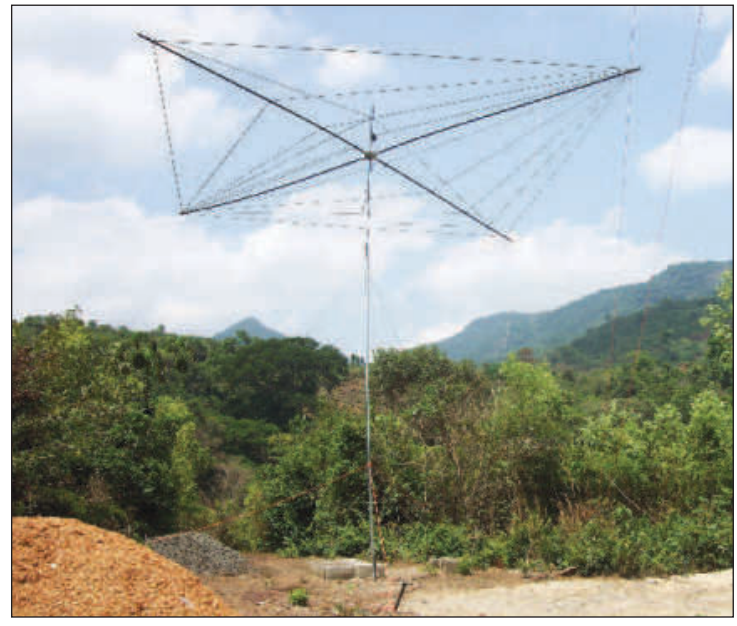
[1]Mercy Ships is a global charity that has operated hospital ships in developing nations since 1978. Mercy Ships brings hope and healing to the forgotten poor by mobilizing people and resources worldwide and serving all people without regard for race, gender or religion.

Preparations

If you intend to go to Sierra Leone you have to realize that this is a country with high unemployment and no tourist accommodations whatsoever. Therefore, the first question to answer is where to go with your station? After a thorough search via the Internet we finally found a suitable location in the mountains near Freetown, 15 km (9.3 miles) from the city center. It was located 400 meters (1300 feet) above sea level, surrounded by luscious green hills. Getting the radio license in time was quite another story. Sending the necessary papers in time is no guarantee for success. Luckily for us, the Advance Team of Mercy Ships was stationed near the right governmental department so the license could be arranged even before we arrived.

The preparations of the DXpedition itself went by the book. In December 2010 all materials (antennas, food and beverages, generators, and so on) were ready for shipment by freight container, all well in advance of the expected DXpedition starting date of March 14, 2011. Then Murphy struck. The transport of the container was delayed by several

Bas den Braven, PD0CAV, works on the radials of one of our vertical antennas.



One of the Spiderbeams, just outside the garden.

weeks and it arrived in Freetown March 8, far too late to clear the customs process before the 14th. The team decided to execute plan B: delay the DXpedition for two weeks. Many e-mails and phone calls followed. Within a few days all was arranged and the final starting date was set for March 28.

Improvising

Four days before the new departure date we got an urgent message from the Mercy Ships Advance Team: The container would be in the customs process for at least one extra week. The impact was huge: We had to go to Africa without generators, antennas and all other stuff you need for a DXpedition. There was no way to accelerate the process. The team felt uncomfortable about this, especially since the point of no return had already passed. We were going to Africa one way or another.

The rented house had a nice garden. Nice means in this case big enough for the three verticals we planned including the radials on the ground.

The risk of having to stay in Sierra Leone for three weeks without ham radio made us decide to go to the next level and draw up a brand new plan C. This meant that in the first week we would work as volunteers on board one of the world's largest hospital ships, the MV *Africa Mercy* in the port of Freetown. After this first week we would try to get on the air with some simple antennas and start the DXpedition with a borrowed Mercy Ships generator and food that we would try to buy locally. We quickly gathered a few fishing rods (5, 8 and 10 meters long), some coax, 400 meters of copper wire and other supporting materials. All were packed in an extra suitcase we soon called the "Magic Siegfried and Roy" suitcase. It contained so many different unexpected things. "Need this or that? Just look in the Siegfried and Roy suitcase. You'll find it there."

Challenged by the adventure and still uncertain of what was to come the team boarded the plane to Africa on March 28 taking along three transceivers and light linears and the magic suitcase. The flight was comfortable and the team arrived in Freetown in the early evening. Assisted by people from Mercy Ships we went through the customs pretty quickly. Getting to the hospital ships was something else. We had to cross a 10 mile river delta over open sea in the dark with a small boat without any lights. It was definitely not comfortable with big waves and a speed of 20 knots. This was followed by a trip with a jeep to the ship. Finally, we arrived on board.

Working Volunteers

As expected the container was still halfway through the customs process. The ETA was still unknown, which was nicely covered by the expression "This is Africa." It was time to execute plan C. The first week we worked on board the hospital ship. The *Africa Mercy* has six operating rooms and performs life-saving operations for the poor. Her crew consists of 480 volunteers. The four hams were added to the engineering staff of the ship, which was appropriate since none of us had any experience in healthcare. They had a nice job for us. The radiocommunication of the ship and Land Rovers was a mess and they had been struggling with it since their arrival in Sierra Leone in February.

Well, what are hams for? After a day of trouble shooting and testing some solutions, all radios were updated with newly configured software. To prevent future problems, we also wrote a manual on how to program the radios and how to use them effectively. That week we also made repairs on electrical pumps, serviced some fire detectors and advised on which radios to use in Mercy Ships' onshore activities.

Plan C in Operation

By the end of the first week there was still no news about our container so we decided to start the radio expedition. Fortunately Mercy Ships had a spare generator that we could use for a few weeks. With our transmitters, fishing rods, two cans of gasoline, normal luggage and the Siegfried and Roy suitcase we left for our house in the mountains. With the generator inside the jeep's cabin and all suitcases securely tied down on the roof it was a two hour drive through the horrible traffic of Freetown.

The rented house had a nice garden. Nice means in this case big enough for the three verticals we planned including the radials on the ground. The idea was to activate 40 to 10 meters. All verticals were supplied with 16 quarter wave radials for the lowest band and 6 quarter wave radials for the other higher bands. So we ended up with a 40-17-10 meter vertical, another for 30-15 meters and one for 20-12 meters.

The way to operate them was simple: Just connect one radiator and keep the other(s) rolled up along the fishing rod. Changing bands takes just an instant: take the fishing rod down, disconnect the used radiator, roll it up along the fishing rod, lower the new radiator, connect it to the coax and restore the vertical. After a while we could change bands within a minute even in the pitch dark African night.

The radio shack was set up in the garage. This way we kept the station operating noise away from the house so that other guests were not bothered by an overly enthusiastic style of SSB operation. The three simple verticals performed reasonably well on all bands. There was one challenge, though. The verticals were pretty close to each other and station interference was sometimes hard to overcome when linears were used. For that reason, many times operators ran barefoot.

A blessing was the absence of man-made electrical noise at our location. Within a range of at least 500 meters (1640 feet) the only electricity generated and used was ours! So there was no noise whatsoever. That's probably why we got so many compliments that the operators had such good ears. Those fine words were probably spoken by the hams we actually worked. But it is a fact that we heard a lot of stations on

The author manages one of the CW pileups.

those simple verticals. We had many pileups with maximum S-3 signals sounding loud.

Hurray, the Equipment is Available!

By the end of the second week we got the long awaited message that the container could be opened. On Friday evening we collected our gear and transported it to our house the same evening. It took several hours on Saturday to unpack and rebuild the station. The new antenna setup became as follows: one 5 band Spiderbeam and two monoband verticals for 40 and 30 meters in the garden, another 3 band Spiderbeam and a 17 meter long loaded vertical outside the garden on a dead end road. There was no more space for another large vertical plus radials. Because of this we decided to use only one large vertical and split the use in 3 nights on 80 meters and 4 nights on 160 meters. For the same reason we also could not build our planned directional receiving antennas for 160-40 meters (a homebrew receiving 4-square for 160/80 meters and two DHDLs for 40 meters).

The typical tropical noise on 160 meters and 80 meters was S-8 to S-9+10 dB. Despite this we were able to work DX. Of course a QSO with another continent is always DX but working Japan on 160 meters (14,500 km/9000 miles) with 300 W gave us a lot of satisfaction. With the new antennas we were also able to use the short openings on 10 and 12 meters to the Pacific (VK and KH6) and Asia in the early morning. The DX cluster helped us a lot. Start CQing on a completely quiet band, then send your spot to the DX cluster and presto…a pileup. You see, solar spots and CQs don't open up a band — a DX cluster does!

We contributed directly to a good cause and at the same time got about 23,500 contacts in the log.

6 Meter EME

Not long before the start of the DXpedition we got a request from the 6 meter EME community to try 6 meter EME from Sierra Leone. Well, we did send an old 6 meter beam along with the other stuff just in case of good 6 meter propagation. Why not give EME a try? Six meter EME is quite another thing, the experts told us. No way that our 5-el (short) Yagi and 500 W could pull this off, not even with the big guns (4×8 el long Yagis and 2 kW) on the other side.

Nevertheless we were invited for some skeds. The best opportunity would be in the last week of the DXpedition so we got our 6 meter beam just in time. The best time was forecast at moonrise and moonset. Point the beam to the horizon in the direction of the moon and hope that the ground lobe (15 dBi gain under 13° elevation) would help us. What made it more complicated is that our location was in the mountains with hills around us, so we had no nice flat sea surface under our antenna. At moonrise in the afternoon our signals were blocked by a hill and we were unable to work or hear any station.

To the west at moonset we really were lucky. Around 03:30 AM we were able to work two stations, the first-ever 6 meter EME from Sierra Leone. We also kept an eye (and ear) out for terrestrial openings, About 50 stations from Southern Europe found their way into our log. We probably could have worked more stations there but most signals were probably blocked by one of the hills. In any case, we made a few people very happy and left many others disappointed.

Ending the DXpedition

After two weeks of ham radio activities the station was disassembled. The question of what to pack and take back by plane was in our case not difficult. All usable things like generators, electricity cables and tools found their way to Mercy Ships projects (for example, an orphanage that was being built). All transceivers and antennas and the light coax were taken back home. We were four men carrying a maximum of 56 kg (123 pounds) per person but had only eight hands available. It was quite a challenge to carry it all, especially crossing the river delta that was again a rough ride.

From the left: **Arie, PA3AN; the author; Ad van Ginneken, PA8AD and Bas den Braven, PD0CAV.**

After one more night onboard the *Africa Mercy* we said goodbye to a lot of new friends we met during the first week working onboard. It is a unique community serving on the world's largest hospital ship. There are 480 volunteers working onboard. Many of them stay for several years serving the mission to improve the life of the less fortunate in this world. These volunteers deserve our respect and support. We are happy that we could support them with our DXpedition.

After three weeks in Africa, this DXpedition came to an end. It was an experience that was completely different than any of us had had before. We contributed directly to a good cause and at the same time got about 23,500 contacts in the log.

All sponsoring and surplus for the QSL request by hams will be donated to the Mercy Vision charity project, **www.mercyships.org**. For more about the DXpedition, see **www.sierraleone2011.com**.

Photos by the author.

International ARRL member Arie Kleingeld, PA3A, has been a licensed radio operator since 1977 and was a member of the 5L2MS and 9L5MS DXpedition teams. He is an active contester and an Elmer to many Dutch radio amateurs in the southwest Netherlands. Arie holds a master's degree in Telecommunications and works as a freelance consultant. He and his wife Marian, PD1AEG, can be reached by e-mail at **pa3a@xs4all.nl**.

Where is the DX Now?

Find DX stations without actually turning on your radio.

Stephen J. Gradijan, WB5KIA

Are you listening for DX stations just by tuning your radio dial? This is the traditional method. It takes patience, but the scavenger hunt spontaneity makes it fun and exciting.

Today most DXers use spotting bulletin boards on the Internet and packet radio. These DX spotting networks allow hams to share DX station information. A DX Cluster, PacketCluster or spotting net can help you find the DX that is operating right now. DX Clusters on the Internet dominate today, though many packet-based DX Clusters exist and many of the Internet DX Clusters have packet radio frequency links.

Using DX Clusters

Using Clusters you can note what stations others are spotting or you can spot stations you have heard or worked. Whether you use an Internet based network or the local RF packet cluster the requirements are fairly simple. A computer with an Internet connection is sufficient to connect to DX Summit (**www.dxsummit.fi./text/dx25.html**) or other web-based networks. A computer with a TNC can interface to a V/UHF FM transceiver and connect to the local cluster.

Spotting software can be stand alone and many logging programs incorporate DX spotting software. When combined with rig control and logging software the cluster becomes a very powerful tool. Such software will recognize spots of DX stations you need. You can then click on the spot and instantly move where the DX is operating.

Providing Useful Information

A basic way to use a DX Cluster involves posting frequency and station information. Additional information, including solar flux and station database information, might also be available.

To best utilize a DX Cluster's features you need to either run cluster-specific software or link to a packet-based DX Cluster running the software. Web page DX Clusters require only your browser to receive and post information. Whether you access a DX Cluster on packet or the Internet, some sites require first time users to register before posting spots; others allow anyone to post without registering. Be aware: If you use different servers and telnets, you need to provide the basic data to each server to gain access.

It is very helpful to know exactly where the spotter is who is hearing the DX. It is usually easy to provide your location grid, either during registration or in the spot "Comment" field (see Figure 1, circled in red). There are different ways to do this depending on the telnet software you use.

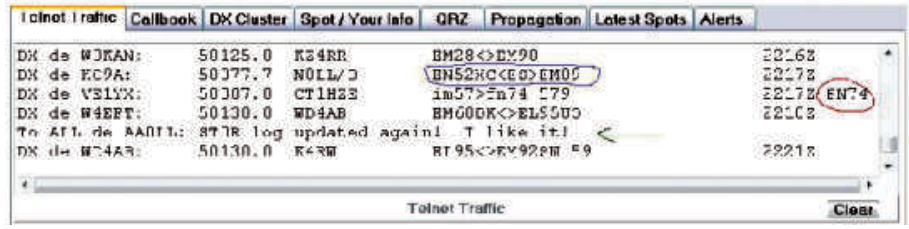


Figure 1 — Raw spot packets depicted here show a formatted grid posted in the spot comment field (circled in blue); the spotter's grid supplied to a packet server (circled in red) and an informational spot (green arrow) that is frequently filtered from most Web-based DX Cluster lists. A "formatted" spot report consists in the Spotter's grid<propagation mode>DX grid, in that order.

Accessing DX Packet Spots Without a TNC

- *DX Monitor* allows you to telnet to specific servers or get data from the DX Summit webpage. Download at **www.ve3sun.com/dxmon/quickstart.html**.
- *DXWeb* (**www.qsl.net/wb5kia/arcs/arcslite.htm**) for the Kenwood TS-2000 accesses both *DXSpider* and *AR-Cluster* servers from a PC.
- *iDXSpot* (**www.gm4jjj.co.uk/iCluster/iCluster.htm)** is shareware for the Mac and makes use of *DXSpider* and *AR-Cluster* technology.
- *CC User* is a full-featured *Windows* Telnet and TNC program that can be downloaded at **www.ve7cc.net**.
- DXLab *SpotCollector* is a *Windows* program that collects spots from up to six sources. Download it at **www.dxlabsuite.com**.
- A list of some current DX Cluster servers is available at **www.dxcluster.info/dxnodes.htm**.

It's becoming popular for the spotter to post their own and the DX station's grid in the comment field. The location information provided by the DX Cluster is limited to a four character Maidenhead grid. You can provide your six character designator allowing smart software to plot spots and spotters on a map.

If you don't know the grid the DX is operating from, do not put your grid in the comment field, which will confuse "smart" software used by other spotters. Once you register your grid information with the DX Cluster, the server adds your grid to your spots automatically.

Filtering the Spots

On a busy weekend several posts a second might occur. In this case use filters to limit the data to prevent software crashes and avoid cluttered displays. If you use telnet software, you have a huge number of filter options. Filter by band, continent, spotter call area, etc. Web-based options also usually allow filtering. You can filter the spots by setting filters at the server or using your software. Filter the spots to instruct the server to reject what you do not want; however, too many filters may cause you to miss some exciting DX.

Reliability

While a majority of the information sent on the spotting networks is fairly accurate, an operator should not rely solely on the spot. The first rule of DXing has always been "listen, listen and listen some more." Verify that the DX call is what is spotted. Listen for instructions from the DX such as his listening frequency or where he is calling (Europe, North America, Japan, etc).

Final Thoughts

If you use a DX Cluster and the band is quiet, do spot the DX you work. Often a simple CQ can provide surprising results considering sometimes, to someone, you may be the DX! You do not have to use the DX reporting clusters to enjoy chasing DX. If you do use them, you will have access to a wealth of information about DX activity that might enhance your operating enjoyment.

Steve Gradijan, WB5KIA, is a Geoscience Consultant in the Dallas, Texas area. He has been licensed for over 48 years and currently holds Amateur Extra class license WB5KIA. He can be reached at 1902 Middle Glen Dr, Carrollton, TX 75007, **sjg47@lycos.com**.

Amateur Radio in Ethiopia

How one ham has kept Ethiopian club station ET3AA on the air for 20 years.

Jim DeLoach, WU0I

Amateur Radio in Ethiopia is not easy. Ethiopia is a poor society making equipment and technical training hard to come by. Import duties are high and customs barriers make importing rigs difficult. Local authorities have little understanding of Amateur Radio and structural impediments make issuing licenses to individuals difficult. One Scottish expatriate, Sid May, ET3SID, has kept Ethiopia on the air for nearly 20 years by creating and promoting the Ethiopian Amateur Radio Society club station, ET3AA.[1]

In Ethiopia radio *equipment* is licensed, not people. In addition, Ethiopian regulatory authorities don't perceive the value of Amateur Radio and are historically resistant to radio transmitters beyond their direct control. While they have occasionally issued licenses to well-connected expatriates with existing foreign licenses and continue to renew the ET3AA club license, they have not issued a license to an individual Ethiopian in many years. This reluctance is why a club station is so important. Without the club station, there would be no access for Ethiopians to ham radio.

ET3AA — the Ethiopian Amateur Radio Society's Club Station

Sid and a group of Ethiopians first licensed ET3AA in 1993 to support a foreign DXpedition. Following that successful DXpedition, Sid kept this call and created the first Ethiopian Amateur Radio Society club station. In 2008, Bob Sutton, ZL1RS, brought an EME DXpedition to Ethiopia and donated a considerable amount of equipment to ET3AA.

As a club activity, Sid set up a training program, which has taught over 150 students about Amateur Radio. Even though Ethiopia has no amateur examinations of its own, Sid used the international radio amateur exam format and training materials allowing several of his students to receive foreign licenses.

ET3AA is currently located atop the Addis Ababa Institute of Technology building, a tall structure on one of the highest hills in town. This site is ideal not just because of its outstanding location, but because of its outstanding students. The Institute of Technology, the technical arm of Addis Ababa University, is the most prestigious school in the country, where Ethiopia's best and brightest science and engineering students prepare to take leading positions in government and industry. Sid's training program is already producing a new crop of hams drawn from these students. These new hams will become some of the most influential people in Ethiopia and indeed many of their parents already are, which may help influence needed regulatory reform.

Thanks to generous support from Amateur Radio groups in Europe and America, ET3AA is now freshly re-equipped and ready to support voice, CW, several digital and satellite modes. When the old US Embassy building was torn down, the club obtained its 17 element, 6-30 MHz rotatable log-periodic antenna. Sid and his students carefully refurbished their "dream beam" and it now proudly rests atop the club station.

Members of the Ethiopian Amateur Radio Society, mostly engineering students at the Addis Ababa Institute of Technology, celebrate the deployment of the VHF antennas. Shown from top-to-bottom and left-to-right are Bilen Mezgebe, Dagmawit Solomon, Daniel Sisay, Surafel Nigusu, Henok Wubet, Kedeste Tadessa May, G7VYF; Brook Yohannes, Leul Abera, Yohannes Belete, Amente Bullo and Nigussu Solomon. [Maggie DeLoach]

Ethiopian Hams Earn US Licenses

Since my departure from Ethiopia, a team led by David Collingham, K3LP, traveled to Addis Ababa in December 2011. David helped administer US Amateur Radio license examinations for Sid's students, 57 of whom passed and received US licenses. David also provided technical assistance for ET3AA, donated significant amounts of equipment and helped plan a "Technology Incubation Program."[2] These US licenses validate the students' technical and operational skills, and significantly raise Amateur Radio's profile with local authorities. With this new momentum we are hopeful that several Ethiopians may soon receive local amateur licenses.

Amateur Radio's Future in Ethiopia

ET3AA is on the air, operated by a new crop of talented young hams but one key obstacle remains. If these gifted new hams cannot receive licenses and set up stations of their own, their enthusiasm will eventually wane. Regulatory reform, specifically the issuance of individual Amateur Radio licenses to Ethiopians, is essential for Amateur Radio to have a future here. The IARU and David Collingham, K3LP, are working with Sid to convince Ethiopian officials of the value of Amateur Radio and encourage this change.

For more information about ET3AA, contact Sid, ET3SID, at ET3AA, PO Box 7392, Addis Ababa, Ethiopia or **sidet3@yahoo.com**.

[1]Sid, ET3SID, a native of Scotland, is a retired electrical engineer who has worked and lived in Ethiopia since 1992.

[2]More information on David's efforts in Ethiopia can be found at **www.k3lp.com/et3aa_december_2011.htm**.

Jim DeLoach, WU0I, gave up his Silicon Valley engineering job to join the US Foreign Service, where his first assignment was as Vice Consul to the US Embassy in Addis Ababa, Ethiopia. With his Ethiopian tour now complete, Jim is training for his next assignment in Turkey (TA5). Jim can be reached at 490 Ives Ter, Sunnyvale, CA 94087, **jim@deloach.net**.

Selecting a Commercial HF Vertical for Your Station

For many hams, large footprint HF antennas are out of the question. A multiband vertical may be a workable alternative.

Joel R. Hallas, W1ZR

In *QST* for December 2011, we talked about triband commercial Yagis, a kind of directional antenna that is of most interest to an experienced operator.[1] This month we'll talk about the kind of multiband vertical HF antennas that cover more than two bands, can be purchased but don't require the same level of commitment of resources as a rotatable Yagi.

By their nature, all antennas are compromises, and it's important to understand what you get and what you have to give up. A multiband vertical offers versatility, ease of operation and omnidirectional coverage in a small footprint. What it gives up is some gain compared to a horizontal dipole, but the dipole would have to be quite high to be as good as the vertical at lower angles.

The Types of Multiband Verticals

There are a couple of flavors of multiband verticals. One type is just a single continuous monopole of some length that is fed against ground using a (usually) remote antenna tuner or matching network. These are becoming more and more popular, especially the ubiquitous 43 footer, but are really more about the tuner than the antenna in some ways. While this is a valid approach, we will leave these to another article.

The antennas we will look at here are those with the band selection built into the antenna itself, usually through resonant traps or some kind of tuning stubs for the different bands. These electronically and automatically isolate different sections to operate as if they were a single band antenna on the band in use. The SteppIR verticals physically change the element height to change resonance while some remotely switch different loading coils to change bands. Electrically all described fit into two categories: electrical quarter wave and electrical half wave vertical antennas.

Electrical Quarter Wave Verticals

These antennas act is if they were half a multiband trap dipole rotated to the vertical. They usually have a trap for all but the lowest frequency band and provide a naturally low impedance feed point if fed against ground. These are straightforward, relatively easy to set up and offer an easy direct feed with coax. With the appropriate ground system, they can be operated on the ground or above it (see Figure 1).

Their main downside is that the efficiency depends on that ground arrangement.[2] Thus, while the antenna may not have a large footprint, the ground system will generally require one. Of course, if it's on the ground, it can be pretty inconspicuous, but some real estate will be needed, depending on the band.

Here's a list of the quarter wave vertical multiband antennas currently offered by major manufacturers.

Butternut

HF-9V. This 26 foot tall antenna covers all HF bands, 80 through 10 meters, as well as 6 meters. An optional kit is available to extend coverage to 160 meters, in the MF region. The antenna is rated to survive 80 mph wind gusts without guying. **www.bencher.com**

Diamond

CP725. This is a shortened electrical ¼ wave vertical that uses four 7 foot long loaded radials to cover 40, 15, 10 and 6 meters from an antenna that is 11.8 feet long. It is rated at 200 W PEP on 40 meters, somewhat higher on the higher frequency bands.

CP5H. This is similar in design and size to the CP725, but adds 20 meters, and one additional radial.

CP6AR. This is similar in design to the CP5, but adds a 20 kHz chunk of 75 meter coverage and is 15.1 feet high. **www.diamondantenna.net**

Gap

Gap Challenger. This 31.5 foot tall ground or elevated mount monopole covers 80, 40, 20, 15, 12, 10, 6 and 2 meters. Three 25 foot radials are required that may be used on top of or under the ground.

Voyager DX. The Voyager is a 45 foot vertical that covers 160, 80, 40 and 20 meters, with special emphasis on 160 and 80 meters. **www.gapantenna.com**

Hy-Gain

12AVQ. The Hy-Gain 12AVQ is a classic ¼ wave trap monopole that covers the 20, 15 and 10 meter amateur bands with a 13 foot high monopole. It can be ground mounted or elevated and is rated at the legal limit.

14AVQ. The Hy-Gain 14AVQ is like the 12AVQ, but adds 40 meters with a height of 18 feet.

18AVQ. The Hy-Gain 18AVQ is like the 14AVQ, but adds 80 meters through the addition of a loading coil and capacitance hat at the top. This antenna requires guys to maintain its vertical orientation.

AV-18HT. The "High Tower" vertical is a classic 53 foot high design built using a galvanized triangular tower as its main structure. It covers 80, 40, 20, 15 and 10 meters using stubs rather than traps and is rated at 1500 W PEP. A 160 meter kit is available to add that band.

AV-18HTJR. The "High Tower Junior" is only 39 feet tall, but covers the same bands as its larger sibling. It uses a folded cage for 80 meters

Figure 1 — A representative electrical quarter wave long HF vertical antenna. This is the SmallIR from SteppIR. The motor control unit near the bottom moves a metal tape up and down within the fiberglass radome to set the resonant frequency.

[1]Notes appear on page 70.

and is based on a traditional mast rather than a tower. **www.hy-gain.com**

New-Tronics – Hustler

4-BTV. This is a traditional ¼ wave trap vertical antenna for 40, 20, 15 and 10 meters that is 21 feet 5 inches high and is rated at 1000 W CW, 1500 W PEP SSB.

5-BTV and 6-BTV. These are similar to the 4-BTV, but the 5-BTV adds 75 or 80 meters and is 21 feet 1 inch high. The 6-BTV adds 30 and 75 or 80 meters. **www.new-tronics.com**

Mosley

RV-3C. The RV-3 is a basic ¼ wave vertical for 10, 15 and 20 meters. It is 12 feet high, and rated for 2000 W PEP on SSB, 1000 W CW and 300 W for AM and high duty cycle modes.

The RV-3W covers the 30, 17 and 12 meter bands in a 16 foot 10.5 inch high structure that shares the power rating of the RV-3C.

Also in the series are the RV-4C, which adds 40 meters to the RV-3C and is 22 feet tall; the RV-6C that in addition to 40 meters adds 12 and 17 meters at 20 feet and the RV-7C at 21 feet that does all plus 30 meters. The RV-8D can be added to any in the C series to add 80 meter operation.
www.mosley-electronics.com

SteppIR

SteppIR offers two multiband verticals, the SmallIR and the BigIR. The former is 18 feet tall and covers all bands from 20 through 6 meters, while the BigIR is 32 feet tall and adds 30 and 40 meters. An optional base loading coil is available that permits 60 and 80 meter operation while using the BigIR. Both antennas are rated at 3000 W continuous, dropping to 1500 W on 60 and 80 meters, if the optional loading coil is used. **www.steppir.com**

Electrical Half Wave Verticals

These antennas are sometimes referred to as "ground independent" verticals, because they are intended to be electrically equivalent to a half wave vertical dipole. If they were center fed as in the usual dipole, they would be easy to feed and would not need any radials. Most are end fed, however, and require an included wideband matching network and at least some short radial rods to make them work (see Figure 2).

Unlike their ¼ wave cousins, these generally need to be mounted typically 8 to 10 feet above ground. This way, pedestrians won't get poked by the radial rods, but they will be more evident. In addition, having the vertical elevated above ground can improve the low angle radiation (for either type), as discussed in a recent *QST* article.[3]

In the following, I list the half wave multiband vertical antennas offered by major manufacturers. See also the Product Review of the N6BT Bravo 7 vertical in this issue.

Cushcraft

MA5VA. This is described as an "off-center fed ground independent" antenna that does not require the usual radials, but does have eight 48 inch radial rods. It covers 20, 17, 15, 12 and 10 meters and is 14 feet 7 inches long, but must be mounted 12 feet above ground. It has a 200 W power rating.

The MA6VA is similar, but adds 6 meters.

R6000. The R6000 is an end fed half wave vertical that covers all six bands from 20 through 6 meters in an antenna that is 19 feet high and is recommended that it be mounted a minimum of 10 feet above the ground. It does not require traditional radials, but does have seven 49 inch radial rods at its base. It is rated at 1500 W PEP.

R8. The R8 is an end fed half wave vertical that covers all eight bands from 40 through 6 meters in an antenna that is 28½ feet high and needs to be mounted a minimum of 10 feet above the ground. It does not require traditional radials, but does have seven 48 inch radial rods at its base. It is rated at 1500 W PEP on those frequencies for which the SWR is 2:1 or less. **www.cushcraftamateur.com**

COURTESY OF CUSHCRAFT

Figure 2 — The Cushcraft R-8, a representative electrical half wave long HF vertical antenna.

Force 12

Force 12 offers a number of remotely bandswitched, center fed, half wave, vertical dipoles. The 11 foot, 11 inch tall Sigma-5 covers 20, 17, 15, 12 and 10 meters and breaks down to 2 foot sections. The Sigma-GT5 is similar, but is in 4 foot sections. The Sigma-40XKR is similar to the Sigma-5, but is remotely switched for 40, 30 and 20 meters. It can be manually tuned to the higher bands. **www.texasantenna.com**

Gap

Eagle DX. This 21 foot tall antenna covers 40, 20, 17, 15, 12 and 10 meters. It will handle the legal limit on 20 through 10 meters, 300 W PEP on 40 meters. It uses three 80 inch rigid counterpoises and can be mounted on or above ground.

Titan DX. The 25 foot Titan covers 10, 12, 15, 17, 20, 30, 40 and 100 kHz on 80 or 75 meters. It uses four 80 inch rigid counterpoises and can be mounted 1 foot or higher above ground. **www.gapantenna.com**

Hy-Gain

AV-620. This is a 23 foot long end fed ⅜ wave radiator made resonant on each band from 20 through 6 meters trough the use of tuning stubs. It uses seven 40 inch long radial rods, is rated at 1500 W PEP and should be mounted at least 8 feet above the ground.

AV-640. This is similar construction and design to the AV-620, but adds 40 and 30 meter operation and is 25½ feet long.

DX-77A. Another choice for the six bands from 40 through 10 meters. This 29 foot antenna is also rated at 1500 W and includes a tilt-over base. It includes four 60 inch radial rods and is recommended to be installed at least 7 feet above the ground. **www.hy-gain.com**

MFJ

MFJ-1796. This 12 foot high antenna covers 2, 6, 10, 15, 20 and 40 meters without the need for any radials or counterpoise. It is rated to the legal limit on HF SSB, somewhat lower on CW or on VHF. It can be mounted near or well above the ground.

MFJ-1796W. This is similar to the 1796, but operates on 12, 17, 30 and 60 meters only.

MFJ-1798. This model is a 20 version of the above that covers 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 meters.
www.mfjenterprises.com

How Well do They Work?

This is a natural question to ask. Unfortunately, the ARRL Lab does not have the capability to test antennas, nor have we found a test range to use. For that reason we don't often do product reviews of antennas, at least not based on measured performance. For straightforward antennas, we can use modeling techniques to assess how well they should work, but these antennas are generally composed of proprietary networks and elements that we can't accurately model.

One way to find out is to talk to club members or other hams about their experiences with them. Alternatively, a website that provides a forum for evaluations can be helpful (for example, **www.eham.net/reviews**). Just be aware that these are subjective impressions and you won't have any idea of the level of expertise of the commenters, nor their frames of reference. On the other hand, real users' experience over time is something that we couldn't easily test, even if we had an antenna range.

Notes

[1]J. Hallas, W1ZR, "How About an HF Beam Under Your Holiday Tree?" *QST*, Dec 2011, pp 61-62.

[2]R. Severns, N6LF, "An Experimental Look at Ground Systems for HF Verticals," *QST*, Mar 2010, pp 30-33.

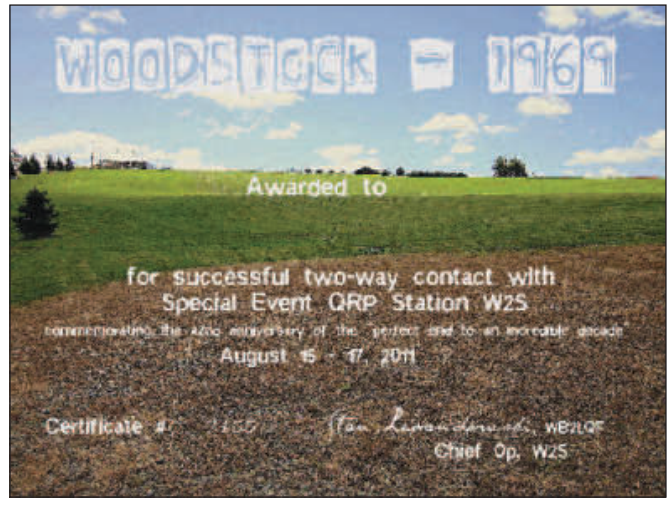
[3]J. Hallas, W1ZR, "How High Should Your HF Vertical Be?" *QST*, Nov 2011, pp 51-52.

WOODSTOCK Memories and Morse

Operating a special event station is not just for clubs and kilowatts.

Stan Levandowski, WB2LQF

It seems that the closer I get to becoming history myself, the more fascinated I've become with reflecting on it. In August 1969, I was one of those 400,000 young people drawn to a dairy farm in upstate New York for 3 days of peace and music. In 2009, on the 40th anniversary of Woodstock, I decided I was going to operate a special event (SE) station.



Stan created this certificate using a photo he took of the Woodstock site as a background. This view is of the audience area taken from the where the stage had been.

Plans and Permission

The Woodstock site is now a performing arts center called Bethel Woods. To their credit, the developers left the original concert site alone and just installed a simple monument. My dream was to set up and operate from somewhere within that natural amphitheater where rock history had been made.

A nice letter, a follow-up e-mail about ham radio and a personal visit failed to secure permission. In 2010 I made a second and more polished attempt, which was also denied. I was told that insurance regulations and the Bethel Woods media policy prohibited a ham radio station on their site. The world had clearly changed and those carefree attitudes of the '60s had given way to today's bureaucratic and legal complexities.

But I had another idea. Unlike an Islands On The Air program or DXpedition, an SE station is about the event not a place. So in 2011 I decided I'd operate from my home station in Fishkill, New York, about 50 miles southeast of Bethel Woods. I am an HF CW low-power addict and live in a townhouse with CC&Rs, so my antenna is a homebrewed multiband 44 foot doublet in my attic.

Getting the Word Out

To be successful the ham community needs to know that your station is going to be on the air. I chose the ARRL to grant my "W2S" call sign (**www.1x1callsigns.org**), after which I filled out the SE listing form to add my event to the ARRL Special Events list (**www.arrl.org/special-events-application**). It is important to remember that there is a 2 month lead time for publication in *QST*. Then, I updated my WB2LQF biography page at **www.qrz.com** to reflect the upcoming event.

