QST

DEVOTED ENTIRELY TO AMATEUR RADIO

February 2013 WWW.ARRL.ORG

Listening to the Sun!

QST reviews:

Inside:

$4.99 US $6.99 Can.

02

19260

0 843655 9

Visit the ARRL Website at www.arrl.org

Page 39

Official Journal of ARRL The national association for AMATEUR RADIO®

The radio... YAESU

HF/50 MHz 100 W Transceiver

FT DX 3000

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

The amazing Crystal Roofing Filter performance

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

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

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

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

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

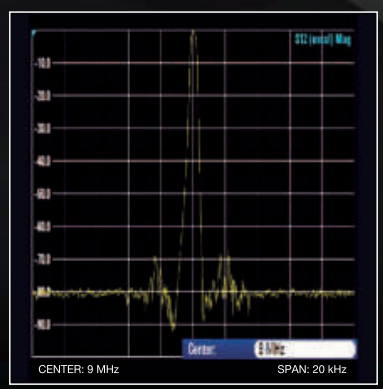
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

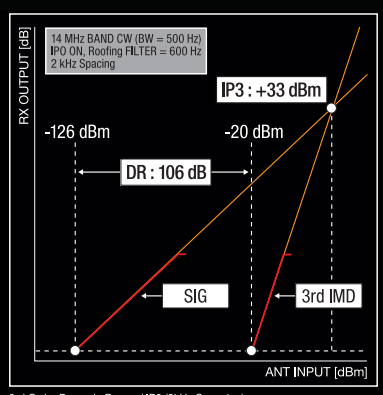
AF SCOPE display and RTTY/PSK encoder/decoder

Other features

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



Characteristics of the Crystal Roofing Filter (300 Hz)



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

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.

The radio YAESU ...

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

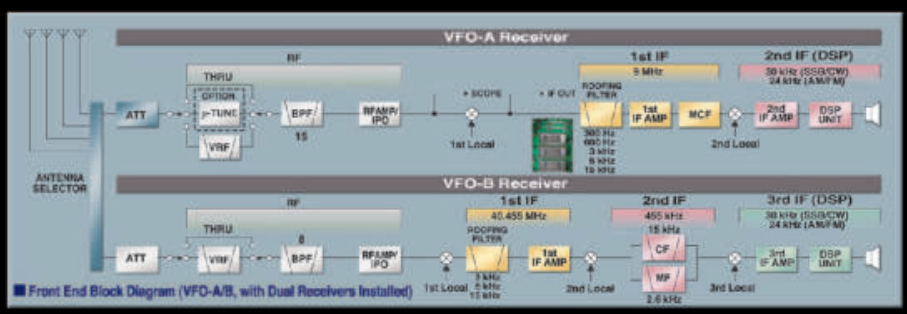
The New Premium HF/50 MHz Transceiver
FT DX 5000 Series

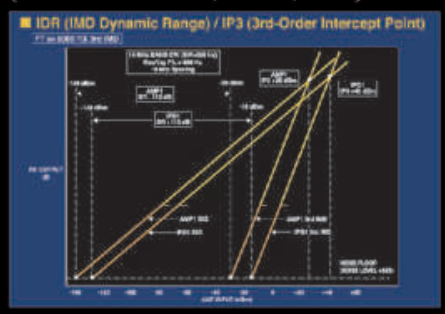
Two Totally Independent Receivers - The VFO-A/Main Receiver utilizes Super Sharp Roofing filters to give you the highest performance and best flexibility

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

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

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





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

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

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

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

HF/50 MHz 200 W Transceiver NEW
FT DX 5000

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

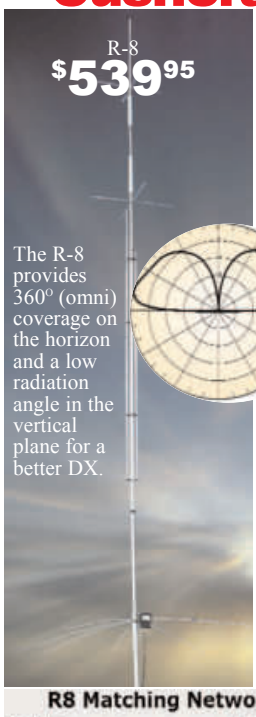
For the latest Yaesu news, visit us on the Internet:
http://www.yaesu.com

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.

