SPECIAL FIELD DAY ISSUE

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

June 2013 WWW.ARRL.ORG

QST reviews:

Inside:

ARRL Field Day

June 22-23, 2013

The Most Popular On Air Operating Event!

ARRL Field Day 2013

Field Day Ad Section page 16A

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Official Journal of ARRL The national association for AMATEUR RADIO

JUNE 2013 QST Vol 97 No 6

The radio... YAESU

HF/50 MHz 100 W Transceiver

FT DX 3000

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

The amazing Crystal Roofing Filter performance

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

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

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

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

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

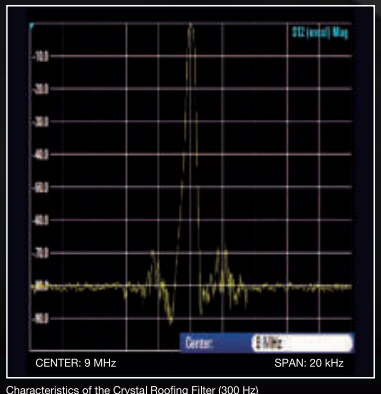
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

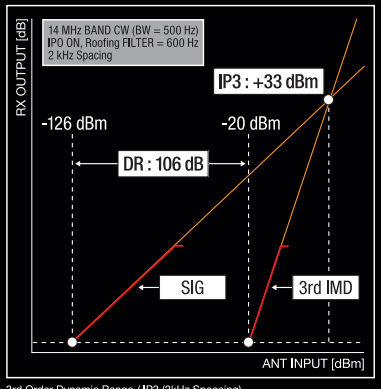
AF SCOPE display and RTTY/PSK encoder/decoder

Other features

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



Characteristics of the Crystal Roofing Filter (300 Hz)



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

YAESU
The radio

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

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

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

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

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

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YAESU
The radio
YAESU USA
6125 Phyllis Drive,
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Cushcraft

R9

80-6 Meters!

No Radials!

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

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

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

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

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

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

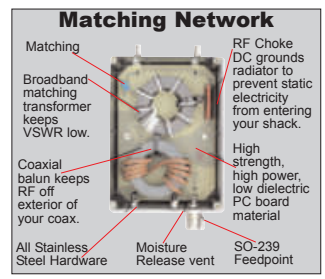
Rugged Construction: Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

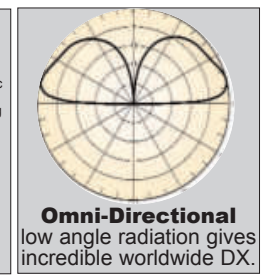
31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

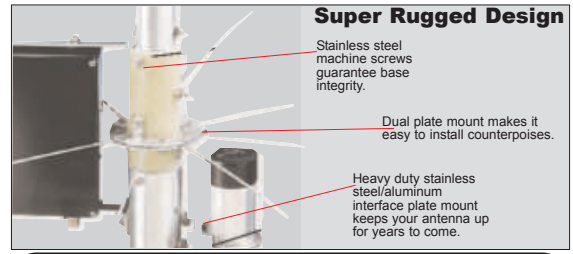
R8, $539.95. Like R9 antenna but less 75/80 Meters.

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

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







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Life is a JOURNEY. Enjoy the ride!

The engineering staff at COMET Antenna Company presents three new products!

CMX-2300 *TWIN Cross-Needle SWR/Power Meters*

Left Side Meter 1.8-200MHz: Max Power 3kW
Right Side Meter 140-525MHz: Max Power 200W

Average and PEP power selector switch
FWD, REF, SWR readings displayed simultaneously.
Separate ANT/TX connectors allow both meters
to be used at the same time - Low loss circuitry - Illuminated

CHV-5X *40/20/15/10/6M Rotatable Dipole*

HOA antenna restrictions? Limited space? Want to operate with a low profile? Need a small, multi-band HF/6M antenna for portable/ emergency use?... The CHV-5X is a great choice! Lightweight, compact, rotatable half-wave center fed dipole. Assembles in several configurations: “V”, “horizontal”, or as a “ground plane”. Each band tunes independently with sliding tuning stubs

Length: Approx 13 ft (assembled horizontally)

Weight: 5 lbs 14ozs (inc mounting plate and balun)

Max Power: 40/20M: 150W SSB 15/10/6M: 220W

CAA-500 *Cross Needle SWR and Impedance Analyzer*

Dual cross-meter real-time analog display of SWR and total impedance with high accuracy.

Seven frequency ranges (Including 222 MHz!) extending up to 500 MHz!

Thumb-wheel frequency adjustment for effortless sweeps of antenna operating range.

Two antenna jacks, "SO-239" and "N" (above 300 MHz).

Internal battery power or external DC (8 - 16 Volts).

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

Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
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COMET™

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

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Technical

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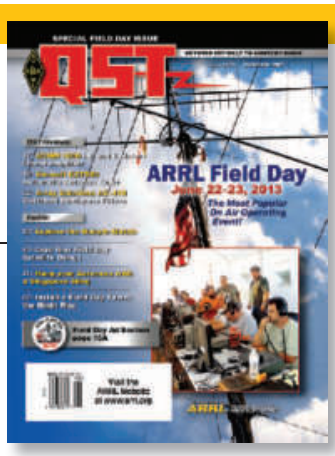
News and Features

Our Cover
Main image: One of twelve 50-foot portable military masts used by the Potomac Valley Radio Club and the Columbia Amateur Radio Association (W3AO) during 2010 Field Day in Glenelg, Maryland. Maurice Cahill, KA3EJJ, built the two rotator system that independently turns a five element 50 MHz Yagi and a stack of Yagis and verticals for 144, 222, 432, 900 and 1296 MHz. [Harold Kramer, WJ1B, photo] Inset: 2012 Field Day fun with members of the Cheshire County DX Club, Keene, New Hampshire. From back to front: Doug, K1ZO; Josh, KB1UPS; Larry, KA1VGM; Mike, N1MXJ; Neil, AE1P; Bill, N1YMP; Derek, W1WWW; Cliff, N1TGB; Rob, NT1Y. [Heather Goodell, photo]



Radiosport

Columns

Departments

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Interested in Writing for *QST*?
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e-mail: qst@arrl.org

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

- Large Backlit LCD Display for easy operation
- Stable RF Power (50 Watts VHF / 45 Watts UHF)
- Reliable performance in harsh environments
- 5 ppm Frequency Stability (-4° F to +140° F)
- 1000 Memory Channels for serious users
- Yaesu Unique Power Saving Circuit Design Minimizes Vehicle Battery Drain

Actual Size

NEW 2 m/70 cm DUAL BAND FM TRANSCEIVER

FT-7900R

2 m/70 cm DUAL BAND

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

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

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

FT-8900R

*70 cm 35 W

QUAD BAND DUAL RECEIVE

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

FT-8800R

*70 cm 35 W

DUAL BAND DUAL RECEIVE

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YAESU
The radio

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

Commercial Grade Field Radio
Submersible Construction

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

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

Actual Size

VHF FM 5 W COMPACT HANDHELD TRANSCEIVER

FT-270R

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

NEW 2 m MONO BAND

Compact Field Radio with Top Mounted LCD and Loud Audio

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

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

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

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

NEW 2 m MONO BAND

YAESU
The radio

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Rugged Emergency HF/VHF/UHF Portable Operations

FT-897D

100 W All Mode Transceiver
HF/50/146/440 MHz

When it's crunch time... the Ultimate Emergency Communications Radio

Rugged
Portable
Reliable
Proven
Manpack

- **SSB/CW/FM modes on all the Bands you need during an Emergency**
- **Rugged Construction...right down to the Carrying Handle**
- **DC 13.8V Mobile Operation**
- **Optional Internal Batteries for walk-around convenience when you need it**
- **AC switching power supply accessory that fits inside the radio**
- **Optional External Antenna Tuner**
- **Built-in DSP for Reliable Receiver Performance under tough conditions**

The FT-897D is a rugged, innovative, multiband, multimode portable transceiver for the amateur radio MF/HF/VHF/UHF bands.

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http://www.yaesu.com

It Seems to Us

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

Building For Our Second Century

"Next year the ARRL will mark the 100th anniversary of its founding with a year long celebration including a Centennial National Convention in Hartford, where it all began. We are proud of what has been accomplished in the first century of the ARRL's existence. What's in store for the second?"

In preparing for the ARRL Centennial in 2014 we have been looking back at the remarkable history of our association. The ARRL had a modest beginning as the brainchild of a committee of the Radio Club of Hartford — itself just a few months old — to fill a perceived need for a network of relay stations throughout the United States and Canada to overcome the severe limitations on the range of amateur stations of that era. Confirmation that the need was real came as hundreds of amateurs across the continent signed up for membership. Thus, the American Radio Relay League was born.

From the very beginning the ARRL was in the forefront, promoting improvements in operating practices and technical advancement. It quickly became apparent that there was another important role for the ARRL to play, as the principal advocate for Amateur Radio to government. The First World War soon forced the fledgling organization into hibernation but it awoke as soon as the Armistice was signed and its members joined together once again for a year long fight to regain their transmitting privileges. Because at the time the ARRL had essentially no resources, initial postwar financing was provided by a bond issue to members. Some never redeemed their bonds, apparently valuing the document as a memento more than the cash.

Despite the hiatus caused by the war, within a decade of its founding the ARRL had led radio amateurs to span the Atlantic and to abandon their inefficient spark transmitters for vacuum tubes. The organization won important friends in Washington to help protect amateurs' direct access to the radio spectrum. It spearheaded the formation of the International Amateur Radio Union to provide a needed global voice. These and subsequent achievements are chronicled in the online *QST* archive that is available to members at **www.arrl.org/arrl-periodicals-archive-search**. In the months to come we will have much more to say about this proud history.

Our Centennial is a time to reflect on the successes, and even the failures, that have brought us to where we are. Where would Amateur Radio be without the contributions of time, talent and treasure from those who created and then resurrected the ARRL in those early years and whose vision established the democratic governance structure, free from commercial influence, that still guides us today? Would Amateur Radio even exist?

Because it does exist, among the 161,200 members of the ARRL are tens of thousands of us whose lives and careers have been enriched beyond measure. We owe a great debt to those who came before us, who did the difficult and sometimes thankless work of building and sustaining a national association to promote and advance the art, science and enjoyment of Amateur Radio.

We are approaching the threshold of the ARRL's second century. What can we learn from our association's proud past, what can we do to build on the strong foundation we have been given, that will ensure an equally proud future for Amateur Radio?

In January 2010 the ARRL Board of Directors took a step toward answering that question when it created a nominating committee with the task of recruiting members for what ultimately has become the ARRL Second Century Campaign (SCC) Committee. Led by Chairman David Brandenburg, K5RQ, the SCC Committee adopted a vision statement that includes securing significant financial resources to fund the ARRL's commitment to its future objectives.

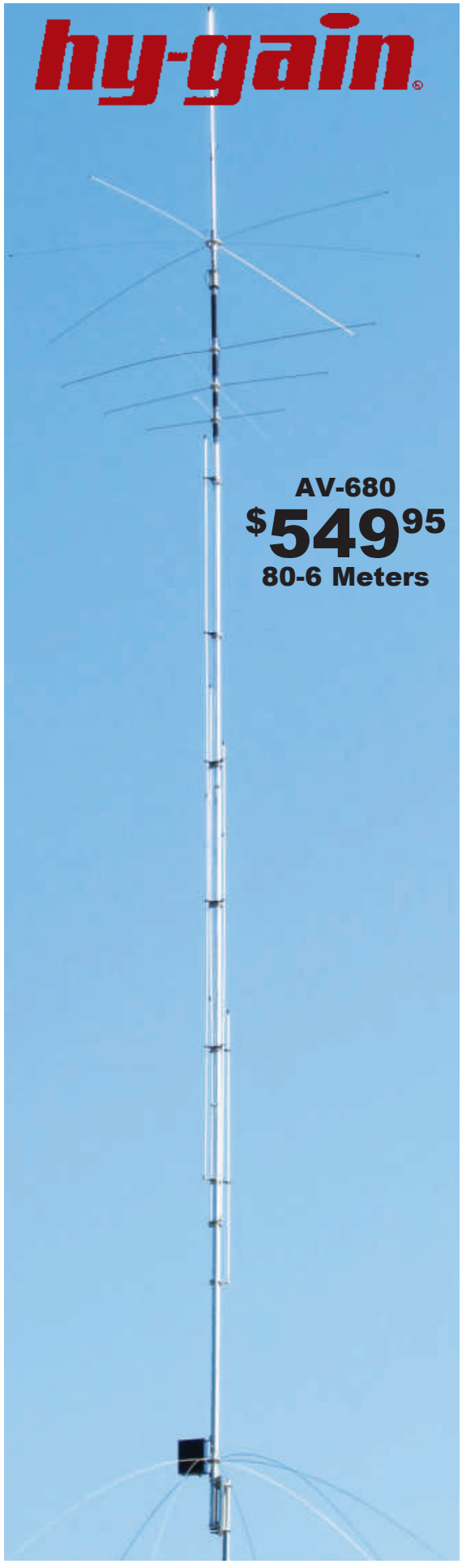
During 2011 and 2012 the SCC Committee tested the waters with a pool of potential major donors for a major fundraising campaign to increase the ARRL Endowment. The results of this "quiet phase" of the campaign were encouraging. By the end of 2012 a relatively small group of ARRL members had committed more than $3.6 million, including $1.55 million in pledged bequests, to the Second Century Campaign. The amount of cash and stock received in fulfillment of pledges was approaching $1 million as of year end and had reached that milestone by March 31, 2013. As of that date, total commitments exceeded $4 million.

Based on those promising initial results, the SCC Committee recommended a fundraising goal of $10 million for the Second Century Campaign and the goal has been adopted by the ARRL Board with a target date for completion of December 31, 2014 — the final day of our Centennial Year.

ARRL Chief Development Officer Mary Hobart, K1MMH, is devoting her full time to the Second Century Campaign and to the work of the SCC Committee. In addition to Chairman Brandenburg its members are Bob Allphin, K4UEE, Frank Donovan, W3LPL, Glenn Johnson, W0GJ, Ken Byers, K4TEA, L. Dennis Shapiro, W1UF, Mike Valentine, W8MM, and Steven West, W7SMW. Every committee member has made a significant personal financial commitment to the campaign.

As you reflect on the role of Amateur Radio in your own life, please consider what you can do to help ensure the future financial strength of the ARRL. None of us can know the specific challenges our association will face in the future or the opportunities that may arise for the ARRL to make Amateur Radio even more valuable as a community and national resource. But we do know this: Our predecessors made great sacrifices so we could enjoy the benefits of Amateur Radio. We owe the same opportunities to the generations of radio amateurs who will follow us.

For more information please visit **www.arrl.org/arrl-second-century-campaign**. If you would like to discuss how to fulfill your own pledge in the way that best meets the needs of you and your family, please contact Mary Hobart at **mhobart@arrl.org** or 860-594-0397, or any member of the SCC Committee.

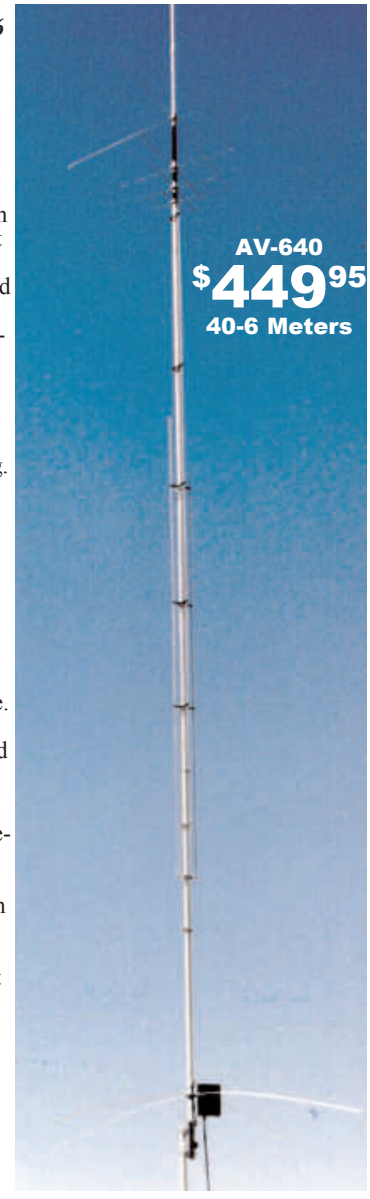


AV-680

80-6 Meters

Hy-Gain's new AV-680 adds 75/80 Meters with no radials!

Includes 40, 30, 20, 17, 15, 12, 10 and 6 Meters operation with low 17 degree radiation angle and omni-directional world-wide coverage. No ground or radials needed. Handles full 1500 Watts key down continuous for two minutes.



Highly Efficient

The AV-680 uses quarter wave stubs on 6, 10, 12 and 17 meters and very efficient end loading coil and capacity hats on 15, 20, 30, 40 and 80 Meters -- no traps. End loading allows efficient operation with a low-profile. Resonators are placed in parallel not in series.

Each band individually tunable

Extra wide low VSWR bandwidth. End fed with broadband matching unit. Single coax cable feed. Automatic bandswitching.

Sleek and low-profile

Low 2.9 sq. ft. wind surface area. Small footprint for mounting easily on decks, roofs and patios. 26 feet, 18.5 lbs.

Built-to-last

High wind survival of 65 mph. Broadband matching unit made from all *Teflon*[R] insulated wire. Aircraft quality aluminum tubing, stainless steel hardware.

Hy-Gain verticals are the best built, best performing and best priced multiband verticals available today.

hy-gain[R] warranty

Two year limited warranty. All replacement parts in stock.

ATB-75, $79.95. Tilt base for Hygain AV-680/AV-640 and AV-620 verticals.

AGK-8, $56.95. Guy Kit, three point non-conductive guy system for Hygain AV-680/AV-640 and AV-620 verticals.

AV-640, $449.95. 8 bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters. 25.5 ft., 17.5 lbs.

AV-620, $349.95. 6 bands: 20, 17, 15, 12, 10, 6 Meters. 22.5 ft., 10.5 lbs.

Inside of Matching Unit

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Call your dealer for your best price!

hy-gain

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The radio

Rebates Expire 6/30/2013

FTDX-5000/D/MP Series
HF/6 200W Built-In Power Supply
3 Roofing Filters, IF DSP Filters
(shown with optional SM-5000)

FTDX3000
Premium HF/50MHz Transceiver, Full color TFT display, High-speed Antenna Tuner and many more great features.

FT-950
HF/6 100W All-Mode, IF DSP filters
3 Roofing Filters, Antenna Tuner

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The Second Century Campaign

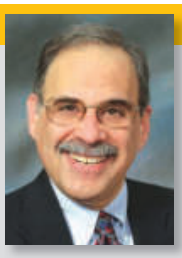
Building the ARRL Endowment for the second hundred years!

The ARRL was created in 1914 by Hiram Percy Maxim to support a growing interest in Amateur Radio. Now, 100 years later, the ARRL has grown into a worldwide organization supporting more than 160,000 members.

As the ARRL enters its next century, we are dedicated to continuing our commitment of excellence and service to ARRL members and the Amateur Radio community. Led by an all-volunteer campaign committee, The Second Century Campaign will build the ARRL Endowment as a "savings account" to ensure that the ARRL has the resources to expand and enrich the ARRL programs and services that members have come to expect.

Toward its $10 million goal, The Second Century Campaign has already raised more than $4,044 million in gifts and commitments through March 2013. The campaign needs your financial support to secure ARRL's second hundred years!

For more information, please visit www.arrl.org/arrl-second-century-campaign or contact Mary M Hobart, K1MMH, ARRL Chief Development Officer at mhobart@arrl.org or call 860-594-0397.



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

DXCC: Frequently Asked Questions

Worldwide, more than 55,000 amateurs participate in our DX Century Club (DXCC) award program. This level of participation generates lots of questions. According to the DXCC staff, these questions are among the most common:

Q: How do I achieve my first DXCC award?

You must submit confirmation of contacts with a minimum of 100 DXCC entities using either paper QSL cards or electronic QSL credits in Logbook of The World. There is a lot more to DXCC that just the initial award, though. There are many endorsements and other special DXCC awards for different bands and modes. Since there are so many levels of attainment, DXCC is considered a lifetime pursuit rather than a one-time award program. Our website has more information about DXCC at **www.arrl.org/dxcc**.

Q: What exactly is a DXCC entity?

The definition of a DXCC entity is based on Clinton B. DeSoto's, W1CBD, 1935 *QST* article, "How to Count Countries Worked, A New DX Scoring System." In this article, he said that "The basic rule is simple and direct: Each discrete geographical or political entity is considered to be a country." DeSoto never intended that all DXCC "countries" would be countries in the traditional sense of the word. Rather, they are the distinct geographic and political entities that DXers seek to contact. For example, we count Hawaii, Puerto Rico and Alaska as distinct DXCC entities.

The rules defining entities are sometimes controversial, particularly when we certify a new entity or delete an older one. A list of all 340 current DXCC entities can be found at **www.arrl.org/country-lists-prefixes**. We also sell a small book listing all the current DXCC rules and entities: **www.arrl.org/shop/The-ARRL-DXCC-List/**.

Q: Where can I find information about which DXpeditions are valid for DXCC credit?

Verification of a DXCC entity and DXpedition certification is a complex process that we initiate to assure the integrity of the program. When a new entity is certified, we post it on our website news page. For the latest information, contact us via e-mail or phone and provide the call sign and QSO information for the contact in question. See **www.arrl.org/dxcc-general-program-faq**.

Q: I mailed my QSL cards to Headquarters, but I haven't heard anything. How can I determine if my application was received?

We post a list of received applications at **www.arrl.org/dxcc-applications-received**. Applications are listed alphabetically, along with the dates they were logged into the DXCC system. It takes about a week between the time we receive your application and the day it appears in the online list.

Q: I submitted an application via Logbook of The World Online DXCC, but I noticed an error in my submission. Can I correct the application?

If you e-mail us promptly at **dxcc admin@arrl.org**, we can often modify or cancel the application before it is processed. Once it has been processed, however, it cannot be changed. You are not charged when you submit an application, only when the processing has been completed.

Q: In the past, I was charged a higher fee for submitting additional DXCC applications in a given year. Is this still true?

We no longer charge higher fees for additional annual submissions. You can submit as many applications as you want and we charge the same fee for each submission. However, each type of application — paper, Logbook of The World or Online DXCC — has its own application fees. The details are at **www.arrl.org/dxcc-awards-fees**.

Q: I am going to have my Online DXCC application checked by a local ARRL card checker. Will I have to pay for the application at that time?

Since you've already entered your credit card information when you completed your Online DXCC application, you do not have to give the card checker a payment for the application.

Q: Since you no longer accept hybrid applications consisting of both paper and LoTW QSLs, how do I apply for an award or endorsement when I need both types of confirmations?

Each type of application has its own procedure and is submitted separately. Please make a note on your submission that your DXCC totals need to be combined if you are applying for an award. Information can be found at **www.arrl.org/dxcc-forms**.

Q: I have not participated in DXCC for many years. Are older records still available if I want to participate again?

Almost all DXCC submissions received since the 1940s are still available and can be added to your DXCC record. You will, however, need a Logbook of The World account to retrieve and display these records. If you need a copy of your old DXCC paper record, send a request to DXCC along with $3 for photocopies or electronic PDF files. You can e-mail **dxccadmin@arrl.org** for further information.

For additional information about the DXCC program, please visit our website at **www.arrl.org/dxcc** and our DXCC FAQs page at **www.arrl.org/dxcc-general-program-faq**.

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

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

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

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

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

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

Programs

★ New! ARRL Centennial 2014 — ARRL2014.org

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

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

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

Community

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

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

Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
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ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
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The American Radio Relay League, Inc. is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

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

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

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www.arrl.org/sections

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Suggested Retail
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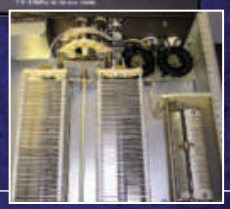

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Steve Ford, WB8IMY, upfront@arrl.org

A 1200 Pound Gorilla on Wheels

by Wayne Overbeck, N6NB
n6nb@arrl.net

One of the biggest challenges of portable operating, including Field Day, is finding a way to get antennas high enough to clear nearby obstacles like buildings and trees. My solution was a *tower trailer*.

I built a low cost utility trailer from a kit and I use it to transport and set up my tower. Major home improvement retailer and tool importers offer utility trailer kits with payload ratings of nearly a ton at prices under $400.

On the road with the tower trailer.

Once the utility trailer was built, I added a steel structure to support and raise a tower that I had on hand, a US Towers TMM-541SS. With a rotator on top, the antenna can be raised to about 45 feet, depending on the length of the mast. The entire unit weighs about 1200 pounds, including the original trailer, the tower and the superstructure to support it, a large orange job site box from Home Depot, antennas, a rotator, three electric winches, a 75 A/h gel cell battery to power the winches and a solar panel to recharge the battery.

The rear of the trailer frame has two trailer jacks that fold down to allow the frame to hold the weight of the tower when it is upright without placing an additional load on the hitch, trailer tires and suspension system. With a front tongue jack in place, the tower can be raised and lowered even if no vehicle is hitched to the trailer — as long as the wheels are blocked. If a vehicle is hitched to the trailer, the receiver hitch may need a drop or a rise of 1 to 2 inches to keep the trailer level and the tower vertical when upright, depending on the hitch height of the towing vehicle.

Setup begins.

Two electric winches are used to tilt the tower upright. The main winch pulls the tower up to a point just short of vertical. At that point, a second winch is used to restrain the tower so it doesn't crash into the supporting frame as its center of gravity shifts.

The typical setup involves just a few steps. First, you park in a level place and set the brake. Then you go to work on the trailer, lowering the two rear jacks and positioning the two outriggers. Next, the tower is raised to its upright position and the lower rear bracket is secured around the tower with two ½ inch bolts. Finally, the tower is elevated to its full height.

I would like to thank Carrie Tai, W6TAI, for her help in building this tower trailer. She did all of the painting, among other things. In fact, it was her idea to paint a red utility trailer and the unpainted steel superstructure the green color shown in the photos. Only she could envision that a green trailer with a silver tower and a bright orange storage box would look okay.

For complete project details, see **www.n6nb.com**.

The modified trailer kit.

This is the hoist setup I used to place the tower onto the trailer.

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Letters from Our Members

The Learning Never Stops

As a new licensee, I am thrilled to be a part of the Amateur Radio community; my new ticket represents the fulfillment of a dream I have harbored for years. But it was quite disheartening to read the letter by Vince Cammarata, NT4I ["Correspondence: Quality Beats Out Quantity," May 2013, page 24]. Could it be that this Amateur Extra class licensee simply cannot remember that he made mistakes or suffered awkward moments when new on the air? I commend the ARRL for opening the doors to the fascinating world of Amateur Radio. Our instructor went the distance to teach our class — his first! At the test session, our VEs were professional, pleasant and even funny, putting us nervous testers at ease. But when my pen hit the paper, that test session evolved into an exciting and challenging evening. Two weeks later, some high school students in our regional CERT obtained their Technician licenses. They are enthusiastic and eager to know more. They're running nets and learning the ropes. You get your ticket, but the learning never stops.

So I, as a newly licensed radio amateur, issue a challenge to the expert who is "personally disgusted" with us: Don't throw your ticket into a junk drawer in self-righteous indignation. Become an Elmer, an instructor, a VE or join the Amateur Auxiliary. Use your knowledge and experience to effect change for the better. Time marches on, and today's new licensees will ultimately phase you out and replace you. If you help them, perhaps they might even remember you.

Mary Duval, K1MTD
Andover, Connecticut

No Foolin'

I found the article by Eric P. Nichols, KL7AJ, a little lacking in technical specifics, so I built a Q-pole to verify its properties ["The 2 Meter Q-Pole," Apr 2013, page 33]. To my astonishment, I found that this antenna is close to a perfect beam. Whereas radio signals normally diminish as the inverse square of distance, I could detect no diminishing whatsoever. Furthermore, it also acts as the perfect radar antenna: The beam stays coherent, even when reflected off a rough surface.

I immediately decided to try some EME with my 5 W handheld transceiver. In rapid succession, I worked Quincy, Massachusetts, Quebec City and Qatar before my neighbors complained of QRM. But the most interesting results have come from reflecting signals off the dwarf planet Quaoar. This is lots of fun because Quaoar is 40 astronomical units from Earth at the closest, meaning it takes about 11 hours for a reflected signal to reach Earth. So I can start an EQE QSO with a ham on the other side of the world, say, the Quirimbus Archipelago, go to bed and get the reply at about the same time the next day. And I don't have to stay up late or miss work, either. All this on QRP, of course. Thank you for the April issue.

Steve Masticola, WX2S
Kingston, New Jersey

Technician Fun

I am in total agreement with ARRL Chief Executive Officer David Sumner, K1ZZ ["It Seems to Us: Techs on Ten," Apr 2013, page 9]. I have been a shortwave listener for more than 50 years, and then I finally got my Technician license. DX is in my blood. Between 6 and 10 meters, I've worked nearly 500 counties; I only need Alaska for my Worked All States Award, and I'm only nine entities short for DXCC. I've built my own antennas. Even though I am somewhat limited as to where I can operate, I love what privileges I do have as a Technician licensee. So all you Techs out there, get a rig, buy or build an antenna and get on the air. Then *enjoy*!

Ron Shopinski, N3KFV
Mount Carmel, Pennsylvania

Controlling Remotely

QST Editor Steve Ford, WB8IMY, reviewed the RemoteHamRadio Station Network, a subscription service that provides remote access to "dream stations" ["Short Takes: RemoteHamRadio Station Network," May 2013, page 59]. It sounds like fun, and it probably is; however, we should prepare for some unintended consequences if remote stations are used for award-chasing or contesting.

Ford noted that remote QSOs count for ARRL DXCC Award under the current rules. What if the dream stations are themselves located in rare DXCC entities, and are remotely controlled by operators in one or more other entities with little or no supervision at the DX end? Would the QSOs with all countries still count? Should they count? How would the DXCC Desk verify that relevant licenses were in order? In these circumstances, remote control has the potential to become "no control."

Paul O'Kane, EI5DI
Dublin, Ireland

Elmers and Jilvers

I am a relatively new ham who has had the great pleasure and luck to have several Elmers who are always ready to help. I am overwhelmed by the overall willingness of experienced radio operators who help us newbies. I've been to several different local radio meetings and met dozens upon dozens in the radio community and I'm proud to be included within such a fine group of people. But after some research, I have come to the conclusion there is no word for a person like me, one who is working with an Elmer. A person who is learning from an Elmer is sort of an apprentice, or a newbie or even a greenhorn, but those are words that have other meanings. What if the ham radio world made up a new word that described those new hams who work with Elmers?

I propose that a new operator should be called a "Jilver." Did you know that no word rhymes with "silver"? Not any more! If you take the out the middle letters, it leaves "JR," a reference to "junior," like a junior apprentice radio operator who is learning skills from an experienced ham, the Elmer. We'd be Elmers and Jilvers. If hams adopted this term and spread the word, it could someday get in the dictionary.

Rochelle Teeny, AE7ZQ
Portland, Oregon

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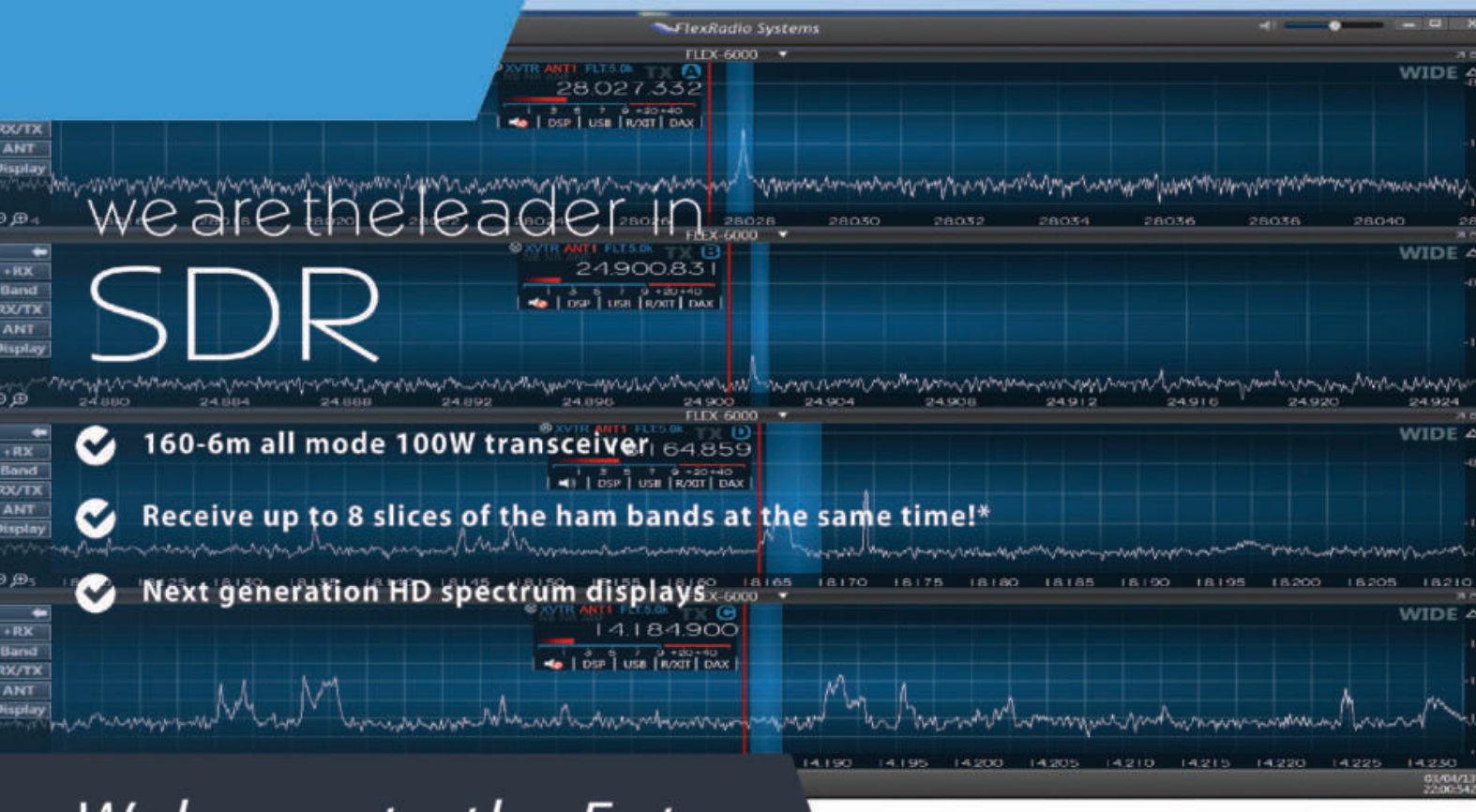

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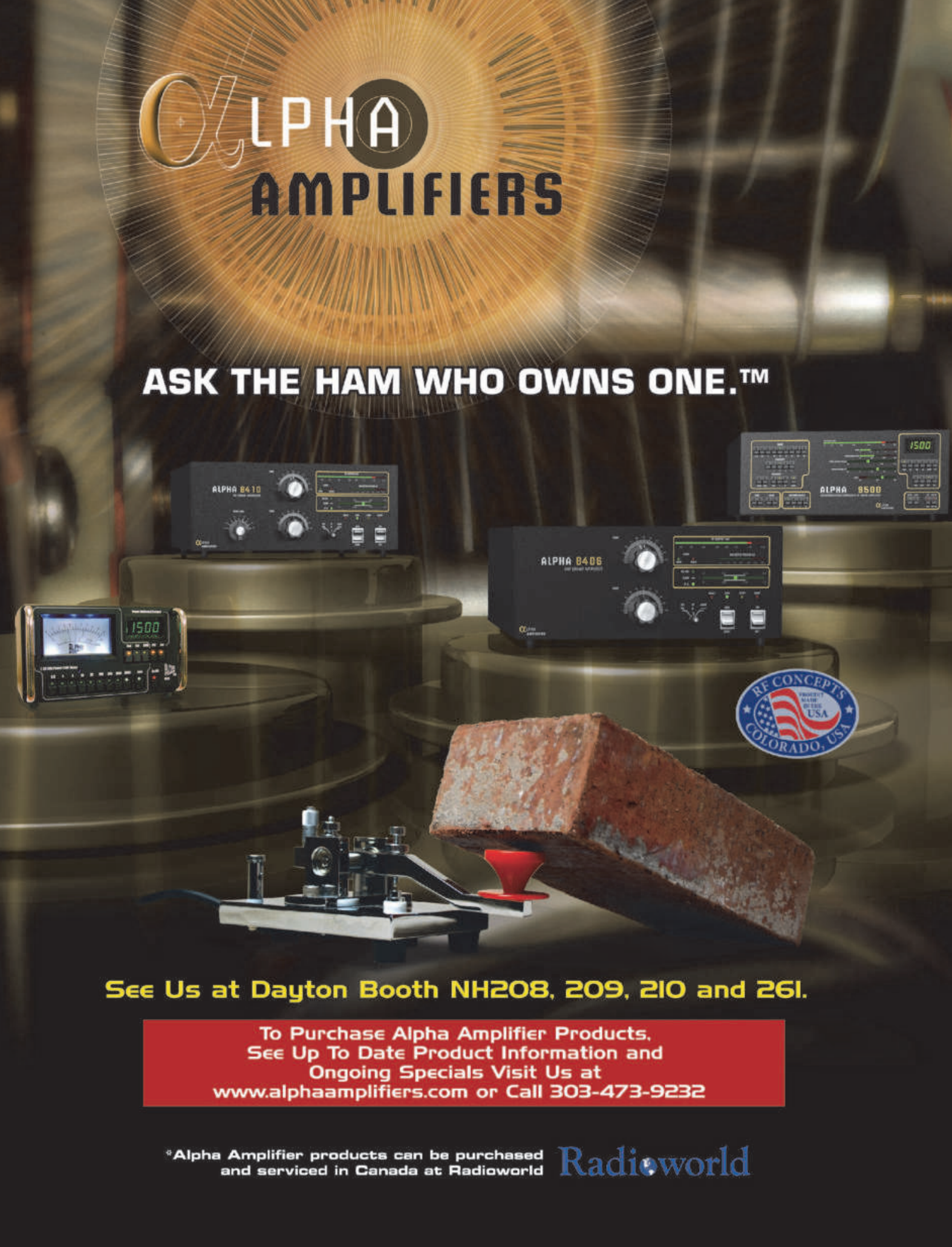
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Bob Fuller W7KWS Kapaa, HI in QSO with Mike (K7IR) and John (WA7IR) at SteppIR HQ.

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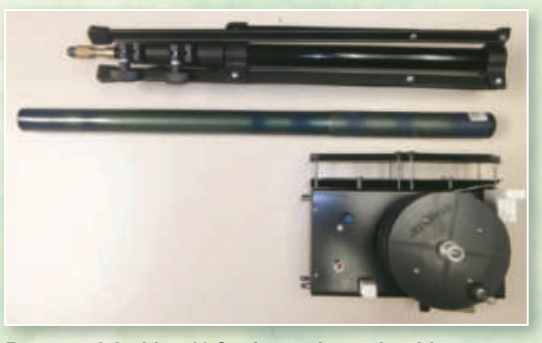

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Sam Moran KH6/KE7MAN.

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The Hairpin Match

Match low impedance antennas to higher impedance feed lines with this simple impedance transforming method.

Bill Wortman, N6MW

Experimental antennas often do not immediately appear with a 50 Ω input that will provide a 1:1 SWR with your usual coax feed line. The ham literature discusses numerous approaches to obtaining the required match.[1,2,3] This article will address a simple matching method often called *hairpin matching*.

Hairpin matching is nothing more than adding an inductance directly across the feed point of the antenna. The inductance may be a simple wire coil or an extended U-shaped wire or rods. This U shape is of course the reason for the name "hairpin," and many applications of this matching style use that form of inductance. Sometimes this method is called *shunt matching*, but beware because other forms of matching, some quite different, also use the word *shunt*.

You might ask why we don't use hairpin matches all the time since they are so simple. Unfortunately simplicity goes hand in hand with limited applicability and dealing with this is the key to matching success.

Why Matching is Needed

The object is to get as much of your transmitter's power as possible to exit the antenna as RF radiation. If your transmitter, with its ability to match a nominal 50 Ω impedance, is well matched to the input impedance at the feed line, this transfer efficiency will be maximized. If the feed line has an SWR near 1:1, the losses in the feed line will be minimized to produce the best efficiency. As a result, operators attempt to have antennas with an input impedance near 50 Ω and then generally use coaxial cable with a characteristic impedance near 50 Ω. Of course, there is nothing wrong with using other transmission lines, such as open-wire feed lines.

Another reason for good matching is sometimes more practical. With a mismatched transmitter and antenna plus feed line system, some transmitters and amplifiers balk when presented with a higher SWR than they are designed for. This can result in automatically reduced power output, or even transmitter shutdown, to prevent damage. If you have a transmitter with an antenna tuning unit or an outboard antenna tuner (both really impedance matching networks) the only remaining potential source of loss is from a high SWR from the feed line mismatch to the antenna, which generally becomes important only for high SWR (typically above 3:1), long cable runs and higher frequencies.

In any case, life is generally better if your antenna input impedance, after matching, is in the neighborhood of 50 Ω although concern about getting very low SWR is sometimes overrated. With resonant antennas and no tuner, a low SWR at its minimum value will give the largest bandwidth with a manageable SWR.

How Hairpin Impedance Transformation Works

If an antenna has an unmatched complex impedance of $Z_A = (R_A + jX_A)$, adding an inductance shunted across the antenna input gives an equivalent circuit as shown in Figure 1, in which $R_0 + jX_0$ is the resulting transformed complex impedance output. The object is then to select the added inductance value to cause R_0 to be close to the feed line characteristic impedance (often 50 Ω) with the net output reactance X_0 near zero.

By adding just one inductance of our choice,

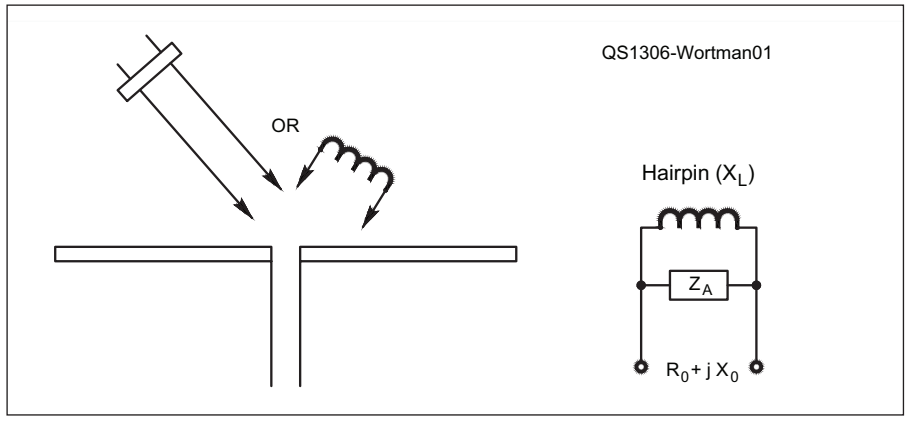

Figure 1 — Diagram of the hairpin matching configuration and the equivalent circuit.

Equations

The equivalent circuit in Figure 1 shows the unmatched antenna complex impedance $Z_A = R_A + jX_A$ in parallel with an inductance with a reactance of X_L. The resulting impedance for the combination, $R_0 + jX_0$, can be found in the standard way for a parallel circuit as:

$$1/(R_0 + jX_0) = 1/jX_L + 1/(R_A + jX_A) \quad \text{[Eq 1]}$$

A perfect match will have R_0 equal to the feed line impedance (often 50 Ω) and an X_0 of zero. This is clearly possible only if X_A is negative (capacitive). If we take $X_0 = 0$ and solve the resulting complex equations (both real and imaginary parts), after some algebraic manipulations the values are:

$$X_A = -\{R_A \times (R_0 - R_A)\}^{0.5} \quad \text{[Eq 2]}$$

and

$$X_L = -|Z_A|^2 / X_A = R_0 \times \{R_A / (R_0 - R_A)\}^{0.5} \quad \text{[Eq 3]}$$

These together will provide a perfect match. Note that the equation for X_A could also provide a correct solution with a plus sign, indicating an inductive unmatched antenna. Then the X_L becomes negative indicating a capacitive shunt. This is an alternate matching method but under different conditions.

[1]Notes appear on page 33.

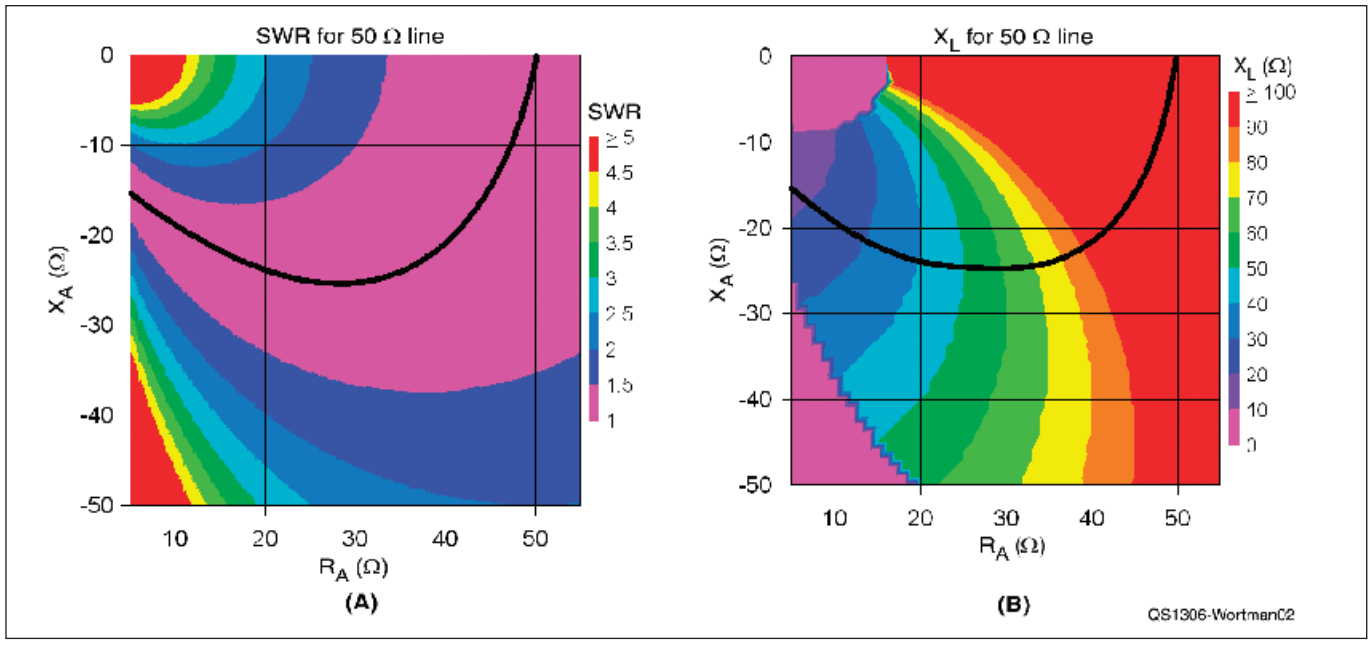

Figure 2 — Plots of SWR (at A) and X_L (at B) for hairpin matching to a 50 Ω line with the black lines at a perfect match.

we can obtain both R_0 to be near the feed line impedance and make X_0 be near zero. You might wonder if it is always possible to achieve both with just one additional component. The answer is generally no. However, if Z_A is within a range of appropriate values, it will work.

The equation that describes this parallel circuit is not difficult, although some hams may be put off by the need to deal with complex numbers. This is expanded on in the sidebar. The upshot is if R_A is less than R_0, there is always a capacitive X_A (negative) and a hairpin inductance X_L that will produce a perfect match.

At first blush you might think that shorting out the antenna input with a bit of wire would lead to the current that's coming up the feed line simply going through the added wire and not the antenna. It turns out that the magnitude of the current in the hairpin is generally comparable with that in Z_A, and it can be larger than the feed line current. This is because the hairpin and Z_A currents are far from being in phase. But this delicate balance makes the hairpin matched antenna appear as an impedance of R_0, even though there are (mostly) non-radiating currents in the hairpin.

How to Design a Hairpin Match

The first requirement for use of the hairpin is that the unmatched antenna resistive part, R_A, must be significantly less than the desired feed line impedance, Z_0. [This is generally the case with Yagi and very low height antennas. — *Ed.*] Second, the unmatched antenna reactive part, X_A, must be capacitive (negative) and also must be near the required value calculated in the sidebar. Z_A can often be adjusted by modest changes in the length of the driven element or by addition of loading. Once the appropriate Z_A is available, there is a hairpin inductive reactance, X_L, that can provide a perfect match.

Sometimes getting a perfect match is out of practical reach, primarily due to lack of knowledge or control of the unmatched antenna impedance. However, the match does not need to be perfect to be useful. It can be helpful to have the design information available in graphical form. With these things in mind, Figure 2 shows the first contours of the best SWR that can be produced by a hairpin match for a wide range of R_A and X_A values, provided you have the right X_L, and Figure 3 provides that optimal X_L value as contours for all the R_A and X_A pairs. The black line is the SWR = 1:1 curve corresponding to the perfect match equations in the sidebar. The first pair is for a target feed line impedance of 50 Ω and the second pair is for a target of 200 Ω. [Often matched to 50 Ω using a 4:1 loop balun. — *Ed.*] The plots appear similar but the scales for the two are different. Note that the SWR changes only slowly with X_A and X_L so great accuracy in their selection is not required.

The plots can be used to design a hairpin match by using your measured or calculated R_A, then finding the corresponding required X_A along the 1:1 SWR curve. Then go to the X_L curve to find the needed hairpin inductance. Finally adjust your antenna to have the needed Z_A and apply the required inductor across the feed point. The inductor might be a simple coil or hairpin shaped unit. These results for R_A are essentially the same as provided in the plots in the Note 2 reference, but the value of X_A is now available.

As has been pointed out by a number of other authors, matching by use of a *capacitive* shunt for a positive X_A (inductive) case is really the same except for the change of signs of X_A and X_L. However, the use of capacitors as shunt components presents other issues.

Dimensions for Hairpin Shaped Inductance

A hairpin shape of two parallel conductors with a shorting bar, perhaps adjustable, at the end can be viewed as a shorted transmission line section. With the length less than ¼ wavelength, the impedance at the open end is inductive. This impedance smoothly increases with length so it can provide a simple way to produce an inductive element. This impedance is directly related to the characteristic impedance of the transmission line, Z_0, that is determined by the ratio of the center-to-center separation of the parallel conductors *S* and the diameter of the conductors, *d*. A good approximation is $Z_0 = 276 \times \log_{10}(2 \times S/d)$ for most cases of interest. Figure 4 provides a plot from the full equation for Z_0 that is a bit more complicated but not much different in result.

Once the characteristic transmission line impedance is found, the impedance of the shorted line of length *L* can be found as $X_L = Z_0 \times \tan(2\pi L/\lambda)$ where λ is the wavelength and the argument of the tangent is in radians. Therefore the separation *S* might be chosen to

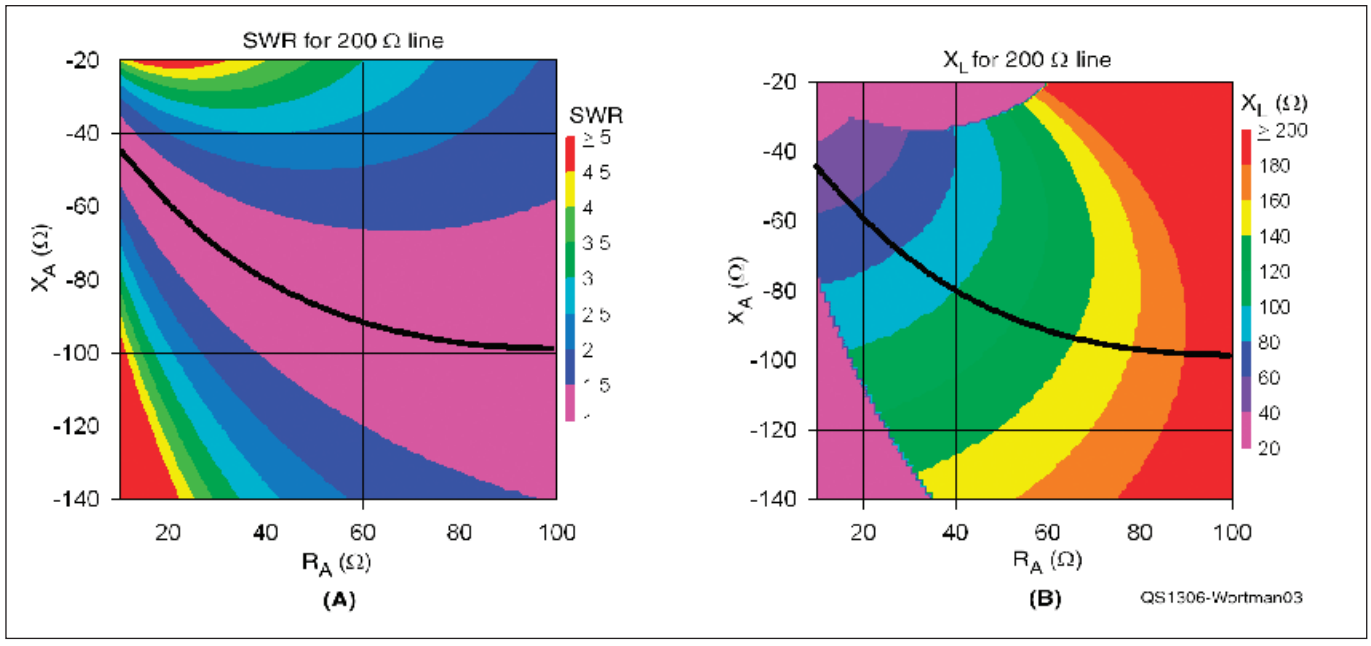

Figure 3 — Plots of SWR (at A) and X_L (at B) for hairpin matching to a 200 Ω line with the black lines at a perfect match.

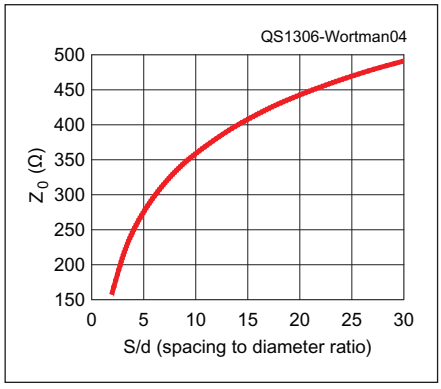

Figure 4 — Characteristic impedance of a parallel wire transmission line as a function of dimensions.

get a practical hairpin length for a particular needed inductance.

If a coil is being used for the inductance, there are numerous calculators available on the Internet and in reference books to define the size and number of turns required.

Applications of the Hairpin Match

The most common use of the true hairpin is for a monoband Yagi. Typically Yagis show an unmatched resistive component in the range of 10 to 20 Ω. Yagi construction naturally lends itself to adding a hairpin shape, sometimes with a shorting bar adjustment, along the boom. As a bonus, the center of the far end of the hairpin can be attached directly to the boom putting the whole antenna at a common dc ground. In some cases, the Yagi design driven element length is directly selected during design to provide a suitable Z_A for hairpin matching. This may avoid tuning by cutting of antenna element tubes, from which there is no return.

Although not usually identified as hairpin matching, short loaded antennas for mobile operation on the lower bands often employ this method using a coil.[4,5,6] Short antennas have R_A well below 50 Ω and usually have a large negative X_A. With loading (coils with a mobile whip, coil loading or capacitive hat loading as in a fixed vertical), the value of X_A can be adjusted downward, often into the range of the hairpin match.

Multi-element higher frequency Yagis are sometimes hairpin matched to provide a balanced 200 Ω antenna impedance that is further transformed with a 4:1 λ/2 coaxial "step up balun." This provides a final 50 Ω unbalanced antenna impedance that is a good match to a 50 Ω (unbalanced) coaxial cable.[7]

At my location a 57 foot high, 160 meter vertical with conducting guy wires attached at the top for loading and two elevated radials, has been used with a hairpin coil match. *EZNEC* indicated that this is possible with this short antenna. Upon assembly, the unmatched impedance at 1.825 MHz was found to be about $Z_A = 8 - j12$. From the chart in Figure 2 (A) the X_A is smaller than needed. Reduction of the lengths of the radials to well less than a ¼ wavelength brought the impedance into hairpin range and matching was accomplished with a handmade 1.7 μH (X_L of 18 Ω) coil of #10 AWG wire. That value is consistent with Figure 2 (B). The useful bandwidth is then about 40 kHz.

Drawbacks of a Hairpin Match

The most glaring weakness of hairpin match for Yagis is the mechanical complication of the need to split the driven element into two insulated halves. The good news is that it is then easy to measure the unmatched impedance with a modest antenna analyzer.

While the R_A range for matching is pretty wide, the required X_A range is a bit less forgiving, with variations of about 25% from the optimal value leading to best case SWR above 1.5:1.

Adjustment of the driven element to get the optimal X_A may be difficult under those conditions in which the length is largely fixed. Furthermore, the value of R_A also depends (but usually to a lesser degree) on the driven element length, so it all can be a bit of a moving target.

The hairpin match will leave you with a balanced antenna. With a coaxial cable feed line, which is unbalanced, conventional wisdom is that a common mode choke or another style 1:1 balun will probably be needed to limit potential distortion of the pattern from common mode currents.

There will be significant current flowing in the hairpin inductance so the size of the wire and the quality of the connections need to be considered to assure there are no significant resistive losses.

Some antenna analyzers do not provide the sign of X_A. This can be resolved by looking at the behavior of X_A with frequency as compared to the model. If a small increase in analyzer frequency results in an increase in

reactance, it's fair to say the reactance is inductive, and vice versa. This holds unless the reactance goes through zero as you change frequency, so observe carefully. The SWR does not depend significantly on cable length so looking for an SWR minimum is another strategy.

Other At-the-Antenna Matching Methods

For some hams a *beta match* is the same as a hairpin match. Others use beta match to mean the case of a true hairpin on a Yagi in which the center of the hairpin is electrically in contact with the boom. The matching capabilities are the same with either configuration, since the center of the loop is at zero voltage.

Gamma matches include a conducting rod running parallel to part of one side of a solid driven element. The rod is then connected to that element at the end of the rod. It usually has a capacitor in series with the rod. Gamma matches are very commonly used with Yagis, base fed towers and some other verticals. The gamma match is an alternative to hairpin in some cases and provides an unbalanced antenna feed point without the need for a split driven element. The tuning of gamma matches with dual adjustments (the gamma rod length and capacitor) is sometimes difficult and some published information on parameter selection is problematic. Omega matches are similar to gamma matches but a second capacitor is placed in shunt between the gamma rod and the driven element allowing tuning with just the capacitors. A T match is essentially a two sided gamma match that provides a balanced antenna feed point.

The ¼ wavelength of transmission line of characteristic impedance Z_0 can sometimes be a useful transformer, since it will convert an antenna impedance of Z_A into an output impedance of Z_0^2/Z_A. A ½ wavelength of coaxial cable can be made into a 4:1 transmission line balun that transforms, for example, 200 Ω into 50 Ω. The ½ wave loop provides both a match and a transition from a balanced antenna to an unbalanced feed point.