Next, I made a trip to the site, narrated a 5 minute video about W2S and uploaded it to YouTube (**www.youtube.com/watch?v=-CBNmyUtbvI**). Now how do I get people to view it? An e-mail to the *Database Helper* at **www.qrz.com** added W2S as a searchable call. Anyone looking up W2S found complete information on the event, a link to the video and QSL requirements.

QSL, Certificate or Both?

The next decision was whether to send a QSL, certificate or both. The simplest solution is a preprinted mailing label applied to your regular QSL card. This is inexpensive but unattractive.

Printing your own QSLs allows you to tailor the text and use a meaningful photo as the background. This is an expensive and slow route, however. If this approach appeals to you then first estimate how many QSLs you may need, run a short test and do the math. If you decide to print your own QSLs plan for size A2 invitation envelopes because most postcard stock won't fit in a #10 envelope. If you decide to have a commercial outfit do your printing, wait until after the event to get an accurate QSL count.

A certificate confirmation is another approach. To produce a certificate with a background photo *Picasa* or *Picnik* can be used. But remember, printer ink cartridges are expensive.

When advertising your event, clearly specify that contacts who want a certificate should send a 9 × 12 inch SASE. My certificate mailings ended up weighing about 2 ounces. You can check the cost of postage for your mail-

Special Event 101

Operating a special event staion (SE) is a privilege open to all hams. They can range from 1 day, single person affairs to operations lasting several days involving multiple persons and stations. SEs commemorate significant events. While most of these events are of a historical nature, that's not a requirement. Many SEs offer distinctive QSL cards or certificates to confirm a contact. Plying the airwaves to work these stations is a subculture and many hams devote themselves to collecting SE confirmations.

The FCC has made available a block of 750, 1 × 1 call signs, such as W2S. Amateurs at all license levels may apply for one of these unique calls. This unusual SE call sign provides "on-air" advertisement of the event and helps to attract attention. This SE call doesn't give you any special operating privileges. You must still operate within the limits of your license class.

So How Do I Get Started?

Obtaining an SE call sign is straightforward. You can find more information at **www.arrl.org/special-event-call-signs**. You can apply for an SE call sign listing by going to **www.arrl.org/special-events-application** and filling out the application.

ings at **postcalc.usps.gov** and include this information in your advertisements.

Planning Hard and Soft

You and your rig need to work together smoothly in order to maximize effectiveness. This is especially important for an individual effort where you won't have helpers to share the workload.

I chose to log by hand so I preprinted some log sheets with minimum information — date, start time, station called, band, RST sent, RST received, name and location. I created a separate database for W2S contacts within *Ham Radio Deluxe* (**www.hrdsoftwarellc.com**). I would enter my log sheets after the event.

I chose to use my K2 transceiver for the event. Nothing prevents you from running an SE with a minimalist rig and the K2's filtering capability and receiver incremental tuning (RIT) were very helpful.

Next, consider what your exchange will be. A standardized CW exchange can be of great benefit when conditions are unsettled and fading is deep. An operator may be able to "fill in the blanks" by anticipating the exchange from having listened to prior contacts.

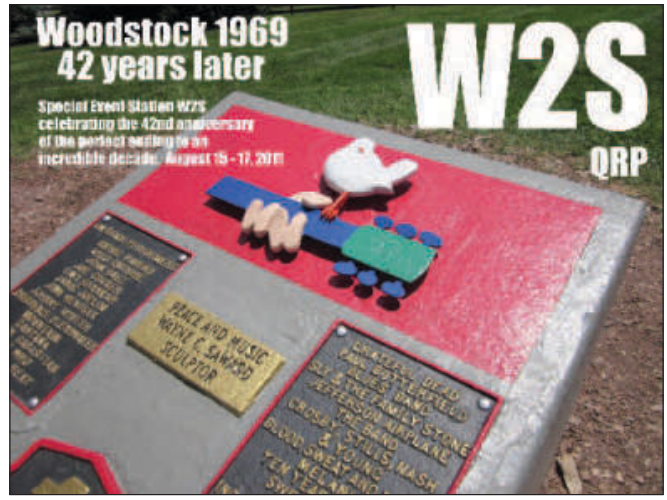
Finally, establish reasonable expectations for your event, especially when operating low power. I concluded that if I could make 50 contacts I'd call it a successful event.

On the Air at Last!

As 1700Z approached on August 15, 2011, I began to doubt the wisdom of an operation combining 5 W and an attic antenna with lousy conditions. Then the moment arrived and I sent my first CQ DE W2S. To my pleasant surprise, Bertrand, F6HKA, came back immediately followed by other stations clearly waiting on frequency. It seemed like the publicity was paying off. This was the shot of confidence I needed. I was getting out okay and people *actually knew about me and wanted to work me*.

Operating an SE station is a lot like fishing — you have to keep your line in the water if you want to hook anything. In radio terms, this meant I had to call CQ almost continually. Experienced low power operators generally shy away from calling CQ. We complete more contacts answering CQs instead of sending them. This low-power mindset needs to be reversed when operating an SE station. Other hams are waiting for you to call on your advertised frequencies.

The most used knob was RIT. In marginal conditions, a weak station slightly off frequency could easily be missed, especially using a tight filter. If you move the main tuning dial you may transmit on a slightly different frequency. This annoys everyone. It's preferable to remain on the exact same transmitting frequency and just vary the receive frequency.



Stan prepared his own QSL using a photograph of the Woodstock commemorative monument as the background with added historical information about his special event.

For filtering, I chose 400 Hz as the best compromise. It provided enough bandwidth for comfortable operating but was tight enough to reduce adjacent interference.

In 31 operating hours I contacted 155 stations across 38 states and nine countries. This significantly exceeded my 50 contacts goal. I was impressed with the polite exchanges, the patient repeats when the fading hit and the many PEACE greetings sent along with 73. There were very few instances of interfering stations and in all those cases I probably was not being heard. Several operators were kind enough to spot me on DX Cluster. I have no doubt that it was the cause of many of those mini-pileups that seemed to come out of nowhere. At exactly 1700Z on August 17 I sent QRT DE W2S.

The Aftermath

First, I collected my handwritten logs and entered them into *Ham Radio Deluxe*. The QSL card I designed was two sided and I elected to print my own. Avery 8387 postcard stock yielded four QSLs per sheet. The front of the card was my photo of the Woodstock memorial monument. I thought the certificates would look more professional if computer printed. I used ivory toned 24 pound parchment paper and the resulting certificate was worthy of being framed.

Out of 155 contacts, I only received confirmation requests from 56 stations. That's a mere 36%. I didn't see this one coming! I had prepared for a near 100% confirmation rate.

Next Time?

This was a deeply satisfying and very meaningful experience for me and I had a great time. I have expanded my ham radio skills inventory and can now say I know how to set up and operate an SE station from conception to licking that last stamp. If I were to do it again I think I'd opt for a "QSL only" award to simplify the process and reduce the expense. I would most certainly design a 3½ × 5½ inch QSL to fit in a standard #10 envelope and have it professionally printed.

I hope my account encourages others, especially low-power operators, to explore the whole niche area of SE stations from both sides — working them as well as setting one up from scratch. Remember, all you need is something to commemorate.

Stan Levandowski, WB2LQF, an ARRL member, earned Novice license WN2LQF at age 11. He is now an Amateur Extra class operator devoted to 100% HF low-power CW. When not hamming, he enjoys kayaking with his wife, Sue, and spending time with their three grandchildren. Stan holds an undergraduate degree in business and an MBA from Long Island University. He retired from a 30 year career at IBM as a software development manager and from Nyack College where he taught organizational management. Stan is a member of The QSY Society and the Mount Beacon Amateur Radio Club. You can contact Stan at 6 Chatham Ct, Fishkill, NY 12524, **wb2lqf@arrl.net**.

ARRL Board of Directors Gathers in Connecticut for 2012 Annual Meeting

The Board says goodbye to an old friend, and greenlights a new way to vote for ARRL Directors and Vice Directors this fall.

S. Khrystyne Keane, K1SFA

The ARRL Board of Directors held its 2012 Annual Meeting January 13-14, 2012 in Windsor, Connecticut, under the chairmanship of President Kay Craigie, N3KN. Newly elected Delta Division Director David Norris, K5UZ, attended his first Board meeting as Director. In addition, two recently elected vice directors — Glen Clayton, W4BDB, Delta Division, and Dale Williams, WA8EFK, Great Lakes Division — attended their first Board meeting.

With the retirement of Jim McCobb, K1LU, after 31 years of service as the ARRL's volunteer Treasurer, the Board elected Rick Niswander, K7GM — an ARRL Life Member and the Vice Chancellor for Administration and Finance at East Carolina University — to this key post. The other volunteer ARRL officers were re-elected for two year terms: President Kay Craigie, N3KN; First Vice President Rick Roderick, K5UR; Second Vice President Bruce Frahm, K0BJ, and International Affairs Vice President Jay Bellows, K0QB. All were unopposed, except Frahm, who withstood a challenge from Central Division Director Dick Isely, W9GIG.

The Board expressed its deep and sincere appreciation to McCobb for his service. Board members noted the countless hours over a span of more than three decades that he has devoted to ensuring the welfare of the ARRL and Amateur Radio through careful stewardship and wise counsel, which have been of great benefit to the ARRL, its members and its staff.

Highlights of Board Actions

■ After viewing a demonstration of electronic balloting, the Board adopted amendments to the ARRL Bylaws that will permit the implementation of electronic voting in the 2012 fall elections for Director and Vice Director of the Central, Hudson, New England, Northwestern and Roanoke Divisions. Plans call for paper ballots still to be mailed to those members who have not shared their e-mail addresses with the ARRL, or who simply prefer to cast their votes by mail. Supervision of the balloting is the responsibility of the Ethics and Elections Committee.

■ *FCC Items*: The Board heard a comprehensive report from the Ad Hoc National Broadband Plan Committee on the implications for Amateur Radio frequency allocations of the skyrocketing demand for mobile wireless broadband spectrum. The Executive Committee was tasked with an ongoing review of the situation and the implementation of strategies to defend amateur access to the bands between 222-3500 MHz. On recommendation of the ARRL Electromagnetic Compatibility (EMC) Committee, the Executive Committee and General Counsel Chris Imlay, W3KD, were also assigned to develop petitions for FCC rulemaking to improve Parts 15 and 18 of the FCC Rules in order to provide better protection for licensed radio services from harmful interference from unintentional emitters such as plasma TV displays, RF lighting devices, electric motors, power lines and associated hardware.

After more than 30 years of service to the ARRL as its volunteer Treasurer, Jim McCobb, K1LU (left) decided to retire after the 2012 Annual Meeting. The Board elected Rick Niswander, K7GM, of Greenville, North Carolina, as its new Treasurer. Niswander is currently the Vice Chancellor for Administration and Finance at East Carolina University.
[Harold Kramer, WJ1B]

■ The Board received reports from other committees, including interim reports on guidelines for 5 MHz operation from the Ad Hoc Band Planning Committee, as well as the ongoing revision of band plans for the bands between 902-3500 MHz from the UHF/Microwave Band Plan Committee.

■ The Board ratified the 2012-2013 budget plan, as prepared by staff and reviewed and approved by the Administration and Finance Committee. The plan calls for an increase in spending of less than 1 percent in 2012, compared to the previous year.

■ The charter of the VHF-UHF Advisory Committee was extended through July 31, 2013 to permit the committee to complete its assigned tasks.

Committees

■ *Executive Committee*: The following were elected for one-year terms: West Gulf Director David Woolweaver, K5RAV; Rocky Mountain Director Brian Mileshosky, N5ZGT, Midwest

The ARRL Board of Directors meets twice a year, once in January and once in July. At its 2012 Annual Meeting — held January 13-14 in Windsor, Connecticut — Board members conducted a wide variety of business, including passing a motion to allow electronic balloting for the Director and Vice Director elections this fall.
[Steve Ford, WB8IMY]

Director Cliff Ahrens, K0CA; Northwestern Director Jim Fenstermaker, K9JF, and Central Director Dick Isely, W9GIG. President Craigie, First Vice President Roderick and Chief Executive Officer David Sumner, K1ZZ, also serve on the Executive Committee by virtue of their offices. Among its duties, the Executive Committee is responsible for applying existing Board policy to make decisions between Board meetings; evaluating proposed rules and regulatory changes for the Board, reviewing and recommending to the Board any changes in the ARRL Articles of Association, By-Laws, Standing Orders, and Memoranda of Understanding with other organizations; monitoring progress of Board actions and recommendations, and reviewing and recommending programs designed to represent the organization to the public, enhance the organization's image and communicate with the media.

■*Programs and Services Committee*: The Programs and Services Committee studies, advises and makes recommendations regarding the League's volunteer programs and services to members, including operating activities and the Field Organization. President Craigie appointed Delta Director David Norris, K5UZ, as chairman of this committee. She also appointed Great Lakes Director Jim Weaver, K8JE; Hudson Director Joyce Birmingham, KA2ANF; Pacific Director Bob Vallio, W6RGG; Southwestern Director Dick Norton, N6AA, and Dakota Vice Director Kent Olson, KA0LDG, to serve.

■*Administration and Finance Committee*: The Administration and Finance Committee studies, advises and makes recommendations concerning administration and financial matters of the League, including recommending the annual budget to the Board, making recommendations in regard to staff management and monitoring investment of ARRL funds. New England Director Tom Frenaye, K1KI, was appointed by President Craigie to chair this committee. She also appointed Dakota Director Greg Widin, K0GW; Roanoke Director Dennis Bodson, W4PWF; Southeastern Director Greg Sarratt, W4OZK; Atlantic Director Bill Edgar, N3LLR, and Southwestern Vice Director Marty Woll, N6VI, to serve. By virtue of his position, Treasurer Niswander is also a member of the Administration and Finance Committee.

■*Ethics and Elections Committee*: Dakota Director Greg Widin, K0GW, will chair this committee. He will be joined by Pacific Director Bob Vallio, W6RGG, and Atlantic Director Bill Edgar, N3LLR. This committee is tasked with applying guidelines for ethical conduct by ARRL officials adopted by the Board; determining the eligibility of candidates for Director and Vice Director, including but not limited to receipt and review of petitions and certification of eligible candidates, and supervising the balloting for Director and Vice Director, including but not limited to receipt of all campaign statements and materials, printing ballots, appointing tellers, counting ballots and releasing results.

■*ARRL Foundation*: New England Director Tom Frenaye, K1KI, and Marty Green, K2PLF, were re-elected to new three-year terms on the ARRL Foundation Board, while Rocky Mountain Director Brian Mileshosky, N5ZGT, was elected to his first term. Mileshosky will replace Tom Comstock, N5TC, who is retiring. The ARRL Foundation was established in 1973 by the ARRL as an independent and separate 501(c)(3) organization to administer programs to support the Amateur Radio community.

Complete Minutes Available

The complete Minutes of the 2012 Annual Meeting of the ARRL Board of Directors are available on the ARRL website at **www.arrl.org/board-meetings**.

The 2012 Second Meeting of the ARRL Board of Directors is scheduled for July 20-21, 2012.

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

ARRL Bestows Awards at 2012 Annual Meeting

S. Khrystyne Keane, K1SFA

The ARRL Board of Directors had the pleasure and distinction of bestowing three annual awards at its 2012 Annual Meeting — the George Hart Distinguished Service Award, the Bill Leonard, W2SKE, Professional Media Award for print, audio and video, and the ARRL International Humanitarian Award.

The George Hart Distinguished Service Award: This year, the Board named two recipients: ARRL Connecticut Section Manager Betsey Doane, K1EIC, and Fritz Nitsch, W4NTO, an Official Emergency Station in the ARRL's South Carolina Section.

Betsey Doane has served more than 50 years in the ARRL Field Organization, beginning as an Official Phone Station in the 1960s. Before becoming Section Manager, she served as Official Relay Station, Net Manager of the Connecticut Section NTS, Section Traffic Manager. Besides serving as Section Manager, Doane is also an Official Emergency Station. In 2005, she was named CCE Mentor/Instructor of the Year.

Fritz Nitsch, a former Official Observer, has served in the ARRL Field Organization for more than 35 years. His nominators stressed his devotion to the Amateur Radio Service and his unfailing support as an Elmer.

The Bill Leonard, W2SKE, Professional Media Award: The Board named Brad Barr, Joel Rose and Ken Grimball the recipients of the three Bill Leonard, W2SKE, Professional Media Awards.

Brad Barr was honored in the print category for his January 2011 article in *Today in Mississippi* , a publication of the 4 County Electric Cooperative, about Billy Beard, K5FUR. Barr explains Beard's love and commitment to Amateur Radio and his community. Read the article at **www.4county.org/Files/Newsletter/2011/Today_Jan11.pdf**.

Joel Rose, a staff reporter at National Public Radio, explained how proposed federal legislation could impact frequencies used by radio amateurs for emergency communications. Cited for his comprehensive overview in the April 2011 story, Rose interviewed Nobel Laureate Joe Taylor, K1JT, to help explain how HR 607 could impact hams. Listen to the story at **www.npr.org/2011/04/30/135873302/ham-radio-volunteers-worry-about-spectrum-plan**.

Ken Grimball, of News 12 Long Island (New York), prepared a television news report on a local Amateur Radio club that featured youth serving as Net Control during Hurricane Irene and the response by radio amateurs to the storm. This story aired in September 2011.

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

Philip J. McGan Memorial Silver Antenna Award

Let's honor a reporter who promotes Amateur Radio.

Allen Pitts, W1AGP

Have you seen a good article about Amateur Radio on your TV or in the newspapers? Who made that happen? Who has been spending the time and effort to not only *say* that we need more publicity, but to actually go *do* something about it?

Throughout the year, hundreds of ARRL PICs, PIOs and other public relations volunteers keep Amateur Radio visible in their communities by publicizing special events, writing press releases, creating media for radio, websites and television, and so much more. If you know of someone who achieved public relations success on behalf of Amateur Radio, nominating him or her for the McGan Award is the perfect way to recognize their efforts and say thank you.

Public Relations activities for which the McGan Award is presented include efforts specifically directed at bringing Amateur Radio to the public's attention (and most often the media's) in a positive light. These may include traditional methods, like news stories, articles and broadcasts, or non-traditional methods such as hosting a radio show or being an active public speaker.

Philip J. McGan, WA2MBQ (SK) served as the first chairman of the ARRL's Public Relations Committee. In honor of Phil, his friends in the New Hampshire Amateur Radio Association joined with the ARRL Board of Directors to pay a lasting tribute to the important contributions he made on behalf of Amateur Radio. The 2012 McGan award will go to that ham who has demonstrated success in Amateur Radio public relations and best exemplifies the great volunteer spirit of Phil McGan.

The ARRL Public Relations Committee will review all nominations and send a recommended winner for approval by the ARRL Board of Directors at the July meeting.

Previous Winners of the McGan Award

By date of receiving award for work done the previous 12 months.

1992	McGan Award announced for first time
1992	James Heil, KB5AWM
1993	Gary Pearce, KN4AQ
1994	Joe Phillips, K8QOE and Michael, Karp, AF2L
1995	Len Winkler, KB7LPW
1996	Bob Josuweit, WA3PZO
1997	James Biddle, WB3DCL and Beverly Priest, N8VZV
1998	Stephan Anderman, K2SMA
1999	Peter Coffee, AC6EN
2000	Diane Ortiz, K2DO,
2001	Bill Morine, N2COP,
2002	Sherri Brower, W4STB,
2003	Tim Lewallen, KD5ING
2004	Mike Duff, KG4SLH,
2005	Jerry Martin, KC9BDA
2006	Dee Logan, W1HEO
2007	Dan McMonigle, N3IXQ
2008	Walt J. Palmer, W4ALT
2009	Nate Brightman, K6OSC
2010	Norm Lauterette, WA4HYJ
2011	Angel Santana, WP3GW

Angel, WP3GW, has been a sparkplug of a PIO in his area, appearing on television, radio and in print. While the media opportunities for Puerto Rico are limited, he has made the most of every means available. He develops not only "contacts" but friendly relationships with area reporters that result in effective public relations. He also translated all of the major ARRL campaigns into Spanish and uses them to promote Amateur Radio throughout the region.

Call for Nominations

1) The award is given to an individual (not a group), who must be a full ARRL member in good standing at the time of nomination. The nominee must not be compensated for any public relations work involving Amateur Radio (including payment for articles) and may not be a current officer, director, vice director or paid staff member, or member of the ARRL Public Relations Committee.

2) The winner of the Philip J. McGan Memorial Silver Antenna Award will demonstrate volunteer public relations success on behalf of Amateur Radio at the local, state or national level, and will live up to the high standard of achievement exemplified by Philip J. McGan.

3) *Anyone* may make a nomination.

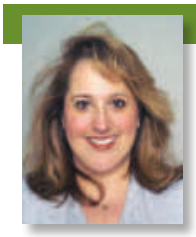
4) Deadline: *Nominations must be received at ARRL HQ in Newington by 5 PM May 25, 2012.* Nominations arriving after the deadline or without an entry form cannot be considered.

5) Eligible nominations will be screened by a committee of Amateur Radio operators knowledgeable about public relations. The committee will forward its recommendation to the Programs and Services Committee of the ARRL Board of Directors. The Board will make a final determination at its July meeting and the winner will be notified shortly thereafter.

6) Nominations must be on an official entry form, available from ARRL Headquarters. The nomination will include a written summary whenever possible.

To obtain the required entry form, go to **www.arrl.org/phil-mcgan-award** or e-mail **apitts@arrl.org**. Ask for an official 2012 Philip J. McGan Memorial Silver Antenna Award entry form.

7) Return the completed entry form and supporting materials to Philip J. McGan Memorial Silver Antenna Award, c/o Allen Pitts, W1AGP, ARRL, 225 Main St, Newington, CT 06111.



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

BPL Provider IBEC Announces Shutdown

Another Access BPL provider admits defeat.

IBEC — one of the very few remaining operators of Access BPL systems — has announced that it is closing down. In an undated announcement that appeared on the IBEC website in early January, the company announced that it has "no other option than to close our doors and cease operations." IBEC claims that it cannot recover financially from the April 2011 tornadoes in Alabama that "ravished [*sic*] some of our major service areas." IBEC provided Internet service via broadband over power lines (BPL) to rural communities.

IBEC said that it expected service to continue through the end of January, but that it "cannot guarantee the quality and availability of service during this period." IBEC said it would discontinue its customer service operations as of January 16. In a letter to IBEC customers dated December 23, 2011, IBEC said that it "will no longer be in a position to provide Internet service to your area. We encourage all of you to pursue other options for your Internet services as soon as possible. This includes your e-mail service."

IBEC and the ARRL

"While we regret the loss of jobs brought about by IBEC's broadband over power lines (BPL) business failure, in the long run the rural areas that IBEC was trying to serve will be better served by broadband technologies that are superior to BPL and do not pollute the radio spectrum," said ARRL Chief Executive Officer David Sumner, K1ZZ. "While initially IBEC was cooperative in addressing the ARRL's concerns about interference to licensed radio services — including Amateur Radio — the ARRL was dismayed to find that the systems as actually deployed fell short of meeting even the inadequate requirements of the FCC's rules. We hope that this latest in the long string of BPL failures will persuade the few remaining fans of Access BPL to turn their attention elsewhere."

More than a year ago, the ARRL filed a complaint with the FCC, documenting ongoing harmful interference and egregious rules violations by IBEC-installed BPL systems in Virginia, Pennsylvania and Indiana. The ARRL had requested that the FCC "initiate immediately an enforcement proceeding regarding these BPL systems, and cause them to cease operation until such time as they are each in full compliance with the Commission's Rules." The ARRL even discovered IBEC BPL systems in operation that were not listed in the online BPL database — another clear violation of the FCC rules, which require listing 30 days prior to initiation of service. To the ARRL's knowledge, even as of today, the FCC has taken no enforcement action to correct these violations.

IBEC Chief Executive Officer Scott E. Lee told customers that although he was sure that the closure was "an unexpected surprise," his team "has done all things possible to stop this day from coming. Our demise, started with the April 27th storms of this year in Alabama, which destroyed over 3.2 million in assets, which our Insurance Provider (CHUB) has refused to pay. We also lost a critical investment from an Investor commitment, due to these storms, putting IBEC into a negative financial situation. IBEC pursued assistance from RUS (our Federal Creditor at US Department of Agriculture), our vendors and endless potential buyers after these events without success."

IBEC Clients at Loss

Jeff Loven, the General Manager of French Broad Electric Membership Corporation, told the ARRL that he had only heard about IBEC's closure around 10 AM January 3. "We really don't know what we're going to do right now," he said. "IBEC only served a small number of our customers." Loven said that of FBEMC's 37,000 customers, only 200 subscribed to IBEC's Internet service. FBEMC serves Madison, Buncombe, Yancey and Mitchell Counties in North Carolina, and Unicoi and Cocke County in Tennessee.

In Virginia, Central Virginia Electric Cooperative's Member Services Manager Greg Kelly told the ARRL that with IBEC leaving the area, they will begin looking for "anyone who is committed to serving rural space for broadband. I'm not sure how many customers IBEC served, as Central Virginia Electric Cooperative had nothing to do with the service; IBEC just put their equipment on our poles." CVEC provides service to 33,000 customers in 14 counties in Central Virginia.

The ARRL asked Kelly if CVEC would use the IBEC equipment to provide broadband Internet service to its rural subscribers. Kelly said he didn't know: "IBEC owns and operates the system. If we used the equipment, we would have to train people on how to use it, how to maintain it. Maybe a third party would have to come in and operate it for us. I just don't know. But if I had to guess, it will just lie dormant if it's not removed."

Kelly cited the Alabama storms as the reason for IBEC's dismantling. "I'm not sure how many customers we have here in Central Virginia," he told the ARRL, "but in Cullman, Alabama where the tornados hit, IBEC lost 1400 customers." IBEC is headquartered in Huntsville, Alabama.

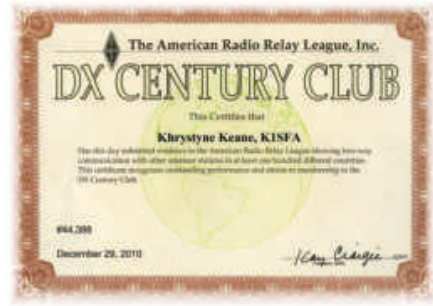
ARRL Laboratory Manager Ed Hare, W1RFI, has made field strength measurements at several of the IBEC BPL sites. Over a period of two years, he has consistently found that these systems were operating at levels much greater than the permitted FCC limits. "Distribution power lines are simply not designed to carry broadband signals," he explained. "Although systems can be designed to work in that hostile environment under ideal conditions, in practice, conditions are not ideal. In system after system measured by the ARRL over the past 10 years, Access BPL systems were operating at levels from 15 to 40 dB greater than the FCC limits, but still not working well."

From an interference perspective, Hare said IBEC's closure is good news: "There are still BPL systems running in the United States. Now that IBEC is out of the game, no other system in the country uses the amateur bands in their deployments."

2011 Sees Tremendous Increase in DXCC Applications

With the coming of more sunspots, comes more DX. And when more amateurs are working DX, that means the ARRL's Membership and Volunteer Programs Department — especially the DXCC Desk and the ARRL Incoming and Outgoing QSL Bureaus — goes into high gear.

"In 2011, we saw an increase in the number of cards we received from ARRL members that were sent to foreign QSL bureaus, as well as the number of cards we sent out to the bureaus," said DXCC Manager Bill Moore, NC1L. "In addition, the number of DXCC applications — including those for initial awards and endorsements — also increased."



"Through December 31, 2011, the ARRL Outgoing QSL Bureau received 802,500 cards destined for international QSL bureaus from ARRL members in the US," said MVP Administrative Manager Sharon Taratula. "This represents an increase of 4 percent over the 2010 number of about 771,900 cards. In 2011, the ARRL shipped 799,675 cards — or close to 5400 pounds of cards — to foreign bureaus."

As the number of QSL cards has increased, so have the number of DXCC applications. In 2010, the DXCC Desk processed 7134 applications for initial awards and endorsements; these 2010 applications included 853,462 QSOs. In 2011, the DXCC Desk processed 11,175 applications, containing 1,250,864 QSOs. "Comparing 2010 to 2011, this represents a 47 percent increase in the number of QSOs and a 57 percent increase in the number of applications," Taratula explained.

Ham Radio in HOLLYWOOD

Amateur Radio a Plot Point in Major Motion Picture: According to previews, the plot of the movie *Journey 2: The Mysterious Island* — set to be released February 10 — hinges on Amateur Radio. The movie's hero Sean Anderson (played by Josh Hutcherson) receives a coded distress signal that comes from a mysterious island where no island should exist. Sean decides to follow the signal with the unwilling assistance from his stepfather Hank (played by Dwayne "The Rock" Johnson).

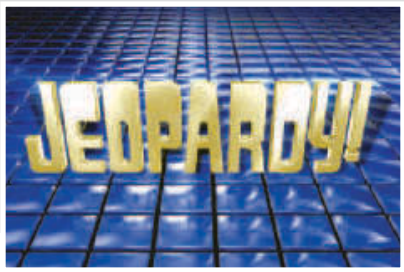
Sean explains to Hank why he wants to hunt down the signal: "A few nights ago, a radio signal got sent out from these coordinates. It could be the mysterious island that Jules Verne wrote about." Hank replies: "You think you're gonna travel halfway around the world and meet up with some lunatic who's messing around on a ham radio?" "That's not some lunatic," Sean says. "That's my grandfather." Other than this mention of "ham radio," it is not yet known how Amateur Radio will be featured in the movie.

Together, Sean and Hank fly out to a tropical island to begin their quest. There, they meet up with Gabato (a helicopter pilot played by Luis Guzman) and his daughter Kailani (played by Vanessa Hudgens). The group sets out to find the island, where they find the island's lone human inhabitant: Sean's grandfather (played by Michael Caine). For a while, the five enjoy the wonders of the island — the lost world of Atlantis — but soon, seismic shockwaves begin destroying this rediscovered world. They must escape before the island is forced under the sea and its treasures are buried forever. Watch the trailer for *Journey 2: The Mysterious Island* at **www.imdb.com/video/imdb/vi4230192665/**.

Can I Have "Amateur Radio" for $800, Alex?

If you were watching the popular television game show *Jeopardy!* — where contestants have to answer in the form of a question — on December 15, you might have noticed there was a question featuring Amateur Radio. In the first round, returning champ Boomie Aglietti was playing the category "Pastimes" when he encountered this "answer" worth $800: "The FCC assigns call signs, like N8DNR, to use in this hobby." Aglietti answered correctly with "ham radio."

N8DNR is the call sign of Debbie Dorfman of West Bloomfield, Michigan. Debbie is the mother of Stephen Dorfman, N6DIW (SK). Stephen was a writer for *Jeopardy!* from 1984 until he passed away in 2004 at age 48 due to complications from cancer. According to the *New York Times*, Dorfman was *Jeopardy!*'s longest serving and most prolific writer, with more than 50,000 clues to his credit. As part of a team of writers, he won six Daytime Emmy Awards for special-class writing, given for shows that do not fit into traditional categories. On the *Jeopardy!* episode that aired January 3, 2008, another Dorfman call sign was featured — this one of Stephen's father Neil — also for $800, in the category "If You're...": "...using a call sign like K8RX, you're engaged in this hobby."



ARISSat-1 Re-enters Earth's Atmosphere

According to AMSAT, ARISSat-1 stopped transmitting on the morning of January 4, 2012. It is believed that the satellite re-entered the Earth's atmosphere around 0700 UTC (+/- three hours) and was destroyed soon after. Telemetry reports showed that the temperature aboard ARISSat-1 had been rising as the atmospheric drag began to affect the satellite. The decay location was said to be at an open part of the South Atlantic, well west of Angola.

The last telemetry reports indicated that the internal temperature had topped 167 degrees Fahrenheit and was rising rapidly. Konstantin Vladimirovich, RN3ZF, sent a reception report of a pass at 0842 UTC and stated, "The telemetry was absent, voice messages were not legible, very silent and interrupted. Most likely, I saw the last minutes in the life of the satellite." The last full telemetry captured was received from ground stations as the satellite passed over Japan at 0602 UTC on January 4.

ARISSat-1 was deployed from the International Space Station on August 3, 2011 during EVA-29 on by Cosmonaut/Flight Engineers Sergei Volkov, RU3DIS, and Alexander Samokutyaev. The satellite carried a student experiment from Kursk State University in Russia that measured atmospheric density. Students from around the world provided the voices for the FM voice announcements.

AMSAT President Barry Baines, WD4ASW, said ARISSat-1 marked a new type of satellite that captured the attention of the national space agencies around the world. "With ARISSat-1, we have been able to design, launch, and operate a unique educational opportunity," he explained. "By designing an educational mission aligned with NASA's Science, Technology, Engineering and Mathematics goals, radio amateurs around the world have been able enjoy a new satellite in orbit."

ARISSat-1 was deployed from the International Space Station in August 2011. It re-entered the Earth's atmosphere the first week of January 2012.

[Courtesy NASA]

ARISSat-1 achieved several "firsts" for Amateur Radio in space, including the first flight test of the AMSAT Software Defined Transponder, which included an FM voice downlink cycling between student messages, spoken telemetry and SSTV; a 16 kHz bandwidth linear transponder; a CW beacon carrying telemetry and call signs of radio amateurs (noting their significant contributions to Amateur Radio in space) and a robust, forward-error-corrected 1 kbps BPSK digital downlink carrying satellite telemetry.

FCC News

FCC DENIES ARRL PETITION ON VANITY, CLUB CALL SIGNS

On January 11, the FCC issued a *Memorandum Opinion and Order*, denying an ARRL *Petition for Reconsideration* concerning vanity and club call signs. Filed with the Commission in January 2011, the ARRL's *Petition* was in response to the FCC's *Report and Order* (*R&O*) that detailed rules changes to the vanity call sign system and call signs for Amateur Radio clubs. These new rules went into effect on February 14, 2011.

The ARRL found that most changes made by the *R&O* were "reasonable codifications and clarifications of existing policies." But it asserted that several amended Sections of Part 97 — including Sections 97.5 and 97.19 — were unclear. In its *Petition*, the ARRL urged the FCC to reconsider and modify these portions "in order to reflect the intent of the *Report and Order*."

In the *R&O*, the FCC pointed out that it had "amended and clarified its rules with respect to vanity call signs and club station licenses to promote processes that are more to limit club stations to holding only one vanity call sign and to limit an individual to being the trustee for only one club station license." It said that the purpose of the rules change was "to prevent club stations from obtaining an unfair share of desirable call signs, given that individuals are limited to holding one operator/primary station license (and, therefore, one call sign), while there was no limit on the number of licenses a club could hold."

The FCC noted that the ARRL supports its efforts to prevent club stations from obtaining an unfair share of desirable call signs, but expresses concern that the specific rule language adopted by the Commission "does not preclude the abuses that the *Report and Order* intended to preclude." In its Petition, the ARRL stated that if a club has multiple station trustees, each of these trustees could obtain a vanity call sign for the club, thereby allowing the club to obtain multiple vanity call signs. The ARRL also argued that a club could "'gam[e]' the club station vanity call sign system" by obtaining multiple FCC Registration Numbers (FRNs) and applying for a vanity call sign under each FRN. "We do not believe that the vanity call sign system is subject to the abuses identified by the ARRL," the FCC said, "or that its suggested rule changes are necessary."