YAESU
The radio

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

Cushcraft R8 *8-Band Vertical*



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

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

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

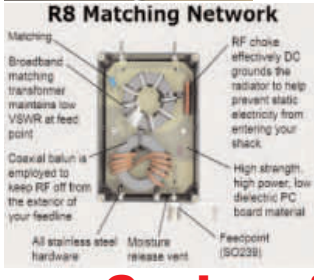
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

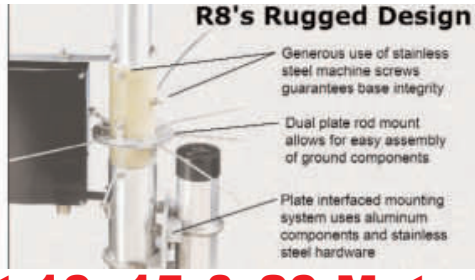
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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

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

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





MA-5B *5-Band* Beam

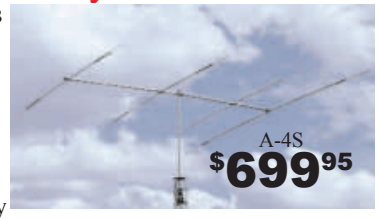
Small Footprint -- Big Signal

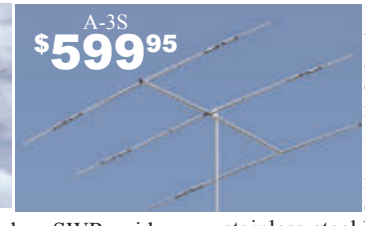
The MA-5B is one of Cushcraft's most popular HF antennas, delivering solid *signal-boosting directivity* in a bantam-weight package. Mounts on roof using standard TV hardware. Perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and full-sized array. Its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

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

Cushcraft 10, 15 & 20 Meter Tribander Beams

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





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

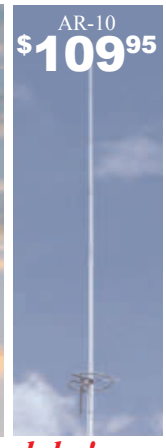
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

Cushcraft Dual Band Yagis

One Yagi for Dual-Band FM Radios

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

Cushcraft Famous *Ringo* Compact FM Verticals



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

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

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

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

Visit www.cushcraftamateur.com

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
909-393-6133 • 800-962-2611 • FAX 909-393-6136 • www.natcommgroup.com

COMET™

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

In This Issue

February 2013 **Volume 97 Number 2**

Technical

News and Features

Our Cover
The two solar flux monitors (far right) at Canada's Dominion Radio Astrophysical Observatory, located just outside Penticton, British Columbia, make accurately calibrated daily measurements of the 10.7 centimeter solar radio flux. A continuation of a pioneering radio astronomy experiment begun in 1946, many agencies — including NASA, NOAA and the Department of Defense, as well as hams, satellite operators and power utilities — use the 10.7 centimeter solar flux for space weather applications. Turn to page 39 to learn more about why solar flux can be so important to radio amateurs.

Radiosport

Page 69

Page 93

Columns

Departments

Digital and Mobile Editions
ARRL members can access the digital edition via a link at **www.arrl.org/qst** and download our *iOs* app from the iTunes Store.

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

February 2013
Volume 97 Number 2

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

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

US & Possessions: Membership in the ARRL, including a one year subscription to *QST*, is available to individuals at $39. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of $20. Life Membership, including a subscription to *QST* is available at $975.* Membership includes $15 per year for subscription to *QST*. Membership and *QST* cannot be separated. Libraries and institutions, $39 per year. Single copies $4.99.

International
To compensate for additional postage for mailing outside the US, the following rates apply:

Canada: Membership in the ARRL, including a one year subscription to *QST*, $49, payable in US funds. Life Membership, including a subscription to *QST* is available at $1225.* Libraries and institutions, $49 per year.

All Other Countries: Membership in the ARRL, including a one year subscription to *QST*, $62, payable in US funds. Life Membership, including a subscription to *QST* is available at $1550.* Libraries and institutions, $62 per year.

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

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

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

Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

*Payment arrangements available. Please write for details.

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department at **circulation@arrl.org** or **860-594-0200** immediately. Thank you for your assistance.

Reprints and permissions: **permission@arrl.org**

Details of our Online Privacy Policy can be found at **www.arrl.org/online-privacy-policy**.