Computer Programs for Modeling

The popular *EZNEC* program is a valuable modeling tool for antenna evaluation and matching. First it will predict the unmatched antenna impedance and allow you to adjust the element dimensions in the model to obtain an impedance that can be matched by a hairpin, if it's possible. Then you can add a parallel inductive load to the model to provide the match and explore the resulting variation of SWR with frequency. Of course, models will provide guidance for a starting point, but the final configuration will need to be physically tested.

Summary

If your split driven element antenna has an unmatched resistance of far less than the impedance of your desired feed line and it has, or can be made to have, a similar magnitude unmatched capacitive reactance, then you may be a candidate for a simple hairpin match consisting of an inductance shunted across the antenna feed point.

Notes

[1]J. Gooch, W9YRV, O. Gardner, W9RWZ, and G. Roberts, "The Hairpin Match." *QST*, Apr 1962, pp 11-14, 146, 156.

[2]*The ARRL Antenna Book*, 22nd Edition, pp 24-20 to 24-33. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6948. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**

[3]J. Devoldere, *ON4UN's Low-Band DXing Antennas, Equipment and Techniques for DXcitement on 160, 80 and 40 Meters. Fifth edition*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8560. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**

[4]See Note 2, pp 21-11 to 21-13.

[5]J. Clement, VE6AB, "Gain Twist 75 Meter Mobile Monobander," *QST*, Jan 2011, pp 39-43.

[6]P. Salas, AD5X, "160 and 80 Meter Matching Network for Your 43 Foot Vertical — Part 1," *QST*, Dec 2009, pp 30-33.

[7]See Note 2, p 15-20.

William Wortman, N6MW, is a physicist with a PhD from Texas A&M University and an undergraduate degree in engineering from Ohio State University. He has spent most of his career in defense contracting research and development. Bill has been licensed since 1957, holds an Amateur Extra class license and has been an ARRL member since he was licensed. His radio interests include DXing, contests and antenna experimentation. He can be reached at 76925 Barker Rd, San Miguel, CA 93451 or at **n6mw@arrl.net**.

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

Feedback

■ In "Overvoltage Protection for ac Generators" [Apr 2013, pp 43-46], some of the identified parts are no longer available, or are not available in single unit quantities. Please make the following changes:

C1 — 220 µF, 35 V electrolytic capacitor (Digikey P5166-ND).
DS1, DS7 — Red LED (Digikey 751-1129-ND).
DS3-DS5 — Green LED (Digikey 751-1099-ND).
DS2, DS6 — Yellow LED (Digikey 751-1144-ND).

The original amber LED is no longer available in 3 mm size so that has been changed to yellow.

■ In Figure 1 of "An MCW Keyer for V/UHF FM" [Apr 2013, pp 37-38], Q1, Q2, Q4 and Q5 are misidentified as PNP transistors. They are actually NPN types. The base diagram for the Q3 is correct as shown, only its label has a typo.

■ In Figure 3 of "The Penticton Solar Flux Receiver" [Feb 2013, pp 39-47], the block labeled "2.75-2.85 GHz Band-pass Filter" in both the A1 and B1 paths should read "GasFET Amplifier."

■ A new version of *GAMMA* software is available. Bill Wortman, N6MW, has reworked the *GAMMA* program provided as a supplement to *The ARRL Antenna Book* and that is also useful to readers of *The ARRL Handbook* and *ON4UN's Low-Band DXing*. The previous version of *GAMMA* failed to find solutions to the calculations if the combination of the desired feed line impedance exceeds the product of the raw antenna resistance and the gamma step-up value. Bill's new code fixes that problem.

The revised program is available for download as a zip (compressed archive) file on the web pages for *The Antenna Book, 22nd Edition* (**www.arrl.org/antenna-book-reference** — SOFTWARE folder) and *The ARRL Handbook, 2012 Edition* (**www.arrl.org/arrl-handbook-reference** — SUPPLEMENTAL INFORMATION AND FILES folder).

The ARRL extends thanks to N6WM for his contribution, as well as to Greg Ordy, W8WWV, for making some tests of the code.

■ In "Overvoltage Protection for ac Generators — Revisited" [Apr 2013, pp 43-46], the author advises that if you are using the circuit board from Far Circuits you will not be able to use the on-board jumpers as part of the calibration process. Instead you will have to carefully touch your positive voltmeter probe to the LM-3914-1 pins. If your meter doesn't have a probe but instead has alligator type clips, attach the positive clip to a small piece of scrap wire, such as a clipped end of a resistor. The negative lead attaches to the negative foil strip on the bottom of the board where the negative lead of capacitor C1 attaches.

LM-3914-1 pin 6 is for the lower voltage setting (0.35 V dc) and pin 4 is for the higher voltage setting (0.55 V dc). Remember, those are starting voltages and will have to be adjusted a little.

Remember, to avoid contact with R5 and U3 when making adjustments and that includes the foil side of the board around those components, including the leads going to the GFCI.

Field Day on the Highest Frontier

Getting the satellite contact bonus is easier — and more enjoyable — than you think.

Steve Ford, WB8IMY

We've all seen images of the stations that make up NASA's Deep Space Network, or perhaps the elaborate satellite ground stations assembled by some of our fellow hams. With dollar signs dancing in our eyes we assume that any kind of space communication is well beyond our reach, especially for Field Day.

But unless you're trying to give a shout-out to the *Voyager* spacecraft at the edge of our Solar System, grabbing Field Day bonus points with a satellite contact can be surprisingly easy.

The Amateur Radio space fleet consists of dozens of satellites, all of which are in low Earth orbits. These "birds," as they are affectionately called, may be hundreds of miles away, but they have the best antenna sites you can possibly imagine. From where they fly huge swaths of the Earth are visible at once — a line-of-sight shot from their antennas to yours. Add their highly sensitive receivers to the equation and you have spacecraft that can hear even low power transmissions with ease.

Mark Spencer, WA8SME, using an Arrow 146/437-10 antenna to make satellite contacts from the W1AW parking lot.

Many of the currently active satellites are research craft that downlink information via telemetry. The birds you want to focus on, however, are the ones that function as orbiting relay stations. There are several of these satellites and they come in two varieties.

The FM Repeaters

Until recent times we had several satellites that operated just like FM repeaters here on Earth. You transmit to the satellite on one band (the *uplink*) and the satellite re-transmits your signal on another band (the *downlink*).

Today we have just one FM repeater satellite that is still active: Saudi-OSCAR 50. This little bird listens on 2 meters and repeats on 70 centimeters. See the list of frequencies in Table 1. Like many FM repeaters, Saudi-OSCAR 50 also requires a CTCSS tone on the uplink (67 Hz).

Table 1
Field Day Satellite Frequencies

Saudi-OSCAR 50 (FM Repeater, 67 Hz CTCSS)

Time	*Transmit*	*Receive (MHz)*
AOS (start)	145.840	436.805
AOS+3 minutes	145.845	436.800
Zenith (maximum)	145.850	436.795
Zenith+1 minute	145.855	436.790
LOS (end)	145.860	436.785

Linear Transponders (SSB/CW)

Satellite	*Uplink Passband*	*Downlink Passband*
VUSat-OSCAR 52	435.225 – 435.275 MHz	145.875 – 145.925 MHz
Fuji-OSCAR 29	145.900 – 146.000 MHz	435.800 – 435.900 MHz
AMSAT-OSCAR 7	432.125 – 432.175 MHz	145.925 – 145.975 MHz

The Linear Transponders

An FM repeater satellite can only receive and transmit on single frequencies, which means that only one station at a time can communicate through the bird. In contrast, linear transponder satellites receive an entire range of frequencies (known as the *passband*) and re-transmit through a range of frequencies as well. As a result, a linear transponder satellite can repeat many signals at once. To perform this neat bit of magic, however, the transponder can only handle narrower, low duty cycle signals such as SSB and CW; FM is forbidden on a linear transponder bird.

What Do You Need to Work the Birds?

If you want to try your luck with Saudi-OSCAR 50, all you need is an ordinary dual-band (2 meter/70 centimeter) FM transceiver. Under normal circumstances a 5 W handheld radio is perfectly adequate, but Field Day is far from a normal circumstance. Your uplink signal is going to be in fierce competition with many dozens of others and only the strongest signal will "win" at any given time. My recommendation would be to add some RF muscle to your OSCAR 50 station. If you have a dual-band mobile rig with 25 or 50 W output on 2 meters, that would be a good choice. Otherwise, consider a separate RF power amplifier for the 2 meter uplink.

If you were operating on any other quiet summer weekend, you could get away with using omnidirectional antennas to work Saudi-OSCAR 50 (I've made contacts with just a dual band magnetic mount antenna on my car). But once again, Field Day isn't a quiet weekend by any measure. I'd strongly suggest the use of a dual band directional antenna such as an Arrow Antennas model 146/437-10 (**www.arrowantennas.com**) or the Elk Antenna model 2M/440L5 (see my Short Takes review of the antenna in this issue).

For the linear transponder satellites such as VUSat-OSCAR 52, Fuji-OSCAR 29 and AMSAT-OSCAR 7, a CW/SSB transceiver designed for satellite operating, such as the Icom IC-9100 or Kenwood TS-2000, makes life a lot easier. These radios have the ability to transmit and receive *simultaneously*, which is a big advantage when dealing with the effects of Doppler shift (more about this in a moment). That's not to say that you can't use an ordinary multiband transceiver with VHF and UHF capability, but compensating for

Doppler can be quite a challenge. Mark Spencer, WA8SME, designed a device that makes it possible to put a Yaesu FT-817 transceiver to work on the linear transponder birds. You'll find his article, "Satellite CAT Interface for Working the Analog Birds," in the October 2012 issue of *QST*.

When it comes to antennas, you can use the same antennas I suggested for Saudi-OSCAR 50, although you'll need a second pair of hands to aim the antenna while you work the radio. High power isn't necessary. In fact, the use of high power is discouraged with the linear transponder satellites. This is particularly true for OSCAR 7. This old bird is fragile and unstable from a power resources standpoint. If too many demands are placed on the satellite, the downlink passband will begin to distort. In some instances the satellite may suddenly shift uplink/downlink frequencies.

Where Are the Satellites?

Amateur Radio satellites aren't like the "fixed" geostationary spacecraft that deliver satellite TV to homes throughout the world. Those satellites orbit at a distance of about 22,000 miles and they match the rotational speed of the Earth, which makes them appear to hover in the sky.

Ham satellites zip around our planet much faster than it rotates, like tiny moons that rise and set rather quickly. They don't show up at the same times each day, nor do they trace the same paths across the heavens.

With that in mind, finding a satellite becomes a bit like consulting a bus schedule. Once you determine where you intend to wait for the bus (your location), you can use software to tell you when the satellites will be passing by. Your location doesn't have to be precise. If you know the latitude and longitude of the nearest city, that's sufficient. You can even use software such as *Google Earth* (**www.google.com/earth/index.html**) to find your Field Day site on the map and see the exact coordinates.

If you plan to have computers at your Field Day site, there are a number of satellite tracking software packages you can put to use. Just make sure you are using the latest orbital elements (consult your software Help file to find sources for this information). See the AMSAT Store at **www.amsat.org** to purchase software for PCs or Macs. In addition to the latest orbital elements, you will need to enter your location before the software can make predictions.

If you own a smartphone or tablet, there are a number of satellite tracking apps available. As an iPhone user my favorite is *GoSatWatch*; many Android users are fond of *Satellite AR*. Since smartphones already "know" your location, these apps will start cranking out predictions within seconds.

Of course, you don't need to have a computer to predict satellite passes. You can use an online prediction tool such as the one at the AMSAT website at **www.amsat.org/amsat-new/tools/predict/**. This useful page was not working correctly at press time, but with luck it will be available for Field Day. If not, try N2YO's excellent site at **www.n2yo.com**. Just select your satellite, generate the predictions and then print them out.

To keep your antenna pointed at the satellite, you'll need to know the path it will follow. Depending on the software you are using, it will provide the following information at minimum:

- AOS Azimuth
- Elevation and Max Elevation Azimuth
- LOS Azimuth

AOS Azimuth is the position of the satellite at "Acquisition of Signal" — the beginning of the pass. Azimuth is measured in degrees with 0 or 360 degrees being due North; 90 degrees East; 180 degrees South; and 270 degrees West (see Figure 1).

Elevation is the angle, measured in degrees, between your position and the satellite. An elevation of 0 degrees puts the satellite on the horizon; an elevation of 90 degrees is directly overhead (see Figure 2). Most prediction programs display the Max Elevation Azimuth so you'll know where the satellite will be located when it is at its highest position in the sky.

A glimpse of the *GoSatWatch* app for the iPhone and iPad showing the position and footprint of Saudi-OSCAR 50.


Saudi-OSCAR 50.

Finally, LOS Azimuth is the position of the satellite at "Loss of Signal" when it slips over the horizon.

By studying the predictions you can use your imagination to see the path the satellite will take. (Many software applications will show you the path graphically.) You'll notice right away that some passes seem to just skim the horizon while others send the satellite whizzing right over your head. As a Field Day rule of thumb, you want to select passes that result in the satellite being as high overhead as possible at the peak of its pass. Higher passes also mean a longer access time, which is important when you're struggling to make contact.

Working the Birds

You'll find that most hams will be using Saudi-OSCAR 50 on Field Day. This is the easiest approach to the 100 point satellite QSO bonus, so it has obvious appeal. But to borrow from Thomas Hobbes, Field Day

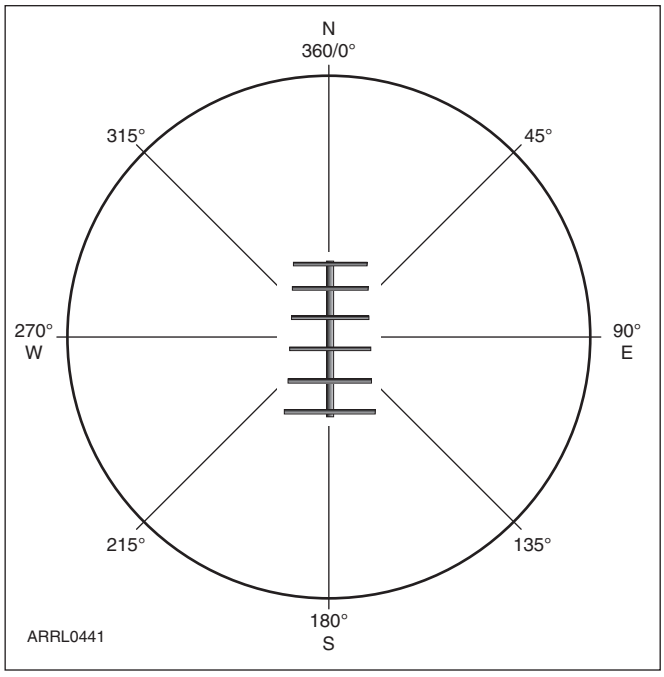

Figure 1 – Azimuth is the direction, in degrees referenced to true north, that an antenna must be pointed to receive a satellite signal.

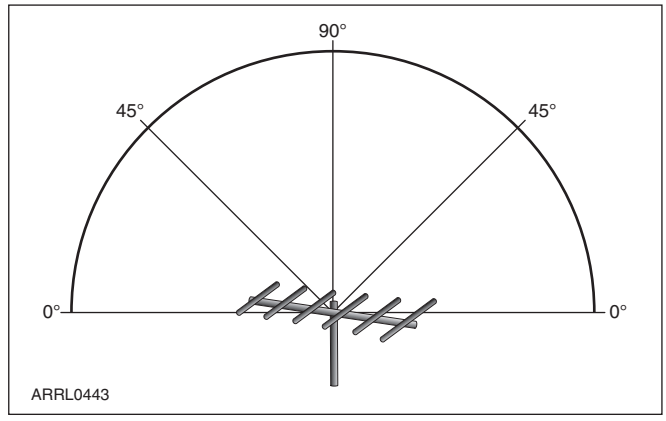

Figure 2 – Elevation is the angle, in degrees, between your antenna and the satellite, referenced to the Earth's surface.

contacts on Saudi-OSCAR 50 will be "nasty, brutish and short."

As the satellite rises in the sky, you'll be treated to buzzes and squeals mixed with occasional whole sentences. What you're hearing is the RF equivalent of a barroom brawl. All you can do is grab your microphone and start punching…er…calling. Wait for a gap in the cacophony and then send your blast:

"W1AW, two alpha, Connecticut!"

If fate is smiling upon the operator at W1AW, he will hear, "W1AW from WW1ME. Three alpha Maine!"

"WW1ME QSL from W1AW. 73!"

Notice that W1AW did not call CQ. Never call CQ on an FM repeater satellite, especially during Field Day. You wouldn't call CQ on a terrestrial repeater, would you?

Once you bag the contact, *stop*. Resist the temptation to try for another. Instead, give someone else a chance. Just smile, pat yourself on the back and enjoy listening to the chaos as the satellite races to the horizon.

Calling CQ is fine on the linear transponder birds. This gives the other station a little time to zero in on your signal. You may hear the other operator's voice swoop onto your frequency, sounding high and tinny at first, then settling down to normal. CW works in much the same way.

For Field Day I'd recommend either VUSat-OSCAR 52 or Fuji-OSCAR 29. Both satellites are reasonably strong and both feature *inverting* transponders. This simply means that the transponder flips the sideband of your transmit signal. If you transmit upper sideband on the uplink, your signal will be lower sideband on the downlink. The convention with both satellites is to transmit lower sideband and receive on upper sideband.

Compensating for Doppler Shift

Satellites in low Earth orbit are screaming along at more than 17,000 miles per hour. At this speed the *Doppler effect* comes into play. The classic example is the sound of an ambulance siren on a nearby highway. Just as the siren changes frequency as the vehicle passes you, RF signals shift frequency according to how fast the satellite is moving relative to your position. You'll need to compensate for this shift while receiving and transmitting.

Look again at Table 1 and you'll see that I've listed a series of transmit and receive frequencies for Saudi-OSCAR 50 because these frequencies change according to where the satellite is during the pass. Notice how the downlink frequency, for example, starts high and then shifts downward. You can program a set of memory channels in your dual-band FM rig and simply jump from one channel to the next at the appropriate times. You'll know it is time to change channels when the receive signals begin to sound distorted.

On the linear transponder satellites Doppler compensation is a matter of setting your receive (downlink) signal at one frequency and then listening to yourself through the satellite, preferably while wearing headphones, as you call and tweak your uplink frequency to keep your voice sounding normal. This method won't prevent drift completely, but it will minimize it for the short time it will take to make the contact. If you really want to compensate for Doppler in the fashion that veteran satellite operators have used over the years, read about "The One True Rule" at **www.amsat.org/amsat/features/one_true_rule.html**.

Obviously, Doppler compensation on a linear transponder satellite depends on your ability to hear your own signal on the downlink while you are transmitting. If you don't have a rig that allows this (most don't), my suggestion would be to pick an uplink frequency that is well above any other signals in the passband, call CQ and then tune to keep the responding station sounding normal. When you transmit again, however, you'll be at a different frequency in the other fellow's radio. The result is that you'll be chasing each other through the passband, so keep the contact as short as possible!

Enjoy!

If you've never tried amateur satellites before, this experience might just strike the spark. Pick up a copy of the *ARRL Satellite Handbook* at **www.arrl.org/shop** and you'll learn much more. There are some exciting new satellites coming yet this year and next, so get ready and get on the air!

Steve Ford, WB8IMY, is the Editor of *QST*. You can contact him at **sford@arrl.org**.

The Great RFI Hunt

Diligent analysis — including unplugging everything in the house — reveals the culprit.

Robert Wilson, NTØA

My return to ham radio after a 10 year break has been one head scratching exercise after another. The most frustrating has been the one that most hams face at one time or another — electromagnetic interference (EMI) or radio frequency interference (RFI) from unknown sources. I upgraded an old computer to use for logging and other ham shack activities. When I moved it out to the ham shack and turned it on, my education began.

Signals Can be Good News or Bad

The computer worked flawlessly, but put a solid S-5 signal on all the HF bands. Sometimes it was uniform across a band, and sometimes it was spotty or uneven. At times it was 10 to 20 dB over S-9. The RFI from the computer covered all but the loudest signals on each band. I didn't expect that since I had had my laptop out there earlier and it did not cause any problem.

Making Sense of the Signals

I Googled *ham radio computer generated RFI* and bookmarked the best sites. I read them all and then started the troubleshooting procedure. With the coax removed from the radio, I started out by slowly tuning through all of the bands. Whenever I heard a birdie, hiss, hash or growl, I shut the computer and monitor down to see if they were causing the problem.

On 80 meters the computer was not heard at all. On 40 meters the computer could be faintly heard around 7.214 MHz, but without any movement of the S meter. On 30 meters the computer could be heard slightly but it was not enough to cover any real signal on the band. The 20 and 15 meter bands were an entirely different story. I could hear RFI as described in Table 1.

Table 1
RFI Received Without Antenna Connected

Frequency Range (MHz)	Received Indication
14.010-14.015	soft hash, no S meter movement
14.055-14.061	soft hash, no S meter movement
14.065-14.070	soft hash, no S meter movement
14.107-14.117	loud hash, S-3+
14.155-14.160	soft hash, no S meter movement
14.185-14.189	soft hash, no S meter movement
14.208-14.215	loud hash, S-3+
21.067-21.072	soft hash

Then I connected coax to the radio and spot checked the frequencies in Table 1. As one would expect, the RFI was stronger and more pronounced with the coax connected to the radio and stronger when connected to the antenna than to the dummy load, although it could still be heard in the dummy load position.

Next I checked the effect of removing the keyboard and/or the mouse. The S meter reading dropped 60 to 70% if the keyboard was removed and dropped the rest of the way when the mouse was disconnected. This was an artificial *eureka!* moment. I then tried different keyboards and mice. Some were better than others but the original combination was the best.

I tuned the rig to 14.112 MHz and disconnected the mouse and keyboard. The noise level dropped dramatically. I then turned on my external keyer and the rig became almost silent and I was unable to explain why.[1] I noted the same effect on white noise when the rig was connected to an antenna with the computer off and the mouse and keyboard disconnected.

Time to Experiment

I turned off the computer, turned off the keyer and disconnected the mouse and keyboard. I tuned the radio to 14.112 MHz and connected the mouse with no noticeable effect. I disconnected the mouse and connected the keyboard with the computer and monitor still off and as with the keyboard PS-2 plug between 1/32 to 1/16 inch from the computer PS-2 socket, the

[1] J.Garrett, WB4VVF, and D. Contini, W4YUU, "The Accu-Memory," *QST*, Aug 1975, pp 11-20.

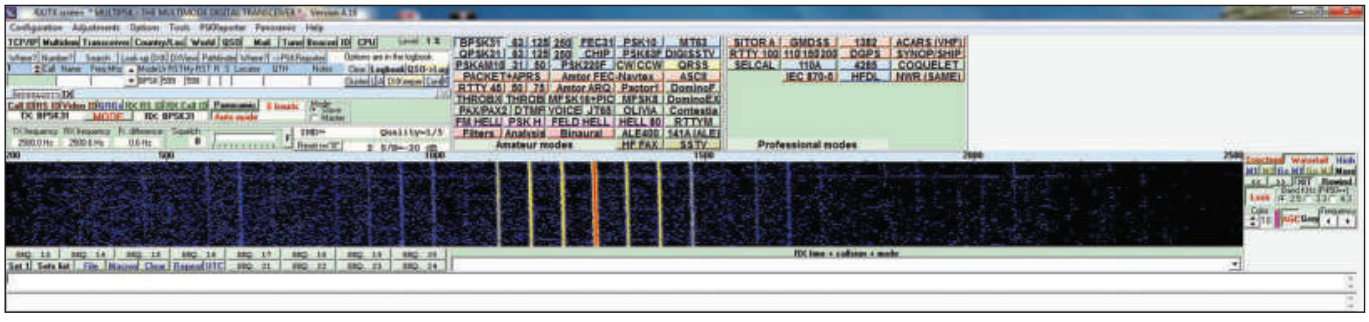

Figure 1 — MultiPSK waterfall display screen shot (with the lower half of the screen cut off) showing the interference that came from my hot tub on the other side of the wall of my ham shack. A change of ham shack location as well as new Times Microwave LMR400 coax significantly reduced that interference.

interference returned at the original S3 level. What is going on? I tried other keyboards and they all had similar, but less pronounced, effects. When I reached up and touched the top of my keyer (still turned off) the RFI went away. I began to suspect I was a victim of *Candid Camera* or *America's Funniest Home Videos*.

I thought about the problem and decided that the computer keyboard line must be acting as either an RFI connection device or as a rectifying antenna for RF energy in the area. The sensible solution seemed to be to put ferrite beads around all the cables in and out of computer. After a fast trip to the local Radio Shack, I installed ferrite beads on each end of each cable into or out of the computer as well as on the radio power cord near the radio. I powered up the computer and concluded that $25 worth of ferrite beads didn't do a thing, except increase the attenuation effect when the keyer was touched. What in the world was going on?

One of the common RFI cures is to ground all of the chassis to the same ground, so I built two new ground cables (the radio and external VFO were already grounded to each other) and daisy chained everything together so that the chassis of each was at the same RF potential. I repeated some tests. The common ground had absolutely no impact. The noise level was exactly the same as before.

I then turned on the keyer, and the computer RFI disappeared completely, except for the hash around 14.112 MHz, which never went away.

Starting to Get Frustrated!

It appeared that while my earlier touching of the keyer silenced the RFI, I may have been adding some unknown capacitance to the RFI network, and that capacitance trapped the RFI in some way. In a similar fashion the keyer was acting as a choke to cut out the RFI. If I knew what that capacitance was and where in the circuit it was, perhaps I could solder in a permanent fix. I concluded that RFI must be feminine and capacitance must be masculine because I understood capacitance, but I could not solve the RFI unhappiness except by accident.

I continued troubleshooting by removing power from everything in the house with the exception of the ham shack by turning off every circuit breaker except the one supplying the ham shack. The result was zero impact on the level of the interference. I was beginning to suspect that the problem lay in the power lines and transformers. It was also possible that the source lay with some equipment in the local industrial park, but because the interference did not vary with the time of the day, I doubted that the problem lay there. In any case, I desperately needed help of someone because I had neither the equipment capable of pinpointing the source nor the experience necessary to successfully hunt down the source or sources.

Help Arrives

Jerome Chamberlin, WAØJRJ, came to the rescue and helped me find out that the source of the RFI. It was literally in my ham shack!

We spent most of one morning trying to track down the source of the noise by using both a mobile HF rig in his car and a scanner with a hand held beam antenna. We found a dozen potential sources within ½ mile of my house, but nothing clearly identifiable as an offending point source. At the end of the third trip around the neighborhood with the mobile rig tuned to one of the offending frequencies, the interference became louder and louder the closer we came to my garage.

It was then that we had Eureka moment #2 — we realized that the problem was in the house.

We made a trip around both the exterior and interior of the house with the following results:

- The 80 meter dipole and open feed line pick up the signal.
- My metal gutters pick up the signal more than the dipole and feed line.
- Nothing was identifiable as a point source.

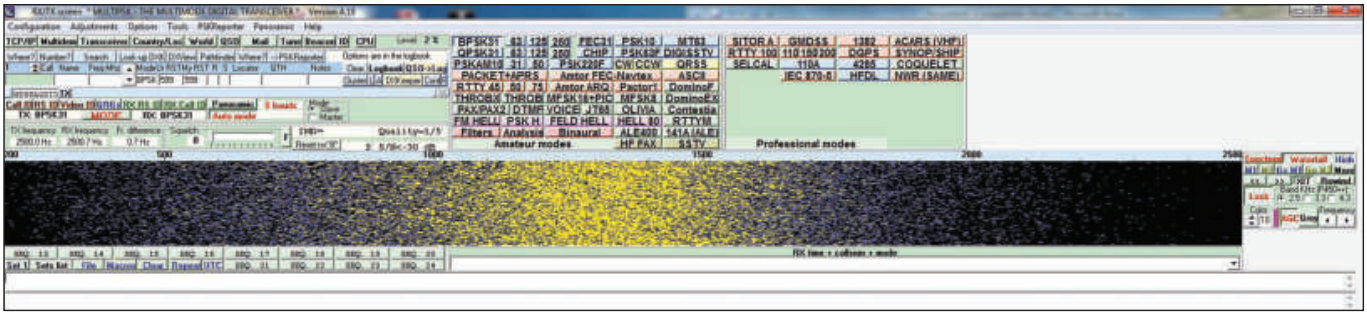

Figure 2 — This interference was seen on 14,005.6, 14,104.9, 14,203.9, 14,303.3, 18,077.4, 21,057.6, 21,156.9, 21,256.0 and 24,931.2 kHz. It decreased in strength as the frequency increased. The fact that the signal repeated roughly every 100 kHz effectively rendered those bands unusable. This was traced to my computer power supply.

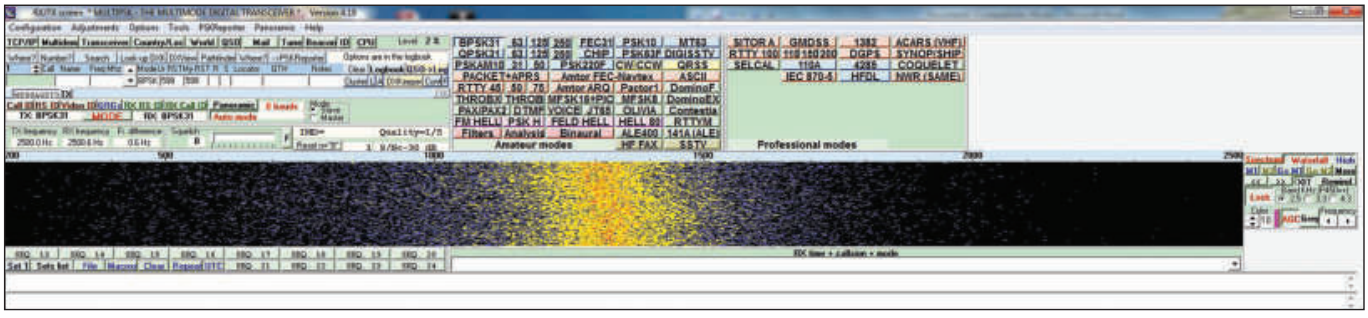

Figure 3 — This interference was seen on 6952.3, 7051.0, 7151.07 and 7250.1 kHz. The fact that the signal repeated roughly every 100 kHz effectively rendered 40 meters unusable.

We went back to ground zero by electrically shutting the house down completely. The interference received on the battery powered mobile HF went away. Finally some progress.

We turned circuit breakers back on one at a time, and when I closed the circuit breaker for the ham shack, the RFI came back. Turn that breaker off and the noise was gone. That would explain why the noise still existed when everything but the shack was shut down, but what could be producing the noise. Nothing was turned on in the shack. The computer was off, the monitor was off, the oscilloscope was off and all of the radio gear was off. Even the lights were off.

By physically unplugging every electrical cord in the shack and plugging them back in one at a time the culprit was revealed to be the computer power supply. Even though the computer was not powered on, the power supply was radiating just like an old spark gap transmitter. With the computer unplugged, some RFI that was previously hidden by the power supply noise revealed itself. All of the newly discovered RFI consisted of discrete signals that I thought I could live with if I were not able to track them down. As Paul Harvey would say, "And now you know the rest of the story."

When I posted my pleas for help, I knew that I had a number of different kinds of RFI:

- Broadband noise across every band.
- Discrete noise spikes or "strobes" across every band.
- Occasional strong signals with equally spaced, decreasing strength "echoes" above and below the main signal.
- Occasional "two-tone" RFI (see Figure 1).

The two-tone RFI was quickly traced to the hot tub that sits on our patio 3 feet from the back wall of my ham shack. I contacted the spa manufacturer and they suggested the problem was the heater. They have not yet responded to my suggestion that the source is the power supply for the circuit board that controls the spa. I can work around that problem by simply powering down the spa when I am on the air. I'll see if some strategically placed ferrite beads help. I could have worked around that problem by simply powering down the spa when I was on the air, but this bit of RFI was eliminated when I moved my ham shack from the garage to the basement, more proof that gaining distance from something bad is a good thing.

The broadband RFI (Figures 2, 3 and 4) was traced to the power supply in the computer in the ham shack. Based on report of other hams on the Internet I ordered a PC Power (**www.pcpower.com**) model Silencer 760W from **Amazon.com**. It is a large, heavy power supply for an ATX motherboard. After I installed it, all of the broadband noise was gone. I highly recommend the PC Power products as a solution to solve an RFI problem generated by a computer power supply.

Discrete Noise Spikes

The remaining RFI that permeated every HF band (Figure 5) was tracked down to my Linksys WRT54GS wireless router. From the many discussions on the Internet it appeared that this was a common problem with this (discontinued) model router, and that a Netgear product offered the best hope for a solution. Netgear systems engineers advised that the best choice for an HF sensitive environment is the WNDR4000(N750). Reluctantly I bought one in the hope that it would solve the problem.

As part of the replacement process I setup the new Netgear N750 and my old Linksys WRT54GS router, tuned my HF rig to a frequency that previous tests had revealed was unusable because of interference from the Linksys router, and then switched between the Linksys and the Netgear routers while checking the HF rig for the level of interference. The Linksys router produced RFI and the Netgear router did not.

I was sure I had found and corrected the problem, but several responders to my request for information about the Netgear router said to make sure that the wall wart was not the culprit. To eliminate that possibility, I depowered the Linksys wall wart and powered up the Netgear router with the Netgear wall

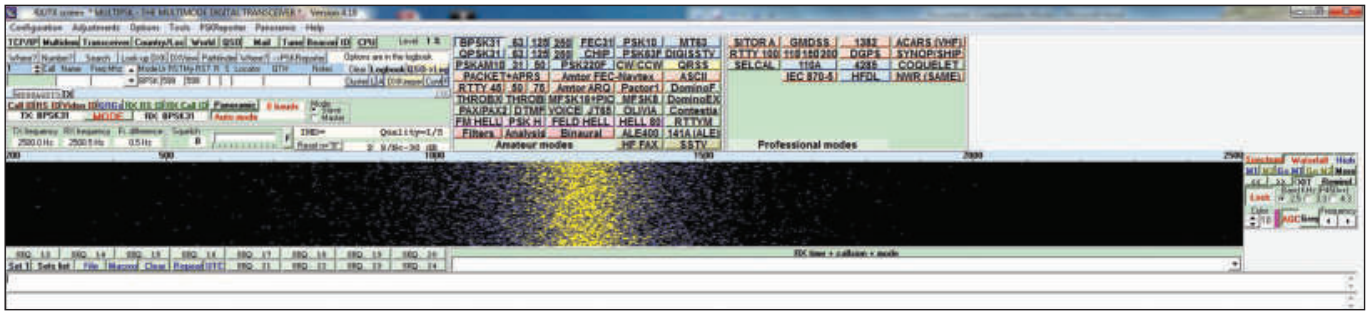

Figure 4 — This single frequency interference appeared on 7349.8 kHz.

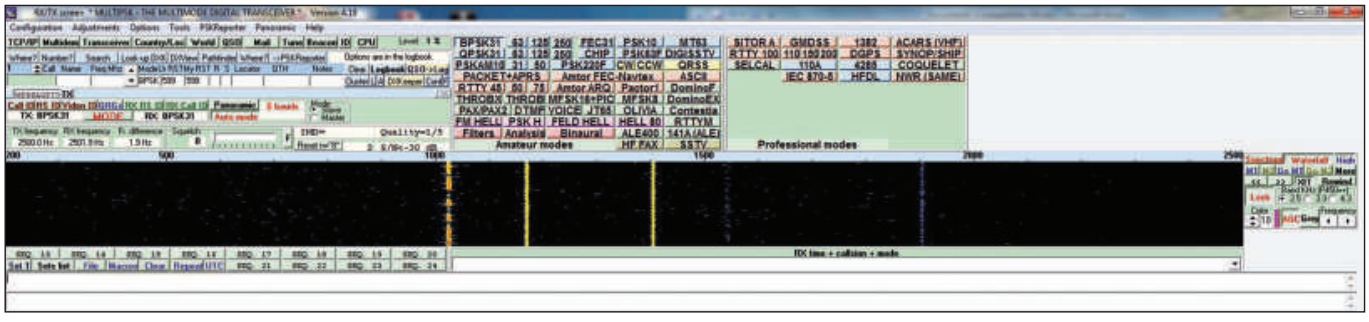

Figure 5 — This interference was seen on 14,150.3, 14,211.4, 14,272.4, 21.050.4, 21,211.5 and 21,172.5 kHz. I don't believe I ever found the source of this signal.

wart. All RFI disappeared from the HF bands. Then I depowered the Netgear router and used the Netgear wall wart to power the Linksys router. This led to Eureka moment #3 because the band crushing RFI was back with a vengeance. I was sure that I had proved that the problem was the Linksys router and not the wall wart, but to be sure, I depowered the Linksys and used the Linksys wall wart to power up the Netgear router, and the RFI did not return. The Eureka moment was validated. There was no doubt that the source of that RFI was the Linksys router.

I set up the Netgear router with its own wall wart, connected a computer to the router with a CAT5 cable, installed the software, and set up the router. Next I brought all of the wireless computers on line and made sure they had network and Internet access. Once all of the wireless connections were made, I checked the rig again. The RFI associated with the Linksys computer was still gone. I hooked up the other two remaining CAT5 connections (one computer and one printer) and went in to watch the news. After the news I went out to the shack and turned on the rig. The signal hiding RFI was back as strong as ever which led to Eureka moment #4. Obviously I had left the Linksys router powered up. Back to computer central only to discover that the Linksys router and wall wart were sitting in a box. Something else was causing the RFI, but what?

I unplugged all three CAT5 cables and the RFI disappeared. Plugging the CAT5 cables in one at a time led to Eureka moment #5 and the final solution. Two of the three CAT5 cables were bad in that they were acting as transmitting antennas. When the cables were replaced, the RFI either disappeared or was so attenuated so much that it was not a factor. Finally success. I thought that I had conquered the RFI demon.

Well, almost — some pesky S-7 birdies still remained, and the plasma HDTV was producing RFI that was worse than anything experienced to date. To this point, the most frustrating thing I had learned was that eliminating RFI is like peeling an onion. You peel off one layer only to discover that there is yet another stinky, tear producing layer below it.

Bird Hunting with Toroids

The remaining S-7 and weaker birdies were tracked to the CAT5 UTP (unshielded twisted pair) cables hooked to the Linksys router.

I put at least one type 31 toroid with 12 to 14 turns on the end of each cable. The impact was minimal. Additional troubleshooting revealed that the culprit was the Time Warner Cable supplied Cisco cable modem and the primary radiator was the CAT5 cable between the modem and the router. Since the impedance of multiple toroidal chokes in series is additive, I put seven toroids on the modem to router CAT5 cable.

The router/modem RFI on 80 and 40 meters was greatly reduced, but on 20 meters and above the reduction was only 6 dB. That left discrete S-5 noise spikes across the upper HF bands. Still looking for an inexpensive solution I researched shielded cables. CAT9 STP (shielded twisted pair) would have provided the greatest attenuation, but I could not find any ready-made CAT9 cables, and the smallest length of CAT9 cable I could find was a 1000 foot spool. The specs on CAT6 STP looked very good and I found some 5 meter CAT6 STP cables with shielded RJ-45 connectors on **Amazon.com** for about $3 each.

Two days later I plugged in a raw cable and ran a test. The result was slightly less attenuation than the CAT5 UTP cable with seven 12 to 14 turn toroids. A type 31 toroid with 12 turns at each end of the CAT6 cable provided minimal additional attenuation.

Perhaps toroids of a different material would do the trick. When they arrived, I added a type 61 toroid to the end of the CAT6 STP cable that already had a type 31 toroid at each end. *Voilà!* The modem/router-generated RFI on 15 and 20 meters dropped to S-0. It's still there, but it doesn't hide weak signals unless they are on the exact same frequency.

Lessons Learned to Minimize Computer Generated RFI

- Apparently there is no consumer grade Wi-Fi router that is free of RFI.
- Never use unshielded cable in your home network.
- At a minimum, put one Fair-Rite type 31 and one Fair-Rite type 61 toroid at each end of each of your cables.
- Never use an unfiltered power supply in your computer.
- I have found that I can rely on power supplies manufactured by PC Power. They cost considerably more, but they eliminate power supply RFI.

I should also note that the type 31 toroids alone cut out the router RFI on 160 meters through 40 meters and the Type 61 toroids took care of 30 through 17 meters. The noise on 15 meters was greatly reduced, but there is still a significant noise on 12 and 10 meters. I suspect that either a type 43 or type 73 toroid to each end of the modem-router cable would knock out the RFI on 15 through 10 meters, but I have not taken the time to double check.

I have not completely conquered the RFI demon, but I've bloodied his lip and he's gasping for breath!

ARRL Life Member and Amateur Extra class licensee Bob Wilson, NT0A, was trained as a photojournalist at the University of Missouri. He, however, spent most of his working life in one aircraft cockpit or another. Immediately after graduation, Bob entered flight training with the US Navy and earned his wings in the fall of 1964. His first two cruises in 1965 and 1966 were spent flying the Douglas A-4E single seat attack aircraft in daily strike sorties. Bob was awarded the Distinguished Flying Cross, 13 Air Medals, and three Navy Commendation medals with combat V. Following a short stint with Continental Airlines, he returned to the Navy for an additional seven years. He then returned to Continental, retiring in 2002 as a captain of a DC-10 aircraft.

Bob was first licensed as WA6MIE in 1977. He upgraded to Extra Class in the 1980s. His favorite operating mode is CW and his favorite events are ARRL Field Day and Straight Key Night. Bob is also active in the Navy/Marine Corps MARS program. You can reach Bob at 5548 NW Platte Dr, Riverside, MO, 64150-1415 or at **nt0a@kc.rr.com**.

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

Strays

QST Congratulates...

William A. Davis, W9KIC, an ARRL Life Member and professor of electrical and computer engineering in the College of Engineering at Virginia Tech, for having the title of "professor emeritus" conferred upon him by the Virginia Tech Board of Visitors.

A member of the Virginia Tech community since 1978, Davis has made significant contributions to research in the areas of antennas, electromagnetic fields, microwave and nonlinear measurements, communications circuits, radio engineering and wireless applications. He has received more than $3 million in external research funding and has been awarded two US patents.

Davis is a senior member of the Institute of Electronics and Electrical Engineers (IEEE) and is the current chair of Commission A (Metrology) of the International Union of Radio Science (URSI).

The "Singapore Sling" Antenna Support Launcher

This contraption will get your Field Day antenna wires aloft in short order!

Translated from the German and adapted for QST *by* NCJ *Managing Editor Rick Lindquist, WW1ME.*

Stefan Johannes Kaiser, DM5CQ

The fellow who invented and patented this novel antenna support launcher — Martin, 9V1MS/DB4SMA — came up with the idea while looking at a supermarket shelf in Singapore that was filled with pet toys The "Singapore Sling," as he dubbed it, combines the concept of a typical slingshot launcher with a repurposed "tennis ball thrower" or catapult that dog owners use to play "fetch" with their pets while also sparing themselves from sore arms and having to retrieve slimy, tennis balls. A variety of these catapults are available, but you'll want the kind that has a cup at its tip to hold a tennis ball in place. The result (see Figure 1) looks a bit like a short, curved fishing rod with a tennis ball on one end and a casting reel on the handle.

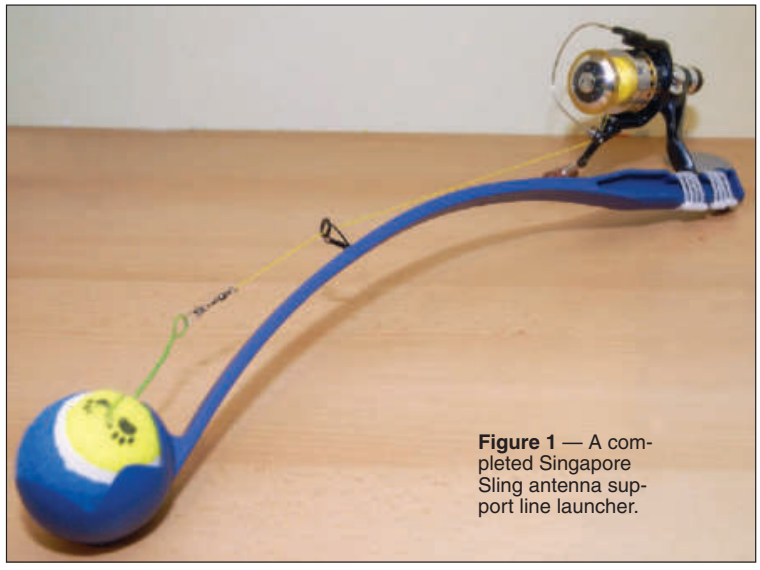

Figure 1 — A completed Singapore Sling antenna support line launcher.

Figure 2 — Notch cut into the tennis ball thrower to accommodate the fishing reel mount.

All components (see Table 1) are readily available online or in sports and recreation stores and pet emporiums. The catapult may cost $15 or so, while a suitable fishing reel could run a bit more, if you don't already have one on hand. One major difference between slingshot-based launchers and the Singapore Sling is that the latter lofts tennis balls instead of lead sinkers up into the tree branches.

Building It

The first thing you'll need to do — and the details may vary, depending on the variety of the tennis ball thrower you obtained — is to notch a flat space that's long and deep enough to accommodate the fishing reel mount. Measure from the midpoint of the handle (see Figure 2). The typical tennis ball thrower has four finger grips and you'll be cutting these away. A band saw is the best tool to use, but a jig saw and a steady hand may work too. Smooth the cutaway area with sandpaper or a file.

Set the fishing reel mount into the cutaway, adjusting its size if the reel doesn't fit. Use a few cable ties to affix the reel to the catapult handle, tightening these to hold the reel securely in place (see Figure 3). Depending on the width of the cable ties you can arrange several side by side. This improves stability and keeps the reel from slipping off the handle. An alternate mounting method is to use wire with a "Clamp Tite" tool (**www.clamptitetools.com**). Stainless pipe clamps also will serve, but they have the disadvantages of sharp edges and protruding parts.

You may want to wrap the hand grip and cable ties, clamps or wire with electrical tape. This greatly reduces the danger of injury from sharp ends on the cable ties, wires or clamps. For a better grip apply the sort of wrapping tape used in cycling and sports, available at sporting goods shops.

To secure the rod ring drill a ⅛ inch hole in the middle of the catapult arm about 6½ inches from the ball cup. The size of the hole depends on the rod eyelet you've purchased. The eyelet used here has a line feed diameter of ¼ inch. For adhesive use, a two part epoxy or hot melt glue. Cover other surfaces to avoid leaving glue residue behind.

Before gluing and taping, clean the surface to be glued. Often the surface has a coating of paraffin, and you can remove this with the flame from a lighter. Move the flame back and forth so that the paraffin burns off. Be careful not to apply the flame for too long, or you'll melt the plastic. Now mix and spread the adhesive in the hole and insert the rod ring. Leave this assembly at room temperature for at least 8 hours for curing.

Table 1
Parts List

1 tennis ball thrower/catapult (Chuckit! or similar style)
1 casting type open-spool fishing reel
300 feet of fishing line, 40 lb to 60 lb test
1 package of fishing line swivels
3 tennis balls (used balls are okay)
1 fishing rod line eyelet
1 roll of handlebar grip tape (optional)

Ready the Missiles!

While the adhesive is setting, you can modify the tennis balls that will loft your line into the trees. Because tennis balls — and especially

Figure 3 — The cable tie method of securing the reel to the tennis ball thrower handle.

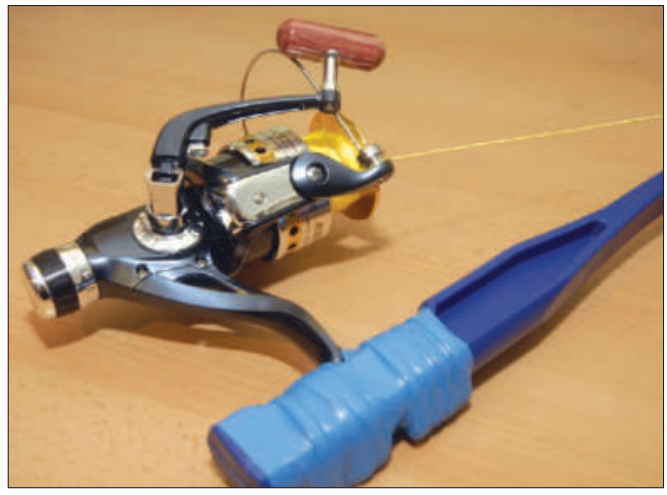

Figure 5 — Handle with athletic wrapping tape applied (optional).

"dog balls" — lack sufficient weight you have to make them heavier. Using a sharp knife, such as an X-ACTO tool, poke a ½ inch wide slit in the tennis ball. Into this slot you'll press 10 or 20 pennies for weight. Alternatively you can use washers or whatever's available in your junk box. Just how heavy a ball should be is something you'll have to determine by hands on testing. Don't exceed a weight of 1 pound, to avoid overstressing the plastic rod.

To secure the ball on the fishing line swivel I use a piece of 0.5 mm telephone wire about ½ to ¾ of an inch long. To do this drill two 2 mm holes at the ball's axis points. Thread the wire through the holes, then tie the ends together with a knot, which you can then hide within the ball by pushing it through one of the holes with the help of a screwdriver or rod. Twist the wire loop remaining outside the ball into a pigtail using a pencil or screwdriver shaft, so you end up with an eyelet at its end (see Figure 4).

I have prepared balls from 0.15 to 0.33 of a pound. For weight I've also used pear-shaped lead sinkers from my tackle box, or washers. You'll want to prepare a small stock of balls of various weights.

Finishing Touches

Back to the Singapore Sling; check that the line eyelet is secure. If you have not already done so, wind the fishing line on the spool and attach a fishing line swivel on the end of the line. Insert one of your modified tennis balls into the holder and, after threading the line through the rod eyelet, snap the swivel onto the eyelet you created at the end of the wire through the ball.

Now the time has come to head to the great outdoors with your Singapore Sling; trying it indoors is not recommended.

Figure 4 — A tennis ball prepared with the wire pigtail and eyelet.

And We Have Liftoff!

Whether you're putting up a long wire or a dipole, it's possible to employ this launcher unaided to launch a wire or support line into the heights of a tree. Here's how to use it.

1. Place the weighted ball into the ball holder cup.

2. Snap the fishing line swivel to the ball (check to make sure the swivel and line are secure).

3. Switch off the reel's drag and set the anti-reverse knob to its "off" position, to permit rapid release of the line.

4. Flip the bale to its casting position (ie, so it's not holding the fishing line in place).

5. *Quick check*: Make sure the fishing line is attached and threaded through the rod eyelet.

6. Assume your throwing stance.

7. Hold the Singapore Sling firmly with both hands and raise the device over your head.

8. With some force and vigor, hurl the ball up into the tree while hollering "Singapore Sling!" (If you don't do this, I can't guarantee 100 percent success.)

9. Do not change your position while the ball is in flight.

10. Switch on the reel's drag and set the anti-reverse knob to its "on" position.

11. Flip the bale to its closed position, securing the line.

12. Reel in a little bit of line.

13. Remove the ball and attach the antenna wire support line onto the swivel. [Users may wish to attach an intermediate small diameter line first, especially if using especially heavy gauge wire, using that line to pull the actual antenna support line and wire back over the limb. — *Ed*]

14. Pull the antenna support line and wire back through the tree using the reel.

Safety Considerations

When using this device, make sure no people, animals or other obstructions are in the vicinity of the throw or between the launch spot and the tree you're aiming for. Also don't use the Singapore Sling in the vicinity of power lines or in other unsuitable environments.

My thanks to Martin Schweiger, 9V1MS/DB4SMA, for allowing me to reproduce his design for this article.

Stefan Johannes Kaiser, DM5CQ, was born in 1973 and has been a ham since 1994. He is an IT support professional in the chemical industry. His ham radio interests include QRP and wire antennas for HF, as well as photography, Apple Macintosh computers and everything technological. He lives in Burghausen, Germany. Readers may contact him via e-mail at **dm5cq@darc.de**.

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

A Battery Monitor for 12 V Systems

Mert Nellis, WØUFO

Being able to monitor a battery in use during operation or while charging can be useful to make sure everything is working as it should. After all, you don't want a power interruption to spoil your Field Day fun. While there are several commercially available monitors, this one is an easy, do it yourself project. You might be able to make it from parts that are in your junk box. I find it useful for monitoring charging with my solar panel.[1]

The schematic in Figure 1 shows that the LM339 quad comparator is the main component. It needs a 5 V reference and four LEDs to indicate four different voltage levels from the battery that is being monitored.

Keep track of the status of those storage batteries for ARRL Field Day.

Operation

The idea is to have an orange LED come on if the battery voltage is above a middle operating range. If during charging it goes higher to its full charge voltage, a green LED lights along with the orange. If the battery voltage goes below the middle range, the above two LEDs are extinguished and a yellow LED comes on. If the discharge continues till the voltage reaches the bottom of safe battery usage, then the red LED lights up. Even if you don't use different color LEDs, the position of the lights (with labels, perhaps) can give the message.

Circuit Details

The unit is powered by the battery being tested, so no other supply is needed. The internal 5 V reference can be provided by either a 78L05 IC or a 5.1 V Zener diode. The schematic shows the Zener but R11 and D1 can be replaced by a 78L05 and the usual bypass capacitors if desired. The 5.1 V also supplies the comparator, so it will continue to function as long as the battery has even a small fraction of its charge.

Note that a switch is provided to remove the sense lead from the operating battery and connect it to a test point so that a separate variable calibration voltage can be applied to test the comparator. A series diode (D2) is used to protect the circuit if the polarity is accidentally reversed when connecting to a battery.

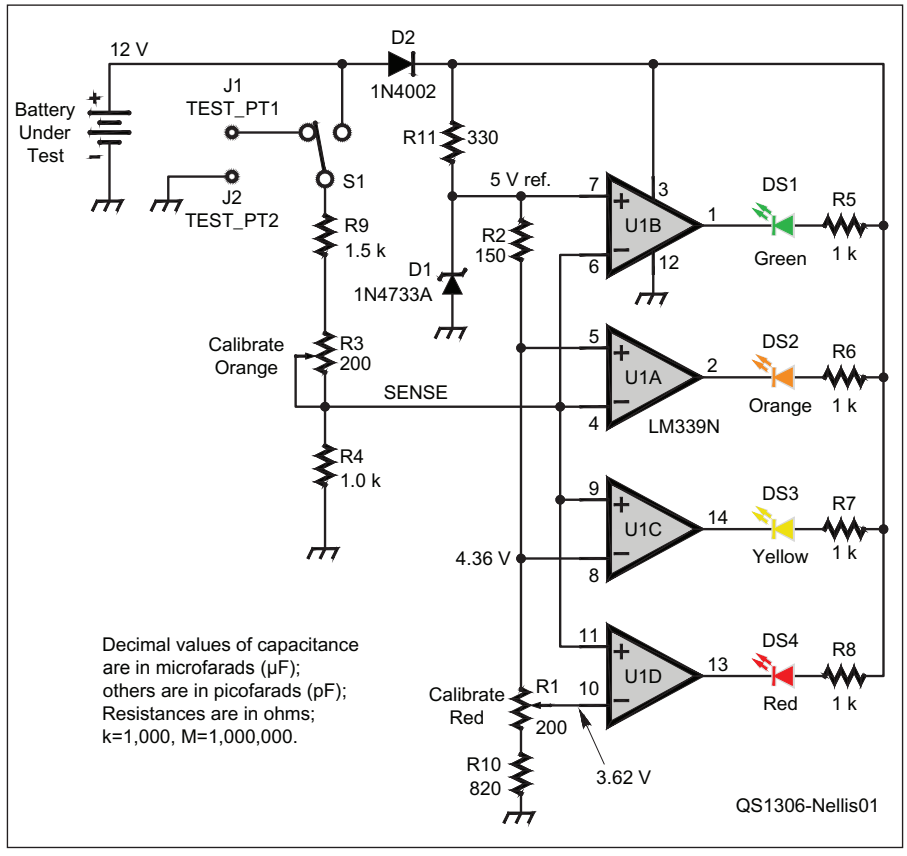

Figure 1 — Schematic diagram and parts list for battery voltage monitor.

D1 — 5.1 V Zener diode (or use 78L05, see text).
D2 — 1N4002 silicon diode.
DS1 — Green LED.
DS2 — Orange LED.
DS3 — Yellow LED.
DS4 — Red LED.
J1-J2 — Test pin jacks.
R1, R3 — 200 Ω potentiometer.
R2 — 150 Ω, ¼ W resistor.
R4-R8 — 1 kΩ, ¼ W resistor.
R9 — 1.5 kΩ, ¼ W resistor.
R10 — 820 Ω, ¼ W resistor.
R11 — 330 Ω, ¼ W resistor.
S1 — SPDT miniature toggle switch.
U1 — LM339N quad comparator IC.

[1]M. Nellis, WØUFO, "Characterizing Solar Panels for Amateur Radio Applications," *QST*, Feb 2012, pp 33-34.

Figure 2 — Front panel of the battery monitor.

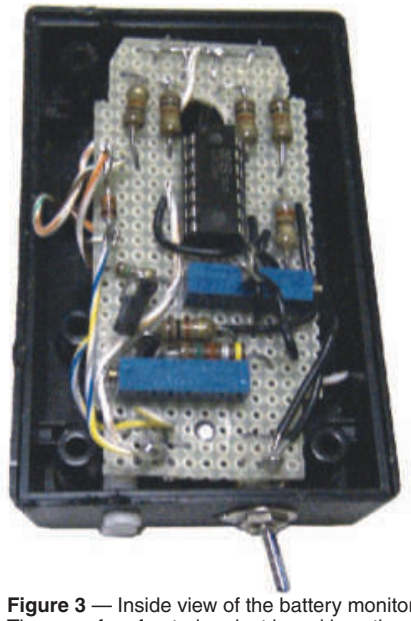

Figure 3 — Inside view of the battery monitor. The use of perforated project board is optional.

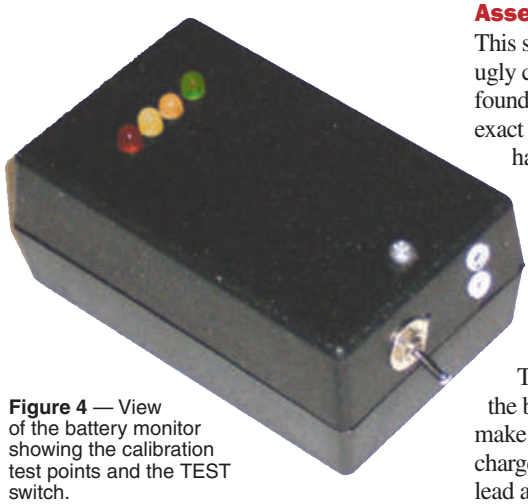

Figure 4 — View of the battery monitor showing the calibration test points and the TEST switch.

Assembly

This small circuit can be assembled using ugly construction or on a prototype board. I found the prototype board to be useful. The exact layout will depend on the parts you have available. I put mine in a small plastic case, but use whatever will work for you. All circuits operate at dc, so layout isn't particularly important. Figures 2 through 4 will give you some ideas of how mine is laid out.