FCC Sees No Reason to Change Rules

In denying the ARRL's *Petition for Reconsideration*, the FCC maintained that a club may have only one license trustee at a time: "Section 97.5(b)(2) of our Rules states, in part, 'A club station license grant may be held only by the person who is the license trustee designated by an officer of the club.' Consequently, we believe that Section 97.19(a), which provides that 'the person named in a club station license grant that shows on the license a call sign that was selected by a trustee is not eligible for an additional vanity call sign,' effectively implements the Commission's decision to limit club stations to holding only one vanity call sign. Any application from a club for an additional vanity call sign when the club already is assigned a vanity call sign will be dismissed because the trustee is not eligible for an additional vanity call sign. Accordingly, we decline to revise Section 97.19(a) as ARRL requests."

With regard to the ARRL's concern that a club could obtain multiple FRNs and thereby obtain multiple vanity call signs, the FCC asserted that vanity call sign applications from club stations are checked not only with respect to whether the FRN on the application matches the FRN on the grant of a vanity call sign to any club station, but also with respect to whether the club name on the application matches the club name on the grant of a vanity call sign to any club station: "Therefore, even if a club obtains or holds multiple FRNs, if an application is received from a club and the database shows that a club with the same name already has a vanity call sign, the application will not be granted, absent further review. We accordingly conclude that the change that ARRL requests to Section 97.5(b)(2) is not necessary."

The FCC maintained that the ARRL's *Petition for Reconsideration* "does not provide any grounds for reconsidering the Commission's decision in the *Report and Order*. The concerns expressed by the ARRL about licensees attempting to evade the rules adopted in the *Report and Order* are already addressed by our licensing rules and processes. We therefore deny the *Petition for Reconsideration*." The FCC also noted that while ARRL suggests that it take up its proposal to increase the pool of available vanity call signs again in a future proceeding, "we have no plans to revisit the issue at this time."

Commenting on the *Memorandum Opinion and Order*, ARRL Chief Executive Officer David Sumner, K1ZZ, observed: "We believe the FCC has been too hasty in denying the ARRL's *Petition for Reconsideration*. In footnote 6, the FCC assures amateurs that 'Club stations may continue to obtain multiple sequential call signs.' However, this is inconsistent with the Commission's interpretation of 97.5(b)(2), as preventing a club from having more than one trustee, because 97.5(b)(2) applies to all club station licenses and not simply to those with vanity call signs. Coupled with 97.17(d), this appears to make it impossible for clubs to obtain more than one sequential call sign, contrary to the Commission's intent as stated in footnote 6."

Rick Palm, K1CE, k1ce@arrl.org

Training and Certifications for ARES® Operators

If you don't know what you should know, you'll want to know about this Emcomm curriculum.

In the landmark report of the ARRL National Emergency Response Planning Committee filed with the League's Board of Directors in 2007, Chairman Kay Craigie, N3KN (now ARRL President) wrote for the panelists when she summed up the issue of training and certification for ARES® volunteers:

> For many years, Amateur Radio has longed to be taken seriously by governmental authorities as a professional-quality resource in disaster response. Although there are areas of the country where achieving and maintaining emergency management agencies' respect is still a struggle, Amateur Radio's service during 9/11 and the major hurricane disasters of the 21st century has brought us a new level of respect and new opportunities at the national level.
>
> Being taken seriously as a resource comes with a price, however. It is a price that must be paid by individual volunteers, not in dollars but in precious personal time. When the federal government instituted the National Incident Management System (NIMS), it imposed a set of requirements on state and local emergency management agencies and their personnel. Affected personnel included not only paid employees of emergency management and related agencies but also volunteers such as those in volunteer fire companies, ARES®, and RACES. If the emergency management agencies are to continue receiving federal funds, personnel must complete a number of FEMA training courses having to do with the Incident Command System (ICS) and NIMS. Individuals who do not complete the training will not be allowed to participate, even as volunteers.
>
> These FEMA courses are free of charge, available online or sometimes in person at emergency management offices, and not particularly difficult. The courses are useful in familiarizing volunteers with the specialized vocabulary and principles of the Incident Command System and showing where communications fits into the ICS structure. This is valuable knowledge, because if radio amateurs — particularly those in leadership positions — cannot "talk the talk," then authorities may well assume that we cannot "walk the walk."
>
> These formal requirements are here to stay and more may follow. At the national level, Amateur Radio has earned the respect we always wanted, bringing us closer to the emergency management establishment. The challenge now is persuading both casual ARES® volunteers and experienced volunteers to meet the requirements that follow from being part of the system. The national-level ARRL must be aware of that and develop ways to help local and section ARES® officials bring their volunteers, both old-timers and newcomers, into the new era.

Current Trends

Since the time of the report, the ARRL — along with the amateur community at large — has started to meet President Craigie's challenges and further embrace emergency communications and ARES®. This trend started with 9/11 and continued through Hurricane Katrina. There has been a concomitant rise in interest in the ARRL and FEMA courses by Emcomm operators, both serious and casual. Conversation on ICS/NIMS topics is now common on nets and in club meetings. The training scene has evolved rapidly in the past few years. ARRL HQ has ramped up its training resources and added a dedicated staff member for support.

In a recent survey by the ARRL Emergency Communications Advisory Committee (ECAC) of the ARRL Field Organization on ARES® topics, 55% of the ARRL sections require minimum training for active members. Of those sections requiring training, 38% require the ARRL EC-001, *Introduction to Emergency Communications* course; 75% require the FEMA IS-100, *Introduction to the Incident Command System*; 71% require IS-200, *ICS for Single Resources and Initial Action Incidents*; 67% require IS-700, *Introduction to the National Incident Management System* (NIMS), and 51% require IS-800, *National Response Framework* (NRF).

Of served agencies, it was reported that 78% require specific training of their volunteers. Seventy-five percent reported that most ARES® members are ICS trained.

Recommended Courses

I've run numerous recommendations in the *ARES® E-Letter* and have subsequently received more recommendations, which were then published, to enhance the value of our program and operators. In an effort to summarize these recommendations and give the ARES® operator some idea of useful courses to take, let's offer the following:

- The ARRL EC-001 — This online course is designed to provide basic knowledge and tools for any emergency communications volunteer. Prerequisites include IS-100 and IS-700. The ARRL also recommends IS-250, *Emergency Support Function 15* and IS-288, *The Role of Voluntary Agencies in Emergency Management*.

- American Red Cross or American Heart Association CPR and Automatic External Defibrillator (AED) courses — These courses are available at hospitals, colleges, and Red Cross offices and centers. Providing emergency communications in an actual emergency increases the likelihood of an ARES® volunteer having to assist someone needing CPR.

- IS-100 — This course is a must-have not only because it is a requirement of most agencies, but because it imparts an understanding of the contemporary emergency management landscape. How can you function as a viable emergency communicator without a basic idea of what is going on around you on a disaster scene? Government agencies manage emergencies and disasters using the ICS as a standard playbook. You need to know how it works.

- IS-700 — This course introduces NIMS, which serves as a "consistent nationwide

template to enable all government, private-sector and nongovernmental organizations to work together during domestic incidents." The NIMS course is the other shoe for the government's emergency response framework and as such should be near the top of any ARES® volunteer's course list.

■ IS-200 — According to FEMA, this course is "designed to enable personnel to operate efficiently during an incident or event within the ICS. IS-200 provides training and resources for ICS supervisory procedures."

■ IS-230, *Fundamentals of Emergency Management* — Garth Kennedy, W9KJ, the emergency manager for the Naperville, Illinois EMA, recommends this course: "I manage a large emergency management agency. Most of our volunteers do not understand what constitutes 'Emergency Management.' As a result, we require IS-230 for any certification level in all of our specialties. I recommend adding this course to your list so ARES® operators will more fully understand the environment in which they work."

Mike Corey, KI1U, ARRL HQ's Emcomm planner and response manager, recommends the following core courses. For the rank-and-file ARES® field operator: ARRL EC-001, a basic SKYWARN class, IS-100, IS-200 and CPR/First Aid/AED.

For ARES® leaders including Emergency Coordinators, District ECs and Section Emergency Coordinators, ARRL HQ recommends ARRL EC-016, *Public Service and Emergency Communications Management for Radio Amateurs*, designed to train Amateur Radio operators for leadership and managerial roles organizing other volunteers. HQ also recommends an advanced SKYWARN class, IS-700, IS-800 and IS-802, *Emergency Support Function #2 – Communications*. And finally, Red Cross Disaster Services training is recommended, even if you do not work directly with the Red Cross. You should know how the Red Cross conducts field operations, an issue that was raised during the Hurricane Katrina mega-response.

Bottom Line

I recently toured a local EOC that is probably typical of most EOCs in size and functioning. The emergency manager turned on his projector to show me his database of volunteer resources: a large matrix of volunteers typed by their function, training in FEMA courses and others. It seemed to me, for the future of ARES®, the writing was, literally, on the wall.

OREGON ARES SHAKE EX 2011: AN EARTHQUAKE DISASTER SET

Vincent Van Der Hyde, K7VV, Oregon Section Emergency Coordinator, **k7vv@arrl.net**

John Core, KX7YT, Oregon Section ARES SET Coordinator, **kx7yt@arrl.net**

In the future a major earthquake will strike the Pacific Northwest. Within half an hour, a tsunami similar to the one that devastated Japan on March 11, 2011, will occur along the Oregon Coast.

On April 9, 2011, 1 month after the disastrous Japanese earthquake and tsunamis, Oregon ARES volunteers conducted a statewide simulated emergency test (SET) to determine their readiness to respond to just such a disaster. Although the SET was planned well before the events in Japan, the reality that similar events could happen in Oregon added to the realism of the exercise.

Geologists tell us that, historically, earthquakes in our region occur at 300 year intervals. Should Oregon be struck there would likely be catastrophic, widespread damage and an immediate need for ARES support.

The SHAKE EX 2011 SET was designed to test ARES ability to exchange very high volumes of written messages between the county Emergency Managers and the Oregon Emergency Management (OEM) office. Much of the radio traffic exchange occurred over the Oregon ARES Digital Network (OADN), which uses Winlink HF and VHF radio systems funded by the State of Oregon.

In addition to statewide communications activities, many counties held their own local drills in coordination with their local Emergency Managers, medical facilities and Community Emergency Response Teams (CERT). The local drills typically included HF radio systems at remote locations using portable antennas. Local drills included the transmission of photographs by radio to county and state EOCs and relaying simulated damage reports between stations.

About 130 members of Oregon ARES participated throughout the state sending and receiving about 2000 messages within the 6 hour SET period. Most of the traffic was sent by HF and VHF using the Winlink OADN system. During the height of the SET activity, OEM operators were receiving about one message per minute from ARES operators throughout Oregon.

The Oregon ARES Digital Network consists of HF radios equipped with Pactor 3 modems as well as V/UHF radios equipped with TNCs for local Winlink RMS gateways. Both radio systems are used with laptop computers loaded with Winlink *Airmail 3* software. With a few exceptions, each county EOC has an identical set of equipment. Training of ARES units receiving the equipment was completed in 2009 during installation. Since then, quarterly connectivity exercises and the twice-yearly statewide SETS have helped insure that the OADN system remains fully operational.

Lessons Learned

During a disaster of the scale anticipated during this SET, there will likely be an overwhelming volume of written and tactical traffic between emergency managers. At such times, it is essential that the flow of messages from ARES radio operators to and from these officials be accurate, efficient and timely. Although the technology used by ARES units to communicate worked well, the flood of messages being received at many EOCs overwhelmed everyone's ability to log, manage and distribute them. Several options have been proposed to deal with this data management issue and they are discussed in the March issue of the *ARES E-Letter*.

On the left, Don Kendall, N6VKW, Curry County (Oregon) Emergency Services Coordinator, is explaining to Bob Wilkinson, W7VN, ARES EC for Curry County the potential for transportation disruption from the probable collapse of the Patterson Bridge across the Rogue River in the predicted earthquake and tsunami. [Lorraine Wilkinson W7RFC].

The demonstrated ability of Oregon ARES volunteers to successfully support the large-volume written and tactical traffic demands of Oregon's emergency managers under the limited restrictions imposed during this SET were impressive. The tougher operating conditions imposed by a real disaster will prove to be the ultimate test, of course.

Contest Corral – March 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
2	0200Z	2	0300Z	1.8-14 / -	SNS and NS Weekly Sprints	CW	Serial, name, and S/P/C	www.ncccsprint.com/rules.html
3	0000Z	4	2400Z	1.8-28 / -	ARRL Int'l Phone DX Contest	Ph	RS and state, province, or power	www.arrl.org/contests
3	0000Z	4	2400Z	- / 432, 3.4G	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org
3	2000Z	3	See web	1.8-28 / -	Open Ukraine RTTY Championship	Dig	Regional abbreviation and serial	uarl.com.ua/openrtty
5	1600Z	5	See web	3.5 / 50	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
6	0200Z	6	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
6	1900Z	6	2100Z	3.5 / -	YL CW Party	CW	RST, serial, if YL "YL," name	www.agcw.de
7	2300Z	8	See web	7,14 / -	John Rollins Memorial DX Contest	CW	RST, name, and S/P/C	www.antiquewireless.org
10	1000Z	11	1000Z	3.5-28 / -	RSGB Commonwealth Contest	CW	RST and serial (Commonwealth only)	www.rsgbcc.org
10	1400Z	10	2000Z	3.5-28 / -	AGCW QRP Contest	CW	RST, serial, class, AGCW number or NM	www.agcw.de
10	1500Z	10	1800Z	3.5-28 / -	QRP ARCI HF Grid Square Sprint	CW	RST, 4-digit grid square, QRP ARCI number	www.qrparci.org/contests
10	1600Z	11	1600Z	3.5-28 / -	EA PSK63 Contest	Dig	RST + serial or EA province	www.ure.es
10	1900Z	11	1900Z	1.8-28 / 50-440	Idaho QSO Party	Ph CW Dig	RS(T) and Idaho county, or S/P/C	www.nx7tt.com
11	0000Z	11	0400Z	3.5-14 / -	North American RTTY Sprint	Dig	Both call signs, serial, name, and S/P/C	www.ncjweb.com
11	1800Z	12	0100Z	3.5-28 / 50+	Wisconsin QSO Party	Ph CW Dig	WI county or S/P/C	www.warac.org
14	1100Z	15	See web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
17	12 PM	17	2 PM	1.8-28 / -	Feld-Hell St Patrick's Day Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
17	0001Z	17	2359Z	28 / -	10-10 Mobile QSO Party	Ph CW Dig	Call, name, county & S/P/C, 10-10 number	www.ten-ten.org
17	0200Z	19	0200Z	3.5-28 / -	BARTG HF RTTY Contest	Dig	3-digit serial and 4-digit time	www.bartg.org.uk
17	1200Z	18	1159Z	3.5-28 / -	CQIR - Ireland Calling	Ph CW	Serial and county code	www.irts.ie
17	1200Z	18	1200Z	1.8-28 / -	Russian DX Contest	Ph CW	RS(T), serial or oblast abbr	www.rdxc.org
17	1300Z	18	See web	3.5-28 / 50	Oklahoma QSO Party	Ph CW Dig	RS(T) and OK county or S/P/"DX"	www.k5cm.com/okqp.htm
17	1400Z	18	See web	1.8-28 / 50-440	Virginia QSO Party	Ph CW Dig	Serial and VA county/city or S/P/C	www.qsl.net/sterling
17	1800Z	18	1800Z	1.8-28 / 50,144	North Dakota QSO Party	Ph CW	RST and ND county or S/P/C	www.w0nd.com
20	1700Z	21	See web	3.5-28 / -	CLARA and Family HF Contest	Ph CW	RS(T), name, QTH, and CLARA	www.claranet.ca
22	0030Z	22	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
24	0000Z	25	2400Z	1.8-28 / -	CQ WPX SSB Contest	Ph	RS and serial	www.cqwpx.com
31	0000Z	1	2400Z	- / 144, 10G+	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org

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 the cover date (February 1 for April *QST*). Listings in blue indicate contests sponsored by ARRL or *NCJ*.

Sean's Picks

Sean Kutzko, KX9X, ARRL Contest Manager

All dates/times are in UTC.

- **State QSO Parties this month:** Idaho, North Dakota, Oklahoma, Virginia, Wisconsin.
- **QRP contests this month:** ARS Spartan Sprint (March 6), AGCW QRP Contest (March 10), QRP-ARCI HF Grid Square Sprint (March 10), Flying Pigs Run for the Bacon (March 19), NAQCC monthly QRP Sprint (March 22).
- **ARRL International DX Contest, Phone (March 3-4):** The phone version of the longest-running DX Contest. Stations in the US/Canada work DX, DX works US/Canada only. With the great propagation available now, DXCC in a weekend, even for a fairly modest station, is achievable with some effort. Can you work 100 countries in a weekend? Yes, you can!
- **North American RTTY Sprint (March 10):** Four hours of fast, frenetic FSK! This event is gaining momentum fast…a great way to spend an evening and get your RTTY contest fix while leaving lots of time on the weekend for other things. Don't miss it!
- **Russian DX Contest (March 17-18):** 24 hours of DXing with both phone and CW. How many Russian oblasts (states or regions) can you work? Find out!
- **BARTG HF RTTY Contest (March 17-18):** One of the great digital-mode contests. Exchange is a 3-digit serial number and the time of QSO (in UTC, of course!). Everybody works everybody.
- **CQ WPX Contest, SSB (March 24-25):** Prefixes are the name of the game for this 48 hour worldwide event, making a KB6 just as important as an XX9. Work as many different prefixes as you possibly can!

2011 ARRL September VHF QSO Party Results

It was all guts! — KB0HH/R

Jeff Klein, K1TEO
wa2teo@aol.com

After terrific activity and band conditions in the 2011 June VHF contest, the hope was that Mother Nature would help create some more excitement in the September contest. Alas, band conditions were mostly rather bland and activity was lower than in prior years. However, with some help from rovers the contest was still a great deal of fun and very competitive across North America. In particular, congratulations are due to Bruce, W9FZ, who once again organized Midwest Mania (see Figure 1) with a slew of rovers operating across the Great Plains.

By the Numbers

Checking all of the submitted logs indicates that a total of about 2800 stations made at least one contact with one of the 434 entrants. Thus, only 15% of the contest participants actually sent in a log. No doubt many were stations that just happened to find a contest station and worked them while not actively seeking contacts. It does indicate the challenge of encouraging contest participants to submit their logs. W2SZ, for example, worked a total of 517 unique calls, more than the total number of official entries in the contest! The Unique Calls table shows the unique calls worked and total contacts for some of the top stations around the country.

Among the Limited Multioperator (LM) stations in the table, W3SO managed to work the most on multiple bands, averaging 2.4 QSOs with each unique call. With LM stations allowed to operate on up to four bands, 'SO did a great job of pushing each station to run the bands with them. I know from direct experience that as soon as you work 'SO regardless of band the operator will encourage you to move to the other three bands with them immediately.

Likewise, Single Operator K1RZ averages 3.7 QSOs with each call worked. Dave does a great job of taking the time to work those difficult microwave contacts that others might pass on. With severe thunderstorms between us, Dave encouraged me to try different dish headings to see which storm cells we could use to work via rain scatter for a 10 GHz contact. It took a good 10 minutes or so but we finally succeeded, adding a new multiplier for both of us.

KB0HH operates in an area of the country with relatively low local activity. To do well — and they did with a high finish in the Multioperator category — they need to work every station available on as many bands as possible. They only worked 84 different stations but had the highest number of QSOs with each unique call of any fixed station. Given the Midwest Mania rovers and several others equipped with many bands, they made sure to work each station on as many frequencies as possible, averaging an outstanding 5.2 QSOs with every unique station they found.

Another factor in contesting success is operating on as many bands as possible. Often in the June contest quite a few of the high-scoring stations will make the bulk of their contacts on 6 meters. In fact, when six is open the other bands often are somewhat inactive. To score well in the September contest it is important to be active on as many bands as possible. Virtually all of the top Single Operator and Multioperator stations were on several microwave bands and many had all bands through 10 GHz.

Two meters is the most popular band for contacts in the September contest followed by 6 meters. However, when QSO points are taken into account 432 MHz is the second "most valuable" band, not far behind 2 meters. 1296 MHz accounts for about half as many points as 6 meters, which is impressive given far fewer stations operate on the band. While grid totals on 6 meters are still an important factor in September, they are not much higher than the totals that can be worked on 222 and 432 MHz. These are far different charts than similar ones for the 2011 June VHF QSO Party in which conditions allowed huge QSO and grid totals on 6 meters.

Another factor in contesting success and enjoyment is how to allocate whatever time is available for operating. Figure 2 shows total QSOs by hour of the contest. There are several overnight hours with very few contacts followed by a large jump at around 9 AM local time on the East Coast. Activity peaks again in the Sunday morning hours and then falls off until a small peak about two to four hours before the finish. If you have limited time and want to make the most contacts, it pays to be active in the first few hours and again on Sunday morning. A different view might be that as QSOs get fewer and farther between, taking a break and getting back on the air on Sunday afternoon as "fresh meat" might be a good way to go.

Single Operator, Low Power

K2DRH	186,519
WB1GQR (W1SJ, op)	119,280
W3PAW	104,760
K1KG	83,750
K2KIB	82,432
N3YMS	74,015
AF1T	66,744
WB2SIH	53,972
W3SZ	39,237
WA2VNV	36,366

Single Operator, High Power

K1TEO	461,370
WA2FGK (K2LNS, op)	315,600
K1RZ	240,975
K3TUF	224,885
W0UC	72,160
K8TQK	61,502
WB2RVX	57,536
VA3ST	44,908
K4QI	44,821
N3HBX	44,118

QRP Portable

W1MR	33,803
W9SZ	22,991
N6LB	4,526
N1PRW	2,574
WB2AMU	2,492
AB1MI	1,717
KB5WIA	1,311
N0JK	851
KD9KC	784
KC8KSK	112

Limited Multioperator

K1WHS	191,574
W3SO	163,805
K2LIM	101,060
AA4ZZ	64,701
W4IY	57,404
K2BAR	37,668
N1WK	25,063
W1QK	15,312
W0VB	6,384
K2TVI	5,576

Multioperator

W2SZ	1,009,348
N3NGE	308,186
W2EA	182,434
KB0HH	109,668
K3EOD	97,760
K5QE	91,096
VE7DXG	31,076
N8KOL	30,923
N9UHF	27,058
W4NH	17,080

Rover

W1RT/R	245,804
VE3OIL/R	119,634
VE3SMA/R	99,802
W9SNR/R	69,760
WA3PTV	55,500
W1AUV/R	36,103
KE3HT/R	27,360
K0DAS/R	22,849
W9FZ/R	19,437
WA2BTR/R	19,435

Limited Rover

K2QO/R	65,968
WA0VPJ/R	22,200
K6BRW/R	11,760
K9JK/R	11,172
WW7D	10,076
AL1VE/R	4,181
N6ORB/R	3,030
K8DOG/R	2,266
W0ZF	1,325
AB8M	1,265

Unlimited Rover

NN3Q	52,041
KR0VER/R	12,768
KJ1K/R	8,320
KD5IKG/R	1,738
VE6KC	816

BRUCE, W9FZ

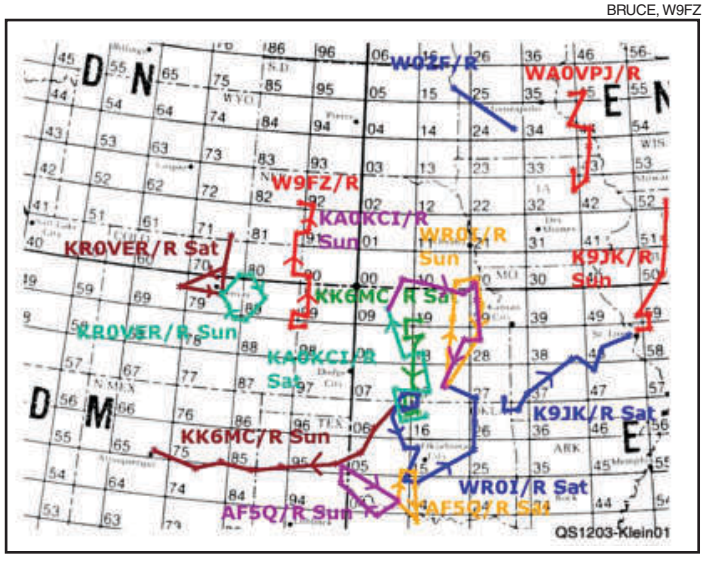


Figure 1 — Bruce, W9FZ, organizes Midwest Mania every year, coordinating and encouraging rover stations to activate as many grids as possible. In 2011, 10 different rover stations were activating grids across the Midwest.

ANDY ZWIRKO, K1RA

The W1RT rover van was active on quite a few bands as this photo shows. John, W1RT, gives his antennas some "hands-on" attention on Mohawk Mountain in FN31!

Band Conditions

September contests can see a wide range of conditions including tropo, meteor scatter, aurora, and even sporadic E on 6 meters. 2011 brought little extra excitement from enhanced conditions though some astute operators were able to make use of a weak aurora opening on Saturday evening to work extra grids. For example, WA2FGK noted working five otherwise unworkable grids on 6 meters from northeast Pennsylvania. Single Operator, Low Power overall winner K2DRH made a number of aurora contacts and even Single Operator, QRP station W9SZ was able to work a few stations using the aurora.

Single-Operator Categories

The Single-Operator Low Power (SOLP) category remains the most popular with over half of all log submissions. Frequent top scorer K2DRH returned to the top spot this year with over 186k points. Bob's key was working terrific grid totals on the bottom four bands combined with impressive totals on the microwaves. On 50 through 222 MHz he was either second or third in grid totals on each band for all categories including multi-operator stations.

Top Regional results included a trio of excellent scores from the Midwest from N0LL, K0SIX and W0ZQ. On the West Coast, the leading SOLP results were from KD7UO, AF6RR, W6OMF, VE7FYC and KG7P. In the Southeast N4QWZ had 15k points to lead the competition followed by KX4R and K4FJW who were separated by only 8 points!

K1TEO repeated as the top scorer in the Single-Operator High Power (SOHP) category. Jeff's score improved about 20% over 2010 despite similar conditions and activity. The big difference was finding and working rovers on the microwaves in rare grid squares helping to improve his multiplier and QSO point total over the prior year.

Other regional scores of note included W0GHZ who just missed making the national Top Ten from the Midwest region. In the Southeast W3IP and KN4SM had a tight contest to finish second and third in the region for SOHP behind K4QI. The top West Coast Region score came from the Pacific Northwest as N7EPD scored 25k with KC6ZWT in second and W7FI in third for the SOHP category.

Single-Operator Portable Operation

Chris, W1MR (formerly KA1LMR) finished atop the Single-Operator Portable (SOP) category. He had some excellent competition from W9SZ in Illinois. Zack was actually able to make some aurora contacts even at the 10 W level though he heard more than he could work during the opening. He noted some good microwave activity this time helping him to his fine finish.

Affiliated Club Competition

Medium Club

Mt Airy VHF Radio Club	17	1,144,326
North East Weak Signal Group	21	1,003,386
Potomac Valley Radio Club	17	637,067
Contest Club Ontario	11	316,651
Northern Lights Radio Society	13	230,054
Society of Midwest Contesters	7	225,999
Badger Contesters	9	140,467
Pacific Northwest VHF Society	20	106,714
Cold Brook Contest Club	3	70,066
Yankee Clipper Contest Club	6	30,669
North Texas Microwave Society	5	21,671
Frankford Radio Club	3	7,744
Mad River Radio Club	3	5,394
Florida Contest Group	5	1,855
Northern California Contest Club	5	1,605
Grand Mesa Contesters of Colorado	4	922
Western New York DX Assn	4	790

Local Club

Bergen ARA	4	37,870
Stoned Monkey VHF Amateur Radio Club	3	27,135
Bristol (TN) Amateur Radio Club	3	9,808
Western New York DX Assn	4	790
Portage County Amateur Radio Service	3	508

Multioperator Categories

After winning the Multioperator (MO) category in 2010 for the first time, the K1WHS team moved into the Limited Multi-operator (LM) category and gained another victory. On 6 meters they managed a contest-leading total of 63 grids, an impressive total given the overall flat conditions.

The MO team of W2SZ had a rare second-place finish in 2010 but came back to dominate the category this time around. Despite the conditions and activity level they still managed to exceed one million points. As is often the case, they had the top QSO and grid totals on all of the microwave bands in addition to impressive results on the bottom four bands. Perhaps 2012 will see another battle of the heavy weights between 'SZ and 'WHS?

Rover Categories

A total of 54 rovers submitted logs this year with over half in the traditional Rover category that was won by a strong effort from W1RT. Operating with the assistance of Andy, K1RA, John piloted the "Jitney" through 7 grids amassing a total of 245k points.

The Limited Rover (RL) category had 18 competitors this year with K2QO leading the pack. Mark managed 65k points in his rove that started in New England and ended up close to home in Western New York. The 'QO team managed nearly 500 QSOs on four bands and noted making many contacts on CW to help the score.

The final rover category is Unlimited Rover (RU) and this year there were five entries. NN3Q roved in the Mid-Atlantic area and was first after several top scores in

Regional Leaders

A = Single Operator, Low Power; B = Single Operator, High Power; Q = Single Operator, QRP Portable; L = Limited Multioperator; M = Multioperator; L = Limited Multioperator; R = Rover; RL = Limited Rover; RU = Unlimited Rover

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

WB1GQR (W1SJ, op)	119,280	A
W3PAW	104,760	A
K1KG	83,750	A
K2KIB	82,432	A
N3YMS	74,015	A
K1TEO	461,370	B
WA2FGK (K2LNS, op)	315,600	B
K1RZ	240,975	B
K3TUF	224,885	B
WB2RVX	57,536	B
W1MR	33,803	Q
N1PRW	2,574	Q
WB2AMU	2,492	Q
AB1MI	1,717	Q
K1WHS	191,574	L
W3SO	163,805	L
K2LIM	101,060	L
K2BAR	37,668	L
N1WK	25,063	L
W2SZ	1,009,348	M
N3NGE	308,186	M
W2EA	182,434	M
K3EOD	97,760	M
W3KWH	2,625	M
W1RT/R	245,804	R
WA3PTV	55,500	R
W1AUV/R	36,103	R
KE3HT/R	27,360	R
WA2BTR/R	19,435	R
K2QO/R	65,968	RL
W0BL/R	182	RL
WB2AIV/R	70	RL
W1PL	56	RL
NN3Q	52,041	RU
KJ1K/R	8,320	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

N4QWZ	15,272	A
KX4R	5,568	A
K4FJW	5,560	A
W2BZY	3,827	A
WK4P	3,335	A
K4QI	44,821	B
W3IP	41,952	B
KN4SM	31,270	B
NT4RT	4,365	B
AA4DD	4,218	B
KC8KSK	112	Q
N3AWS	6	Q
AA4ZZ	64,701	L
W4IY	57,404	L
NE5BO	96	L
W4NH	17,080	M
WY3P	10,553	M
W4PK	306	M
K4QE	180	M
KD2JA	136	M
AG4V	3,400	R
K6PFA/R	816	RL

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

K2DRH	186,519	A
KC9BQA	18,648	A
WZ8T	17,854	A
VE3KZ	14,555	A
KF8QL	10,384	A
W0UC	72,160	B
K8TQK	61,502	B
VA3ST	44,908	B
K8MD	34,776	B
K9EA	28,704	B
W9SZ	22,991	Q
KC9MMM	32	Q
KD8LDX	4	Q
N2BJ	3,920	L
W9RVG	3,276	L
N8KOL	30,923	M
N9UHF	27,058	M
KO9A	7,672	M
VE3OIL/R	119,634	R
VE3SMA/R	99,802	R
W9SNR/R	69,760	R
VE3CRU/R	17,215	R
VE3MSC	481	R
K9JK/R	11,172	RL
K8DOG/R	2,266	RL
AB8M	1,265	RL
VE3RKS/R	1,152	RL

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

N0LL	34,884	A
K0SIX	25,628	A
W0ZQ	23,166	A
K0MHC	15,450	A
WB5ZDP	11,592	A
W0GHZ	43,890	B
WQ0P	40,460	B
K0AWU	10,647	B
K9MK	8,477	B
KF0M	4,387	B
N0JK	851	Q
KD9KC	784	Q
NA5O (AA5JG, op)	6	Q
W0VB	6,384	L
WB0BQV	2,440	L
WD5IYF	1,566	L
N0LD	819	L
KB0HH	109,668	M
K5QE	91,096	M
KC5MVZ	1,220	M
W0RIC	273	M
K0DAS/R	22,849	R
W9FZ/R	19,437	R
KA0KCI	12,852	R
AC0VQ/R	7,095	R
KK6MC/R	6,683	R
WA0VPJ/R	22,200	RL
W0ZF	1,325	RL
K0NR/R	40	RL
KR0VER/R	12,768	RU

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

KD7UO	9,020	A
W6AQ	10,745	A
AF6RR	8,772	A
W6OMF	5,764	A
VE7FYC	5,092	A
KG7P	4,587	A
N7EPD	25,830	B
KC6ZWT	10,528	B
W7FI	10,258	B
W7CE	7,755	B
K7AWB	4,028	B
N6LB	4,526	Q
KB5WIA	1,311	Q
W6MDH	6	Q
VA7GNR	6	Q
W7BI	3,132	L
WW7LW	1,140	L
N7KN	798	L
VE6AO	128	L
VE7DXG	31,076	M
W6TV	14,322	M
W6AB	7,480	M
KC7I	6,201	M
VE6NQ	1,617	M
KD7TS/R	12,264	R
K7HPT/R	4,110	R
K7MDL/R	867	R
VE7BQQ	216	R
K6BRW/R	11,760	RL
WW7D	10,076	RL
AL1VE/R	4,181	RL
N6ORB/R	3,030	RL
K6LMN/R	468	RL
VE6KC	816	RU

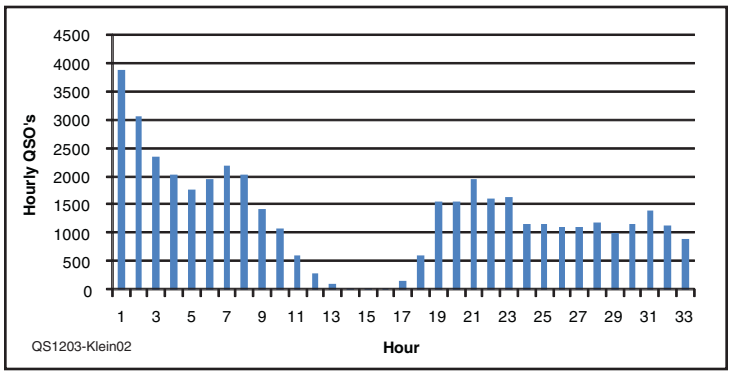


Figure 2 — QSOs made by hour for all stations shows the pattern of activity throughout the contest.

Unique Calls and Total Contacts

Station	*Category*	*Unique Calls Worked*	*Total QSOs*	*QSOs Per Unique Call*
W2SZ	MM	517	1599	3.2
K1WHS	LM	416	869	2.1
W3SO	LM	294	690	2.4
K1TEO	SOHP	290	920	3.2
K2BAR	LM	274	438	1.7
AA4ZZ	LM	255	437	1.7
N3NGE	MM	247	765	3.1
WA2FGK	SOHP	197	699	3.5
WB1GQR	SOLP	195	549	2.9
K1RZ	SOHP	184	669	3.7
K5QE	MM	176	332	1.9
K2DRH	SOLP	141	491	3.5
W1RT/R	R	102	740	7.5
W3PAW	SOLP	101	381	3.9
KB0HH	MM	84	434	5.2

prior years in Rover. This time they racked up 52k points on 10 bands.