Telephone: **860-594-0200**
Fax: **860-594-0259**

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

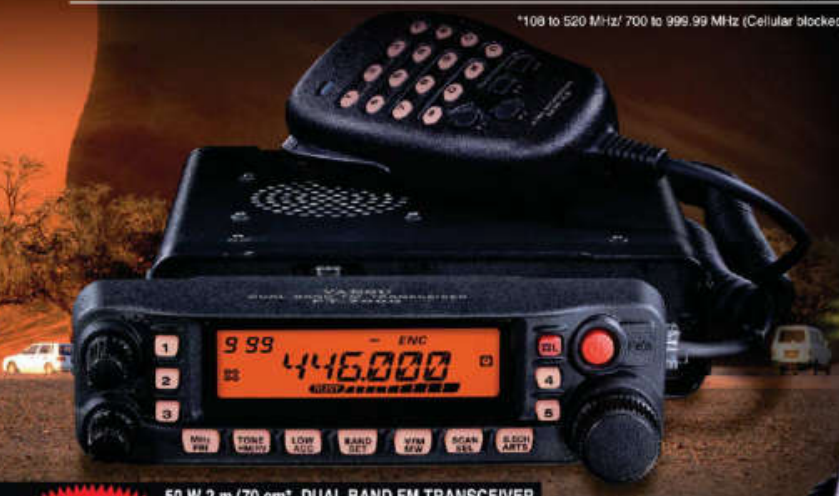
Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may differ in some countries. Check with your local Yaesu Dealer for specific details.

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

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

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

The King of Mobile



75 WATTS

NEW 50 W 2 m/70 cm* DUAL BAND FM TRANSCEIVER
*70 cm 45 W
FT-7900R
Size: 5.5" (W) x 1.6" (H) x 6.6" (D) / Weight: 2.2 lb
2 m/70 cm DUAL BAND

Best Selling, Reliable Mobile

55 WATTS

2 m MONO BAND
HEAVY-DUTY 75 W 2 m FM TRANSCEIVER
FT-2900R NEW
Size: 6.3" (W) x 2.0" (H) x 7.3" (D) / Weight: 4.0 lb

NEW ULTRA RUGGED 55 W 2 m FM TRANSCEIVER
FT-1900R
Size: 5.5" (W) x 1.6" (H) x 5.8" (D) / Weight: 2.2 lb
2 m MONO BAND

Commercial Grade Field Radio Submersible Construction

COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER
FT-270R
Size: 2.4" (W) x 4.7" (H) x 1.3" (D) Weight: 13.8 oz.
2 m MONO BAND NEW

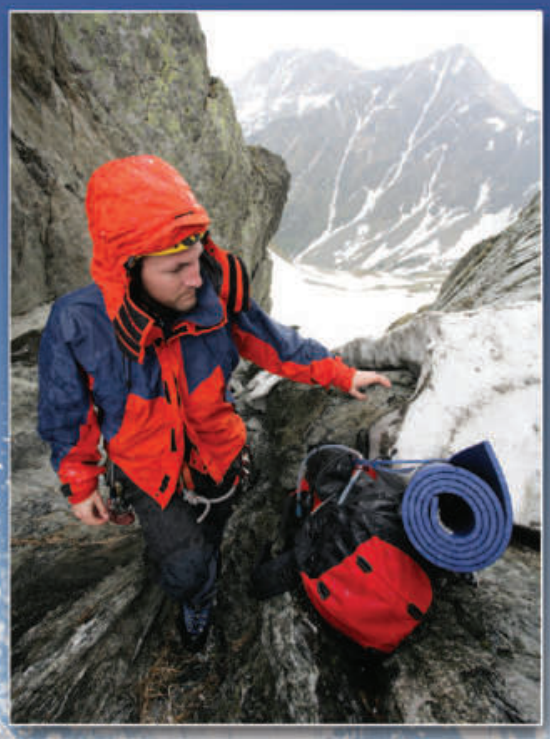
Compact Field Radio with Top Mounted LCD and Loud Audio

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER
FT-250R
Size: 2.3" (W) x 4.3" (H) x 1.0" (D) / Weight: 12.4 oz.
2 m MONO BAND NEW

For the 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.

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



Field Gear That Goes The Distance!

FT-897D

HF/VHF/UHF Portable Operation Powerful Transceiver

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

FT-857D

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

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

FT-817ND

The Ultimate Backpack, Multi-Mode Portable Transceiver

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

FT-450D

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

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

YAESU

The radio

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

It Seems to Us

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

Two New Bands?