Calibration

The voltage sense input is switched from the battery input to a separate test point to make it easier to calibrate. To calibrate, a full charge voltage of about 13.8 V from a sealed lead acid battery can be connected to the test point input and R3 adjusted until the orange LED just lights along with the green LED. The mid-range point at which the top end LEDs (orange and green) go out is already set by the voltage divider string R1, R2 and R10 to be about 12 V. The red LED for the battery low charge point is set by adjusting R1 for red to come on (probably near 10 V).

To recap: when the battery is low both the low voltage red and yellow LEDs are on and, as the battery comes up, the red goes out, then the yellow goes out and the upper orange comes on and finally at full charge the green LED comes on along with the orange.

Polarity

The correct polarity must be observed when connecting the battery. A series diode, D2, is used to provide protection against reversed polarity connection to a battery but the circuit will work only with the correct polarity.

Amateur Extra class operator Mert Nellis, WØUFO, was first licensed as W9UFO in Nashwaulk, Minnesota, then as W8CNC in East Lansing, Virginia before he obtained his current call. He received a BSEE degree from Iowa State University, then an MSEE from Michigan State University and is a Registered Professional Engineer in Minnesota, working in magnetic and industrial control.

Mert enjoys low power operating, homebrewing gear and building kits. He is a member of ARRL, QRP-ARCI, FISTS, NAQCC, SKCC, SOC and is a life member of IEEE. He also enjoys hunting, fishing, private flying and gardening, as assistant to his wife the Master Gardener. You can reach Mert at 651 11th Ave NW, St Paul, MN 55112 or at **mertnellis@msn.com**.

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

New Products

MFJ Adventure Radios for 17 and 12 Meters

MFJ has added two new SSB transceivers to its Adventure Radio series. The MFJ-9717 covers 18.080-18.170 MHz and is rated for 12 W PEP on SSB. The MFJ-9412 covers 24.890-24.990 MHz and is rated for 20 W PEP. Both radios use a superhet receiver design with a 2.3 kHz crystal ladder filter. They have analog S meters and 500 mW audio output. On transmit, the transceivers use speech processing and have built-in low pass filters to suppress harmonics. A handheld dynamic microphone is included. They require a 13.8 V dc, 2 A power supply or an appropriately sized 12 V battery. Size (HWD): 2.5 × 6.5 × 6 inches. Price: MFJ-9417, $269.95; MFJ-9412, $289.95. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

Done In One: Build a Hidden Switch

Having kids underfoot — and on the air — is part of the fun of Field Day. Prevent unsupervised operation by installing a stealth switch.

Paul Danzer, N1II

My 2½ year old grandson got out of sight for a few seconds and the next thing I knew he was sitting in front of my rig, the rig was on, and he was talking — in a manner of speaking — into the microphone. Apparently he copied his grandpa's motions to kick on the power strip that controls my station. Fortunately the rig was set to CW so his one sided conversation was not propagated on 20 meters. The same kind of problem can happen during ARRL Field Day, if precautions aren't taken. Unauthorized operation of any type has to be prevented. Moving the power strip out of reach on the wall would result in a cluster of ugly drooping wires. A key lock strip would result in a lost key. My solution is the magnetic sensor shown in Figure 1.

There is a Better Way

The sensor, called a *Ratiometric Linear Hall Effect Sensor,* is made by Optec Technology, with a part number OHS3150U. Many suppliers carry the part. Mouser has a stock number of 828-OHS3150U, which costs around $3 plus shipping. The sensor is shown with the lettering on its face toward you; then the left hand lead is connected to the 5.1 V supply from D1, a Zener diode. Do not apply more than 6 V dc to the sensor. With the circuit mounted in a plastic box with the Hall effect sensor on the left near the box top, relay K1 closes when a magnet is placed near the sensor.

The Circuit is Simple

The circuit is shown in Figure 2 built on a RadioShack modular IC breadboard socket 276-003. Only three wires have to be soldered, the three leads to R4. To make a permanent device, you can use RadioShack printed circuit board 276-170 with the same layout.

The red and black leads on the left in Figure 2 are the +12 V and ground connections. The green lead and black lead on the right are the output and return respectively. After

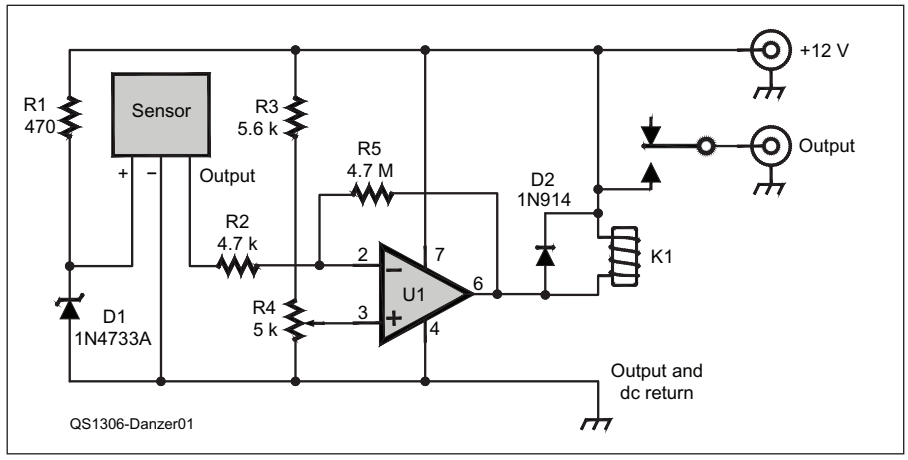

Figure 1 — Schematic diagram and parts list for the magnetically controlled switch.

D1 — Zener diode, 1N4733A. Any Zener diode between 5 and 6 V may be substituted. It is mounted "pointing up" toward R1.
D2 — 1N914 or equivalent switching diode.
K1 — SPST reed relay, 12 V, 1050 Ω coil (RadioShack 275-233). See text.
R1 — 470 Ω (yellow violet brown), ¼ W resistor.
R2 — 4.7 kΩ (yellow violet red), ¼ W resistor.
R3 — 5.6 kΩ (green blue red), ¼ W resistor.
R4 — 5 kΩ potentiometer (RadioShack 271-1714).
R5 — 4.7 MΩ (yellow violet green), ¼ W resistor.
U1 — Op-amp. Any member of the 741 op-amp family may be used. RadioShack 276-0007 suitable.
Hall effect sensor — see text.

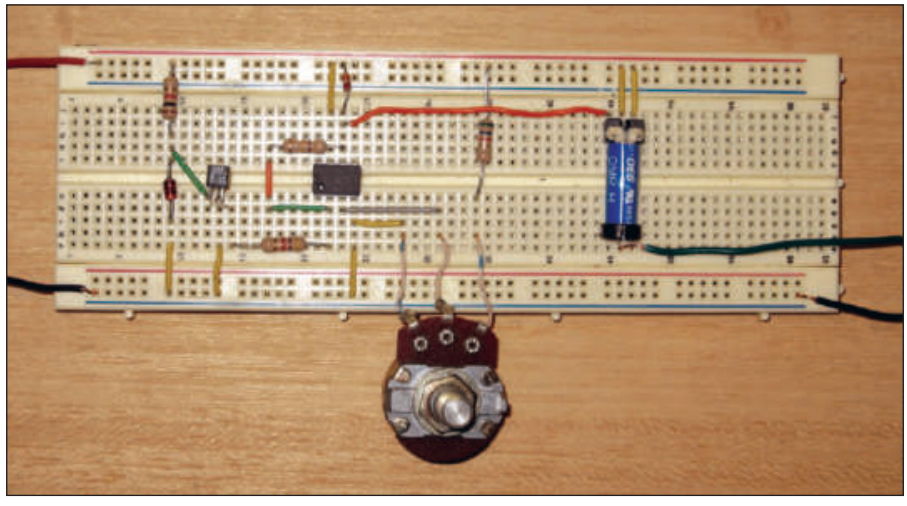

Figure 2 — Completed project built on a prototype board and ready to be installed in a plastic enclosure.

building the circuit, connect it to a 12 V supply. A voltmeter goes to the green and black leads. Adjust R4 until the meter reads 12 V, and then back off R4 until the meter reads 0 V.

Test the circuit by bringing a magnet near the sensor. The voltmeter should read 12 V. If it does not, reverse the magnet. Most small magnets are not labeled N or S for north and south, so you will just have to experiment and make your own label.

The relay in Figure 1 could be used to control a 120 V circuit directly, but with this type of construction having 120 V around is a very poor idea. Therefore the relay is wired to provide 12 V to an external relay. One approach would be to take a standard wall junction box, mount a wall outlet in the front, and attach a line cord. In the box, mount a suitable relay such as the RadioShack 275-248. This SPDT relay has a coil that operates on 12 V dc and contacts rated for 125 V ac at 10 A.

Putting it to Use

This circuit stays activated as long as the magnet is near the sensor. I installed mine with the sensor near the top edge, so I can just leave the magnet in place until it's time to shut down. Of course, when all is said and done, you could lose the magnet just as you could lose a key. A magnet is more easily replaced, however. Now all I have to do is palm the magnet, so my grandson does not associate the magnet with turning the rig on.

You might also feel challenged to see what else you can control with this circuit. Perhaps wave your hand (with a magnet in it) near a blank wall and just as in the movies, an electronic lock opens a safe that contains your valuable old radio gear.

Photos by the author.

ARRL Member Paul Danzer, N1II, was first licensed in 1953 and now holds an Amateur Extra class license. Paul has been operating 40 meter CW almost constantly since he first started. He uses his years of experience as an electronic engineer to design and build small, one-night, ham radio projects. Currently he is a Professor of Computer Science at Housatonic Community College in Connecticut.

You can reach Paul at 2 Dawn Rd, Norwalk, CT 06851 or at **n1ii@arrl.net**.

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

2013 *QST* Video Contest Winners

Our congratulations to these video-active amateurs!

Steve Ford, WB8IMY, *QST* Editor

We received a number of entries for this year's contest and they ran the gamut from educational to comedic. All entries were creative and entertaining, but in the end it came down to just three winners…

1st Prize: $500

Levi Maaia, K6LCM, for his outstanding video highlighting the activities of the Near Space Exploration Club at the Anacapa School in Santa Barbara, California. Watch this video on YouTube at **www.youtube.com/watch?v=ykgdazTqZbM** or on the ARRL website at **www.arrl.org/winners**.

2nd Prize: $250

Kevin Thornton, K5KVN, for his video of the 2012 first-time "activation" of Horseshoe Island on Beaver Lake in northwest Arkansas as part of the US Islands awards program. In a relatively short time they worked more than 350 stations. Watch this video on YouTube at **www.youtube.com/watch?v=QFBA5LPyPHQ** or on the ARRL website at **www.arrl.org/winners**.

3rd Prize: $100

David Fugleberg, WØZF, who used video to showcase the techniques and excitement of VHF contest "roving" in the midwest. Watch this video on YouTube at **www.youtube.com/watch?v=-wOFAETB4Lw** or on the ARRL website at **www.arrl.org/winners**.

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

ACOM 1500 HF and 6 Meter Linear Amplifier

A rugged legal limit amplifier that's easy to tune.

Reviewed by Norm Fusaro, W3IZ
Assistant Manager, Membership and Volunteer Programs Department
w3iz@arrl.org

Many amateurs find a linear amplifier to be a useful station accessory when the 100 W from a typical transceiver is not enough for reliable communication. There are many options to consider when purchasing an amplifier — solid state or tubes, manual tuning or automatic operation, power output and, of course, price. Solid state amplifiers offer instant-on operation (no warm-up time) and automatic band switching. A few high end tube-type amplifiers can cruise at full legal limit output with fully automatic tuning, but these models come with a considerable price tag.

Overview

If you're looking for something in a compact desktop package that is able to tip the scale to the legal limit output but requires manual tuning to change bands, then check out the ACOM 1500. It uses a single 4CX1000A/8168 ceramic tetrode to produce 1500 W PEP (1200 W for continuous carrier operation) from 160 through 6 meters. It requires a 120 V or 240 V ac line and about 50 W drive. Full break-in (QSK) operation is provided with a quiet vacuum relay.

The compact ACOM 1500 fits nicely into just about any station arrangement, but at more than 55 pounds it's not light. I wish modern amplifier designers would add handles on the side to make it easier to hoist the amp onto the desk or move it about. I remember the Kenwood TL-922 of the 1980s that had a nice set of recessed handles in the cabinet for this purpose.

The ACOM 1500 has a clean front panel layout and operation is ambidextrous. The TUNE and LOAD control knobs are at the center with the BAND switch to the left, allowing quick access with the amplifier placed to the left, right or center of your operating position. The internal fan is super quiet, so when operating without headphones the amplifier is not a distraction. The manufacturer offers an optional external fan for additional cooling during continuous operation or extended operation using full carrier modes. We didn't test this option and found the standard fan more than sufficient for typical SSB, CW and digital mode operation.

The amplifier is shipped from the factory ready to operate from 240 V ac but can be configured to operate using lower voltages. Output power must be reduced to 1000 W when operating from 120 V ac or less. A 240 V ac line is highly recommended for any legal limit amplifier.

The rear panel offers three antenna ports that can be configured to be active or inactive via the menu, thus preventing accidental transmission into a port without an antenna connected. Antenna selection is not automatic. If a band change also involves a different antenna, then the new antenna must be selected by pressing a front panel ANT button. I didn't find this to be any more of a nuisance than using an external antenna switch.

Bottom Line

The ACOM 1500 delivers legal limit power on 160 through 6 meters and is quiet and easy to tune. The compact package will fit in most operating spaces.

Display and Tuning

The upper line of the vacuum fluorescent display (VFD) is a bar graph that always shows peak output power. The lower line displays other parameters. By tabbing through the screens using the NEXT or PREV buttons, you can monitor forward and reflected power, net output power, antenna SWR, drive power, power gain, plate voltage and current, screen current, peak RF plate voltage, dc power input and exhaust air temperature. Menus allow adjustment of display brightness and other settings.

While band changes and tuning are not fully automatic, the ACOM 1500 employs some clever technology that makes operating the amplifier a snap. The true resistance indicator (TRI) tuning aid is a visual indication for adjusting the controls and makes band hopping with the ACOM 1500 quick and easy.

As with many high power amplifiers, the tuning procedure begins with a small amount of drive power before adjusting to full output. First, preset the TUNE and LOAD controls according to a chart in the manual. Next, press the PREV and NEXT buttons simultaneously. This inserts a 6 dB attenuator at the input and puts the display into the TRI mode. The attenuator allows you to tune up the amplifier at reduced power without adjusting your transceiver. Apply drive and adjust the LOAD control until the V-shaped marker is centered on the scale. Arrows show which way to turn the LOAD control. Then turn the TUNE knob for peak forward power and you're done.

You can also select the TRI scale without the input attenuator and manually adjust your transmitter power to 20 W or less. Or if you transmit at normal power and the amplifier isn't tuned, the protection circuitry will automatically select the attenuator and TRI mode. This combination of automatic attenuator

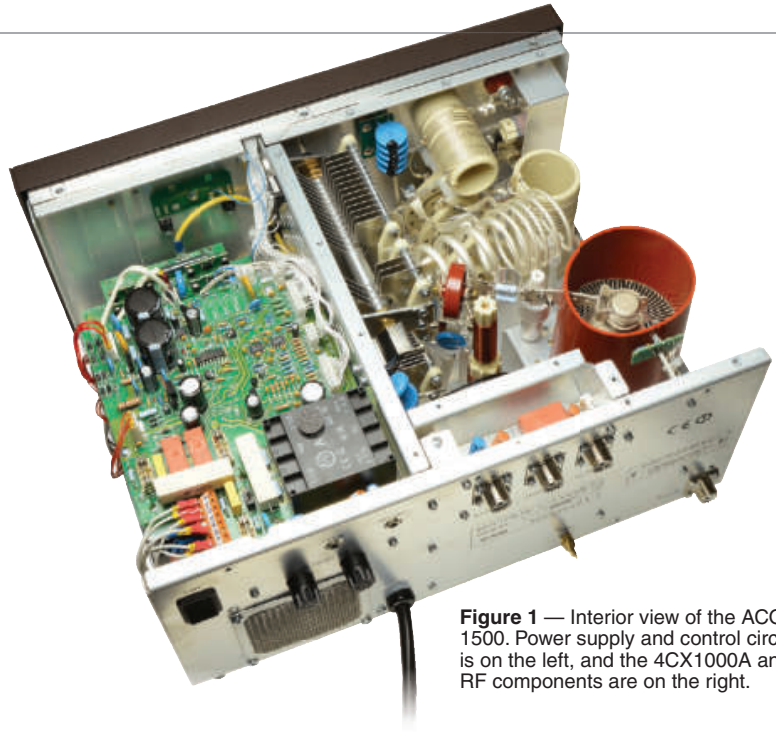

Figure 1 — Interior view of the ACOM 1500. Power supply and control circuitry is on the left, and the 4CX1000A and RF components are on the right.

limit, the amp switches to standby mode and displays an error message. In the AUTO OPERATE mode, if the amplifier faults, it will reset automatically after a few seconds. The only way I made the amp fault was to deliberately transmit into a mismatched load with reflected power exceeding 300 W; otherwise I encountered no situations that tripped the protection circuitry.

If you are looking for a compact amplifier able to ring the bell at 1500 W from 160 through 6 meters without breaking the bank, then consider the ACOM 1500. Just as the small block V8 did for hot rods, the ACOM 1500 packs a lot of horsepower into a nice compact package.

Manufacturer: ACOM OOD, PO Box 90, 1330 Sofia, Bulgaria; **www.acom-bg.com**. *North American distributor*: Array Solutions, 2611 North Beltline Rd, Suite 109, Sunnyvale, TX 75182; tel 214-954-7140; **www.array-solutions.com**.

selection and TRI make tuning the amplifier so quick that I was able to do it in less than 20 seconds.

On the Air

So how does the ACOM 1500 play in real world operation? I had no problem loading it into a variety of resonant antennas. Note that transmitting with reflected power of 300 W or more results in a soft fault that places the amplifier in standby mode.

My station consists of monoband antennas and all antenna selection is done automatically when the transceiver is switched, so I only used one antenna port on the ACOM 1500 and deactivated the unused ports. As an experiment, I connected my 80 meter dipole to a second antenna port on the amp and left the 80 meter vertical in the main antenna switching array. I found this convenient for my station configuration as it allowed me to quickly switch between 80 meter antennas.

Each amplifier is tested at the factory, and a range of TUNE and LOAD settings for each band is written in a table in the operating manual. After becoming familiar with the ACOM 1500, I found that I could tune the amp using the recorded band settings as a starting point or simply position the LOAD and TUNE controls to the 12 o'clock position and go from there.

The amplifier worked well running RTTY, CW or SSB for extended periods. It includes a number of protection features. If you approach the limit of normal operating parameters (such as excessive plate current), the display flashes a warning. If you exceed the

Table 1
ACOM 1500, serial number 120126

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz, 50 to 54 MHz.	160, 80, 40, 30, 20, 17, 15, 12, 10, 6 meters. (Note: US power limit is 200 W PEP output on 30 meters.)
Power output: 1500 W PEP (SSB, CW), 1200 W continuous (no mode limit).	As specified.
Driving power required: 60 to 85 W.	53-73 W typical (HF), 47 W (6 meters).
Input SWR: <1.3:1.	As specified.
Output impedance range: Up to 3:1 SWR.	Not tested.
Spurious and harmonic suppression: 1.8 to 21.5 MHz, >50 dB; 24 to 54 MHz, >66 dB.	As specified except 61 dB at 29.7 MHz. Meets FCC requirements.
Third order intermodulation distortion (IMD): <–35 dBc.	14 MHz, 3rd/5th/7th/9th: 33/39/50/55 dB below PEP.
Primary power requirements: 100-264 V ac, 50-60 Hz, 3500 VA maximum; taps provided for 100-120 and 200-240 V ac nominal.	As specified.
Size (height, width, depth): 7.7 × 16.6 × 14 inches; weight, 58.4 lb.	
Price: $4750.	

See the Digital Edition of *QST* for a video overview of the ACOM 1500 HF and 6 Meter Linear Amplifier

Elecraft KAT500 Automatic Antenna Tuner

Reviewed by Phil Salas, AD5X
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Unless you have an almost perfect antenna and feed line system you will need some sort of antenna tuner, especially if you have a solid state amplifier. An automatic antenna tuner such as Elecraft's new KAT500, rated at 1000 W into a 3:1 SWR, can extend the no-tune capability of your station to many, if not all, of the HF ham bands.

Overview

The KAT500 is a switchable-L auto tuner that can match a wide variety of loads. It completes the Elecraft K-Line as it currently exists, and is designed to interface seamlessly with the K3 transceiver and KPA500 amplifier. Physically, it is the same length and width as these two units. However, the KAT500 is also designed to work with any transceiver and/or amplifier up to 500 W output power or more, depending on the matching range necessary. As shown in Table 2, the KAT500 is rated for higher RF power for loads presenting lower SWR mismatches.

KAT500 Features

The KAT500 provides automatic or manual (user initiated) tuning. If you select AUTO, it will begin a tune whenever it senses an SWR above the 1.8:1 threshold (default). If you select MAN, tuning is initiated only when you press the TUNE button and apply approximately 20 W of RF carrier. Even in the manual mode, if the band/frequency/antenna has previously been tuned and stored in memory, the KAT500 will automatically select this solution once the frequency is determined. You can select BYP, which bypasses the tuner, if your antenna does not require tuning or if you want to see your untuned SWR. Bypass is also a tuning solution if it results in an SWR of 1.2:1 or less (default). The KAT500 tuning modes (AUTO, MAN, BYP) are not remembered on a per-band basis — if you select a specific mode, that will be the mode on all bands until you change it.

The KAT500 determines the band by reading K3 or Yaesu BCD (binary coded decimal) band data, so it will switch bands automatically with these transceivers when using the correct interface cable. The KAT500 also includes RF sensing for band switching so it can operate with any transceiver. Of course, RF sensing requires that you transmit a signal for band sensing, antenna switching, and memory recall to occur.

The KAT500 includes amplifier keying pass-through connectors (phono jacks). This permits the KAT500 to interrupt the amplifier key line during a tune or sudden high SWR condition. You can set a power level where the amp key line will not operate if RF is present to protect your transceiver, amplifier and KAT500 from damage due to hot-switching.

The KAT500 includes a three port antenna switch with connectors on the rear panel (Figure 2). Each port includes a static drain resistor and gas discharge tube for secondary lightning and static protection (primary protection should always be provided by approved external methods). Feed lines connected to these ports can be memorized, along with tuning data, on a per-band basis.

The KAT500 is protected against high power under high SWR conditions. It analyzes the untuned SWR, the tuned SWR and the incident power to determine if any internal components may be damaged. If there is a potential problem, the KAT500 will open the amp key line and drop to bypass.

Figure 2 — Rear panel view of the KAT500.

Finally, there are software settings to consider. You can set the "start-tuning" SWR threshold, the power level above which the amp key line will not be interrupted, bypass as a tuning solution and the SWR above which the amp key line will not be re-enabled after a tune. You can also set preferred antenna ports per band. Your preferences can be saved and recalled later should you lose the KAT500's memory.

Building the KAT500

The KAT500 is available factory assembled or as a no-solder kit. I chose the kit, which turned out to be the simplest of all of the Elecraft kits I've built! The assembly process is so short that instructions are included in the user manual.

Assembly consists of attaching RF connectors to the back panel, installing standoffs on the PC board and bottom cover, mounting the board to the bottom cover and back panel, and then attaching the front, top and side panels. Two hours will be about right for the average builder. Figure 3 shows the KAT500 ready for the front, top and side panels. When you're done, download the *KAT500 Utility* from **www.elecraft.com** and install the firmware.

On the Bench

I performed several bench tests to assess the basic performance of the KAT500. These tests included resistive tuner matching and power loss measurements, open/short testing and antenna port isolation.[1]

Resistive matching range and loss test results are given in Table 3. Tuning power was set at 20 W per Elecraft recommendations, though I found little difference when tuning at 10 W. As my NIST-traceable test equipment is specified to ±3% accuracy I didn't show measured

Bottom Line

The KAT500 automatic antenna tuner rounds out the K-Line from Elecraft and provides wide range automatic matching as well as a three-port antenna switch. It also works well with any transceiver and amplifier combination that doesn't exceed its specified power capability.

[1]Resistive matching range and loss testing was performed with the precision setup described in August 2012 *QST*, page 47 and follows the methods used in the ARRL Lab.

Table 2
KAT500 Manufacturer's Specifications, serial no. 0415

Frequency range: 1.8 to 54 MHz, continuous.
Power supply required: 11 to 15 V dc at 1 A max, 200 mA typical.
Matching range and power limits: 1.8-2 MHz, 600 W into 10-500 Ω (5:1 low impedance, 10:1 high impedance SWR).* 3-30 MHz, 600 W into 5-500 Ω (10:1 SWR). 1000 W into 16-150 Ω (3:1 SWR).* 30-60 MHz, 500 W into 5:1 SWR (10-250 Ω).*
Auto tune power: 10 to 100 W. For best matching accuracy, tune with ≥20 W.
Antenna interfaces: Three, front panel and auto selectable.
Size (height, width, depth): 1.75 × 10.8 × 11.8 inches; weight, 4.6 lb.
Price: KAT500 assembled, $699.95; kit, $649.95. KPA500 or K3 interface cable, $24.95.
*Matching specified to a 1.0:1 to 1.6:1 SWR. Power rating is ICAS (Intermittent Commercial and Amateur Service: equal time on and off, 5 minutes max at full power.)

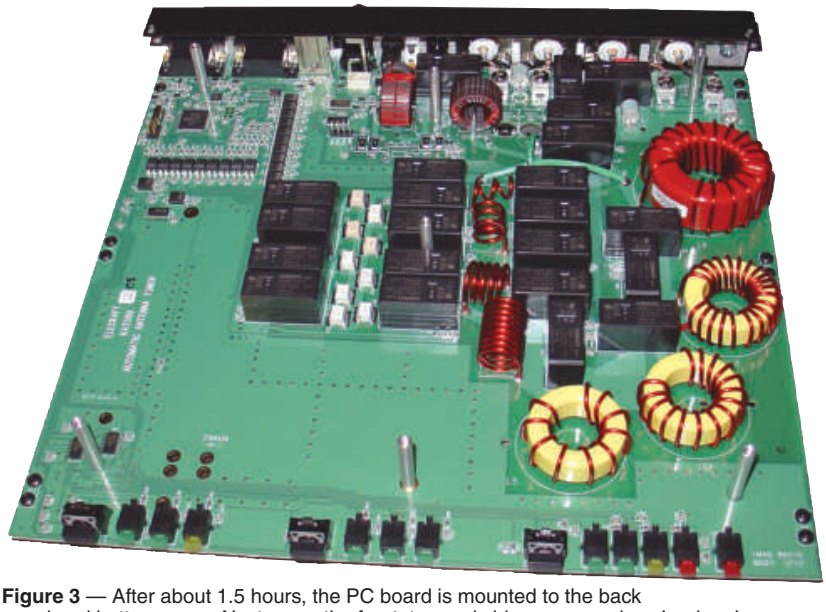


Figure 3 — After about 1.5 hours, the PC board is mounted to the back panel and bottom cover. Next come the front, top and side covers and you're done!

losses below 3%, and measured losses above this are subject to the ±3% accuracy.

As you can see, the KAT500 achieved its 1.6:1 or better SWR target. While it did not match 8:1 and 10:1 low impedance mismatches on 160 meters, the Elecraft low impedance matching spec on this band is 5:1. Antenna tuner losses are also very reasonable, and are a bit lower than I've measured on other auto tuners.

Ideally a tuner should not be able to match an open or short. If it does, this means that it is tuning into its own internal losses. However, no antenna tuner is lossless due to finite-Q components. From past experience I've found that most wide-range antenna tuners can find a match on one or more frequencies when connected to an open or a short. The KAT500 tuner achieved its target 1.6:1 or better SWR match on 15 and 6 meters when presented with an open, and on 10 meters with a short. There were some matches above a 2:1 SWR, but high SWR opens the amp key line. Of course, these results could change depending on the location of the open or short in your antenna system.

With most antenna tuners, a successful open or short match could result in most or all of your transmit power being dissipated within the tuner — which could damage the tuner. This is *not* the case with the KAT500. As discussed earlier, the KAT500 firmware analyzes the operating parameters and opens the amp key line and switches to bypass under extreme conditions.

Since the KAT500 includes an antenna switch, I measured the non-selected-to-selected port isolation with an Array Solutions VNAuhf. For this test I selected port 1, terminated port 1 in 50 Ω, and then measured the isolation from port 2 and port 3 to the transceiver port. I repeated this test for the other ports and results are shown in Table 4.

So what does this data show? Assume you have a 20 meter antenna selected on port 3. On receive, 20 meter signals on the port 1 antenna will show up 37 dB down from your port 3 signal, and 20 meter signals on port 2 will show up 36 dB down (about six S units in both cases). Of course, if the unselected antenna is not optimized for the same band as the selected antenna, the isolation from common signals will be greater. So the KAT500 antenna switch will be adequate for many installations. The interesting measurement was the port 3-1 isolation, as it was very different from the port 1-3 isolation. I would expect these measurements to be closer together, as with the other ports.

On the Air with the KAT500

I used interface cables to connect the KAT500 to my K3 transceiver and KPA500 amplifier. The use of these cables permits automatic band changing and antenna selection within the KAT500 and KPA500 when changing bands with the K3. Elecraft sells an optional 3 foot cable for K-line interfacing. For different cable length requirements or non-Elecraft interfacing, you can buy or build your own cables. The KAT500 manual gives the necessary details.

Regular SVGA cables *cannot* be used, as many have some of the conductors shorted to each other, shorted to ground or missing — and some connections must be interrupted for proper operation. I purchased and modified 1 foot and 6 foot DB15HD M/F extension cables (10H1-20201NF and 10H1-01106, respectively, from **www.cablewholesale.com**) as my K3 is placed directly on top of the KAT500, and my KPA500 is located off to the side.

My antenna system consists of a 43 foot vertical, a 20/15/10/6 meter rotatable dipole, and a 4 element beam for 6 meters — perfect for the KAT500's three antenna ports. I put the 43 foot vertical on port 1 and the rotatable dipole on port 3 so I could take advantage of the greater isolation between the two ports when port 1 is selected. The dipole and 6 meter beam didn't need tuning, as they are both resonant in the CW portions of the bands where I normally use them. I had no trouble achieving a good match on all bands with my 43 foot vertical (on 160 and 80 meters I use remote matching at the antenna; see Jan 2010 *QST*, p 34).

First I set up the desired antenna ports for each band. The KAT500 defaults to "all

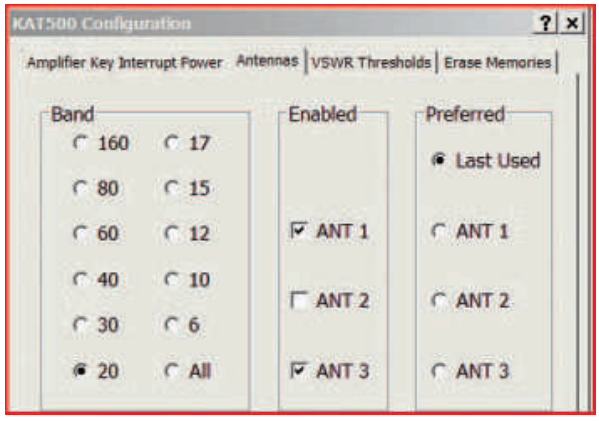


Figure 4 — *KAT500 Utility* screen showing the antennas selected for 20 meters.

Table 4
Antenna Port to Transmitter Port Isolation

Band	*Port 1 Selected* Port 2-1	Port 3-1	*Port 2 Selected* Port 1-2	Port 3-2	*Port 3 Selected* Port 1-3	Port 2-3
20 m	43 dB	65 dB	38 dB	41 dB	37 dB	36 dB
10 m	39 dB	62 dB	33 dB	36 dB	33 dB	32 dB
6 m	35 dB	58 dB	29 dB	30 dB	28 dB	26 dB

Table 3
KAT500 Resistive Load and Loss Testing

SWR	Load (Ω)		160 m	80 m	40 m	20 m	10 m	6 m
10:1	5	Loss (%) SWR	n/a† 	7 1.15	7 1.15	9 1.57	11 1.52	15 1.34
8:1	6.25	Loss (%) SWR	n/a† 	4 1.17	<3 1.07	<3 1.15	<3 1.18	<3 1.3
4:1	12.5	Loss (%) SWR	<3 1.18	<3 1.19	<3 1.24	<3 1.20	<3 1.12	3 1.18
3:1	16.7	Loss (%) SWR	<3 1.15	<3 1.26	<3 1.06	<3 1.16	<3 1.08	4 1.3
2:1	25	Loss (%) SWR	<3 1.14	<3 1.12	<3 1.21	<3 1.04	4 1.19	5 1.43
1:1	50	Loss (%)* SWR*	<3 1.08	<3 1.06	<3 1.06	<3 1.08	<3 1.1	<3 1.16
2:1	100	Loss (%) SWR	4 1.1	4 1.16	4 1.24	4 1.12	4 1.18	6 1.7
3:1	150	Loss (%) SWR	4 1.16	4 1.06	4 1.16	5 1.11	4 1.51	<3 1.31
4:1	200	Loss (%) SWR	4 1.15	4 1.1	5 1.15	5 1.47	6 1.31	4 1.08
8:1	400	Loss (%) SWR	6 1.19	7 1.16	6 1.06	6 1.27	8 1.19	7 1.03
10:1	500	Loss (%) SWR	6 1.01	6 1.16	7 1.18	7 1.1	12 1.05	19 1.16

*Bypass mode insertion loss and SWR
†Low impedance matching spec is 5:1 SWR on 160 and 80 meters.

antennas enabled" with the "last used" antenna preferred. However, I wanted to refine this further — an easy task with *KAT500 Utility*. I wanted the 43 foot vertical available for 160-10 meters, the rotatable dipole for 20/15/10/6 meters, and the 6 meter beam for 6 meters only. Figure 4 shows the *KAT500 Utility* antennas configuration page. On that screen, I selected ports 1 and 3 for 20 meters — the 43 foot vertical and rotary dipole. And I specified that the last antenna used would be the preferred antenna whenever I returned to that band. By checking the different bands, you can make the appropriate antenna selection for that band.

Next I memorized tuning for the appropriate antennas on all bands. You can see your tuning solutions on the *KAT500 Utility* Operation page.

Once everything is set up, operation is a breeze. I don't have to think when changing bands between 60 and 6 meters, as the KAT500 picks the right antenna and tuning solution as it follows my K3. I do have to manually enable the 160 or 80 meter remote match for my 43 foot vertical — but then the KAT500 selects the final match based on the band data input. It's a very pleasant experience! So now I leave my KPA500 amplifier set to stay in OPERATE when I change bands for 40-6 meters. I do have the amplifier drop to STANDBY on 160 and 80 meters in case I forget to set my remote matching switch.

Operation will be just as seamless with Yaesu transceivers as they have the same band data interface. There is an Icom interface whereby KAT500 tuning and low power transceiver output occurs automatically when you push the Icom TUNE button (I'm looking forward to when this is implemented in the K-Line). With other transceivers, a short RF signal results in the appropriate band, antenna and tuning memory selection.

Summary

There are benefits in using an auto tuner, primarily because it extends your no-tune operating range on many, if not most, bands. The KAT500 provides this capability for any transceiver and/or medium power HF amplifier feeding less than perfect antenna systems.

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

See the Digital Edition of *QST* for a video overview of the Elecraft KAT500 Automatic Antenna Tuner

Array Solutions AS-419 Switched Band-pass Filters

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

When Array Solutions announced they were selling a new integrated package of band-pass filters, the AS-419 Bandpasser, my ears perked up. After some years of operating with a basic one radio setup, I was getting a station ready for a low-power multiop effort in the ARRL CW Sweepstakes and an SO2R (single-op, two radio) entry in the CQ World Wide CW contest.

If you do not receive and transmit at the same time with antennas in close proximity, you may never hear the harmonics and wideband phase noise produced by most modern radios, even top-of-the-line models. To be effective with two stations on the air simultaneously from the same location — and to protect an investment in sensitive front-end electronics — band-pass filters are required!

While transmission line stubs or individual filters can be used, in recent years a set of relay-switched band-pass filters has become a popular piece of equipment and it's easy to see why. Most radios have *band output* signals that indicate what band the radio is tuned to. With a *band decoder*, that signal can be used to control the filter select relays and antenna switches. Logging software can also control filter-select relays through a USB port or an external serial/parallel port interface. The operator can then concentrate on making contacts as the filters follow the radio instead of the operator having to manually switch between filters. Enter the AS-419 Bandpasser reviewed here.

Bottom Line

The Array Solutions AS-419 Bandpasser offers a one-box solution to interstation interference in a multitransmitter station. Filters can be selected manually, or with a little work the Bandpasser can be controlled from the transceiver or station automation hardware.

Feature Summary

The Bandpasser has one band-pass filter for each of the six HF "contesting" bands: 160, 80, 40, 20, 15 and 10 meters. (Array Solutions recently introduced another model, the Bandpasser-WARC, that covers 60, 30, 17 and 12 meters.) The filters can be selected manually using the front panel pushbuttons or automatically through the direct relay control REMOTE interface (with a sourcing band decoder). A third option is using an Array Bandmaster band decoder or Integrated Controller, compatible with the Array Solutions/Hamation ShackLAN digital network. Note that the ShackLAN network uses 6-pin modular connectors (with just 4 wires) as well as 4-pin green screw terminals on some devices and is not an Ethernet-style network!

The REMOTE interface (Figure 5) uses a female 9-pin subminiature D-type connector with each relay selected by applying +12 V dc at 75 mA to a corresponding pin. All filters can be bypassed by using the front-panel MODE control to place the unit in BYPASS mode or by removing power to the unit. In AUTO mode, the REMOTE interface becomes an output that can drive other accessories to follow the filter band. The manufacturer states that the interface is protected if +12 V from an external control unit is applied to the REMOTE interface in AUTO mode, but I did not verify this claim.

From the user manual, "Filters for 160M thru 15M are 3-pole Chebyshev designs... Due to the narrow separation between 15M and 10M (25%), the 10M filter is a Cauer high pass design that provides deep notches on the 15M and 20M bands." Each filter is rated at 100 W continuous into a 50 Ω load and presents a maximum SWR of 1.25:1 at the input. Insertion loss is specified as 0.6 dB maximum on any band along with typical adjacent band rejection (not including the 60, 30, 17 and 12 meter bands) of 40 dB or more. These figures are competitive with other switched filter sets. Note that the 10 meter filter is a high-pass unit and does not attenuate 6 meter signals.

Table 5 shows the filter's data measured in the ARRL Lab. Performance was as expected, with rejection ranging from 37 to 67 dB depending on the band combination. Figure 6 shows the measured frequency response of the test unit's 20 meter filter.

The Bandpasser unit is the smallest of the

Figure 5 — The AS-419 Bandpasser offers several options for automatic filter switching via application of 12 V dc to the appropriate pin on the REMOTE jack or as part of a ShackLAN network. The rear panel network connector type has changed since this photo was taken. Newer versions have a pair of 6-pin modulator jacks for the network connection in place of the green screw terminals.

Table 5
Array Solutions AS-419 Bandpasser

Bands: 160, 80, 40, 20, 15, 10 meters.
Power requirements: 12-14 V dc at 100 mA (specified). Measured at 13.8 V dc: 30 mA (bypass), 92 mA (band pass).
Dimensions (height, width, depth): 2.2 × 6.5 × 9.0 inches; weight: 3.1 lbs.
Price: $595.

ARRL Lab Measurements

Insertion Loss (specified <0.6 dB typical)

Band (meters)	Measured Loss (dB)
160	0.2
80	0.24
40	0.5
20	0.53
15	0.46
10	0.2

Adjacent Band Rejection (specified >40 dB typical)

Band (meters)	Next Lower/Next Higher Band Measured Rejection (dB)
160	na/41
80	41/47
40	46/51
20	67/46
15	45/38
10	37/na

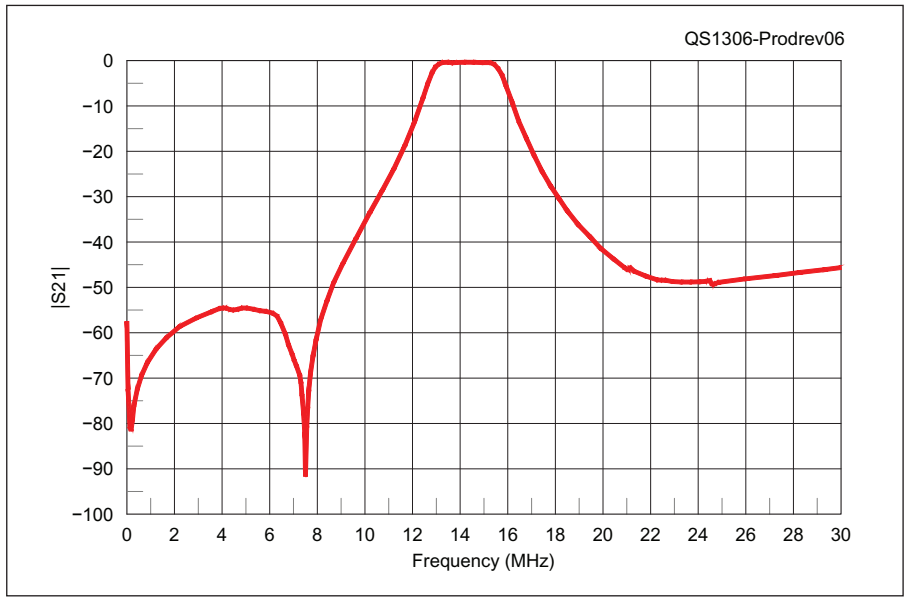


Figure 6 — Measured frequency response of the 20 meter filter section terminated in 50 Ω.

three popular switched filters I'm familiar with and is constructed in a really nice-looking and rugged enclosure. The filter mode and band are clearly indicated by front-panel LEDs and white labels. The package easily fit on top of my TS-590S transceiver and is heavy enough to stay put when pushing buttons. Power requirements (not including external relay drive) are 12 to 14 V dc at 100 mA, including reverse polarity and overvoltage protection.

Note that the filter is to be inserted *between* a transceiver and an amplifier and is rated for 200 W maximum at up to a 2:1 SWR. Furthermore, high SWR at the filter output may also create high voltages or currents that could damage a filter component — even at 100 W power levels. High SWR at the output can also cause a reduction in attenuation performance. To remove spurious transmission products, the filters must be used *at the transmitter* and will not attenuate in-band noise or harmonics if used at a nearby receiver.

AS-419 Performance

While evaluating the Bandpasser during ARRL Sweepstakes and CQ World Wide CW, most of the time I could not even detect noise from the TS-590S on other bands. Harmonics were faint and no impediment to receiving. With the filter in BYPASS mode, both noise and harmonics were quite audible when receiving with an antenna about 100 feet from the transmit antenna.

I did not use a band decoder, so all filter switching was performed manually. That means I also forgot to switch the filter on a couple of band changes and attempted to transmit through the wrong filter. This did not cause any problems, possibly because the TS-590S detected the high SWR and limited power output to a safe level. The filter enclosure did not get any warmer than the radio it was sitting on even after many hours of use during the contests.

Although the early production unit I received had only a minimal user manual, a complete manual has been completed and is shipping with current units. Control via the ShackLAN network interface is described separately by documentation on the Hamation website.

Summary

The AS-419 Bandpasser's performance is competitive and the ShackLAN interface can be used to simplify complex antenna system control or a common multiwire interface is provided. The enclosure and construction are top quality. The product is a welcome addition to the switchable band-pass filter products for HF station builders.

Manufacturer: Array Solutions, 2611 North Beltline Rd, Suite 109, Sunnyvale, TX 75182; tel 214-954-7140; **www.arraysolutions.com**.

See the Digital Edition of *QST* for a video overview of the Array Solutions AS-419 Switched Band-pass Filters

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

Shielding Keeps Signals Apart

Q Mike, N7DG, asks: I have a question that I've been thinking about for a long time: I use an entrance panel with coaxial lightning arrestors on all the individual antenna coax runs. What effect is there, on HF antennas particularly, with one side of all the antennas grounded together? I have an ADS-B Radar Box antenna, 50 MHz and 2 meter omnidirectional antennas, a G5RV, a broadband dipole fed with ladder line to a 9:1 balun at the entrance panel and a broadband vertical, all together on the same ground bus. They all seem to work okay, but it just seems wrong somehow. Should I configure them differently?

A I can understand your wonderment, but the key idea that will help it all make sense is to remember that, because of skin effect, the inside and outside of the shields act like different conductors. Thus the outside can be grounded without affecting the signals on the inside. That is what we mean by shielding.

Q Donald, KD5UGY, asks: With my transceiver in CW mode with the key down, the SWR indicator in my antenna tuner reads an SWR of 1.3:1. At the same time, my transceiver's SWR meter reads 2.1:1. Which one is more likely to be correct?

A Many SWR meters are notoriously inaccurate, although they are usually pretty good at indicating a match. So in practical terms, it is best to tune your tuner for minimum SWR at the radio, since that SWR value may be what is used to "foldback" the transmitter power output at what it thinks is high SWR. To paraphrase, "if the radio ain't happy, ain't nobody happy!"

Another possibility is that if you happen to have 75 Ω (rather than 50 Ω) cable between the tuner and the radio, the transformation (depending on electrical length of cable) could be such that both meters are actually correct.

Q Paul, K1WVX, asks: J-pole antenna designs often show the center conductor of the coax connected to the ¼ wave matching section rather than to the ¾ wave radiating section. Wouldn't the operation be more efficient if the transmitter power were coupled directly to the radiating section?

A Actually, as shown in Figure 1, the antenna is actually a ½ wave end-fed dipole, fed through a ¼ wave matching section of balanced transmission line. The antenna was used as an end-fed HF trailing wire antenna on Zeppelin airships in the 1930s. The resulting antenna design was popularized as an "end-fed Zepp."

The action of the ¼ wave line section is to transform the high impedance of the end of the antenna to the low impedance that the transmitter wants to see. In the days of the original Zepp, they didn't use coax, but connected the end of the line to the link coupled winding of the transmitter output circuit. At the end of the balanced line, it should make no difference which connection goes to which on the coax. By connecting the long rod to the shield, there might be an advantage in dissipating static electricity or even a lightning strike.

In theory, the end of the dipole is a "zero current" point, so no current need flow from the line — thus the open connection doesn't matter. In practice, the other side of the line ends up as common mode current on the matching section and best practice is to choke off the current using a few ferrite beads at 2 meters. It takes a bit more at HF, but the Zepp operators didn't seem to notice the problem.

Q Bob, W5XW, asks: What's the optimum direction to point a rotary antenna while not in use to minimize wind damage? What does W1AW, the ARRL Headquarters station, do?

A I checked with W1AW Station Manager Joe Carcia, NJ1Q, and he said: *Normally, the antennas are set to North when not in use. If there is a particular wind storm coming up — and we're here to do it — we orient our rotatable antennas in such a way to reduce the overall wind load. But this varies. We have some antennas with 47 foot booms, and others with 25 foot booms. I try to place them at a bit of an angle so that neither the elements nor the boom is taking a direct hit of wind.*

In my case, my boom is much stronger than my elements, so I orient my tribander with the element ends pointing toward the wind

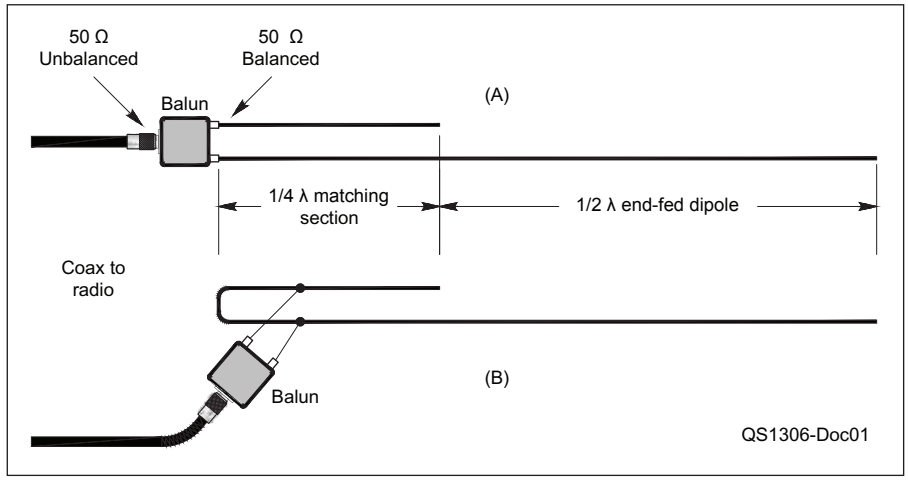


Figure 1 — The popular J-pole antenna, also known as an end-fed Zepp, is a half wave end-fed dipole fed through a ¼ wave matching section of balanced transmission line. The original version at (A) offers a fixed input impedance depending on antenna diameter and matching section Z_0, while the version at (B) can be adjusted for the for the best match by sliding the connections to the transmission line back and forth.

direction to minimize the projected surface of the elements. In either case, the antennas should survive, if rated for the conditions in the region.

Q Eduardo, KC8R, asks: The ARRL publishes Amateur Radio band plans that subdivide some of the bands allocated by the FCC. My understanding is that band plans are sometimes different in different countries, based on the operator privileges and frequency availability. US amateurs are requested to follow the band plans for the US, so I would like to ask a question about the band plan.

Sometimes there are stations using voice in our CW portion of the band, usually DX stations. Is the band plan simply a strong recommendation, which most follow, or a rule that can be enforced by the FCC? Also, is it okay to respond to DX stations using voice in the CW portion of the band, as long as we are within the allocated amateur band?

A There are a number of parts to your question. First, most of our band segments are not *band plans*, but are *frequency allocations* explicitly defined in FCC rules. By international agreement made during International Telecommunications Union (ITU) World Telecom Conferences, there are bands of frequencies allocated to the Amateur Radio service. The ITU allocations do not get into the detail of the modes and segments within each band. Each national regulatory agency — the FCC in the case of the US — may or may not decide that the bands need to be segmented such that licensees of certain classes, as in the US, may operate in particular segments using particular modes.

Some countries just allocate the band to Amateur Radio and some have segments specifically allocated for different modes, as we often do. In other cases, countries in different regions of the world have slightly different allocations. For example for many years the 7200 to 7300 kHz portion of our 40 meter amateur band was allocated to broadcasting in ITU Region 1, including Europe. Thus you would find voice operation from European stations well below our voice band.

Our segments are defined by FCC regulations for most bands (but not for 160 meters, for example) and thus we can only operate voice in the segments allocated for voice by the FCC, no matter where others operate. In our country the segments are further restricted by our license class in most bands. So even if an amateur in another country is using voice in our CW sub band, we must call in the range allocated for that mode to us. In many cases, if the other amateur is interested in working US amateurs, he will announce that he is, for example, "listening on 7189 kHz."

A *band plan* is a different matter. This refers to a voluntary division of a band to avoid interference between incompatible modes. For example, since the FCC permits voice, data and CW across the entire 160 meter band, the ARRL has defined a "considerate operators' guide," to avoid interference. This is listed in Table 1.

There is nothing in the FCC rules that would prevent you from operating voice below 1.843 MHz, however, you would very likely make a bunch of CW operators very upset if you did.

In the March 2013 column, I described a 40 dB resistive attenuator that could be used to obtain a sample of a transmitted signal for use as an input to oscilloscopes and other station monitoring equipment. I was remiss in not discussing the required power rating of the resistors. The 50 Ω resistor, if needed, is not an issue — less than ¼ W is dissipated there, even with a 1.5 kW signal, so standard carbon resistors are suitable. The 4950 Ω resistor, on the other hand, requires a rating of 1 W for a 100 W transmitter going up to 15 W at 1.5 kW.

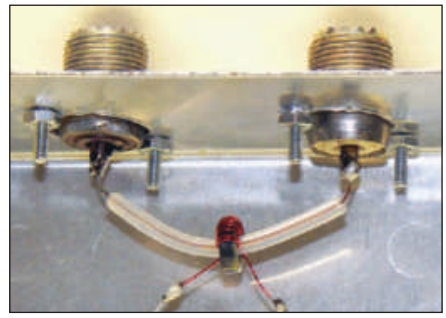


Figure B — Close up of N1II's RF sampling transformer. The other parts from Paul's current meter are not used. Follow the other design details (15 turns, three resistors) from the sampler in Figure A.

Suitable non inductive 5000 Ω resistors (40.1 dB, rather than 40.0 with the specified 4950 Ω) resistors are made by Caddock (Mouser part 684-MP25-5K, about $4), however, even though it is rated at 25 W, it will require heat sinking to keep the case temperature within specification.

A few readers pointed out that an easier solution to exactly the same problem is described in QST *"Technical Correspondence" and the 2012 edition of* The ARRL Handbook.[1,2] *This solution (see Figure A) makes use of a simple transformer with a primary made of a wire through a toroid. While the unit described in* QST *is carefully fabricated so that it can respond into the VHF range, a simpler transformer implementation, as described by Paul Danzer, N1II, in a recent* QST *article (see Figure B) should be satisfactory through the HF range.*[3]

[1]T. Thompson, WØIVJ, "Technical Correspondence — A High Power RF Sampler" *QST*, May 2011, pp 52-53.
[2]*The ARRL Handbook for Radio Communications,* 2012 Edition, p 25.47.
[3]P. Danzer, N1II, "A Simple Transformer to Measure Your Antenna Current" *QST*, Sep 2009, p 35.

Table 1
160 Meter ARRL Considerate Operators' Guide

Frequency (MHz)	Suggested Operating Mode
1.800 - 2.000	CW
1.800 - 1.810	Digital Modes
1.810	CW QRP
1.843 - 2.000	SSB, SSTV and other wideband modes
1.910	SSB QRP
1.995 - 2.000	Experimental
1.999 - 2.000	Beacons

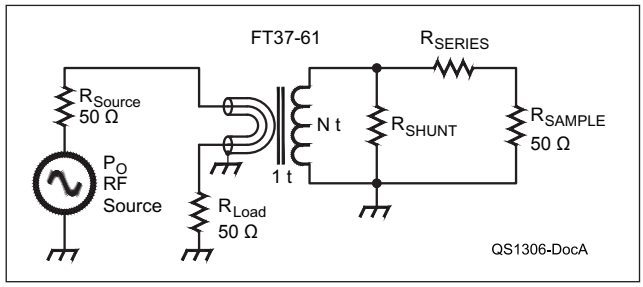


Figure A — Schematic diagram of transformer sampler. For power up to 1500 W and a –40 dB sample, N1 is 15 turns on an FT37-61 core, R_{SERIES} is a 38.4 Ω, ¼ W, 1% noninductive resistor and R_{SHUNT} is a 15 Ω, 2 W, noninductive resistor.

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**.

Steve Ford, WB8IMY, wb8imy@arrl.org

Elk Antennas 2M/440L5 Dual-Band Log Periodic Antenna

If you're not familiar with log periodic dipole antenna designs, the Elk Antennas 2M/440L5 may look like an ordinary 5 element Yagi. Look closer, however, and you'll notice some unusual differences. The feed point, for example, is located at the very front of the antenna. Not only that, the metal boom appears to be split lengthwise into two sections supported with a structure made of PVC pipe. What is going on here?

A detailed discussion of log periodic dipole array (LPDA) design is well beyond the scope of a Short Take column, but in simple terms the Elk LPDA is a set of dipole elements attached to a balanced feeder (the "split" boom supported by the insulated PVC tubing). The feeder polarity is reversed between successive elements. When the signal meets the first few elements the fields from these elements cancel each other out as the feeder sense reverses.

Then, as the signal progresses down the antenna, a point is reached where the feeder reversal and the distance between the elements gives a total phase shift of about 360 degrees. The point where this takes place is called the *active region* of the antenna. The element behind the active region acts as a reflector and the elements in front act as directors. This means that the direction of maximum radiation is *toward* the feed point, which is why the coaxial cable attaches at the front of the antenna.

The result in the 2M/440L5 is directional radiation pattern with gain in the neighborhood of 7 dBd on both bands. While an LPDA doesn't offer as much gain as a Yagi with the same number of elements, its 2:1 SWR bandwidth is much broader. The Elk Antennas 2M/440L5 design also offers the advantage of functioning simultaneously on 2 meters and 70 centimeters without the use of a diplexer or any kind of matching device.

Ready in Less Than 5 Minutes

The Elk Antennas 2M/440L5 arrives as an assemblage of black aluminum tubes, the feeder boom and several lengths of PVC tubing. The black tubes are the antenna elements and they all look very similar. How do you know which elements attach to which points on the boom?

At just 1.5 pounds, the Elk Antennas 2M/440L5 can be easily supported with one hand.

(Top) The SO-239 coaxial feed point connection is at the front of the antenna. An N connector option is available as well.

(Bottom) Attaching the elements is a simple matter of matching the color codes.

Elk Antennas solves this dilemma by color coding the elements and the boom. You simply match the colors of the elements to those on the boom and screw them into position. The PVC support fits snugly into place, as does the PVC handle for portable operating.

Moving slowly and deliberately, I assembled the 2M/440L5 in just under 3 minutes.

Working the Birds

For my first test I attached a 12 foot length of RG-8 coaxial cable and swept the antenna with an analyzer. I was pleasantly surprised to measure an average 1.2:1 SWR from 144 to 148 MHz. On 70 centimeters I measured less than 2:1 SWR from 430 to 441 MHz with the best SWR being 1.4:1 at 436 MHz.

The next step was to take the Elk on the air. The first satellite to pop over the horizon was CO-65, a CubeSat sending CW telemetry on 437.275 MHz. Using a Yaesu FT-817 transceiver, I heard a remarkably strong signal from the little bird, despite the fact that I didn't have a preamp in the line.

Next up was Saudi-OSCAR 50, an FM repeater satellite that listens on 2 meters and repeats on 70 centimeters. Running less than 5 W output I made several contacts and received excellent reports.

While the 2M/440L5 is a terrific portable satellite antenna, I used it during the ARRL January VHF Contest to make a number of terrestrial contacts as well. In fact, the antenna can be permanently mounted if you attach the elements with locking compound such as Loctite 222 and assemble the PVC support with PVC cement.

Manufacturer: Elk Antennas, 2308 Lomond Ln, Walnut Creek, CA 94598-3705; tel 925-330-0049; **www.elkantennas.com**. *$124.95.*

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #125

The Schmitt Trigger

Once you start building radio gear, you learn that a great deal of "radio" has little to do with RF. This month we're going to work with one of the non-radio building blocks you'll encounter when an analog signal and a digital function come together — the *Schmitt trigger*. Long-time readers may recall the Schmitt trigger making an appearance in Experiment #11 about op-amp comparators.[1,2] Adding positive feedback to the basic comparator circuit creates *hysteresis* — a switching threshold that changes depending on whether the circuit's output is on or off. This turns out to be desirable in certain applications.

If you're not familiar with op-amp comparators, download and read Experiment #11 from the "Hands-On Radio" web page. Page two covers hysteresis and how to design the comparator-based Schmitt trigger with discrete components. If you have an LM311 (or one of the equivalents listed) build a Schmitt trigger circuit and perform the experiment.