Club Competition

The September VHF QSO Party features an ARRL Affiliated Club Competition in addition to the individual categories. The Mt Airy VHF Club has a long history of Medium Club wins in the January VHF Sweepstakes and has now extended that success to September. With 17 log entries they ended up with over a million points to edge the North East Weak Signal Group by a little over 100k points.

In the Local Club competition the Bergen Amateur Radio Association took the top spot in a close competition with the Stoned Monkey VHF Amateur Radio Club. Third place went to the Bristol Amateur Radio Club.

In Closing

The 2012 September VHF QSO Party is slated for September 8 through 10. It's a great end of the summer bash for those dedicated VHF+ operators looking forward to the possibility of good conditions, an opportunity to work some new grids, and the chance to say hello to old friends on the bands. Plan to get on and enjoy the fun and do not forget to submit a log so your score counts!

Details Online

More details of the competition, photos and charts are available in the online version of this article at **www.arrl.org/contests**.

2011 IARU HF World Championship Results

We've come a long way...

Carl Luetzelschwab, K9LA
k9la@arrl.net

The July 2011 running of the IARU HF World Championship was very similar to the July 1998 event — both were during the initial ascent of a solar cycle — Cycle 23 for the 1998 contest and Cycle 24 for the 2011 contest. Figure 1 depicts "where we are" and "where we were."

So what's happened to this increasingly popular summer contest in the last 13 years? The most obvious difference is the number of logs submitted. Back in 1998 there were 1340 log submittals. The 2011 event ended up with 3676 log submittals. That's almost a three-fold increase in participation that gives everyone that many more people to work (and don't forget that translates into more stations to work on all the bands and on the two modes, too).

With more logs submitted, one would expect higher scores in 2011 compared to 1998. Indeed, the scores are higher — except for the World Phone category. See the web version online for score details. (I assumed High Power for 2011, whereas the 1998 contest did not delineate power.) But I also believe operator skill, available operator tools and station improvements have pushed scores higher in the 13 years since 1998.

From Novice Roundup to IARU HF Championship

Jim, N1RU, posted this to the Soapbox area on the ARRL website about IARU 2011: "This was the first contest that I'd entered since the 1981 Novice Roundup. I had a great time. After nearly 20 years off the air, I'm back on HF with a QRP signal and an attic antenna. I'm enjoying ham radio as much as ever, and I'm looking forward to my next contest."

Jim participated in the 1981 ARRL Novice Roundup (NR) as a Technician with the call N3BLZ/T from Maryland-DC. He made 53 QSOs in 29 sections and operated a total of 10 hours: In 1981 the NR was 9 days long and you could operate a total of 30 hours. Welcome back to contesting, Jim!

The old NR was a great event geared toward Novices and Technicians to whet their appetite to contesting, to increase their WAS and DXCC totals, and to increase their code speed. I can vouch that all three of these enticements worked, based on my participation in the 1962 NR.

Propagation

As Cycle 24 continues its ascent, we will experience better propagation. The July 2011 running of the IARU contest took advantage of the improved conditions on the higher bands. Figure 1 shows Cycle 24 is on the increase but what's not certain is how high it will go. Most solar scientists believe is will be below average with a peak smoothed sunspot number of 90 in early 2013.

The 10.7 cm solar flux hovered around 90 for the contest weekend. That's not bad but being in the summer months doesn't help the maximum useable frequency (MUF) on the higher bands as much as it would help in the fall, winter and spring months.

There were a couple of B-Class solar flares (the smallest ones on the B, C, M and X scale) on the 9th and 10th, but their effect was minimal. The K index was well-behaved for the most part — mostly 3 and under from 1200 UTC on July 9 to 1200 UTC on July 10. The K indices were a bit higher than on previous days due to a high-speed stream of material from a coronal hole.

Overall, we had pretty decent space weather for the 2011 contest, which re-

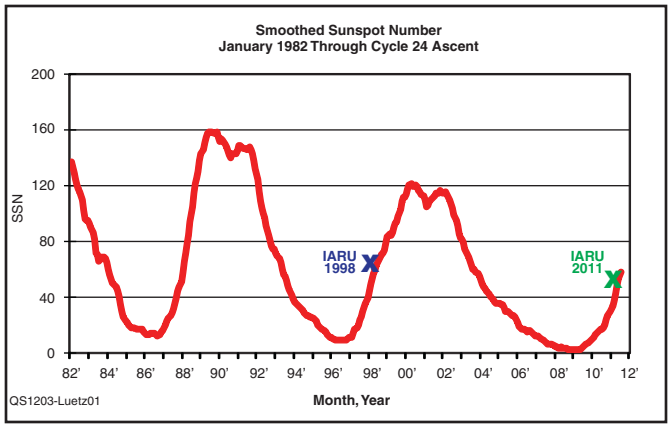


Figure 1 — Solar activity during the 2011 and 1998 IARU contests.

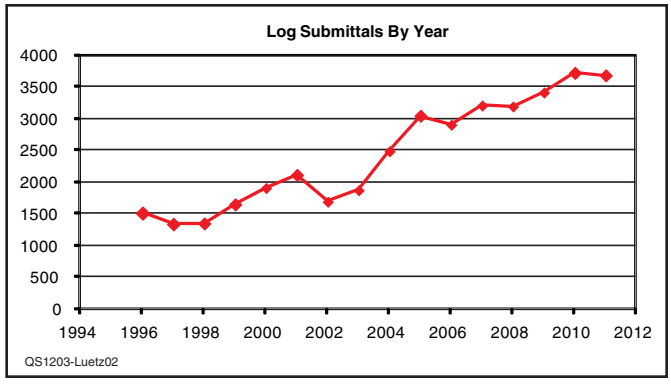


Figure 2 — Log submittals by year.

sulted in pretty decent propagation. Next year should be better with even higher solar flux/sunspot numbers (barring a major solar eruption that would adversely affect the ionosphere).

2011 Participation Statistics

Logs — As mentioned above, the 2011 event had 3676 logs submitted, containing over 1.2 million QSOs. There were almost 1.4 million QSOs in 2010 — no doubt WRTC 2010 in Russia helped last year. The 2011 event didn't break last year's record number of logs of 3714 but it wasn't far behind (only 1% lower). Figure 2 shows a steady increase in log submittals each year.

Zones — Participants from 52 ITU zones submitted logs for the contest. Zone 28 (eastern and southern Europe) led the pack with the most submitted logs — approximately 30% of the logs submitted came from Zone 28. Zone 29 (the old European Russia) was a distant second (approximately 13% of the logs). Rounding out the Top Five was Zone 8 (east coast of North America), Zone 27 (northwestern Europe) and Zone 45 (Japan).

Category and Power — With respect to category and power, CW Low Power was the most popular at just over 21% of the participants. Phone Low Power was next with just under 20% of the participants. In third was Mixed Low Power (15.5%), and in fourth was MultiOp with just under 15%. Only 48 and 47 contesters braved Mixed QRP and Phone QRP, respectively. By category, CW led the group, Phone was second, and Mixed was last. By power, Low Power won handily with over 56% of the participants running barefoot. High Power was second with about 24% of the participants and QRP was third with about 6%.

Bands — As expected from previous years' results, 20 meters had the most QSOs — almost one half of the total. Coming in second for the total of QSOs was 40 meters at about 20% and 15 meters was right behind at 18.4%. With increased solar activity, 10 meters (7.3%) beat out 80 meters (6.4%). As expected, 160 meters was the least-used band at 1.2%.

W/VE

Single Operator, Mixed Mode, QRP

K8ZT	112,592
NN7SS (K6UFO, op)	72,242
KS4X	21,632
W9XN	11,100
ND3D	8,658

Single Operator, Mixed Mode, Low Power

VE3DZ	1,196,192
N8OO	1,036,350
K2PO	487,277
K9OM	431,148
NR3X (N4YDU, op)	387,660
W9IU	351,650
N7ZG	317,312
AD4Z	312,984
VE1ZA	237,690
W1WBB	226,980

Single Operator, Mixed Mode, High Power

VY2ZM (K1ZM, op)	2,989,540
VE3EJ	2,544,638
K3CR (LZ4AX, op)	2,494,800
N5DX	2,395,215
NK7U (KL9A, op)	1,921,539
W2GD	1,582,725
K3ZO	1,478,304
K7RL	1,456,730
W4AN (K4BAI, op)	1,425,936
K6XX	1,126,816

Single Operator, Phone Only, QRP

W6QU (W8QZA, op)	39,375
NT4TS	21,294
KC5WA	8,502
VA7IR	4,375
VA3WPV	3,332
N6LB	1,020
KD4OFG	960
N8XA	900
AA2VK	209
N6RWT	116

Single Operator, Phone Only, Low Power

W4SVO	633,060
K1WO	110,445
K5DHY	83,904
W5GFI	78,806
VA3GKO	65,504
N8RF	47,988
WB0TSR	42,918
K4WES	38,252
K3FIV	37,520
VE2HIT	34,880

Single Operator, Phone Only, High Power

W7WA	1,314,975
KK1KW	996,060
WB9Z	799,755
K5ER	293,454
N2RJ	259,000
KM2O	239,580
K9MWM	169,944
NN4F	145,530
K7LY	135,920
AC8G	133,868

Single Operator, CW Only, QRP

VE3GTC	100,580
K0PK	80,301
K4QPL	71,024
W5GAI	28,221
AI9K	27,898
KK1W	25,694
VA3RJ	13,275
N3CZ	12,246
N8XX	11,886
K5TA	10,152

Single Operator, CW Only, Low Power

W1NN	576,774
K2SSS	533,822
VA1CHP	531,632
VE1RGB	492,072
WI2E	423,984
WB4TDH	389,973
KB1T	388,700
KV8Q	325,872
VE3EY	322,230
N2GA	311,454

Single Operator, CW Only, High Power

K8PO	2,216,578
AA3B	2,061,210
WC1M	1,762,736
N2IC	1,710,859
NY3A	1,690,242
N4OGW	1,421,192
N9RV	1,389,617
K9NW	1,093,260
K5TR (K5OT, op)	1,066,338
N4AF	1,011,675

Multioperator

NN3W	2,390,710
N0NI	1,878,170
K0RF	1,774,150
K8AZ	1,743,605
NX5M	1,738,100
NR4M	1,557,612
W1UJ	1,536,270
K2LE	1,296,012
WT1T	1,174,187
N1LN	1,117,185

Worldwide

Single Operator, Mixed Mode, QRP

HA8BE	520,905
R3VA	328,933
US2IZ	231,568
SP4GFG	181,350
RW7M	159,555
CT7/LZ3ND	155,064
9A2EY	148,992
SP5DDJ	120,704
LY4BF	120,523
K8ZT	112,592

Single Operator, Mixed Mode, Low Power

LY9A	1,536,954
S53MM	1,240,680
RW0A (RA0AM, op)	1,223,592
VE3DZ	1,196,192
LY4L	1,085,696
JT0YPS (UA9YPS, op)	1,045,302
N8OO	1,036,350
7Z1SJ	1,005,916
RW9C	948,090
PY2SEX	936,792

Single Operator, Mixed Mode, High Power

CN3A (IK2QEI, op)	4,281,588
UP0L	3,627,600
RG9A	3,621,264
UP2L (UA9BA, op)	3,553,932
UU7J (UU4JMG, op)	3,135,114
RG3K	3,080,916
R9DX	3,004,410
VY2ZM (K1ZM, op)	2,989,540
ES5TV	2,771,454
OM3BH	2,576,284

Single Operator, Phone Only, QRP

HG1W (HA1WD, op)	298,284
HA5BKV (HA5NB, op)	182,864
TG9ANF	145,432
SP4LVK	106,368
IV3AOL	83,974
IZ1JLF	59,994
OK4AS	45,479
W6QU (W8QZA, op)	39,375
M0LPT	38,024
US5IND	36,672

Single Operator, Phone Only, Low Power

ZX2B	740,624
UV8M (UX3MR, op)	705,572
HA3DX (HA4XH, op)	653,691
W4SVO	633,060
KP2/AA1BU	632,487
RW1CW	622,557
IW1QN	543,982
CR5M (CT1DHM, op)	542,304
UA3BL	416,355
HI3TEJ	399,312

Single Operator, Phone Only, High Power

PP5XX	2,249,190
ES5RW	1,781,472
US5D (UT7DX, op)	1,511,486
EA4KD	1,377,068
UX0FF	1,373,157
W7WA	1,314,975
YO3CZW	1,172,947
KK1KW	996,060
F4BKV	952,754
EA1PP	909,792

Single Operator, CW Only, QRP

UR9QQ	595,629
OK3C (OK2ZC, op)	551,050
UU2CW	499,083
HA6NL	481,580
RA3AN	425,500
UA6LCJ	210,456
DD1IM	176,547
UA6AK	152,963
LZ1MG	142,884
UX8ZA	131,068

Single Operator, CW Only, Low Power

ZC4LI	1,810,575
UX4U (US7UX, op)	1,538,840
YT3M	1,440,283
LZ3FN	1,408,365
EF3A (EF3AO, op)	1,388,860
FP/VA2WA (VA2WDQ, op)	1,093,791
LZ9R (LZ3YY, op)	999,926
LY6A	998,244
RA9AP	905,532
OK2ZI	893,329

Single Operator, CW Only, High Power

CR6K (CT1ILT, op)	3,200,313
HG7T (HA7TM, op)	3,143,484
PJ4C (N5WR, op)	2,967,030
ST2AR	2,948,268
LZ8E (LZ2BE, op)	2,731,750
UT5UGR	2,629,566
TA2ZF (UT5UDX, op)	2,387,952
K8PO	2,216,578
UW1M (UR5MW, op)	2,212,116
YU1LA	2,206,413

Multioperator

P33W	7,236,873
RT4F	4,483,534
UZ2M	4,331,353
C49C	3,780,324
HG6N	3,497,364
4O3A	3,323,571
SN3R	3,305,904
PS2T	3,059,442
HG8DX	2,861,682
RT5G	2,831,444

IARU HF Championship Records

World Records	*Call*	*Score*	*Year*
Single-Op HP Mixed	3V1A	4,414,517	2007
Single-Op LP Mixed	HG3M (HA3MY op)	2,095,522	2005
Single-Op QRP Mixed	HG5Y	1,067,647	2007
Single-Op HP Phone	CN2R (W7EJ op)	4,718,736	2005
Single-Op LP Phone	D4C	2,975,632	2008
Single-Op QRP Phone	HG1W (HA1WD op)	348,517	2007
Single-Op HP CW	5B/W2TAA (RV1AW op)	4,219,995	2010
Single-Op LP CW	HA8DU	2,278,782	2006
Single-Op QRP CW	HA5KDQ (HA7ANT op)	1,412,260	2006
Multioperator	**P33W**	**7,236,873**	**2011**

W/VE Records	*Call*	*Score*	*Year*
Single-Op HP Mixed	**VY2ZM (K1ZM op)**	**2,989,540**	**2011**
Single-Op LP Mixed	**VE3DZ**	**1,196,192**	**2011**
Single-Op QRP Mixed	N0KE	187,590	2008
Single-Op HP Phone	KH6ND	2,257,190	2002
Single-Op LP Phone	**W4SVO**	**633,060**	**2011**
Single-Op QRP Phone	KC5R	172,080	2007
Single-Op HP CW	VY2ZM (K5ZD op)	2,631,694	2005
Single-Op LP CW	W1RM	1,135,630	2010
Single-Op QRP CW	W2GD	427,392	2009
Multioperator	W1AW/4	10,720,370	2000

Continental Leaders

Table shows Call, Score, Class and Power. For class: A=Mixed Mode, B=Phone Only, C=CW Only, D=Multioperator. For Power, A=QRP, B=Low Power, C=High Power.

Africa			
3V8SS			
(KF5EYY, op)	682,195	A	B
EA8BQM	206,142	A	B
5N6/YL2SW	151,938	A	B
CN3A			
(IK2QEI, op)	4,281,588	A	C
EA8AGF	1,932	A	C
EC8ADW	39,931	B	B
SU1HZ	6,156	B	B
EA8CST	5,883	B	B
CT3HF	188,244	B	C
ZS5NK	12,054	B	C
EA8BVP	3,255	C	A
V51YJ	165,024	C	B
EA8DA	130,356	C	B
EC8AFM	40,600	C	B
ST2AR	2,948,268	C	C
ZS4TX	605	D	
Asia			
JR3RWB	95,996	A	A
RK9DO	56,620	A	A
JK1TCV	47,520	A	A
RW0A			
(RA0AM, op)	1,223,592	A	B
JT0YPS			
(UA9YPS, op)	1,045,302	A	B
7Z1SJ	1,005,916	A	B
UP0L	3,627,600	A	C
RG9A	3,621,264	A	C
UP2L			
(UA9BA, op)	3,553,932	A	C
JA2MWV	9,553	B	A
VU2GUR	636	B	A
ZC4MIS	84	B	A
R9FR	110,448	B	B
TA1DK	107,219	B	B
RW9TP	101,864	B	B
JA2IVK	442,874	B	C
RA8T			
(RA9SPF, op)	320,250	B	C
UA9JDP	271,746	B	C
RU9UN	123,656	C	A
BD4GNV	33,480	C	A
JR1NKN	26,680	C	A
ZC4LI	1,810,575	C	B
RA9AP	905,532	C	B
VU2PTT	391,685	C	B
TA2ZF			
(UT5UDX, op)	2,387,952	C	C
R9FT	1,714,840	C	C
RT9A	1,696,613	C	C
P33W	7,236,873	D	
C49C	3,780,324	D	
RF9C	2,561,878	D	
Europe			
HA8BE	520,905	A	A
R3VA	328,933	A	A
US2IZ	231,568	A	A
LY9A	1,536,954	A	B
S53MM	1,240,680	A	B
LY4L	1,085,696	A	B
UU7J			
(UU4JMG, op)	3,135,114	A	C
RG3K	3,080,916	A	C
ES5TV	2,771,454	A	C
HG1W			
(HA1WD, op)	298,284	B	A
HA5BKV			
(HA5NB, op)	182,864	B	A
SP4LVK	106,368	B	A
UV8M			
(UX3MR, op)	705,572	B	B
HA3DX			
(HA4XH, op)	653,691	B	B
RW1CW	622,557	B	B
ES5RW	1,781,472	B	C
US5D			
(UT7DX, op)	1,511,486	B	C
EA4KD	1,377,068	B	C
UR9QQ	595,629	C	A
OK3C			
(OK2ZC, op)	551,050	C	A
UU2CW	499,083	C	A
UX4U			
(US7UX, op)	1,538,840	C	B
YT3M	1,440,283	C	B
LZ3FN	1,408,365	C	B
CR6K			
(CT1ILT, op)	3,200,313	C	C
HG7T			
(HA7TM, op)	3,143,484	C	C
LZ8E			
(LZ2BE, op)	2,731,750	C	C
RT4F	4,483,534	D	
UZ2M	4,331,353	D	
HG6N	3,497,364	D	
North America			
CO8ZZ	29,016	A	B
XE2B	16,264	A	B
FG1PP	5,952	A	B
HI8A	63,336	A	C
TG9ANF	145,432	B	A
XE2JA	10,638	B	A
KP2/AA1BU	632,487	B	B
HI3TEJ	399,312	B	B
TI2CDA	212,816	B	B
XP1A	232,288	B	C
J68HS	4,980	B	C
AH0AH/KL7	28	B	C
FP/VA2WA			
(VA2WDQ, op)	1,093,791	C	B
WP3C	65,377	C	B
KV4FZ			
(N2TTA, op)	37,708	C	B
VP5CW			
(W5CW, op)	1,450,068	C	C
KL7DX			
(W6NV, op)	631,116	C	C
NP2X	235,492	C	C
KL2R	67,306	D	
AL1G	41,407	D	
HH2/PY1ZV	39,660	D	
Oceania			
YB3IZK	33,192	A	B
DV1UBY	1,508	A	B
ZL2K	370	A	B
KH7X			
(KH6ND, op)	1,723,623	A	C
VK4CT			
(VK4EMM, op)	1,028,196	A	C
VK3TDX	601,216	A	C
YB0NFL	78,898	B	B
YC8AHH	45,950	B	B
YB0MWM	39,840	B	B
VK7ZE	718,510	B	C
KH2JU	132,056	B	C
WH7Z			
(W0CN, op)	65,940	B	C
KH6ZM	613,802	C	B
YB3BOA	45,695	C	B
ZL4NX	24,338	C	B
VK2IM	664,125	C	C
ZM4G	411,464	C	C
ZL3TE	222,500	C	C
DU1/JJ5GMJ	255,588	D	
YB1ALL	172,900	D	
DV1/JO7KMB	124,338	D	
South America			
PY2SEX	936,792	A	B
PY2NY	759,962	A	B
PY1NB	497,006	A	B
PP5BZ	1,726,368	A	C
YW4D	1,574,191	A	C
AY5F			
(LU5FC, op)	1,535,600	A	C
LU1FM	660	B	A
ZX2B	740,624	B	B
LU1FU	151,360	B	B
LW7DUC	67,800	B	B
PP5XX	2,249,190	B	C
ZV2K	235,520	B	C
PY5KW			
(PY2DJ, op)	130,644	B	C
AY9F			
(LU5FZ, op)	114,933	C	A
PY4ZO	9,328	C	A
PY3OZ	143,448	C	B
PY2IU	94,650	C	B
PY4HO	50,700	C	B
PJ4C			
(N5WR, op)	2,967,030	C	C
PV8ADI	159,783	C	C
PR7AR	96,943	C	C
PS2T	3,059,442	D	
LS1D	1,833,192	D	
HK1NA	1,574,672	D	

Gayle, K6GO/ZF2GO (L) and Anna, W6NN/ZF2LL joined Joe, W6VNR/ZF2AH to put the Cayman Amateur Radio Society (CARS) HQ station, ZF1A, on the air for IARU. They used the club shack and excellent antenna farm on ZF1EJ's property to give out the CARS HQ multiplier in Zone 11. Outside the contest Gayle, Joe and Anna spent time relaxing on Seven Mile Beach on the west side of the island.

[Anna Sombor, W6NN]

Records

Four new records were set in the 2011 event. One was a new World record and the other three were W/VE records. Way to go, everyone!

The World Multiop record by P3A in 2003 was broken by P33W. One of the P33W ops, RW4WR, was also on the 2003 P3A team.

The W/VE Mixed High Power record by KQ2M in 2001 was beaten by VY2ZM (K1ZM). Interestingly, the VY2ZM station now holds two W/VE records — CW High Power in 2005 when K5ZD keyed this fine station to a win and now K1ZM operating his own station in 2011.

VE3DZ decided to go after his old 2009 record in W/VE Mixed Low Power and squeaked by it by 1.5% (1,179,150 in 2009 versus 1,196,192 in 2011).

Finally, the W/VE Phone Low Power record by N1UR set in the 2010 event fell to W4SVO by a decent amount — 7%.

W/VE Region Leaders

Table shows Call, Score, Class and Power. For class: A=Mixed Mode, B=Phone Only, C=CW Only, D=Multioperator. For Power, A=QRP, B=Low Power, C=High Power.

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

ND3D	8,658	A	A
VE1ZA	237,690	A	B
W1WBB	226,980	A	B
VE2AWR	176,562	A	B
VY2ZM (K1ZM, op)	2,989,540	A	C
K3CR (LZ4AX, op)	2,494,800	A	C
W2GD	1,582,725	A	C
AA2VK	209	B	A
K1WO	110,445	B	B
VE2HIT	34,880	B	B
WB9KPT	32,594	B	B
KK1KW	996,060	B	C
N2RJ	259,000	B	C
KM2O	239,580	B	C
KK1W	25,694	C	A
VE2DJN	4,880	C	A
W3TUA	2,508	C	A
K2SSS	533,822	C	B
VA1CHP	531,632	C	B
VE1RGB	492,072	C	B
K8PO	2,216,578	C	C
AA3B	2,061,210	C	C
WC1M	1,762,736	C	C
NN3W	2,390,710	D	
W1UJ	1,536,270	D	
K2LE	1,296,012	D	

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

KS4X	21,632	A	A
N8OO	1,036,350	A	B
NR3X (N4YDU, op)	387,660	A	B
AD4Z	312,984	A	B
N5DX	2,395,215	A	C
W4AN (K4BAI, op)	1,425,936	A	C
K5KG	957,088	A	C
NT4TS	21,294	B	A
KC5WA	8,502	B	A
KD4OFG	960	B	A
W4SVO	633,060	B	B
K4WES	38,252	B	B
KE4VCS	19,584	B	B
K5ER	293,454	B	C
NN4F	145,530	B	C
AC5O	104,728	B	C
K4QPL	71,024	C	A
N3CZ	12,246	C	A
KS4YX	5,797	C	A
WB4TDH	389,973	C	B
WA1FCN	256,399	C	B
WK2G	240,882	C	B
N4OGW	1,421,192	C	C
N4AF	1,011,675	C	C
K4RO	917,796	C	C
NR4M	1,557,612	D	
N1LN	1,117,185	D	
W5WMU	1,088,832	D	

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

K8ZT	112,592	A	A
W9XN	11,100	A	A
VE3DZ	1,196,192	A	B
K9OM	431,148	A	B
W9IU	351,650	A	B
VE3EJ	2,544,638	A	C
N0IJ	106,506	A	C
VE3CX	76,570	A	C
VA3WPV	3,332	B	A
N8XA	900	B	A
VA3GKO	65,504	B	B
N8RF	47,988	B	B
KF8BT	28,992	B	B
WB9Z	799,755	B	C
AC8G	133,868	B	C
KK7Z	26,928	B	C
VE3GTC	100,580	C	A
AI9K	27,898	C	A
VA3RJ	13,275	C	A
W1NN	576,774	C	B
KV8Q	325,872	C	B
VE3EY	322,230	C	B
K9NW	1,093,260	C	C
K9CT	954,618	C	C
N2WQ/VE3	673,920	C	C
K8AZ	1,743,605	D	C
K9SD	845,774	D	C
K3WA	775,478	D	C

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

VE4YU	191,529	A	B
AA5JG	80,872	A	B
WA7LNW	76,383	A	B
N7VM	733,408	A	C
K0OU	180,684	A	C
K7IA	172,912	A	C
K5DHY	83,904	B	B
W5GFI	78,806	B	B
WB0TSR	42,918	B	B
K9MWM	169,944	B	C
K0RH	57,005	B	C
WD0BMS	42,180	B	C
K0PK	80,301	C	A
W5GAI	28,221	C	A
K5TA	10,152	C	A
NA0N	279,896	C	B
W5RYA	206,170	C	B
W0ETT	165,743	C	B
N2IC	1,710,859	C	C
K5TR (K5OT, op)	1,066,338	C	C
K7KU (K0KR, op)	542,016	C	C
N0NI	1,878,170	D	
K0RF	1,774,150	D	
NX5M	1,738,100	D	

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

NN7SS (K6UFO, op)	72,242	A	A
K2PO	487,277	A	B
N7ZG	317,312	A	B
WA6FGV	118,736	A	B
NK7U (KL9A, op)	1,921,539	A	C
K7RL	1,456,730	A	C
K6XX	1,126,816	A	C
W6QU (W8QZA, op)	39,375	B	A
VA7IR	4,375	B	A
N6LB	1,020	B	A
K3FIV	37,520	B	B
N7VPN	28,544	B	B
KI6JJW	20,286	B	B
W7WA	1,314,975	B	C
K7LY	135,920	B	C
WX7P	84,429	B	C
N7IR	4,564	C	A
K6MI	18	C	A
K7WP	166,212	C	B
KS5A	98,256	C	B
K6AAB	69,339	C	B
N9RV	1,389,617	C	C
N6MA	491,087	C	C
AD6E	385,190	C	C
K7ZSD	556,575	D	
N7AT	452,187	D	
NX6T	391,297	D	

The Records table shows all records, with those set in 2011 in bold. Note that 2005 was the first year with separate High Power, Low Power and QRP categories. As you might expect, more were set in the early years and it's getting tougher to set new records, but review these results and think about taking a shot at a new record next year. You may have to improve your antenna farm to do this but you have several months to get ready — the IARU HF World Championship is held on the second full weekend in July. For 2012 that puts it on July 14 and 15. I hope to hear you on!

More IARU for You!
Visit **www.arrl.org/contests** for expanded results.

IARU Member Society Headquarters Stations

Headquarters and Administrative Council station scores were tabulated by the World Wide Radio Operator's Federation (**www.wwrof.org**) and are listed in *QST* as a courtesy to the Amateur Radio community.

Call Sign	*Final QSOs*	*Mults*	*Final Sore*	*IARU Society*
EF8HQ	15,059	424	30,651,384	URE
TM0HQ	15,716	461	23,810,650	REF
DA0HQ	21,052	457	21,113,400	DARC
E7HQ	15,612	460	20,267,600	BA
IOxHQ	15,641	458	18,988,222	ARI
GR2HQ	13,818	433	18,512,482	RSGB
S50HQ	13,188	452	16,988,872	ZRS
9A0HQ	13,787	447	16,985,553	HRS
SN0HQ	14,230	463	16,432,796	PZK
YU8HQ	13,365	438	15,655,434	SRS
OL1HQ	12,676	432	15,120,864	CRC
EM5HQ	11,084	420	13,737,360	UARL
4X3HQ	7,818	359	13,030,982	IARC
HG0HQ	11,087	427	12,545,687	MRASZ
OE1A	10,872	413	12,295,010	OVSV
LX0HQ	9,387	375	11,639,625	RL
YR0HQ	9,736	408	9,955,200	FRR
LR0F	6,356	331	9,919,408	RCA
LZ7HQ	9,860	395	9,848,930	BFRA
OZ1HQ	7,533	360	8,893,800	EDR
OH2HQ	7,259	361	8,383,503	SRAL
LY0HQ	7,753	368	8,096,368	LRMD
NU1AW/5	8,180	332	8,066,936	IARU
W1AW/6	8,873	282	7,158,570	ARRL
8NxHQ	9,274	311	6,313,300	JARL
LN2HQ	5,750	331	6,195,658	NRRL
OP0HQ	5,748	336	5,955,264	UBA
R3HQ	6,247	322	5,672,674	SRR
HB9HQ	6,990	336	5,518,464	USKA
SX0HQ	7,102	328	5,040,704	RAAG
BxHQ	4,658	276	4,779,216	CRSA
SK9HQ	4,814	307	4,746,834	SSA
CX1AA	2,596	262	3,048,108	RCU
CE3HQ	2,756	226	2,867,036	RCCH
YL4HQ	3,136	286	2,332,044	LRAL
ZV13HQ	1,492	191	1,282,374	LABRE
EI0HQ	1,865	203	1,143,905	IRTS
ER7HQ	2,032	194	1,093,384	ARM
EY1HQ	1,547	148	984,940	TARL
ZF1A	2,061	112	742,448	CARS
OM1HQ	1,742	126	711,900	SARA
DX0HQ	839	110	429,330	PARA
TC3HQ	937	89	390,087	TRAC
5J3HQ	638	119	342,482	LCRA
ZL6HQ	658	108	332,208	NZART
ES9A	886	106	252,280	ERAU
HB0HQ	688	133	205,618	AFVL
VK5WIA	524	76	178,448	WIA
BV0HQ	655	90	173,970	CTARL
9M4DXX	453	90	136,350	MARTS
HR2RCH	452	69	99,360	RCH
HS0AC	281	94	89,394	RAST
OY6FRA	585	34	59,738	FRA
JU1HQ	199	35	23,765	MRSF
9K9HQ	164	16	12,352	KARS
HI8RCD	69	41	9,307	RCD
TI0HQ	45	16	2,352	RCCR
OA4O	21	13	897	RCP

IARU Administrative Council Stations

Call Sign	*IARU Region*	*Final QSOs*	*Mults*	*Final Score*
9A5W	1,500	223	1,129,272	R1
NB2T	1,589	172	847,788	R1
G3PSM	454	155	222,890	R1
HB9JOE	497	133	127,547	R1
XE1KK	434	65	86,970	AC
PT2ADM	244	77	75,922	R2
CE3PG	215	62	52,266	R2
JA1CJP	199	74	43,290	R3
9Y4X	119	44	19,932	R2
LA2RR	66	52	6,448	AC

2011 ARRL 10 GHz and Up Contest Results

Microwavers get their annual dose of RF on two weekends.

Bruce Richardson, W9FZ
w9fz@w9fz.com

The ARRL 10 GHz and Up contest, held August 20-21 and September 17-18, 2011, again yielded fun and adventure for those who participated. Even though the low number of operators active on the microwave bands makes every contact an accomplishment, clubs and groups across the country are promoting microwave activity and welcoming new interested operators.

Top 10 Scores

10 GHz Only	*Score*	*10 GHz and Up*	*Score*
WB0LJC	74,981	AA6IW	64,896
W0ZQ	49,094	N6RMJ	51,230
WA2VOI	46,885	W6BY	50,303
KK6MK	43,483	K6GZA	47,552
N0UK	42,653	N6TEB	38,985
K0HAC	40,958	W6QIW	33,858
AF6NA	40,674	N1JEZ	26,339
WA6JBD	39,829	KA1OJ	23,484
N0KP	38,114	W1GHZ	22,075
W7XU	37,450	W1FKF	21,849

Top 10 QSOs Completed

10 GHz Only	*QSOs*	*10 GHz and Up*	*QSOs*
WB0LJC	360	N6RMJ	278
W0ZQ	236	AA6IW	274
WA2VOI	220	W6BY	267
N0UK	198	K6GZA	200
K0HAC	192	N6TEB	180
N0KP	187	W6QIW	161
KK6MK	177	KA1OJ	125
KC0P	176	N1JEZ	104
W7XU	169	W1GHZ	93
N9RIN	169	W1FKF	92

2011 Contest Highlights

Groups across North America got on the air again in the ways they know how to have fun. For instance in California, that means groups on mountaintops and rovers moving in the flat valleys.

During the August weekend, Lloyd, NE8I and Neil, W9NU operated from several locations on the lower peninsula of northern Michigan. They worked a fair amount of rain scatter leading to a nice 450 km DX shot to Mike, WA3TTS, located on the south shore of Lake Erie.

Just as they were about to move on, the artist Laurel Prafke from Ludington, Michigan came up to them and presented them with an artistic painting she made that day that includes them and their equipment in the scene! (The painting can be viewed in the online version of this article at **www.arrl.org/contests**.)

Jeff, KN6VR, awaits the next QSOs on top of Mt Frazier.
[Tony Long, KC6QHP]

Participation by Call Area

Call Area	*Entries*	*Call Area*	*Entries*
6	29	5	5
0	23	2	3
1	17	3	3
8	12	9	3
VE	12	7	1
4	8	DX	0

Mel, WA6JBD made his long 840 km QSO with Chip, N6CA. Mel was on Mt Potosi near Las Vegas. Chip was at the base of Mt Shasta in far northern California. To complete their contact they used airplane scatter requiring coordination through a wide-area repeater system. The contact took over an hour to complete and there was no other enhancement at all.

Tony, KC6QHP tried to focus on 24, 47 and 79 GHz this year. Tony traveled northward to Long Beach to meet up with Doug, K6JEY and over a 2 km path, he was able to work K6JEY and Helen, KI6LQV, on 79 GHz with strong signals and plenty of margin.

10 GHz Only Category

In the 10 GHz Only category, Gary, WB0LJC led all 87 operators in this class with a score of 74,981. Gary traveled on all days of the contest and operated from 41 different locations. In second and third place are Jon, W0ZQ, and Donn, WA2VOI.

The highest number of unique calls worked in the 10 GHz Only category goes to Brian, AF6NA with 60. Close behind were Chris, N9RIN and Ben, KD0EJT with 50. California operators are doing a good job of getting participants on the air and having fun during this event. Longest DX in the 10 GHz Only category goes to Mel, WA6JBD with an 840 km QSO.