"Amateur Radio's roots are in experimentation. Soon we should have new opportunities to apply the latest signal processing technologies to a part of the radio spectrum that for a century has been off limits to us."

In his classic work *Two Hundred Meters and Down* published in 1936 Clinton B. DeSoto tells the story of how, by legislation adopted in 1912, it came to be that radio amateurs were relegated to wavelengths of 200 meters or less — in modern terms, frequencies of 1500 kHz or more. In those days the conventional wisdom was that the effectiveness of radio waves increased in proportion to their wavelength — that is, the longer the wavelength the farther the signal would travel. That was true for groundwave propagation, but as amateurs would soon demonstrate it was not the case once the ionosphere was brought into play.

Imagine the difficulties faced by the commercial radio engineers of that day. They were under pressure to use ever longer wavelengths, requiring massive antennas and high powered transmitters to overcome the natural noise and manmade interference that plagued — and still plagues — the spectrum below, in terms of frequency, what is now the AM broadcast band. And the lower in frequency they went, the more diminished were the available bandwidth and the opportunities for frequency reuse through geographic separation.

Being consigned to the "useless" shorter wavelengths turned out to be a blessing for amateurs rather than the intended curse. Today it is not an idle boast to say that the largest body of practical knowledge about ionospheric radio propagation resides in the Amateur Radio Service. The same is true of tropospheric ducting at VHF and higher, as we touched on here last month. But we have never had the opportunity to explore the longer wavelengths.

It hasn't been for lack of trying. The ARRL's preparations for the 1979 World Administrative Radio Conference included a serious effort to secure an international allocation of 160-190 kHz. The effort fell victim to objections from electric power utilities that used, and still use, frequencies below 490 kHz for Power Line Carrier (PLC) operations on high voltage transmission lines. In the 1990s several European countries began to allow amateurs to experiment in the band 135.7-137.8 kHz, a practice that became the basis for a CEPT Recommendation in 1997. So in 1998 we tried for a domestic low frequency (LF, below 300 kHz) allocation. At first it looked promising, and in 2002 the FCC went so far as to issue a Notice of Proposed Rule Making for a secondary amateur allocation of 135.7-137.8 kHz. Unfortunately, a year later the Commission decided not to adopt its own proposal, citing generalized but technically unsubstantiated concerns about possible PLC interference from the Utilities Telecom Council (UTC, an industry group) and a committee of the IEEE.

The 2003 World Radiocommunication Conference (WRC) put this band on the agenda for consideration of a possible amateur secondary allocation at the next WRC, and in 2007 it finally became a reality in the international Table of Frequency Allocations. The ARRL did not immediately press for domestic implementation; we knew UTC would offer its usual objections and we wanted to be prepared to meet them. Also, WRC-07 had put another possibility before us: a secondary allocation of up to 15 kHz somewhere in the band 415-526.5 kHz (in the medium frequency, or MF range) was on the agenda for what eventually became WRC-12. There was more interest in this band among amateurs in the US, so during domestic preparations for WRC-12 we did not want to complicate that issue. The story of how an allocation of 472-479 kHz in the international Table came about was told in April and May 2012 *QST*.

Since then, two things have happened that move new amateur LF and MF allocations closer to reality in the United States. In November 2012 the FCC released a comprehensive 130 page document addressing various implementation issues arising from WRC-07, including the 135.7-137.8 kHz amateur allocation. That proceeding, known as ET Docket No. 12-338, is now open for public comment. The document can be found on the ARRL website at **www.arrl.org/fcc-documents**. The sections of greatest interest to radio amateurs are paragraphs 13-19 and paragraphs 20-24, the latter dealing with a proposed upgrade of the amateur allocation at 1900-2000 kHz, i.e. the top half of the 160 meter band.