The Logic IC Schmitt Trigger

The ability to switch reliably in the presence of noise is a valuable function for digital circuits that have analog signals as inputs. Op-amps and discrete components take up valuable printed circuit board space, so the Schmitt trigger function was packaged into an IC. The basic set of six hex inverters (7414-type or CD4069 ICs) and quad NAND gates (74132 or CD4093) are the most common Schmitt trigger ICs. They are inexpensive and widely available.[3]

The difference in switching characteristics between standard logic gates and Schmitt triggers can be seen in the device data sheets. Download the Texas Instruments data sheets for the CD4011 (standard quad NAND) and CD4093 ICs from **www.datasheetcatalog.org**. Look in the dc or Static Electrical Characteristics tables and find the Input Low and Input High voltage specifications for a V_{DD} value of 5 V at 25° C. For the standard gate the typical values of V_{IH} and V_{IL} are 3.5 and 1.5 V, respectively, and the response to an input signal in that 2 V range is undefined. For the Schmitt trigger IC, V_N and V_P are 1.9 and 2.9 V, only 1.0 V apart — a much smaller switching window — and drawing (b) at the bottom of the CD4093 datasheet's first page shows the *transfer characteristic* of the gate. Note that the output voltage is defined for all values of input voltage. Let's put that to work.

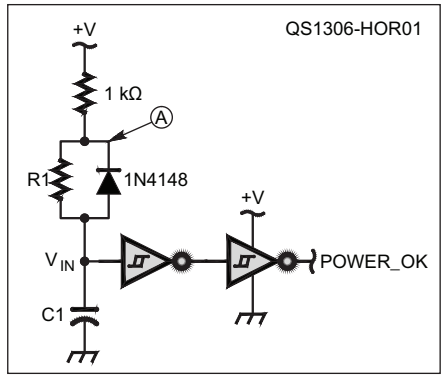


Figure 1 — A simple power-on circuit created from an R-C circuit and Schmitt trigger inverters.

Sensing Slowly Changing Signals

Any device controlled by a microprocessor needs to have a POWER_OK signal to prevent its digital circuits from attempting to operate before the power supply is fully up and running. Such premature operation can yield strange results.

Similarly, when power is lost, the same signal notifies the digital circuits to shut down in a hurry. Specialized power monitoring ICs are available for this task, but the simple circuit in Figure 1 can also do the job.

When power turns ON, capacitor C1 charges slowly through R1, keeping V_{IN} below the buffer's V_P threshold for a time delay of about one time constant, R1 × C1. (The back-to-back inverters form a non-inverting *buffer*.) After that time, the buffer's POWER_OK signal goes high to indicate the power supply has had enough time to stabilize. If power is lost at any time during the charging process, or if power is turned OFF after stabilizing, C1 is rapidly discharged through the 1N4148 and the POWER_OK signal goes low.

You can build this circuit using two of the inverters in a 74HC14 IC powered by 5 V. To make it easy to observe the time delay, use a 1 MΩ resistor for R1 and a 1 µF capacitor for C1. The 1 kΩ resistor provides current limiting during the experiment and is small compared to R1, so it has an insignificant effect on the charging time of C1.

Build the power-down detector using a CMOS hex inverter such as the 74HC14 or CD40106. TTL versions (7414 or 74LS14) draw too much current for the 1 MΩ resistor to act as a pull-up. Also, in a real-world design, the inverter would be powered from a large capacitor to allow it to hold POWER_OK low for several msec, insuring a controlled shut-down period.

Watching the POWER_OK signal with a voltmeter or oscilloscope, apply power to the circuit and verify that the signal stays low and does not go high until about 1 second has passed. If you connect one end of a clip lead or piece of wire to ground and simulate a power dropout by brushing the other end against the cathode of the diode (point A in Figure 1), the output signal should immediately go low, signifying power is *not* OK and there should be a 1 second delay before it returns to the OK state. POWER_OK might be used as a reset signal for a digital circuit.

Switch Debouncing

A switch may feel quite solid to you, leaving little doubt that when you close a switch, it instantly closes and stays closed. In truth, the contacts of almost all mechanical switches and relays literally bounce for a few milliseconds before settling down to stay closed. Because digital devices are so fast, software can react to those bounces as multiple switch closings and openings. While it's possible to "debounce" a switch signal in software, it can be done with hardware, too.

Reconfigure your circuit as shown in Figure 2; only one inverter section is needed here. That wire you just used to simulate a power dropout can also simulate the noisy signal from a switch, or you can use a real momentary switch. The two time delays, t_{CL} and t_{OP} depend on the values of R1 and R2, respectively:

$t_{CL} \approx R2 \times C1$ and $t_{OP} \approx R1 \times C1$

Start with R1 = 1 MΩ, R2 = 10 kΩ, and C1 = 1 µF. You'll need an oscilloscope to see the bounces of the switch contacts and the short delay, t_{CL}.

If you swap R1 and R2, you'll find that R1 has to be much larger than R2 for SW_CLOSE to go

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

[2]The Schmitt trigger is named for Otto Schmitt who identified the function when studying properties of squid nerves in the 1930s!

[3]7400-family model ICs are available in many different logic families such as HC, LS, and AC.

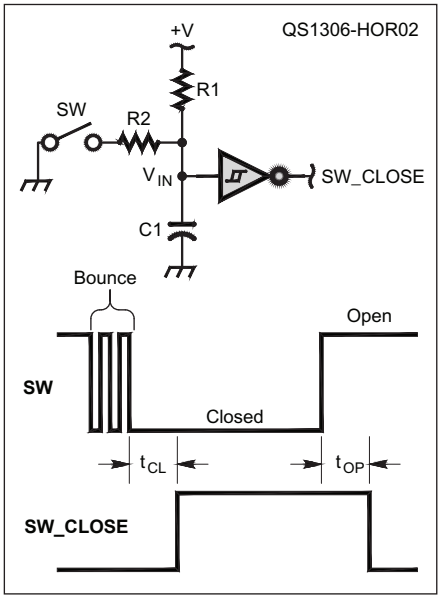


Figure 2 — Switch debouncing by using an R-C circuit and a Schmitt trigger inverter. R1 must be much greater than R2.

high. If R1 is too small, closing the switch does not discharge C1 below the V_N threshold for the inverter because R1 "overpowers" R2 and keeps the capacitor charged to higher than V_N. Experiment with different values; you'll find that R1 has to be about three times larger than R2 to get reliable results.

The squelch function in your radio also requires a continuously changing signal to cause switching at a threshold. If the input signal to R2 is the rectified and filtered output of a receiver's audio amplifier, the output of the inverter indicates whether a signal is present.

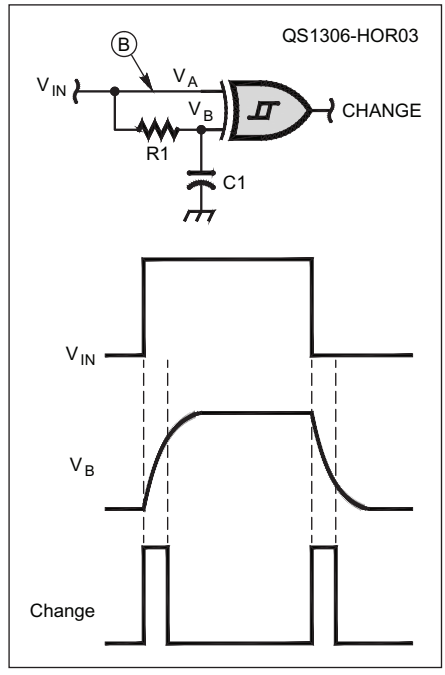


Figure 3 — The edge detector circuit uses the memory created by the R-C delay circuit. Inserting a Schmitt trigger inverter at B inverts the output pulses.

Edge Detectors

In many cases you want to be able to tell when the input signal changes state without having to monitor it continuously. This requires an elementary form of memory that will allow a circuit that can compare "then" to "now." The circuit in Figure 3 uses a two-input XOR gate to make the comparison and an R-C circuit to create the time delay that acts as memory. The Schmitt trigger input is required because of the slowly changing R-C circuit output.

V_A is the "now" state of V_{IN} while V_B is the "then" state. An XOR gate's output is high only when just one of its inputs is high. If both inputs are in the same state — high or low — the output, CHANGE, is also low. During the delay period while C1 is charging or discharging (approximately equal to the time constant R1 × C1), one input lags behind the other so that the XOR function is true and CHANGE is high — but *only* during the charge/discharge period. The Schmitt trigger action insures that the slowly-changing voltage V_B causes only one pulse with every transition of V_{IN}.

You can build the circuit in Figure 3 using one section of a 74HC86 quad exclusive-OR gate with Schmitt trigger inputs. R1 and C1 values of 100 kΩ and 0.01 μF will provide output pulses about 1 msec long. Use a 50% duty-cycle, 5 V pulse output from a function generator or a 555 timer circuit as V_{IN} (don't use a square wave with a negative voltage) with a repetition rate of about 100 Hz. Vary the time constant of R1-C1 to see the effect on the output pulse width, viewed on an oscilloscope.

Another name for this circuit is a *frequency doubler*. Two output pulses occur for every input pulse — one at each edge of the input pulse. If you insert a Schmitt trigger inverter at point B, the CHANGE pulses change from positive pulses at each edge to negative pulses.

Shopping List

74HC14 hex inverter
74HC86 quad XOR gate
1N4148 diode
¼-watt resistors: 1 kΩ, 10 kΩ 100 kΩ, 1 MΩ
Capacitors: 0.01 μF, 1 μF (ceramic or electrolytic)
Momentary switch (optional)

ARRL VEC Volunteer Examiner Honor Roll

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

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

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

Examiner	*Sessions*	*Accreditation Date*	*Examiner*	*Sessions*	*Accreditation Date*
Harry Nordman, AB0SX	561	09-Jan-02	Gerald Grant, WB5R	344	04-Jan-85
Sammy Neal, N5AF	520	20-Nov-84	Victor Madera, KP4PQ	341	01-Mar-92
David Bartholomew, AB0TO	454	22-Mar-02	John Hauner, K0IH	327	11-Jan-85
Franz Laugermann, K3FL	433	01-Dec-91	David Fanelli, KB5PGY	324	01-Oct-91
Kevin Naumann, N0WDG	430	17-Nov-02	Adolph Koehler, K5VCR	310	29-Sep-95
Bill Martin, AI0D	417	01-Nov-84	E. Drew Moore, W2OU	307	01-Aug-90
John Moore III, KK5NU	399	21-May-95	Daniel Calabrese, AA2HX	302	01-Nov-91
Karen Schultz, KA0CDN	387	06-Sep-84	Robert Hamilton, N0RN	299	19-May-87
Paul Maytan, AC2T	381	06-Sep-84	Morris Jones, AD6ZH	295	27-Nov-01
Jeanette Nordman, AB0YX	374	21-Aug-03	Loren Hole, KK7M	294	06-Sep-84
Royal Metzger, K6VIP	368	29-Apr-85	Michael Faucheaux, N5KBW	293	15-Jul-96
John Mackey Jr, KS0F	355	01-Oct-90	Roland Kramer, W0RL	293	21-Jun-01
Richard Morgan, KD7GIE	345	11-Aug-00			

Steve Ford, WB8IMY, wb8imy@arrl.org

Remote Station Control with Google *Chrome*

Dave Wright, KB9MNM, has discovered how to use a Google *Chrome* web browser to remotely control your station from any location without expensive, complicated software. If you'd like to try this, you will need a couple of free items from Google:

- A *Chrome* web browser installed on your station computer as well as on whatever computer you will be using to access the station. You'll find it at **chrome.google.com**.
- A Gmail account. Sign up at **mail.google.com**.

In addition, it's assumed that you have your transceiver interfaced to your computer and you have software on your station computer that can "talk" to the radio.

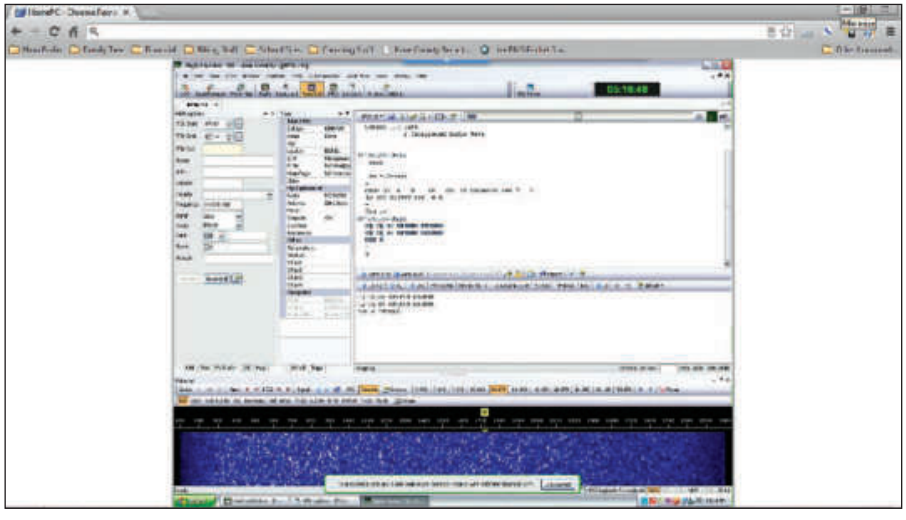
To get started, open the *Chrome* browser and navigate to the *Chrome* Web Store at **chrome.google.com**. Click on the Web Store link in the upper right corner, and then do a search for "remote desktop." Select *Chrome Remote Desktop*. This will need to be installed on both computers.

On your station computer, start the *Remote Desktop* app. A window will open and request authorization. Click CONTINUE. The next page gives you a list of all programs/apps that *Remote Desktop* will be accessing. Click ALLOW ACCESS.

The next screen has two windows: REMOTE ASSISTANCE and MY COMPUTERS. Choose MY COMPUTERS.

Click ENABLE REMOTE CONNECTIONS and you'll be asked for a PIN. After you have created a PIN, it may ask you for your PIN under your Gmail user name. If so, use the PIN you just created. Once a computer has been set up it will appear under MY COMPUTERS.

Repeat these steps on the computer you're going to use for remote access.



Dave, KB9MNM, runs PSK31 at his home station via Google *Chrome* remote control. In this example, he accessed his PC and then started *Ham Radio Deluxe*.

Within the *Chrome* browser Dave can see a list of the computers that can be connected to each other. In this example, they are his home station PC and his laptop.

Now you're ready to go. From your remote location, start the *Remote Desktop* app. Select which computer you want to connect to (your station computer), then enter the PIN. You will then see the desktop of the connected computer in the middle of the *Chrome* web browser. There is a blue tab at the top; click on it to resize the desktop image.

The *Remote Desktop* connection will also pass audio from your station computer back to you, and vice versa. For more information, contact **kb9mnm@gmail.com**.

Filtering for RTTY

Kok Chen, W7AY, has posted an excellent article about transmit filtering for RTTY at **www.w7ay.net/site/Technical/RTTY%20Transmit%20Filters/index.html**. While the article focuses on transmit filtering, Kok makes the point that transmit filters and receive filters are cascaded. So, a filter that is too narrow for transmit is also too narrow for receive. This can be a critical factor in contesting or DXing environments.

The best explanation is in Kok's own words: "The absolute minimum bandwidth for an 'ideal' RTTY filter is of course the 261 Hz Raised Cosine that I often cite. For no loss in Character Error Rate, the perfect practical filter will need to be at least 270 Hz to 280 Hz wide. By perfect, I mean that the filter has to (1) be flat to a fraction of a dB, and (2) is phase linear (i.e., zero group delay), within that 270 to 280 Hz.

"If a filter allows more Mark energy to go through than Space energy, you will suffer the equivalent of sustained selective fading. And group delay will show itself as something similar to a sustained multipath (you *really* don't want that!).

"So, if you are going to place a crystal filter in between the antenna and the RTTY modem, you need to make sure that whatever filter you use has 280 Hz worth of a flat passband that has no group delay. If not, you will incur extra errors.

"How much error? When you narrow a 'perfect' DSP filter by just 60 Hz, you will double your error rate. And it gets much worse as you narrow further."

Steve Sant Andrea, AG1YK, hk@arrl.org

Pool-tenna, Hearing Help and Computer Case Conversion

Pool Pole Antenna

The telescoping pole handle for my swimming pool brush broke and would no longer stay extended. The two aluminum tubes nest together nicely so I thought they could make a vertical antenna. I live in a neighborhood with CC&R so the antenna would need to be stealthy.

Building the Antenna

The two poles are both 8 feet long, making them about 15 feet tall when nested. However, the tubes do not nest snugly. The bottom tube has an inside diameter of 1.187 inches while the top tube has an outside diameter of 1.125 inches. The plastic locking device that fits in the space between the poles was broken and couldn't be used. I needed a way to lock the sections together.

I modified the bottom tube by sawing a single vertical, 7 inch slot down the tube wall at one end. The tubes have an anodized coating inside and out, which acts as an insulator. For conductivity between the two tubes, I used a small wire wheel (or you can use sandpaper) to remove the coating for 7 inches along the mating surfaces of the two tubes. Once the conductive surfaces were exposed, I slid the top tube inside the bottom tube. I secured this joint with a stainless steel hose clamp (see Figure 1).

Near one end of the bottom tube, I drilled a hole for a #10 screw. Again, I removed the coating around the hole on the inside of this tube. I slid a stainless steel internal star washer on to a 1 inch #10-32 stainless steel screw, then I inserted this screw through the hole *from the inside* of the bottom tube. I dropped a flat washer on to the screw projecting out from the tube. Then I threaded on a stainless steel nut but did not tighten it. This screw would be used as the RF connection to the mast and would be tightened after the tube is inserted into the PVC base support.

I added a whip to the top. RadioShack still sells 102 inch whips for a competitive price (catalog # 21-903). I obtained the bracket pieces for the whip from the CB radio section at a nearby truck stop (see Figure 2). I sanded away the anodized coating from the top 2 inches of the tube. I reinforced the inside of the top tube with a 1 inch dowel before clamping the whip to the top. The walls of these tubes are quite thin, so too much clamping force will easily distort them.

Figure 1 — A slot is cut in the wall of the lower tube and a screw clamp is used to compress the lower tube on the upper one holding them together. Green paint was applied to help conceal the antenna. [John Marshall, WA7BSR, photo]

Figure 2 — This bracket attaches the 102 inch whip to the top of the upper pole. [John Marshall, WA7BSR, photo]

The Ground Mount

Next, I needed a mount for the antenna. Fully assembled, the vertical stands about 24 feet tall. I decided on a ground mount. I bought a 5 foot length of 1¼ inch Schedule 80 PVC pipe. This pipe has an outer diameter of 1.66 inches and an inner diameter of 1.278 inches.

Schedule 80 PVC pipe is generally not available at local home improvement stores. I had to go to a plumbing supply store. (Some plumbing supply stores will sell the pipe by the foot while others will require you to buy a 10 or 20 foot piece.) This PVC pipe made a tight, sliding fit with the bottom aluminum tube. I cut a 7 inch slot in the PVC pipe. At the bottom of the slot I drilled a hole for the #10 screw that projects from the tube to be the RF connection point.

Digging Detour

I chose to make a hole 40 inches deep next to the trunk of an olive tree to conceal the antenna within the tree's branches.

The Schedule 80 PVC pipe dropped right into the hole made by a hydraulic ram I constructed. I The dirt that was forced out of the hole was piled up around the pipe and watered back into the hole. I didn't use concrete since the soil where I live is similar to concrete. You may need to use a bag of ready-mix concrete to stabilize the Schedule 80 pipe in your soil. used a bubble level to insure that the PVC pipe was vertical.

Ground Radials

I bought a 1 foot square, ¼ inch aluminum plate for use as a ground radial plate. I drilled and tapped 40 holes for #10-32 screws along the edges of the square and cut a large hole in the center for the antenna base to pass through. I used #10-32 socket head stainless steel screws and internal star washers for the radials.

I made 20 radial wires, each 15 feet long, from 18 gauge stranded, insulated wire. Each radial wire has a ring lug for attachment to the aluminum plate (see Figure 3).

Final Assembly

To reduce the antenna's visibility, I painted

Figure 3 — A square aluminum plate is drilled and tapped for 40 radials. The black wire is the ground connection for the MFJ tuner. [John Marshall, WA7BSR, photo]

the aluminum tubes with a flat olive paint. On reflection, a dark gray-brown paint may have been a better choice for blending with tree trunks and branches. I painted the whip the color of the sky at the horizon. When I look up, the sky is a deep blue, but looking at the horizon the blue is more pastel. I used a flat non-reflective paint. The idea is that no one will notice the camouflaged antenna.

I slipped a 2 inch stainless steel pipe strap over the Schedule 80 pipe. I fed the whip end of the antenna up through the branches of the tree then fed the other end into the Schedule 80 pipe. I tightened the screw that projects outward from the PVC pipe, then I tightened the pipe strap at the top of the Schedule 80 pipe and the antenna was ready to go.

Testing

I attached an MFJ-993BRT automatic antenna tuner to the #10-32 screw at the bottom of the antenna and to the ground radial plate. For testing, I used my Icom IC-706 transceiver. On the first day of testing I made contacts to Santa Barbara, California; Boston, Massachusetts; Ottawa, Quebec; Vancouver, British Columbia and Japan.

EZNEC *Modeling*

Usually I model an antenna in *EZNEC* before building it but, in this case, I built the antenna first and then I modeled it. On the 160-12 meter bands the launch angle varies from 18-28°. It rises to 49° on 10 meters.

Some Further Observations

- This antenna has the lowest angle of radiation on 12 meters where the antenna is approximately ⅝ wavelength long.
- The primary lobe launch angle is high on 10 meters, but there is a minor lobe at 10 degrees elevation that is 10 dB down.
- This antenna may not match with an automatic tuner on 17 meters since it is close to ½ wavelength. I have not tested the antenna on 17 meters.
- Efficiency will decrease and Q will increase progressively from 60 meters down. Do not expect great results.
- The antenna performs well on 40, 20 and 15 meters, the bands that I use most.
- The antenna should perform well on 40-12 meters.

Conclusions

This antenna was inexpensive, easy to build, and performs well on the bands I am most active on. It has been in operation for more than 6 months and has stood up to the strong winds, summer monsoons, and haboobs that really churn up the desert. Finally, my wife and I hosted a neighborhood party and none of our guests noticed the antenna, so it meets its covert requirement. — *73, John Marshall, WA7BSR, 7828 W Caribbean Ln, Peoria, AZ 85381-3441*, **wa7bsr@arrl.net**

T-coil Hearing Help

The item "Hearing Loss Help" got my attention.[1] I, too, have gone through many years of gradual hearing loss as I've aged. I would think that 60 years of ham radio might have sharpened my hearing from all that straining to pull weak signals out of the noise, but it's more likely that the abuse of loud interference during contesting and other ham activities has made it worse. Like Fred, W3NJZ, I found myself missing more and more, which started to impede my ham activity. I would like to suggest another solution.

I use a hearing aid. Many hearing aids have an optional T-coil or Telecoil, a built-in inductor that picks up the magnetic field from a telephone earpiece, allowing you to talk on the phone. Since most radio headsets produce a similar field, the T-coil allows me to hear radio signals well. I use a Heil BM-10 microphone headset that provides a more-than-adequate magnetic field. My first hearing aid, a Phonak device, required me to manually switch to the T-coil mode with a tiny pushbutton switch. My present one, an Oticon, senses the magnetic field and switches automatically.

Fred's hearing loss (90 dB) is greater than mine and this solution may not work for him, thus requiring the more elaborate setup he created. I believe this approach will help many hams who have a less drastic hearing loss. Remember the old saying, "If you can't hear 'em, you can't work 'em." — *73, Sumner Weisman, W1VIV, 43 Agnes Dr, Framingham, MA 01701*, **w1viv@rcn.com**

[1]F. Ryan, W3NJZ, "Hearing Loss Help," *QST*, Jul 2012, pp 62-63.

Desktop to Kilowatt

The cost of cabinetry for ham gear is daunting and some of us are not able to pay big bucks for new equipment enclosures. In many cases, they are the highest dollar item on the component list. Computer cabinets are inexpensive, reliable enclosures. Both the desktop and bench top style cabinets are plentiful and sufficiently RFI shielded for most projects, plus, they are real space savers. Figure 4 shows an RF linear amplifier I built using a desktop case I bought new on eBay for less than $30. Of course, there are many similar cases available used from thrift shops, garage sales and such. In fact, you may have an old computer yourself that could be recycled in this way. — *73, Richard Calhoun, W6DZT, PO Box 77313, Corona, CA 92877*, **richardcalhoun@hotmail.com**

Figure 4 — This amplifier uses two 4-400A tubes to generate 600+ W on 80-10 meters. It uses an external power supply to provide 2500 V. The filament transformer is installed next to the tubes. [Richard Calhoun, W6DZT, photo]

Mast Bracket for Rotator Replacement

Like many ham installations, my rotator sits inside my tower with a thrust bearing at the tower's top. When my rotator needed replacement, I needed some way of keeping the mast from turning and shifting sideways when the rotator was removed. The solution I used was to make brackets using Unistrut, a steel channel used for supporting conduit, which is available from electrical supply stores. The Unistrut pipe clamps slide into the channel and adjust for length. They are available for all common pipe sizes. I used three brackets, one from each tower leg to the mast. The brackets work well and can be used for other tower sizes and mast diameters by changing the pipe clamp sizes. — *73, Dave Palmgren, N8DP, 6132 County 420 - 21st Rd, Gladstone, Michigan 49837*, **n8dp@arrl.net**

Give Your Rigs Some Room

As my ham radio interests extended up into the V/UHF area, I decided to obtain a set of three transverters for these bands. In using them, I found that they tend to heat up. I tried using a computer fan to improve cooling, but found that it wasn't sufficient to maintain a proper temperature. My mounting arrangement that had all three units stacked on top of each other only aggravated the situation.

Seeking a solution, I went to my local home improvement store to look for some inspiration. I found the perfect solution — a paint roller screen. They are less than $3 each, come in different sizes and can be easily bent to fit your needs. You can even paint them to match your gear.

After removing the plastic feet from my gear, I simply added some double-sided tape and attached them to the screen (see Figure 5). The coax and other wiring keeps the gear in place. — *73, Sebastian Acosta, W4AS, 19340 Franjo Rd, Cutler Bay, FL, 33157-8818*, **w4as@arrl.net**

Fishing with a Magnet

After building an octagon shaped magnetic loop antenna using ¾ inch copper pipe I realized that remote tuning was essential. I built a motorized unit for the air variable capacitor and decided to run the control cable on the inside of the pipe as suggested in my *ARRL® Antenna Book*.[2] I tried repeatedly to push the control wire through the pipe but found that negotiating the 45° elbows was a real challenge.

Instead of using a vacuum cleaner or other method for pulling a string through the pipe, I had the idea to use a small, round head screw with the string tied to it. Using a strong magnet, I was able to run the magnet on the outside of the pipe to easily pull the screw with string all the way from top to bottom. It was then a simple matter to attach my control cable to the string and pull it through the pipe. — *73, John Merritt, K4KQZ, 2430 Hidden Lake Cir, Columbia, TN 38401-5832*, **k4kqz@arrl.net**

J-38 Backpacking Modification

I like to operate low power CW portable from remote locations and I prefer to use a J-38 key. The J-38 is too tall for my pack, plus the adjustment knobs get caught on straps and cables.

To solve these problems, I replaced the adjustors with 8 × 40 slotted screws cut just long enough for my preferred settings. The 8 × 40 screws are used for mounting rifle sights and should be available at any gunsmith or well-stocked hardware store.

I also found that reversing the key on the base reduced the overall length and helped prevent unexpected tip-up. The key is lower, more stable and only a screwdriver away from its original condition. — *73, Scott McCann, W3MEO, 160 Shields Ln, Queenstown, MD 21658*, **achess@juno.com**

[2]Available from your ARRL dealer or from the ARRL Store, ARRL order no 6948. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@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.

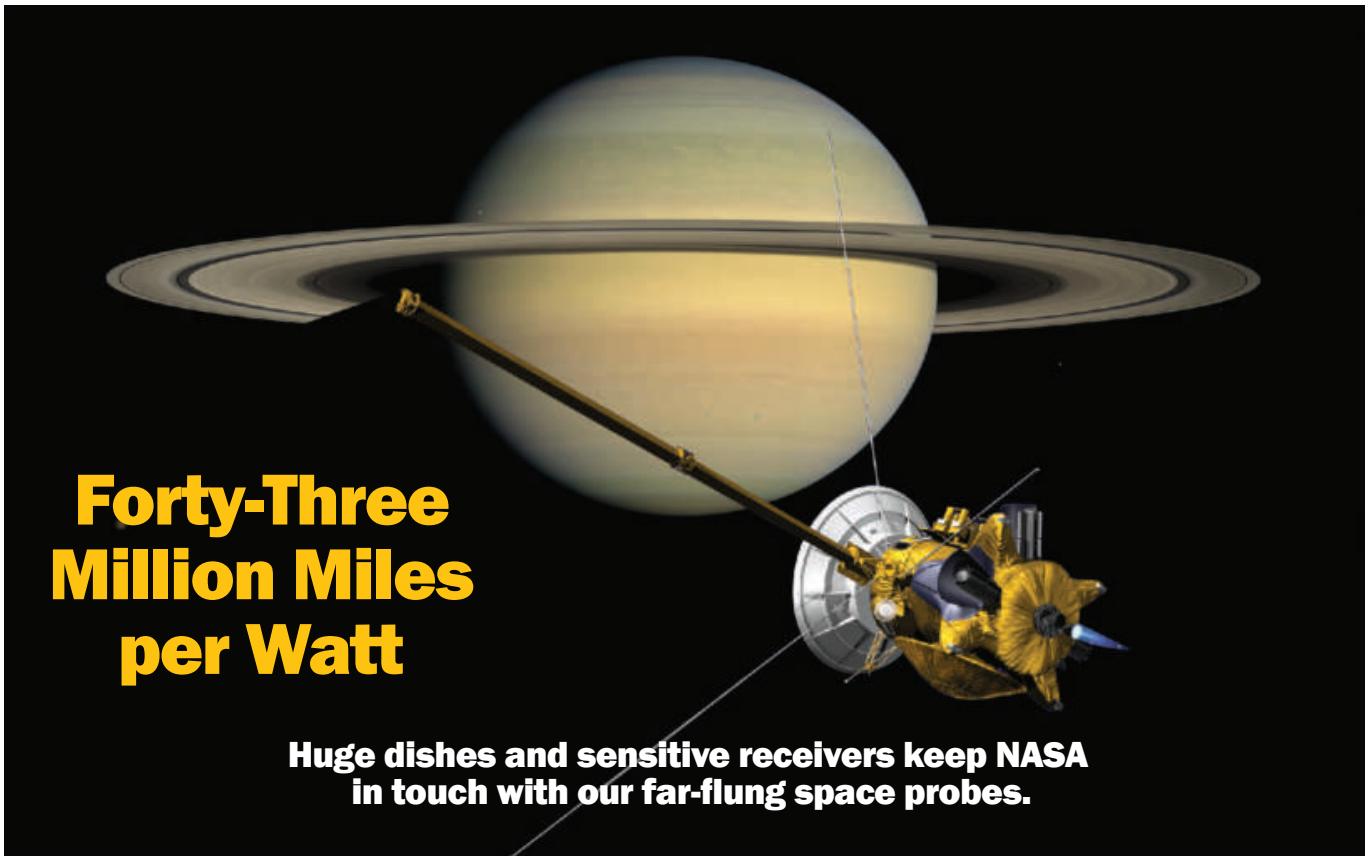
QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **hk@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence.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

Figure 5 — Using modified paint roller screens to separate stacked equipment improves air flow and cooling while also eliminating a cluttered look in your shack. [Sebastian Acosta, W4AS, photo]

New Products

High Performance Sub-Receiver for TEN-TEC Orion Transceivers

Model RX366 is a high performance sub-receiver for the Orion Model 565 and Orion II Model 566. This is a new contest grade second receiver for the Orion series of transceivers. The new second receiver module uses ASR (Advanced Signal Reception) technology that is already used in the TEN-TEC Eagle transceiver. The RX366 requires V3 Orion 565 and Orion II 566 firmware. With V3 and the RX366 installed, the Orion sub-receiver performance is said to be greatly improved over the original sub-receiver in terms of immunity to interference from adjacent strong signals and immunity to overload from very strong signals present on the band. Price: $639 (one 2.4 kHz filter included). For more information, or to order, visit **www.tentec.com**.



Forty-Three Million Miles per Watt

Huge dishes and sensitive receivers keep NASA in touch with our far-flung space probes.

An artist's rendering of the *Cassini* spacecraft approaching Saturn. The three long, slender antennas aren't used for communications; they are receiving antennas for science projects such as detecting lightning on Saturn. The Huygens probe, which was jettisoned so it could land on Saturn's moon Titan, is the large circular object on the downward side of the craft.

Bil Paul, KD6JUI

EME (Earth-Moon-Earth or "moonbounce") enthusiasts are pleased when they can bounce a 100 W signal off the moon and have it received back here on Earth — for a round trip of approximately 756,000 miles. Now consider receiving a 12 W signal sent from 11.3 billion miles out in space: Wouldn't that be the ultimate low power distance record? Yes, and it happens often.

The 12 W transmitter is aboard the *Voyager 1* spacecraft, launched in 1977, which is now about 11 billion miles from Earth, far beyond Pluto's orbit. Its transmissions take 17 hours (yes, hours) to reach the massive parabolic dish antennas of NASA's Deep Space Network (**deepspace.jpl.nasa.gov/dsn**).

As I was curious about how NASA handles communications between distant spacecraft and Earth, I interviewed Real Time Flight Operations Lead Engineer Dave Doody, who leads a team of engineers maintaining the radio link with *Cassini*, a spacecraft launched in 1997 and now orbiting the ringed planet Saturn. Doody's team works at the Jet Propulsion Laboratory in California.

Cassini is a complex space vehicle the size of a small school bus and it weighs about 6 tons. It has performed nearly perfectly, which is good, considering that building and launching it cost approximately $1.8 billion.

Radio *Cassini*

This article is about the radio communications between Earth and *Cassini*, now "only" about 870 million miles away from Earth. Scientists talk to it almost daily, and from the deep cold of distant space, it talks back.

Cassini, during the early part of its mission when still in the vicinity of Earth, communicated using one of its two low gain antennas (which offer 8 dB of gain). But as it moved farther from Earth, *Cassini* began to depend entirely upon its 13 foot wide dish antenna, with 47 dB of gain, to send and receive signals. This antenna isn't independently movable. In order for *Cassini* to communicate with Earth, the entire spacecraft has to be turned toward us using small thrusters or internal reaction wheels.

As with the *Voyager* spacecraft, *Cassini*'s transmitters have a low power output of 8-20 W. Sensitive receiving systems here on Earth handle the 10^{-18} W signal strength well.

Desert Dishes

Back on Earth, NASA uses its Deep Space Network to communicate with its many active spacecraft, including *Cassini*. In order to communicate with these craft at any time, the network consists of three sites more or less equally spaced around the globe — Goldstone in California's Mojave Desert, another near Madrid, Spain and a third near Canberra, Australia. Each site has multiple parabolic antennas of different sizes. To communicate with *Cassini*, each site uses a 230 foot wide dish with 75 dB of gain. When transmitting, each site has a power output of approximately 18 kW.

Dave Doody's *Cassini* communications team has to schedule time on the dishes months in advance. The team communicates with *Cassini* an average of 9 hours per day, 329 days per year.

Of course, all communications are digital. The primary mode for communicating with *Cassini* is phase-shift keying modulation (PSK), which is similar to the PSK31 protocol used by hams, but with a complex error correction feature.

Rigs in Space

Cassini uses one transceiver for two-way microwave communications with Earth. It operates in what's called the X-band in the vicinity of 9 GHz. The unit receives commands from NASA and sends back camera images, science experiment results and re-

ports of the spacecraft's internal health. The transmitter outputs 20 W of power using a traveling wave tube. In case of failure, there's a duplicate backup transceiver.

There are two other transmitters — operating respectively in the 3 and 30 GHz bands — with unique functions. When *Cassini* emerges from behind Saturn in its regular orbit, one or both of these transmitters can send a pure tone signal with 8 W of power that will pass through Saturn's atmosphere and be affected by it (just as the ionosphere affects signals here on Earth). Scientists can then analyze these signals, looking for evidence of refraction, attenuation, changes in polarization and phase, and other data. Because *Cassini* also sometimes passes by Saturn's moon Titan the same experiment has been carried out there.

Finally, there's a receiver that was used only to receive signals from the European-built Huygens Titan lander, which piggybacked on *Cassini* and was jettisoned for a soft landing on Titan. The probe sent images and science telemetry to *Cassini*'s high gain antenna and this receiver. Huygens returned 350 photos of the descent and the area around the landing site on the frozen moon, which were transmitted to *Cassini* and then relayed to Earth.

Doody's team sends commands up to *Cassini* that can modify its flight plans and experiments or deal with any equipment issues. The remote installation of new versions of operating software is also possible. As for the telemetry sent to Earth, Doody says "The amazing thing is that when we're receiving telemetry on Earth…it's perfect telemetry. It's a perfect copy of the [data] that was sent out." One of the few things that would interfere with receiving perfect telemetry is a rain cloud between *Cassini* and the receiving dish antenna. "That's because liquid water…naturally sends out radio noise at about the same frequencies that *Cassini* uses." he says. That's why the Deep Space Network sites are located in desert areas with lots of clear days.

Cassini's telemetry isn't scrambled or encoded to prevent others from receiving the data and using it, but not many would have the huge parabolic dish antenna and sensitive receivers required to acquire the weak signal from Saturn. Doody mentioned that a radio amateur was able to pick up a different spacecraft's signals from Mars with a 16 foot wide dish antenna, but not well enough to make out the digital telemetry.

Cosmic Communications

I asked Doody about any difficulties communicating with *Cassini*. One challenge occurs when the Sun is between Earth and the craft. The telemetry is harder to receive because of solar noise. Often in this situation, Doody's team tells *Cassini* to send telemetry at a lower baud rate to ensure that it's received correctly.

Because the Motorola-built transmitters aboard *Cassini* aren't capable of transmitting at perfectly accurate frequencies on their own, they are designed to lock on to and use the extremely accurate frequencies of the command signals sent from Earth. Because of this capability, taking into account the Doppler effect caused by the rapidly moving spacecraft, the speed and location of *Cassini* can be finely calculated.

One of the wild cards about operating in space is the presence of cosmic rays (actually particles) that hurtle through space at high speeds and hit the spacecraft. "Once in a while — in fact about twice a year — we can expect a random cosmic ray will hit one of our [transistor] switches and shut something off." says Doody. "Once it did that to a radio on *Cassini*… After hours and hours of panic, we recognized what happened and corrected the problem with commands."

Even though radio communications with *Cassini* have generally been very reliable, there were several times when it inexplicably went silent. "We started troubleshooting as best we could on the ground, hoping that the spacecraft hadn't died on us." says Doody. He and his team uncovered a different problem each time and were able to send the particular commands that resolved the difficulties.

Another challenge for scientists communicating with their interplanetary vehicles (such as the *Curiosity* rover on Mars) is the time delay between sending a command to the vehicle and receiving information back. In the case of *Cassini*, the delay for a radio signal round trip is 2½-3 hours! So if engineers are uneasy about commands they've sent to *Cassini*, they have a long time to wait to see if the commands worked.

Tech Today, *Cassini* Tomorrow

The US has come a long way since the beginning of space exploration in the late 1950s. In 1977, two *Voyager* spacecraft were launched at about the same time, in case one of them failed. In contrast, in 1997 just one very complicated *Cassini* spacecraft was built and tested on Earth before being launched. The *Cassini* engineers had to have a high level of confidence that thousands of parts, circuits, antennas, instruments and propulsion components would work properly — and work together — to make this expensive project a home run. *Cassini*'s longevity has meant its mission has been extended several times and now is expected to end in 2017. Its success is a testament to American technology and ingenuity.

One of the reasons for getting young people interested in Amateur Radio is to give them the background and interest to pursue a career in spacecraft communications. Dave Doody and his colleagues will retire someday and there will be a need for experienced radio people to take their places.

For more detailed technical information about telecommunications with the *Cassini* spacecraft, visit **descanso.jpl.nasa.gov/DPSummary/Descanso3--Cassini2.pdf**.

Current information about the *Cassini* mission can be found at **saturn.jpl.nasa.gov**.

The prime antenna used for communicating with the *Cassini* spacecraft is a 230 foot wide parabolic dish antenna of the type pictured here at NASA's Goldstone site in California's Mojave Desert. The two other similarly equipped sites are in Australia and Spain.

Images courtesy of NASA/JPL-Caltech

Bil Paul, KD6JUI (former W9KSJ), an ARRL® member, is a General class licensee who enjoys low power field operations, antenna design and everything about Mars. He was first licensed during the Sputnik era and now lives in Dixon, California. Bil can be reached at 1300 Pembroke Way, Dixon, CA 95620, **naturalbornwriter@hotmail.com**.

Field Day Flyover

For 2012 Field Day, Eastern Pennsylvania Section Manager Bob Famiglio, K3RF, went on the air, in the air.

Bob Wilson, W3BIG

On Field Day one of the big challenges is the rush to raise antennas. However, for 2012 Field Day, that wasn't the case for Eastern Pennsylvania Section Manager Bob Famiglio, K3RF, who was able to raise his to 3000 feet in minutes with the help of a Cessna 182 Skylane piloted by his friend Jim Goldman, W3JG.

Bob was intrigued by the idea of visiting Field Day sites from the air. His territory covers all of Eastern Pennsylvania so it would have been impossible for him to drive through the Section in 24 hours. A pilot himself, Bob is no stranger to operating from aircraft. Doing a series of Field Day flyovers seemed to be a natural solution.

Operating the High Bands

After a preflight check that included installing VHF and UHF transceivers in the cockpit along with an APRS station, K3RF and W3JG lifted off around 1600 UTC from Brandywine Airport in West Chester. An Amateur Radio operator for 40 years, Jim, W3JG, has been flying since 2003.

W3JG banked the Cessna northward and headed up the eastern side of the Keystone State. "I've been a Pennsylvania resident my entire life but could not have been prouder to be the new Section Manager than when flying over our wonderful state enjoying the panoramic view of our Eastern Pennsylvania mountains," Bob said.

One of the interesting operating features of the flight was the inclusion of a beaconing APRS station so hams on the ground could track the position of the aircraft en route to various Field Day sites. This proved a valuable tool to alert those on the ground when the Cessna was approaching their site.

As the small plane flew over many of the Field Day locations, operators on the ground got creative in signaling their Section Manager. Some waved makeshift flags while others placed signs on pavilion rooftops that read, "Welcome SM."

Operating from a small plane with a modestly sized cockpit required the use of handheld transceivers. That decision worked well — the handhelds' 5 W output was adequate. Bob worked stations at a range of 40-60 miles simplex without difficulty.

Stopovers

While most of the visits were flyovers, Bob and Jim scheduled two landings at Field Day sites located at airfields. The first was a refueling stop at the Scranton Pocono Amateur Radio Klub (SPARK), at Seamans Airport in Factoryville, just north of Scranton. The owner of the airport, William Dobitsch, Jr, KB3NEP, is both a pilot and fellow ham, as are most of the SPARK members.

The second landing was to visit the Susquehanna Valley Amateur Radio Club at Penn Valley Airport in Selinsgrove. The club maintains a permanent station with a building along one of the airfield's runways complete with a tower mounted tribander. Bob and Jim enjoyed a visit with club president John Thompson, K3MD.

Jim, W3JG (L) and Bob, K3RF, discussing operating frequencies before takeoff.

For a new Section Manager, the trip was a real treat. Bob found it a great way to combine two of his passions — Amateur Radio and flying. "Landing at some of the Field Day sites and meeting fellow hams in the Section reminded me of how we are all so alike and how much we really have in common that many of us as radio amateurs may never fully appreciate," he said.

The 2012 Field Day flyovers were a success. Bob visited 21 Field Day sites from the air, with Jim's, W3JG, help. During the 6 hour trip that covered 500 air miles, Bob worked dozens of stations on 2 meters and on 70 and 33 centimeters.

Bob and Jim are already making plans for another aerial sojourn for 2013 Field Day and will add amateur television to the airborne station so Field Day operators will be able to get a glimpse of their sites from the air. Bob will be posting updated information about his 2013 Field Day Flyover on the Eastern Pennsylvania Section web page at **www.arrl.org/Groups/view/eastern-pennsylvania**.

All photos courtesy of Bob Wilson, W3BIG.

Bob Wilson, W3BIG, an ARRL® member, has been licensed for over 30 years and serves as the ARES® Emergency Coordinator for Delaware County, Pennsylvania. Bob can be reached at 58 King Ave, Folcroft, PA 19032-1022, **w3big@arrl.net**.

Bagging the Field Day QRP Multiplier

Limiting yourself to 5 W of output power gets you a score multiplier of 5.

Carey Fuller, KXØR, and Fred Maas, KT5X

More and more Field Day participants are operating from unusual sites as individuals, pairs, or small groups, often operating QRP — meaning with very low power. Operating at QRP power levels offers the opportunity to experiment with antennas and batteries and see how many contacts we can make with only 5 W.

Our three transmitter QRP group began as a 1B2 QRP setup in 2000. On its own, the B category means either a one or two man operation in which that person or pair must do everything. When the letter B follows the number of transmitters used by the group, as in 1B2B, it means the operation is using QRP — or 5 W output — and batteries for the power source.

The 1B1B Field Day operating position of Carey, KXØR. [Carey Fuller, KXØR, photo]

In 2000, partners Steve, WD9FJL, and Fred, KT5X, operating with the club call sign W5YA, used an Elecraft K2, a single deep-cycle battery and a 52 foot G5RV antenna supported by trees. The setup was simple and it produced over 500 contacts.

Economizing with Antennas

When we go out into the field, it's a good idea to keep antennas simple. Try a random length end-fed wire with an antenna tuner, or perhaps a 67 foot long insulated wire pulled up, into and through a tree in an inverted V, then fed on the end with an impedance transformer. This antenna can be made to work on 15, 20 and 40 meters since it would be a multiple of a half wave on each of those bands.

In our second year together, W5YA put up two parallel catenary lines. We hung two 52 foot G5RV antennas across them, then, between the G5RVs, we placed reflectors for 15, 20 and 40 meters. Using the dual inputs of the transceiver, we could instantly reverse directions with the touch of a button. The whole thing was set up by just two people in only a few hours using four trees as supports.

The next year we decided to try Moxon arrays. The Moxon array is a bent form of a two element beam. This makes for a smaller footprint than a full sized Yagi, and with the ends of the elements close coupled, creates a pattern with a broad frontal lobe, and the deep null in the back characteristic of a cardoid.

You can read more about our 2012 setup at **www.n7un.com/**.

Charge It! — The Issue of Batteries

Learning about batteries is part of preparing for either Field Day or an emergency operation. Your choice of power source will depend greatly on your choice of approach to Field Day. Being able to drive to your operating site makes using larger batteries and bigger antennas much more possible than if you choose to hike to your site.

To plan your battery capacity for FD, find out the current drain of the radio, accessories, and lights. Measure the peak current key-down or while talking, and the receive current, and then estimate transmit duty cycle with normal FD operating, then estimate the total ampere-hours required.

Going It Alone

Carey, KXØR, has been enjoying Field Day solo Class B for many years. He's found that a 5 W rig can be run with a modest battery and without a generator.

Choosing a site is critical to success; find a site that aids your effort. A site on a hill or mountain beats one in a valley every time. It's important to maximize antenna efficiency, too. Hundreds of Field Day contacts can be made with 5 W, a 40 meter dipole, window line and a tuner. Operating on 20 meters during the day and 40 meters at night produces many Qs, but other bands provide additional action. Moving from band to band as conditions change is fun, especially if 10 meters opens up!

Wire antennas are the best bet when you're operating alone. Prepare them in advance and wind them on spools. With practice, it's easy to get lines over trees using a fishing pole or sling shot. If there are no trees, options for portable masts include painter's poles, fishing poles and telescoping fiberglass. An inverted V dipole needs just one good center support — the ends can be tied off with long strings to rocks or stakes. An end-fed wire going up the pole and out in an inverted L allows the pole to be braced instead of guyed.

Carey, KXØR, has also taken a chance on antennas that are more difficult to erect, such as a wire Bird Yagi for 20 meters and 40 meters hung between four trees, as well as an 80 meter full wave loop and a 40 meter full wave loop, oriented with lobes to the SW/NE and SE/NW respectively. It's challenging and time consuming to put up so much wire, but the results have provided plenty of motivation!

Making the most of your battery-powered QRP Field Day will require some additional planning, but there is a lot of freedom in shedding the extra gear that larger Field Day efforts require. Don't miss out! Be safe, have a "Plan B" in case of lightning, and have fun!

George Carey Fuller, KXØR, first licensed in 1962 as WN4JAQ, has a degree in physics from Duke University. His career includes technical purchasing for RF manufacturing companies, and he is currently at RF Concepts. He was the top Bumblebee in 2012, and has been in the top 10 of Field Day 1B1B for several years. He can be reached at **kx0r@arrl.net**.

Fred Maas, KT5X, first licensed in 1958 as KN3EPQ, has a degree in geology from Duke University. He is a retired teacher of math and science, a track and cross-country coach and has been the organizer of the W5YA Field Day since 2000. The group has won 1B2B six times, 1AB twice and 3AB twice. He can be reached at **just.one.hill@gmail.com**.

Field Day Towers — Doing It Right

Guidelines and examples for tower and mast safety on Field Day.

Don Daso, K4ZA, and Ward Silver, NØAX

For many Field Day operations, short towers or masts are used to support Yagis or wire antennas. While easy to transport and assemble, towers can be tough to raise and lower safely in temporary installations. Masts — push-up or multi-section — have their own challenges. For either support, it's easy to compromise safety when you're in a hurry to get on the air.

The Risk of "Temporary"

Whenever we start thinking in "temporary" terms, compromises and other challenges inevitably creep in. Questions or considerations that would be logically and cautiously addressed for a permanent installation can easily be overlooked or not thoroughly considered in the field. Problem solving sometimes takes a back seat to the immediate challenge of getting an antenna up high, in the clear and on the air.

The watchword of the day when dealing with *any* type of tower or mast is, of course, safety. There have been far too many instances where someone thought that a part or procedure "wasn't really necessary," or that time could be "saved" by only installing one set of leg bolts, or that the tower was so short it did not need proper guying, or that tent stakes could be used as earth anchors and so on.

Always pay attention to where you're installing any antenna. Be particularly concerned with any power or utility lines nearby, let alone overhead. Because this is a temporary location, you may not know where the lines are, especially in sites with a lot of trees. Be mindful — should the worst thing happen and the tower fall — of the area surrounding the tower or the potential footprint of the entire setup. Do not set up a station or any other facility within that footprint!

Towers

Let's get back to that temporary installation mindset. For instance, can 40 feet (four sections) of Rohn 25 tower be "walked up" safely? Will it stay up at the Field Day site all weekend if guyed with ropes? A simple "yes" is not enough — there are always circumstances to consider in every case. Failing to assess and respond to those circumstances creates the potential for injury and damage. As always, there's no free lunch when discussing, planning and executing antenna and tower installations.

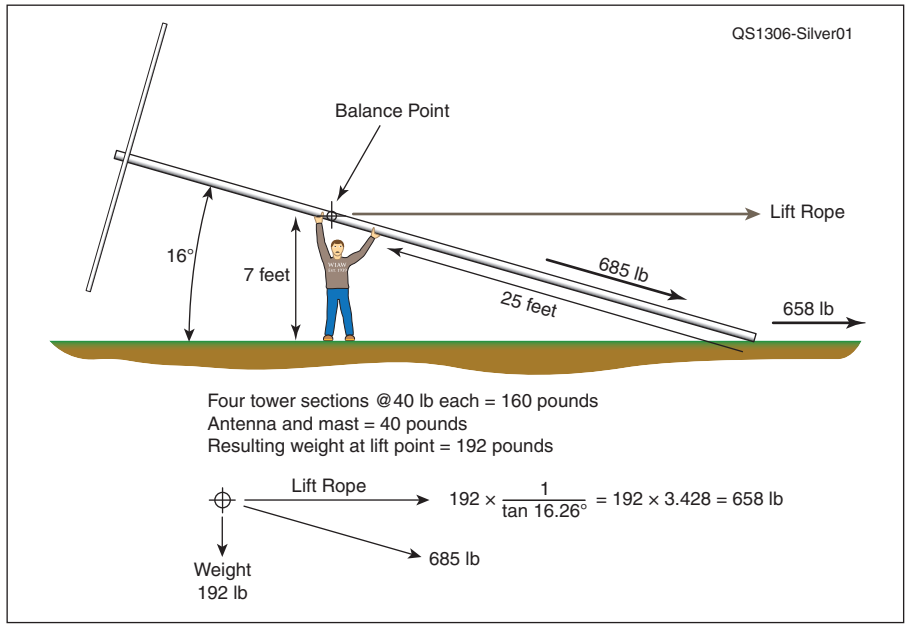


Figure 1 — Substantial force is needed to lift a tower off the ground using nearly horizontal pull rope. The same force is pushing the base of the tower horizontally, requiring the base to be securely held in place. [W1UJ, photo]

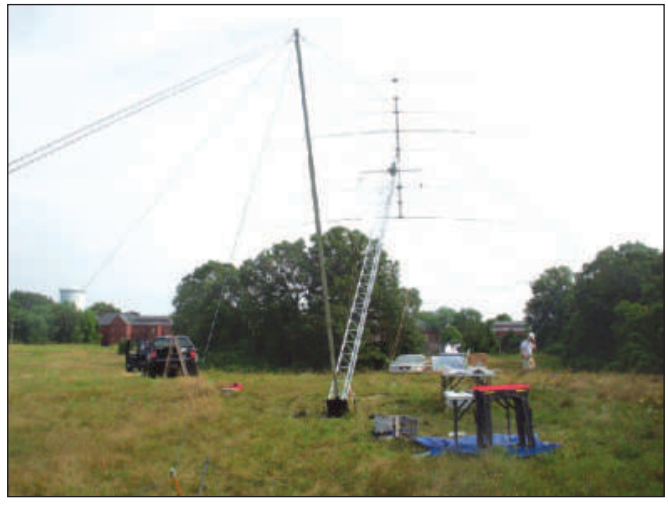


Figure 2 — The 2014 World Radiosport Team Championship stations will all use this simple and effective "falling derrick" method to erect 40 foot towers for more than fifty portable stations! [Mark Pride, K1RX, photo]

Yes, it is possible for a tower to be walked up by lifting and pulling, but the base must be secured adequately or it will slip along the ground, dumping the weight abruptly onto the lifting team. Of course, walking the tower up with a beam, mast and rotator already installed makes the task even harder.

Figure 1 illustrates the problem of walking up a tower consisting of four 40-pound sections of Rohn 25 topped with a 40-pound beam/mast/rotator. The total weight is 200 pounds balanced 25 feet from the base. Assuming your crew can lift the load to 7 feet, a horizontal pulling force of 658

pounds is required to lift the tower at its balance point and 685 pounds is compressing the tower. The same 658 pounds of force is pushing horizontally against whatever is holding the base to the ground. What do you think will happen if the base is not secured well enough?

Remember and account for this multiplication of force when walking up a ladder or other light-duty support as well. It must be adequately rated for the load during raising, as well as holding the dead weight afterward.

What if the crew walks toward the base to raise the tower further and reduce the pulling force? That will place the balance point *behind* them, causing the tower to pivot around the crew lift point and raising the base off the ground. This is not a good combination and many a tower lifting operation has suddenly gone awry at that very moment.

The secret to tilting any tower into position is having a hinged base plate that is securely held in place. Without a hinged base, the lift will be risky. Make certain the base is secure by driving stakes through the base plate or by having something heavy holding it in place, like a vehicle. Avoid the temptation to rely on a shallow hole as a seat for the base, or the dangerous practice of having someone stand on the base to hold it down. If the base begins to slip, you'll have a lot of unwieldy tower and aluminum that is dangerously out of control.

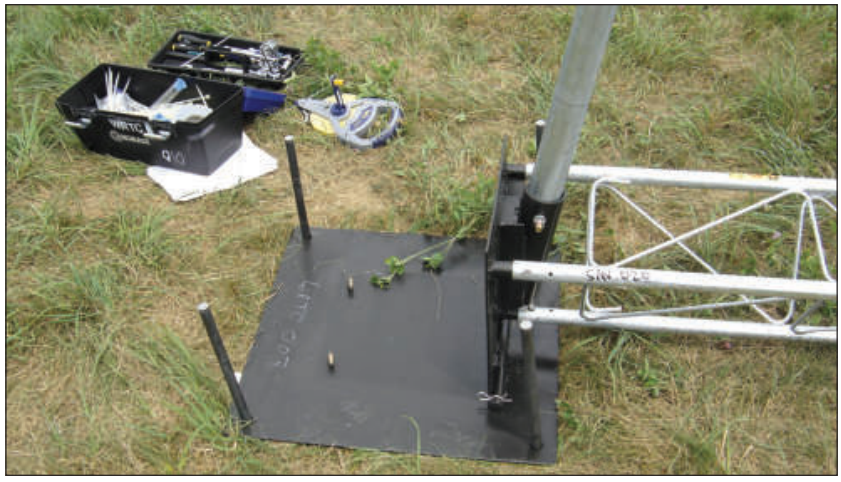


Figure 3 — A close-up of the hinged base and derrick attachment method for the 2014 World Radiosport Team Championship station towers. [Jason Corriveau, W1UJ, photo]

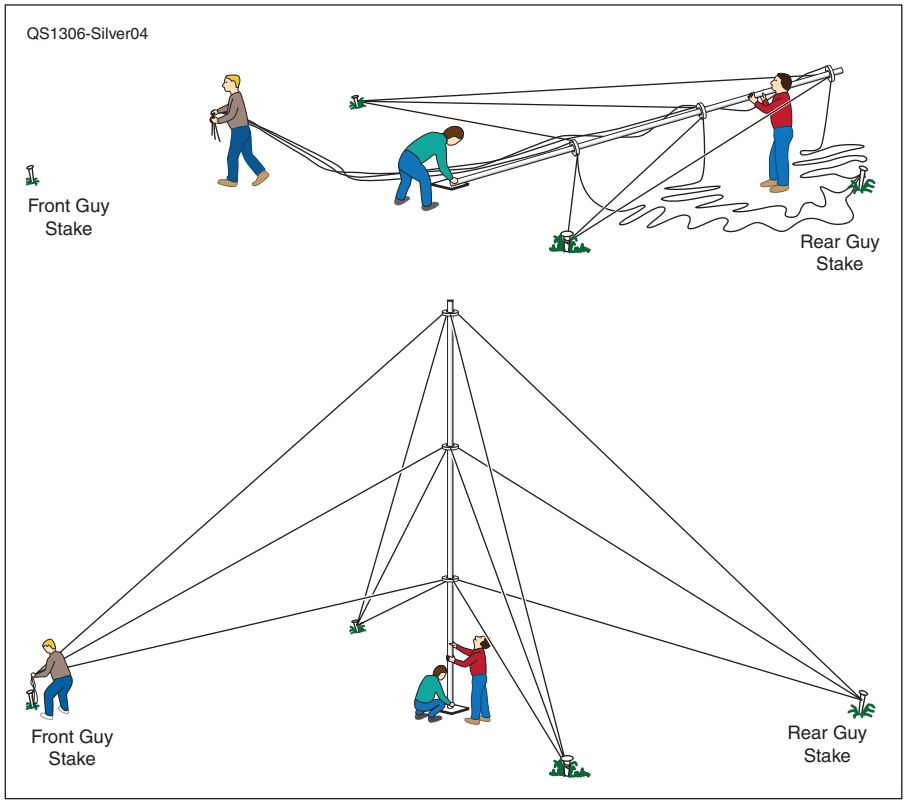


Figure 4 — By using side-guys, a multi-section mast can be walked up.