10 GHz and Up Category

Entries in the "And Up" category fell slightly to 29 this year. Repeating this year at the top of this category is Lars, AA6IW with 64,896 points. Second and third were Pat, N6RMJ with 51,230 and Brian, W6BY with 50,303. Those scores were generated by working the most unique call signs; Lars with 75, Brian with 69, and Pat with 66.

All logs in this category included contacts on 10 GHz and 24 GHz. Five operators submitted contacts on the 47 GHz band. Two operators reported contacts on the 78 GHz band. Notable 10 GHz DX distances in this category were 652 km by Ronald, K6GZA and 639 km by John, W3HMS. Lars, AA6IW and Brian, W6BY each worked 343 km on 24 GHz — impressive! Equally impressive was Gary, AD6FP working 257 km on 47 GHz and KC6QHP's 2 km contact on 78 GHz with K6JEY and KI6LQV.

Looking Ahead

For 2012, make a point to get on the air on August 18-19 and September 15-16. Plan a new adventure different from past years. Also include new operators in your plans to expand the fun! What will you plan in your part of the country?

Expanded Report on our Website

You can find more details online at **www.arrl.org/contests**.

Bernie McClenny, W3UR, w3ur@arrl.org

Temotu 2011

Warsaw to Fiji to Vanuatu to Guadalcanal...

Jacek Kubiak, SP5DRH/H40KJ

Has anyone really ever heard of Temotu? Well, those who DX, heard and even know that this is part of the country called Solomon Islands and that's it. To tell the truth, I also had just such an idea of this country and the region.

Temotu is the most distant province of the Solomon Islands and its least tourist discovered and organized territory. I had been planning to go there with Jurek, SP3BQ, in 2010. Unfortunately, an extremely unfavorable combination of events in air traffic caused us to cancel our plans, although the entire expedition was prepared and paid for.

This time, however, despite the many strands of adverse situations, I managed to reach the goal, which was Pigeon Island, a small island the size of an American football field. It is part of the Reef Islands of the archipelago, located about 50 miles from the main island of Temotu, Santa Cruz. To get to Pigeon Island, I had to take the long way, from Warsaw where I live, via London to Los Angeles, then to Fiji, and from Fiji through Vanuatu to Guadalcanal, which is the main island of the Solomon Islands.

I applied for the license several months before I got there, but to get it, I had to appear in person and pay applicable charges. There is no other way. When I had it in my hands, I could continue my trip to Lata, the capital of the Temotu Province. I was taken by Air Solomons on a DASH 8 plane, filled to the brim, which after less than two hours landed on the airfield, in the middle of the jungle. Luckily, on Lata I was greeted by Ben Hepworth, the owner of Pigeon Island. Next, the final part of the trip, was a 50 mile long sail through the open ocean in a small 20 foot long boat. The weather was favorable, so after two and a half hours of sailing I heard Ben say "Welcome to Pigeon Island."

Going It Alone

I decided to go alone for this long trip as I could not convince any of my friends to take part in it. The expedition alone seemed to be difficult and perhaps too dangerous. Moreover, traveling alone strongly restricted the amount of the equipment that I could carry with me. And yet, I still had more than 70 kg (150 pounds) of luggage! Nevertheless, I so much wanted to go there that I did not listen to the warnings and good advice of others.

Imagine taking this boat in open seas for 50 miles!

Where to Put the Antennas

I started searching for space for my antennas. I am a 160 meter band fan and as such I put this band as a main target of the expedition. Therefore the position of the 160 m antenna was my priority over the localization of other antennas. On the north shore there turned out to be a cliff about 6 meters high, densely overgrown with thick and wonderfully twisted trees, all of them among the bushes difficult to go through. I was very disappointed, as I thought, I could put the antenna in the lower part of the north shore so that one radial would follow to a tiny island located on the southern edge of the main island. Unfortunately, the small island also had a high cliff around it and basically was inaccessible.

So from the very beginning the concept that was thought to be the main source of my sporting success was ruined. I needed to come up with a backup plan that would at least partially resolve the situation. In the beginning I put up a vertical dipole antenna for 21 MHz. This antenna as simple as it can be, as my friend Jacek, SP5EAQ, says, and its construction will take 15 minutes. Perhaps to him, yes, but never to me, I tuned and tuned this antenna. I put it up and down, I don't know how many times, all in the heat pouring from the sky and humidity that makes you heavily sweat while little flies and mosquitoes "take care" of your feet.

The effect of this effort was lackluster as the SWR does not go below 3, only at 24 MHz 2.2! 24 MHz worked fairly well, so I tried this one. My K3 put out 40 W with such an SWR. What a pileup fell on me — all Japanese and Americans wanted to work Temotu on 24 MHz at the same time. Rys, SP5EWY, my Topband guru and friend informed me that the next band with increased demand for beside 160 m was 12 m (24 MHz), but this exceeded my imagination! All the time, however, I was intrigued by one question — why can I not tune this

This was the paradise home of H40KJ for two weeks in October.

simple antenna? I've done it all my life, almost with my eyes closed and at the time when the analyzers were only a dream.

My 160 Meter Antenna

In the meantime I started preparation to build an antenna for 160 m, my main task. A number of palms, bushes and other trees worsen the case, and after all, the antenna on 160 m needs space! I still had hope that I could implement the construction of the antenna I used on Fiji and Kiribati, a "T" type that has worked so well. At first I assembled the support, meaning the Spiderbeam mast 18 m high, prepared and fastened to it the antenna itself, then adjusted two levels of three Kevlar guy wires on each. I started to push it up, but without some support from one guy I probably would not have succeeded. Although he only held the mast and I went around adjusting guy wires it would be difficult to put up such a mast by myself.

Although very important, setting the mast was only a small part of what was to be done. Now it was the time to distribute the radials, each 42 meters in length. Unfortunately I did not manage to do it in a straight line. I had to zig and zag in such a manner that they would not touch any of the trees or palm trees. When I successfully spread them it started to resonate. Well the basic problem was the appropriate radiator; after the first few attempts I came to the conclusion that the implementation of the type "T" antenna was in this circumstance simply impossible. The only thing I could do in this situation was attempt to try a quarter wave inverted "L" antenna. I managed to disentangle from the palm pieces of my so called Top Hat, meaning horizontal line of the "T," connect them together and extend them by a few meters so as to catch the resonance at my ideal 1826 kHz. It went surprisingly smoothly after the analyzer showed 1.5:1 SWR. Well, pretty good and as I also had a CWS unun transformer, I matched it to the SWR of 1.2:1, which was outstanding.

Now it was time to connect coaxial cable and to test it. Tests with the transceiver and amplifier came out perfectly, so I waited with great anticipation for sunset. But the sunset was still far away so I turned back to 12 m and was surprised. I do not know what happened, but the antenna stopped working on 24 MHz but was now okay on 21 MHz. This made me think that apparently I made a mistake somewhere. Anyway, I spent the rest of the day working 21 MHz mercilessly besieged by the US and Japan, and then by evening stations from Europe.

In the meantime, I set a vertical dipole for 17 meters. Surprisingly, the antenna worked well immediately and without any problem, just as described in the books. This made me think that it must be something with the antenna for 21 MHz that it behaved so strangely. Moreover, after the exclusion of use of it for two days, it started "showing up." I disassembled it again with the intent to throw it as far as possible away from me. In its place I made, entirely from scratch, another antenna for 24 MHz only. Strangely enough this one also worked perfectly! So I took the pileups on 24 MHz. As it was the best to hear Europe here, I started first on RTTY. Excellent conditions on 24 MHz caused my next move — to launch an antenna on 28 MHz.

Storms Arrive

From the moment I placed the 160 m antenna the weather began to worsen rapidly and stayed that way until the end of my trip. Every night there were storms, lightning, strong winds, tropical rain, or as we say in Polish "cats and dogs." Unfortunately, it had a very bad influence on my 160 m work. It seemed to me that while on Tarawa, which lies almost on the equator, I learned everything about glitches and nothing worse could happen to me and here we are — a surprise called "TEMOTU."

Jacek at his H40KJ station on Pigeon Island, Temotu Province.

Crashes that I had at night on Tarawa are only some of what happened to me on Temotu. This is really an unpleasant thing, to a large extent making it difficult and significantly limiting the possibility of listening to 160 m. Usually I sat at the station from about 10 GMT, to give a chance to the Caribbean and soon after the East Coast. I sat until 14 GMT when the sun was rising on the banks of the West Coast. Then a two hour nap and from 16 GMT, occasionally even earlier, Russia on the two continents, and shortly after — Europe — till my sunrise at approximately 18:30 GMT. To put it in local time on Temotu — I started at 9 PM and ended at 5:30 AM the next day and then usually went to bed.

The term "went to bed" is rather literary, because at this time the jungle does not sleep long, and all sorts of birds are yelling, so that there is no way to sleep normally. And even if I fell from exhaustion, I could not sleep longer than three hours. Local teenagers put on the radio or a tape, full volume of music representing a mixture of rap, reggae and disco.

Next in line was the antenna on 80 m. It took me all day to build this fairly simple antenna. I erected the antenna a dozen times before it managed to resonate. The antenna constantly encountered problems and finally after three days was damaged by a piece of a tree that fell on it during a night-time thunderstorm. The accident with the 80 m antenna weakened my desire to build another antenna and made me spend more time working on the higher bands on CW and RTTY.

A Wonderful Journey

Two weeks passed very quickly and then it was a time to go back home. The return journey was a kind of escape: Bad weather resulted in an extremely difficult journey through the Pacific on Ben's boat, and a plane that was to take me to Honiara did not arrive at all. I waited for the next call the whole week. But I was glad! I had a wonderful journey. The expedition was also a great adventure, and the result is about 5200 QSOs and over 500 on 160 m! Probably not that bad if you consider the conditions. All QSOs are on LoTW as of December 2011.

Photos by the author.

Jon Jones, N0JK, n0jk@arrl.org

How the Grinch Stole the Winter E_s Season (Almost!)

A sporadic E event arrives just in time to ring in the New Year.

The month of December is the peak of the minor winter sporadic E (E_s) season in the northern hemisphere. In recent years there have been all day coast-to-coast openings with double hop to the Caribbean and even triple hop from the Midwest to Hawaii. But as the December Holidays approached, there was no E-skip to be found. Only a few short openings earlier in the month. Not much E_s in the ARRL 10 Meter Contest compared to the last couple of years.

Christmas came and went with a "lump of coal" in many VHFers' stockings. It looked like the month would end up as one of the most dismal winter E_s seasons to date. This was disappointing in light of the higher solar activity. While the solar flux was not high enough to support direct F2 in December, 6 meter DXers hoped that winter E_s would support links to F2 and TEP to South America and the South Pacific. But with no E_s — no links.

What happened? Had the Grinch stole the winter E_s season? Why was this season so poor?

Sporadic E occurs throughout the year in North America. It occurs in the E-layer of the atmosphere, between 90-160 km above the earth. There are two distinct peaks — the major summer peak is centered around June and the minor winter season peak is best between Christmas and the first week of January.

Scientists do not know why this occurs, as the cause of sporadic E itself is still unclear. E_s does not seem to be directly connected to the solar cycle. It occurs during peak years and the minimum. The solar angle is a factor, as the sun is highest in the northern hemisphere around the solstice during the summer E_s peak. The sun angle is lowest in December — one may ask why there is a winter E_s peak. Wind shear in the E-layer is currently considered the most plausible theory for E_s. Other theories include gravity waves, metallic ions from meteors, geomagnetic activity, weather patterns in the lower atmosphere with thunderstorms and the associated sprites, volcanic eruptions, etc. We do not need to know the exact cause of E_s. One can record the occurrence and duration of E_s openings and analyze the data. Patterns may emerge that may give a clue how the Grinch "stole the E_s."

Some propagation observers such as Pat Dyer, WA5IYX (**www.qsl.net/wa5iyx**) suspect there may be an 8-10 year E_s cycle independent of the solar cycle. Pat has kept meticulous records of E_s reception of commercial FM broadcast stations from 1972 to date. These are listed by minutes of E_s reception per month. Reviewing these, one can clearly see the variation of E_s per month and by year (see Figure 1).

The years 1990, 1994 and 1995 each had over 7000 minutes of E_s while 1999 had only 2935 total minutes. Even more telling are the minutes of E_s in December. 1990, 1998 and 1999 had less than 1 hour of E_s. The peak year for December E_s was 1997 with 1750 minutes, followed by 1995 with over a thousand. Though 1990 was a "good year overall" for E_s, December 1990 had less than 1 hour of E_s.

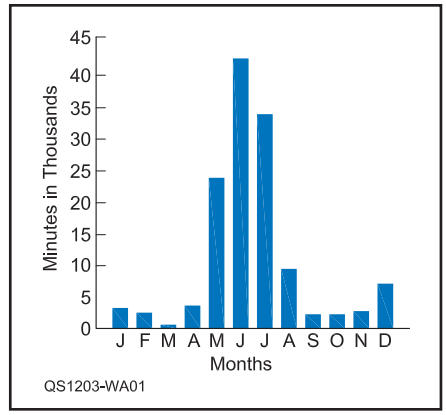


Figure 1 — This chart shows the number of minutes of E_s activity per month for a 6 year period. Note the surge in activity May through August and another mini-surge in December. Information used to prepare this chart provided by Pat Dyer, WA5IYX.

This Month

March 5-9	Best EME conditions of 2012* (only 0.9 dB of degradation)

*Moon data from EA6VQ

The 1980s show a similar pattern with 1987 and 1988 being overall great years. December 1987 was the peak winter E_s season of the '80s with over 1000 minutes. Perhaps this represents a pattern appearing with peak winter E_s seasons every 8-10 years? December 2003 was also a good year with Pat reporting many new loggings. December 2010 had many E_s openings as well. Pat notes "a healthy amount of December FM E_s" for 2010. His records hint that after a great winter E_s season, the following year is usually poor. December 1988, 1998 and 2004 had far fewer E_s minutes than the year before. So perhaps 2011 was the "poor year" after a great 2010 winter E_s season.

Before we attribute the poor 2011 December season to a multiyear E_s cycle, some caveats. Pat's observations are over a 40 year period. Other patterns may be present that could be discerned with a longer period of observation. He is also recording commercial FM broadcast stations. They are above the 50 MHz band, but also use higher ERP (effective radiated power). Six meter E_s propagation could be different. My opinion is that it is not significantly so, except perhaps 6 meters is open more minutes on marginal openings than FM broadcast.

The amount of December E_s year-to-year may be simple statistical variation. Like flipping a coin, you may get four "heads" in a row, but flip it enough times and the result will eventually be half heads, half tails. Others think high solar activity may "dampen" the occurrence of midlatitude E_s. Some of the best years for E_s were during the solar minimums. Has rapid growth of

Figure 2 — If you were lucky enough to work K5N this is the QSL card you will be receiving. It was designed by Jacque "JD" Dupuy, N0IRS.
[Courtesy JD, N0IRS, and Marshall Williams, K5QE]

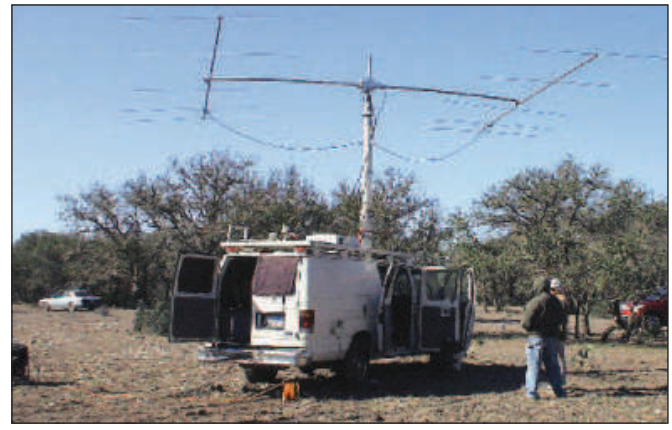


Figure 3 — The two M^2 6M5X Yagis on a 20 foot cross boom on an H pole, about 20 feet above ground at K5N in DL99/DM90.
[Courtesy JD, N0IRS, and Marshall, K5QE]

geomagnetic activity in solar cycle 24 limited E_s? Others have wondered if the exceptionally mild winter in many states is a factor. Some pundits even blamed the poor E_s season on Global Warming.

Well, the Grinch finally relented and tossed out a couple of great E_s openings at the very end of December. Starting on the 29th, long lasting E_s occurred daily through January 1. E_s links appeared at times and some lucky North American stations worked the South Pacific the evening before and New Year's Eve. The K5N group was active from DL99/DM90 and made many E_s contacts. A large CME was predicted to strike the Earth December 28, but it "missed." No enhanced geomagnetic activity was noted. But some wonder if the CME really missed the Earth or did it hit and spark the E_s?

K5N

The K5N Grid Activation Group was active from the DL99/DM90 grid line on 50 MHz from December 27-30 near Rocksprings, TX (DL99vx). These are very rare grids and needed by many for VUCC and the FFMA. There were only three operators — Bill, NY5A; George, NR5M, and Marshall, K5QE. JD, N0IRS, set up a web page for them, designed the QSL card and provided additional liaison support (see Figure 2). They used an ICOM IC-756PROII transceiver with two 6M-1000 M^2 amplifiers combined for 1500 W total output. The antennas were two M^2 6M5X Yagis mounted on a 20 foot cross boom about 20 feet high (see Figure 3).

Their announcement speculated "What kind of propagation should we expect? The week between Christmas and New Year's is supposed to be the peak of the winter E_s season, so we may get some E_s to various lucky spots in the country. I (Marshall) am planning to run some EME, the rest of the time we will be running digital MS with FSK-441 or ISCAT. We certainly do want to work everyone possible."

K5N was on the air by 1655 UTC on the 27th and made tropo/ground wave contacts across southern Texas and digital meteor scatter contacts to Florida, the Midwest and Wyoming (K7TNT). Activity continued on the 28th with more meteor scatter contacts including N0KK (EN35). No E_s was noted either day. The 29th started the same way with meteor scatter. That changed abruptly at 2037 UTC when N3LL (EL86) Florida found K5N "on E_s 30 over!" The opening expanded in coverage and strength across the southeast states to the Midwest and to the 3rd call area by 2245 UTC. NW0W (EM47) spotted K5N "5×9 LOUD DM90/DL99 Rare Grid(s)!" VE3SUB in EN82 Ontario logged K5N at 2330 UTC.

The opening continued into the evening with N4QWZ (EM66) working K5N at 0253 UTC. I arrived home from Salina, KS at 0315 UTC and heard nothing on my attic dipole. Was about to shut down for the evening when I saw a spot by K0HA (EN10) for K5N at 0359 UTC. Thanks, Bill! I listened closely, nil at first, then at 0402 UTC K5N rose out of the noise on SSB. Heard K5N for about 5 more minutes, then they were gone. Perhaps off a single "rogue" E_s cloud?

K5N 11/12/30 0404Z
50128.0 EM28IX<ES>DL99 worked tnx N0JK (see Figure 4)

K5N 11/12/30 0359Z
50128.0 DL99 & DM90 - EN10 E_s now K0HA

K5N continued to have E_s until 0505 UTC to N5OMG New Orleans, N0LWF (EN10), W0BLD (EM37), N0LL (EM09) and others. Bill, K0HA, reported an unusual "quick bubbling" effect with sudden jumps in signal strength on K5N's audio between 0405-0420 UTC. He has not heard this on E_s before. Al, W5LUA (EM13) and K9MK (EM12) noted K5N was strong on tropo to the Dallas/Fort Worth metroplex between 0300-0600 UTC. K5N closed down the next morning at 1400 UTC.

W3XO/5 noted "K5N was lucky to hit E_s as the first day we had it was while they were there." K5N made 254 contacts on 6 meters. QSL via Richard Fiero, W5TFW with SASE.

The K5N Group is planning two simultaneous grid activations next summer. One is to DL88 (currently the rarest grid needed for FFMA) with the two 6M5X Yagi array, the other to the DL79/DL89 line with a single 6M5X. Anticipated dates are June 20-24, 2012. Plan your summer vacation accordingly.

On the Bands

50 MHz. K7JA (DM03) worked ZL1RS and ZL3NW on December 3. K4RX (EM70), N3LL (EL86) and W4BP Florida also worked ZL1RS that evening. Bob, K6QXY (CM88) worked ZL3NW and ZL1RS on December 4 and 5. KH7Y worked ZL1RS on December 4 around 0050 UTC. The California to New Zealand contacts were probably direct F2/TEP, those from Florida may have had an E_s link. Lefty, K1TOL (FN44), W1IPL (FN54) and K1SIX (FN43) worked several New Zealand stations on December 3! These contacts may be E_s linked, as N4QWZ (EM66) spotted K1TOL on E_s during this time frame. The small

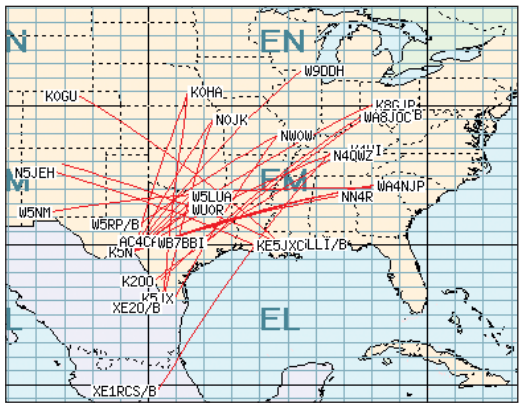


Figure 4 — This map shows the December 30, 2011 E_s activity over Texas.
[DXSherlock]

footprint is typical of E_s links and solar flux was too low for direct F2 from New England to New Zealand. This is Lefty's account of his remarkable contacts:

> I walked to the kitchen to get coffee and was parked on 50.110. I heard a "CQ ZL2DX" clear as a bell 45 feet away in my speaker. Thought it was a stateside person calling "CQ ZL DX." DAH!!!!!!!!!!!!!!! I heard the CQ 4-5 times and ignored it. Then I walked back to radio shack and was still hearing the "ZL2DX" CQs. After a few more (like 7-8 CQs) from the ZL2, I decided to drop my call once in case it was a stateside person and I was "mistaking" his constant CQs on .110. He came right back and gave his grid as RE78....
> I almost hit the floor!! Our QSO was at 2145Z. Then called CQs on 105 and worked ZL3NW at 2153. Then saw that W1IPL & K1SIX were working ZLs on .110, so went there and later worked ZL2OK on SSB at 2201.

The Geminds Meteor shower peaked the night of December 13-14. Dave, N7DB, in OR noted 6 meter meteor scatter contacts with ND, AZ, CA and NM.

After a very slow month, E_s appeared with a vengeance starting December 29. Numerous long lasting single-hop E_s openings across the country and even a few double-hop E_s contacts were reported. E_s links appeared for some lucky stations. Orin, N5ORT (EM50) worked E51EME on 50.107 MHz at 0047 UTC December 30 with just 100 W. E51EME is Bob, ZL1RS. Orin reported he heard Bob for around 20 minutes with low slow fading. He heard no one else call him at the time. Orin said "I was very lucky to work him!" Others working E51EME on this opening included K5RK, N5DG, K8NXI (EN90) (529 report), W8IF (EM79) and WK3N (EN91). The most eastern US stations to work E51EME may have been via double hop E_s link.

On December 31, Pedro, NP4A (FK68) was in on double-hop E_s to K0HA (EN10), N0JK (EM28), KA9CFD (EN40), VE2XK (FN07), N8CJK (EN84) and others around 1630 UTC. There was no warning in the Midwest of this opening. Pedro suddenly appeared out of the blue on a dead band. Almost like F2, but the solar flux was too low. Could it be due to chordal type E_s hops? Pedro was strongest at 1615 UTC for K0HA.

W7OUU (DN22) was strong into Kansas at the same time on Pedro's frequency off the back of my Yagi. He may have heard NP4A briefly. That would be triple hop E_s, a rarity in the winter E_s season. Pedro, NP4A, also heard E51EME at 2327 UTC on the 31st. A rare country active on the 31st was 6Y1X Jamaica. Bill, W3XO/5 (EM10) heard W5HNK (EL29) work 6Y1X at 1726 UTC and barely missed him. Bill notes that 6 meters "was open for four hours, after hearing 6Y1X, to the south. I worked a number of XEs plus TI2ALF, TI7/N5BEK, HP3TA and TG9AJR. The YS1YS beacon (50.023) was in strong for several hours."

New Year's Eve (December 31 local, January 1 UTC) brought more E_s and E_s links to the South Pacific. Ed, N5DG, worked VK5PO "for a new one" at 0020 UTC on January 1 for "an early start for the New Year." Pat, W5OZI, had a good reason to celebrate New Year's Eve as well with two ZLs and seven VKs logged between 0042-0230 UTC on the 1st. He worked two XE1s at 2340 UTC on December 31. This would support an E_s link, with the first hop to XE1, then to VK/ZL via the F-layer. Among the VKs he logged was VK7NO, Tasmania.

Bill, W3XO/5, also had a nice New Year's Eve with the opening to VK/ZL. Before the opening to the South Pacific, Bill saw XE2HWB (DL44) "spotted by a nearby station." Starting at 0048 UTC January 1, Bill heard and worked VK3ZAZ; he reports: "For the next hour, it was the most extreme VK/ZL opening I have ever encountered, even at the height of the last Solar Cycle." W3XO/5 worked VK5AK, VK5ACY, VK5CF, VK5NY, VK3OVR, VK2KRR, VK5RJ, ZL1IW, VK3XQ, VK3AKK, ZL4AAA, VK3DUT, VK7DX ("the only VK7 I have ever worked"), VK3AMK, VK2ZQ, ZL1AIX and ZL1GO.The last was at 0132Z.VK5NY was an honest S-9 for quite some time.

He was also hearing XE2HWB (DL44) on E_s and, "in fact, I informed VK5NY that XE2HWB was calling him. They worked right away. It seems that this is a classic case of an E_s link-up to some kind of transequatorial F2… "

144 MHz. Bob, K6QXY (CM88) and K7JA (DM03) reported reception of the KH6HME 144 MHz beacon on Mauna Loa via tropo on December 27. You can read an account of KH6HME's beacons here **at dx.qsl.net/kh6hme.**

432 MHz, 1296 MHz. Bob, K6QXY, also heard the KH6HME the 432 and 1296 MHz beacons in CM88 on December 27. He notes the Hawaiian beacon on 1296.250 got up to 519! This transpacific tropo opening was due to a huge high pressure system over the Pacific Ocean. Bob notes "this is very unusual for this time of year. We are very *dry,* no rain."

Jim Andrews, KH6HTV, reports a new distance record was set with amateur high definition television on the 70 cm band:

"On Monday (21 Nov), we set a new long distance record for Digital Television here in Colorado. Jim, KH6HTV, transmitted a high definition (1080i, 16:9) live picture from Cheyenne a distance of 75 miles to Bill, K0RZ, in Boulder. We were on Channel 58.1 (429 MHz) using a 5 watt transmitter with QAM-64 modulation."

Adrian Pollock, VK4OX, reports a 432 MHz meteor scatter contact with Arie, VK3AMZ, at 1830 UTC December 14 during the Geminds meteor shower at a distance of 1457 km. Both were running 400 W. They used a meteor scatter program called "multi-keyer," which is similar to FSK-441a. Meteor scatter contacts on 432 MHz are extremely rare, the strength and duration of the meteor bursts on this band being much less than on 144 MHz.

Here and There

Karsten, DL2LAH, says that he will be part of a group operating 144 MHz EME from Thailand in April. Unfortunately, no 50 MHz operation is allowed in Thailand. You can find more information at **www.moonbouncing.net**.

Special Events

Maty Weinberg, KB1EIB, events@arrl.org

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Feb 11-Feb 12, 0800Z-1400Z, W7W, Mesa, AZ. Mesa Amateur Radio Club. Arizona Centennial. 14.260. QSL. Mesa Amateur Radio Club, PO Box 159, Mesa, AZ 85211. **mesa-arc.org**

Feb 17-Feb 18, 1900Z-2359Z, W1AW/7, Yuma, AZ. Yuma Amateur Radio Hamfest Organization. 2012 ARRL SW Division Convention & Arizona Centennial. 28.348 21.312 14.248 7.212. QSL. ARRL W1AW/7 Special Event, c/o Joe Carcia, NJ1Q, W1AW Station Manager, 225 Main St, Newington, CT 06111. **www.yumahamfest.org**

Feb 18, 1500Z-2100Z, K8BF, Kent, OH. Portage County Amateur Radio Service. 7th Annual Freeze Your Acorns Off. 21.315 14.315 7.215 3.815. Certificate. Al Atkins, KB8VJL, 12433 Chamberlain Rd, Aurora, OH 44202. *7th Annual FYAO QRP operating event.* **www.portcars.org**

Feb 18-Feb 26, 1200Z-2359Z, W8WRK, Hamilton, OH. Butler County Amateur Radio Association. Washington's Birthday Amateur Relay Message 1916. 28.410 14.245 7.220 7.052. QSL. Kevin Jones, 7035 Morris Rd, Hamilton, OH 45011. *See URL for updates.* **www.bcara.net**

Feb 24-Mar 19, 1200Z-0200Z, K5R, Houston, TX. Northwest Amateur Radio Society 80th Annual Houston Livestock Show and Rodeo. 28.390 21.390 14.290 7.185. QSL. Tom King, 9438 Cedar Point Cir, Houston, TX 77070. **hlsr.com** *or* **k5r.org**

Feb 29, 1500-2200, W7ASL, Mesa, AZ. Sunlife Amateur Radio Club. Fourth Annual Snowbird Field Day. 28.490 24.980 21.440 18.158 14.340 7.290. QSL. Earl, Palmer, 560 S Rosemont, Meza, AZ 85206. **www.sunlifearc.webs.com**

Mar 1-Mar 31, 0000Z-2300Z, W5WWL, New Orleans, LA. WWL Radio. 90th Anniversary of WWL 870 AM New Orleans. 28.425 14.235 7.185 3.820. QSL. W5WWL, 400 Poydras, Ste 400, New Orleans, LA 70130. *Special operation by Club Station W5WWL.* **wwl.com**

Mar 9-Mar 10, 1800Z-2300Z daily, W8NVY, Muskegon, MI. American Red Cross. American Red Cross Month Special Event Stations. 147.420 Simplex 14.260 7.245 Echolink Node # 349350. Certificate & QSL. Karen Strait, 1479 Sullivan Rd, Ravenna, MI 49451. *Other American Red Cross Chapters participating as well. Contact as many as you can! QSL direct to them. E-mail questions/comments to* **dstlead@arcmon.org**. **www.arcmon.org**

Mar 9-Mar 11, 1000Z-1700Z, W4M, Newport News, VA. The Mariners' Museum. 150th Anniversary Battle of Hampton Roads. SSB CW All HF. Certificate. Cindi Verser, The Mariners' Museum, 100 Museum Dr, Newport News, VA 23606. **ironcladbattle@gmail.com**

Mar 10, 1400Z-2100Z, W4OT, Vero Beach, FL. Vero Beach Amateur Radio Club. 109th Anniversary Pelican Island National Wildlife Refuge. 28.450 21.350 14.240 7.255. Certificate. VBARC-W4OT, PO Box 2082,Vero Beach, FL 32961. *Leave the QTH for the park – commemorating the country's first National Wildlife Refuge.* **www.vbarc.net**

Mar 10, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. Navy Seabees' Birthday, Girl Scouts of America Founded 1912. SSB 14.320 7.250 PSK31 14.070 D-STAR 012C and 2 m/70 cm SOCAL rptrs. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Mar 10-Mar 11, 1300Z-2359Z, WM3PEN, Philadelphia, PA. Holmesburg Amateur Radio Club. Pennsylvania Charter Day. 28.410 21.310 18.140 14.240. QSL. Holmesburg ARC, 3341 Sheffield Ave, Philadelphia, PA 19136. *Celebrating the month William Penn was granted a charter for land called Pennsylvania. It's Pennsylvania's 331st birthday.* **www.harcnet.org**

Mar 13-Mar 15, 1421Z-1421Z, W4LX, Fort Myers, FL. Fort Myers Amateur Radio Club. Gunners at Buckingham Air Field/Lee County Mosquito Control. 28.340 21.350 14.240. Certificate. FMARC, PO Box 61183, Fort Myers, FL 33906. **fmarc.net**

Mar 14, 0000Z-2359Z, KD8DKU, Marquette, MI. Lake Effect Amateur Radio Club. International Pi Day/Einstein's Birthday. PSK31 14.070 SSB 7.285. QSL. Lake Effect ARC/Pi, 36 Southfork St, Marquette, MI 49855. *A fun event for the nerd in all of us. Lemon pi(e) at club HQ for drop-ins! Will sked QSOs.* **www.lakeeffectarc.info/Event-PiEinsteinDay/PiDay.htm**

Mar 14-Mar 15, 1200Z-0000Z, N0S, Springfield, MO. Larry Grinstead, WA**0**JZK. Pi Day 2012. 28.468 21.368 14.268 7.268. QSL. Larry Grinstead, 2469 E Montclair Ct, Springfield, MO 65804. *The station will promote math education by discussing various topics, quizzes and oddities about the number pi during QSOs. Students are particularly encouraged to make contact and seek a pi-related QSL card.*

Mar 15-Mar 17, 1521Z-1521Z, K9TAL, Indianapolis, IN. The American Legion Amateur Radio Club. 93rd Birthday of the American Legion. 14.270. Certificate. The American Legion Amateur Radio Club, TAL National Headquarters, 700 N Pennsylvania St, Indianapolis, IN 46204. **www.legion.org/hamradio**

Mar 16, 1500Z-2200Z, W5G, Goliad, TX. Goliad County Amateur Radio Operators. 263rd Anniversary of the Founding of Goliad. SSB CW all HF frequencies. QSL. Skip Stem, WB4DAD, 655 N Loop 337 #405, New Braunfels, TX 78130. *Operating in conjunction with the Goliad County Fair.*

Mar 17, 0800Z-2000Z, N4F, Eastpoint, FL. Franklin County Amateur Radio Club. Eastpoint Rib Cookoff. 14.285 14.280 14.275 14.270. QSL. Tom Dasen, AF4WU, 615 Ridge Rd, Eastpoint, FL 32328. *Annual volunteer fire department fundraiser.*

Mar 17, 1500Z-2200Z, W4BKM, Macon, GA. Macon Amateur Radio Club. 30th Annual Cherry Blossom Festival. 14.240 7.225. Certificate. MARC, PO Box 4862, Macon, GA 31208. **w4bkm.com**

Mar 17-Mar 18, 1200Z-2200Z, N4G, Greensboro, NC. Greensboro Amateur Radio Association. The Battle of Guilford Courthouse. 21.315 14.315 7.231 3.900. Certificate. N4G Special Event Station, c/o GARA, PO Box 7054, Greensboro, NC 27417. *Fought on March 15, 1781.* **www.n4g-gch.org**

Mar 25-Mar 30, 0009Z-2359Z, GB5TST, Tollerdown, Dorset, England. Radio Society of Great Britain. Tollerdown Shutter Telegraph Over 200 Years. 14.200. QSL. RSGB or direct to John Wakefield, Oakhurst, Lower Common Rd, West Wellow, Romsey SO51 6BT, England. **www.qrz.com/db/gb5tst**

Mar 28-Apr 1, 1600Z-2300Z, W4GGM, Columbia, TN. Maury Amateur Radio Club. Mule Day. 14.260 14.070 7.260 7.060. QSL. Andreas Eastep, KJ4JEK, 504 Hemingway Dr, Columbia, TN 38401. *Mule Day is a annual celebration of all things related to mules and is held in Columbia TN, the "mule capital" of the world.* **www.w4ggm.org**

Mar 30-Apr 1, 1200Z-2000Z, NA5MS, New Albany, MS. Northeast Mississippi Amateur Radio Club. 150th Anniversary of the Civil War Battle of Shiloh, TN. 3.860 Lower Gen phone, 10 m Tech band. Certificate and QSL.* Charles Buster, 305 N Broad St, New Albany, MS 38652. *From the Shiloh Battlefield during battle reenactment.*

Mar 31, 1330Z-1930Z, K4LKL, Kathleen, FL. Lakeland Amateur Radio Club. Celebration of the 38th Annual Fly-In and Expo in Lakeland, Florida. 28.370 21.320 18.155 14.280. Certificate. Lakeland ARC, PO Box 187, Kathleen, FL 33849. **lakelandarc.org**

Mar 31, 1500Z-2300Z, W5RRA, San Antonio, TX. Southwest Research Center Amateur Radio Club. 35th Anniversary. 28.450 21.350 14.250 7.250. Certificate. SwRC Amateur Radio Club, 6220 Culebra Rd, Bldg 58, San Antonio, TX 78238. **w5rra@swri.org**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **May** *QST* would have to be received by **Mar 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 Jan 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

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

RAST Club Station Tries to Rebuild After Floods

In October 2011, Thailand experienced some of its worst flooding in recent history, with almost 800 people reported dead. Even six months later, many communities are still trying to recover from the flood waters — some that rose as high as 10 feet — that swept through the country. The flood affected at least 58 of Thailand's 76 provinces.