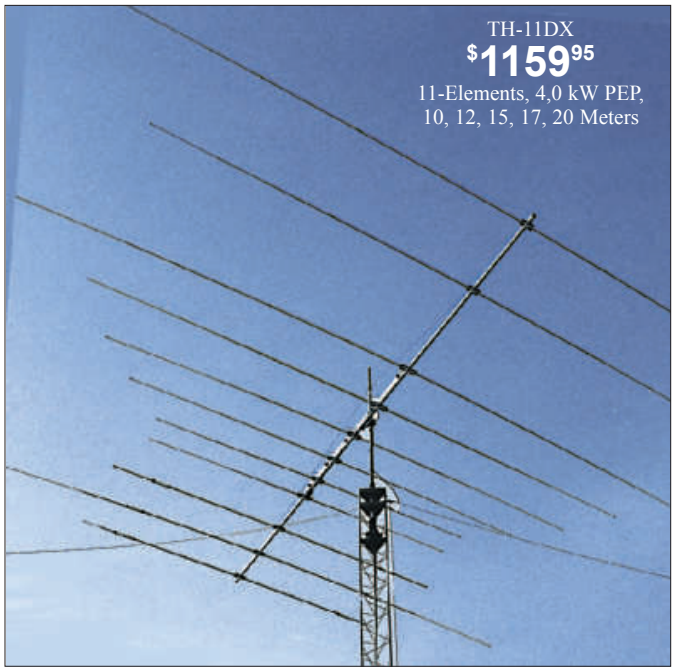
Also in November, the ARRL submitted a Petition for Rulemaking to the FCC seeking implementation of the 472-479 kHz allocation. We did so only after determining that there is no reasonable basis for an objection from UTC, since there is very little if any use of frequencies above 450 kHz for PLC. Until the petition is assigned an RM number comments are not in order, but we are hopeful that this step will be taken soon. In the meantime you can read the petition at **www.arrl.org/fcc-documents**. (An FCC notation on the petition suggests that it was erroneously assigned to the Media Bureau, but that will be straightened out in due course.)

It is important to note that the FCC has not actually proposed an amateur allocation at 135.7-137.8 kHz. Without labeling it as such, the Commission in effect has opened a Notice of Inquiry seeking comment on the pros and cons of such an allocation and how it might be made compatible with PLC systems. At paragraph 17 the Commission says, "…we would only consider adding an amateur allocation if we were comfortable that amateur radio and utility PLC systems could successfully co-exist in the band." While that puts a burden on us of demonstrating to the Commission's satisfaction that co-existence is possible without endangering the reliability and security of the power grid, the Commission clearly expects more from UTC than "It can't be done."

FCC proceedings tend to take a long time and these two will be no exception, but it is encouraging to see some progress toward our being able to explore new spectrum territory — or very old territory, if you prefer to look at it that way.

hy-gain HF BEAMS...

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



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

The choice of top DXers.

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

Handles 2000 Watts continuous, 4000 Watts PEP.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

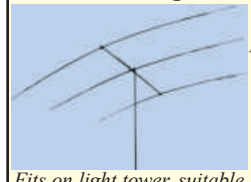
BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

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

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

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV



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

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

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

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

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

Tooled Manufacturing . . . Highest Quality Materials

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

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

3. Thick-wall *swaged* aluminum tubing

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

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

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

Durable precision injection molded parts.

Hy-Gain *antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.*

Free Hy-Gain Catalog
and Nearest Dealer . . . 800-973-6572
Call your dealer for your best price!

hy-gain®

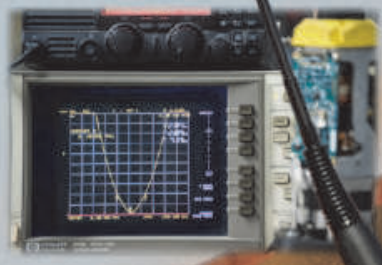
Antennas, Rotators & Towers

308 Industrial Park Road, Starkville, MS 39759 USA
Toll-free Customer Sales Hotline: 800-973-6572
• **TECH:** 662-323-9538 • **FAX:** 662-323-6551
http://www.hy-gain.com

STEALTH 9310

AUTOTUNE WHIP HF MOBILE ANTENNA

- ✔Continuous 1.8 to 30 MHz Coverage
- ✔125 W PEP CW, 200W PEP SSB
- ✔0.5 sec. Fast Automatic Tuning
- ✔Typical VSWR 1.3:1 or Less
- ✔Rugged yet Sleek Design
- ✔Submersible to 1 meter for 30 minutes
- ✔Built to MIL-STD-810F and MIL-STD-461
- ✔Compatible with All HF Transceivers
- ✔2-Year Limited Warranty
- ✔Affordably Priced



Adaptive Matching

Algorithm rapidly ensures maximum injected RF Power is converted into Radio Waves via controlling Hi-Q VariStep Inductor and three Matching Networks. Tuned Parameters for up to 200 frequencies which are stored in Memory intelligently adjusted if surrounding conditions have changed.