Over the years, hams with metalworking experience have fashioned some clever solutions to this problem. Figures 2 and 3 show the design worked up for the more than 50 2014 World Radiosport Team Championship stations (**www.wrtc2014.org**). This implementation of the "falling derrick" erection system is elegant and simple. By lifting from a point high above the base of the tower, you avoid the high forces that are encountered from lifting at a small angle. The same method works to lower towers safely, too.

Rick Karlquist, N6RK, has presented a detailed set of photos showing how to construct and use the falling derrick. You'll find it at **www.n6rk.com/falling_derrick_gme/falling_derrick_gme.html**. Rick also gives a great piece of advice: lift the tower a foot or two and check everything before proceeding.

Masts

For wire antennas and very light beams, using a mast is often a good choice. Multi-section aluminum masts such as the AB-155/U and MS-44 surplus packages are widely available and the telescopic TV antenna push-up masts are making a comeback, too. Heights of 20 through 50 feet are available. (Telescoping fiberglass masts are not strong enough to hold anything except wires and very light antennas.) Homemade masts constructed from 10 foot or longer sections of pipe or tubing are also common and can be walked up (carefully). All types of masts present challenges; don't overload them.

A mast's flexibility makes the side guys especially important since they will keep it from bending sideways under load. Masts require extra care during installation to be sure they are kept straight. Once a curve develops, a collapse can occur very quickly. Surplus "rocket launcher" AB-577 masts (**www.ontariosurplus.com/ab577.htm**) are much sturdier and can support a triband HF Yagi if erected properly.

Steel push-up masts are heavy, especially when raising the final sections that are carrying the full weight of the extended mast. A slipping section can seriously injure fingers and hands. Push-up masts can be walked up,

but only with the lightest of antennas attached (the top section is likely to bend if loaded and out of vertical alignment).

Guying

Use a four-way arrangement with the guys separated by 90 degrees instead of the 120 degrees typical of permanent installations. When lifting a tower or mast, use a four-way system with one set of guys aligned with or performing the lift while the two side guy sets steady the tower and stiffen a mast.

The four-way system has the advantage of allowing side guys (perpendicular to the lift) to be strung to their final length while still on the ground. This stabilizes the tower (or mast) to prevent tipping away from the plane of the lift. When the lift is finished, there will be three set of guys in place and by quickly attaching the front guys, the tower will be stabilized. Secure and adjust the guys for vertical plumb and you're all done.

A tower can be guyed with ropes, provided the load it carries is limited, no serious winds come up and no one climbs the tower. If you use rope, choose at least ⅜-inch diameter material without a lot of stretch such as Kevlar or Dacron. Do not use nylon or manila rope. Follow the manufacturer's recommendations and instructions for guying masts; it is often a more involved process than for the stiffer towers.

Guy Anchors

Make certain the guy anchors are strong enough to do their job. Use heavy pipes driven deep into the soil or screw-in earth anchors. For any temporary tower setup, the earth anchors will be the weakest link in the chain. Do not use brush or saplings as anchors. Only mature trees are safe enough to use as guy anchors and even then only attach guys near the base of the trunk. Vehicles? Forget about it!

Managing the Process

As with permanent installations, the secret to success is to have someone in charge with not only enough experience to make the proper decisions, but the ability to manage and prioritize the actual construction itself. Invariably, this person will not be able to be everywhere and do everything, so the proverbial "tailgate meeting" is mandatory. That's where the various jobs, and the process of getting them done safely, are discussed.

Finally, don't let yourself or others be talked into doing something you know isn't safe. Putting up an antenna is not a race and it's not a contest to show one's bravado. When something starts looking "iffy," or isn't going according to plan, *stop*. Return to the last safe configuration if at all possible. Take time out to determine what went wrong and correct the situation before resuming. Make sure all crew members feel comfortable asking questions and don't be shy about asking for help.

More Reading

Every situation is different, so inform yourself and your team about tools and techniques. Read the tower and antenna safety section in *The ARRL Handbook*, the more complete chapter in *The ARRL Antenna Book*, or K4ZA's *Antenna Towers for Radio Amateurs* and K7LXC's *Up The Tower*. Don't put anyone at risk by doing the job without the proper equipment or skills. You'll find that a job done safely and properly usually takes less time in the long run, avoids accidents and equipment damage, and gets you on the air reliably.

Thanks to Hank, KR7X, for the engineering review.

Ward Silver, NØAX, is the lead editor of *The ARRL Handbook* and *The ARRL Antenna Book*. He is the author of all three *ARRL License Manuals* and the *Q&A Study Guides* along with writing the monthly *QST* columns "Hands-On Radio" and "Contest Corral." The ham radio detective mystery, Ray Tracy: *Zone of Iniquity* is his most recent book. Outside of ham radio, Ward plays the mandolin, dabbles in digital photography, and enjoys camping and canoeing. You can contact Ward at 712 Jefferson St, Saint Charles, MO 63301-2740; **n0ax@arrl.net**.

Don Daso, K4ZA, is a tower installation expert who operates a business doing installations for amateur clients. He has been a licensed ham since 1963 and is the author of an ARRL book on tower installations titled *Antenna Towers for Radio Amateurs*. You can contact Don at 515 Withershinn Dr, Charlotte, NC 28262-0477; **k4za@juno.com**.

New Books

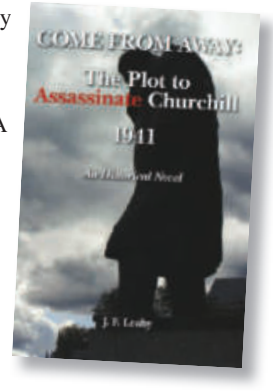
Reviewed by Rick Lindquist, WW1ME

Come From Away: The Plot to Assassinate Churchill 1941, J. F. "Jack" Leahy, KW5A

Radio communication plays a major role in this thriller. Drawing from the early years of World War II, Leahy skillfully weaves historical fact and fantasy in such a way that the division between truth and fiction appears seamless. Set in the months before the US enters the war, the intrigue centers upon a secret August 1941 meeting in Newfoundland between US President Franklin Delano Roosevelt and British Prime Minister Winston Churchill, who wanted a reluctant US to enter the hostilities. Although not formally a combatant then, the US did aid the British with ships and built a Navy facility in Newfoundland. Much of the action takes place at this base and aboard a German U-boat.

The overarching conceit is a Nazi plot to assassinate Churchill in the belief that this would keep the US out of the war and soften Great Britain, which was already suffering Hitler's wrath.

True to his naval background, Leahy's tale evokes the life of 1940s US Navy radiomen and how they fared in that remote part of the world, where Newfoundlanders described outsiders as having "come from away." A US Navy radioman and ham, Timothy "Hambone" Hannigan, is a central player. While anything but a squared-away sailor, Hannigan can copy code better than anyone on the base. This leads to the investigation of strange, unidentified signals he hears while tuning around on a Hallicrafters SX-28 receiver.



Leahy imagines in realistic fashion the dialogue between the many historical figures, from Churchill and FDR to the various Nazi High Command figures who play into the whole mysterious business, as well as among the Navy personnel. I won't give away the ending, of course, but I did find the plot resolution startlingly abrupt.

This editor found the surfeit of editorial errors (in two languages) a bit distracting. While the frequent German misspellings may be overlooked, those in English could not. Examples: "Wallace" for "Wallis" Simpson; "Artic" for "Arctic," "peaked" for "piqued," and others. A few anachronisms popped out. For instance, a sailor's girlfriend is referred to as his "new squeeze," and a sailor is called "one weird dude."

I chuckled at the subtle pun in a passage describing how a sailor — a boatswain or "bos'n" aboard the USS *Higgs* — was lost overboard. "No one ever found the Higgs bos'n," the narrator deadpans.

Readers who love history and mystery involving radio (a la The Hardy Boys' *The Short-Wave Mystery*) will enjoy this novel and relish its rich and detailed historical context.

Naval Writers Group, Annapolis/Newport/San Diego, 2012. ISBN: 9780615669625, softcover, 6 × 9 in, 301 pp. Available from Amazon.com, $19.95.

The SSB Legacy of W9DYV

This year's Field Day will be special in Jonesborough, Tennessee.

George Maier, W1LSB

On June 22, 2013, Central Electronics collectors will gather in Jonesborough, Tennessee to meet legendary company founder Wes Schum, W9DYV, and discuss their favorite topic: Central Electronics SSB phasing exciters. This year's event was set to coincide with ARRL Field Day to encourage attendees to bring their Central Electronics, Lakeshore, Drake, Collins, Eldico, and other vintage gear to set up and enjoy Field Day operating on the 20 acre meeting site.

Organized by Schum's longtime friend, Nick Tusa, K5EF, the first meeting took place last June at Storybrook Farm, a bed and breakfast establishment operated by Diane (Schum) Vogt and her husband John. Until recently, the main guest house on the property was the home of Wes Schum and his wife Marge, K9EMP, who have since relocated to a senior's condominium nearby.

Wes's Legacy

At the 2012 event, attendees were treated to a one on one opportunity to meet Wes and gain some perspective on his many accomplishments in helping to popularize single sideband transmission on the ham bands.

Wes's goal was to make SSB equipment simple and affordable, and his 10A exciter was the perfect solution in 1951. Central Electronics maintained entry level products throughout most of their existence, but also developed the most sophisticated SSB equipment available at the time. Imagine creating a 600 W "no-tune" linear amplifier for 160 through 10 meters way back in 1955. Wes Schum and his lead engineer Joe Bachelor, W4EGK, did just that and the model 600L was born. Later, the pair developed the 100V and 200V "no-tune" exciters, which remain to this day the high water mark in tube-type SSB exciter sophistication.

The Central Electronics 2013 Meet will feature a tailgate party, vintage SSB Field Day venues, a special event station, hands-on workshops, and several presentations. Everyone is invited! Details will be posted on the Central Electronics website at **www.ce-multiphase.com**.

A Central Electronics transmitter lineup: 10B exciter, 458 VFO, 20A exciter, MM-1 monitor scope, 600L amplifier, 100 V exciter and 200 V exciter. All units shown are from Wes Schum's personal collection. [George Maier, W1LSB, photo]

Wes Schum in the 1950s working on a 100 V transmitter. [Photo copyright Nick Tusa, K5EF]

Nick Tusa, K5EF (right), with his longtime friend and mentor, Central Electronics founder Wes Schum, W9DYV. [George Maier, W1LSB, photo]

Dillard Carr, one of Central Electronic's key employees, working at a module test station. [Photo copyright Nick Tusa, K5EF]

You can contact the author at 64 Shadow Oak Dr, Sudbury, MA 01776; **george@maiergroup.com.**

Jammin' and Hammin' with the Scouts

Join Scouts worldwide for the 56th Jamboree-on-the-Air and during the 2013 National Scout Jamboree.

Jim Wilson, K5ND

Many Amateur Radio operators credit their interest in ham radio to an early exposure through Scouting activities. For some, it was an encounter with ham radio at a pack or troop meeting, a Camporee or perhaps through attending a Jamboree-on-the-Air event. For others, it was working on the Radio Merit Badge as part of their journey toward Star, Life and Eagle Scout ranks (see Figure 1).

That early encounter with ham radio might have sparked an immediate response in many Scouts, which might have included getting their license and continuing in the hobby. On the other hand, it might have remained dormant until sometime later in life when it emerged as a great way to enjoy communicating with other ham radio operators and working with technology. In many cases, it all began with a Jamboree.

Jamboree-on-the-Air

Jamboree-on-the-Air (JOTA) is an annual event, held the third weekend of October, which fosters Scout-to-Scout communication across borders — city, county, state or country, or even between continents. JOTA is not a contest. Its purpose is to foster conversations, rather than multiple contacts. It is a way to get Scouts everywhere on the air simultaneously to communicate with other Scouts and learn about their Scouting experience wherever they live. While learning about each other, it also introduces them to the fun and technology of Amateur Radio.

JOTA is the largest Scouting event in the world. In 2011, the World Organization of the Scout Movement (based in Geneva, Switzerland) reported that nearly 750,000 Scouts participated from more than 6000 stations in operation from 150 countries. As of this writing, it is too early to report the 2012 World Organization numbers, but the USA numbers show a staggering increase in participation.

In early 2012, the Boy Scouts of America's National Radio Scouting Committee took on a number of improvement projects. Those projects included several new supporting resources, such as updated frequency listings, as well as an extensive promotional campaign across a number of media outlets to reach Scouting volunteers, Scouting professionals and Amateur Radio operators.

In addition, Icom America stepped up to promote JOTA as a part of its sponsorship agreement with the BSA providing stations for JOTA and other Scouting events, including the 2013 National Scout Jamboree (see Figure 2) through 2015. Icom loaned stations to local councils, with five stations in action for Jamboree-on-the-Air. You can see all this and more at **www.scouting.org/jota**.

All that effort resulted in a 200 percent growth in the number of stations reporting their activities, along with a nearly 500 percent increase in the number of reported Scout participants (see Table 1). Stations reported on their events from 136 Scout councils and 41 states.

The station reports documented 1011 Amateur Radio operators involved across 434 stations. Contacts with all 50 states along with 66 countries were reported.

Table 1
USA JOTA Participation Growth, 2010-2012

	2010	2011	2012	Percentage Change 2011 to 2012
Stations	31	68	204	200%
Scouts	454	3,185	18,537	482%

National Scout Jamboree

K2BSA has been in action at every national Scout Jamboree since 1977. However, Amateur Radio has been present since at

Figure 1 — Jamboree-on-the-Air is the largest Scouting event in the world, with nearly 750,000 Scouts participating from more than 6000 stations across 150 countries. Here is a Scout on the air from K2TD during the 2012 Jamboree-on-the-Air. Equipment was obtained through the Icom America equipment loan program.

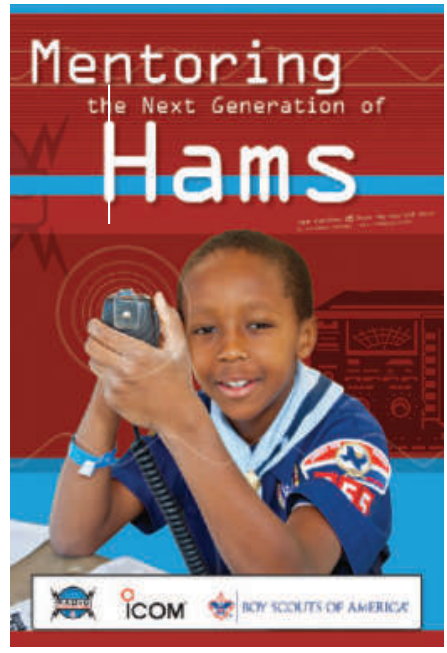


Figure 2 — Icom America promoted Jamboree-on-the-Air through posters and advertisements such as this one.

Figure 3 — The 2013 National Scout Jamboree will be on the air via K2BSA July 15-24, 2013, introducing Scouts to Amateur Radio.

least 1953, when K6BSA was in operation from Irvine, California. Jamborees are held every 4 years. Scouting estimates that roughly 50,000 Scouts have experienced Amateur Radio over the subsequent 15 events.

The 2013 National Scout Jamboree (see Figure 3) will be held at Scouting's newest national high-adventure base, the Summit Bechtel Family National Scout Reserve in West Virginia. The exciting news is that the Summit will be the permanent home of the Jamboree. This means any Amateur Radio infrastructure put in place can benefit all Scouting programs held at the Summit, as well as future Jamborees.

Icom America (**www.icomamerica.com**), through its sponsorship of Radio Scouting, will provide a permanent installation of three repeaters on the property, serving not only the Jamboree and all programs at the Summit, but also the local community. Icom America is also providing all HF/VHF/UHF Amateur Radio transceivers for the Jamboree operation as the exclusive Amateur Radio transceiver sponsor of the 2013 National Scout Jamboree.

The Jamboree opens on July 15, 2013 and closes on July 24. Over that time, approximately 40,000 Scouts and leaders will be engaged in many high adventure activities including mountain biking, technical rock climbing, zip lines and whitewater rafting. In addition, they will have many opportunities to experience Amateur Radio for the first time, or if they are licensed, to bring along their handheld unit to keep in touch via repeaters. The primary K2BSA activity will be the demonstration station, where Scouts will engage in SSB and PSK31 communication. The operation will also provide Radio Merit Badge training and Amateur Radio Direction Finding (ARDF) events, a perfect outdoor activity for the high adventure focus of the Jamboree. You can see the full operations plan at **www.k2bsa.net/2013-plan**.

All in all, the 2013 National Scout Jamboree will be a fantastic Amateur Radio experience. You're encouraged to visit if you're in the West Virginia area or to get on the air and help with all those Scouting contacts!

Radio Scouting Update

Perhaps your introduction to Amateur Radio was through working on the Radio Merit Badge. You'll be pleased to note that Scouts earned more than 6000 Radio Merit Badges in 2011. This number has grown steadily since the early 1980s, when fewer than 1000 Scouts earned the badge each year.

All that effort resulted in a 200 percent growth in the number of stations reporting their activities, along with a nearly 500 percent increase in the number of reported Scout participants.

In 2012, the Boy Scouts of America introduced two new Amateur Radio-related badges: the Morse Code Interpreter Strip and the Amateur Radio Operator Rating Strip (see Figure 4). An interpreter strip denotes proficiency in a language and availability for communication. The new strip features the word M-O-R-S-E spelled out in code. In its first year of availability, it has become the second highest selling interpreter strip! You can find the requirements at **www.k2bsa.net/morse-code**.

The Amateur Radio Operator Rating Strip recognizes the Scouting member's availability as an Amateur Radio operator for communication services at events and activities as well as emergencies. All registered youth members and adult leaders who hold any valid Amateur Radio license issued by the Federal Communications Commission are eligible to wear the rating strip. More information can be found at **www.k2bsa.net/operator-rating**.

Getting Involved

Amateur Radio and Scouting have grown together since 1918 when the first Wireless Merit Badge was introduced. That original Wireless Merit Badge has evolved into today's Radio Merit Badge. Jamboree and Amateur Radio have gone together since the 1953 National Scout Jamboree and the first Jamboree-on-the-Air in 1957. The fantastic growth in participation shown in JOTA in 2012 proves Amateur Radio remains a fascinating topic for Scouts.

If you're involved in Radio Scouting in your local community, thank you for all you've done to support introducing Amateur Radio to youth. If you're not involved, what are you waiting for? Check with your local radio club and see if they're connected to Scouting. If they are, please get involved. If not, locate your local BSA council at **beascout.scouting.org** to learn how to get involved. You can set up a JOTA station at a local Camporee in October, volunteer as a Radio Merit Badge counselor or get on the air in July to hand out contacts and conversation to the Scouts operating K2BSA at the National Scout Jamboree. It's a great time to introduce youth to the fun and adventure of Amateur Radio.

Figure 4 — The Amateur Radio Operator Rating Strip was introduced in 2012 and is available to all registered youth members and adult leaders who hold any valid Amateur Radio license.

Photos courtesy Boy Scouts of America.

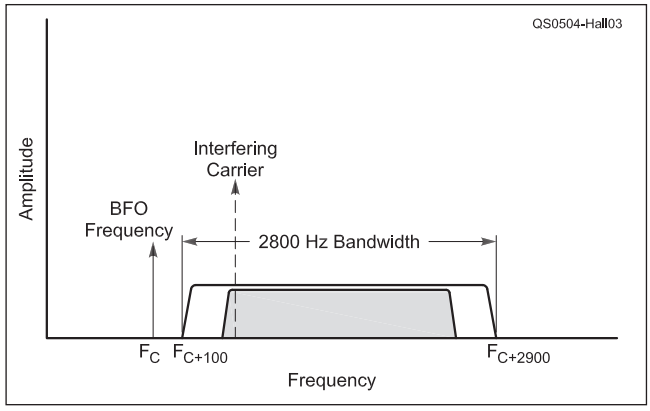
Jim Wilson, K5ND, an ARRL® member, works as director of communication services for the Boy Scouts of America. His volunteer role is chairman of the National Radio Scouting Committee. He publishes a weblog titled "My Radio Adventures" at **www.k5nd.net**. Jim can be reached at 2605 Valleywood Dr, Grapevine, TX 76051–6584, **jim.wilson@scouting.org**.

Straining to Hear: Why Filters are Our Friends

Transceivers offer many selectivity-enhancing filtering tools that help you to hear only the desired signal.

Rick Lindquist, WW1ME

Newcomers and seasoned radio amateurs alike may be confounded by the sheer number of filter adjustments on their transceivers. Receivers have long employed filters, primarily in intermediate frequency (IF) stages and sometimes in radio frequency (RF) and audio frequency (AF) stages. A more recent twist is *user-adjustable* IF and AF filters and designers continue to fine tune (pun intended) this technology through digital signal processing (DSP) techniques.



The USB signal shown above fits within the 2800 Hz passband of the filter. You can filter out the interfering carrier either by raising the low cutoff frequency of the filter or by using a notch filter to cut a "slice" from the passband.

In very general terms a filter blocks signals in one frequency range while allowing signals in another to pass to the receiver's next stage and ultimately to the operator's ears. You don't need to be conversant in the vagaries of the many filter families and their assorted kin to appreciate their practical value.

The Filterer on the Roof

Roofing filters are all the rage, with the innovation being the ability to choose from among several roofing filters that are narrower than the typical 15 or 20 kHz roofing filter. A roofing filter acts much like a flow constrictor on a shower head. Narrowing a receiver's passband ahead of its 1st IF stage reduces the impact of interfering signals on the signal you're trying to pull out, especially when the band is busy (think Field Day). Some narrow roofing filters take the IF passband down to 3 kHz (for SSB) and even to 300 Hz (for CW). The difference can be dramatic in reducing overall "band noise" as well as interference from nearby signals. Inrad (**www.inrad.net**) offers roofing filter modifications for many current and older transceivers.

Monoliths, Passbands, Shape Shifters and Black Boxes

Ham transceivers once employed monolithic IF filters, usually quartz crystal, sometimes mechanical. Today's DSP filters have revolutionized receiver design. Instead of a fixed-bandwidth IF filter of, say, 6 kHz, 2.8 kHz or 500 Hz, DSP offers continuously variable IF selectivity that many — but not all — consider superior to that of crystal filters. Most transceivers let you set up a few favorite DSP filters for SSB or CW, avoiding the expense of equipping two IF stages with crystal filters.

Even before DSP, an IF SHIFT control was a common transceiver feature. Some transceivers offer dual or twin passband tuning controls that afford greater flexibility. A basic IF SHIFT control slightly shifts the IF center frequency up or down, narrowing the passband to avoid adjacent signal interference. Dual or twin passband tuning goes a step further, letting you cut *both* sides of the passband as necessary, in essence narrowing the filter setting.

An adjunct to passband tuning is the adjustable notch filter. Most transceivers offering a DSP notch filter include automatic and manual notches. Today an effective notch filter can eliminate interference from a nearby (sometimes very nearby) station and newer transceivers even let you set the notch bandwidth. A notch filter also can assist in filter *shaping*, helping you pull out signals in the presence of noise or other factors, not just interfering signals. Experiment with yours to get a feel for it.

Many newer transceivers with DSP filtering let you shape the "shoulders" of your filter settings to "sharp" or "soft." This can make a subtle difference in the timbre of the signal reaching your ears but has scant effect on interference. A "soft" setting may ameliorate certain noise profiles, however.

External "black boxes" such as the MFJ-784B tunable DSP filter (**www.mfjenterprises.com**) provide narrowing, notching and even signal peaking capabilities at baseband AF level and can be nearly as effective as built-in IF-level DSP filters. These accessories can be valuable add-ons for older transceivers that lack the sort of IF and AF filter flexibility DSP can provide. IF-level DSP filtering offers distinct advantages, though, in part because it's done before extensive signal processing has already occurred.

Caveats

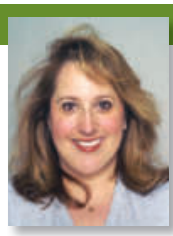
Filtering a signal into a passband that's tighter than the signal's original bandwidth (think narrow SSB filters) will alter the sound of the audio. The greater you squeeze, the more you'll roll off (attenuate) the low frequency components of the audio waveform. This will make the audio sound "thinner" but also may eliminate the impact of nearby interference.

IF shift and passband tuning may prove more effective in CW or PSK31, owing to the narrow bandwidths of those modes, but they can help to fend off nearby interference in SSB too. Using either of these IF adjustments is likely to alter the tone of the received audio and can make it "muddy."

This is just an overview of filters. For a more detailed description of filters and their design, see the "RF and AF Filters" chapter of the *ARRL Handbook*.[1]

[1]Available from your ARRL dealer or from the ARRL Store, ARRL order no 4197 or 4050. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

Rick Lindquist, WW1ME, is the Managing Editor of *NCJ* and can be reached at **ww1me@arrl.org**.



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

FCC Again Denies ARRL's *Petition* in BPL Proceeding

Though BPL is both a commercial failure and a proven interference source, the FCC remains unwilling to adopt rules sufficient to protect licensed radio services.

On April 16, the FCC issued a *Second Memorandum Opinion and Order*, denying the ARRL's December 2011 *Petition for Reconsideration* regarding the FCC's *Second Report and Order* that "fundamentally affirmed" its rules for Access Broadband over Power Line (Access BPL) systems. In denying the ARRL's *Petition*, the FCC noted that its previous rulings "strike an appropriate balance between the dual objectives of providing for Access BPL technology — which has potential applications for broadband and Smart Grid uses — while protecting incumbent radio services against harmful interference."

The ARRL made 14 principal points in its *Petition*, each of which was aimed at urging the FCC to enact additional rules that would permit BPL systems to operate without the severe interference potential inherent in BPL technology. The ARRL argued that the current rules do not address this severe interference potential, which was manifested in every deployment of BPL in which the safeguards urged by the ARRL were absent. The FCC dismissed all of the ARRL's arguments, claiming that the ARRL "did not submit any new information," made "no new argument" or that it had, in the Commission's view, failed to make its point.

In 2004, the FCC adopted rules for Access BPL systems, and on reconsideration sought by the ARRL and others, it reaffirmed those rules two years later. In 2007, the ARRL challenged these same rules in the US Court of Appeals for the District of Columbia; the Court found for the ARRL on two of its major points and remanded the rules to the FCC for reexamination. In July 2009, the FCC issued a *Request for Further Comment and Further Notice of Proposed Rulemaking* to address the issues remanded to them by the Court. In October 2011, the FCC issued a *Second Report and Order* (*BPL Second Order*) that "fundamentally affirmed" its rules for Access Broadband over Power Line (Access BPL) systems.

In its December 2011 *Petition for Reconsideration*, the ARRL maintained that the FCC's BPL rules failed to acknowledge the substantial interference potential of Access BPL systems relative to Amateur Radio HF communications, and repeated its previous request for full-time notching (frequency avoidance) of all amateur frequency allocations of at least 25 dB. If this was done, the distance extrapolation factor assumed for signal decay at distance from BPL-carrying power lines is of far less concern, though the ARRL expected the FCC to adopt a scientifically valid and supportable extrapolation factor.

One of the 14 points in the ARRL's *Petition* concerned BPL systems operated by International Broadband Electric Communications (IBEC). The FCC noted that in December 2010, the ARRL submitted a BPL interference complaint regarding some IBEC-operated BPL systems to both the FCC's Enforcement Bureau and the Office of Engineering and Technology. In February 2011, the ARRL submitted a request to the Office of Engineering and Technology to set aside IBEC's certification grants for their BPL equipment. In January 2012, IBEC announced it was closing.

"The ARRL argues that because no action has been taken on these complaints, the rules should require permanent notching of amateur frequencies since *post hoc* enforcement of interference issues is not adequate," the FCC stated in the *MO&O*. "We observe that over the years, the Commission has investigated and taken action on BPL complaints where it appeared that it was warranted. We notice that before the Commission could take action on ARRL's December 2010 interference complaint and February 2011 request regarding IBEC, IBEC had started the shut-down of all its BPL operations, making investigation of its operations as they related to the complaints moot. This anomalous case cannot be extrapolated to conclude that the Commission does not have the capability and/or readiness to enforce its BPL rules. To the contrary, the Commission has diligently investigated previous complaints about interference from BPL systems."

"The denial of our *Petition for Reconsideration*, some 16 months after it was filed, comes as no surprise, although some of the rhetoric the Commission resorts to in continuing to defend its wrong-headed promotion of the flawed BPL technology is disappointing," said ARRL Chief Executive Officer David Sumner, K1ZZ. "At one point, the Commission even goes to a dictionary to debate our use of the term 'ubiquitous' to describe amateur operation. More disturbing is that the Commission says the shutdown of IBEC's systems occurred 'before the Commission could take action on ARRL's December 2010 interference complaint,' rendering the complaint moot — but the shutdown did not occur until January 2012, more than a year later. Are the Commission's licensees supposed to wait until BPL operators become victims of their own financial failings before they gain relief from interference from unlicensed emitters that are operating in clear violation of the Commission's own rules?"

ARRL General Counsel Chris Imlay, W3KD, said that full time, mandatory notching of amateur bands to a notch depth not less than 25 dB was "the least that the FCC should have required in its rules, because interference prevention is possible; *post-hoc* remediation is not. In this instance, the FCC has not acted responsibly in its stewardship of the MF and HF radio spectrum. The ARRL will continue to vigilantly guard against the abuse and pollution of the radio spectrum in the use of BPL technology on a case-by-case basis as necessary, wherever necessary."

Radio Amateurs Provide Communication Support in Boston Marathon Bombings

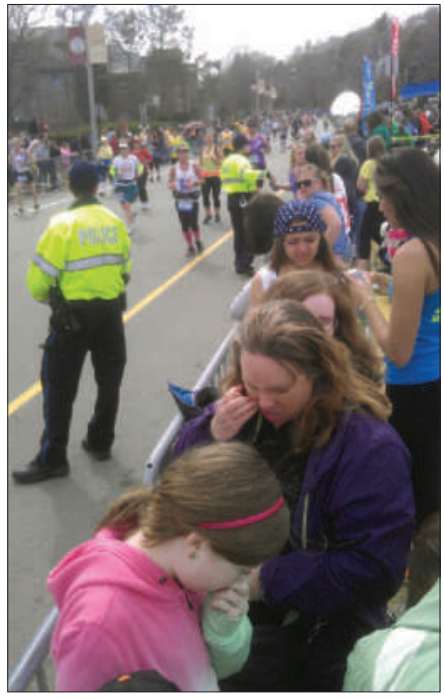
As has happened many times in years past, over 200 Amateur Radio operators participated in communications for the Boston Marathon on Monday, April 15, 2013. Unlike prior challenging situations such as very warm weather for the runners or other weather-related challenges, this year's marathon will be remembered for the bombings that took place at the finish line. Despite this heinous act, professional first responders, medical volunteers from the American Red Cross that staffed the route, and Amateur Radio operators performed magnificently in the face of adversity.

"Within minutes, cell phone systems became overloaded and making phone calls and text messages was difficult. Amateur Radio operators performed communication duties under duress and performed admirably. No Amateur Radio volunteers were injured on the course in this terrible act," said Steve Schwarm, W3EVE, who is the Amateur Radio Course Communication Coordinator and associated with a consortium of clubs and groups known as Marathon Amateur Radio Communications (MARC).

"At the finish line net control, which was only 400 feet from the initial blast, we heard the explosion. I poked my head outside to confirm what I thought it was and saw the white smoke. We immediately knew what had happened and commenced a roll call of all ham operators and medical tents. State Police authorities initially ordered us to lock down and post a ham for security watch outside the net control trailer. Thankfully none of our people were hurt," said Paul Topolski, W1SEX, Amateur Radio Finish Line Coordinator.

Following the explosion and roll call, Topolski stated that they began pulling together updates and sent the information via the Massachusetts Emergency Management Agency (MEMA) Web-EOC software tool and provided updates via Amateur Radio. Shortly after sending a few updates both Boston Police and Massachusetts State Police gave the order for the tent area to be evacuated. "In my mind, the course end of things is where a lot of work needed to happen as runners eventually needed to be stopped, congregated and transported to safety and staging areas," Topolski said. "At the finish line, our job was to check on the safety of our people, provide those initial updates and evacuate per police instructions. Three of our Amateur Radio operators redeployed to the Boston Marathon Course Net Control Center."

Across the course outside of the finish line after the bombings occurred, first aid stations were consolidated to larger first aid stations to pool runners for pickup and to keep runners warm as there were enhanced tents along the route where runners could be kept warm and hydrated. At the Heartbreak Hill first aid station, amateur operators had a complete base station setup, including a computer, and were prepared to handle health and welfare traffic as required. Several shelters were set up along the route at churches and schools, and Amateur Radio operators from secured first aid stations went to those shelters, providing communications in those areas until runners were moved out of their locations.



At mile 20 of the marathon, anxious spectators monitor their smartphones immediately after the explosion. [Phil Temples, K9HI, photo]

"My role at the request of Steve, W3EVE, as event organizer before the race was to shadow the course medical tent coordinator for the Red Cross, Kandi Finch," said Rob Macedo, KD1CY, who is also the Eastern Massachusetts ARES Section Emergency Coordinator. "It was a challenging position but all organizers on both the Amateur Radio side and Red Cross side said things went well in coordinating during normal race conditions and particularly after the bombings."

At course net control, which was away from the bombings, ham operators controlled their nets calmly and professionally while also expressing an appropriate level of urgency. Over a dozen amateurs at the net control center pooled together to announce messages and keep status of changes along the course route as required.

"Despite the total lack of warning in this situation, amateurs followed a creed I've long since preached since the 9/11 terrorist attacks and the mutual aid response to those attacks: 'blessed are the flexible for they will not get bent out of shape,'" said Steve Schwarm, W3EVE. "Amateurs on the course did what they had to do to assure their own safety and runner safety working with the Red Cross medical people. They did an outstanding job and I was told so by Red Cross organizers as well."

From an ARES perspective, a heightened state of awareness on the Boston Marathon event is typical, but within 15 minutes of the bombings, Eastern Massachusetts ARES Assistant Section Emergency Coordinator Carl Aveni, N1FY, issued an ARES Stand-By and requested that amateurs give availability for the next 24 hours. Within minutes, 20 amateurs offered their availability.

"In terms of having amateurs within ARES who cannot get directly involved in the marathon, we have a process where we have them monitor in case of a situation like what occurred on Monday. That process paid off and facilitated a rapid response to our request for possible additional support," said Aveni. — *by MARC Amateur Radio Finish Line Coordinator Paul Topolski, W1SEX; MARC Amateur Radio Course Communication Coordinator Steve Schwarm, W3EVE, and ARRL Eastern Massachusetts Section Emergency Coordinator Rob Macedo, KD1CY*

ARRL Meets with FEMA Administrator Craig Fugate, KK4INZ

Federal Emergency Management Agency (FEMA) Administrator Craig Fugate, KK4INZ, met with ARRL leadership at FEMA Headquarters in Washington, DC in March. Fugate, an ARRL member, spoke with ARRL President Kay Craigie, N3KN, and ARRL Chief Executive Officer David Sumner, K1ZZ, as well as ARRL General Counsel Chris Imlay, W3KD, and ARRL Emergency Preparedness Manager Mike Corey, KI1U, about Amateur Radio's role in public service and disaster communications.

Fugate wrote on his blog about the meeting: "For those of you that are not familiar with Amateur Radio, or ham radio as it is sometimes referred, it is the use of certain radio frequencies as a hobby, to exchange non-

ARRL leadership traveled to Washington, DC in March to meet with FEMA Administrator Craig Fugate, KK4INZ. From left to right: ARRL General Counsel Christopher Imlay, W3KD; ARRL Chief Executive Officer David Sumner, K1ZZ; ARRL Emergency Preparedness Manager Mike Corey, KI1U; ARRL President Kay Craigie, N3KN; FEMA Administrator Craig Fugate, KK4INZ, and FEMA Chief Technology Officer Ted Okada, K4HNL. [Photo courtesy of Craig Fugate, KK4INZ]

commercial messages, as a tool for education and experimentation and for public service community activities, including assisting in emergency communications. As a radio amateur, I enjoyed talking with [the ARRL] about the contributions that hams can make in times of disaster 'when all else fails.'"

Fugate also mentioned that he was looking forward to ARRL Field Day, calling it "a great event to encourage first responders and citizens to think about how to prepare for disasters and how to develop a plan for themselves and their communities. And perhaps it will inspire more to consider this great hobby that also has a long and legendary history of public service to the nation."

FCC Chairman Julius Genachowski, FCC Commissioner Robert McDowell to Step Down

FCC Chairman Julius Genachowski and FCC Commissioner Robert McDowell have both announced that they will soon leave the Commission. McDowell announced his resignation during the FCC's open meeting on March 20, while Genachowski made his announcement in remarks to FCC staff on March 22.

Genachowski was nominated by President Barack Obama to lead the Commission in June 2009. McDowell was appointed by President George W. Bush in 2006 and reappointed by President Obama in 2009. Both commissioners' terms are up later this year. Neither Genachowski nor McDowell has announced their post-Commission plans.

In his announcement, Genachowski noted that during his term as Commissioner, the FCC heavily promoted broadband connectivity for all Americans, auctioned and adjusted spectrum, guarded against digital threats, strengthened cybersecurity, enforced rules and regulations, adopted rules "to preserve Internet freedom and openness" and more.

McDowell announced that "[a]fter nearly seven years of carrying out the incredibly high honor of serving the American people at the FCC, it is time to turn more of my energies towards an even higher calling: serving my family. After a great deal of deliberation, I have decided that I will step down as a commissioner of the Federal Communications Commission in a few weeks."

The departure of Genachowski (a Democrat) and McDowell (a Republican), leaves Mignon Clyburn and Jessica Rosenworcel as the FCC's Democrats, and Ajit Pai as its sole Republican, giving Democrats a 2 to 1 voting advantage. Only three commissioners at a time may be members of the same political party. With two seats open on the FCC, the Obama Administration could advance a Republican and a Democratic nominee simultaneously, as it did with Pai and Rosenworcel in 2012.

FCC Chairman Julius Genachowski

FCC Commissioner Robert McDowell

FCC Grants ARRL's Request for Temporary Waiver for TDMA Systems

Acting upon a request by the ARRL, the FCC issued an Order (WT Docket No, 12-283) on March 25, granting a temporary waiver to transmit communications on amateur service channels above 30 MHz using single time-slot Time Division Multiple Access (TDMA) systems. The temporary waiver was granted pending the reso lution of a related rulemaking proceeding (RM-11625).

Currently, amateur stations are authorized to transmit messages using telephony and data emissions. The ARRL noted in its request that Amateur Radio Service licensees have recently established numerous narrowband repeater facilities using multiple time-slot TDMA repeaters and single-slot TDMA handheld digital transceivers in the 70 centimeter (420-450 MHz) band, but Part 97 as it currently stands does not permit amateur stations to transmit single-slot TDMA emissions on Amateur Radio Service channels above 30 MHz.

The FCC stated in its Order that the purpose of specifying emission designators for the Amateur Radio Service "is to relegate the transmission of certain inharmonious emission types to different segments of the frequency bands, while still allowing great flexibility in the types of emissions that may be transmitted by amateur stations." In granting the temporary waiver, the FCC agreed with the ARRL, noting that the digital systems that radio amateurs have recently implemented are "compatible with existing amateur repeater channelization plans."

The FCC also noted that allowing FXE and F7E as phone emissions and emission type FXD as a data emission "is unlikely to result in inharmonious emission types being used in the same segments of the frequency bands. We also conclude that allowing amateur stations to transmit these emission types is consistent with the basis and purpose of the amateur service, specifically to continue to contribute to the advancement of the radio art. We conclude that good cause has been shown for temporary waiver of Section 97.3(c)(5) to allow amateur stations to transmit emission types FXE and F7E as a phone emission and Section 97.307(f)(8) to allow amateur stations to transmit emission type FXD as a data emission. We therefore waive these rules accordingly, conditioned on the outcome of the pending rulemaking proceeding."

Rick Palm, K1CE, k1ce@arrl.org

State of the National Traffic System: A View from Within

Ham radio's transcontinental workhorse still pulls its weight.

George Hart, W1NJM (SK), would have been both pleased and concerned about the condition of the National Traffic System (NTS) as it moves into its 63rd year of continuous operation. As principal NTS architect on the League staff, Hart struggled in the beginning with too few proficient operators, poor band conditions in the summertime, motivated but inadequately trained volunteer leaders and some early organizational "adjustments." Today, it is a proven system that continues to function in the 21st century. So, what is the current state of the NTS?

Robert Griffin, K6YR, at his post, ready to move traffic. [Photo courtesy Robert Griffin, K6YR]

ARRL Support and Management

Management of the NTS is unique among ARRL® volunteer programs because it is bifurcated. The long haul aspects (Region, Area and Transcontinental Corp) are managed by a national leadership structure consisting of three area (Eastern, Central and Pacific) *elected volunteer* staffs, each of which is headed by an *elected* chairperson. The local and section aspects are managed within the ARRL Field Organization under the section manager and section traffic manager. The area staffs run NTS functions at the region, area and inter-area levels, and rely on the section level for delivery outlets, originations and message handling/net training; the section level looks to the higher echelons to route messages effectively over the long haul and hone operator skills.

This sense of mutual reliance extends to the support role that the NTS can play for the ARES® program. There is considerable evidence that the ARES community too often views its disaster response role as limited to tactical communications within the section. That view leaves little or no support role for the NTS to provide health and welfare message services. This is an old issue and one that needs attention.

NTS Moves into the 21st Century

Message handling through the NTS increasingly makes use of the efficient digital modes (primarily PACTOR), particularly on the longer-haul circuits, while CW, SSB and FM retain their value across the NTS levels.

Area staff chairs have promoted the work of League-designated committees in developing a robust national messaging platform to support ARES, and thereby served agencies (as a supplement to traditional NTS functions). Termed "Radio E-mail," this platform relies on the Winlink 2000 (WL2K) global network (**wx4j.com/MDCWL2KOVwAM.htm**), NTS-designated section "target stations" and practical protocols. This will be a powerful platform as the NTS moves further into the 21st century.

Routine Messages

A high volume of routine radiograms has taken the place of third-party messages as the crux of the NTS workload. This shift is causing considerable angst among those who perceive the system as a diminished public service program. Yet, even such "common-text" traffic, originated in proper radiogram format and accurately relayed and delivered, using accepted methods and practices, represents a valuable exercise of both the operator and the system. Further, the volume of this traffic does test, to a degree, the capability of NTS facilities.

Taking a Measure of NTS

Here is a sampling of my findings from an anecdotal survey of NTS activity:

- Functioning local and section nets (and resulting outlets for message deliveries) vary widely across the country. "No outlet" service messages are common.
- Several region nets are inactive for the primary operational cycles and some region nets function more as "wide-area" nets for lack of active section nets or operators to serve as liaison to/from those nets.
- There remains a cadre of top-flight, dedicated operators (who take on multiple duties), but operator proficiency is uneven and probably not progressing. Too few well-conceived training programs and trainers exist, although there is much material on the Internet.
- While many sections have active NTS nets and participants, others have little or no activity or knowledgeable leadership. This is not a static condition, since a change in section leadership often prompts a renewal of activity and participation.
- Net managers, Transcontinental Corp directors and digital coordinators are continually challenged to find operators to take and keep assignments on a scheduled basis.

Message Passed...

George Hart, W1NJM, the chief developer of the National Traffic System (NTS), passed away Sunday, March 24. He was 99. Hart first announced the National Traffic System in an article in the September 1949 issue of *QST*.[1] In his article he outlined the new national system: "During 1948, practically every section in the ARRL field organization had a net of some kind going and 47 sections had nets devoted exclusively to traffic handling. If, in each section net, a certain station (or stations) was designated to take all traffic going outside the section, this station then to report into a later net having greater coverage, and the same procedure repeated funneling into still greater coverage areas, we would have a traffic organization of national scope capable of handling traffic to (and from) any point in the entire field organization, which includes the entire United States, most of its Possessions and most of Canada.

"This in briefest outline, is the essence of the ARRL National Traffic Plan. It takes the already-existing section net as a unit and makes two larger unit categories, which are called 'regional' and 'area' nets. Each regional net covers a certain number of section nets (normally those within a certain call area) and each area net covers a certain number of regional nets (normally those within a time zone). The area nets, of which there are four (one for each time zone), pass traffic around among themselves and it then comes back down through regional and section nets again *in the same evening*. This requires organization and teamwork of no small dimensions, but it will work if we get together on it and push."

For any traffic handler, there is a must-read article in the September 1999 issue of *QST*.[2] I wrote it after interviewing Mr Hart at his home in Newington. I will always remember his graciousness and that I was in the presence of a giant. — *K1CE*

[1]G. Hart, W1NJM, "New National Traffic Plan," *QST*, Sep 1949, pp 50-51, 96, 98.
[2]R. Palm, K1CE, "Golden Anniversary: A Look at Fifty Years of the National Traffic System," *QST*, Sep 1999, pp 50-53.

- Section traffic managers are finding it difficult to appoint qualified operators as net managers or other station appointments.

- There is some breakdown in delivery reliability (not just lack of outlets); relaying accuracy suffers and response to handling instructions is inconsistent.

Yet on the whole, the system circuits stay open. George Hart could have related! — *NTS Pacific Area Staff Chair Robert Griffin, K6YR*

Tennessee Leads Major Interoperability Exercise for Earthquake Awareness Month

In February, the Tennessee Emergency Management Agency (TEMA) conducted an exercise in conjunction with the Central United States Earthquake Consortium's (CUSEC, **www.cusec.org**) Earthquake Awareness Month. This one day exercise tested TEMA's ability to communicate with other CUSEC member states and other agencies in the aftermath of a moderate to major earthquake in the New Madrid Seismic Zone (NMSZ).

The exercise featured both HF voice and the Winlink 2000 Radio E-mail system (**www.winlink.org**). "This was the most interoperable communications exercise any of us have witnessed to date," said Steve Waterman, K4CJX, Winlink 2000 network administrator. "Amateur Radio, the three branches of the Military Auxiliary Radio System (MARS) and other auxiliary communications volunteers worked side by side with agencies at all levels including non-governmental organizations (NGOs) such as AT&T, FedEx, Southern Baptist Disaster Relief, the Red Cross and the Bridgestone Emergency Response Team. For an eight state exercise in four FEMA regions, it went perfectly," he added.

The simple scenario was an earthquake and loss of normal infrastructure. The purpose of this short exercise was to demonstrate the capabilities of HF Winlink 2000 and HF voice communications to TEMA from other states, local agencies and volunteers using no infrastructure other than operators' radio systems and the Internet outside the simulated area of destruction.

This 1 day exercise tested TEMA's ability to communicate...in the aftermath of a moderate to major earthquake...

TEMA EOC operators set up four positions: two Winlink kits with HF voice capability, one logging position and one backup position. To start, the eight CUSEC state EOCs sent short Winlink messages to TEMA over HF radio. Then, agency and individual participants sent Winlink messages. Messages identified the agency, the operator and the equipment used. The TEMA EOC acknowledged all messages sent on both Winlink and by e-mail.

In the early afternoon, the eight-state ALL-MARS CUSEC voice net was held on frequencies in the MARS bands. Seventy-eight stations checked into the net representing all eight CUSEC states.

Exercise Analysis

The exercise exceeded objectives and expectations. Winlink messages were received from the state EOCs in Kentucky, Illinois, Missouri, Alabama, Arkansas and Mississippi. The North Carolina state EOC also sent a message of support. Winlink messages were received from 12 National Guard stations in Kentucky and Tennessee. Messages were also received from multiple hospitals, local governments, state agencies, homeland security districts, NGOs, the Center for Earthquake Research and Information and numerous individuals with personal Winlink drop kits.

Although the MARS HF Winlink system was the primary service, the Amateur Radio HF system, and the MARS and amateur packet systems were also used effectively. Some aspects of interoperability that were demonstrated:

- EOCs, NGOs, the National Guard, MARS and individual hams were able to communicate with complete interoperability via Winlink.

- PACTOR, WINMOR (Winlink Message Over Radio) and packet radio modes were integrated seamlessly, achieving interoperability regardless of the protocol or the use of VHF, UHF or HF frequencies.

- Time independence was shown by messages being sent without requiring simultaneous radio operation at the receiving site.

Participants realized the parallel value of voice communications for command and control. The exercise also helped prepare participants for the CAPSTONE-14 multi-state exercise (**www.cusec.org/plans-a-programs/capstone14/173**) scheduled for this month; communications is one of its major focal points. — *David Wolfe, WA4VVX/NNNØBAN, Chief of Communications, Tennessee Emergency Management Agency*

Contest Corral – June 2013

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

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

Start - Finish Date-Time		Date-Time		Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
1	0000Z	2	2400Z	28 / -	Ten-Ten Open Season	Dig	Call, name, S/P/C, member numbers	www.ten-ten.org
1	0400Z	2	See web	3.5-28 / -	Digifest	Dig	RST and grid square	www.mixw.net/misc/DigiFest/index.html
1	1100Z	1	1500Z	14 / -	LZ Open 20 Meter Contest	CW	6-digit serial and serial from previous QSO	www.lzopen.com
1	1200Z	1	2359Z	1.8-28 / 50,144	Maritime QSO Party	Ph CW	Maritime county or S/P/C	www.maritimecontestclub.com
1	1200Z	2	1200Z	3.5-28 / -	SEANET Contest	Ph CW	RS(T), serial	www5.big.or.jp/~ja1rju/flash_seanet-2013_doc.html
1	1300Z	2	1300Z	- / 50	UKSMG Sporadic E Contest	Ph CW Dig	RST, member nr, 6-char grid locator	www.uksmg.org
1	1500Z	2	1459Z	1.8-28 / -	IARU Region I Field Day	CW	RST, serial	IARU society websites
1	1500Z	2	2359Z	- / 50	Six Meters World Wide Club Contest	Ph CW Dig	Call sign, grid square, member number	www.6mt.com
1	1600Z	2	0400Z	1.8-28 / -	Alabama QSO Party	Ph CW	RS(T) and AL county or S/P/C	www.alabamaqsoparty.org
3	1600Z	3	See web	3.5 / 50, 144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
4	0200Z	4	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C and power	www.arsqrp.blogspot.com
7	0230Z	7	0300Z	1.8-14 / -	NS Weekly Sprint	CW	Serial number, name, S/P/C	www.ncccsprint.com
8	0000Z	9	2359Z	1.8-28 / -	WFF Green Days	Ph CW Dig	RS(T) and WFF number if available	www.wff44.org
8	0000Z	9	See web	3.5-28 / -	DRCG Long Distance Contest	Dig	RST, CQ Zone and UTC time	www.drcg.de
8	0600Z	9	0600Z	3.5-28 / -	Australian Shires Contest	Ph CW	RS(T) and VK Shire or CQ Zone	groups.yahoo.com/group/vkshires
8	1100Z	8	1300Z	14-21 / -	Asia-Pacific Sprint	Ph	RS and serial	jsfc.org/apsprint/aprule.txt
8	1200Z	9	1200Z	3.5-28 / -	Portugal Day	Ph CW	RS(T) and serial or district code	portugaldaycontest.rep.pt
8	1500Z	9	1500Z	3.5-28 / -	GACW WWSA CW DX Contest	CW	RST, CQ zone	www.wwsatest.org
8	1600Z	9	1600Z	- / 50	REF DDFM Six Meter Contest	Ph CW	RST, serial number, grid square	concours.ref-union.org
8	**1800Z**	**10**	**0300Z**	**- / 50+**	**ARRL June VHF Contest**	**Ph CW Dig**	**Grid square**	**www.arrl.org/contests**
12	0030Z	12	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C and NAQCC mbr nr or power	naqcc.info
12	1300Z	13	See web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
15	0000Z	16	2400Z	- / 2.3G	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org
15	0000Z	16	2400Z	1.8-28 / -	All-Asian DX Contest	CW	RST, operator age (YL may send 00)	www.jarl.or.jp/English
15	0000Z	16	2359Z	- / 50	SMIRK QSO Party	Ph CW	Grid square and member number	www.smirk.org
15	1500Z	16	1500Z	1.8 / -	Stew Perry Warmup Contest	CW	4-char grid square	www.kkn.net/stew
15	1500Z	16	See web	1.8-28 / -	QRP ARCI QRP Shootout	Ph CW	RST, S/P/C, power or QRP ARCI number	www.qrparci.org/contests
15	1600Z	16	0200Z	3.5-28 / -	West Virginia QSO Party	Ph CW Dig	RS(T), WV county or S/P/C	www.qsl.net/wvsarc
15	**1800Z**	**15**	**2400Z**	**3.5-28 / -**	**Kids Day**	**Ph**	**Name, age, location, favorite color**	**www.arrl.org/kids-day**
15	2000Z	15	2200Z	28 / -	Feld-Hell Field Day Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
16	0900Z	16	1500Z	- / 50	WAB 50 MHz Phone	Ph	RS, serial, WAB square or DXCC entity	www.worked-all-britain.co.uk
17	0100Z	17	0300Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
20	0000Z	24	0000Z	1.8 / -	SARL Top Band QSO Party	Ph CW	RS(T) and province or country	www.sarl.org.za
20	0030Z	20	0230Z	3.5-14 / -	NAQCC Milliwatt Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
22	1200Z	23	1200Z	1.8-28 / -	His Majesty King of Spain	Ph	RS, serial or EA province	www.ure.es
22	1400Z	23	1400Z	1.8-28 / -	Marconi Memorial HF Contest	CW	RST and serial number	www.arifano.it/contest_marconi.htm
22	**1800Z**	**23**	**2100Z**	**1.8-28 / 50+**	**ARRL Field Day**	**Ph CW Dig**	**Category, ARRL/RAC section or DX**	**www.arrl.org/contests**
29	0000Z	30	2400Z	- / 3.4G	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org
29	0000Z	29	2359Z	1.8-28 / -	Full Day of Hell	Dig	RST, S/P/C, Feld-Hell mbr nr, 4-char grid square	www.feldhellclub.org

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

An Introduction to VHF+ Contesting

Try operating in this month's June VHF contest!

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

When most Amateurs think of contesting, visions of giant stacks of HF Yagis fill their heads. Yet the portion of the radio spectrum above 50 MHz offers competitive radio opportunities that have elements of HF without the giant stacks, and VHF propagation that can be radically different!

VHF+ contesting's basic premise is the same as its HF counterpart: work as many different stations on as many different bands in as many different places as possible during the contest period. The two most-used bands during a VHF+ contest are 6 meters and 2 meters; both bands can be found on most of the all-in-one radios sold today. SSB and CW are the most common modes used, but there's FM activity too.

VHF+ contests use Maidenhead grid squares as part of the exchange. The Earth is divided into "grid squares" that are 1 degree of latitude high by 2 degrees of longitude wide (roughly 64 × 128 miles). These are grouped into a cluster of 100 called a *grid field*. Operating from a rare grid square during a VHF+ contest is easy and a lot of fun when you're the sought-after DX! For complete information on grid squares, visit **www.arrl.org/grid-squares**.

Band Layout

Both 6 and 2 meters have a CW/SSB calling frequency (50.125 MHz and 144.200 MHz, respectively). Feel free to use the calling frequency to solicit QSOs, but keep in mind that it's considered bad form to sit on the calling frequencies all weekend during a contest. Six meter FM operators should listen to 52.525 MHz. Note that the 2 meter national simplex frequency, 146.520 MHz, is not allowed for contest use.

On 6 meters CW is used from 50.080-50.100 MHz, and SSB from 50.125 all the way up to 50.300 MHz (higher if the band has a big opening). Between 50.100 and 50.125 MHz is the DX window. This window is for CW/SSB QSOs between DX stations and stations in the US/Canada. (Do not make domestic QSOs in the DX window.) *CW and SSB are used in the DX window*.

Two meter SSB/CW activity will be between 144.170 and 144.230 MHz, with activity focused around 144.200.

You don't need large antennas to enjoy a VHF contest! Stu Turner, WØSTU, had great fun in the 2011 ARRL January VHF Contest with a 6 meter dipole and a small dual-band Yagi for 144 and 432 MHz. Of course, his location at the top of Mount Herman in Colorado helped his QSO rate! [Stu Turner, WØSTU, photo]

Propagation

The two most common forms of enhancement you'll encounter on the VHF+ bands are *sporadic E* and *tropospheric ducting*. Sporadic E becomes possible when charged particles clump together and become dense enough to reflect radio signals. Its name is very descriptive: it occurs in the E layer of the ionosphere and is unpredictable. It is most common during the months of May-August, centered around the summer solstice in June. Single-hop openings can allow communications between 700-900 miles. If E_s "clouds" are positioned properly, multiple hops can occur, allowing QSOs around 1300-1500 miles. Openings can last from a few minutes to several hours.

Tropospheric ducting occurs in the troposphere. It will affect 2 meters and up. It's most associated with warm, cloudless days brought on by high pressure weather systems. Because of the correlation to high pressure, tropospheric ducting can be predicted fairly reliably. Check for good "tropo" about an hour before sunrise and just after sunset.

Entry Classes

You can enter a VHF+ contest in one of three basic classes: Fixed station, a low-power Portable station, or as a Rover. Fixed stations (such as your home, club station or a campground) operate from a single spot for the entire contest and can run high power if you wish. A Portable station does not operate from a location where Amateur Radio normally takes place (such as your home or club). These stations are limited to 10 W PEP but you can operate anywhere you can transport your gear, such as a hilltop or mountain. This is a great class for backpackers. Being a Rover means you can operate from your vehicle from more than one grid square. If you like the combination of a road rally with a radio contest, roving might be for you. See the rules for complete details.

New for 2013 are two single operator, fixed-station entry classes aimed at VHF contesting newcomers: 3 Band and FM Only. Single operator 3 band, "SO3B," allows 100 W on 6 and 2 meters, plus 50 W on 70 centimeters. This is a perfect category for those with an all-in-one rig. You can operate from home, from a campground, from a hilltop, a parking garage, or wherever you can set up some antennas. Single operator FM, "SOFM," allows 100 W on 6 meters – 70 centimeters, with all QSOS using FM only (hence the name).

Small Antennas

Because wavelengths at VHF frequencies are small, the antennas can be small, too. CW/SSB frequencies use horizontal polarization, while FM uses vertically polarized antennas. It's important to get the polarization correct; attempting to work FM QSOs with a horizontally polarized antenna can reduce your ability to hear stations (and be heard) by as much as 20 dB. A 6 meter dipole is less than 10 feet long and horizontal loops for 6 and 2 meters are easy to construct. If you want gain antennas, Yagis for VHF are much smaller than their HF counterparts.

VHF+ contesting offers rewards and challenges that HF contesting cannot. If you're looking to try something new, need a good activity for your club or public service group, or want to make the most of your Technician class license, VHF contesting is ready and waiting for you! Use that rig in this month's ARRL June VHF Contest; June 8-10, you'll be glad you did!