The flood waters reached up to the top of the windows and door — as seen by the water lines — at the RAST club station.

This Kenwood TS-440S was one of the many radios destroyed in the flood.

The damaging waters also destroyed the club station of the Radio Amateur Society of Thailand (RAST), HS0AC, located at the Asian Institute of Technology in Bangkok. On December 10, 2011, a delegation led by RAST President Chaiyong Wongwuticomjon, HS1QVD, and Station Manager Finn Jensen, OZ1HET, visited the station. They found the flooding had almost reached the ceiling, while outside, all the grass, plants and shrubbery had died. Most of the furniture and equipment in the station were destroyed, including a Yaesu FT-1000MP, a Kenwood TS-440S and TS-950S, and a Drake T-4XC.

RAST President Chaiyong Wongwuticomjon, HS1QVD, checks out the base of one of the antenna towers outside the station.

The National Broadcasting and Telecommunications Commission — Thailand's telecommunications regulator — presented this plaque to RAST (held by RAST President Chaiyong Wongwuticomjon, HS1QVD) in appreciation for the society's flood relief work.

"The club station was completely destroyed," Jensen said on the RAST website. "Everything in there was spoiled, so we could only 'scrap' all out as garbage. All the furniture had fallen apart and everything was full of mud and smelling very bad. I must say, it was far worse than expected. This was a very, very bad experience."

According to HS0AC Station Manager Finn Jensen, OZ1HET, all of the equipment and furniture in the station was completely destroyed. The team led by Jensen and Wongwuticomjon carefully removed everything in the station, including the cabling that had been submerged by the flood water and furniture, as well as the remains of desks that had collapsed due to the weight of equipment and the corrosive water.

As of January, hams around the world have donated more than 200,000 BHT (about $6315 USD) to refurbish the station. According to RAST, all funds donated before December 2011 went to help flood victims, but all donations received after that are earmarked for the recovery and restoration of the club station, with the objective of getting HS0AC back on the air as soon as possible. If you would like to assist, please notify RAST International Liaison Officer Tony Waltham, HS0ZDX, via e-mail at **tony.waltham@gmail.com**. More photos of the damage can be seen at the RAST website at **www.qsl.net/rast**. There is also a PayPal link on that page for donations.

All photographs courtesy of the Radio Amateur Society of Thailand.

Strays

CQIR — ST PATRICK'S DAY QSO PARTY

Everyone, whether you are Irish or not, is invited to a party on St Patrick's Day, March 17. The Irish national society, IRTS, is celebrating its 80th birthday and as part of the fun has organized a 24 hour contest — more of a QSO party really — that begins at noon UTC on St Patrick's Day. This is an "everybody works everybody" contest. The real fun is that if you are Irish (that is, if you have even a drop of green blood) you will be giving away extra points and multipliers, which should make you very popular.

If you are not actually operating from Ireland and want to operate as an Irish station for the contest you need to adopt an Irish county for multiplier purposes.

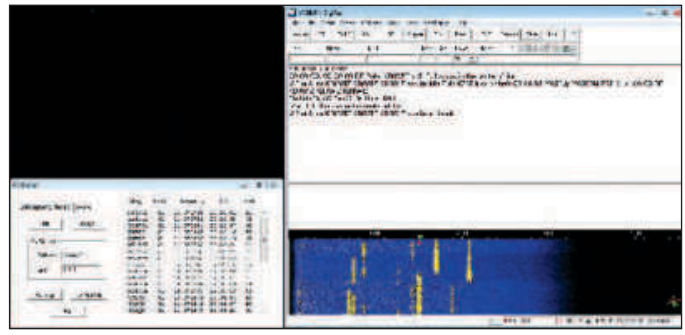
If you have no idea which Irish county you might have a family link with, you can get some help from a website that links Irish surname to likely counties, **www.irishtimes.com/ancestor**. For example if your name is Murphy chances are your family came from County Cork! Your exchange would be 59001 COUNTY CORK.

There are SSB, CW and Mixed mode sections and full rules including a list of Irish counties are available on the IRTS website, **www.irts.ie/CQIR**. Further information can also be obtained by e-mail from **cqir@irts.ie**.
— *Séamus McCague EI8BP*

Steve Ford, WB8IMY, wb8imy@arrl.org

PSKimmer

In my November 2011 column I discussed the concept of *reverse beacons* — websites that keep their fingers on the pulse of real-time Amateur Radio activity and make the information available for all to see. You might consider a DX Cluster as a reverse beacon of sorts since it stores and displays DX spots sent in by operators throughout the world.

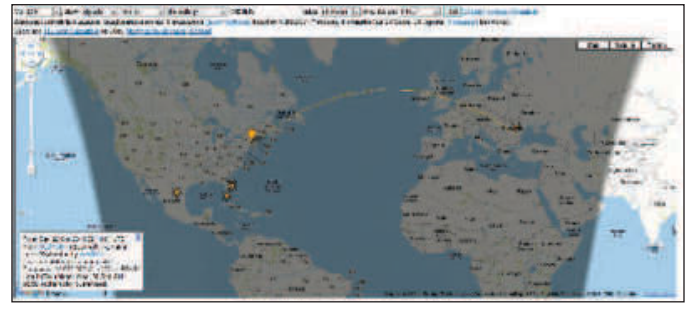


Here is *PSKimmer* running alongside *DigiPan* at 14.070 MHz.

As I explained in my column, however, what makes a reverse beacon different is that it is totally automated. Information is sent directly from amateur stations to the Internet without any human intervention whatsoever. In contrast to a DX Cluster, the reverse beacon network isn't dependent on the whims of individual operators who may, or may not, choose to post certain DX spots.

At the heart of any reverse beacon network is specialized software that monitors the output of individual station receivers the world over. Take W6CQZ's *JT65-HF* program as an example. Park your rig on a JT65 HF frequency and Joe's software will automatically upload call signs (and more) for every JT65 signal it decodes — even while you are using the software to make contacts. *JT65-HF* is available at **http://jt65-hf.sourceforge.net/**.

For CW reporting the most popular reverse beacon software is *CWSkimmer* by Alex Shovkoplyas, VE3NEA, which you'll find at **www.dxatlas.com/CwSkimmer/**. The software does a remarkable job of sweeping through a receiver's available bandwidth and decoding and uploading every CW call sign it can find.



In this image from the PSKReporter website, my station reports receiving a PSK31 signal from YO3FOM, thanks to *PSKimmer*.

Thanks to Al Gerheim, K1QN, amateurs now have a program that will do the same for PSK31, the most popular HF digital mode in use today. Known as *PSKimmer*, this free *Windows* application is intended for use with the equally free *DigiPan* PSK31 software by KH6TY (available at **www.digipan.net**).

You simply start *DigiPan* and tune to a PSK31 hangout such as 14.070 MHz. Next, you start *PSKimmer* and allow it to work its magic.

PSKimmer will grab everything *DigiPan* can decode and will upload the information automatically to the PSKReporter reverse beacon website at **http://pskreporter.info/pskmap.html**. If you're not in the mood to make a PSK31 contact at that moment, you can simply walk away and let *PSKimmer* perform a valuable service for your fellow amateurs by allowing them to catch a glimpse of what you are "hearing." *PSKimmer* is available for downloading at **http://k1qn.info/PSKimmer**.

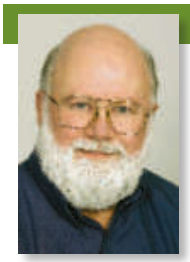
Homebrew Your Own Supercomputer

Whoever says that "old guys" can't keep up with technology has never heard of GreenArrays. Many of the founders and designers were beyond the traditional "retirement" age, yet they had lifetimes of technical skills that they weren't ready to discard. The result is GreenArrays Corporation and cutting edge products such as their GA144 series processor chips with *144 cores* (and you probably thought the quad-core processor in your home PC was impressive).

Last October they announced an OEM partnership with Schmart Board that will allow hobbyists like us to play with their super processor. The GA144 is an astonishing device that can execute 90 billion instructions per second at a total power consumption of less than one watt. Its power consumption plunges to only 14 µW when the chip is idle.

GreenArrays suggests you use the Schmart Board 202-0048-01 to experiment with their chip. This is a surface-mount processor, so you must take care when soldering it to the board. Schmart Board has posted an instructional video on YouTube at **http://youtu.be/qaMPp_5tXSY**. GreenArrays offers instructions with more detail in PDF form at **www.greenarraychips.com/home/documents/greg/AN005-110926-SCHMART.pdf**.

The GA144-1.20 chips are sold in minimum order quantities of 10 for $200 (total), so unless you have a need for 10 of these processors, you might want to spread the cost among some of your likeminded friends. You can order the chips online at **www.greenarraychips.com/home/products/**.



John Dilks, K2TQN, k2tqn@arrl.org

Pauline Raser, W2QCC (SK)

W2ZI's Museum had tubes, keys, old magazines — and rigs galore.

This portrait of Pauline Raser, W2QCC, written by Rose Ellen Bills, WA2FGS, was pub-lished in the Gloucester County (New Jersey) ARC newsletter, Crosstalk, in October 1973.

Many YLs have been active just about as long as any records of OMs, and one of these gals is none other than Pauline Raser, W2QCC (XYL of Ed, W2ZI) of Trenton, N.J. Pauline says she was introduced to the wonders of wireless by her future OM in 1918. He was at the time in Naval Service as a radio operator. Polly learned the code unbeknown to him and one day tried to send code via the hand-squeeze system — holding hands! — a big surprise to Ed. It brought its reward — by 1920 Polly was operating Ed's spark coil rig using his call 3CS and later 3ZI (now W2ZI).

Polly received her first call 3AEC in 1923; then W3HVO in 1930, which was changed to W2QCC when South Jersey became part of the 2nd district. She has been 3rd District Chairman of YLRL wherein a write-up of all women ops in her area was submitted for publication in *YL Harmonics* (a publication of the YLRL). Most of her more recent operating has been on 20, 40 and 80, usually CW. She says one of the early women she remembers contacting was W2WP, Alice Picard, of Staten Island, New York. Polly is not active on the air now but was active in club work. She has served as president of the Ladies Auxiliary of The Delaware Valley ARC and as vice president. This club has a station active on the air known to us as W2ZQ. We remember well the talk Ed Raser, W2ZI, gave to the club and a reminder of this event is the picture in the clubroom of his collection of antique wireless gear.

Today it is much more common for the YL to learn about the hobby of radio with so many books and modern equipment found right in our homes. The average OM would be more than pleased if his XYL took enough interest to an elementary understanding of radio and not necessarily going all the way to face the FCC examiner. This example has been shown since we all know the many happy years both Polly and Ed have enjoyed together. Why not follow her example?

Pauline and Ed Raser in 1957.

W2ZI museum in his home.

W2ZI's Historical Wireless Museum

The W2ZI Historical Wireless Museum, one of the first private institutions, was entirely a one-man project. It was the result of over 30 years of collecting and research in the pioneer field of wireless and radio.

The museum included over 400 items on display of apparatus and instruments from the 1899 period, when Marconi first came to America, to the end of the amateur Spark

Inside view of W2ZI's collection, Titanic Radio Room, at the AWA Museum.

Ed Raser SOS CQD

From Milt Schwartz, W2SF, in Volume 1 No. 1 Society of Wireless Pioneers, December 7, 1977, Elmo Pickerill Chapter No. XI

Speaking of Biographies...One of these is Ed Raser who was recently elected into CQD/SOS club. Ed joined the Navy in 1917 and was assigned to the Philadelphia Navy Yard to work their 5 KW Lowenstein quenched gap spark. From there he went to aeronautical mobile operation using a SPARK set.

Airplanes being what they were in those days, on a mission to spot German submarines, the aircraft motor conked out. Ed got his SOS/CQD call out but the airplane was in the water before he got his acknowledgement. As it turned out Ed Raser and the rest of the crew floated around for about 6 hours before the Navy found him. It was then that he discovered that they had indeed heard his distress call, proving that wireless was really a workable thing.

Showroom inside Ed's 1930 radio store.

Era, 1925. There were a few early broadcast sets, but the collection consisted mainly of amateur wireless gear from about 1909, naval and marine receivers removed from many ships, and equipment used by the old time shore stations.

A side collection of some 98 Morse and wireless keys and some 100 significant types of vacuum tubes from 1907 to about 1925 were shown. The W2ZI collection also included a large historical library on the art of wireless and radio, and files of magazines back to 1908 along with many papers and photographs of the early stations, pioneers of wireless and their biographies.

Ed Raser always thanked all those Amateur Radio operators, commercial wireless ops and friends who had so willingly contributed to the success of his project.

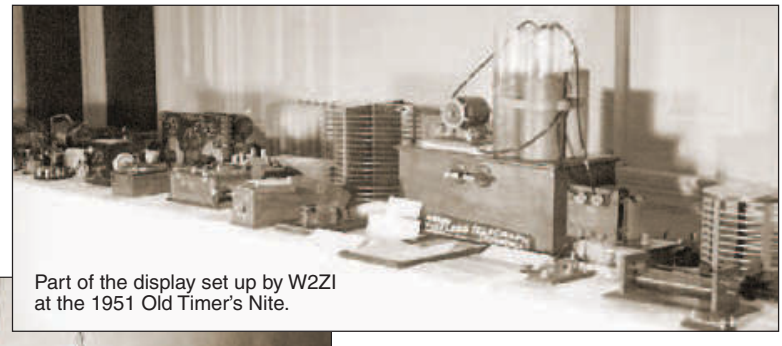
The Museum was open to the public by appointment only. If you wanted to visit, you had to write or telephone a few days in advance so arrangements could be made. [Lightly edited from Ed's museum brochure.]

What Happened to the Museum?

Ed was a generous man. He loved radio so much that he wanted to share his collection with as many people, as long as possible. To this end, along with his close friend Bruce Kelley, W2ICE, they arranged for the wireless and key collections to be on display in the AWA Museum for all time.

You can see in the photos, "The Ed G. Raser W2ZI Wireless Room" in the AWA museum. The simulated ship wireless room displays Ed's Marconi equipment and is an almost duplicate to the Titanic Wireless Room.

Ed's broadcast-related pieces went to the National Broadcasters Hall of Fame, now located at Infoage in New Jersey. See the December 2010 Vintage Radio column and **www.infoage.org**.



Part of the display set up by W2ZI at the 1951 Old Timer's Nite.

Prior to the founding of the AWA, Ed sponsored gatherings for "Old Timers" where he would display some of his collection. Speakers at one of the "Old Timer's Nite" were from the left: Irving Vermilya, W1ZE; Ed Raser; Lloyd Espenshied; Les Allen, W2CCO; Clarence Tuska, 1ZT; Merrill Budlong, W1MB, unknown person in uniform.

Key Collections at the AWA Museum

Louise Moreau, W3WRE (SK), collected keys and became an expert. She wrote important papers on key history that were published in several of the yearly *AWA Reviews*. She also wrote the *Story of the Key and American Telegraph Instrument Makers 1837-1900* with Roger W. Reinke.

Louise was good friends with Ed Raser and Bruce Kelley, visiting both many times. In fact she learned much about keys in the beginning from both of them. Today visitors can see both key collections, W2ZI and W3WRE, at the AWA Museum. There are hundreds of keys on display that are being augmented with those of member donations. (I'll have more on Louise Moreau in a future column.)

AWA Museum and Research Campus

The AWA Museum began six decades ago and is evolving into the world's premier and most important radio and electronic communications history museum. It will officially open during the summer of 2013. The "new" AWA Museum and Research Campus will be located in Bloomfield, New York, just 2 miles east of the present AWA Museum on Routes 5 and 20 in upstate New York. If you visit now, you can see the old and new museums while volunteer members are moving and setting up the displays anew. For information on memberships, the address and times open, check their web page, **www.antiquewireless.org/**.

All photos by W2ZI.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Arkansas (Fort Smith) — Apr 7
D F H Q R S T V
8 AM-3 PM. *Spr:* Fort Smith Area ARC. Columbus Acres, 10203 Columbus Acres Rd. *Tl:* 146.64 (88.5 Hz). *Adm:* advance $8, door $10. Tables: $10. Jimmie Lowrey, W5JNL, Box 6622, Fort Smith, AR 72906; 479-649-7249; fax 866-829-6269; **W5JNL@IRSTaxes.biz**; **www.HangingJudgeHamfest.com**.

Colorado (Longmont) — Apr 7 D F H R S V
8 AM-2 PM. *Spr:* Longmont ARC. Boulder County Fairgrounds, 9595 Nelson Rd. *Tl:* 147.27 (100 Hz). *Adm:* $5. Tables: $10. Gerald Schmidt, N0OUW, 1541 Judson Dr, Longmont, CO 80501; 303-772-6736 (phone and fax); **n0ouw@arrl.net**; **w0eno.org**.

Connecticut (Dayville) — Mar 17 D F H R V
8 AM-noon. *Spr:* Eastern Connecticut ARA. St Joseph's Church Hall, 350 Hartford Pike (Rte 101). *Tl:* 147.225 (156.7 Hz). *Adm:* $3. Tables: $10. Paul Rollinson, KE1LI, 182 Wrights Crossing Rd, Pomfret Center, CT 06259; 860-928-2456; fax 860-928-3844; **ke1li@arrl.net**; **www.qsl.net/k1muj/**.

Florida (Fort Walton Beach) — Mar 23-24
D F H Q R V
Friday 5-9 PM; Saturday 8 AM-3 PM. *Spr:* Playground ARC. C. H. "Bull" Rigdon Fairgrounds, 1958 Lewis Turner Blvd. *Tl:* 146.79 (100 Hz). *Adm:* $5. Tables: $10. Harry Steck, KG4YWY, Box 873, Fort Walton Beach, FL 32549; 850-243-4315; **parcfest@w4zbb.org**; **www.w4zbb.org**.

Florida (Punta Gorda) — Mar 10 F H R T
7 AM-2 PM. *Spr:* Peace River Radio Assn. Tropical Gulf Acres Clubhouse, 28245 Pasadena Dr. *Tl:* 147.255 (136.5 Hz). *Adm:* $5. Tables: $10. Tom Lambie, N4XJQ, c/o PRRA, Box 510943, Punta Gorda, FL 33951-0943; 941-639-3670; **n4xjq@comcast.net**; **www.w4dux.net**.

SOUTHERN FLORIDA SECTION CONVENTION
March 17, Stuart
D F H Q R S T V
The Southern Florida Section Convention (37th Annual Free Martin County Hamfest), sponsored by the Martin County ARA, will be held at the Martin County Fairgrounds, 2616 SE Dixie Hwy. Doors are open 8 AM-5 PM. Features include dealers and exhibitors, flea market, tailgating, QSL card checking, forums, VE sessions (1 PM), handicapped accessible, limited RV parking, refreshments. Talk-in on 147.06 (107.2 Hz). Admission is free. Tables are $25 (commercial vendors), $15 (clubs and associations). Contact Doug Shields, W4DAS, Box 1901, Stuart, FL 34995; 772-349-7820; **hamfest@stuarthamfest.com**; **www.stuarthamfest.com**.

Georgia (Marietta) — Mar 17
D F H Q R S V
8 AM-3 PM. *Spr:* Kennehoochee ARC. Jim Miller Park, 2245 Callaway Rd. 59th Annual Hamfest. *Tl:* 146.88 (100 Hz). *Adm:* advance $7, door $8. Tables: $20. Ricky DeLuco, K4JTT, 4281 Moon Station Ln NW, Acworth, GA 30101; 770-833-2290; **k4jtt@yahoo.com**; **www.w4bti.org/hamfest__2012.html**.

Coming ARRL Conventions

February 17-18
Southwestern Division, Yuma, AZ*

February 18
Arkansas Section, Hoxie*

February 25
Vermont State, South Burlington*

March 3
Santa Clara Valley Section, Del Rey Oaks, CA*
South Texas Section, Rosenberg*

March 3-4
Alabama Section, Birmingham*

March 9-10
Louisiana State, Rayne*
Oklahoma State, Claremore*

March 10-11
Roanoke Division, Concord, NC*

March 17
Southern Florida Section, Stuart
Nebraska State, Lincoln
West Texas Section, Midland

March 23-24
Maine State, Lewiston

March 31
MicroHAMS Digital, Redmond, WA

April 7
North Carolina State, Raleigh

April 14
Delta Division, Bartlett, TN

April 14-15
Communications Academy, Seattle, WA

April 20-21
Southeastern VHF, Charlotte, NC

April 20-22
International DX, Visalia, CA
Idaho State, Boise

April 21
Delaware State, Georgetown
Louisiana Section, Monroe

May 4-6
EMCOMMWEST, Reno, NV

*See February *QST* for details.

Illinois (Jeffersonville) — Apr 7
D F H Q R S T V
8 AM-1 PM. *Spr:* WHERE ARC. Geff Ruritan Bldg., W Jefferson and N Washington Sts. April Fools Fest. *Tl:* 442.625 (123 Hz), 146.52. *Adm:* $2. Tables: $5. Steven Hamilton, KC9GMX, 207 S Washington St, Geff, IL 62842; 618-919-0536; **stevelton17@hotmail.com**; **www.whereradio.com**.

Indiana (Columbus) — Mar 31 D F H R T V
Set up Friday (Mar 30) 6-9 PM; public Saturday 8 AM-2 PM. *Spr:* Columbus ARC. Bartholomew County 4-H Fairgrounds Community Building, 750 W County Rd 200 S. 29th Annual Hamfest. *Tl:* 146.79 (100 Hz). *Adm:* advance $4.50, door $5. Tables: 8-ft $8. Marion Winterberg, WD9HTN, 11941 W Sawmill Rd, Columbus, IN 47201; 812-342-4670; **mlw467@gmail.com**; **carcnet.org**.

Indiana (Terre Haute) — Mar 10 D F H S V
9 AM-2 PM. *Spr:* Wabash Valley ARA. Indiana State University Dede Activity Center, 550 Chestnut St. Hamfest and Computer Expo. *Tl:* 146.685 (151.4 Hz). *Adm:* $7. Tables: Free. Chuck Procarione, W9COD, 444 South 4th St, Clinton, IN 47842; 812-239-8061; **famabc@yahoo.com**; **w9uuu.org**.

Iowa (McClelland) — Mar 3 D F
8 AM-1 PM. *Spr:* South West Iowa ARC. McClelland Town Hall, 170 Main St. *Tl:* 146.82. *Adm:* $4. Tables: $5 (includes admission). Greg Ross, N0GR, 22106 320th St, Minden, IA 51553; 712-566-2698; **n0gr@arrl.net**; **swiarc.org**.

Kentucky (Elizabethtown) — Apr 7
D F H R S T V
8 AM-2 PM. *Spr:* Lincoln Trail ARC. Elizabethtown Community and Technical College, 630 College Street Rd. *Tl:* 146.98. *Adm:* advance $5, door $6. Tables: 6-ft $7. Archie Mack Sr, AF4EB, 102 Primrose Ln, Radcliff, KY 40160; 270-351-6931; **amack1@insightbb.com**; **www.qsl.net/ltarc/**.

MAINE STATE CONVENTION
March 23-24, Lewiston
D F H R S V
The Maine State Convention (34th Annual "Andy" Hamfest and Computer Fair), sponsored by the Androscoggin ARC, will be held at the Ramada Inn and Convention Center, 490 Pleasant St. Doors are open Friday 7-9 PM, Saturday 8 AM-noon. Features include exhibitors, vendors, new and used radio and electronics gear, computers, forums, VE sessions, handicapped accessible, refreshments. Talk-in on 146.61. Admission is $7. Tables are $7 in advance, $8 at the door. Contact Ivan Lazure, N1OXA, 440 Webber Ave, Lewiston, ME 04240; 207-784-0350; **n1oxa@arrl.net**; **www.w1npp.org**.

Maryland (Timonium) — Mar 31
D F H Q R V
7 AM-3 PM. *Spr:* Baltimore ARC. Maryland State Fairgrounds, 2254 York Rd. 43rd Annual Greater Baltimore Hamboree and Computerfest. *Tl:* 146.67 (107.2 Hz). *Adm:* advance $8, door $9. Tables: $20 (basic indoor, plus admission), $30 (flea market, plus admission), $75 (commercial). William Dobson, N3WD, Box 120, Reisterstown, MD 21136; 443-590-1444; **w3ft67@yahoo.com**; **www.gbhc.org**.

Massachusetts (Framingham) — Mar 25
D F H R V
Set up 7:30 AM; public 9 AM-noon. *Spr:* Framingham ARA. Keefe Technical School, 750 Winter St. *Tl:* 147.15. *Adm:* $5 (under 12 free with adult). Tables: 6-ft advance $20, door $25. Bev Lees, N1LOO, c/o FARA, Box 3005, Framingham, MA 01705; 508-626-2012; **beverlylees@hotmail.com**; **www.fara.org/flea**.

Michigan (Lowell) — Apr 7 D F H R V
8 AM-noon. *Spr:* AR Group of Youth in Lowell. Lowell High School, 11700 Vergennes St.

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

Hamfest and Computer Show. *Tl:* 145.27, 146.62 (both 94.8 Hz). *Adm:* advance $4 (plus table fee), door $5. Tables: 5-ft $5, $8 (for 10-ft table space). Al Eckman, WW8WW, 725 Bowes Rd, Apt K6, Lowell, MI 49331; 616-450-4332; **al.eckman@comcast.net**; **www.argyl.org**.

Michigan (Marshall) — Mar 17 D H R V

8 AM-noon. *Spr:* Southern Michigan ARS. Marshall Activity Center, 15325 W Michigan Ave. 52nd Annual Michigan Crossroads Hamfest. *Tl:* 146.66 (94.8 Hz). *Adm:* $5. Tables: $10. David Ashbolt, K8OLY, 7008 E Morgan Rd, Battle Creek, MI 49017; 269-223-7141; **crossroadshamfest@gmail.com**; **www.w8df.com/hamfest.html**.

Minnesota (Buffalo) — Mar 31 D F H R V

8 AM-1 PM. *Spr:* Maple Grove RC (previously known as Robbinsdale ARC). Buffalo Civic Center, 1306 County Rd 134. 31st Annual Midwinter Madness Hobby Electronics Show. *Tl:* 147.0. *Adm:* $9. Tables: $25. Jerry Dorf, N0FWG, Box 22613, Robbinsdale, MN 55422; 763-537-1722; **k0ltc@k0ltc.org**; **www.k0ltc.org**.

NEBRASKA STATE CONVENTION

March 17, Lincoln

D F H Q R S V

The Nebraska State Convention, sponsored by the Lincoln ARC, will be held at the Lancaster County Event Center, N 84th St and Havelock Ave. Doors are open 8:30 AM-3 PM. Features include flea market; vendors; forums; ongoing technical presentations and demonstrations all day; special guest from ARRL Hq Harold Kramer, WJ1B, Chief Operating Officer; QSL card checking; CW certification; VE sessions (10 AM and 1 PM); handicapped accessible; 200 RV camper hookups; refreshments. Talk-in on 146.76. Admission is $8 (under 18 free). Tables are $10 in advance (by Mar 1), $20 (after midnight Mar 1). Contact Lonnie Rech, WD0AOP, 3200 Rock Creek Rd, Davey, NE 68336; 402-432-2139; **wd0aop@arrl.net**; **www.lincolnhamfest.org**.

New Hampshire (Henniker) — Mar 18
D F H R S V

8 AM-2 PM. *Spr:* Contoocook Valley RC. Henniker Community School, 51 Western Ave. *Tl:* 146.895 (100 Hz). *Adm:* $3. Tables: $10. Donald Curtis, N1ZIH, 353 N State St, Apt 1, Concord, NH 03301; 603-651-8000; **n1zih@comcast.net**; **www.k1bke.org**.

New Jersey (Succasunna) — Mar 24
D F H Q R T V

Sellers 6 AM, buyers 8 AM-3 PM. *Spr:* Splitrock ARA. Roxbury Senior Center, 72 Eyland Ave. *Tl:* 146.985 (131.8 Hz). *Adm:* $7. Tables: $25. Greg Mohr, W2GCM, 551 State Rte 10, Randolph, NJ 07869; 973-945-5191; **w2gcm@arrl.net**; **www.splitrockara.org**.

New Jersey (Township of Washington) — Mar 4 H R **(Auction)**

1-4 PM. *Spr:* Bergen ARA. Westwood Junior and Senior High School, 701 Ridgewood Rd. *Tl:* 146.79 (141.3 Hz). *Adm:* Free. James Joyce, K2ZO, 286 Ridgewood Blvd N, Township of Washington, NJ 07676; 201-664-6725; **k2zo@arrl.net**; **www.bara.org**.

New York (Horseheads) — Feb 25 D H R V

8 AM-2 PM. *Spr:* ARA of the Southern Tier. NYS National Guard Armory, 128 Colonial Dr. 31st Annual Hamfest. *Tl:* 147.36. *Adm:* advance $5, door $6. Tables: 8-ft $17 (discounted rate of $14 if paid by Feb 15). Randy Viele, N2SYT, c/o ARAST, Inc, Box 614, Horseheads, NY 14845; 607-398-0411; **2012Winterfest@arast.org**; **www.arast.org**.

North Carolina (Dobson) — Feb 18
D F H R T V

8 AM. *Spr:* Friends of the Foothills Food Pantry. Dobson Fire Department, 212 N Crutchfield St. "Stop HungerFEST." *Tl:* 145.43. *Adm:* $5. Tables: No table fee. Drew Poindexter, AD4T, 128 Gene Culler Rd, Dobson, NC 27017; 336-374-6753; **ad4t@triad.rr.com**.

NORTH CAROLINA STATE CONVENTION

April 7, Raleigh

D F H Q S V

The North Carolina State Convention (40th Annual RARSFest), sponsored by the Raleigh ARS, will be held at the North Carolina State Fairgrounds, Jim Graham Bldg, 1025 Blue Ridge Rd. Doors are open 8 AM-3:30 PM. Features include huge electronics flea market; computers; new equipment dealers; major Amateur Radio exhibitors; vendors; forums and meetings; VE sessions (9 AM, walk-ins accepted, $14 fee; Joe White, WA4GIR, 919-387-9152, **WA4GIR@arrl.net**); equipment test station; QSL card checking; contests; Special Event Station W4DW that you can operate; hands-on construction projects; Youth Lounge; RV parking with full hookup for nominal fee; handicapped accessible. Talk-in on 146.64 (backup 146.88). Admission is $7 in advance (by Mar 31), $8 at the door or after Mar 31; age 16 and under admitted free when accompanied by an adult. Tables with 2 chairs are $18 each in advance (by Mar 31), $20 each after Mar 31 (power is $25 per outlet, bring your own extension cords). Contact Chuck Littlewood, K4HF, 2005 Quail Ridge Rd, Raleigh, NC 27609; 919-872-6555; **k4hf@arrl.net**; **www.rars.org/hamfest**.

North Dakota (Bismarck) — Feb 25
F H R S V

7 AM-3 PM. *Spr:* Central Dakota ARC. St Mary's Grade School, 807 E Thayer Ave. 22nd Annual Hamfest. *Tl:* 146.94. *Adm:* advance $6, door $7. Tables: $5. Dick Veal, KA0ETO, 701-223-7481; **georgerv@bis.midco.net**.

Ohio (Gallipolis) — Mar 10 D F H R T V

8 AM-2 PM. *Spr:* Mid-Ohio Valley ARC. Gallipolis Christian Church, 4486 State Route 588. *Tl:* 147.06 (74.4 Hz). *Adm:* $5. Tables: $5. Lester Cardwell, KD8ZU, 15422 Hannan Trace Rd, Crown City, OH 45623; 740-256-1312; **kd8zu@arrl.net**; **sites.google.com/site/midohiovalleyarc/**.

Ohio (Perrysburg/Toledo) — Mar 18
D F H R S V

8 AM-2 PM. *Spr:* Toledo Mobile Radio Assn. Owens Community College, 30335 Oregon Rd. 57th TMRA Hamfest and Computer Fair. *Tl:* 147.27 (103.5 Hz). *Adm:* $6. Tables: $20 (non-wall), $25 (wall). Brian Harrington, WD8MXR, 4463 Holly Hill Dr, Toledo, OH 43614; 419-385-5624; **wd8mxr@gmail.com**; **www.tmrahamradio.org**.

Tennessee (Tullahoma) — Mar 17
D F H R S T V

8 AM-2 PM. *Spr:* Middle Tennessee ARS. First Methodist Church Center, 208 W Lauderdale St. *Tl:* 146.82 (114.8 Hz). *Adm:* $5. Tables: 6-ft $10, 8-ft $15. Michael Glennon, KB4JHU, 302 Twelve Oaks Rd, Tullahoma, TN 37388; 931-461-3037; **kb4jhu@arrl.net**; **www.qsl.net/mtars/**.

Tennessee (Union City) — Mar 17
D F H Q R S T V

7 AM-2 PM. *Spr:* Reelfoot ARC. Tennessee National Guard Armory, 2017 E Reelfoot Ave. *Tl:* 146.7 (100 Hz). *Adm:* $5. Tables: Free. Bob Miles, K9IL, 113 Greenacres Dr, Martin, TN 38237; 731-588-2840; **greenacres113@charter.net**; **www.reelfootarc.com**.

WEST TEXAS SECTION CONVENTION

March 17, Midland

D F H Q R S T V

The West Texas Section Convention (57th Annual St Patrick's Day Hamfest), sponsored by the Midland ARC, will be held at the Midland Lions Club, 200 Plaza Ave. Doors are open 8 AM-2 PM. Features include large indoor flea market, dealers, ARRL Forum, VE sessions (1 PM), QSL card checking, handicapped accessible, snack bar. Talk-in on 147.3. Registration is $8 in advance, $9 at the door. Tables are $10 each (online registration available). Contact Joe Coldewey, KK5ZG, 4510 Fairbanks Dr, Midland, TX 79707; 432-697-7846; **kk5zg@grandecom.net**; **hamfest.w5qgg.org**.

Texas (Weatherford) — Mar 24
D F H R S T V

7 AM-noon. ARC of Parker County. Couts United Methodist Church, 802 N Elm St. *Tl:* 147.04 (110.9 Hz). *Adm:* advance $4, door $5. Tables: $10. Ken Stout, K5KMS, Box 1795, Weatherford, TX 76086; 817-822-5899; **ken_stout66@yahoo.com**; **www.w5pc.org**.