Indestructible

Glass Fiber Reinforced Polycarbonate Shroud integral to Shock Mounted Die Cast Base equipped with Military Grade Connectors and NANO-Tech Air Vent guarantees long term reliability in harsh climates. With attached Fiberglass Whip designed to withstand hard knocks and substantial flexing the system ensures operational stability on all Terrains.

PC Aided Setup

The Software Defined Antenna Interface and CPS9300 Configuration Software are included. Connect your PC to Antenna via waterproof Mini-USB connector. Select your transceiver, correct Adaptor Cable and suitable Antenna Mounting System from the CPS9300 Menu. Upcoming new radios are On-line supported at no charge.

IN STOCK FOR IMMEDIATE SHIPPING

AUTO TUNE TO ANY FREQ 1.8-30MHz In 0.5 Sec

Also available in Marine, Commercial and Military versions

Distributed in USA by Continental Wireless Inc.
Dallas TX, TF: 800-527-2000
Email: sales@cntlwire.com

www.stealth-tele.com

An ARRL Headquarters Progress Report

During the past few months we've been working to improve current services and adding a few more.

DXCC application processing has been improved with the addition of an Online DXCC Application at **https://p1k.arrl.org/onlinedxcc/** that is now used by about 20% of all DXCC applicants. We've also introduced a new DXCC rate structure that encourages additional, smaller DXCC submissions spread throughout the year. In 2012, DXCC applications were up 20% compared to 2011. Despite the increase, paper applications submitted in 2012 were processed in three to four weeks and Logbook of The World (LoTW) applications were processed within five business days. LoTW participation continues to increase with over 54,000 certificate holders and almost half a *billion* QSO records. The first non-ARRL award, CQ WPX, was added to LoTW in July.

The ARRL Volunteer Exam Coordinator (VEC) department has been busy processing exam sessions. The final numbers are not in quite yet, but we predict that new licensees should increase by 13% compared to 2011. This is good news for Amateur Radio overall.

Our Instruction and Resource Coordinator, Nathan McCray, K9CPO is currently revising curriculum materials used to support a new Radio and Wireless Technology patch program for Girl Scouts, as well as to support classroom and ham radio license instruction. He is also creating an orientation course for ARRL instructors. A new band chart that features Technician Amateur Radio privileges has been developed and is now published on the ARRL website for download. (You'll find it in the "Aids and References" section at **www.arrl.org/get-on-the-air**.) The ARISS program partnership has just completed a very busy period, supporting 14 contacts with US schools and educational organizations in the September-November period. Finally, we updated the online management course, EC-016.

We've published eight issues of Digital *QST* to date. As Digital *QST* evolves we continue to experiment with adding more content. For example, each issue features informative Product Review videos, along with occasional text and illustrations you won't find in the printed *QST*. In the August edition we even included the complete 2012 *DXCC Yearbook*.

We've expanded our electronic publishing "reach" by releasing a dedicated Digital *QST* Apple iOS app beginning with the November issue. We also recently added all of the 2012 Digital *QST* issues to the online archive and to the iOS app.

The Field Organization and Emergency Preparedness group, under the direction of Mike Corey, KI1U and Ken Bailey, K1FUG, provided Ham Aid equipment and other support for served agencies and ARES groups during hurricanes Sandy and Isaac. They continue to represent the ARRL and Amateur Radio in meetings with government officials, served agencies and non-governmental organizations.

We've made some modifications to the ARRL website and traffic has improved considerably, In fact, during the past year, the number of visits to our website has increased by over 50%. To make it easier for members to navigate the site, the Quick Links page was expanded and renamed the "Site Index" **www.arrl.org/site-index**. The ARRL Foundation, the Scholarship Program and Prospective Ham Info Request pages were updated as well.

There is always room for improvement, of course, and in that sense our jobs will never be finished. We always appreciate your input. Just go to **www.arrl.org/contact-arrl** and share your ideas!

No Longer Microphone Shy

These eight Scouts experienced Amateur Radio for the first time during a 2012 Jamboree On the Air campout near Fort Davis, Texas. As a result, several are already studying for their Technician licenses. The group included (left to right) Oscar Nunez; Julie Isola; Leilani Gilmore; John Isola, Scout Leader; Anneliese Banta; Doug Cooney, N1FBI, Scout Leader; Ethan Isola; Matt Brooks; Mike Pearson, Scout Leader; Jason Roman and Josiah Bencomo.