2012 ARRL November Phone Sweepstakes Results

The year that Ontario cracked up and split.

by Steve London, N2IC, n2ic@arrl.net

By all measures, Solar Cycle 24 has been less than stellar. Ol' Sol started really cranking for last year's Phone Sweepstakes, but just when we thought the solar flux was headed up-and-away, the sunspot cycle stopped dead in its tracks and the solar indices were nearly identical to last year's. However, that is actually a good thing for Phone Sweepstakes: 10, 15 and 20 meters were great in the daytime and 40 and 80 meters were great all night. The weather over North America was tranquil, too, resulting in low noise levels on all bands.

This was the first year since 2000 that the number of available multipliers increased — from 80 to 83, thanks to Ontario splitting into four new Radio Association of Canada (RAC) sections. With Ontario North (ONN) being the most thinly populated, there were fears of a difficult Clean Sweep. But as with the CW weekend, Ontario North was *not* the rarest section.

This was the second year for entries in the Single Op Unlimited Low Power and Multioperator, Low Power categories. The popularity of these categories has increased, now that there are "new" records to be broken and benchmarks to be set. As a result, we have 103 new section records and 28 new division records!

The New Clean Sweep

The splitting of Ontario into four RAC sections (Ontario North — ONN, Ontario South — ONS, Ontario East — ONE, and Greater Toronto Area — GTA) created new challenges for earning a Clean Sweep. By working at least one station in each of the 83 sections, 329 participants made the grade. For a number of entrants, this was their first Clean Sweep. KØKR (operating as K7KU), who has been operating Sweepstakes since 1963, commented that this was his first sweep on both modes in the same year.

104 more operators came so close, missing by just one section. It looked like Ontario North would be the most challenging section, but no....it was Ontario East with 17 missed sweeps! What's the story there? ONE contains Ottawa, the Canadian capital and fourth largest city. Seems those ONE-philes prefer CW to SSB. Next was the perennial toughie, Puerto Rico (12 missed sweeps). The third most difficult was the Virgin Islands (10 missed sweeps). For those of you still wondering "Where were these sections?" they were all well represented. Many thanks to VE3PUX, VE3KI, VE3AAQ, VA3NW, VE3IAE, VE3DVY, NP4G, NP4A, WP3GW, KP4/KH2RU, WP2Z and NP2X. Special thanks also to Northwest Territories stalwarts VY1EI, VE8GER and VE8NSD.

Who was the first to earn a Clean Sweep? That honor goes to team W2FU, who made the sweep in the Multioperator, High Power category at 0118Z. Their last section was San Francisco. Just five minutes later, team K1LZ completed their sweep, working Quebec. The first single operator to make the Clean Sweep was WB2ZAB, working Virgin Islands at 0307Z.

Close Races

Intra-section rivalries have been part of Sweepstakes since the very beginning, resulting in very close races. Sometimes, the photo finishes are completely accidental and the participants didn't even know their competition was going to be active. 2012 was no exception.

In what has to be an amazing coincidence, Alec, W2JU, was again part of the closest section race, just as he was in 2011. Alec changed to the Single Op, High Power category this year, beating Jack, W1WEF, by a single contact for the Connecticut title. Alec and Jack both operated only 12-13 hours, so there was plenty of opportunity for either of them to take a commanding lead.

Only two QSOs separated the South Texas Georges, NR5M and K5TR, in the Single Op, High Power category. Nationally, this put NR5M in the #4 slot and K5TR in #5. K5TR had what appeared to be a solid 32 QSO lead with 2 hours left in the contest. It was George versus George on 40 meters to the end but NR5M simply had a better frequency and better rate to finish up the contest.

In the Illinois Single Op, High Power category, Matt, KB9UWU operating at WR9D, beat Craig, K9CT by 10 contacts. Congratulations, Matt! Colorado also had a close race in the Single Op, Low Power category, with Tom, NØGOS finishing just 11 contacts ahead of Shel, KFØUR. These weren't the only close races. Details of all the section close races can be found in the table "Close Races."

Single Op, High Power Category (SOHP)

Almost every year, Single Op, High Power is the most competitive of the six Sweepstakes

Accuracy Honor Roll (Minimum of 400 QSOs)

Call	# QSOs	Category	Error Rate (%)
K1OW	410	SOLP	0.2
W3WC	460	SOHP	0.4
N4BP	1469	SOHP	0.5
KE8FO	408	SOLP	0.5
VE5MX	755	SOUHP	0.5
WA8ZBT	612	SOLP	0.5
VA7RR	1392	SOLP	0.6
AB2KX	405	SOHP	0.7
N4CW	417	SOHP	0.7
N4VA	416	SOULP	0.7
K4IVF	565	SOHP	0.7
NUØQ	543	SOULP	0.7
VE3RCN	713	SOLP	0.7
W1MA	683	SOUHP	0.7
W2JU	602	SOHP	0.7
AB4GG	936	SOUHP	0.8
N9IO	651	SOUHP	0.8
NDØC	527	SOQRP	0.8
NK8Q	469	SOQRP	0.8
WD9CIR	1202	MH	0.8
AE7AP	434	SOLP	0.9
K3TN	426	SOHP	0.9
KDØS	781	SOQRP	0.9
KH6CJJ	445	SOLP	0.9
N1YX	552	SOHP	0.9
N3AFT	645	MH	0.9
N4HXI	418	SOULP	0.9
N8SNM	1211	SOUHP	0.9
N9TF	439	SOULP	0.9
VE2AWR	432	SOLP	0.9
VE3KI	642	SOHP	0.9
VE6BBP	947	SOHP	0.9
WDØECO	645	SOUHP	0.9

Close Races

Winner	Runner-Up	Section	Category	Margin of Victory (#QSOs)
NØGOS	KFØUR	CO	SOLP	11
K1KG	WC2W	EMA	SOLP	30
K2UF	K2XA	ENY	SOLP	21
WQ5L	AE5BR	MS	SOLP	21
W2JU	W1WEF	CT	SOHP	1
WR9D	K9CT	IL	SOHP	10
NR5M	K5TR	STX	SOHP	2
K4OV	W4MR	NC	MH	33
W3LL	N3RR	MDC	UH	28

Sponsored Plaque Winners

ARRL is pleased to award a Sweepstakes plaque to the Overall and Division Leaders in each entry category, thanks to Icom America and numerous clubs and individuals who sponsor these awards. For more information on plaque sponsorship or to order a duplicate plaque, contact ARRL Contest Branch Manager Sean Kutzko, KX9X at (860) 594-0232 or **kx9x@arrl.org**. Plaques cost $75, which includes shipping charges.

Division/Category	*Plaque Sponsor*	*Winner*
Overall		
Single Operator High Power Phone	Don Lisle, K6IPV	VY2ZM
Single Operator Low Power Phone	ARRL Contest Branch — Ken Adams, K5KA Memorial	KH6LC (NH6V, op)
Single Operator QRP Phone	QRP Amateur Radio Club International	KDØS (WDØT, op)
Single Operator Unlimited High Power Phone	Icom America	K4XS
Single Operator Unlimited Low Power Phone	Icom America	W4AAA (KK9A, op)
Multioperator High Power Phone	Icom America	W6YI
Multioperator Low Power Phone	Icom America	K3JD
School Club Phone	David Brandenburg, K5RQ	W6YX
Atlantic		
Single Operator High Power Phone	North Coast Contesters	W2RE
Single Operator Low Power Phone	Potomac Valley Radio Club	WB2WPM
Single Operator QRP Phone	Icom America	NK8Q
Single Operator Unlimited High Power Phone	Icom America	N2MM
Single Operator Unlimited Low Power Phone	Icom America	K3MD
Multioperator High Power Phone	Mark Sickmeyer, KB3GJ Memorial	W2FU
Multioperator Low Power Phone	Icom America	K3JD
School Club Phone	Icom America	K2CC
Central		
Single Operator High Power Phone	Society Of Midwest Contesters	AA9A
Single Operator Low Power Phone	Society Of Midwest Contesters	WT9U
Single Operator QRP Phone	Sean Kutzko, KX9X	N9NE
Single Operator Unlimited High Power Phone	Icom America	N2BJ
Single Operator Unlimited Low Power Phone	Icom America	W9IU
Multioperator High Power Phone	Icom America	WD9CIR
Multioperator Low Power Phone	Icom America	W9QL
School Club Phone	Icom America	N9GTC
Dakota		
Single Operator High Power Phone	Minnesota Wireless Association	NEØU
Single Operator Low Power Phone	Minnesota Wireless Association	NØKK
Single Operator QRP Phone	Tod Olson, KØTO	KDØS (WDØT, op)
Single Operator Unlimited High Power Phone	Minnesota Wireless Association	K1KD
Single Operator Unlimited Low Power Phone	Tod Olson, KØTO	KØAD
Multioperator High Power Phone	In Memory of Jim Dokmo, KØFVF Minnesota Wireless Association	NØGF
Multioperator Low Power Phone	Icom America	WØZF
School Club Phone	Tod Olson, KØTO	KØVVY
Delta		
Single Operator High Power Phone	Icom America	KØEJ
Single Operator Low Power Phone	Icom America	NA4K
Single Operator QRP Phone	Icom America	N5EE
Single Operator Unlimited High Power Phone	Icom America	W5WMU
Single Operator Unlimited Low Power Phone	Icom America	K2FF
Multioperator High Power Phone	Icom America	W5RU
Multioperator Low Power Phone	Icom America	KJ5FA
School Club Phone	Icom America	W5YM
Great Lakes		
Single Operator High Power Phone	Mad River Radio Club	K8AO
Single Operator Low Power Phone	Mad River Radio Club	WZ8T
Single Operator QRP Phone	Mad River Radio Club	KT8K
Single Operator Unlimited High Power Phone	Icom America	N8SNM
Single Operator Unlimited Low Power Phone	Icom America	KW8N
Multioperator High Power Phone	Icom America	W8BI
Multioperator Low Power Phone	Icom America	KC8PKY
School Club Phone	Icom America	W8SH
Hudson		
Single Operator High Power Phone	Icom America	N2NC
Single Operator Low Power Phone	Icom America	W2ID
Single Operator QRP Phone	Icom America	W2JRO
Single Operator Unlimited High Power Phone	Icom America	W2GDJ
Single Operator Unlimited Low Power Phone	Icom America	K2DFC
Multioperator High Power Phone	Icom America	KA2D
Multioperator Low Power Phone	Icom America	W2EF
School Club Phone	Icom America	No Entrant
Midwest		
Single Operator High Power Phone	Icom America	WAØN
Single Operator Low Power Phone	Society Of Midwest Contesters	KUØG
Single Operator QRP Phone	Icom America	KCØMO (KØOU, op)
Single Operator Unlimited High Power Phone	Icom America	NØXR
Single Operator Unlimited Low Power Phone	Icom America	NUØQ
Multioperator High Power Phone	Icom America	KØS
Multioperator Low Power Phone	Icom America	KBØVVT
School Club Phone	Icom America	KØHC
New England		
Single Operator High Power Phone	Icom America	NC1I (K9PW, op)
Single Operator Low Power Phone	Icom America	AE1P
Single Operator QRP Phone	QRP Club of New England	W1MR
Single Operator Unlimited High Power Phone	Icom America	WB1GQR (W1SJ, op)
Single Operator Unlimited Low Power Phone	Icom America	K1ZO
Multioperator High Power Phone	Icom America	K1LZ
Multioperator Low Power Phone	Icom America	WA1J
School Club Phone	Michael McKaughan, K1DM	W1AF

Division/Category	*Plaque Sponsor*	*Winner*
Northwestern		
Single Operator High Power Phone	Icom America	W7WA
Single Operator Low Power Phone	Icom America	N7XU (K4XU, op)
Single Operator QRP Phone	Barbara Yasson, AC7UH	NN7SS (K6UFO, op)
Single Operator Unlimited High Power Phone	Icom America	W7IJ
Single Operator Unlimited Low Power Phone	Icom America	KL2HD
Multioperator High Power Phone	Icom America	K7IR
Multioperator Low Power Phone	Icom America	KU7K
School Club Phone	Icom America	No Entrant
Pacific		
Single Operator High Power Phone	The Carroll Dean Jensen Memorial (K6CDJ)	WC6H
Single Operator Low Power Phone	Icom America	KH6LC (NH6V, op)
Single Operator QRP Phone	Icom America	K9YC
Single Operator Unlimited High Power Phone	Icom America	W7RN (WX5S, op)
Single Operator Unlimited Low Power Phone	Icom America	K7XC
Multioperator High Power Phone	Icom America	K6MMM
Multioperator Low Power Phone	Icom America	NZ6Q
School Club Phone	Icom America	W6YX
Roanoke		
Single Operator High Power Phone	Potomac Valley Radio Club	NN3W
Single Operator Low Power Phone	Raleigh Amateur Radio Society — W4DW	WA3OFC
Single Operator QRP Phone	Ronnie Reams WA4MJF & Sherry Reams KB4EXL	WK4P
Single Operator Unlimited High Power Phone	Ronnie Reams WA4MJF & Sherry Reams KB4EXL	W4NF
Single Operator Unlimited Low Power Phone	Icom America	W4AAA (KK9A, op)
Multioperator High Power Phone	Ronnie Reams WA4MJF & Sherry Reams KB4EXL	K4OV
Multioperator Low Power Phone	Icom America	N2XQM
School Club Phone	Ronnie Reams WA4MJF & Sherry Reams KB4EXL	K4KDJ
Rocky Mountain		
Single Operator High Power Phone	Grand Mesa Contesters of Colorado	WØUA
Single Operator Low Power Phone	Icom America	WA7LNW
Single Operator QRP Phone	Colorado QRP Club	N1XIH/7
Single Operator Unlimited High Power Phone	Grand Mesa Contesters of Colorado	WA5ZUP
Single Operator Unlimited Low Power Phone	Icom America	WØRAA
Multioperator High Power Phone	Icom America	KØCL
Multioperator Low Power Phone	Icom America	W5MPZ
School Club Phone	Icom America	No Entrant
Southeastern		
Single Operator High Power Phone	David Brandenburg, K5RQ	WP2Z (NQ6N, op)
Single Operator Low Power Phone	David Brandenburg, K5RQ	W4LT
Single Operator QRP Phone	Icom America	W4SVO
Single Operator Unlimited High Power Phone	Charlie Wooten, NF4A	K4XS
Single Operator Unlimited Low Power Phone	Icom America	N4KH
Multioperator High Power Phone	David Higdon Jr KD4ICT — With thanks to W4QO	WD4IXD
Multioperator Low Power Phone	Icom America	WA1F
School Club Phone	Icom America	W4UAL
Southwestern		
Single Operator High Power Phone	Icom America	K6NA (N6ED, op)
Single Operator Low Power Phone	Icom America	K9WZB
Single Operator QRP Phone	N6HE and W6DLD	KK7EL
Single Operator Unlimited High Power Phone	Icom America	K6LL
Single Operator Unlimited Low Power Phone	Icom America	W6TK
Multioperator High Power Phone	Icom America	W6YI
Multioperator Low Power Phone	Icom America	NX6T
School Club Phone	Icom America	No Entrant
West Gulf		
Single Operator High Power Phone	Icom America	NR5M
Single Operator Low Power Phone	Icom America	WD5K
Single Operator QRP Phone	Icom America	WJ5RM
Single Operator Unlimited High Power Phone	Icom America	N5ZC
Single Operator Unlimited Low Power Phone	Icom America	N5DO
Multioperator High Power Phone	Icom America	KBØHH
Multioperator Low Power Phone	Icom America	K5LIB
School Club Phone	David Brandenburg, K5RQ	K5LBJ
Canada		
Single Operator High Power Phone	Icom America	VY2ZM
Single Operator Low Power Phone	Icom America	VA7RR
Single Operator QRP Phone	Frank Merceret, NA4CW	VA3DF
Single Operator Unlimited High Power Phone	Icom America	VE3ONN
Single Operator Unlimited Low Power Phone	Icom America	VE3MGY
Multioperator High Power Phone	Icom America	VO2WL
Multioperator Low Power Phone	Icom America	No Entrant

Top Ten by Category

Single Operator, High Power

VY2ZM	341,794
W7WA	333,826
WP2Z (NQ6N, op)	331,170
NR5M	319,550
K5TR	319,218
K7RL	312,246
NN3W	302,618
WC6H	288,176
K5NA (WM5R, op)	283,860
K6XX	281,204
W2RE	281,204

Single Operator, Low Power

KH6LC (NH6V, op)	273,568
VA7RR	231,072
NØKK	230,076
VE5ZX	202,852
VE6EX	200,362
K9WZB	198,370
W4LT	191,066
NP4G	189,406
WD5K	179,612
KI6LZ	173,470

Single Operator, QRP

KDØS (WDØT, op)	129,646
NN7SS (K6UFO, op)	96,778
W4SVO	92,988
NDØC	87,482
NK8Q	77,854
VA3DF	69,056
KT8K	66,584
KJ5RM	62,240
KCØMO (KØOU, op)	61,254
N9NE	59,360

Single Operator, Unlimited, High Power

K4XS	318,720
K6LL	293,156
N5ZC	281,536
NØXR	273,070
WB1GQR (W1SJ, op)	265,102
W7RN (WX5S, op)	249,830
K1KD	248,004
W5WMU	247,340
W1SRD	245,508
N2BJ	245,182

Single Operator, Unlimited, Low Power

W4AAA (KK9A, op)	233,728
KW8N	200,030
K7XC	184,260
K8BL	177,288
N5DO	171,976
N6ZFO	138,092
N4KH	134,128
K2DFC	133,464
W6TK	126,160
K2FF	124,998

Multi-Operator, High Power

W6YI	371,342
KØCL	305,440
W5RU	285,520
K7IR	280,208
K4OV	276,224
W4MR	270,746
WY7SS	266,430
W2FU	266,098
K1LZ	261,450
W1VE	245,016

Multi-Operaator, Low Power

K3JD	198,868
KBØVVT	168,158
K3AJ	145,084
NX6T	134,792
N2XQM	106,904
W2TZ	101,094
WA1J	95,284
NZ6Q	85,822
W5MPZ	85,822
WØZF	80,524

School Club

W6YX	258,296
KØHC	231,736
W1AF	137,614
W5YM	130,974
WØEEE	101,260
W8SH	97,940
KØVVY	74,240
K2CC	73,470
W1KBN	64,306
W1YK	63,018

categories. This year, the top three competitors were from the continent's "corner pockets" and their time-off strategy seems to have converged — take off 5 to 6 hours between 0700Z and 1300Z.

Congratulations to Jeff, K1ZM, operating from VY2ZM at his Prince Edward Island QTH. This is the second time in three years he has taken the title. Jeff took advantage of 40 meters on Saturday night to stay in the race, and 20 and 10 meters on Sunday to take and hold the lead.

In 2nd place, 48 contacts behind, was Dan, W7WA. Dan had a substantial lead through Saturday night, but the high bands were not kind to him on Sunday, putting him in the #3 position most of the day. From the Virgin Islands, Matt, NQ6N, operating from WP2Z, came close to challenging Jeff on Sunday by taking advantage of the great high band propagation from down south, but slipped once the Sun went down in the tropics.

Single Op, Low Power Category (SOLP)

The Low Power category continues to be the most popular with 781 submitted logs. Unlike most other years, in 2012 the Single Op, Low Power Top 10 was missing stations from the central and northeast portions of North America. As in 2011, Rob, NH6V, and Gary, VA7RR, battled for the top spot. However, unlike last year, the victory was decisive with Rob, operating from KH6LC taking first by 301 contacts. Congratulations, Rob!

The battle between 2nd and 3rd place was extremely tight, between Gary, VA7RR, and Kirk, NØKK. Gary got off to a great start, building up a 125 contact margin by 0300Z. However, that lead quickly dissipated, with Kirk taking advantage of excellent 80 meter conditions from Minnesota, while Gary struggled. Gary made a total of only 50 contacts between 0400Z and 0900Z. Ouch! Kirk continued to dominate through mid-day Sunday, building up a 154 contact lead. But then, as can often happen in contests, Gary's fortunes changed. He had great hours on 10 and 15 meters on Sunday afternoon and clawed his way back, finally taking the lead from Kirk in the last hour. Great perseverance, Gary!

Single Op QRP Category (SOQRP)

The QRP category increased in popularity with 97 operators toughing it out. The winner was Todd, WDØT, operating from KDØS in South Dakota. Todd tried QRP last year, finishing number 9. He obviously learned some lessons, making 781 QSOs and setting a new division record. Todd's 5 watts sustained some excellent runs on 15 meters. Mark, K6UFO, operating from NN7SS near Seattle, came in 2nd with 583 QRP contacts and a Clean Sweep.

Single Op Unlimited, High Power Category (SOUHP)

After many great Phone Sweepstakes finishes from Hawaii, Bill, K4XS, returned to his North Florida roots with a decisive win. 40 meters was Bill's workhorse band with nearly half of his contacts. Surprisingly, a total of only 302 contacts were made on 10 and 15 meters. For the second consecutive year, 2nd place went to Dave, K6LL, operating from Arizona. Dave's southwestern strategy was entirely different from Bill's, making 982 contacts on 10 and 15 meters.

Single Op Unlimited, Low Power Category (SOULP)

In this, the second year of this category, 140 participants entered. Competition is heating up! John, KK9A, operating as W4AAA, from North Carolina was the winner, with 1408 contacts setting a new category record, more than double the previous mark. John's contacts were almost equally divided among 80, 40 and 20 meters. Perennial high-power competitor Bob, KW8N, stuck his toe into low power, taking 2nd place with 1205 contacts. Tim, K7XC, turned off his amplifier this year to take #3.

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Potomac Valley Radio Club	20,112,044	267
Northern California Contest Club	8,116,740	107
Society of Midwest Contesters	7,370,044	126
Minnesota Wireless Assn	6,558,292	101
Yankee Clipper Contest Club	5,958,598	82
Medium Category		
Southern California Contest Club	4,928,036	48
Florida Contest Group	4,090,446	50
Arizona Outlaws Contest Club	3,030,364	44
Contest Club Ontario	3,011,416	50
Frankford Radio Club	2,981,556	37
Alabama Contest Group	2,895,106	40
Western Washington DX Club	2,737,760	27
Georgia Contest Group	2,395,710	31
Tennessee Contest Group	2,367,700	37
Mother Lode DX/Contest Club	2,279,988	32
Mad River Radio Club	2,159,562	24
Grand Mesa Contesters of Colorado	2,063,458	21
Central Texas DX and Contest Club	2,040,868	18
DFW Contest Group	1,947,168	30
North Coast Contesters	1,887,368	20
Hudson Valley Contesters and DXers	1,609,918	20
North Texas Contest Club	1,319,544	13
Willamette Valley DX Club	1,108,996	18
Maritime Contest Club	950,120	12
Utah DX Assn	928,892	9
Saskatchewan Contest Club	827,112	9
Louisiana Contest Club	783,584	8
CTRI Contest Group	769,694	10
Northern Rockies DX Association	752,286	5
South East Contest Club	685,140	13
Kentucky Contest Group	599,736	8
Order of Boiled Owls of New York	595,150	8
ORCA DX And Contest Club	575,618	7
Rochester (NY) DX Assn	561,732	14
Contest Group Du Quebec	547,146	13
Mississippi Valley DX/Contest Club	454,472	9
Allegheny Valley Radio Association	339,316	8
Radio Club of Redmond	329,676	6
Eastern Iowa DX Assn	317,002	4
Motor City Radio Club	301,480	11
East Coast Canada Contest Club	256,794	4
Western New York DX Assn	192,988	4
Carolina DX Association	173,406	6
Local Category		
New Mexico Big River Contesters	1,194,616	7
Iowa DX and Contest Club	927,234	6
Kansas City Contest Club	689,182	9
Spokane DX Association	541,636	8
Contoocook Valley Radio Club	446,414	3
Sussex County ARC	313,790	3
Central Oregon DX Club	304,898	3
Bristol (TN) ARC	298,168	8
Hazel Park ARC	291,694	10
CorTek Radio Association	289,646	4
Oakland County Amateur Radio Society	254,914	3
Metro DX Club	254,644	7
Delara Contest Team	242,368	5
Lincoln ARC	237,212	3
All Amateur Radio Club	183,750	3
Hilltop Transmitting Assn	178,546	4
Rappahannock Valley Amateur Radio	148,828	4
Portage County Amateur Radio Service	146,476	7
Kansas City DX Club	135,898	3
West Park Radiops	122,418	5
Granite State ARA	113,872	5
Alexandria Radio Club	109,846	4
Stoned Monkey VHF ARC	108,926	5
Bergen ARA	93,756	5
Milford (OH) ARC	83,694	3
Sterling Park ARC	73,972	4
Badger Contesters	73,252	3
10-70 Repeater Assn	70,812	3
Pueblo West Amateur Radio Club	67,242	6
Falmouth ARA	58,616	3
Northern Ohio DX Assn	53,464	3
Southern Berkshire ARC	50,740	5

In the Single Op Unlimited, Low Power category 37 new section records were set. But there is still a lot of low-hanging fruit to go after in 2013.

Multioperator, High-Power Category (MH)

The W6YI team of Jim,W6YI; John, K6AM; Dan, N6MJ, and Dennis, N6KI, added Tim,

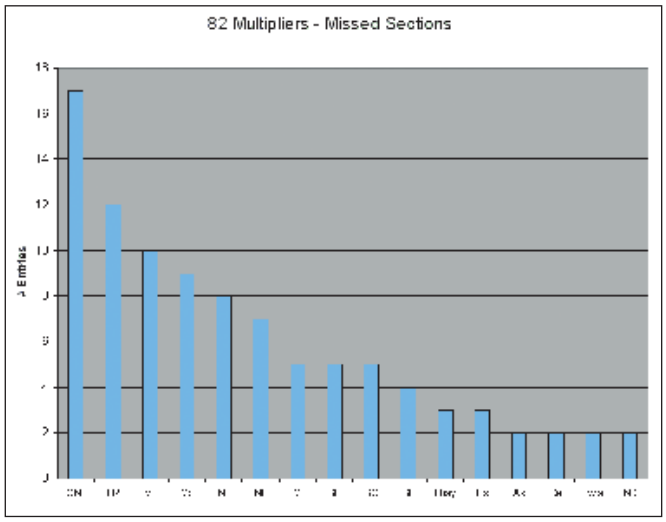


Figure 1 — So close and yet so far — this chart tallies how many stations missed only one of these sections in their quest for a Clean Sweep.

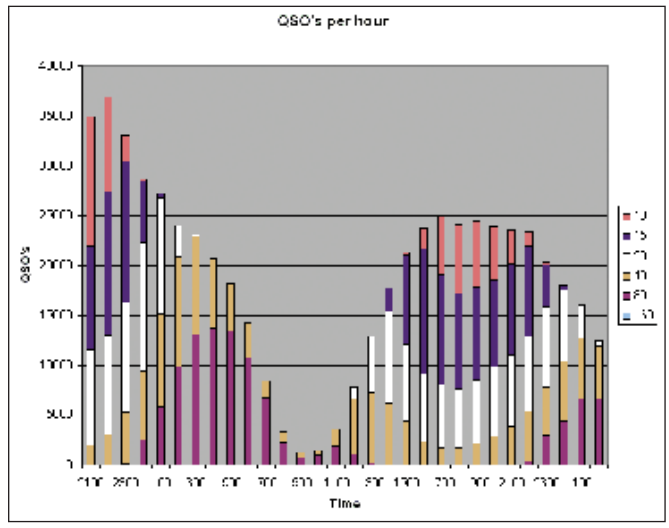


Figure 2 — If you want to know where the stations were throughout the contest, this chart shows how many contacts were made on each band during each hour.

N6WIN to their team and ran away with the #1 spot for the 6th consecutive year dynasty! The Colorado team of KØDU, KØCL and KØUK slipped into 2nd place, knocking out last year's 2nd place W5RU Louisiana team who took 3rd place in 2012.

Multioperator, Low-Power Category (ML)

The Multioperator Low-Power category increased in popularity. Sixty five entries were received. The winner was a new team at K3JD, operated by K3JD, W7TBG and KB3YYB. With nearly 1200 contacts in this low power category, they showed they were a force to be reckoned with! They made all but 19 of their contacts on 80 and 20 meters!

Making it a family outing, the Rich family of Rebecca, KBØVVT; Dave, KGØUS; and Barbara, KGØUT, took the #2 slot from Missouri. 95% of their contacts were made on 15 meters! K3AJ made it a team effort in 2012, partnering with AB3CV while placing 3rd. A large team of operators shared NX6T from San Diego, taking 4th place. This was another almost-single-band entry, with 812 of their 830 contacts made on 15 meters.

Mike, K2KR, operated at the "Field Day in November" Family Sweepstakes station that was the Missouri Multioperator High-Power winner. [Mike Wilson, K2KR, photo]

Twenty five new section records were set in this category.

School Club Category (S)

Twenty four schools competed in the School Club Category. The perennial battle between Stanford University, W6YX and Hesston College, KØHC continued. This year, KØHC was short-handed, giving W6YX a decisive victory. However, the Hesston College team should be proud of their lowest error rate in the category, losing only 1% of their contacts.

Harvard University, W1AF, placed 3rd. The University of Arkansas, W5YM, moved up from 11th in 2011 to 4th in 2012, more than doubling their previous number of contacts. The Missouri University of Science and Technology club, WØEEE, remained in the 5th slot this year.

Club Competition

Thanks go to the many clubs who encouraged their members to get on the air for Sweepstakes. In comparing the number of Sweepstakes entries and contacts from 2012 with 2011, there is no doubt that club support plays a key role in overall activity. We can't thank the clubs enough — and, of course, their members for their commitment, dedication and understanding families. Please, clubs...support Sweepstakes in 2013! Encourage your members to be active. This year, 1558 participants submitted their CW and Phone SS scores towards club aggregate scores.

In the Unlimited Club category, the Potomac Valley Radio Club ran away from the other four megaclubs, with 267 entries for 20.1 million points. In 2nd place was the Northern California Contest Club, with 107 entries totaling 8.1 million points. The Society of Midwest Contesters again took 3rd place, with 126 entries and 6.6 million points.

In the Medium Club category, The Southern California Contest Club emerged victorious, with 48 entries and 4.9 million points. That is 8.9% higher than 2011 and a whopping 102,667 points per entry! The Florida Contest Group took 2nd place with 4.0 million points. The race between the 3rd place Arizona Outlaws Contest Club and 4th place Contest Club Ontario was a photo finish. Just 140 more total contacts in the 50 logs of Contest Club Ontario would have put them ahead.

In the Local Club Category, the Albuquerque, New Mexico-based Big River Contesters again took first place with 7 entries, averaging 170,659 points per entry. Super job! The Iowa DX and Contest Club took 2nd place just one big score behind, and the Kansas City DX Club took 3rd place.

Acknowledgments

Many thanks to "Tree" Tyree, N6TR, for his hard work checking the logs and George, K5TR, for logistical and infrastructure support. Additional thanks to K9JK, K9DUR, K9ZM, KB9OWD and K5OT who painstakingly transcribed handwritten logs so that they could be adjudicated. We'll see you on the third weekend of November (Nov 16-18) again this year!

Sweep Up More Online

There's more available in the online version of the Sweepstakes writeup: additional detail about the contestants, charts and tables, QSO-by-QSO horse races and the complete set of line scores. Browse to **www.arrl.org/sweepstakes** for Steve's full article!

2012 ARRL 160 Meter Contest Results

It was a great year to be in the middle of North America.

by Gary Breed, K9AY, k9ay@k9ay.com

The November 30-December 2, 2012 running of the ARRL 160 Meter Contest was, once again, a highlight of the year for many Top Band fans. This event brings together competitive contesters, casual contest operators, 160 meter specialists plus all the other hams who enjoy the adventure of operating at the low-frequency end of the spectrum. When you combine unpredictable propagation with a crowd of operators squeezed into a bit more than 100 kHz on a single band, things get interesting! Thankfully, the tradition of 160 meters as the "gentleman's band" continues and all those stations manage to fill each other's logs with contacts from all ARRL and RAC sections, plus many DXCC entities.

The 160 meter band is a growing part of the Amateur Radio spectrum! With new ham bands being developed (or already in place) at even lower frequencies — 63 kHz, 136 kHz, 500 kHz — learning about medium wave behavior on 160 meters is an excellent way to prepare for these challenges. In parts of the world where these new bands are already in place, they are providing hams with interesting experiences.

What About Cycle 24?

"Not bad for a 'down year' on 160..." said N4UA on the 3830 reflector (you can read the archives of this post-contest score sharing reflector at **lists.contesting.com/_3830**). There are always complaints about poor low band propagation during the peak years of every sunspot cycle and Cycle 24 is no exception. However, as N4UA noted, during the first weekend of December 2012, things were not as bad as expected. Sure, DX openings were shorter, but there was still DX to be worked. Yes, cross-continent signals were heard with greater difficulty, but there are plenty of QSOs in the logbooks of the 1174 hams who entered the event (50+ more logs than 2011, and just 14% fewer than the record-setting 2009 contest). As Top Band fans often point out, 160 meters at the peak of the cycle is usually much better than 10 meters at the bottom!

Overall, the 2012 160 Meter Contest was a great success, with high activity and some strong competition. There was a clear continuation of the overall trend toward more 160 meter activity in recent years. Band conditions were good enough to make the event fun. Much of North America had low noise levels, which partially compensated for higher absorption and weaker signals. Also, many stations noted that conditions were above average to the Far East, resulting in a good number of JA stations in the log.

Winners from the Heartland

In the most popular entry class — Single Operator, Low Power — nine of the Top Ten finishers did so from their far inland QTHs! In fact, the top scores in four of the five entry categories were achieved far away from the East Coast and its alleged advantage of being closer to European multipliers and 5 point QSOs. In 2012, stations that could run up high QSO numbers and maximize the number of section multipliers had the advantage — that meant being in the center of the continent.

DX Results

DX logs were down 21% compared to the best year ever (2009). This is no surprise, as weaker propagation makes it much harder to complete long distance QSOs, especially for hams without efficient transmit antennas and quiet receiving locations. Even so, there were a good number of DX multipliers available during the contest. European sunrise provided some propagation enhancement, with several ops commenting that North American sunset had a noteworthy enhancement. Between those times, there were some of the well known 160 meter short "spotlight" propagation episodes. Your author experienced some of these, as a DX station would occasionally call with a signal rivaling more "local" stations.

Affiliated Club Competition

Every year, I remind new 160 meter operators

Affiliated Club Competition

	Score	Entries
Unlimited Category		
Potomac Valley Radio Club	6,188,037	81
Yankee Clipper Contest Club	2,947,079	58
Medium Category		
Society of Midwest Contesters	3,121,646	47
Frankford Radio Club	2,983,137	42
Minnesota Wireless Assn	2,514,547	49
Contest Club Ontario	2,297,169	29
Mad River Radio Club	1,733,887	15
North Coast Contesters	1,229,412	15
Alabama Contest Group	757,141	15
Northern California Contest Club	707,837	27
Arizona Outlaws Contest Club	550,166	17
Southern California Contest Club	540,426	14
North Texas Contest Club	506,758	5
Rochester (NY) DX Assn	482,764	8
Grand Mesa Contesters of Colorado	470,194	7
Florida Contest Group	467,621	14
Contest Group Du Quebec	399,868	4
Hudson Valley Contesters and	330,744	8
Georgia Contest Group	308,663	5
Mississippi Valley DX/Contest Club	296,700	3
Utah DX Assn	288,168	6
Western New York DX Assn	259,215	7
Northern Rockies DX Association	258,936	3
South East Contest Club	253,064	7
Willamette Valley DX Club	169,827	9
Carolina DX Association	138,358	5
ORCA DX And Contest Club	118,384	3
CTRI Contest Group	110,883	4
Western Washington DX Club	102,226	10
Local Category		
Central Virginia Contest Club	968,021	8
Maritime Contest Club	830,583	10
Delara Contest Team	277,976	3
DFW Contest Group	258,711	6
Spokane DX Association	257,072	5
Bristol (TN) ARC	204,190	6
Mother Lode DX/Contest Club	158,180	5
Low Country Contest Club	99,890	3
West Park Radiops	77,228	5
Metro DX Club	57,846	4
Bergen ARA	35,785	3
South Texas DX and Contest Club	33,859	3

Figure 1 — WB9Z ops (l-r) Jerry, KE9I; Don, K9NR; Val, NV9L; Mike, K9XZ; Carl, K9CS and station owner Jerry, WB9Z racked up a score of 408,044 points with 1617 QSOs and 118 multipliers. [Jerry Rosalius, WB9Z, photo]

Division Winners

Single Operator, High Power

Atlantic	AA1K	395,520
Central	K9CT	363,634
Dakota	WØSD (WØDB, op)	350,892
Delta	WD5R (N5ECT, op)	321,048
Great Lakes	K1LT	372,411
Hudson	NX2X	136,986
Midwest	NØTT	315,700
New England	K1DG	362,706
Northwestern	N9RV	191,282
Pacific	N6RO	98,370
Roanoke	K3ZM	468,336
Rocky Mountain	WD5COV	210,235
Southeastern	KV4FZ	227,290
Southwestern	N7GP (N5IA, op)	258,588
West Gulf	K5RX	327,348
Canada	VY2ZM	587,928

Single Operator, Low Power

Atlantic	W2TZ	143,092
Central	NE9U	169,560
Dakota	KØTI	170,694
Delta	N4ZI	86,616
Great Lakes	WB8JUI	157,035
Hudson	K2UF	64,870
Midwest	KIØI	135,830
New England	N1UR	101,166
Northwestern	KØPP	102,564
Pacific	N6RK	42,408
Roanoke	NN3W	84,480
Rocky Mountain	NN7A	52,219
Southeastern	K1DC	78,720
Southwestern	AC7A	44,968
West Gulf	WØUO	148,104
Canada	VE3XL	114,807

Single Operator, QRP

Atlantic	K2ZR	63,516
Central	N9NE	53,922
Dakota	NØUR	36,960
Delta	K5LG	51,000
Great Lakes	N8BB	83,951
Hudson	W2DPT	11,266
Midwest	WØGJ	77,000
New England	N2KW	62,208
Northwestern	N9ADG	4,896
Pacific	K9YC	9,288
Roanoke	WB4MSG	60,970
Rocky Mountain	KIØII	13,488
Southeastern	W5NZ	10,040
Southwestern	N7IR	51,680
West Gulf	W5ESE	5,643
Canada	VE3CV	23,409

Multioperator, High Power

Atlantic	K3WW	295,495
Central	WB9Z	408,044
Dakota	WØMR	94,858
Delta	N8OO	398,520
Great Lakes	K8KS	343,640
Hudson	K2TTT	170,688
Midwest	NØNI	491,631
New England	N9NC	236,250
Northwestern	N7XU	170,443
Pacific	W6DR	65,676
Roanoke	N3UA	394,208
Rocky Mountain	K7NJ	227,136
Southeastern	WJ9B	353,787
Southwestern	N6KI	99,876
West Gulf	K5KC	303,450
Canada	VE3TA	331,934

Multioperator, Low Power

Atlantic	W2CCC	62,244
Central	WE9R	56,088
Dakota	NØIM	52,185
Delta	WF7T	27,054
Great Lakes	K8BL	178,572
Hudson	K2ZC	28,826
New England	W1WBB	62,853
Northwestern	KB7Q	59,570
Pacific	K7XC	55,280
Roanoke	WU4G	36,639
Rocky Mountain	WØDLE	138,780
Southeastern	N4GG	66,975
Southwestern	W8KA	35,190
West Gulf	NS7B	19,836
Canada	VE3MGY	165,968

Figure 1 — According to Milt, N5IA (operating at N7GP), nothing is better than running JAs on 160 meters while viewing a beautiful sunrise over Arizona's Whitlock Mountains. [Milt Jensen, N5IA, photo]

to check the Club Competition listing! These local and regional clubs have experienced operators who are happy to help you build a better station and hone your skills. In the 2012 160 Meter Contest, the Potomac Valley Radio Club fielded 81 stations, amassing well over 6 million points to earn the Unlimited Club gavel, besting the Yankee Clipper Contest Club. The Society of Midwest Contesters had fewer entries than in recent years, with their 47 logs placing them in the Medium Club category, where they came out on top. Their 3+ million points was the second-highest total score of any club regardless of category. In the Local Club category, the eight entries from the Central Virginia Contest Club totaled just shy of 1 million points, earning the number one position among their smaller club colleagues.

Final Thoughts

Take a look at that great antenna photo from Milt, N5IA (at N7GP). Figure 1 was taken Saturday morning shortly before sunup in Arizona. "I was slow-running JAs when I noticed a red glow through the slots between the shades in my operating bus. I stepped to the door and was greeted by this view. My TX antenna is visible. The mountain range in the distance is the Whitlock Mountains, about 25 miles away. It doesn't get much better than this; running JAs on 160 meters and viewing a southwest US sunrise!"

Every year, many hams use the ARRL 160 Meter Contest as their reason to start learning about the unique propagation and antenna challenges of this band. Make your own plans for the 2013 contest. Talk to your friends and get on 160 meters in other contests (and between contests). Use the warm weather of summer and fall to work on antenna projects. December 6, 2013 will be here faster than you think!

Top Ten

W/VE

Single Operator, QRP

N8BB	83,951
W8VK	79,380
WØGJ	77,000
K2ZR	63,516
N2KW	62,208
WB4MSG	60,970
W3TS	58,140
K4CNW	57,821
W4UX	54,404
N9NE	53,922

Single Operator, Low Power

KØTI	170,694
NE9U	169,560
WB8JUI	157,035
K8NVR	154,392
WØUO	148,104
W2TZ	143,092
NØAT	137,600
K9MMS	137,060
KIØI	135,830
K9IG	133,861

Single Operator, High Power

VY2ZM	587,928
K3ZM	468,336
VE3EJ	406,692
AA1K	395,520
K1LT	372,411
K9CT	363,634
K1DG	362,706
WØSD (WØDB, op)	350,892
NO3M	342,760
VA2EW	331,430

Multioperator, High Power

NØNI	491,631
WB9Z	408,044
N8OO	398,520
N3UA	394,208
N1LN	387,321
WJ9B	353,787
K8KS	343,640
VE3TA	331,934
K5KC	303,450
NX5M	301,875

Multioperator, Low Power

K8BL	178,572
VE3MGY	165,968
K4FT	157,140
WØDLE	138,780
N4GG	66,975
W4UAL	64,320
W1WBB	62,853
W2CCC	62,244
K8UO	61,124
KB7Q	59,570

DX

Single Operator, High Power

PJ2T (K8ND, op)	131,664
FM5CD	104,566
CE1/K7CA	104,438
ZF2AH	75,312
TM6M (F1AKK, op)	56,760
OM2VL	42,600
M5O (G3LET, op)	35,148
DF2PY	7,954
UYØZG	6,882
JA1XMS	5,760

Single Operator, Low Power

VP5CW (WBØOAJ, op)	52,480
CO6YAC	16,632
XE2YWH	2,322
DL4UNY	1,850
CO6LP	1,258
JH7IMX	1,134
JA4CUU	1,008
JA1BJI	714
OLØA (OK1CZ, op)	570
IKØXBX	560

Single Operator, QRP

JH7UJU	8
JH4UYB	8
CO8ZZ	8
OK1CZ	2

Multioperator, High Power

C6AUM	181,600
OL7M	30,894
JH2FXK	10,764
LY5W	7,128
MDØCCE	6,586
PAØO	4,270
JE1ZWT	3,776
DK2OY	3,410
JH3PRR	3,392
ON4WW	3,072

Multioperator, Low Power

XE1GRR	1,550
JA1SVP	828
GM4WZG	416
US8ICM	224
UY5VA	160
ES1WST	8
SM5EPO	2
IT9SFT	2

More Info Online

K9AY provides a great deal more reporting and an interesting comparison of Top Ten stations in the online version of this article at **www.arrl.org/contest-results-articles**.

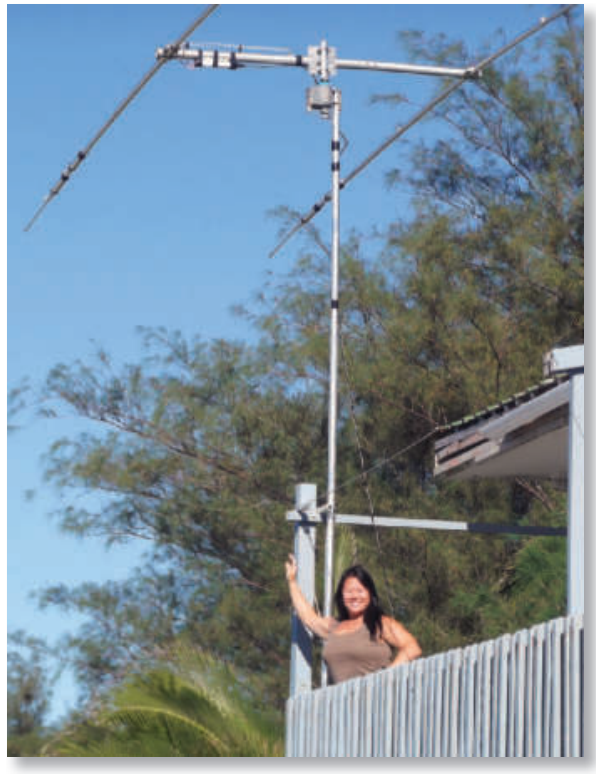
The 2013 IARU HF World Championships

1200 UTC Saturday, July 13 - 1159 UTC Sunday, July 14

- The HF bands heat up in July for the biggest contest of the season!
- Exchange is a signal report and your ITU zone (not your Q zone).
- Single Op entrants choose from High, Low or QRP power and Mixed Mode, CW only or Phone only.
- Stations from IARU member societies all around the world will be active. How many HQ stations can you work?
- E-mail Cabrillo formatted electronic logs to **iaruhf@iaru.org** no later than 1200 UTC Tuesday, August 13. Paper logs can be mailed to IARU HF Championships, c/o ARRL, 225 Main St, Newington, CT 06111 USA.

Complete rules, paper log forms and ITU zone maps can be found at www.arrl.org/iaru-hf

Scan this QR code with your smartphone to go directly to the IARU HF rules page.



Carrie Tai, W6TAI, set off for the South Cook Islands for IARU 2012 and took second place Oceania in the Phone Only, High Power category as E51TAI. [Wayne Overbeck, N6NB, photo]

2013 June Kids Day

1800 UTC - 2359 UTC Saturday, June 15

Nick McPherson, son of Greg McPherson, N2KUN, of Glenville, NY, was very excited to have his CQs answered during Kids Day in 2012. "It's tough prying the mike out of his hands!" says Greg.

- The third Saturday in June is the time to get youngsters on the air and share the joys and fun that Amateur Radio can provide!
- Sponsored by the Boring (Oregon) Amateur Radio Club, this event helps bring the excitement of Amateur Radio to a younger audience. The exchange is simple: First name, age, location and favorite color. After that, the contact can be as long or as short as each participant likes.
- Kids Day opens minds. Open your shack doors and invite youngsters over to learn and enjoy themselves. Let's all work to get some fresh, young voices on the air on June 15!

Complete info can be found at www.arrl.org/kids-day

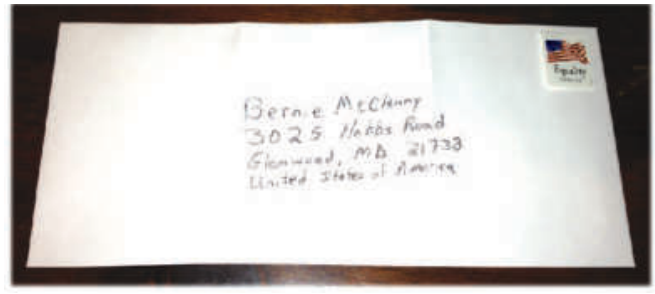
Scan this QR code with your smartphone to go directly to the Kids Day rules page.

Bernie McClenny, W3UR, w3ur@arrl.org

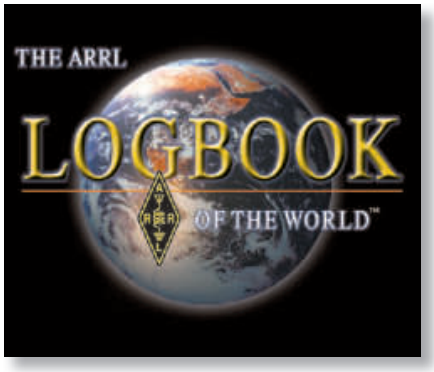
QSLing the DX Station

The fight for that rare DX entity isn't over until the contact is confirmed.

It's often said that the final courtesy of a contact is a QSL. A QSL is an acknowledgment of a contact that can be made either by the traditional QSL card or the more recently developed method of electronic confirmation. QSLs date back to just before the 1920s and are still widely used today by both Amateur Radio operators and Short Wave Listeners (SWLs). With the 21st century came electronic QSLing in the form of eQSL and Logbook of The World (LoTW).[1]



Always include an SAE or SASE with your QSL request. The more folds in the return envelope the more likely it won't get back to you. [Bernie McClenny, W3UR, photo]



Whether the traditional postcard or electronic version, a QSL contains key details about the contact including the call signs of both stations in the contact, the date and time (in UTC), the frequency or band, mode of transmission, signal report and location (city, county/province, state, grid locator, IOTA reference, etc). The traditional QSLs should also say something to the effect of "Please QSL" or "Thank you for your QSL." This lets the other party know if a return QSL is desired by the sender or if the sender is acknowledging receipt of a QSL.

QSLing Direct

Given the current economic state here in the US and around the globe, money is tight and the price of postage continues to rise. When you are sending a direct traditional QSL card there are several things you will want to do to have the best chance of a return QSL. First, make sure your QSL card is properly filled out with all the details of the contact(s) and that both the date and time are always in UTC, unless otherwise requested by the other station. UTC is the same worldwide and should always be used when referring to time. It's a good idea for you to include your e-mail address on your QSL card so the DX station or his/her QSL manager can contact you in case there are any discrepancies.

For a DX contact always send a self addressed envelope (SAE). If you are QSLing someone in your own country send a self addressed stamped envelope (SASE). I personally like to use a business size envelope (also known as a #10 envelope) for the outgoing envelope. For the return envelope, I send a smaller envelope that is *not folded*! Folded envelopes can get caught in the postal machines along the trip home and be torn up, damaged or simply disappear or disintegrate. The more folds in the return envelope the more likely it won't get back to you. Finally, be certain your return address is legible. If you're not sure, ask someone else if they can read it back to you.

When sending a direct QSL request to a station in another country or even to a station in your own country, you should always send some form of postage unless the operator specifically requests otherwise. The recipient should not have to pay the postage to mail your direct request back to you. What do I mean by postage? You should include the proper amount of postage in the stamps of the recipient's country, the proper number of US dollars ("green stamps") or an International Reply Coupon (IRC), if you can get one. Don't send US postage to overseas destinations unless you know for sure the recipient can use it.

Now that the US and many other countries no longer sell IRCs it is even more difficult to get those direct QSLs.[2] IRCs can be purchased secondhand through reliable QSL managers who sell "good IRCs" for about 60-85% of the face value ($2.10 here in the US). Here in the US the going rate is $1.25-$1.75. A "good IRC" is one that is current (yes, they have expiration dates) and has the correct validation stamp of the issuing country. In the January issue of *QST*, there is information about where to get foreign stamps and how to determine how many "green stamps" are needed to cover the postage.

If you send a direct request and don't include proper return postage you risk (at best) having your QSL card sent back to you via the bureau or (at worst) not receiving it at all. You cannot expect the DX station or the QSL manager to pay for the postage.

The New QSL

Over the past few years a new method of direct QSLing has been developed. It's called OQRS (Online QSL Request Service) and it uses PayPal, a fast, safe method of sending money (in this case for postage) via the Internet. With the advent of online log searches like Club Log (**www.ClubLog.org**) and other DXpedition websites it's now possible to check your contacts online and then order the QSL cards that you need. Many of

[1] **www.arrl.org/logbook-of-the-world**

[2] B. McClenny, W3UR, "International Reply Coupons," *QST* Jan 2013, p 91.

the bigger DXpeditions are now using this method. After the DXpedition is over you go to the DXpedition's website or Club Log and enter the dates and times of your contacts. Then, using the OQRS you follow a very simple process to pay the postage for their QSL manager to mail the QSL(s) to you.

Some DXpeditions and DX stations now also offer the option to QSL via the bureau at no cost. Some hams may interpret this to mean that their QSL card is being paid for. I disagree and here is why: Most of us will agree the DX station or DXpedition should not pay for the postage to send a direct QSL card, as it wouldn't take long to go broke confirming contacts with the many stations they work. We can all agree that postage rates are getting higher all over the world. By using the OQRS you are saving time in getting your request to the DX station or QSL manager, and with PayPal you have a confirmation that the person handling the QSLs has received the postage funds.

You've just saved at least 5-7 days over mailing a letter from the US to Europe, Africa, Asia or South America! In addition, you don't have to fill out an envelope (which means there's no chance for writing down a wrong address) or QSL card, or pay the postage to send a card to the DX station or QSL manager. So you are saving time and money — and you have a confirmation that your request made it through.

Moreover, it is a fact that the DXpeditions using OQRS are likely to reward those who use this method by answering their QSL requests first. Why? Because they don't have to enter the data and do searches since the OQRS has already done so. Also, the QSL manager doesn't have to open all those hundreds, if not thousands, of envelopes.

Currently the OQRS on Club Log is set up such that a given QSL manager can only handle one station's QSLs at a time. That is, if you worked CT8/G3TXF, OJØR, Z6ØK and ZF2XF, which are all handled by Nigel, G3TXF, you would need to do four different "orders" for QSLs using Club Log. Tim, MØURX, who handles QSL chores for a number of stations, has set up his own OQRS on his website (**www.m0urx.com/oqrs**); it can handle up to four stations for one "order." Club Log is working on an enhancement to handle multiple QSLs when more than one call sign is being handled by a single QSL manager.

Like many DXers, I enjoy receiving the traditional QSL cards; however, I cannot afford to QSL everyone direct. I try to collect one paper QSL from each country to be displayed on my shack wall. The rest I prefer to send via LoTW, as it can be the fastest, cheapest and, quite honestly, the "greenest" method. I do enjoy getting bureau QSLs, even if it takes many months or many years. I believe all current QSL methods will continue to be successful, at least for the foreseeable future.

Donations

There is a difference between providing postage for your QSL cards and making a donation. If you want a direct QSL card from a DXpedition or a semi-rare or rare DX station you need to provide some kind of postage, as mentioned above. That postage is not a donation. A donation is an amount paid that is above and beyond the cost for direct postage.

A donation is, by definition, a gift or free contribution. Donations to DXpeditions should never be required! Individuals, clubs and organizations must decide if they wish to contribute amounts above and beyond postage to help support a DXpedition. Donations are completely voluntary and are never, ever mandatory. When I first got involved in DXing as a teenager I could not afford to make donations and didn't see the need to do so. I later realized that some DXpeditions would not be possible without donations so when I could I began to help out the DXpeditions that were most interesting to me. Many DXers do the same.

I won't delve too deeply into this subject as there is not enough space in the column to completely cover all the minutiae of DXpedition donations. Some DXpeditions need contributions or donations in order to take place and some don't; for example, a "DXpedition" (or what many would call a "holiday style operation") to a Caribbean island like Barbados or Dominica — and there are literally dozens of these locations (DX entities) — doesn't need donations or contributions to get on the air.

So which DXpeditions should we donate to? Well, it is best for each individual, club or organization to determine their own criteria for donating. My suggestion would be to make donations to the rare and rarest of the rare entities. In other words, entities at the top of the most wanted lists. I would also include places that require a boat to access the entity.

6 Meter News in Corsica

In the March 7 issue of France's official gazette, the *Journal Officiel de la République Française*, it was announced that French Amateur Radio operators are now allocated privileges on 50-52 MHz using 120 W. This includes all French hams in IARU Region I, including Corsica (TK)! "You will probably hear some resident TK stations as soon as condx permit," says Patrick, TK5EP. Until early March 2013 only about half of France had allocations on 6 meters and operation was limited to 10 W, reminds Rob, F5VHN.

Rob Chipperfield, MØVFC, receives the first "Cass Award," which "encourages DXpedition operating excellence" from Michael Wells (R), G7VJR. The award is named after Hugh "Cass" Cassidy, WA6AUD (SK), who edited the *West Coast DX Bulletin* for many years. [Photo courtesy Michael Wells, G7VJR]

Wrap Up

That's it for this month. A special thanks for TK5EP and F5VHN on the great news of 6 meter activity now expected in Corsica and all of France in IARU Region I. As a reminder May, June and July are usually great times for 6 meter sporadic E or E-skip. If you are new on the band or need a refresher make sure you read the June 2012 "How's DX?" column for some helpful hints and suggestions, and remember the 6 Meter DX window is 50.100-50.125 MHz.[3] Don't forget to send your photos, DX news and club newsletters. Until next month, see you in the pileups! — *Bernie, W3UR*

[3]B. McClenny, W3UR, "6 Meter Summer E-Skip Season," *QST* Jun 2012, p 88.

Jon Jones, NØJK, n0jk@arrl.org

Moon Over Clipperton

EME, some TEP and a dash of sporadic E make for a great DX journey.

Lance Collister, W7GJ, accompanied the TX5K Cordell Expedition to Clipperton Island in March and he operated on 50 MHz, both EME and terrestrial. TX5K was active on 6 meters from March 2-9, 2013. Lance made a total of 317 contacts on 6 meters. Here's his story:

Thanks to generous contributions from many 6 meter DXers, I was able to join the TX5K team to add a serious, dedicated 6 meter operation to the DXpedition. Unfortunately, the period scheduled for the Clipperton operation was over the worst week of the month for 6 meter EME (Earth-Moon-Earth, or "moonbounce"). Since we reached the island a day late and had to tear down earlier than expected, we missed the better EME days at the beginning and end of the operation. However, as expected, there was trans-equatorial propagation (TEP) to South America every evening, which provided most of our 6 meter contacts. Rich, KF4ZZ, made many of those. I am glad I was able to get everything going for that first moonrise since half of the EME contacts were made on the first night!

The 92 foot *Shogun* sport fishing boat transported the gear and team members to the island. The *Shogun* was comfortable and the crew was great. The food was surprisingly good. However, the 10 day trip from San Diego to Clipperton and the 7 day return trip became rather tedious. The highlight of the trip for me was the magical approach to Clipperton Island on the evening of Wednesday, February 27. The full moon was rising over the calm sea and porpoises escorted us next to the bow as the outlines of palm trees loomed on the dark horizon.

The last day of February was spent circling the island, searching for the most suitable place to land. The dangerous surf was high all around the island and changed with the tide, which was at maximum with the full moon. By afternoon, a site was selected and Zodiac shipments to shore were begun at dawn March 1.

I was able to go ashore with my 6 meter gear in late morning. The transceiver was my reliable K3 and PR6 preamp driving a 6M8GJ Yagi fed with LMR600 and using my homemade manual elevation mount. The 6M-1000 amplifier has been modified by M2 for overseas use and provides a solid kW output on JT65A mode with under 3 W of drive. Thanks to the generous support of RF Concepts (**www.rfconcepts.com**), I also had an Alpha 8406 as the primary amplifier.

I found a site 360 meters south of the main camp and landing zone. I was trying to get away from all the other generators, radios, computers and other gear in the main HF camp in order to get a location quiet enough for weak signal work.