Washington (Elma) — Feb 25 H R S V

8:45 AM-4 PM. *Spr:* Grays Harbor ARC. Church of Jesus Christ of Latter Days Saints, 702 E Main St. *Tl:* 147.16 (88.5 Hz). *Adm:* Free. Les Morgan, N7GH, 109 N Newell St, Aberdeen, WA 98520; 360-532-0157; **n7gh@arrl.net**; **gharc.org**.

MICROHAMS DIGITAL CONFERENCE

March 31, Redmond, WA

H R S

The MicroHAMS Digital Conference (5th Annual Event), sponsored by the MicroHAMS Radio Club, will be held at the Microsoft Main Campus, One Microsoft Way. Doors are open 9 AM-5 PM. Features include a full day of talks on topics which cover the full spectrum of digital ham radio, handicapped accessible, refreshments. Talk-in on 147.58. Admission is $45 in advance, $55 at the door. Contact Kenny Richards, KU7M, 12522 SE 75th Pl, Newcastle, WA 98056; 206-266-7827; **ku7mradio@gmail.com**; **www.microhams.com/mhdc.**

West Virginia (Charleston) — Mar 17
D F H Q R S V

9 AM-2 PM. *Spr:* Charleston Hamfest Committee. Coonskin Armory, 1707 Coonskin Dr. 28th Annual Charleston Area Hamfest and Computer Show. *Tl:* 145.35 (95.5 Hz). *Adm:* $5. Tables: $5. David Ellis, WA8WV, 610 Hillsdale Dr, Charleston, WV 25302; 304-344-4488; **wa8wv@aol.com**; **www.w8gk.org/**.

Wisconsin (Jefferson) — Mar 18 D F H R V

8 AM-noon. *Spr:* Tri-County ARC. Jefferson County Fairgrounds Activity Center, 503 N Jackson Ave. *Tl:* 145.49 (123 Hz). *Adm:* $5. Tables: advance 8-ft $8, door $10. Paul Marowsky, KD9PM, Box 411, Johnson Creek, WI 53038; 920-674-4968; **hamfest@w9mqb.org**; **w9mqb.org/**.

Wisconsin (Milwaukee) — Mar 30-31
D H Q R S V

Friday 2-6 PM; Saturday 8:30 AM-3 PM. *Spr:* Amateur Electronic Supply. AES Milwaukee, 5710 W Good Hope Rd. "AES Superfest 2012;" Gordon West and special guest ARRL Technical Editor Joel Hallas, W1ZR. *Tl:* N9LKH 145.130/144.530 (127.3 Hz); D-Star KC9LKZ 442.46875 (Port B), 145.425 (Port A). *Adm:* Free. Tables: Free. Ray Grenier, K9KHW, 5710 W Good Hope Rd, Milwaukee, WI 53223; 414-358-4088; fax 414-358-3337; **rayk9khw@aol.com**; **www.aesham.com**.

75, 50 and 25 Years Ago

Al Brogdon

March 1937

- The cover photo shows the desk of a ham who is ready for the A.R.R.L. DX Contest. The bug and straight key are in place, as is a stack of sharpened pencils...and the wall clock shows the time as one minute before Contest Time!
- In the editorial, Ye Editor reports that he was ruminating on making editorial comments about our need to prepare for emergency communication when a real-life emergency hit — massive flooding along the Ohio River. The flooding was so bad that the F.C.C. shut down our two lowest-frequency bands to everything except emergency communication. Hams did well, but there were lessons learned!
- Central Division Director R. H. G. Mathews (whose naval call sign is N9ZN) reports on some of the hams who worked in disaster-relief communication following that flood. A sidebar promises a complete report on ham support following the flood in detail in next month's *QST*.
- George Grammer, W1DF, describes "A 75-Watt Output Transmitter or Exciter Combining Band-Switching and Plug-In Coils."
- George also explains "More on the Directivity of Horizontal Antennas."
- Clark Rodimon, W1SZ, tells us about "Push-Pull and Push-Push Operation without Complications."
- In Part II of "More DX per Dollar," Charles Perrine, W6CUH, discusses the final amplifier, and keying and antenna systems of his modern transmitter.
- Harold Campbell, W2IP, presents "A 56-Mc. Crystal-Controlled Transmitter with 6L6 Output."

March 1962

- The cover shows the architect's drawing of the new Headquarters Building, to be constructed in Newington, Connecticut, later this year.
- The editorial, "A Building Fund?" discusses how the new HQ building can be financed.
- In "A Crystal-Controlled Converter with Bandswitching," Don Meredith, W5QZK, tells how he used hybrid tubes (designed for a plate voltage of 12 volts) to result in a very small unit for mobile use.
- Dave Muir, W2VYO, describes his new baby, "The Penultimate Electronic Key."
- George Thurston, W4MLE, reports on "Hurricane SET," a simulated scenario of ham response to a pretend hurricane that tracked across Miami, Tampa, and Pensacola.
- "Making Your Own Orbital Predictions from Doppler Measurements," by Edgar Hilton, W6VKP, is a tutorial on the whys and hows of tracking Earth satellites.
- Lew McCoy, W1ICP, tells us how to make "A 50-Kc. Marker Generator" for our receivers.
- Robert Vreeland, W6YBT, describes "The 'Heavyweight'," a compact 2-watt all-transistor 6-meter portable unit.
- According to J. M. Filipczak, K2BTM, we can get "Five Watts at 432 Mc. with the 6939 Dual Pentode."
- Charles Tiemeyer, W3RMD," tells about "The Trap Vertical" for multiband use with automatic bandswitching.

March 1987

- The cover photograph shows the architect's model of the proposed ARRL Visitors' Center.
- The editorial discusses the new Novice enhancements that have been adopted by the FCC, which will soon go into effect..
- In "Novice Enhancement: It's Here!" Curt Holsopple, K9CH, reports that the FCC *appears* to have adopted all the ARRL's proposals (details of the FCC action were not available by press time).
- Stan Horzepa, WA1LOU, presents "The Shopper's Guide to Packet-Radio TNCs."
- Al Ward. WB5LUA, gives us Part 2 of "Monolithic Microwave Integrated Circuits," which tells how to combine the MMICs for greater power output.
- In "The Omni-Shift Tuner — A Comprehensive Tuning System for HF Packet/AMTOR/RTTY," Richard Nelson, WB0IKN, describes his precision tuning aid for those signals.
- Doug DeMaw, W1FB, tells us "How to Build and Use Balun Transformers," with good explanations of when and how to use them.
- Phil Sager, WB4FDT, describes the "Next Steps to the ARRL Visitors' Center."
- In Ellen White, W1YL's, "How's DX?" column, GW3AHN describes his station and tells how he made the DXCC Honor Roll while running QRP. He gives a big tip of the hat to W2QHH, the superlative DXer who was running QRP before it became fashionable.

Field Organization Reports

December 2011

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**.

885
W7TVA
534
W5KAV
405
KT2D
400
KI4KWR
390
K0IBS
320
N9VC
KA2ZNZ
309
W4CAC
305
K2DYB
300
WB9YBI
K8OLY
290
KB2ETO
260
W7FQQ
250
NX9K
237
WB9FHP
226
W2MTA
220
K2HAT
206
KA4IZN
205
WB9JSR
200
WD9FLJ
195
KB2KOJ
190
KE5HWY
WA2BSS
187
KJ4KZ
186
W9YQ
WW4CC
185
W5DY
KT5SR
182
AE5VY
180
K8RDN
173
K2ABX
168
K7OAH
164
K0LQB
161
KCSFU
160
KG0GG
N8IO
158
N9WLW
157
WD8USA
155
WA9LFO
KC5ZGG
150
VE7DXD
148
N7IE
145
WS6P
K6HTN
KB2BAA
WK4P
KJ7NO
141
WB8RCR
140
K7BFL
WE2G
KB5SDU
KK3F
WB6OTS
137
N8OSL
135
N7CM
W3YVQ
131
W4LHQ
130
WB2FTX
K9LGU
W0LAW
K6JT
K4IWW
W4DNA
KW1U
128
W3CB
125
K6FRG
KA8ZGY
K7EAJ
KB8RCR
K2TV
123
W2DWR
122
W4AVD
120
KC0M
WA9LOU
AG9G
KB2RTZ
NN7H
WB8HHZ
W8UL
N2JBA
KA4FZI
KB1NMO
K4JUU
WI2G
WB8WKQ
119
K5CRX
118
KK5NU
117
W2LIE
115
N3RB
K4GK
KJ4JPE
114
W9WXN
112
NA9L
N2VC
110
W7QM
W7GB
W4OTN
N2GS
AA2SV
KC2EMW
WA2NDA
KC5OZT
N9MN
WB8SIQ
WA3EZN
K7BDU
W7QM
N5NVP
K4BG
KE4CB
KB1RGQ
NM1K
N7XG
N7YSS
N2RTF
W2EAG
N1IQI
KD1LE
N1LKJ
108
W7JSW
102
W4GLE
100
K0VTT
K4SCL
W0CLS
N0MEA
KD7ZUP
W9BGJ
N5OUJ
KI4AAN
KA1G
NU8K
KT4YA
WG8Z
WD8Q
N8CJS
N3SW
W3TWV
WM2C
K5MC
W8CPG
W4TTO
N2YHQ
KB3LNM
K8VFZ
KF7GC
K0PTK
98
N8SY
97
KJ4PZI
95
KD8CYK
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AA3SB
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KF5IOU
N4HUB
92
AK4AS
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W9MBT
N2GJ
W5CU
W3GQJ
KJ4HGH
W8IM
KZ8Q
W8DJG
N8DD
KB8HJJ
WB4BIK
NC3F
N2WKT
K3IN
N3ZOC
N5ASU
KD8LZB
NX8A
WB6UZX
88
W5GKH
N2VQA
WA4UJC
KE8BP
K7FLI
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KC4PZA
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N7EIE
AL7N
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K2GW
KK7DEB
NA7G
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W7ELI
KK7TN
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N2DW
KB9KEG
KB5PGY
81
KC2SYM
80
K7MQF
KJ6IJJ
K0DEU
NI0I
N0MHJ
N0UKO
KF0XO
N1JX
K5AXW
WD0GUF
N4ELI
K8KV
W8MAL
KD8KWG
N2YJZ
N5EEO
WB3FTQ
KB7RVF
KC8BW
KD8QPF
N1TF
78
KE5ABO
77
KE5YTA
N8FVM
76
W8QZ
75
K4MSG
KC2UMX
WB8R
KB0DTI
74
W0RJA
W9LW
73
KD4EXS
72
W5XX
W4BKG
KA4SZQ
N8MHC
W1PLK
71
WB8YYS
KJ4KZT
70
KD0AYN
K0DLK
N0DUW
N0DUX
W0FUI
N3NTV
K0PTK
K0RXC
WA0VKC
KC0ZDA
KK4EYH

The following stations qualified for PSHR in previous months, but were not recognized in this column: (Nov 2011) KC2SFU 143, KB5SDU 140, KG4GPJ 138, N4HUB 131, KW1U 130, W1GMF 120, W5CU 120, W4LHQ 111, KD1LE 110, N1IQI 110, KJ4KZ 94, N1TF 90, K1YCQ 90, KE8BP 88, K5MC 86, W9YQ 86, N2VQA 79, W4AVD 77, W1PLK 72, W4BKG 72.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AR, CT, EB, EMA, ENY, EPA, EWA, IL, IN, KS, LA, LAX, MDC, MI, MN, NC, NE, NFL, NLI, NNJ, NTX, OK, OR, ORG, SD, SFL, SNJ, STX, TN, VA, WCF, WI, WNY, WV, WWA, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, CO, ENY, EWA, GA, IA, IN, KS, MDC, MI, MN, MO, NLI, NM, NTX, OK, SD, SFL, UT, WTX, WV, WWA.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W5KAV 3830, WB9FHP 2494, W6WW 2019, K7BDU 1944, N1IQI 1092, WB5NKD 1011, WB9JSR 994, KK3F 848, KW1U 854, W9WXN 797, W7TVA 794, K6HTN 791, NX9K 788, W8UL 762, WB8WKQ 702, N9VC 598, WD8Q 573, W4OTN 546, K6FRG 530.

The following stations qualified for BPL in September, but were not recognized in this column: (Nov 2011) W1GMF 1733, N1IQI 1437, KW1U 597.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

KB1CQ **Goolsby**, Leon, Bloomfield, CT
KB1EFJ **Greene**, Helen M., Bow, NH
N1JGV **Tumasz**, Charles, Malden, MA
K1RST **Fountain**, Richard W., Broadalbin, NY
W1SQM **Wilcox**, George E., Woonsocket, RI
W1ZHU **Baldrate**, Joseph, Burlington, MA
W2AX **Amodeo**, Larry, Manhasset, NY
KC2EVL **Chase**, Walter J., Manville, NJ
WA2FOY **Bechard**, Roger R., Clifton Park, NY
KE2JM **Condello**, Anthony, Fryeburg, ME
KB2NIF **Mroz**, Paul A., Hillsborough, NJ
W2NRD **Brandow**, Arthur H., Cairo, NY
W2TFT **Thatcher**, Thomas W., Shawano, WI
W2TMW **Mills**, John W., Endicott, NY
N2QHJ **Chapman**, William L., Jamestown, NY
♦WA2UNN **Fishman**, Clark A., Andover, NJ
WA2UXY **Streger**, Sam, Black Hawk, CO
WA2WUC **Walters**, Alvin H., Mohegan Lake, NY
N2XTB **Ace**, Carle H. Jr, Belleview, FL
W3AZ **Leavitt**, William E., Silver Spring, MD
KA3BCM **King**, Susan, Greensburg, PA
WB3FTO **Denmon**, Kenneth D., Beaumont, PA
W3KUJ **Fulton**, Robert A., Berwick, PA
N3TS **Funk**, Preston D., Forkston, PA
N3UYV **Gore**, Charles W., Arcadia, FL
N3XBL **Wilson**, Minos J., Georgetown, DE
K3YBJ **Laskey**, Charles L. Sr, Norristown, PA
WD4AAS **Freedman**, Marc P., Ft Lauderdale, FL
N4BD **Jones**, Harold W., Rocky Face, GA
KS4CI **Wendorf**, Robert E. Sr, Orange City, FL
KE4FH **Christian**, Franklin J., Johnson City, TN
N4FIK **Roberts**, Peggy R., Jacksonville, FL
K4JJH **Howard**, Jerald M., Cleveland, TN
♦KB4JO **Pugh**, Thomas D., Winston-Salem, NC
KD4KN **Arntzen**, Clyde E., Juno Beach, FL
N4OEF **Dutton**, Benjamin B. Jr, Winchester, VA
W4OHA **Canup**, Bobby, Marietta, GA
W4OOG **Mauney**, Richard L., Mount Holly, NC
WD4PIW **Dixon**, Samuel "Sonny" T. Jr, Bluff City, TN
WA4PKM **Grayson**, Paul L., Dover, KY
KC4SGR **Tharpe-Chancey**, Jamie D., Ozark, AL
N4SXG **Hulth**, Peter T. Jr, Smithfield, NC
KD4THB **Yawn**, George D., Helena, AL
KJ4TNB **Dial**, Paul T., Gadsden, AL
N4VGB **Rogers**, Dilmus "Mack" Jr, Apison, TN
AA4XU **Shaver**, Ben A., Falls Church, VA
♦K4YR **Parrish**, Harry L. Jr, Newland, NC
♦W4ZW **Hamlet**, Jon E. Jr, Nokomis, FL
N4ZWA **White**, Evelyn, Rice Lake, WI
KD5DUQ **Parnell**, Terry L., Oklahoma City, OK
♦WA5IPS **Jorgensen**, Ole, Alamogordo, NM
W5JHS **Scheiderer**, John H., El Paso, TX
W5LVV **Collins**, Curtis M., Athens, TX
N5PHR **Holmes**, William Jr, Carthage, TX
K5PNO **McKinley**, Arthur L., Colmesneil, TX
W5QJY **Powell**, Clarence W., Topeka, KS
KA5RHZ **Williamson**, James M., Arp, TX
AD5TL **Richardson**, Jack D., Camp, AR
W5UZD **De Stwolinski**, Louis C., Norman, OK
W5XM **Mitchell**, Leonard R., Plano, TX
N6CEC **Hartwick**, Charles E., Crescent City, CA
W6EOA **Teresi**, Salvatore "Sam" P., Los Altos, CA
WA6FGE **Taylor**, Kenneth, Temple City, CA
KD6HDQ **Faherty**, Thadeus C., Fresno, CA
KB6JQK **Lee**, Edward S., Fresno, CA
♦W6KAS **Sherman**, John W., Bakersfield, CA
W6POK **Paul**, Hugh R., Paw Paw, MI
KC6UJC **Tully**, Carol, Eastsound, WA
W6UKH **Altschuler**, Marvin S., Paso Robles, CA
W7AKA **Underwood**, Eugene K., Newcastle, WA
N7BB **Holsclaw**, Frederick B., Glendale, AZ
W7CBU **Culbertson**, George K., Spanish Fork, UT
KC7EXV **O'Dea**, Paul J., Miles City, MT
W7HKF **Mitchell**, Henry S., Sequim, WA
K7JPM **Mocabee**, David A., Green Valley, AZ
KG7LN **Mayhak**, Don, Moses Lake, WA
KF7MXM **Rose**, Jack L., Prescott, AZ
KD7TOO **Wolford**, John B., Hesperia, MI
W7WXW **Simsen**, Calvin A., Grandview, WA
♦W7YS **Schuchman**, William G., Flagstaff, AZ
KC8APM **Peck**, Kevin J., Quakertown, PA
♦K8EFS **Anderson**, Merlin D., Charlotte, MI
♦N8GUZ **Smith**, Michael W., Lake Orion, MI
KC8OH **Ward**, Richard F., Harrison Township, MI
W8PDJ **Sherlock**, Arthur R., Columbus, OH
♦K8RR **Sheller**, John R., Wetmore, MI
WB8SDM **McDonald**, Lyle W., Willis, MI
K8TRF **Benham**, David R., Berkley, MI
K8TYS **Mocha**, Douglas G., Saint Petersburg, FL
K8VLT **Burger**, Bernard F., Monroe, MI
♦WB9AVD **Rambow**, William A., Geneva, IL
K9AWG **Jolly**, Jesse F., Decatur, IL
WD9CUP **Beeman**, Kenneth J., West Chicago, IL
K9DAG **Current**, James R., Forsyth, IL
K9DUW **Guthridge**, Garry A., Indianapolis, IN
KD9FF **Yomantas**, Edward J., Rockford, IL
KB9LGN **Madary**, Marc R., Woodstock, IL
W9OLO **Gjelsten**, Glenn R., Green Bay, WI
♦W9OTX **Neilson**, George E., Cape Girardeau, MO
♦W0DEL **Goll**, Wilbur E., Shawnee, KS
K0HJC **Graham**, Keith M., Waterville, MN
W0KHW **Welshinger**, Paul H., Shoreview, MN
W0KPV **Haraldson**, Comet W., Pierre, SD
W0LKQ **Lenz**, Oliver R., Webster Groves, MO
ex-WA0OQP **Beasley**, Richard L., Kansas City, KS
W0QNI **Brandenburg**, William J., Novato, CA
N0RBS **Oliverius**, Raymond Sr, Sidney, NE
K0UDB **Ottun**, Gaylord B., Sargent, NE
NR0X **Blankenhagen**, Heinz H., Martelle, IA
K0YAB **Moen**, Richard S., Omaha, NE
K0ZXA **Dando**, Donald C., Liberty, MO
ex-VE3DLY **Huneault**, Lambert "Bert," Windsor, ON, Canada
VE3GHZ **Adams**, Ralph G., Essex, ON, Canada
VE3PP **Johns,** Alan S., Windsor, 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.

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 26 Volunteer Examiners according to the total number of exam sessions they have participated in since their accreditations. Since each session requires an average time commitment of 2-4 hours or more, the thousands of hours these VEs have invested is extraordinary! Whether you are one of our VE Teams that test once a week, once a month or once a year, we want to express our warmest appreciation to all volunteers for their generous contribution to the ARRL VEC program.

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

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

Examiner	*Sessions*	*Accreditation Date*
Sammy Neal, N5AF	513	20-Nov-84
Harry Nordman, ABØSX	494	9-Jan-02
David Bartholomew, ABØTO	399	22-Mar-02
Kevin Naumann, NØWDG	384	17-Nov-02
Franz Laugermann, K3FL	383	1-Dec-91
Karen Schultz, KAØCDN	370	6-Sep-84
Royal Metzger, K6VIP	368	29-Apr-85
John Moore, III, KK5NU	363	21-May-95
William Martin, AIØD	344	1-Nov-84
John Mackey, Jr, KSØF	342	1-Oct-90
Paul Maytan, AC2T	332	6-Sep-84
Victor Madera, KP4PQ	323	1-Mar-92
Gerald Grant, WB5R	316	4-Jan-85

Examiner	*Sessions*	*Accreditation Date*
Richard Morgan, KD7GIE	312	11-Aug-00
Jeanette Nordman, ABØYX	311	21-Aug-03
John Hauner, KØIH	308	11-Jan-85
David Fanelli, KB5PGY	305	1-Oct-91
Daniel Calabrese, AA2HX	295	1-Nov-91
Adolph Koehler, K5VCR	284	29-Sep-95
Michael Faucheaux, N5KBW	284	15-Jul-96
Robert Hamilton, NØRN	283	19-May-87
Gary Mangels, AD6CD	282	30-Jul-97
Loren Hole, KK7M	282	6-Sep-84
Frankie Mangels, AD6DC,	278	14-Oct-97
Eldred "Drew" Moore, W2OU	277	1-Aug-90
Roy Johnson, N1IKM	277	24-Jul-95

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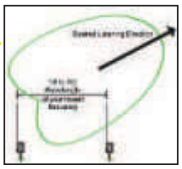
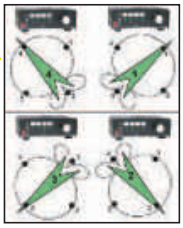


The NCC-1 is a two-channel receiving phasing system. This sophisticated controller allows the user to combine and independently adjust the phase and level of two antenna inputs, creating a fully adjustable phased array from any two antennas.

DXE-NCC-1	Receive Antenna Phasing Controller	$599.95
DXE-AAPS3-1P	Two Antenna System, electronically rotatable	$1,099.95

Receive Four Square Arrays



The patented* DXE-RFS-SYS-2P uses time delay phasing to produce wider and deeper rear nulls and a narrower main lobe in four selectable directions. The result is greatly reduced levels of noise and undesirable signals for a superior front-to-rear ratio. Use with DX Engineering Active Vertical Antennas for great F/R response over octaves of bandwidth from 100 kHz to 30 MHz with just a 102" whip as the antenna element.

US Patent Number 7,423,588

DXE-RFS-SYS-2P	Four Square Controller/ Switch Package	$389.95
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This switchable 8-direction array allows the user to pinpoint the exact direction for maximum receive signal performance. It uses the same time delay phasing technique as the Receive Four Square system to provide excellent bandwidth and pattern control with 102" long active antenna elements.

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DXE-7580FS-VA-1	Vertical Antenna, standard HD	$379.50
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This optional winch for the VA-2 and VA-3 Vertical Antennas allows easy one-man raising and lowering. You can use the DXE-VRW-1 winch on similar DX Engineering antennas in a multi-antenna installation.

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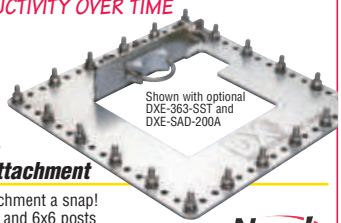

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DXE-8XDU1.5	1.5 ft.	$9.88
DXE-8XDU002	2 ft.	$10.88
DXE-8XDU003	3 ft.	$11.88
DXE-8XDU006	6 ft.	$13.88
DXE-8XDU012	12 ft.	$16.88
DXE-8XDU025	25 ft.	$23.88
DXE-8XDU050	50 ft.	$32.88
DXE-8XDU075	75 ft.	$40.88
DXE-8XDU100	100 ft.	$47.88
DXE-8XDU150	150 ft.	$69.88

FREE SHIPPING on $50.00 or more Coax order!

DXE-400MAX Cable Assemblies with PL-259 Connectors

DXE-400MAXDU003	3 ft.	$13.88
DXE-400MAXDU006	6 ft.	$15.88
DXE-400MAXDU009	9 ft.	$19.88
DXE-400MAXDU012	12 ft.	$24.88
DXE-400MAXDU018	18 ft.	$31.88
DXE-400MAXDU025	25 ft.	$39.88
DXE-400MAXDU050	50 ft.	$61.88
DXE-400MAXDU075	75 ft.	$85.88
DXE-400MAXDU100	100 ft.	$104.88
DXE-400MAXDU150	150 ft.	$159.88
DXE-400MAXDU175	175 ft.	$179.88
DXE-400MAXDU200	200 ft.	$199.88

FREE SHIPPING on $50.00 or more Coax order!

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	$39.95
DXE-UT-808X	Cable Stripper for RG-8X, 9258, etc	$39.95
DXE-UT-80P	PL-259 Assembly Tool	$22.95
DXE-UT-80N	2-Piece N Connector Tool	$22.95
DXE-CNL-911	Coax Cable Cutters	$23.75
DXE-170M	Precision Shear Side Cutters	$7.95
Now available in cost-saving tool kits with carrying case		
DXE-UT-CASE	Molded carrying case only	$22.95
DXE-UT-KIT1	Basic Coax Cable Prep Kit	$99.95
DXE-UT-KIT2	Complete Coax Cable Prep Kit	$174.95

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Plus Great Customer Service and Fast and Inexpensive Shipping!

hy-gain

Antenna Rotors

HYG-AR-35	Light Beam/TV	$89.95
HYG-CD-45II	8.5 Sq. ft. Rating	$419.95
HYG-HAM-IV	15 Sq. ft. Rating	$594.95
HAM-HAM-V	15 Sq. ft. Digital Control	$919.95
HYG-T-2X	20 Sq. ft. Rating	$689.95
HYG-HDR-300A	25 Sq. ft. Rating, Heavy Duty	$1,339.95

Rotor Accessories

DXE-CW8	8-Wire Rotor Cable	$0.48/ft.
DXE-CW8-HD	8-Wire Heavy Duty Rotor Cable	$0.98/ft.

Green Heron Digital Rotor Controller

Replaces your existing rotor control system. Preprogrammed for Hy-Gain HAM series and T2X rotors. Solderless setup for other rotor types (with jumpers) and field programmable. Fully user-programmable including reversal and brake delay, maximum/minimum speed, limits, ramps, etc.

- RS-232 and USB interface for computer control
- Master/slave for stacked arrays—turn together or separately
- PWM variable speed control
- FREE Software for easy setup
- Precision heading accuracy up to 720° of travel
- Fully supports side-mounted antennas
- Offset control for multiple directions on one mast
- High visibility display with adjustable backlight

GHE-RT-21	Green Heron Rotor Controller	$559.00
HYG-HAM-IVRLC	HAM-IV rotor only	$499.95
HYG-T-2XRLC	T2X rotor only	$599.95

The Experts in Phased Antenna Systems!

Four-Square Hybrid Controllers

Our hybrids offer 20dB F/B and up to 5dB gain at a lower cost than most beams. Available for 160 through 10 meters.

COM-ACB-4 Series.....from **$364.95**

2-Element Vertical Controllers

No space for a four-square phased vertical array? Three switched patterns—available for 160 through 10 meters.

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Stack Yagi Switches

The STACK-2 is ideal for tribanders, logs or monobanders. The K3LR-design STACK-3 is for monoband 3-stack Yagis. Select any combination.

COM-STACK-2.....**$221.95**

COM-STACK-3.....**$399.95**

Call us for custom-tuned phasing cables and monoband antenna systems!

Limited Time Offer— FREE Shipping on Comtek Baluns!

COM-BAL-11130T

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COM-BAL-11130E

Better Performance, Lower Prices—from just $49.95

COMTEK W2FMI Series Baluns

Design inspired by Jerry Sevick W2FMI and perfected by DX Engineering's balun R&D department.

- High voltage compensating capacitors for unequalled low SWR—a DX Engineering innovation!
- Large fender washers distribute fastener loading to prevent case `
- Special coated toroid core handles close coupling without extra stress
- High, consistent common mode impedance across specified bandwidth—provides isolation where most needed
- Special wire sizing and Teflon-insulated wire sleeves for exact impedance matching and better isolation than Thermaleze wire
- Typical insertion loss: less than 0.2 dB
- Power handling: 3 kW continuous to 5 kW+ intermittent depending on model
- Silver-plated gasketed SO-239 connectors, stainless hardware, weatherproof NEMA box

1:1 Dual Wire/Single Core, 1.8 to 54 MHz		
COM-BAL-11130E	3 kW, side eyebolts	$49.95
COM-BAL-11130ET	3 kW, side and top eyebolts	$49.95
COM-BAL-11130S	3 kW, side studs/wingnuts	$49.95
COM-BAL-11130T	3 kW, top studs/wingnuts	$49.95
1:1 Coax/Single Core		
COM-BAL-11150E	5 kW, side eyebolts	$49.95
COM-BAL-11150ET	5 kW, side and top eyebolts	$49.95
COM-BAL-11150S	5 kW, side studs/wingnuts	$49.95
COM-BAL-11150T	5 kW, top studs/wingnuts	$49.95
1:1 Dual Wire/Dual Core		
COM-BAL-11140T	5 kW, top studs/wingnuts	$69.95
COM-BAL-11140S	5 kW, side studs/wingnuts	$69.95
1:1 Coax/Dual Core		
COM-BAL-11150DS	5 kW, side studs/wingnuts	$69.95
COM-BAL-11150DT	5 kW, top studs/wingnuts	$69.95
4:1 Dual Wire/Single Core		
COM-BAL-41130E	3 kW, side eyebolts	$59.95
COM-BAL-41130ET	3 kW, side and top eyebolts	$59.95
COM-BAL-41130T	3 kW, top studs/wingnuts	$59.95
COM-BAL-41130S	3 kW, side studs/wingnuts	$59.95
4:1 Dual Wire/Dual Core		
COM-BAL-41150T	5 kW, top studs/wingnuts	$89.95
COM-BAL-41150S	5 kW, side studs/wingnuts	$89.95
COM-BAL-41150E	5 kW, side eyebolts	$89.95

Contact DX Engineering Customer Support for recommendations for your application.

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Rohn Commercial Towers

FIBERGLASS TUBING TELESCOPING SIZES HIGH STRENGTH

Great for wire antenna spreaders or insulated stacking frames! Build your favorite antenna design!

50 Ft. Telescoping Fiberglass Tubing Mast Kit

- Tubing custom made just for DX Engineering
- Smoothly telescoping sections
- Neutral light gray color
- Uses DX Engineering Stainless Steel Element Clamps to assemble slit lengths

DXE-FTK50 Telescoping Tubing Kit.....**$138.00**

Telescoping Fiberglass Tubing

- 1/8" nominal wall x 8 feet long

Unslit Tubing		
DXE-FT0500-8	0.500" O.D.	$6.45
DXE-FT0750-8	0.750" O.D.	$8.95
DXE-FT1000-8	1.000" O.D.	$9.95
DXE-FT1250-8	1.250" O.D.	$11.95
DXE-FT1500-8	1.500" O.D.	$18.95
DXE-FT1750-8	1.750" O.D.	$20.95
DXE-FT2000-8	2.000" O.D.	$25.95
Tubing with One End Slit		
DXE-FT0750-8S	0.750" O.D.	$13.95
DXE-FT1000-8S	1.000" O.D.	$14.95
DXE-FT1250-8S	1.250" O.D.	$16.95
DXE-FT1500-8S	1.500" O.D.	$23.95
DXE-FT1750-8S	1.750" O.D.	$25.95
DXE-FT2000-8S	2.000" O.D.	$30.95

PSK-31 SSTV WSJT

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TIG-SL-USB.....$86.95

Then choose a cable for each radio!

Any Radio Interface Cable*, only **$12.95** when purchased with SignaLink™ unit

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For your complete digital solution!

**except the special Elecraft K3 cable*

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LDG ELECTRONICS

#1 Line of Autotuners!

- *5 to 1,000 Watts PEP*
- *RF Sensing*
- *Auto and Semi Tuning Modes*
- *Two-Position Antenna Switch*
- *2,000 Memories per Antenna*
- *1.8 to 54 MHz range*
- *6 to 800 ohm range (15 to 150 on 6M)*

M-1000 Meter sold separately

NEW! AT-1000Proll

Building on the success of the AT-1000Pro, LDG Electronics has refined and expanded its flagship 1KW tuner with optional external 4.5" analog meter. The new AT-1000Proll 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 $539.99; Optional M-1000 external analog meter $129.99

Z-11Proll

Meet the Z-11Pro II, 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

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***

AT-600Pro

The AT-600Pro handles up to 600 watts SSB and CW, 300 on RTTY (1.8–30 MHz), and 250 watts on 54 MHz. Matches virtually any kind of coax-fed antenna and will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use it with longwires, random wires, and antennas fed with ladder line just by adding a balun. Two antenna ports with a front-panel indicator, and separate memory banks for each antenna. LED bar-graph meters shows RF power, SWR and tuner status, tactile feedback control buttons and an LED bypass indicator. Operates from 11–16 volts DC at 750 mA. Includes six-foot DC power cable.

Suggested Price $359.99

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

We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

LDG Electronics, 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-100ProII

This desktop tuner covers all frequencies from 1.8–54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch with LEDs, allowing you to switch instantly between two antennas. The AT-100ProII requires just 1 watt for operation, but will handle up to 125 watts. Includes six-foot DC power cable.

Suggested Price $229.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-200ProII

The AT-200ProII now includes LEDs to show antenna position and if the tuner is in bypass. A two-position antenna switch stores 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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LDG ELECTRONICS

hy-gain® ROTATORS

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

HAM-IV

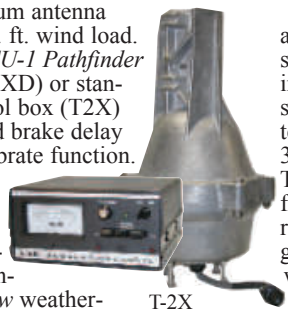
HAM-IV
$649.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II

For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.



T-2X
$799.95

T-2XD
$1229.95
with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II
$449.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V
$1099.95
with DCU-1

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

AR-40

AR-40
$349.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A
$1499.95

King-sized antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

ROTATOR OPTIONS

MSHD, $109.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $49.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

Digital Automatic Controller

DCU-1
$749.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35
$89.95

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

RBD-5
$29.95

NEW! Automatic Rotator Brake Delay

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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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!

FT-8800R 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
- Crossband repeat • YSK-8900 included!

FT-8900R Quad-Band FM Mobile

- Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 included!

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 • YSK-857 included!

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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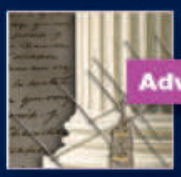

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Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
Intl CD	$39	$76	$111	Annual CD-ROM (*QST*, *NCJ* and *QEX*) for international members
Blind	$8	$16	$24	No *QST* delivery, all other member benefits apply
Family	$8	$16	$24	Reside at the same address as the primary member, no additional *QST*. Membership dates must correspond with primary member.