This was the first year that the Boy Scouts of Fort Davis and Van Horn, Texas were represented during the event. Doug Cooney, N1FBI, is the trustee for the Fort Davis, Troop 30, Amateur Radio Club with the new call sign of KG5BSA. According to Doug, the Boy Scouts and Venture Scouts made many over the air contacts over the two day period. In addition, seven Scouts earned their Radio Merit Badges in classes held during the campout. [Doug Cooney, N1FBI, photo]

Live from Huntsville, Texas

If you live in the Houston metro area, you may have heard the voices of Larry Crippen, AB5AA (left), and Joe Connell, KB5DTS, together on KSAM Radio last October. Larry is the KSAM News Director and he partnered with Joe, the Emergency Coordinator for Walker County District 2 ARES, to promote Amateur Radio in general, and the Simulated Emergency Test in particular, in a special public affairs show. [Brooke Addams, KSAM Operations Director, photo]

Best 73!

Keith Leite, AA1JF, entered and completed the Buzzards Bay Triathlon in Dartmouth, Massachusetts last Fall. When he registered he was pleasantly surprised to be assigned runner number "73." Was it a coincidence, or did someone on the marathon committee know more about Keith than he realized? [Patty Leite, photo]

ARRL Member Services

Get Involved
www.arrl.org/get-involved

Join or Renew
www.arrl.org/join

Donate
www.arrl.org/donate

Shop
www.arrl.org/shop

Membership Benefits

Your ARRL membership includes ***QST*** magazine, plus dozens of other services and resources to help you **Get Started**, **Get Involved** and **Get On the Air**. ARRL members enjoy Amateur Radio to the fullest!

Members-Only Web Services

Create an online ARRL Member Profile, and get access to ARRL members-only Web services. Visit **www.arrl.org/myARRL** to register.

- ***QST* Digital Edition – www.arrl.org/qst**
  All ARRL members can access the online digital edition of *QST*. Enjoy enhanced content, convenient access and a more interactive experience. An app for *iOs* devices is also available.
- ***QST* Archive and Periodicals Search – www.arrl.org/qst**
  Browse ARRL's extensive online *QST* archive.
  A searchable index for *QEX* and *NCJ* is also available.
- **Free E-Newsletters**
  Subscribe to a variety of ARRL e-newsletters and e-mail announcements: ham radio news, radio clubs, public service, contesting and more!
- **Product Review Archive – www.arrl.org/qst**
  Search for, and download, *QST* Product Reviews published from 1980 to present.
- **E-Mail Forwarding Service**
  E-mail sent to your **arrl.net** address will be forwarded to any e-mail account you specify.
- **Customized ARRL.org home page**
  Customize your home page to see local ham radio events, clubs and news.
- **ARRL Member Directory**
  Connect with other ARRL members via a searchable online Member Directory. Share profiles, photos and more with members who have similar interests.

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

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

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

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

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

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
  Insurance is available to protect you from loss or damage to your station, antennas and mobile equipment by lightning, theft, accident, fire, flood, tornado, and other natural disasters.
- **The ARRL Visa Signature® Card**
  Every purchase supports ARRL programs and services.
- **MetLife® Auto, Home, Renters, Boaters, Fire Insurance and Banking Products**
  ARRL members may qualify for up to a 10% discount on home or auto insurance.

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

Programs

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

Amateur Radio Emergency Service® – **www.arrl.org/ares**
Emergency Communications Training – **www.arrl.org/emcomm-training**

Radiosport

Awards – **www.arrl.org/awards**
Contests – **www.arrl.org/contests**
QSL Service – **www.arrl.org/qsl**
Logbook of the World – **www.arrl.org/lotw**

Community

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

Licensing, Education and Training

Find a License Exam Session – **www.arrl.org/exam**
Find a Licensing Class – **www.arrl.org/find-an-amateur-radio-license-class**
ARRL Continuing Education Program – **www.arrl.org/courses-training**
Books, Software and Operating Resources – **www.arrl.org/shop**

Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
Support for Teachers – **www.arrl.org/teachers**
ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
Public and Media Relations – **www.arrl.org/media**
Forms and Media Warehouse – **www.arrl.org/forms**
FCC License Renewal – **www.arrl.org/fcc**
Foundation, Grants and Scholarships – **www.arrl.org/arrl-foundation**
Advertising – **www.arrl.org/ads**

Interested in Becoming a New Ham?