Figure 1 — Lance, W7GJ, rushing to raise the 6M8GJ beam before the first nightfall. [Photo courtesy Lance Collister, W7GJ]

Figure 2 — Shooting the Moon, Clipperton Island style. [Lance Collister, W7GJ, photo]

I first selected a spot for the antenna, just 55 yards from the pounding surf. Then, I marked out a place for the operating tent at an azimuth of 325° from the antenna, a direction between JA and W6, where I would never be aiming the antenna. The generator tent was located an additional 50 feet beyond the operating tent in the same direction, to minimize any electrical noise. I started out setting up the 8 × 8 foot 6 meter operating tent so I would have a safe place for all the equipment, which was sitting out in the open, surrounded by hundreds of masked boobies. I was very grateful for the assistance of Louis-Philippe Loncke, who came by to help me erect the frame and install the cover of the small structure.

I rushed to assemble the 6M8GJ beam before sunset and finally got it set up just as night fell (see Figure 1). I had packed an LED lantern and was able to set up the equipment, including installing the transformer in the Alpha 8406 amplifier, by headlamp and lantern light. I tied down the antenna securely, aimed at moonrise and began calling OH2BC, whose moon was just about to set (see Figure 2). I never copied anything from Kari, but at 0536Z March 2, I completed the first contact from the 2013 Clipperton Island DXpedition by working Peter, G8BCG. I stayed up all that night working stations under the rapidly degrading EME conditions. My last contact of that 25 contact session was 9 hours later with Jennifer, N6BBS, as my moon was setting.

I was incredibly fortunate to be able to visually aim the antenna on all but the very last days (after the sun rose and the faint sliver of a moon was no longer visible in the daylight). While I did have my calibrated aiming circle installed at the base of the rotating mast, it was always reassuring to be able to confirm that the elevation was also correct and that the antenna was right on target!

The effort to establish the remote 6 meter operating site so far from the HF camps really paid off — we had absolutely *no* noise at all! At least not *electrical* noise. KF4ZZ measured the ambient audio levels from the constant wind and hungry boobies as being 75-80 dB.

The boobies were great neighbors and stayed away from the antenna. The rats usually scampered away as we approached them to tie down the antenna. Our sealed tents provided more than adequate protection from the ubiquitous crabs.

Sea Salt Snags

The continuous salt spray from the pounding surf did take its toll on the antenna and equipment. The antenna receive performance degraded a bit every day. On March 7, I went back to hand logging TEP contacts when I found that I could no longer type numbers on my laptop computer. On March 8, the next to last day of operation, the 100 W module in my K3 transceiver stopped working between EU moon set and the start of NA moon set. No longer able to drive the Alpha 8406, I quickly dismantled it and packed it up to make space for my 6M-1000 solid state amplifier, which fortunately only requires 3 W of drive. The open antenna relays in the 6M-1000 were not as reliable in the salt air as the vacuum relays in the Alpha, but they did provide two more EME contacts and a number of additional TEP contacts.

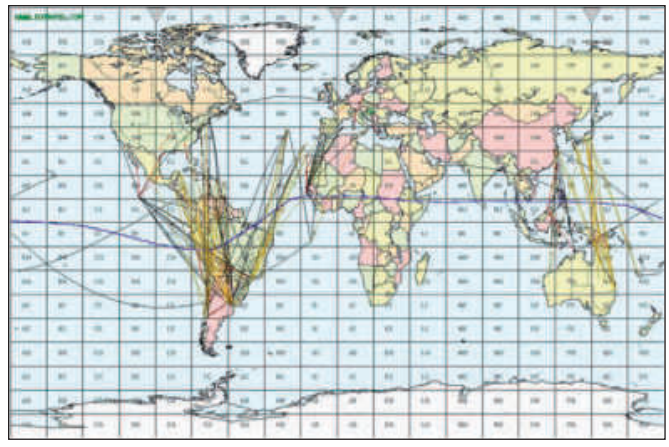


Figure 3 — Map of TX5K to Mexico E_s spots. [**dxmaps.com**]

The final 6 meter results were 317 overall contacts (212 SSB, 53 CW and 52 JT65A). I used JT65A to contact Alvaro, XE2AT, on D layer scatter and Javier, LU5FF, on TEP; the other 50 JT65A contacts were EME. The EME contacts with 21 countries were broken down as follows: One contact each with ES, F, FK, GM, GW, I, LA, OH, SP and UT. Two contacts with HA, OK, SM, VE and ZL. Three contacts with G, ON, S5 and OZ. There were 17 contacts with USA stations.

Eleven additional DXCC entities were added via terrestrial mode, bringing the total DXCC count up to 32. TEP and E_s added CE, CP, CX, HC, HK, LU, OA, PY, XE, YS and ZP. I worked only one station in the USA on E_s and that was with Larry, K5RK, during an E_s opening on March 7 UTC that had a very small footprint. I did complete a contact with Scott, K9SM, on what sounded like a meteor burst but the only locations close enough for meteor scatter were in Mexico, so I am assuming he was either operating portable there or via a remote station.

Lance worked Larry, K5RK (EL29) in Texas March 7 at 0235 UTC via E_s. TX5K had been working XE1s via single hop E_s prior to Larry's contact (see Figure 3). The distance between TX5K and K5RK is about 2560 km. This is over the usual one E_s hop limit of 2200 km. Perhaps it was via a chordal E_s hop or double hop? If you have questions or comments about TX5K, Lance can be reached at PO Box 73, Frenchtown, MT 59834, **w7gj@q.com**

NØJK/KH6 Hawaii March 2013

My family and I vacationed in Maui, HI (BL10) March 16-23. I brought along my FT-897, a ¼ wave magnet mount whip and wire for a dipole antennas on 6 meters for casual operation. The whole station fit in a carry-on bag.

We stayed in Wailea, which is on the west coast of Maui. The 10,000 foot high Haleakala volcano to the east blocks great circle paths to North, Central and South America. However, it is clear to the southwest and west. I heard the KH9/WA2YUN beacon 50.014 MHz loud several evenings for hours. On the 22nd the Wake Island beacon was very loud at 0430 UTC. I heard someone CQing on 50.110 MHz and called, thinking it may be the KH9. But it was Ross, VK4RO, and Randson, BV2DQ, calling me!

The noise level was high by the hotel swimming pool where my dipole was and I just could not pull out their calls. KH7Y told me later he heard both of them call me. BV2DQ is about 8300 km away. After dark I took down the dipole and placed the whip antenna on a large metal plate away from our room. The noise level was lower and I chatted with Ross, VK4RO, and several other VK4s on SSB via TEP around 0545 UTC. I had a short CW contact with a loud Rémi, FK8CP, a few minutes later and a back-scatter CW contact with Fred, KH7Y, on the Big Island. Fred worked BV2DQ, a loud KHØXH, 9M6YBG, a VK4 and 15 JAs among others.

On March 23 my family and I drove to Lahaina in west Maui for lunch at Mick Fleetwood's restaurant. On the way back my wife was driving and I checked DXScape (**www.dxscape.com**) on my phone where I saw that KH7Y had just spotted the Wake Island beacon:

KH9/WA2YUN/B 13/03/23 0244Z 50014.0 599 early today KH7Y

We drove until we reached a turnoff called McGregor Point where I could set up safely. I put the whip on the car and turned on the

Figure 4 — On his way home from lunch on Maui, Jon, NØJK, saw the Wake Island beacon spotted. Pulling into McGregor Point he contacted Colin, KH9/WA2YUN, at a distance of 3900 km, not bad for a mag mount. [Photo courtesy Jon Jones, NØJK]

radio (see Figure 4). The Wake Island beacon was booming in. I tuned up the band and heard Colin, KH9/WA2YUN, with a 20 over S9 signal! We chatted briefly, then my kids were ready to go. The propagation between Wake Island and Hawaii may have been F2 or E_s. The distance is around 3900 km and seemed to be a very consistent path. Thanks to KH7Y for his spots and tips on DXing on 6 meters from Hawaii.

On the Bands

50 MHz. March was slow — as expected — for E_s. But an increase in solar and geomagnetic activity sparked some F2 propagation. There was a little E_s left over from February as well. K6QXY worked TX5K on EME March 4 at moon set for Bob's DXCC #171. Lefty, K1TOL, in Maine found CE4WJK and CX9AU on March 7 around 2245 UTC, possibly a weak E_s-TEP. On March 17 UTC Fred, KH7Y, worked H44G for a new one and 3D2MF on 6 meters. He noted there was a "wall of JAs" on both of these DXpeditions and it was difficult to crack the pileups from Hawaii.

There was a major CME impact March 17 ~ 0600 UTC and a moderate geomagnetic storm followed with the K_p rising to 6. No enhancement in VHF propagation in Hawaii, but a strong aurora opening occurred for North American and European stations. NZ8U (EN66) worked KØSIX (EN35) and VE3MMQ around 2100 UTC. In the afternoon the geomagnetic activity boosted the MUF over 50 MHz on north-south paths. Stations in Texas, the Gulf Coast and Florida found strong signals from South America. Bill, W3XO, worked HC5VF at 2122 UTC. The Ecuador station was 59 with his 50 W. Bill suspects the propagation was direct F2. Later he worked LU7YA, LU9EHF, LU1DA, LW3EX and LU7YS between 2154–2256 UTC. Bill runs 700 W to an 11 element M^2 Yagi at 70 feet.

WA5IYX (EL09) spotted LU9EHF (FF95) and LU7YS on 50.110 MHz at 2315 UTC. On March 24, W9DR (EL86) spotted the CP6B/b at 1918 UTC and K5UR (EM35) AR worked CE2AWW in Chile at a peak of 599 at 2205 UTC. K5SW was not there at the time, Sam was on 20 minutes later but heard nil (the CE2 was gone from K5UR at that time). CE2AWW was also spotted by N5DG, K5RK and W5PR in Texas around the same time.

On the 25th, KH7Y worked E6RQ at 0915 UTC. Earlier at 0313 UTC, Fred worked OZ4VV via EME for the first Denmark — Hawaii 6 meter contact. That afternoon N3LL (EL86) worked ZP5SNA at 1952 UTC. March 26 KH6SX spotted E6RQ calling CQ on 50.110 MHz at 0700 UTC. Joel, KG6DX, heard the KH9/WA2YUN/b at 1018 UTC. N3LL (EL86) spotted the OA4TT/b with 599 signals on the 27th at 1945 UTC. There was a major F2/TEP opening March 31; details are coming next month.

144 MHz. Roger, VE1SKY, reported a rare tropo opening on March 10-12. He observed "The ducting was delineated in a compressed band along the East Coast from Prince Edward Island to North Carolina. There are only a few openings like this each year, so it's good to work them hard when they are around. I generally only see these New England call signs on reflectors and in non-radio media." He sent a log showing 16 contacts on 2 meters to W1, W2, W3 and VE2DSB. His best DX was N3RG (FM29) at 1172 km. He uses 160 W and a 30 element LPDA covering 41-1300 MHz, which translates to about a 4 element beam on the VHF/UHF bands.

On March 16, N4TUT (EL98) worked Dick, K5AND (EM00) via tropo at 1130 UTC across the Gulf of Mexico. Jay, W9RM, found loud signals on 2 meters during the aurora on March 17. He noted the coverage of the aurora was limited, in part due to it occurring early in the afternoon. Thus the aurora oval was not in a favorable location for North America. He "heard a large number of W9, W8 and VE3 stations on 2 meters, mostly all with good signals" 2100-2200 UTC. It appears the first aurora signals were spotted around 2000 UTC, the last was VA3ST by W9RM at 2246 UTC.

222 MHz. Jay, W9RM (EN52) worked K8MD (EN82) and K8TQK (EM89) on 222 MHz aurora with strong signals around 2150 UTC on March 17.

432 MHz. W9RM (EN52) logged K8MD (EN82) on 70 centimeter aurora March 17 at 2200 UTC. "His aurora signal had about +1500 Hz of Doppler but did not appear 'spread' to any major degree — just a normal raspy signal. Not like some openings where the signals are very broad. At around 2200 UTC, signals on all bands were peaking at 30 degrees from here in EN52. I heard VA3ELE (FN03) on 432 MHz with a copyable signal around 2215 UTC. He, however, could not copy me, possibly because of Doppler, but I did get an audio recording of him. That was, I think, the farthest station I have ever heard on 432 aurora."

902, 1296 MHz and Up. Vic, WB4SLM (EM82), worked N4TUT (EL98) on 1296 MHz March 13 at 492 km. (Thanks *205MorningReport.*)

Here and There

Directive Systems is moving to Virginia. It has been taken over by Terry, W8ZN, who will be setting up the operation in Haymarket. The name will be "Directive Systems & Engineering." I have retired from the antenna business and will pursue other things. — 73, Dave, K1WHS.

The new beacon frequencies for the KH6HME/b are 144.276 MHz and 432.310 MHz. The 1296.250 MHz frequency will remain the same. It will continue to operate on 144.170, 222.100, 432.078 and 1296.250 MHz for contacts. We do not plan to have a beacon on 222 MHz but will be active on CW and SSB/FM on 222.100 when there are openings. [July and August are the best months for transpacific tropo between Hawaii and the West Coast of the USA. — *Ed.*] — Aloha, Fred, KH7Y, and crew.

A DXpedition to Wake Island, K9W, has been announced for October, 2013, which includes 6 meters. More information and updates at **www.wake2013.org**.

Special Events

Maty Weinberg, KB1EIB, events@arrl.org; www.arrl.org/special-event-stations

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jan 1-Dec 31, 0000Z-2359Z, EI13CLAN, Dublin, Ireland. Irish Radio Transmitters Society. The Gathering. 28.050 21.320 18.080 14.220. Certificate & QSL. David, O'Connor, Silver Howe, Sydenham Mews, Corrig Ave, Dunlaoghaire Co Dublin, Ireland. **www.qrz.com/db/EI13CLA, clan@irts.ie** *or* **irts.ie**

Apr 20-May 24, 0001Z-2359Z, PG6KING, Leiden, Netherlands. The King Call Group. The Coronation of King Willem Alexander. 14.008 18.072 24.892 28.008. QSL. Edwin PD9ND, via bureau. *The following special event stations are also on the air with the "KING" call sign Apr 18 – May 20, 2013: PA6KING PC6KING PD6KING PE6KING. QSL manager for all stations is Edwin PD9ND (only via bureau).* **www.qrz.com/db/pg6king**

May 12-May 27, 1212Z-1212Z, N4G, Woodbury, TN. Cannon-DeKalb Amateur Radio Club. Cannon County Good Ole Days. 14.225 14.050 7.220 7.050. QSL. Jerry Elkins, N4LZY, 108 Bellehill Ln, Woodbury, TN 37190. **geode@heartoftn.net** *or* **www.dccarc.org**

May 16-May 18, 1420Z-1420Z, W8H, Dayton, OH. Feld Hell Club. Dayton Hamvention Special Event. 14.063 7.077. QSL. Joe Miller, 6928 Forest Park Ct, Troy, MI 48098. **www.feldhellclub.org**

May 16-May 20, 0800Z-1800Z, NØA, Eldon, MO. Northside Amateur Radio Club Oma Noma Days. 14.275 7.188 3.900. Certificate & QSL. David Meye, Box 224, Lake Ozark, MO 65049. **www.aa0nc.com**

May 18-May 19, 1400Z-2200Z, W2GSB, Lindenhurst, NY. Great South Bay Amateur Radio Club. The American Airpower Museum. 14.270 7.250 3.600. QSL. GSBARC, PO Box 1356, West Babylon, NY 11704. *S0-50 Satellite demonstration if available.* **gsbarc.org**

May 29-Jun 3, 0000Z-2359Z, W7P, Page, AZ. 50 Years of Lake Powell. 28.425 18.155 14.295 7.225. QSL. QSL via LoTW or postal mail within the US to Chris Powell, 5651 W Altadena, Glendale, AZ 85304. **www.qrz.com/db/w7p**

Jun 1, 1400Z-2000Z, W5WQ, Tylertown, MS. South West Mississippi Amateur Radio Club. Dairy Festival. 14.270 7.270. QSL. Homer Richardson, 1545 Friendship Ln NW, Brookhaven, MS 39601. **www.w5wq.net**

Jun 1-Jun 2, 0000Z-2359Z, W1T, Shelburne, VT. Radio Amateurs of Northern Vermont. Museum Ship Weekend. 21.300 14.260 7.250 3.970. QSL. Bob Brown, W4YFJ, 5 Repa Dr, Essex Junction, VT 05452. *From the Steamboat Ticonderoga during daylight hours.*

Jun 1-Jun 2, 0000Z-2359Z, KK5W, Sugar Land, TX. Brazos Valley Amateur Radio Club. Museum Ships Weekend 2013. 28.360 21.360 14.260 7.260. QSL. Brazos Valley ARC, KK5W, PO Box 2997, Sugar Land, TX 77487. **www.qrz.com/db/kk5w** *or* **bvarc.org**

Jun 1-Jun 2, 0001Z-2359Z, NJ2BB, Camden, NJ. Battleship New Jersey Amateur Radio Station. Museum Ships Weekend Event 2013. 21.326 14.262 7.262 7.042. Certificate & QSL. Margaret Burgess, KB2BRR, 150 Schooner Ave, Barnegat, NJ 08005. 16th Annual MSWE. *Work 15 different ships for certificate.* **www.nj2bb.org**

Jun 1-Jun 2, 1000Z-1630Z, N4WIS, Virginia Beach, VA. USS *Wisconsin* Radio Club. Museum Ships on the Air. 14.264 7.264. QSL. N4WIS, USS *Wisconsin* Radio Club, PO Box 6682, Virginia Beach, VA 23456. **www.n4wis.org/n4wis/index.php**

Jun 1-Jun 2, 1300Z-2100Z, W1AW, Newington, CT. United States Power Squadrons ARC. 100th Anniversary of United States Power Squadrons and American Radio Relay League. 28.365 21.365 14.265 7.265. QSL. American Radio Relay League, 225 Main St, Newington, CT 06111. *Also the 75th Anniversary of W1AW. This event celebrates the partnership between the two organizations and their shared century of public service.* **www.usps.org**

Jun 1-Jun 2, 1400Z-2000Z, VE3MIS, Mississauga, ON, Canada. Mississauga Amateur Radio Club. Streetsville Bread & Honey Festival. 14.240 7.230. Certificate & QSL. Michael Brickell, VE3TKI, 2801 Bucklepost Cr, Mississauga, ON L5N 1X6, Canada. **www.marc.on.ca**

Jun 1-Jun 2, 1400Z-2100Z, NB9QV, Manitowoc, WI. USS *Cobia* Amateur Radio Club. WW II Submarine USS *Cobia* AGSS-245. 14.250 7.240. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220. **www.qrz.com/db/nb9qv**

Jun 1-Jun 9, 0600Z-2000Z daily, W2W, Baltimore, MD. Amateur Radio Club of the National Electronics Museum. D-Day Commemoration. 14.241 14.041 7.241 7.041. Certificate & QSL. W2W D-Day Special Event Station, PO Box 1693, MS 4015, Baltimore, MD 21203. *Operating primarily June 6, 8 and 9.* **ww-2.us**

Jun 1-Jun 30, 0100Z-2359Z, K2CT, Troy, NY. Albany Amateur Radio Association. 100th Anniversary. All bands, all modes. Certificate. **bud@wf2b.com** or H. Hovey, 15 Sylvan Ln, Troy, NY 12180. **www.wf2b.com**

Jun 1-Jul 1, 1300Z-2359Z, CK3C, Mississauga, ON, Canada. VE3RHE. 100th Anniversary of the Canadian Arctic Expedition 1913-2013. All HF bands (no WARC). QSL. Robert Emerson, VE3RHE, 6950 Summer Heights Dr, Mississauga, ON L5N 7E9, Canada. **www.qrz.com/db/ck3c**

Jun 7-Jun 10, 1200Z-1700Z, WØW, Gunflint Trail, MN. EN48 Grid Activation for ARRL FFMA. SSB/CW 144.208 50.148; FSK441 144.148 50.248. QSL. Vince Pavkovich, 23260 189th St NW, Big Lake, MN 55309. *Operation will run with the 2013 ARRL June VHF QSO Party. No access to Internet or cell service. Schedule yourself for meteor skeds on the public Google spreadsheet. We will print a copy before departing on June 6th.* **www.k0six.com/w0w**

Jun 8, 0030Z-1800Z, W7C, Cheyenne, WY. Team Frequency. Relay For Life — American Cancer Society. SSB 14.270 7.270; PSK14.070 7.035 . QSL. Fred Culek, KD7LLF, 3008 Terry Rd, Sp 25, Cheyenne, WY 82007.

Jun 8, 1400Z-2100Z, KØWAR, Englewood, CO. Wings Over The Rockies Air and Space Museum. B-17 Fly-In at Centennial Airport. 146.460 14.260 14.252. Certificate & QSL. Wings Over The Rockies Air and Space Museum, 7711 East Academy Blvd, Denver, CO 80230. **wingsmuseum.org**

Jun 8, 1400Z-2100Z, W4T, Woodstock, VA. Woodstock Amateur Radio Group. 24th Annual Massanutten Antique Tractor Show. 14.250 7.260 3.815. QSL. Wayne Frye, 545 South Ox Rd, Edinburg, VA 22824. *Frequencies will move as band conditions change.* **kd4wie@arrl.org**

Jun 8, 1400Z-2200Z, W8VP, Cambridge, OH. Cambridge Amateur Radio Association. W8VP 25 Year Record Holder June VHF Contest in Great Lakes. 14.260 7.235. Certificate & QSL. Cambridge Amateur Radio Association, PO Box 1804, Cambridge, OH 43725. *6th Special Event in CARA's year-long 100th Birthday Celebration. Certificate available for anyone who works* all *12 of CARA's monthly Special Events of 2013.* **www.w8vp.org**

Jun 8, 1600Z-2300Z, NI6IW, San Diego, CA. USS Midway (CV-41) Museum. D-Day Normandy 1944, Navy Hospital Corps Established 1898. SSB 14.320 7.250 SSB PSK31 14.070 D-STAR 012C. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Jun 8-Jun 9, 0917Z-0917Z, W9EBV/W9W, Fond du Lac, WI. Fond du Lac Amateur Radio Club. Walleye Weekend. 28.450 21.325 14.265; 20 15 10 meters. QSL. Fond du Lac Amateur Radio Club, PO Box 53, Fond du Lac, WI 54935. **fdlhams@fdlhams.org** *or* **www.fdlhams.org**

Jun 9, 1400Z-2200Z, KDØMC, Gary, SD. Murray County Amateur Radio Club. Flying Sioux Plane Crash. 21.300 14.240 7.225. QSL. KDØMC, PO Box 149, Slayton, MN 56172. *70th Anniversary (June 13, 1943) of the Flying Sioux B-17 Plane.* **info@murraycountyradioclub.com**

Jun 13-Jun 16, 1700Z-1700Z, WØL, Hutchinson, KS. Reno County Kansas Amateur Radio Association. American Veterans Traveling Tribute. 14.250 7.200. QSL. RCKARA, PO Box 1304, Hutchinson, KS 67504. **www.rckara.org**

Jun 14-Jun 16, 1300Z-2100Z, K3J, Butler, PA. Butler County Amateur Radio Association Inc. Bantam Jeep Heritage Festival. 14.265 7.230. QSL. BCARA, PO Box 1787, Butler, PA 16003. **www.w3udx.org**

Jun 15, 0012Z-0021Z, W1MSN, Hampton, NH. Scottish Rites. Scottish Rites 200 Year Anniversary. 14.260 14.072. QSL. Dick Cooper, 51 Gove Rd, Seabrook, NH 03874.

Jun 15-Jul 15, 0000Z-0000Z, XL3S, Niagara, ON, Canada. Niagara Peninsula Amateur Radio Club. Laura Secord Bicentennial. SSB 18.130 14.218; CW 7.0181; PSK31 14.070. QSL. Dave Digweed, VE3FOI, 4117 Hazelnut Ct, Vineland, ON L0R 2C0, Canada. *Please send $2 for out of country postage.* **www.qrz.com/db/xl3s**

Jun 16-Jun 29, 0000Z-2359Z, WØM, Muscatine, IA. Muscatine Amateur Radio Club. Muscatine Amateur Radio Club 65th Anniversary. 146.910 28.310 7.258 3.970. Certificate. Tom Brehmer, 1114 E 10th St, Muscatine, IA 52761. **www.muscatinehams.org**

Jun 20, 1200Z-2359Z, W8S, Fayetteville, WV. Plateau Amateur Radio Association. State of WV Sesquicentennial — 150 Years. 18.163 14.263 7.263 3.863. QSL. Robert Kelly, Plateau Amateur Radio Association, 125 Rogers St, Oak Hill, WV 25901. **www/parawv.com**

Jun 20-Jun 22, 1900Z-1800Z, W1A, Fayetteville, AR. ARKANHAMS. Women's Air Race Classic. 14.440 14.305 14.280 14.265. QSL. Joe Dunn, 167 Ireland, Springdale, AR 72762. This an all women air race, from Pasco, WA to Fayetteville, AR. **www.airraceclassic.org**

Jun 22, 1400Z-2359Z, K3C, Snow Hill, MD. Peninsula Radio Operators. 64th Annual Delmarva Chicken Festival. 14.265 7.182. QSL. Rick Holloway, 30427 W Rustic Dr, Salisbury, MD 21804.

Jun 22-Jun 23, 0000Z-2300Z, W4J, Jupiter, FL. Jupiter Tequesta Repeater Group. Field Day. 28.325 14.229 7.225 3.914. QSL. Jupiter Tequesta Repeater Group, PO Box 7751, Jupiter, FL 33468. **www.jtrg.org**

Jun 22-Jun 23, 1800Z-2059Z, WØF, Fort Dodge, IA. Webster County Auxiliary Communications Service. 2013 WCACS Field Day Special Event Station. 446.000 146.555 14.330 3.915. QSL. Ronald Vought, KØRJV (IACEM/COML), WCACS 2013 Field Day, 1927 4th Ave S, Fort Dodge, IA 50501. **k0rjv@arrl.net**

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Offline completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Aug** *QST* would have to be received by **Jun 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 April 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

Jun 29, 1200Z-1800Z, N4USA, Floyd, VA. Foundation for Amateur International Radio Service. Film screening: *House of Good and Evil*. 21.450 14.300 14.250 7.300. Certificate. FAIRS, N4USA, PO Box 179, Floyd, VA 24091. **fair.org**

Jun 29, 1300Z-2300Z, WØKY, Kearney, NE. Midway Amateur Radio Club. Lincoln Highway 100th Anniversary Celebration. 14.260 7.225. Certificate. Midway ARC, PO Box 1231, Kearney, NE 68848. **w0ky.kearney.net**

Jun 29, 1400Z-2100Z, W8MRM, Wyandotte, MI. Motor City Radio Club. Trenton Mid-Summer Festival. 14.240 14.040 7.240 7.040. Certificate. Motor City Radio Club, PO Box 1337, Southgate, MI 48195. **w8mrm.net**

Jun 29-Jun 30, 1400Z-2100Z, KØKBX, Youngville Cafe, Watkins, IA. Benton County Amateur Radio Club. Lincoln Highway Centennial 1913-2013. 14.260 14.040 7.260 7.040. Certificate. E-certificate or direct to Benton County ARC, 4263 Highway 13, Central City, IA 52214. *Some history* **www.youngvillecafe.com**; *more info* **www.qrz.com/db/k0kbx**

Jun 30-Jul 6, 0900Z-1900Z, GB2BRT, Blandford, Dorset, England. RSGB. Blandford Racecourse Shutter Telegraph over 200 Years. 21.300 14.300 7.195. QSL. RSGB Bureau or John Wakefield, Oakhurst, Lower Common Road, West Wellow, Romsey, Hampshire SO51 6BT, England. **www.qrz.com/db/gb2brt**

Sean's Picks

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

- **State QSO Parties this month:** Alabama, Maritimes, West Virginia.
- **QRP Contests this month:** ARS Spartan Sprint (June 4), NAQCC Monthly QRP Sprint (June 12), QRP-ARCI QRP Shootout (June 15), Flying Pigs Run for the Bacon (June 17), NAQCC Milliwatt Sprint (June 20).
- **Ten-Ten Open Season (June 1-2):** With June comes sporadic E on 10 meters. This PSK event makes the most of the summer propagation. No 10-10 number? Work 10 stations with a 10-10 number and qualify for your own!
- **ARRL June VHF Contest (June 8-10):** The best VHF+ contest there is. Take advantage of the great propagation on 6 meters and up. If you've never operated a VHF+ contest before, read my article on VHF Contesting in this issue of *QST*!
- **ARRL Kids Day (June 15):** If you need a reason to share the fun of Amateur Radio with kids, this 6-hour event is geared toward the kids in your life! Open your station to the youth you know!
- **Stew Perry Warmup – Summer Stew (June 15-16):** 160 meters is known as a winter band, but that doesn't keep Top Band enthusiasts from having fun in the summertime! This fun event uses grid squares as the exchange and distance-based scoring.
- **ARRL Field Day (June 22-23):** While it's not officially a contest, Field Day is the largest operating event on Earth. Go camping, set up in a park or even operate from home. Always fun, always great. Do you have your plans finalized yet? Find a Field Day operation near you at **www.arrl.org/field-day-locator**.

June 2013 W1AW Qualifying Runs

W1AW Qualifying Runs are held at 10 PM EDST on Friday, June 7 (0200 Z, June 8) and at 7 PM EDST (2300Z) on Tuesday, June 18. The West Coast Qualifying Runs will be transmitted by station K6KPH at 3581.5, 7047.5, 14047.5, 18097.5 and 21067.5 kHz at 2 PM PDST (2100Z) on Saturday, June 15. Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

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

Field Day in IARU Region 1

Field Day doesn't just happen in the USA — it's popular all over the world!

Ulrich Weiss, DJ2YA, and
Ulrich Mueller, DK4VW

In Great Britain as early as 1930, Field Day was the first form of organized contesting in Europe and it has been a regular Amateur Radio event since. On the continent in the 1950s, Field Day enthusiasts in Germany and other European countries first met in the open on a summer weekend to compete against each other using CW or phone. Later, these activities developed into what is now called IARU Region 1 Field Day. In Europe, Africa, the Middle East and parts of Asia, Field Day is a little different from its American counterpart, as there are two Field Day events each summer: a CW event (held the first full weekend in June) and a phone event (held the first full weekend in September). Today, there are a lot of Field Day activities in most European countries.

During the early years, the number of Field Day participants was rather limited because the homebrew equipment back then was rather bulky. Beginning in the 1970s, the number of hams participating in Region 1 Field Day grew considerably, thanks to factory-made Amateur Radio transceivers becoming popular; these new, lighter rigs were easier to transport to more remote locations. In Germany, the number of participants was boosted even more when the Field Day standings were counted toward the German Club Championships, making Field Day an ideal occasion to practice teamwork in the local branches of the DARC.

The fundamental idea of Region 1 Field Day is to establish radio communications that are entirely independent of modern infrastructures: no mains, no buildings and no fixed towers. All gear and antennas must not be assembled earlier than 24 hours before the beginning of the contest. Throughout the years, hams have developed quite a number of ways to participate; while some still use tents or cars, mobile homes and even ex-government mobile trucks with huge mobile towers can be found on hilltops on Field Day weekends.

In some countries (such as Germany, Switzerland and Great Britain) hams participating in Region 1 Field Day have to announce their Field Day activity in advance and provide information to enable Field Day inspectors to trace them and check to see if their operation complies with the rules. These volunteers often travel hundreds of miles to visit several Field Day teams, making sure that participants do not exceed the limits of the class in which they have chosen to compete.

Martin Wilton, MØHTC; Michael Maude, G1UPP; Lyns Owen GØAZE, and Bob White, G8SPC, of the Gordano Radio Club operate in the 2012 SSB Field Day in Somerset, England. [Malcolm Pitt, G4KPM, photo]

The goal of Region 1 Field Day is for radio amateurs to establish as many contacts as possible in as many countries as possible on 80, 40, 20, 15 and 10 meters (and 160 meter CW in the DARC and RSGB Field Day events). Contacts between Field Day stations earn extra points; a QSO with a Field Day station — even in your own country — counts more than an ordinary DX contact. Of course, for a Field Day-to-DX QSO, there's a bonus. During both Field Day weekends, the number of contacts and multipliers within the 24 hours of operation compare very favorably with those in the big DX contests. Especially in the multioperator class — with hams using mobile high power generators and multi-element beam antennas on a huge mobile telescoping tower — you can find the same call signs on the operators' lists as you can in the top scores from big DX contests.

But not all participants consider Field Day a competitive exercise; some are still devoted to the original idea of providing communication in a case of emergency, when all civic infrastructure has broken down. Others regard Field Day a social event, where members of the local radio club meet for a BBQ and some fun, sometimes accompanied by their families.

Quite often, the local press is invited to report about Amateur Radio and its usefulness to the public. Declaring Field Day as an emergency communications exercise really helps to get the necessary permits from the local authorities to use areas protected for ecological or cultural reasons.

Each of the IARU Region 1 Member Societies sets their own rules for Field Day, and each publishes their national result lists after adjudication. But as there are no fundamental differences in the rules, the DARC encourages participants in all European countries to send their logs for an international ranking. All entries are rewarded with a detailed quality report, as well as certificates for all operators. That is why you can find more and more entries from different countries in DARC's international result lists.

The DARC website has a short summary about IARU Region 1 Field Day (see **www.darc.de/de/referate/dx/contest/fd/en**). It characterizes Field Day activity as "one of the last serious outdoor adventures in ham radio — radio sports and team spirit at its best."

If you happen to hear stations signing /P after their call signs on the first weekends in June or September, don't hesitate to give them a call and reward them for their great efforts in this fascinating facet of Amateur Radio.

[Editor's note: Region 2 hams also participate in ARRL Field Day. While there is no organized IARU Region 3 Field Day, Member Societies in that region — such as Taiwan, Australia, New Zealand and Korea — host their own Field Day each year.]

John Dilks, K2TQN, k2tqn@arrl.org

The Heathkit HW-30 "Twoer"

Harold Kramer, WJ1B, fondly remembers the "Benton Harbor Lunchbox."

If you were a Novice in the 1960s, the Heathkit "Twoer," model HW-30, might be familiar. It was a 5 W, 2 meter AM transceiver — ideal for the days when Novice amateurs were permitted to operate AM phone from 145 to 147 MHz. Back then a bare-bones Twoer offered an easy way to get on the air. It cost $44.95 ($350 in today's dollars) and included a 45 page manual and a ceramic microphone. It was a kit, however I did not build mine. I purchased my Twoer from one of my Elmers. I mowed a lot of lawns to earn the $35 that it cost!

Figure 1 — WJ1B's Heathkit "Twoer." It is still in reasonably good shape after almost half a century.

Along with the Twoer, Heathkit sold other transceivers with similar features including the "Sixer" for 6 meters and the "Tener" for 10 meters. The first ads for these radios appeared in December 1960 issue of *QST*. Heathkit sold thousands of these radios through the end of the decade.

I put my Twoer on the air in the late 1960s. At that time many of my teenage ham radio friends were active on 2 meters, but FM had yet to catch on. Using 2 meter AM I could work local hams, participate in local Civil Defense activities; (CD was the predecessor to Homeland Security) and join The Connecticut Mobileers, an early Emergency Communications group. With some luck and a decent antenna, you could work stations a few hundred miles away when the band opened.

The Twoer was nicknamed the "Benton Harbor Lunchbox" because Heath Company was located in Benton Harbor, Michigan and it actually looked like a lunchbox with its metallic beige case, boxy shape and its handle on the top (see Figure 1). There was even a handy slot on the side of the case to hold a copy of your license. The front panel had only three controls: **On/Off /Volume**; **Tuning**; and **Transmit/Receive** — with both PTT and lock positions on transmit. It weighed only 6½ pounds and was factory configured for 110 V operation, although it could also run on 6 or 12 V dc with Heath's GP-11 external power supply.

Inside the Twoer's Design

The Twoer had only five tubes (see Figure 2). It used a super regenerative receiver, a circuit popular in the 1920s and early 1930s. The receiver itself used half of a 6BS8 triode and was plenty sensitive, particularly since the other half of the 6BS8 was an RF preamp. Heath claimed the sensitivity was "as low as one microvolt at the antenna terminals." Receive sensitivity was set with a "Regeneration" pot on the back of the transceiver.

Selectivity was not the receiver's strong point and separating signals was a problem. This did, however, make it easy to listen for other stations since you could set the tuning knob midway between 144 and 146 MHz and hear just about any signal on that portion of the band.

A downside of the design was that the superregen receiver produced a lot of RF noise that got into the other receivers in my shack. I installed a switch on the back of my Twoer to disable its receiver when it was not in use.

The transmitter was crystal controlled. Most stations operated between 145.2 and 145.7 MHz and that required 8 MHz crystals. The standard FT-243 crystal socket was inconveniently located inside the case, so you had to remove the case to change crystals. I relocated the crystal socket to the rear of the case where it could be reached easily. This was a very common modification among Twoer owners.

The transmitter used a Pierce oscillator and two 6BA8 tubes that tripled the 8 MHz

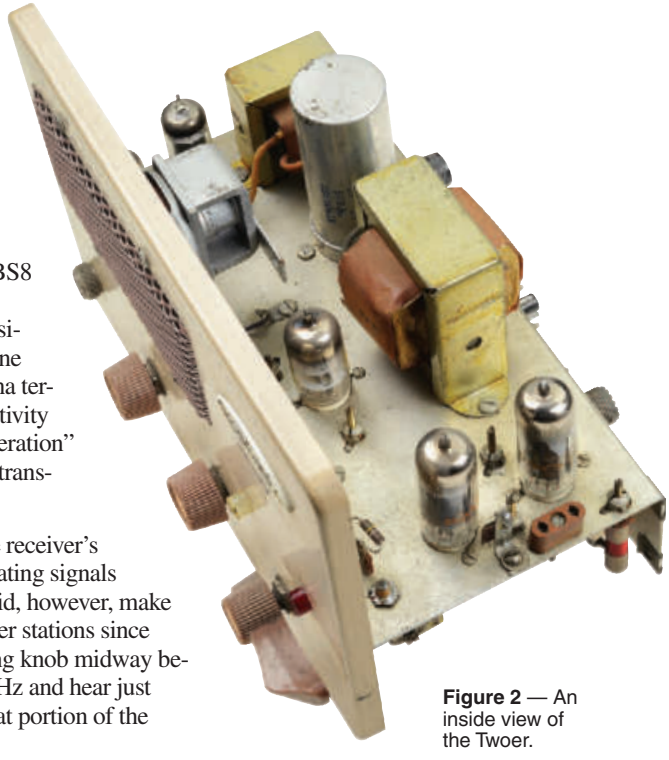


Figure 2 — An inside view of the Twoer.

A Heathkit Twoer advertisement from the December 1960 issue of *QST*.

crystal frequency to 24 MHz, then tripled it again to 72 MHz and finally doubled it to 144 MHz where it went "straight through" the final amplifier, a 6AQ5 power pentode that ran "approximately 5 watts," according to the manual. The 6AQ5 also served as the audio power amplifier for the receiver. The Twoer used plate modulated AM with good quality audio. It could also run CW, more or less, but the manual cautioned that there would be "considerable back wave that may result due to the fact that the previous transmitter states are running constantly." I tried CW a couple of times and the other stations could hear the transmitter even when it was not keyed!

The internal power supply used a power transformer, solid state rectifiers and a full wave voltage doubler circuit to provide 260 V at 90 mA when transmitting. My Twoer has a homebrew 12 V power supply attached to the rear of the cabinet. You can see it protruding behind the handle in Figure 1.

Tuning and Operating

Like most Twoer owners, I changed the original phono plug antenna jack to an SO-239 because it made a more secure connection. To tune the final, you placed a #47 lamp dummy load in the antenna jack and adjusted the tuning capacitor for maximum brightness.

Unfortunately, the tuning capacitor was inside the case so you had to poke a screwdriver through a hole in the side of the case to get to it. In accordance with a suggestion found in a 1965 *QST* "Hints and Kinks" column, I put some heat shrink tubing over the screwdriver's metal blade since I found from personal experience that sparks would result if I accidentally touched the screwdriver to the metal case while tuning up! There was also a power output metering circuit jack that, when used with an external meter, was used to tune the final tank circuit for maximum power and to measure cathode current. The metering jack was also put to work for CW keying.

Good Times

I made hundreds of contacts with my Twoer. My first antenna was a 19-inch (¼ wavelength at 2 meters) coat hanger bent 90 degrees at the bottom with a banana plug that was pushed into the SO-239. I was able to work stations easily in the city where I lived, although it helped that my parents lived on the top of a hill.

My next antenna was a 2 meter halo, essentially a half wave dipole bent in a circle. I mounted this antenna on a pole outside the house and was able to extend my range to 15 miles or so. Eventually, I installed a roof tower and a Cushcraft beam with a Channel Master TV rotator. It was no big deal in those days to have a tower on your roof since outdoor TV antennas were very common. With all of 5 W, I could consistently work stations 30 miles from home. During band openings, I managed to work five or six states from my Connecticut location, including a station in Maryland, which was my farthest 2 meter DX.

It was not that easy to work VHF DX since most everyone was rockbound and the procedure for calling CQ and tuning for a reply was quite different. When calling CQ, you also defined your tuning range. For example, "WJ1B calling CQ and tuning from 145.20 to 145.40 for a call." You used this method so you would not miss stations calling you on different frequencies.

My most memorable experience with the Twoer was when the local Emergency Communications authorities asked me to bring the Twoer to the Waterbury, Connecticut Armory during the Great Northeast Blackout of 1965. As a teen, it was quite a thrill to operate my Twoer on generator power, and pass messages to hams at other support facilities in adjacent towns.

The Heathkit Twoer and I have a long history together. It still occupies a proud place in my shack and reminds me that my early experiences with this little rig gave me my start in the communications industry where I have spent my entire career. I am sure that many of us have similar stories.

Harold Kramer, WJ1B, is the ARRL Chief Operating Officer. You can contact him at **hkramer@arrl.org**.

New Products

Solderless BNC Connectors for Times Microwave LMR-400 Cable

Times Microwave Systems now offers two new BNC connectors for LMR-400 coaxial cable. The EZ-400-BM is a BNC male straight connector, and the EZ-400-BM-RA is a BNC male right angle connector. The new crimp-style connectors do not require soldering of the center conductor into the contact. These connectors are compatible with the Times Microwave CST-400 cable prep tool and either the CT-400/300 or HX-4 (with Y1719 dies) crimp tools. Price: EZ-400-BM (part no. 3190-2611), $21; EZ-400-BM-RA (part no. 3190-2612), $33. For more information, visit your favorite dealer or **www.timesmicrowave.com**.

The Joys of Wilderness Radio

Packing technology into the wilderness makes sense when you keep it simple.

Dr Peter Ewing, GMØWEZ

Amateur Radio is a popular adjunct to a wilderness trip, but at first glance it makes little sense. You spend hours, dollars and sweat getting away from people — and then spend hours, dollars and sweat trying to contact them.

There is also an argument that electronic gadgets simply don't belong in the wilderness. One of the attractions of the trail is the sound of nature — and sometimes that sound is silence. No one wants to reach a distant summit to find the cacophony of a 20 meter pileup blaring from a loudspeaker.

Yet, despite all this, the attraction of operating from wild country is strong. For me the low power CW transceiver in my pack is as essential as the knife, compass and matches. Why is this?

Self Reliant Radio

The English wilderness skills guru Ray Mears says: "Know more, carry less." The outdoorsman who can improvise shelter, make fire by friction and forage for food is less reliant on equipment.

The same attitude applies to Amateur Radio in this environment. If you don't know Morse code and cannot build equipment from a kit, you are tied to heavy factory-built equipment with large batteries. Yes, there is the excellent Yaesu FT-817, but it draws as much current on receive as a kit radio does on transmit and 2.5 W of SSB to a field-expedient antenna is not very effective.

Trail Transceivers

If you follow the "know more, carry less" mantra, then you have a wide choice of inexpensive, low power CW transceiver kits. Self contained units with radio, battery and tuner in a single box are the most convenient. Elecraft (**www.elecraft.com**) and Hendricks (**www.qrpkits.com**) both make a trail radio kit in this format.

Your choice of band is important. You're most likely to use the radio in the evening after making camp. For that reason, 40 meters is a good choice, as the band is always open to somewhere.

As for antennas, keep it simple. Originally I used a center-fed dipole with RG-174 mini coax, but I found that the SWR varied depending on location, wire height and surrounding trees. The trend now is toward the end-fed half-wave antenna tuned against a counterpoise wire. This is a very high impedance antenna and requires a simple tuner comprising a toroid-wound transformer and a variable capacitor. The tuner can be home-brewed or is available as an inexpensive kit from Hendricks. You will need to use a simple LED SWR bridge to aid tuning. I have found this configuration to be far more practical to erect in the field. Its performance is very similar to that of a coax-fed dipole at equivalent height and the packed weight is actually lower.

The Simple Life

I get the same satisfaction from CW contacts from the shore of a remote loch as I do from making fire by friction. In both cases I am abandoning high technology in favor of older, simpler — perhaps purer — methods. I am doing something that not everybody can do.

CW operation fits well into a wilderness trip. When using headphones, operation is nearly silent. A complete station weighs a few ounces. Just as a fireplace turns a forest clearing into a home, a small radio turns it into a station. We are working with nature, not against her. We use a tree as an antenna support, the sky as a mirror and perhaps sunlight for power. This is low impact radio. Done properly, it does not detract from anyone else's enjoyment.

Of course, if you break a leg you might be very glad of that little radio in your pack. One trip found me paddling my canoe on Loch Hourn on the west coast of Scotland, en route to the Knoydart Peninsula — sometimes called Europe's last wilderness. Like all the best places, it's protected by distance — that means 7 miles of maple paddle through saltwater and you must hit the narrows at high tide to get through.

Upon reaching the peninsula, I found that, of the four radios I had brought, only my kit radio provided communications. I contacted ON5TO in Bruges, who gave me the SIGS FB FER QRP accolade.

It's hard to explain why radio operation from wild country is so satisfying, but I believe there is a parallel with fishing. When you catch a trout on a hiking trip, you are proving to yourself that you have the skill to live there, to feed yourself, to be a connected part of the environment. Making contact with Ulan Bator on a flea-power radio proves that you have the skill to communicate, to obtain human companionship in the back country and to do it all with the simplest technology.

My fellow Scot John Muir said "Break clear away, once in a while, and climb a mountain or spend a week in the woods. Wash your spirit clean." He was right and I don't think he would have minded us tucking a radio into our pack.

Peter Ewing, GMØWEZ, got hooked on radio as a medical student, thanks to the Aberdeen University Officer Training Corps. Currently he works as a general practitioner in Crieff, on the edge of the Scottish Highlands. Peter is married to Janie and they have three sons, one of whom is licensed. His radio interests vary from WSPR to Hellschreiber, but his true passion is pounding brass. Peter can be reached at Kildonan House, Caerlaverock, Caerlaverock By Muthill, CRIEFF PH5 2BD, Scotland, **pete.ewing@btinternet.com**.

Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to 900 words in length.

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111 or via e-mail to **qst@arrl.org** (subject line Op-Ed).

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Fort Payne) — Jun 15
D F H T V

8 AM. *Spr:* DeKalb County ARC. DeKalb County VFW Post #4138, 151 18th St NE. *Tl:* 147.27 (100 Hz). *Adm:* $5. Robert Williams, N1UMC, 256-868-0133; **ncsailor62@gmail.com**; **www.w4gbr.org**.

ROCKY MOUNTAIN DIVISION CONVENTION

June 28-30, Estes Park, CO

D H Q R S V

Friday 4 PM-Sunday 1 PM. *Spr:* HamCon Colorado Committee. Rocky Mountain Park Inn & Convention Center, 101 S Saint Vrain Ave. *"Amateur Radio — Adventure, Service, Knowledge."* W1AW/Ø Special Event Station, contests, Saturday eve banquet (7-9 PM, $40). Wouff Hong Ceremony. *Tl:* Estes Park area 146.685, 449.8 (both 123 Hz); Denver area 449.225 (141.3 Hz). *Adm:* advance $21 (by June 15), door $25. Steve Williams, KØSRW, 719-337-8103; **k0srw@arrl.net**; **www.hamconcolorado.org**.

Connecticut (Newington) — Jun 15
D F H R S T V

8 AM-1 PM. *Spr:* Newington AR League. St Mary School, 625 Willard Ave. *Tl:* 145.45 (127.3 Hz). *Adm:* $5. Armando Landrian, KB1PRP, 860-805-3107; **kb1prp@arrl.net**; **www.narlhamfest.org**.

Illinois (Wheaton) — Jun 16
D F H Q R T V

7 AM-noon. *Spr:* Six Meter Club of Chicago. Wheaton Fairgrounds, 2015 Manchester Rd. *Tl:* 146.97 (107.2 Hz), 146.52. *Adm:* advance $6, door $8. Mike Huedepohl, WD9GJK, 708-485-5481 (after 6 PM); **wd9gjk@arrl.net**; **k9ona.com**.

Maryland (West Friendship) — May 26
D F H R T V

8 AM-1 PM. *Spr:* Maryland FM Assn. Howard County Fairgrounds, 2210 Fairgrounds Rd. *Tl:* 146.76, 224.76, 444.0 (107.2 Hz). *Adm:* $6 donation. John Elgin, WA3MNN, 301-641-5313; **marylandfm@verizon.net**; **www.marylandfm.org**.

Massachusetts (Cambridge) — Jun 16. Nick Altenbernd, KA1MQX, 617-253-3776 (9 AM-5 PM); **w1gsl@mit.edu**; **www.swapfest.us**.

Michigan (Monroe) — Jun 16 D F H R T
7:30 AM-1 PM. *Spr:* Monroe County Radio Communications Assn. Monroe County Fairgrounds, 3775 S Custer Rd. *Tl:* 146.72 (100 Hz). *Adm:* $6. Fred VanDaele, KA8EBI, 734-652-3843; **ka8ebi@yahoo.com**; **www.mcrca.org**.

New Jersey (Piscataway) — Jun 15
D H Q R T V

8 AM-noon. *Spr:* Raritan Valley RC. Piscataway HS (Lots 11/12), 110 Behmer Rd. *Tl:* 146.625, 442.25 (141.3 Hz). *Adm:* $7. Drew Moore, W2OU, 732-801-4654; **drumor@optonline.net**; **w2qw.org**.

New Jersey (Township of Washington) — May 25 D F H Q R T V
8 AM-3 PM. *Spr:* Bergen ARA. Westwood Regional HS, 701 Ridgewood Rd. *Tl:* 146.79 (141.3 Hz). *Adm:* $5. Jim Joyce, K2ZO, 201-664-6725; **k2zo@arrl.net**; **bara.org**.

Coming ARRL Conventions

May 17-19
Dayton Hamvention®, Dayton (Trotwood), OH*

May 31-June 2
Northwestern Division Convention, Seaside, OR*

June 1
Georgia State Convention, Marietta, GA*

June 7-8
West Gulf Division Convention, Plano, TX*
Wyoming State Convention, Buffalo, WY

June 8
Delta Division Convention, Rogers, AR*
Tennessee State Convention, Knoxville, TN*

July 6
Eastern Pennsylvania Section Convention, Harrisburg, PA

July 19-21
Montana State Convention, East Glacier, MT

July 25-27
Central States VHF Society Conference, Elk Grove Village, IL

July 26-27
Oklahoma State Convention, Oklahoma City, OK

August 2-3
Texas State Convention, Austin, TX

August 2-4
Pacific Northwest DX Convention, Spokane Valley, WA

August 3
Great Lakes Division Convention, Columbus, OH

*See May *QST* for details.

New York (Chaffee) — Jun 15
D F H R T V

8 AM-noon. *Spr:* Pioneer Radio Operators Society. Manion Park, 9990 Grove St. *Tl:* 145.39. *Adm:* $5. Roy Schwedt, KC2LEE, 716-258-8647; **rschwedt@wildblue.net**; **facebook.com/pioneerradiooperatorssociety.pros**.

New York (Queens) — Jun 30
D F H Q R T V

9 AM-2 PM. *Spr:* Hall of Science ARC. New York Hall of Science Parking Lot, 47-01 111th St (Flushing Meadows Corona Park). *Adm:* $5. Stephen Greenbaum, WB2KDG, 718-898-5599; **wb2kdg@arrl.net**; **www.hosarc.org**.

North Carolina (Greensboro) — May 18
D F H

8-11 AM. *Spr:* RFMD ARC. RFMD Headquarters Rear Parking Lot, 7628 Thorndike Rd. *Tl:* 145.25 (88.5 Hz). *Adm:* Free. Duane Brantley, AG4C, 336-678-5792; **duane.brantley@rfmd.com**; **kd4rf.org**.

North Carolina (Salisbury) — Jul 6
D F H R V

8 AM-1 PM. *Spr:* Rowan ARS. Salisbury Civic Center, 315 S Martin Luther King Ave. *Tl:* 145.41 (136.5 Hz). *Adm:* advance $4, door $5. Ralph Brown, WB4AQK, 704-636-5902; **rkbrown5902@bellsouth.net**; **rowanars.org**.

Ohio (Milford) — Jun 15 D F H R S T V
8 AM-2 PM. *Spr:* Milford ARC. Eastside Christian Church, 5874 Montclair Blvd. *Tl:* 147.345. *Adm:* $5. Jim Linn, WB8RRR, 513-831-6255; **wb8rrr@arrl.net**; **www.w8mrc.com**.

Pennsylvania (Dallas) — Jul 7 D F H R V
8 AM-1 PM. *Spr:* Murgas ARC. Luzerne County Fairgrounds, 3621 Rte 118. *Tl:* 146.61 (82.5 Hz). *Adm:* $7. Herb Krumich, K2LNS, 570-829-2695; **wa2fgk@yahoo.com**; **murgasarc.org**.

EASTERN PENNSYLVANIA SECTION CONVENTION

July 6, Harrisburg

D F H Q R S T V

7 AM-2 PM. *Spr:* Harrisburg RAC. Harrisburg Area Community College (Shumaker Public Safety Ctr), 3599 Industrial Rd. 41st Annual Firecracker Hamfest and Electronics Expo, Special Event Station W3W. *Tl:* 146.76 (100 Hz). *Adm:* $5. Terry Snyder, WB3BKN, 717-896-0256; **wb3bkn@gmail.com**; **www.w3uu.org**.

Pennsylvania (Kimberton) — Jul 7
D F H R V

7 AM-noon. *Spr:* Mid-Atlantic ARC. Kimberton Fire Company Fairgrounds, Rte 113 and Firehouse Ln. *Tl:* 145.13, 147.06 (131.8 Hz). *Adm:* $6. Mike Pilotti, KF3CD, 610-696-5040; **kf3cd@arrl.net**; **www.marc-radio.org**.

Quebec (Sorel-Tracy) — Jun 2. Luc Leblanc, VE2DWE, 450-232-1888; **ve2cbs@raqi.ca**; **www.hamfest.qc.ca**.

Texas (Big Spring) — Jun 29 T
8 AM. *Spr:* Big Spring ARC. W5AW Clubhouse, 3707 S 87. *Tl:* 146.82 (88.5 Hz). *Adm:* Free. Leland Pechacek, KF5AEO, 432-816-2401; **kf5aeo@yahoo.com**; **www.qsl.net/w5aw/**.

Washington (Port Ludlow) — Jun 8 H T
8 AM-noon. *Spr:* Port Ludlow ARC. Grace Christian Church, 200 Olympic Pl. *Tl:* 146.52. *Adm:* Free. Mark McKibbin, WR7V, 360-437-0337; **wr7v@n7pl.org**; **www.n7pl.org**.

West Virginia (Beckley) — Jun 15
D F H R S T V

7 AM-2 PM. *Spr:* Black Diamond ARC. Raleigh County Commission on Aging, 1614 S Kanawha St. *Tl:* 145.37 (100 Hz). *Adm:* $5. Zandle Cline, AC8DU, 304-683-3395; **ac8du@yahoo.com**; **www.qsl.net/bdarc/**.

Wisconsin (Oak Creek) — Jul 6 D F H R T
6:30 AM-2 PM. *Spr:* South Milwaukee ARC. American Legion Post #434, 9327 S Shepard Ave. *Tl:* 146.52. *Adm:* $5. Robert Kastelic, WB9TIK, 414-764-3871; **wb9tik@arrl.net**; **www.qsl.net/wa9txe**.

WYOMING STATE CONVENTION

June 7-8, Buffalo

D H Q R S T V

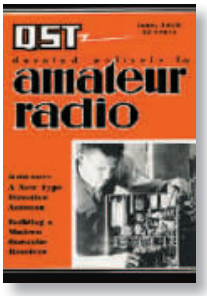
Friday 6 PM, Saturday 8 AM-5 PM. *Sprs:* Northeast Wyoming ARA and Johnson County Hams. Bozeman Trail Steakhouse and Convention Center, 675 E Hart St. Foxhunt; Ham of the Year Award; special guest from ARRL HQ Dave Patton, NN1N, MVP Manager. *Tl:* 145.49 (110.4 Hz), 146.52. *Adm:* by Jun 1 $25 (buffet and Sat events); door $10. Robert Underwood, K7EMR, 307-689-0103; **k7emr@arrl.net**; **www.wyominghamcon.org**.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

75, 50 and 25 Years Ago

Al Brogdon, W1AB

June 1938



- The cover photo shows a homebrewing ham checking out his latest project.
- The editorial discusses the practical value of Field Day — that of preparing us for real emergency operation.
- HQ's Don Mix, W1TS, tells about building a rig with "Gang Tuning for the Multi-Stage Transmitter."
- "The Extended Double-Zepp Antenna," by Hugo Romander, W2NB, describes how to get improved gain and horizontal directivity with simple antenna structures.
- S. Leibowitz, W8BXN, reports on his latest project, "A C.W. and 'Phone Station Freqmeter-Monitor and Modulometer with Cathode Ray Tube."
- George Grammer, W1DF, tells about "A New Type of Frequency-Checking Device," a signal generator that produces signals at 10-Kc. intervals throughout the high-frequency spectrum.
- In "75-Meter 'Phone Goes Hunting in the Maine Woods," P. L. Spencer, W1GBE, tells us about the small and simple portable 75-meter 'phone transceiver he built for hunting trips deep into the Maine woods — in case of the need for emergency communication.
- G.C.F. Whitaker discusses "The Pentagrid Tube as a Combined Second Detector and Beat-Frequency Oscillator."
- HQ's T. M. Ferrill presents "A Simple One-Tube Receiver" for the beginner.

June 1963

- The cover photo peeks into the trunk of W1NI's car to see the base of his remotely tuned mobile antenna.
- Albert Jackson, W1NI, reports on two versions of his "Remotely Tuned Mobile Antennas."
- George Grammer, W1DF, gives us Part IV of "A.C. in Radio Circuits," titled "Coupled Radio-Frequency Circuits."
- "Practical Gear for Amateur Microwave Communication," by Karl Peterson, K3KRU, tells us how to build equipment for the microwave bands, while using a minimum of hard-to-find components.
- Lew McCoy, W1ICP, describes "The Scotsman's Delight," a 15-meter beam for less than $5.00.
- Benjamin Vester, W3TLN, reports that he built "A Solid-State S.S.B. Transceiver" for 14 Mc, in a tiny 5 x 7 x 2 package.
- Robert Forster, W2DVG, tells us how to get "Full-Band V.H.F. Coverage with Amateur-Bandspread Receivers."
- In "A 50-Mc. Hand-Carried Transceiver," David Light shows that we can get effective local communication with a small package.
- Robert Heslin, K7RTY, describes his "Three-Band Log-Periodic Antenna" for v.h.f. and u.h.f.
- By Goodman, W1DX, discusses "Criticizing C.W. Signals," and the need for us to accurately report the flaws of the signals we encounter on the ham bands. Along the way, he educates us about what to listen for.