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WX-SPK


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KG-UV3D2/440 2M/440 MHz FM HT

• TX: 144-148, 420-450 • RX: 136-174, 420-520, and 76-108 MHz FM Broadcast • Power: 5/1W VHF & 4/1W UHF • Memories: 128 • Dual Band Monitor (VHF/UHF, VHF/VHF, UHF/UHF) • Li-Ion Battery

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KG-UV3D2/220 2M/220 MHz FM HT

• Same but TX: 144-148, 223-225 and RX: 136-174, 216-280 and 76-108 MHz FM Broadcast • Power: 5/1W

$119.99

KG-UV6D VHF/UHF Commercial HT

• TX/RX: 136-174, 420-470 MHz • 76-108 MHz FM Broadcast RX Only • Power: 5/1W VHF & 4/1W UHF • Memories: 199 • Dual Band Monitor (VHF/UHF, VHF/VHF, UHF/UHF) • 2.5 kHz step for FCC 2013 narrow-band compliance • Li-Ion Battery

$174.99

KG-UVA1 VHF/UHF Commercial HT

• TX/RX: 136-174, 400-470 MHz • 76-108 MHz FM Broadcast RX Only • Power: 5/2W VHF & 4/2W UHF • Memories: 16 • Dual Band Monitor (VHF/UHF, VHF/VHF, UHF/UHF) • Li-Ion Battery

SPECIAL ORDER $129.99

KG-UVA1X VHF/UHF Commercial HT

• Same but includes 2.5 kHz step for FCC 2013 narrow-band compliance & uses standard SMA antenna connector

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WX-SPK Speaker/Mic	15.99
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MT-7 Floor/Seat Bolt Mount – Easy to install without drilling. Simply loosen a passenger-side seat track bolt and slide the mounting bracket under it.

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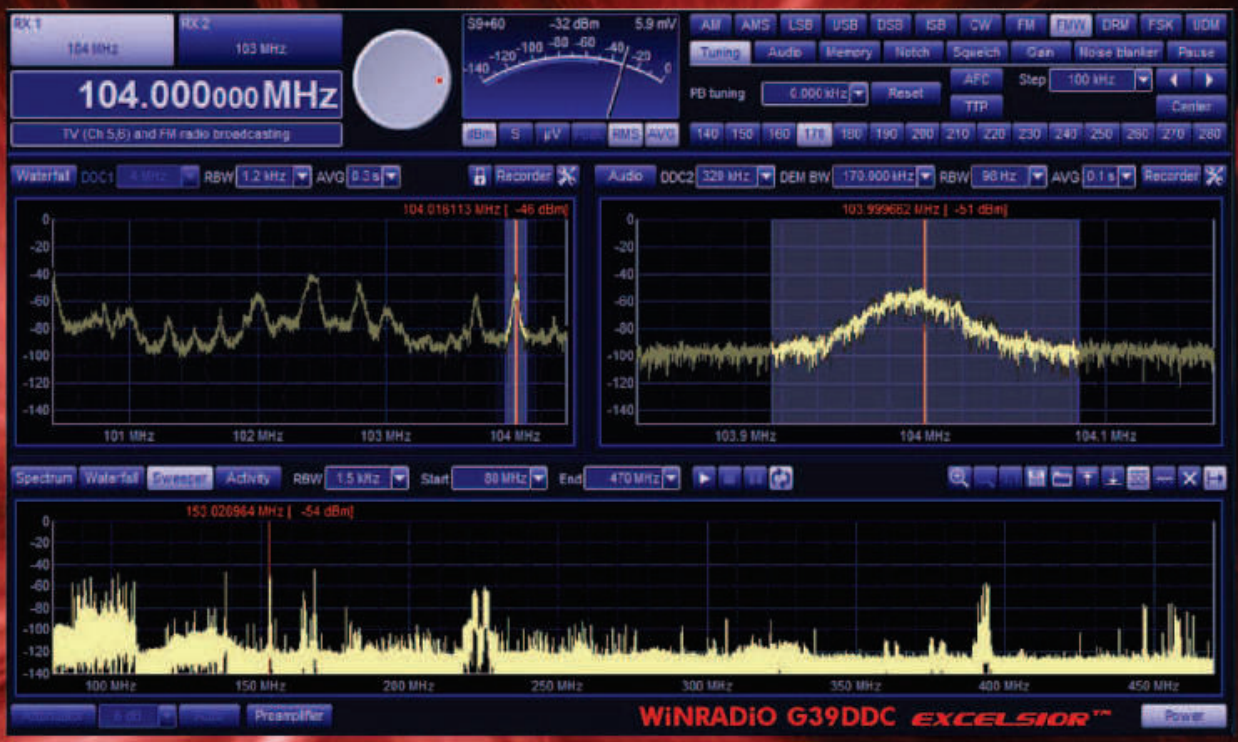

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QST QuickStats

sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for December 8 through January 6.

Get on the web and vote today at **www.arrl.org/quickstats**!

When measuring SWR, do you most often rely on the meter in your antenna tuner, an independent meter or the meter built into your transceiver?

Independent meter: **43%**
Transceiver meter: **27%**
Antenna tuner meter: **30%**

SWR

Do you regularly monitor the 6-meter domestic SSB calling frequency (50.125 MHz)?

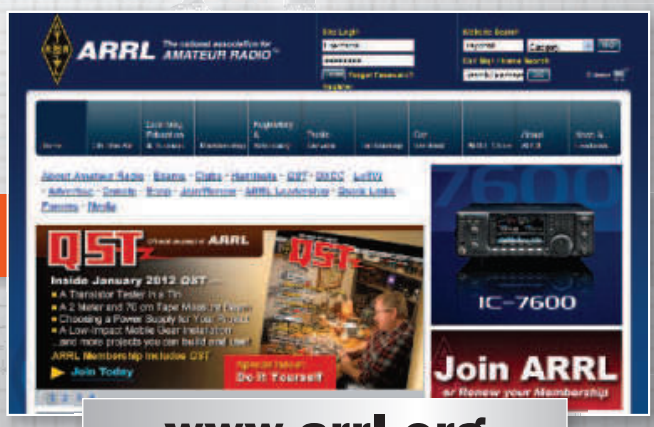
Yes: **18%** No: **82%**

At your home station do you use a single antenna to operate on your favorite HF bands, or individual antennas for each band?

Single antenna: **60%**
Individual antennas: **33%**
I don't operate HF: **5%**
I don't operate from home: **2%**

How often do you check the ARRL Web page at www.arrl.org?

Once a day: **54%**
Once a week: **31%**
Once a month: **10%**
Less than once a month: **5%**



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MFJ-259B *World's* most popular Antenna Analyzer is super easy-to-use!

MFJ-259B
$289.95

The MFJ-259B is the world's most popular Antenna Analyzer and the easiest to use! Just select a band and mode. Set frequency. Your measurements are instantly displayed!

Handheld Antenna Lab

Owning the MFJ-259B is like having an entire antenna lab in the palm of your hand!

Measure SWR quickly or make sophisticated measurements such as Return Loss, Reflection Coefficient, Resonance, Complex Impedance (R+jX), Impedance Magnitude (Z) plus Phase in degrees. Covers 1.8 to 170 MHz -- no gaps.

Coax Analyzer

Determine coax cable velocity factor (Vf), loss in dB, coax length, distance to open or short plus detect wrong coax impedance.

Frequency Counter

Measure frequency of external signals using the separate BNC counter input.

Signal Generator

Use as a signal source 1.8-170 MHz with digital dial accuracy for testing and alignment.

Inductance and Capacitance

Measure Inductance (uH) and Capacitance (pF) at RF frequencies not at audio frequencies used by most L/C meters.

Digital and *Analog* Meters

A high-contrast backlit LCD gives precision readings and *two* side-by-side *analog meters* make antenna adjustments intuitive.

Smooth, Stable Tuning

Velvet-smooth reduction drive tuning and precision *air-variable capacitor* makes setting frequency easy and stable.

Battery Saver & More

Battery-saver, low-battery warning, battery voltage meter and charger are all built in. Use ten Alkaline, NiCad or NiMH AA batteries (not included) or 110 VAC with MFJ-1312D, $15.95. 4Wx6¾Hx2D inches.

Here's What You Can Do

Find true antenna resonant frequency
Tune *antenna quickly for minimum SWR*
Match complex loads to your feedline
Adjust *mobile whips without stressing finals*
Determine safe 2:1-SWR operating windows
Adjust *tuners without generating QRM*
Find exact location of shorts and opens
Cut *stubs and phasing lines accurately*
Check cable for loss and contamination
Find *value of unknown coils and caps*
Test RF transformers and baluns
Troubleshoot *filters and networks*
Find self-resonance and relative Q
Check *patterns and compare gain*
MFJ-259B does all this and more!

MFJ Analyzer Accessories

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Special foam-filled fabric cushions blows, deflects scrapes and protects knobs and meters from harm. **MFJ-39C, $24.95.** Like MFJ-29C, but for MFJ-269.

MFJ-66, $24.95. Plug-in coils turns any MFJ Antenna Analyzer into a sensitive and accurate *band switched* dip meter. 2 coils.

MFJ-92AA10, $29.95. Ten MFJ *SuperCell*™ Ni-MH AA rechargeable batteries.

MFJ-99B, $88.90. ***Save $7!*** MFJ-259B Deluxe Accessory Pack: MFJ-29C Pouch, 10 Ni-MH batteries, dip coils, AC adapter. **MFJ-98B, $88.90.** Like MFJ-99B but for MFJ-269.

MFJ-99, $60.85. ***Save $5!*** Like MFJ-99B, less batteries, for MFJ-259B. **MFJ-98, $60.85.** Like MFJ-99 but for MFJ-269.

MFJ-99C, $40.90. ***Save $5!*** AC Adapter and 10 Ni-MH batteries for MFJ-259B/269.

MFJ-917, $29.95. Current balun lets you make balanced line antenna measurements on HF with your MFJ Analyzer. **MFJ-7702, $3.95.** MFJ-917 to MFJ Analyzer adapter.

MFJ-731, $99.95. Tunable RF filter allows accurate Antenna Analyzer measurements in presence of strong RF fields. 1.8-30 MHz.

MFJ-5510, $9.95. Cigarette lighter cord.

MFJ-269 ...1.8-170 MHz and 415-470 MHz plus 12-bit A/D!

The MFJ-269 does everything the MFJ-259B does - and much more!

Expanded Frequency Coverage

MFJ-269 adds UHF coverage from 415 to 470 MHz -- right up into the commercial band. With it, you can adjust UHF dipoles, verticals, Yagis, quads and repeater collinear arrays with ease -- plus construct accurate phasing harnesses and timed cables. Also use it as a signal source to check UHF duplexers, diplexers, IMD filters and antenna patterns.

Much Better Accuracy

New *12-bit* A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads *parallel* equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

MFJ-269
$389.95

CoaxCalculator™

Lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and coax loss with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Logarithmic Bar Graph

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Uses instrumentation grade N-connector to ensure minimum mismatch on all frequencies. Includes N to SO-239 adapter.

MFJ-269*PRO*™ Analyzer

Like MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

MFJ-269PRO
$419.95

MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

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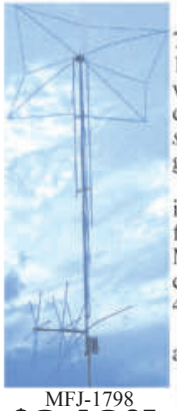
Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground 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.

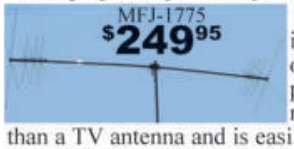
MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

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.

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MFJ 160-6 Meter Antenna

Self-supporting 43 foot vertical -- no guy wires required . . . 1500 Watts . . . exceptional performance . . . low-profile . . . includes base mount and legal limit balun . . . assembles in an hour . . .

MFJ-2990
$359.95

New!

Operate all bands 160 through 6 Meters at full 1500 Watt with this self-supporting, 43 feet high performance vertical! It assembles in less than an hour and its low-profile blends in with the sky and trees -- you can barely see it from across the street.

Exceptional Performance

The entire length radiates to provide exceptional low angle DX performance on 160 through 20 meters and very good performance on 17 through 6 Meters. You can shorten it by telescoping it down for more effective low angle radiation on higher bands if desired.

With an automatic antenna tuner there's no fuss -- just talk!

A wide-range automatic or manual antenna tuner *at your rig* easily matches this antenna for all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up!

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than 1/2 dB 60-6 Meters and less than 1 dB 160-80 M with good quality, low-loss coax).

Fully self-supporting, Extremely low wind loading, Very low visibility . . .

With just 2 square feet wind load, the fully self-supporting MFJ-2990 -- *no guy wires needed* -- has the lowest wind-loading and lowest visibility of any vertical antenna! The key is a six foot section of tapering diameter *stainless steel* whip that flexes in strong wind instead of stressing the bottom sections. Its 2-inch O.D. and .120 inch thick walled tubing bottom section makes it incredibly strong -- it'll stay up!

Weighs just 20 pounds -- you can easily put it up by yourself because its corrosion resistant *6063 aircraft aluminum* tubing and stainless steel construction make it light *and* super-strong.

Assembles in an hour

You can easily assemble it in an hour! Ground mounting lets you completely hide its antenna base in shrubbery. Includes ATB-65 high-strength antenna mount. Requires ground system -- at least one radial. More extensive ground system will give much better performance.

Great for Stealth Operation in antenna restricted areas

This very low-profile antenna is perfect for stealth operation in antenna restricted areas. Hide it behind trees, fences, buildings, bushes. Use it as a flagpole. Telescope it down during the day. Put it up at night and take it down in the morning before the neighbors even notice!

Quick and easy installation makes it great for DXpeditions, field day and other portable and temporary operations.

MFJ *Automatic* Tuners

MFJ-998
$699.95

For legal limit 1500 Watt SSB/CW amplifiers. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, amp bypass, matches 12-1600 Ohms, 1.8-30 MHz.

MFJ-993B
$259.95

Dual power range -- 300 Watt range matches 6-1600 Ohms. 150 Watt/6-3200 Ohms. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, 1.8-30 MHz.

MFJ *Manual* Tuners

MFJ-989D
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1500 Watts SSB/CW, 1.8-30 MHz. Active peak-reading Cross-Needle SWR/Wattmeter, balun, dummy load, antenna switch, aircore roller inductor.

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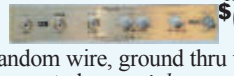

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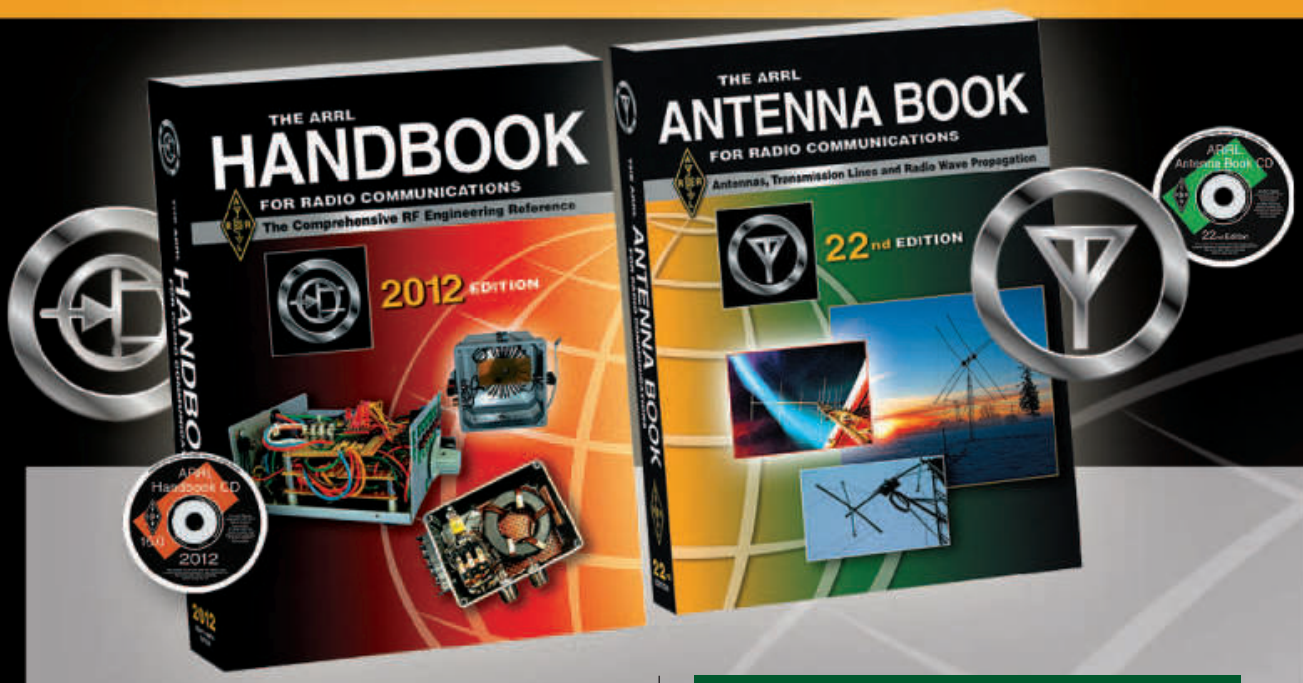

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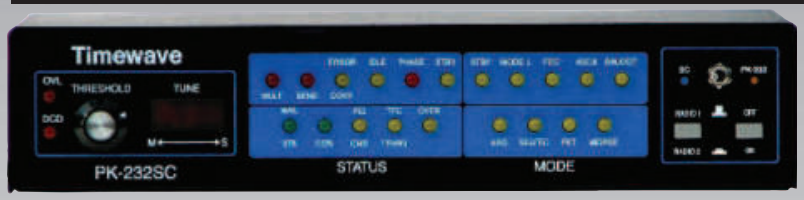

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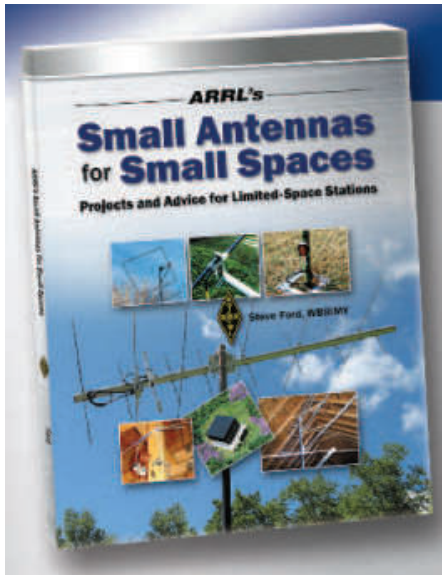

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By Steve Ford, WB8IMY

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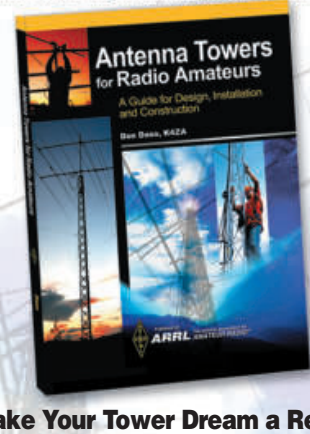

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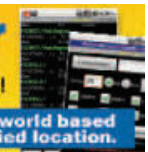

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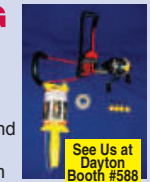

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COMET **SMA-24** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: SMA Super flexible featherweight whip

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

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

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

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

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

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

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

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

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

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

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

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

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

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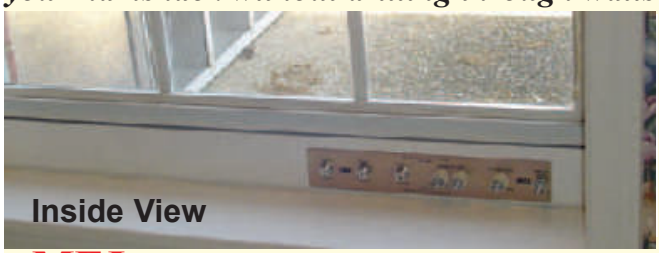
MFJ Weather-Proof *Window Feedthrough Panels*

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!



MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603 **$89.95**

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

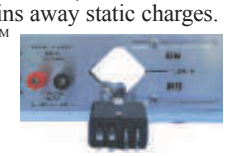
A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.



3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602 **$69.95**

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601 **$59.95**

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New! MFJ-4600 **$79.95**

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

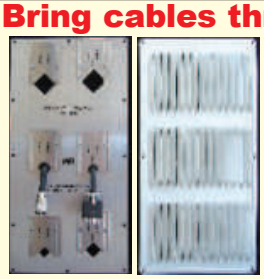
MFJ-4604 **$99.95**

All-Purpose FeedThru/CableThru™

***Stacks** MFJ-4603 and MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

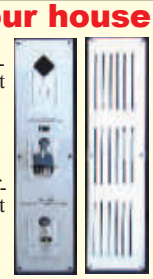
MFJ-4605 **$159.95** **New!**

Bring cables thru eave of your house



MFJ-4616 shown with standard full-size vent (not included) it replaces. For *6 Cables* **$26.95**

MFJ-4613 shown with standard half-size vent (not included) it replaces. For *3 Cables* **$14.95**



Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ Wall Plates

MFJ-4614 *For 4 Cables* **$34.95**

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612 *For 2 Cables* **$24.95**

MFJ-4611 *For 1 Cable* **$14.95**

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Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation

MFJ-949E **$179.95** up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full *size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

Full *size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

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More hams use MFJ tuners than all other tuners in the world!

MFJ-989D *Legal Limit* Tuner

MFJ-989D **$389.95** ***New***, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob *Differential-T™*

MFJ-986 **$349.95** ***Two*** knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95** **A** few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-969 **$219.95**

MFJ-941E *super value* Tuner

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-941E **$139.95**

MFJ-945E HF/6M *mobile* Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-945E **$129.95**

MFJ-971 *portable/QRP* Tuner

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-971 **$119.95**

MFJ-901B *smallest* Versa Tuner

MFJ-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

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902 **$99.95**

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

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-16010 **$69.95**

MFJ-906/903 *6 Meter* Tuners

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB.

MFJ-906 **$99.95**

MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-921/924 **$89.95**

MFJ-931 *artificial* RF Ground

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-931 **$109.95**

MFJ-934, $209.95, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B **$259.95**

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

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300 Watt...*Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

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200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No extra space needed! Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

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G5RV Antenna

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feed-point insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

MFJ-1778 **$44.95**

200W...Weather-sealed

for Remote/Outdoor/Marine

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926B **$279.95**

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 **$259.95**

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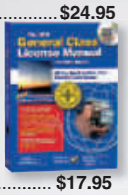

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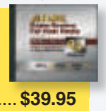

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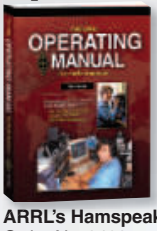

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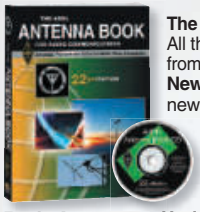

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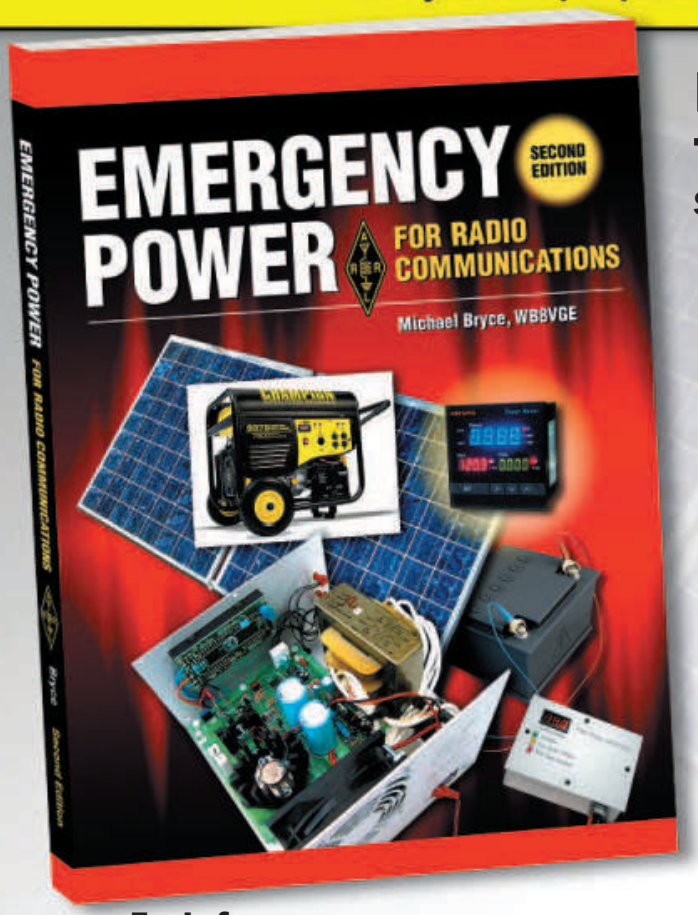

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When it comes to antenna performance, amongst the most critical hams may be the "moonbouncers" who require both high antenna gain and efficiency to launch a signal a quarter million miles, have it reflect off an irregular lunar surface and then return another quarter million miles to earth suffering attenuation through the ionosphere twice in the process, and extreme receive performance to separate these insanely weak signals from noise, both galactic and man-made. Serious moonbouncers (are there any other kind?) use Ta (total antenna "temperature," in other words total antenna pattern quality) and G/T (a Figure Of Merit for an antenna's total receive capability) figures to compare antenna performance. InnovAntennas' G/T Figures are better on a boom-length basis than any other Yagis, period. (These antenna performance charts are available from independent sources online; Google 'em yourself and see.)

Even if you don't intend to hear weak signals off the moon wouldn't you like to know your antennas were designed with that level of performance in mind and that you are hearing more DX and less of your neighborhood's consumer electronic devices and other QRM?

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If you want to be assured of the absolute best performance and antenna stability, along with design consideration for your intended use, InnovAntennas are your best option.

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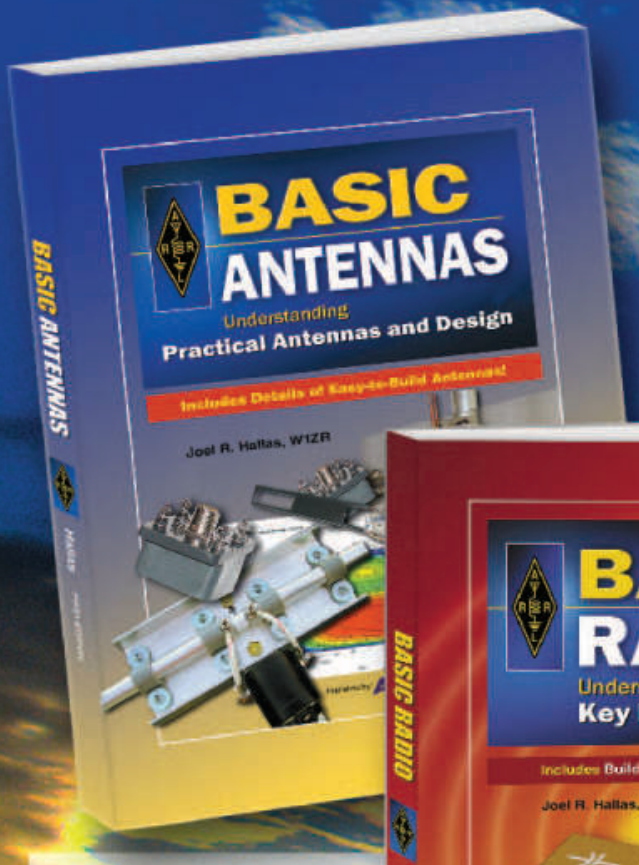

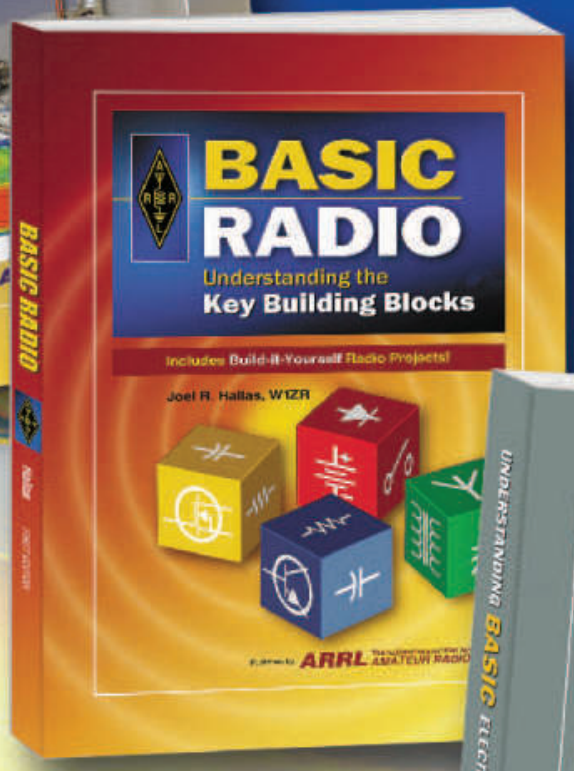

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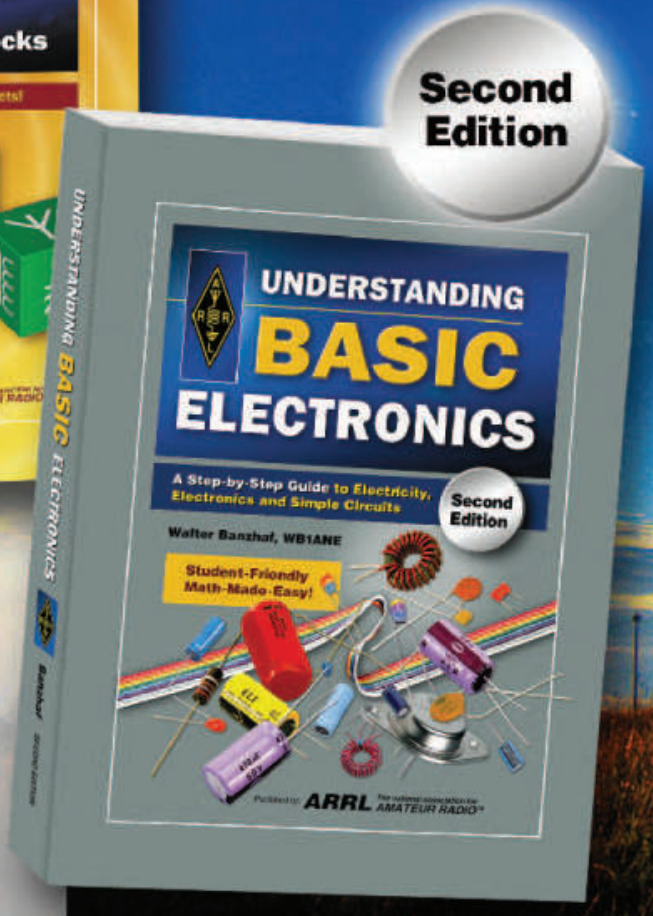

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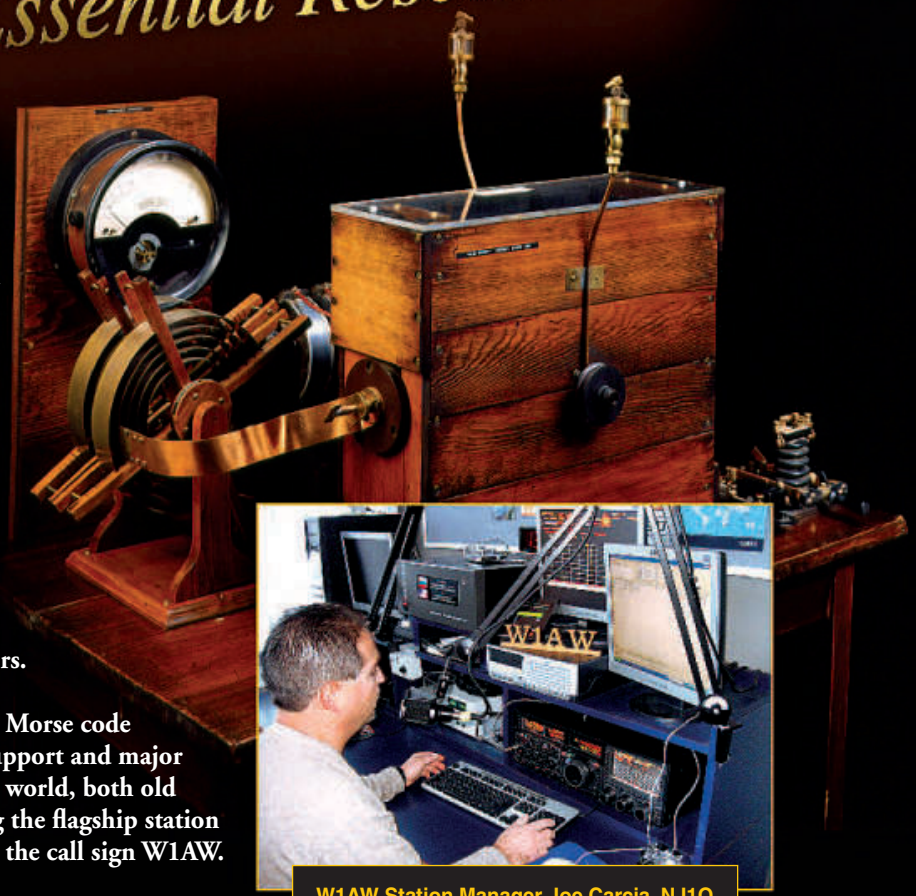

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W1AW Station Manager Joe Carcia, NJ1Q

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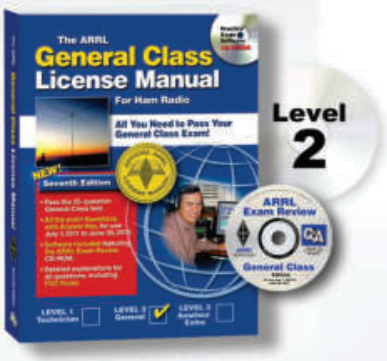

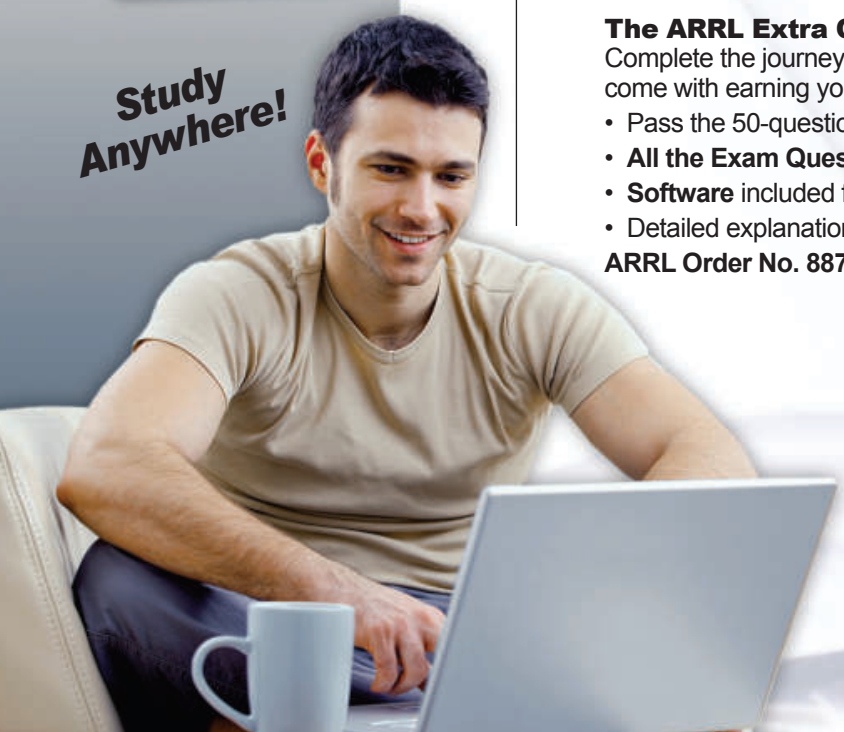

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Tunes any Balanced Line

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Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

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Balanced lines give extremely low loss.

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