June 1988

- The cover photo shows work on the Phase 3C OSCAR satellite, soon to be placed into orbit.
- The editorial discusses current problems with "QRM."
- HQ Lab Technician Tom Miller, NK1P, explains how to build "A Cheap 'n' Easy Modem."
- In "Introducing Phase 3C: A New, More Versatile OSCAR," Vern Riportella, WA2LQQ, reports that Phase 3C will be easily accessible and will provide many operating alternatives.
- Richard Nelson, WBØIKN, tells us how to build "The Replay Digital Voice Message System," to save our voices during phone contests.
- Paul Newland, AD7I, describes how we can use four CMOS ICs and a handful of components to build "The AD7Iambic Cheap Keyer."
- Phil Sager, WB4FDT, reports that "FCC Announces Proposed Rewrite of Amateur Rules (PR 88-139)."
- "The Adventure of VHF Contesting," by Curt Roseman, K9AKS, Emil Pocock, W3EP, and Mike Owen, W9IP, tells us how easy it is to get into these exciting events and how much fun they can be.
- Tom Atkins, VE3CDM, reports on the "USSR/Canada Polar Bridge Expedition," a transpolar ski trek.

Field Organization Reports

March 2013

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at **www.arrl.org/public-service-honor-roll**.

510
W5KAV

410
KT2D

405
KØIBS

340
WB9FHP

315
KB2ETO

300
N5NVP

296
KC5ZGG

294
WM2C

290
W5DY

285
KT5SR

248
W2MTA

247
WB8RCR

240
W4SEE

231
N8OSL

230
KJ4G

225
K8RDN

215
KA2ZNZ

205
N7CM
K7EAJ

202
K2ABX

200
KB8QKC
K2HAT

199
WB8R

196
K4BEH

179
W7JSW
KB2KOJ

178
WA2BSS

175
WS6P

170
AG9G
VE7GN
W7ARC
WE2G
KK4BVR

WB4ZIQ

169
WD8USA

165
KE5HYW
K7OAH

163
W7FQQ

160
KE4CB
WB8YYS
KGØGG
WK4P
N1UMJ

155
N8IO
W4DNA

148
KE5YTA

146
KB5SDU

144
NA9L

142
K1PJS

141
KK7DEB

140
W9BGJ
N9VC
N5TMC
KK5NU
KB2RTZ
KB2BAA
KC2QVT
KK3F
K7BFL
KJ4JPE
N7IE

136
KC8EO

135
WB9WKO
NM1K
WA3EZN
W3YVQ
WV8CH
KD7OED
N1IQI

134
AB9ZA

130
W7EKB
K9LGU
K6JT
WØLAW
W8DJG
K4IWW
WI2G
KW1U

129
KA8ZGY
KV4MA

128
KB5PGY

127
AE5VY

126
K6HTN

125
K6FRG
N2JBA

122
N8FVM

120
NX9K
KA4FZI
KB1RGQ
NN7H
K4GK
K4JUU
NA7G
WB8WKQ

119
NX8A

117
W9WXN
KF7PDV

115
KD2AXP
AK4RJ
W7YV

114
WØSS

110
WA5LOU
KC5OZT
KF5IOU
K7BDU
W7QM
WØRJA
AA2SV
WA2NDA
KB3MXM
K7MQF
W7GB
N7XG
N7YSS
WA1STU
K4BG
W2EAG
N2WKT
KD8QPF
K1YCQ

109
W3CB

105
N3RB
KB1NMO
KF7GC
N2RTF
N1TF

104
KØLQB
K4VWK

102
K2GW

101
N2VC

100
N1JX
NC3F
KJ6IJJ
KJ6GYL
KJ6PCC
N5OUJ
N2RAI
WB8HHZ
WB8SIQ
WG8Z
WD8Q
WØCLS
NØMEA
WAØVKC
W5CU
KB5KKT
KB3LNM
WB4FDT
N3SW
KØVTT
KK7TN
N9VT
K4SCL
W4TTO
NS7K
WB8TQZ
KD8CYK

99
W8CPG

98
AA3SB

97
N2GJ

96
KC2EMW
N7EIE

95
NØYR
WB4Y

92
KD7THV
N1LKJ

91
K7FLI

90
W2CC
KA5AZK
WA4BAM
N5RL
K5AXW
N3KB
K1HEJ
KB1UAU
WDØGUF
W8MAL
N8CJS
N3ZOC
K3IN
WAØCGZ
WB4BIK
KC8BW

89
KB9KEG

88
KB8VXE

87
KF5TTN

86
KB8HJJ
KJ7NO

85
N5MBQ
KC2UMX

84
KB2QO
N8JMW
N8SY

83
N2DW

81
KC8QWH
K8VFZ

80
WA9QIB
KØDEU
NIØI
NØMHJ
KFØXO
KCØZDA
WB3FTQ
KB7RVF
WK4WC
KZ8Q
K8ED

79
KC5MMH

78
N9WLW

77
KD8RPP

76
AA5VZ

75
W9RSX
KB1YNE
N2YJZ
KC4PZA

74
KBØDTI

73
N9EXM
K6RAU
KB1WXC

72
AJ7B

70
KDØAYN
KØDLK
NØDUW
NØDUX
WØFUI
KDØNJH
N3NTV
KØPTK
KØRXC
KD7ZUP
W5XX

The following stations qualified for PSHR in previous months, but were not recognized in this column yet. (Feb) W5KAV 531, VE7GN 150, K7BDU, W7QM 110.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IL, IN, KS, LA, LAX, MDC, ME, MI, MN, MS, NC, OH, OK, OR, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WPA, WI, WMA, WV, WWA, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: GA, IA, ID, IN, MDC, MI, MN, MT, NH, NLI, NM, OK, SJV, SNJ, STX, SV, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

KK3F 3750, NX9K 3117, WB9FHP 2876, K6HTN 1837, N1IQI 1576, NS7K 1124, KW1U 1111, N9VC 1020, K6FRG 933, WØRJA 919, WD8Q 705, WA4BAM 680, K6JT 633, W7ARC 502.

The following stations qualified for BPL with Originations plus Deliveries: NM1K 129, K8LGJ 113.

The following stations qualified for BPL in previous months, but were not recognized in this column yet. (Feb) K7BDU 680. W5KAV 102 (Originations plus Deliveries)

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

KS1B **Rizzo**, Lawrence F., Spencer, MA
KD1BD **Kostrey**, David J., Orange, CT
W1CUO **Goonyep**, Edwin, Andover, MA
KA1EOM **Heleba**, Michael J. Jr, Shrewsbury, VT
N1GUW **Wistrand**, John, Flat Rock, NC
N1HEJ **Wilson**, Billie J., Kingsport, TN
N1HTM **Joiner**, W. Perry, Eden Prairie, MN
ex-K1IQL **Geroux**, Alfred W., Old Town, ME
N1JSK **Bergeron**, Christine G., Chicopee, MA
N1KHV **Brown**, Russel, Palmer, MA
W1LIM **Topliff**, Hubert J., Auburn, NH
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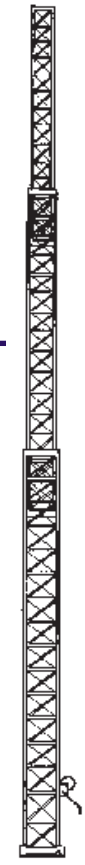

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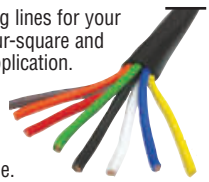

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Part Number	**Length/Ft.**	**Price**	**Part Number**	**Length/Ft.**	**Price**
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DXE-TCB10-RT03	3	**$8.75**	DXE-TCB05-RT03	3	**$5.75**
DXE-TCB10-RT05	5	**$12.75**	DXE-TCB05-RT05	5	**$6.75**
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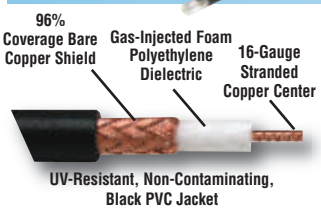


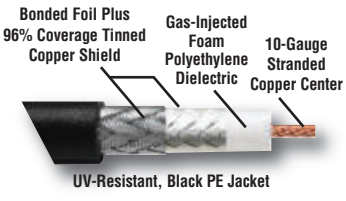
DXE-8X Low-Loss Foam Dielectric Cable (also known as RG-8X or Mini-8)

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

Pre-cut Cable with Connectors

Part Number	Length/Ft.	Price
DXE-8XDU003	3	**$10.75**
DXE-8XDU006	6	**$11.75**
DXE-8XDU012	12	**$13.75**
DXE-8XDU025	25	**$20.75**
DXE-8XDU050	50	**$29.75**
DXE-8XDU075	75	**$39.75**
DXE-8XDU100	100	**$48.75**
DXE-8XDU150	150	**$68.75**



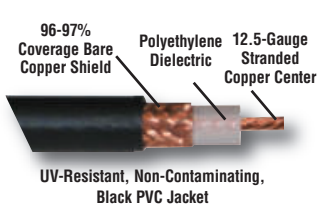
DXE-400MAX Low-Loss Cable

- Low-loss, gas-injected foam polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density polyethylene jacket is UV resistant, ideal for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	6.9 kW	93%
0.5 dB @ 10 MHz	4.8 kW	90%
0.8 dB @ 30 MHZ	2.8 kW	83%
1.1 dB @ 50 MHz	2.1 kW	79%
1.8 dB @ 150 MHz	1.2 kW	65%
3.3 dB @ 450 MHz	0.7 kW	47%

Pre-cut Cable with Connectors

Part Number	Length/Ft.	Price
DXE-400MAXDU003	3	**$13.75**
DXE-400MAXDU006	6	**$16.75**
DXE-400MAXDU018	18	**$28.75**
DXE-400MAXDU025	25	**$34.75**
DXE-400MAXDU050	50	**$60.75**
DXE-400MAXDU075	75	**$91.75**
DXE-400MAXDU100	100	**$109.75**
DXE-400MAXDU150	150	**$164.75**



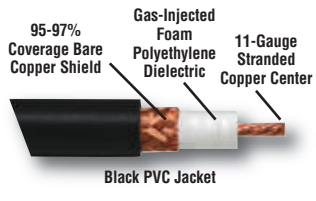
DXE-213U MIL-Spec Cable

- .405" Type II jacket is non-contaminating and UV-resistant, suitable for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

Pre-cut Cable with Connectors

Part Number	Length/Ft.	Price
DXE-213UDU003	3	**$12.75**
DXE-213UDU006	6	**$16.75**
DXE-213UDU012	12	**$22.75**
DXE-213UDU025	25	**$35.75**
DXE-213UDU050	50	**$62.75**
DXE-213UDU075	75	**$87.75**
DXE-213UDU100	100	**$108.75**
DXE-213UDU150	150	**$157.75**



Gas-Injected Foam Won't Absorb Water.

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket
- Low-loss foam dielectric

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	5.4 kW	93%
0.5 dB @ 10 MHz	4.1 kW	90%
0.9 dB @ 30 MHZ	2.2 kW	81%
1.2 dB @ 50 MHz	1.8 kW	77%
2.2 dB @ 150 MHz	1.0 kW	60%

Pre-cut Cable with Connectors

Part Number	Length/Ft.	Price
DXE-8UDU002	2	**$12.75**
DXE-8UDU003	3	**$13.75**
DXE-8UDU006	6	**$16.75**
DXE-8UDU025	25	**$31.75**
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Continued from page 106

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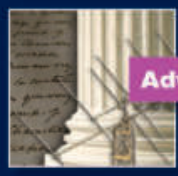

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DX ENGINEERING

ICOM · COMET · AMERITRON · CREATE · COMTEK · OPTIMA BATTERIES · RADIO · Telrex · MFJ · Cushcraft · DREMEL · DAIWA · GRIPPLE · hy-gain · HEIL SOUND · butternut · PHILLYSTRAN · rt SYSTEMS · KLEIN TOOLS, INC. · LOCTITE · LDG · Lido · 3M · VECTRONICS · Palstar · DIAMOND · ASTRON CORPORATION · MIRAGE · TITAN · Maldol · HUSTLER · Tigertronics · samlex · ROHN · PolyPhaser · VIBROPLEX · PLUS MORE....

Now Even More of Your Favorite Brands are at DX Engineering!

DX Engineering Offers You Complete, Ready-to-Install Antenna Packages!

They include an antenna, tilt base, radial plate with wire, a direct coax adapter and more. Plus, with free shipping to the lower 48 states, you'll save money while you're working more bands.

Get Totally Free Shipping with Your Order

DXE-HSR-4BTV-P 4-Band Package **$379.00**
DXE-HSR-5BTV-P 5-Band Package **$419.00**
DXE-HSR-6BTV-P 6-Band Package **$454.00**

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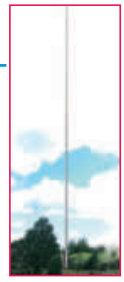
See website for all available configurations

Full Size 75/80 Meter Quarter-Wave Vertical Antennas



These 68 foot tall, high-performance, full size antennas have rugged base sections (2, 3 or 4 inch diameter) made from aircraft-grade aluminum tubing.

See video on how these four UNGUYED DX Engineering 80M Verticals easily withstood SuperStorm Sandy at DXEngineering.com!

The VA-1 requires simple guying. The VA-2 and VA-3 models are very stout and don't require guying. The VA-2 and VA-3 antennas are supplied with a Heavy Duty Plus Stainless Pivot Base and can be lowered easily with the optional, DXE-VRW one-man, manual winch.

- 2:1 bandwidth up to 500 kHz
- DX Engineering structural design + high strength tubing custom manufactured to our rigid specifications **= Highest Wind Ratings**
- High strength, UV-protected Extren® insulator **= High Power Handling Capacity**
- Specially manufactured stainless steel and aluminum saddle clamps, stainless steel bolts, and precision machining **= Reliability Second to None**
- Specially manufactured Pivot Base supplied with VA-2 and VA-3 antennas **= Easy Tilt Up and Down**

DXE-7580FS-VA-1 Vertical Antenna, standard HD, 2 inch O.D. base section.....**$379.50**
DXE-7580FS-VA-2 Vertical Antenna, Heavy Duty, 3 inch O.D. base section.....**$825.00**
DXE-7580FS-VA-3 Vertical Antenna, Super Duty, 4 inch O.D. base section **$1,775.50**

Not Cheap Aluminum! Guarantees Best Radial System Conductivity Over Time

Stainless Radial Plate with Coax Attachment

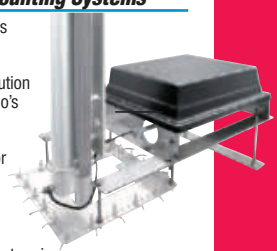
Makes radial attachment a snap!

- Fits 3" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

Now fits up to 3" O.D. mount

DXE-RADP-3 Complete with 20 stainless bolt sets.....**$54.50**
DXE-RADP-1HWK 20 sets of 1/4" stainless hardware ...**$7.50**
DXE-SSVC-2P Stainless Saddle Clamp for attachment to steel tube 1" to 2" O.D. **$11.95**

MFJ-998RT Remote Tuner Mounting Systems

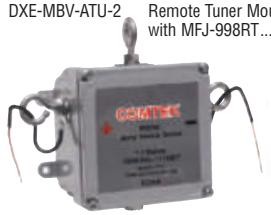


These Remote Tuner Mounting Systems provide an easy way to mount your MFJ-998RT tuner to any quarter-wave vertical antenna. They're the perfect solution for the Full Legal Limit Power DX'er who's using MFJ-998RT's great auto-tuning features. The ATU-2 mounts to the DX Engineering RADP-3 Radial Plate for a secure connection.

The DXE-ATU-2 has custom laser-cut stainless steel brackets, a right angle PL-259/SO-239 adapter, an insulated stranded copper feedline cable with ring terminal and other specialized hardware that facilitates the correct RF connections for maximum power transfer to antenna without arcing. Stainless steel hardware and instructions are included.

The DXE-MBV-ATU-2 has everything that the DXE-ATU-2 features, plus it includes a bias tee power injector and the MFJ-998RT remote IntelliTuner, making it a complete setup!

DXE-ATU2 Remote Tuner Mounting System **$64.50**
DXE-MBV-ATU-2 Remote Tuner Mounting System with MFJ-998RT.....**$824.45**



Stay ready—don't wait until the power is out to make a backup plan, get prepared with DX Engineering.

Optima YellowTop Deep Cycle 12-Volt Battery

Your DC power source needs to be reliable and rugged. OPTIMA's YellowTop battery is resistant to the elements, recharges quickly and can recover from deep discharges. This spill-proof battery can be safely used indoors and lasts longer than most other AGM batteries.

ULT-9050-160 YellowTop Deep Cycle 12V Battery...**$275.95**

Astron RS-50A Linear Power Supply

When you've still got 105-125 Vac available, make sure your DC power demands are met with this power supply from Astron. It puts out a reliable 13.8 Vdc at 50A (peak)/37A (cont.) and features over-voltage and current limiting protection.

ASR-RS-50A Linear Power Supply.....**$271.95**

West Mountain Radio Super PWRgate PG40S

The Super PWRgate maintains a steady stream of up to 40A continuous from your power supply or battery. It instantly switches to battery backup if you lose power and it has a built-in battery charger.

WMT-58403-1046 Super PWRgate PG40S .....**$xxx.xx**

West Mountain Radio PWRguard Plus

If your DC voltage is rapidly changing, the PWRguard Plus can sense it and shut the system down. To further protect your equipment, you can set the voltage trip threshold. The PWRguard Plus is rated for 40 amps peak.

WMT-58402-1045 PWRguard Plus .....**$xxx.xx**

West Mountain Radio RIGrunner 4008

To distribute power, RIGrunners feature Powerpole® connectors and use automotive-style fuses. The RR-4008 is rated for up to 40 amps.

WMT-58307-1035 RIGrunner 4008.....**$xxx.xx**

Super Duty Tilt Bases Available Separately

DXE-VRW-1 Manual Winch

A great option, this winch allows one person to easily raise or lower a VA-2 or VA-3 vertical antenna.

DXE-VRW-1 Manual Winch.....**$169.99**

Low Sale Price!

Made in USA

SignaLink™ USB Unit from Tigertronics

- Software included on CD ROM
- Built-in low noise sound card
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Any radio interface cable is only **$14.95** when purchased with a SignaLink™ unit

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Antennas

FREE! ***RBA-1:1 Balun or RU-4:1 Unun When You Buy A S9V 43', 31' or 18' Multiband Antenna***

Purchase an S9v 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!

S9v43 $199.99
80-6 meters *Fixed Operation*

The S9v 43' is a high-performance lightweight telescoping fiberglass vertical. The best value in high-performance 'tall' verticals!

S9v31 $99.99
40-6 meters *Fixed or Portable Operation*

S9v18 $49.99
20-6 meters *Fixed or Portable Operation*

The S9v 31' and 18' are tapered, ultra-lightweight fiberglass vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

S9rp $39.99
Aluminum Radial Plate

Includes 20 sets of stainless steel nuts & bolts

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

NEW! Z-817H

The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal Alkaline batteries (not included). 2000 memories cover 160 through 6 meters.

Suggested Price $159.99

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-200ProII

The AT-200ProII now includes LEDs to show antenna position and if the tuner is in bypass. A two position antenna switch stores 2000 memories per switch. Handles up to 250 watts SSB or CW on 1.8 to 30 MHz and 100 watts on 54 MHz. Rugged and easy to read LED bar graphs simultaneously show RF power and SWR. Includes a six foot DC power cable. ***Suggested Price $259.99***

AT-1000ProII

LDG Electronics' new flagship 1KW tuner features: 5 to 1,000Watts PEP; RF Sensing; Auto and Semi Tuning Modes; 1.8 to 54 MHz range; 6 to 800 ohm range (15 to 150 on 6M); simplified operation; and an optional external 4.5" analog meter. With the two position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six foot DC power cable. ***Suggested Price $539.99***

Optional M-1000 external analog meter $129.99

IT-100

Matched in size to the IC-7000 and IC-706, for either manual or automatic tunes, and status LEDs. Control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. For your Icom radio that is AH3 or AH-4 compatible.

Suggested Price $179.99

YT-100

For Yaesu FT-857, FT-897 and FT-100 (and all D models) an integrated tuner, powered by the interface. Press the tune button on the tuner, and everything else happens automatically.

Suggested Price $199.99

KT-100

For AT-300 compatible Kenwood transceivers (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies.

Suggested Price $199.99

YT-450

Designed for Yaesu's newest 100 watt radios. Interfaces directly with the Yaesu FT-450 and FT-950 radios. Press the tune button on the tuner and the rest happens automatically. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1. 2000 memories recall settings in an instant! Seamless connection to a PC. ***Suggested Price $249.99***

YT-847

YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the tune button on the tuner and everything else happens automatically! ***Suggested Price $249.99***

LDG ELECTRONICS

Your Favorite Dealer has these tuners in stock NOW!

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We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

LDG ELECTRONICS

radio not included

AT-897Plus
for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price $199.99***

NEW! AT-600ProII

Building on the success of the AT-600Pro, we refined and expanded the model with an optional external 4.5" analog meter. The new AT-600ProII keeps many of the same features of the previous model, but simplifies the operation. With the two-position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six-foot DC power cable.

Suggested Price $369.99

Optional M-600 external analog meter $129.99

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes six foot DC power cable. ***Suggested Price $159.99***

- ***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

Z-11ProII

Meet the Z-11ProII, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes six foot DC power cable. ***Suggested Price $179.99***

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required.

Suggested Price $129.99

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HAM-IV

HAM-IV
$649.95

The most popular rotator in the world!
For medium communications arrays up to 15 square feet wind load area. *Has* 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM-VI
$749.95
with DCU-2

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

T-2X
$799.95
T-2XD2
$899.95
with DCU-2
See more info below

For large medium antenna arrays up to 20 square feet wind load. Has 5-second brake delay and Test/Calibrate functions. Low temperature grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch maximum mast size.

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II
$449.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

hy-gain® DCU-2 Digital Rotator Controller

. . . gives you full automatic and manual control of hy-gain rotators

DCU-2
$399.95

New!

New hy-gain DCU-2 Digital Controller gives you fully automatic or manual control of your *hy-gain HAM or Tailtwister Rotators.* Just dial in your beam heading and press the rotate button or let *Ham Radio Deluxe* (or other program) control your DCU-2. Your antenna automatically rotates to your desired direction precisely and safely.

First, the DCU-2 makes sure your antenna is free and safely unlocked before turning begins and then turns off your motor before your antenna reaches its final destination. Your antenna gently coasts to a stop before the brake locks. This greatly reduces potentially damaging overshoot.

Fine tuning and full manual control is effortless with *automated* Left and Right direction buttons - - no more worrying about manually releasing and relocking the brake. Brake automatically releases before fine tuning begins and relocks after fine tuning is completed.

Bright blue LCD displays actual heading, dial-in beam heading, computer controlled beam heading in one degree increments and your call sign.

Advanced Features

AutoBrake *Release* - no need to remember to release brake or release too soon - release time is automatic and settable 0-8 seconds.

Coast feature allows antenna to gently stop before the brake locks. Adjustable coast delay (*0-10 degrees*) turns off motor before antenna reaches its final destination to reduce potentially damaging overshoot.

AutoJog unlocks and frees your antenna before turning begins. Great for older rotators with "sticky" brakes. It jogs your rotator backwards slightly to ease brake pressure enough to release.

Offset feature allows you to calibrate your display to show actual beam heading.

USB and RS-232 ports for computer control. Compatible with *Ham Radio Deluxe* and other programs. Adjustable LCD sleep time. Field upgradeable Firmware. 8.5W x 4.3H x 9D inches. 110 VAC. **Order** DCU-2X for 220 VAC.

HAM-VI

HAM-VI
$749.95
with DCU-2

New!

New HAM-VI, $749.95, like HAM-IV but with DCU-2 digital controller. For medium antennas up to 15 square feet wind load.

Rotator Options

MSHD, $109.95. Above tower heavy duty mast support. For T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$ to $2^{5}/_{8}$ inch OD. Centers on 2 ½ inches.

TSP-1, $34.95. Lower spacer plate for HAM-IV, HAM-V and HAM-VI.

AR-40

AR-40
$349.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

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ARRL Field Day is June 22-23, 2013

The Most Popular On-Air Operating Event!

Show off your support for ARRL Field Day!

Official Field Day T-shirts, Hats, Mugs, Participation Pins, and more—are a great way to recognize your involvement in this annual operating event. All items are now available. **Clubs, order early!** Collect orders from members, and place a single order—pay only $12.50 shipping for orders over $50, while supplies last.

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  T-shirt featuring the 2013 Field Day logo on front chest. ARRL diamond and "Ham Radio" silkscreened on top back.
  ARRL Order No. 0002 (S-4XL) ..... **Only $12.95**
- **Field Day Hat**
  Gray hat embroidered with "ARRL Field Day". One size fits most.
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  Official 2013 Field Day Pin. Size 1-1/4" round.
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- **GOTA Pin**
  Don't forget GOTA pins for your Field Day newcomers. Size 1"x 1".
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  Encourage participation in ARRL Field Day. A great recruitment tool!
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  Show off your Field Day pride with a special patch. Size: 3" round.
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  Ceramic 11 oz. mug featuring the 2013 Field Day logo. Opposite side includes the ARRL Web address.
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- **Field Day Logbook**
  Filled with items to tackle Field Day! Log sheets, dupe sheets, VHO Operating Tips, WAS map and more.
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Portable HF/VHF/UHF Transceiver

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YAESU VX-8DR
50/144/220/440 MHz FM Handheld

$ Check our Website or Call!

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YAESU FT-1900R
2M FM Mobile

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YAESU FTDX-3000D
Compact 100W HF/6M Transceiver

$ Check our Website or Call! Add to Cart

YAESU FT-8800R
2M/440 FM Mobile

$ Check our Website or Call! Add to Cart

YAESU FTDX-5000MP
200W HF/6M Transceiver

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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

CoxCalculator™

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

MFJ-269PRO
$419.95

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-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

Free MFJ Catalog

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MFJ . . . The World Leader in Amateur Radio!

MFJ TUNERS

Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation

MFJ-949E **$179.95** up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

***Full** size* 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

***Full** size* built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D *Legal Limit* Tuner

MFJ-989D **$389.95**

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore™* Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob *Differential-T™*

MFJ-986 **$349.95**

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-969 **$219.95**

MFJ-941E *super value* Tuner

***The** most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-941E **$139.95**

MFJ-945E HF/6M *mobile* Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-945E **$129.95**

MFJ-971 *portable/QRP* Tuner

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-971 **$119.95**

MFJ-901B *smallest* Versa Tuner

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-901B **$99.95**

MFJ-902 *Tiny Travel* Tuner

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902 **$99.95**

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

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.

***Free* MFJ Catalog**

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MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-998 1500 Watt *Legal Limit IntelliTuner*™

Only the MFJ-998 gives you fully automatic antenna tuning for your legal limit full 1500 Watts SSB/CW linear amplifier!

MFJ-998 **$699.95**

Ultra-fast Automatic Tuning

Instantly match impedances from 12-1600 ohms using MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms with over 20,000 *VirtualAntenna*™ Memories.

Safe auto tuning protects amp

MFJ's exclusive *Amplifier Bypass Control*™ makes tuning safe and "stupid-proof"!

Digital/Analog Meters

A *backlit* LCD meter displays SWR, forward/reflected power, frequency, antenna selected, an auto-ranging bargraph power indication, and much more.

Has quick-glance auto-ranging Cross-Needle SWR/Wattmeter.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 switchable antenna coax connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total. Has binding post for end-fed long wire antennas.

Download & Upgrade Remotely

Download from internet and upgrade your MFJ-998 firmware as new features are introduced.

Plus Much More!

Built-in radio interface controls most transceivers.

Automatically bypasses with excessive tuning power.

Use balanced line antennas with external **MFJ-912, $59.95**, 1.5 kW 4:1 balun.

Small 13Wx4Hx15D inches easily fits into your ham station. 8 pounds. Requires 12-15VDC at 1.4 amps maximum or 110 VAC with **MFJ-1316, $21.95**.

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**

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

300 Watt...Best Seller

Digital Meter, Ant Switch, Balun

The *world's best selling* automatic antenna tuner is *highly acclaimed the world over* for its ultra high-speed, wide matching range, reliability, ease-of-use! Matches virtually *any* antenna.

MFJ-993B **$259.95**

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

G5RV Antenna

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/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.

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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MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $59.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ 1500 Watt *Fully Balanced* Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get superb 10 Meter performance due to MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

Ladder line, Twin lead, Insulators, Copper wire . . .

Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

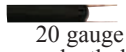
MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at midpoint with SO-239, quadruple weave-through ladder line stress relief.

MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead



20 gauge stranded copper wire. Black polyethylene. MFJ-18T050, **50 Ft.**, $24.95. MFJ-18T100, **100 Ft.**, $44.95. MFJ-18T250, **250 Ft.**, $99.95.

Copper Antenna Wire

Flexible, 7-strand, 14 gauge, hard solid-copper wire. Strong/long-lasting. MFJ-18G100, **100 Ft.**, $24.95. MFJ-18G250, **250 Ft.**, $59.95.

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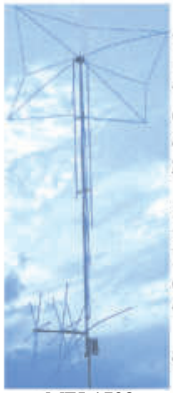
QS6/2013

10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .



MFJ-1798
$349.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . .7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter *Rotatable* Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency.*

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 M as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

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MFJ *giant* 6.5 inch SWR/Wattmeter

World's *largest HF SWR/Wattmeter has giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868
$149.95

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5 1/2Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 7 1/4Wx4 1/2Hx4 1/2D in.

MFJ-891
$109.95

MFJ *high-accuracy* Digital SWR/Wattmeter

MFJ-826B has a large high-contrast, high-accuracy *backlit* LCD display. Auto-ranging selects optimum full-scale range from 25W, 250W and 1500W ranges with full 10-bit resolution on each range. Covers entire amateur power spectrum. Built-in frequency counter selects frequency compensated data set to insure highest accuracy for each band. Displays frequency, provides digital read-out for older rigs and QRP rigs. *True* peak/average and forward/reflected power, SWR and frequency are *simultaneously* displayed. Select bargraphs to display forward/reflected power *or* forward /SWR *or* SWR only. MFJ's *PeakHold*™ freezes highest forward power displayed 1, 2 or 3 seconds. When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds. Use 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6 1/2Wx2 5/8Hx6D inches.

MFJ-826B
$179.95

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MFJ-822
$59.95

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862
$69.95

Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864
$99.95

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C
$89.95

Lighted 3" C/N Meter, SWR/Watts, 1.8-30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B
$39.95

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B
$149.95

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7 3/4Wx4Hx2 1/8D inches.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

MFJ-1164B
$79.95

100 Watts SSB from cigarette lighter socket!

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ-4403
$119.95

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

MFJ-655B
$219.95

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Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them with one hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

MFJ-4125 **$84.95**

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. $5^{3}/_{4}$Wx3Hx$5^{3}/_{4}$D".

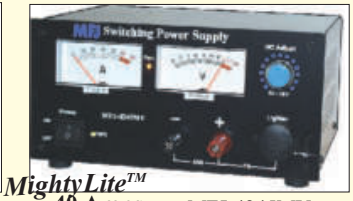
MFJ-4125P, $94.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. $5^{1}/_{4}$Wx $4^{1}/_{2}$Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4225MV **$99.95**

40 Amp Continuous



MightyLite™

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. $7^{1}/_{2}$Wx $4^{3}/_{4}$Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4245MV **$149.95**

70 Amp Continuous

75 Amps maximum and 70 Amps continuously. Adjustable voltage 4.0-16 VDC. Short circuit, overload and over-temperature protection, 10.5 lbs. $9^{3}/_{4}$Wx$5^{1}/_{2}$H x$9^{1}/_{2}$D". Great for Ameritron's ALS-500M mobile amplifier!

MFJ-4275MV **$249.95**

High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a* single *DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118 **$84.95**

MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. $12^{1}/_{2}$x$2^{3}/_{4}$x$2^{1}/_{2}$ in.

MFJ-1116 **$59.95**

MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112 **$44.95**

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117 **$64.95**

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

MFJ-1128 **$104.95**

All PowerPoles™

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$D".

MFJ-1126 **$84.95**

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®*, *extra* fuses -- *no extra cost*. 9Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$ inches.

MFJ-1129 **$114.95**

PowerPoles™ AND 5-Way Binding Posts

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, $12^{1}/_{2}$Wx$1^{1}/_{4}$Hx$2^{3}/_{4}$D inches.

MFJ-1124 **$64.95**

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost*.

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. $1^{1}/_{2}$ lbs. Tiny $3^{3}/_{4}$Wx$2^{1}/_{4}$Hx$3^{3}/_{4}$D inches fits easily in an overnight bag.

MFJ-4115 **$59.95**

30 Amps Continuous

Linear with 19.2 lb.Transformer

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. $9^{1}/_{2}$Wx6Hx$9^{3}/_{4}$D in.

MFJ-4035MV **$149.95**

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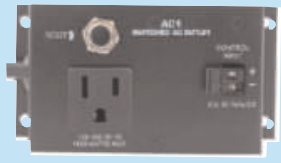

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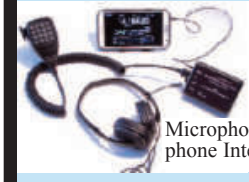

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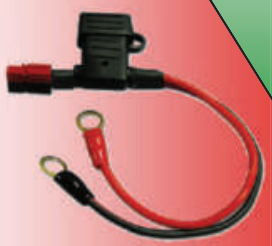

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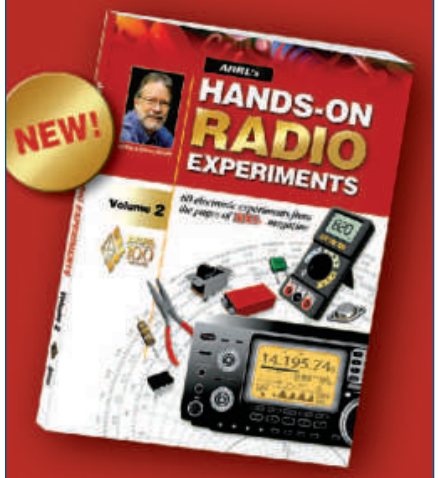

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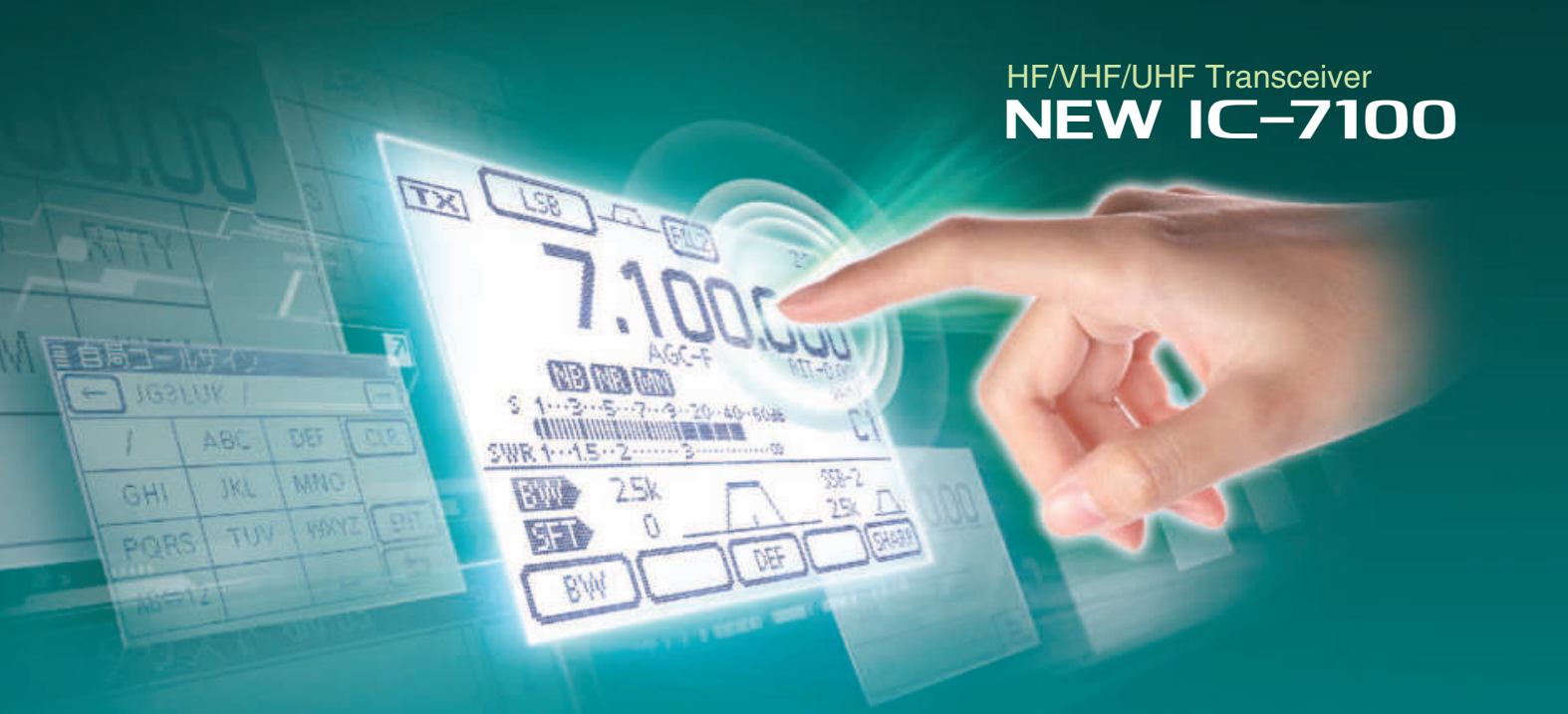

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sta•tis•tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

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Is your primary FM transceiver a single or dual–band model?

- Single band **21%**
- Dual band **55%**
- More than two bands **19%**
- I don't own an FM transceiver **5%**

Do you consider your local Amateur Radio club dues to be too low, too high or just right?

- Too high **5%**
- Too low **11%**
- Just right **52%**
- My club doesn't charge dues **5%**
- I don't belong to a local club **27%**

Does your flat screen TV generate interfering signals?

- Yes **12%**
- No **73%**
- I don't own a flat screen TV **15%**

How often do you back up the data in your station computer?

- Daily **22%**
- Weekly **20%**
- Monthly **24%**
- Yearly **9%**
- Never **13%**
- I don't own a station computer **12%**

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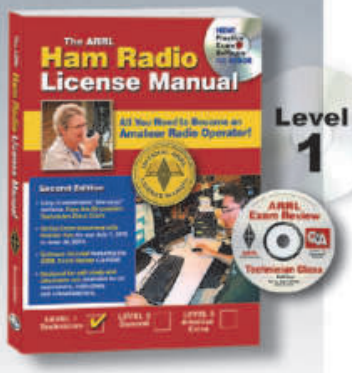

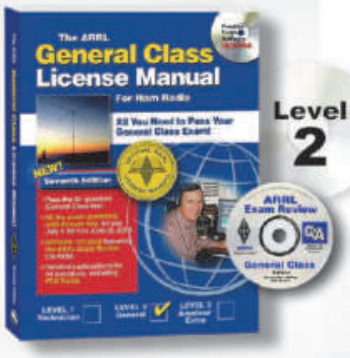

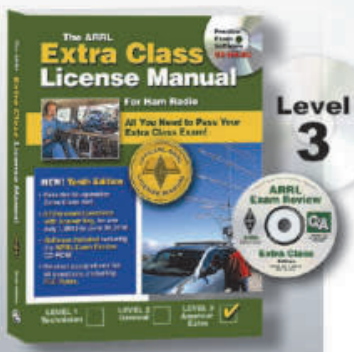

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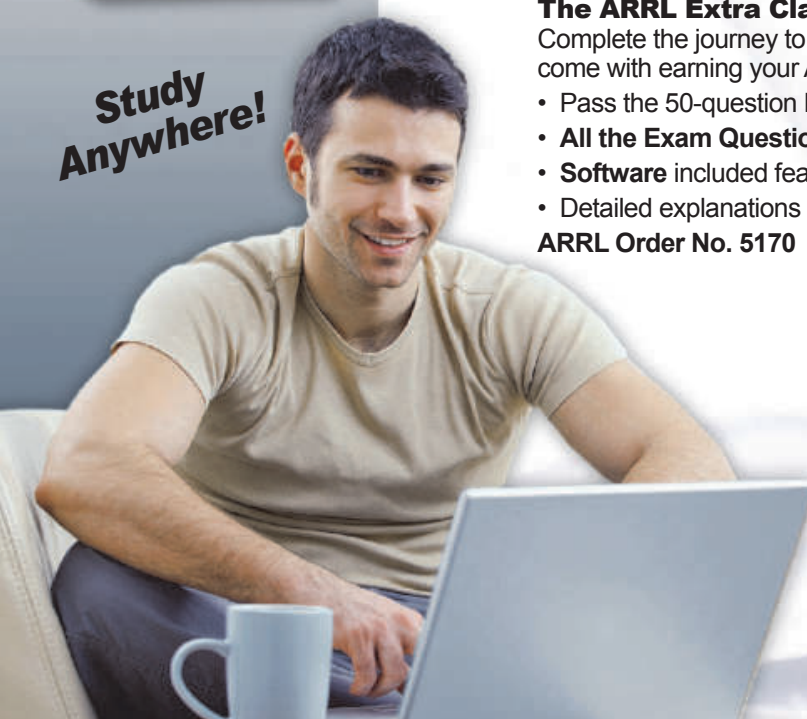

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Rules: 1 radio will be given away each week from May 27, 2013 to August 18, 2013. Only 1 entry per week per person. Winner may pick up prize at 1315 Maple Ave, Hamilton, Ohio 45011 or R&L Electronics Inc will ship the prize at no charge. Must be in the United States to be eligible. We reserve the right to cancel this program at any time. You may only win 1 radio every 90 days. R&L Electronics Inc is not responsible for any technical problems limiting entries IE: website outages, internet outage, computer issues. Entry period will be from 12:00:01 am Monday till midnight Sunday eastern standard time. Winner will be randomly selected on the following Wednesday. Must be over 18 years of age. Not valid where prohibited by law. We reserve the right to publish the winning names. Duplicate entries will be deleted. Employees of R&L Electronics Inc are not eligible to enter. Not eligible to win if you have a past due invoice with R&L Electronics Inc.

YAESU
The radio

Ham Ads

Please contact the **Advertising Department** at **860-594-0231** or **hamads@arrl.org** for further information or to submit your ad.

1. Advertising must pertain to products and services which are related to Amateur Radio.

2. The Ham-Ad rate for commercial firms offering products or services for sale is $2.25 per word. Individuals selling or buying personal equipment: ARRL member 1.00 per word. Non-ARRL member $1.50 per word. **Bolding** is available for $2.50 a word. Prices subject to change without notice. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

4. Closing date for Ham-Ads is the 15th of the second month preceding publication date. No cancellations or changes will be accepted after this closing date. Example: Ads received April 16th through May 15th will appear in July *QST*. If the 15th falls on a weekend or holiday, the Ham-Ad deadline is the previous working day. Please contact the Advertising Department at 860-594-0209 or hamads@arrl.org for further information or to submit your ad.

5. No Ham-Ad may use more than 200 words. No advertiser may use more than two ads in one issue. A last name or call must appear in each ad. Mention of lotteries, prize drawings, games of chance etc is not permitted in *QST* advertising.

6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

The publisher of *QST* will vouch for the integrity of advertisers who are obviously commercial in character and for the grade or character of their products and services. Individual advertisers are not subject to scrutiny.

The American Radio Relay League does not discriminate in its advertising on the basis of race, color, religion, age, sex, sexual orientation, marital status or national origin. The League reserves the right to decline or discontinue advertising for any other reason.

7. AN IMPORTANT NOTICE TO ALL HAM AD POSTERS AND RESPONDERS, FROM THE ARRL ADVERTISING DEPARTMENT Greetings from ARRL HQ! Please note that we have received reports from many ARRL members who have placed classified ads in these listings, and have received responses from individuals proposing "creative" payment schemes. These particular instances involved offers of overpayments for goods by bank check, followed by instructions to deduct the cost of your item from the overpayment, and to transfer the overage back or to another individual. This is a well-known scam. Unfortunately, we have no control over this and other scams of this type. Once your email address is posted, you are vulnerable to those individuals seeking to provide you with questionable information.

QST Ham Ads on the Web Updated Monthly!

www.arrl.org/ham-ad-listing

Club/Hamfests/Nets

ARMS-Amateur Radio Missionary Service Net Christian Fellowship Net - Everyone Welcome 14.307.5 Daily xcpt Sunday 1500-1700Z Website: www.qsl.net/arms

FRIEND OF BILL W-Join HAAM net daily 12:30 East (09:30 Pac) time on 14.316 Mon-Sat and 14.340 Sun w/290 or 340 as the alt freq's. www.qsl.net/haam

Ham Radio Club Websites & Newsletters Domain names, websites, email, newsletters, logo's and club marketing aids. Newsletters customized for your club. So affordable any size club can now have a professional newsletter. http://www.HamRadioWebsites.Net 503-717-3484

MARCO The Medical Amateur Radio Council Ltd is a charitable non-profit group of health care professionals who meet weekly at 11:00am Eastern time Sundays for the "Grand Rounds of the Air" net on 14.307 MHz. All interested are welcome. Request info & free newsletter to Danny@w4dan.com or write MARCO, 2712 Bryant Dr, Cleveland, TN 37311. Ph 423-665-2621. Web site www.marco-ltd.org

RAINBOW AMATEUR RADIO ASSOCIATION Serving the gay/lesbian/GLBT community since 1995. ARRL affiliated. Privacy respected. Active HF/VoIP nets, newsletter, chat room, message forums, cruises, Dxpeditions. Web Site: WWW.RARA.ORG. Information: 214-810-0285 PO Box 18541, Rochester NY 14618-0541.

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Ham Cruise 2013 N5DSR info mypinmoneytravel@yahoo.com

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CODE PRACTICE OSCILLATOR MUSEUM: http://www.n4mw.com

Visit THE SOUTHERN APPALACHIAN RADIO MUSEUM! - www.saradiomuseum.org 828-299-1276. Asheville, NC.

W4QCF MANUALS 828-298-1847 http://www.w4qcfmanuals.com

QSLCards/Call Sign Novelties

CALL SIGN DECAL 1-1/4 white vinyl characters. Interior or exterior window mount. $6.00. Gary Hengstenberger 6880 Rolling Ridge Rd NE Canton, OH 44721 330-354-1755

DCALLKD8PER@HOTMAIL.COM for info. WOUNDEDWARRIORPROJECT.ORG contributor

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General

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Advertisers

QST Advertising Deadlines:

Issue	Reservation Date	Materials Due Date
July 2013	Wednesday, May 15, 2013	Friday, May 17, 2013
August 2013	Wednesday, June 12, 2013	Friday, June 14, 2013

For links to the Web sites of all ARRL advertisers, visit www.arrl.org/ads/adlinks.html

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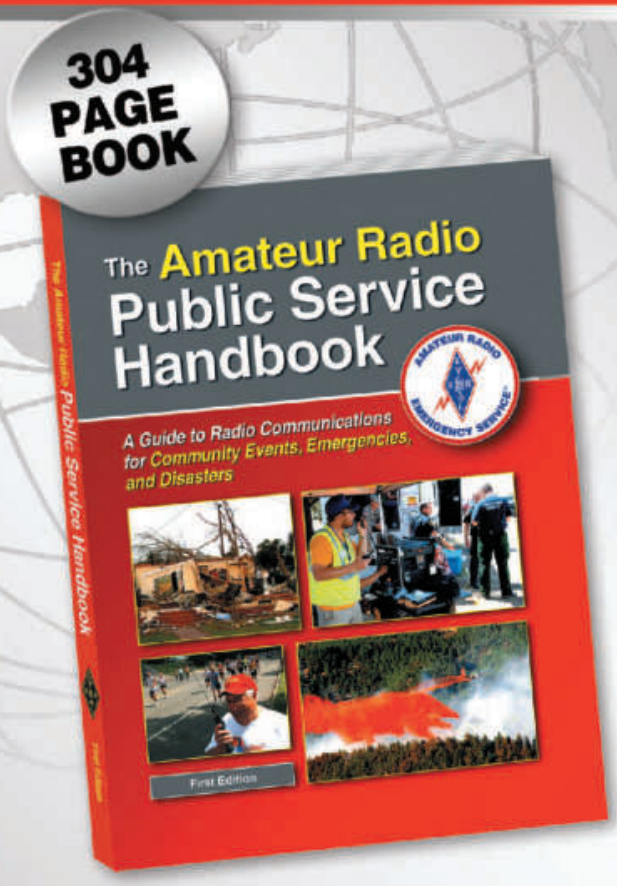

The Amateur Radio Public Service Handbook

A Guide to Radio Communications for Community Events, Emergencies, and Disasters

First Edition

Amateur Radio has consistently been the most reliable means of communications when other systems have failed. Hams work closely with disaster relief agency officials from FEMA, the American Red Cross, the Salvation Army, and other response organizations to offer wireless communications aid. From wildfires and earthquakes to marathons and road races, when getting the message through is critical, ham radio works.

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Target Markets:

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SRP: $174.99

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- 2013 Narrowband Compliant

Target Markets:

Fire, Police, Rescue, CAP, EMS, Schools, Business, Hotels, Construction

SRP: $149.99

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Target Markets:

EMS, Schools, CERT, Business, Hotels, Hospitals, Construction

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YAESU

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AL-811HD/AL-82	$1129/2419
ALS500M/ALS500MR	$749/779
ALS600/ALS600S	$1259/1319
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RCS-8V/RCS8-VL	$159/209
RCS-10/RCS-10L	$179/219
RCS-12/RCS-12L	$299/339

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R6000/R8	$419/519
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A50-6S	$369
A6270135	$269
A270-6S/A270-10S	$119/159
A13B2/A17B2	$239/349
A148-3S/A148-10S	$65/129
AR-270/AR-270B	$129/179

LDG ELECTRONICS

AT-1000PROII/M1000	$489/129
AT-600PROII/M600	$339/129
AT-200PROII	$229
AT-100PROII	$209
AT-897 PLUS	$189
IT-100/KT-100	$169/189
YT-100/YT-450	$189/239
Z-100 PLUS/Z11PROII	$149/169
Z-817/Z-817H	$119/159
FT METER/FTL METER	$49/79
RBA1:1/RBA4:1	$29/29

COMET

CH-250B 80-6m Vertical	$399
CH-V5X 40-6m Rot. Dipole	$319
GP-3/GP-6	$99/149
GP-9/GP-9N	$189/189
GP-15/GP-98	$169/189
H422 40-10m Rot. Dipole	$369

DIAMOND

CP-725H 40-6m Vertical	$359
CP-5H 40-6m Vertical	$379
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X-300A/X-300NA	$139/139
X-50A/X-50NA	$99/99

HYGAIN

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TH-3JRS, 10/15/20m	$339
TH2MK3, 10/15/20m	$319

M2

6M3/6M3SS	$175/159
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Yaesu G-550	$409
Yaesu G-800SA	$399
Yaesu G-800DXA	$499
Yaesu, G-1000DXA	$599
Yaesu, G-2800DXA	$1399
Yaesu G-5500	$789

US TOWER

We Ain't Braggin'
But we've helped so many Hams order US Towers over the years that we've become the US Tower experts. Please call for help selecting the perfect US Tower for your QTH!

TX Series

TX-438	$1829
TX-455	$2549
TX-472	$4199
TX-472MDP	$6779
TX-489MDPL	$10959

HDX Series

HDX-538	$2179
HDX-555	$3819
HDX-572MDPL	$9969
HDX-589MDPL	$12969
HDX-689MDPL	$38199

UNIVERSAL TOWER

We carry the complete line of Universal self-supporting aluminum towers.

B14 Series

4-30	$419

B18 Series

4-40/4-50	$699/959
7-40/9-30	$839/549

B22 Series

3-70/4-60	$1739/1349
5-50/6-60	$1069/1619
7-50/9-40	$1199/939
9-50/12-40	$1329/1079
15-40/21-30	$1209/819

B26 Series

4-70/4-80	$2199/2739
6-70/7-60	$2219/1749
7-70/9-60	$2309/1889
15-50/21-40	$1759/1369
23-40/35-30	$1629/1239

B30 Series

HD8-70/HD8-80	$2379/3059
HD8-90/HD8-100	$3709/4409
HD9-60/HD9-80	$2109/3129
HD11-80/HD11-90	$3559/4189
HD12-70/HD12-80	$2899/3579
HD16-60/HD16-80	$2569/3799
HD21-50/HD21-60	$1989/2619
HD21-70/HD35-40	$3239/1859

GUY HARDWARE

3/16"EHS, 500 / 1000'	$139/259
1/4"EHS, 500' / 1000'	$159/329
3/16" / 1/4" Big Grip™	$7/8
5/16" Thimble	$1.35
3/8" Thimble	$1.45
3/8x6" EE Turnbuckle	$16
3/8" x6" EJ Turnbuckle	$19
1/2"x9" EE Turnbickle	$25
1/2"x9" EJ Turnbuckle	$28
1/2x12" EE Turnbuckle	$29
1/2"x12" EJ Turnbuckle	$32
#502 Strain Insulator	$8
#504 Strain Insulator	$10

GLEN MARTIN

H2 Hazer (12 sq. ft.)	$609
H3 Hazer (8 sq. ft.)	$459
H4 Hazer (16 sq. ft.)	$589
RT-424, 4.5' (6 sq. ft.)	$319
RT-832, 8' (8 sq. ft.)	$469
RT-936, 9' (18 sq. ft.)	$779
RT-1832, 17.5' (12 sq. ft.)	$1029
RT-2632, 26' (9 sq. ft.)	$1709

PHILLYSTRAN

HPTG-1200I	$.49/ft.
HPTG-2100I	$.75/ft.
HPTG-4000I	$1.05/ft.
HPTG-6700I	$1.45/ft.
PLP-2738 Big Grip™	$9
PLP-2739 Big Grip™	$12
PLP-2755 Big Grip™	$18

ROHN

25G, Middle Section	$119
25AG2, Sleeve Top	$189
25AG4, Flat Top	$239
AS25G, Rotor Shelf	$65
BPC25G, Base Plate	$69
BPH25G, Hinged Base	$279
HB-25AG/BG/CG	$119/129/149
GA25GD, Guy Assembly	$179
SB25G, Short Base	$79
SB25G5, Short Base (5')	$109
SBH25G, Hinged Short Base	$249
TB3, Thrust Bearing	$159

ALUMINUM

O.D.	WALL	$/FT.
6063-T832 DRAWN TUBING		
.375"	.058"	$.65
.500"	.058"	$.70
.625"	.058"	$.80
.750"	.058"	$.90
.875"	.058"	$.95
1.000"	.058"	$1.00
1.125"	.058"	$1.10
1.250"	.058"	$1.30
1.375"	.058"	$1.40
1.500"	.058"	$1.50
1.625"	.058"	$1.65
1.750"	.058"	$1.80
1.875"	.058"	$1.95
2.000"	.058"	$2.10
2.125"	.058"	$2.25

ROTOR CABLE

R62, 6-C (6#18)	$.59/ft.
R81, 8-C (2#18/6#22)	$.49/ft.
R82, 8-C (2#16/6#18)	$.79/ft.
R83, 8-C (2#14/6#18)	$.89/ft.

COAX

9913F7	$1.39/ft.
BuryFLEX	$.89/ft.
LMR-100	$.59/ft.
LMR-200	$.65/ft.
LMR-200 Ultraflex	$.85/ft.
LMR-240	$.69/ft.
LMR-240 Ultraflex	$.89/ft.
LMR-400	$.89/ft.
LMR-400 Ultraflex	$1.39/ft.
LMR-600	$1.59/ft.
LMR-600 Ultraflex	$2.49/ft.
RG-8X Mini	$.29/ft.
RG-213/U	$.79/ft.

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Dynamic Range 112 dB/IP3 +40 dBm

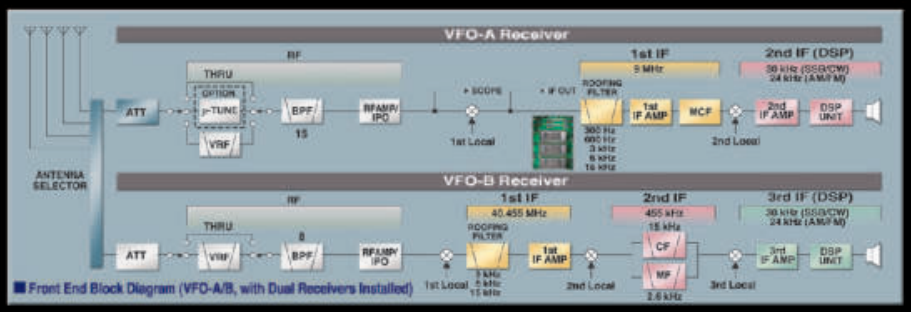
The New Premium HF/50 MHz Transceiver
FT DX 5000 Series

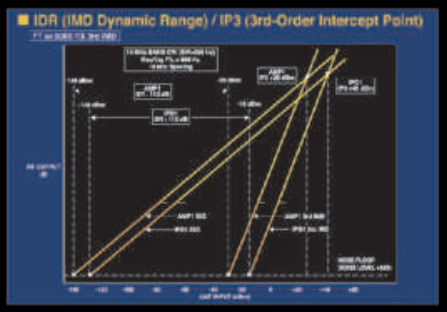
Two Totally Independent Receivers - The VFO-A/Main Receiver utilizes Super Sharp Roofing filters to give you the highest performance and best flexibility

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

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

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





HF/50 MHz 200 W Transceiver
FT DX 5000MP
Station Monitor SM-5000 included
± 0.05ppm OCXO included
300 Hz Roofing Filter included

HF/50 MHz 200 W Transceiver
FT DX 5000D
Station Monitor SM-5000 included
± 0.5ppm TCXO included
300 Hz Roofing Filter optional

HF/50 MHz 200 W Transceiver
FT DX 5000
Station Monitor SM-5000 optional
± 0.5ppm TCXO included
300 Hz Roofing Filter optional

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

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HF/50MHz ALL MODE TRANSCEIVER TS-590

Nothing But Performance

The TS-590S

Kenwood has essentially redefined HF performance with the TS-590S compact HF transceiver. The TS-590S RX section sports IMD (intermodulation distortion) characteristics that are on par with those "top of the line" transceivers, not to mention having the best dynamic range in its class when handling unwanted, adjacent off-frequency signals.*

- HF-50MHz 100W
- Digital IF Filters
- Built-in Antenna Tuner
- Advanced DSP from the IF stage forward
- 500Hz and 2.7KHz roofing filters included
- Heavy duty TX section

- 2 Color LCD

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*** For 1.8/3.5/7/14/21 MHz Amateur bands, when receiving in CW/FSK/SSB modes, down conversion is automatically selected if the final passband is 2.7KHz or less.**