www.arrl.org/newham
e-mail **newham@arrl.org**
Tel 1-800-326-3942 (US)

Contact Us

ARRL, the national association for Amateur Radio®
225 Main Street, Newington, CT 06111-1494 USA
Tel 1-860-594-0200, Mon-Fri 8 AM to 5 PM ET (except holidays)
FAX 1-860-594-0259, e-mail **hqinfo@arrl.org**, website – **www.arrl.org**

Facebook
www.facebook.com/ARRL.org

Follow us on Twitter
twitter.com/arrl · twitter.com/w1aw
twitter.com/arrl_youth · twitter.com/arrl_emcomm

YouTube
www.youtube.com/ARRLHQ

The American Radio Relay League, Inc.

The American Radio Relay League, Inc. is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communication in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

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

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

Officers, Division Directors and Staff

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

Officers

Founding President (1914-1936)
Hiram Percy Maxim, W1AW

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

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

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

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

Chief Executive Officer
DAVID SUMNER, K1ZZ*

Secretary
DAVID SUMNER, K1ZZ

Treasurer
RICK NISWANDER, K7GM

Chief Financial Officer
BARRY J. SHELLEY, N1VXY

Chief Operating Officer
HAROLD KRAMER, WJ1B

Chief Development Officer
MARY HOBART, K1MMH

Chief Technology Officer
BRENNAN PRICE, N4QX

Staff

General Counsel
Christopher Imlay, W3KD

Business Services Manager
Debra Jahnke, K1DAJ

Education Services Manager
Debra Johnson, K1DMJ

Laboratory Manager
Ed Hare, W1RFI

Marketing Manager
Bob Inderbitzen, NQ1R
Amy Hurtado, KB1NXO
Circulation Manager
Diane Petrilli, KB1RNF
Membership Manager

Membership & Volunteer Programs Manager
Dave Patton, NN1N
Mike Corey, KI1U
Emergency Preparedness Manager

Production & Editorial Manager
Steve Ford, WB8IMY

Regulatory Information Manager
Dan Henderson, N1ND

VEC Manager
Maria Somma, AB1FM

Business Staff
Business Manager
Barry J. Shelley, N1VXY

Controller
Diane Middleton

Information Technology Manager
Michael Keane, K1MK

*Executive Committee Member

Atlantic Division

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

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

Central Division

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

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

Dakota Division

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

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

Delta Division

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

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

Great Lakes Division

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

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

Hudson Division

Mike Lisenco, N2YBB
1635 East 46 St, Brooklyn, NY 11234
(917-865-3538); **n2ybb@arrl.org**

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

Midwest Division

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

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

How to Find an ARRL HQ Staff Member

Can't find the department you're looking for? Call 860-594-0200 or e-mail **hq@arrl.org**. Sending e-mail to any ARRL Headquarters staff member is a snap. Just put his or her call sign (or first initial and last name) in front of **@arrl.org**. For example, to send to Hiram Maxim, First President of the ARRL, use **w1aw@arrl.org**, or **hmaxim@arrl.org**. If all else fails, send a message to **hq@arrl.org** and it will get routed to the right person or department.

New England Division

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

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

Northwestern Division

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

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

Pacific Division

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

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

Roanoke Division

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

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

Rocky Mountain Division

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

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

Southeastern Division

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

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

Southwestern Division

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

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

West Gulf Division

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

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

*Executive Commitee Member

ARRL Section Managers

www.arrl.org/sections

The 15 divisions of ARRL are arranged into 71 administrative *sections*, each headed by an elected *section manager* (SM). Your section manager is the person to contact when you have news about your activities, or those of your club. If you need assistance with a local problem, your section manager is your first point of contact. He or she can put you in touch with various ARRL volunteers who can help (such as technical specialists). Your section manager is also the person to see if you'd like to become a section volunteer. Whatever your license class, your SM has an appointment available. Visit your section page on the Web at **www.arrl.org/sections/**.

Atlantic Division (DE, EPA, MDC, NNY, SNJ, WNY, WPA)

Delaware: Frank T. Filipkowski, Jr, AD3M, 1130 N Hilton Rd, Oak Lane Manor, Wilmington, DE 19803-5216 (302-656-0409); **ad3m@arrl.org**
Eastern Pennsylvania: Robert B. Famiglio, K3RF, PO Box 9, Media, PA 19063-0009 (610-359-7300); **k3rf@arrl.org**
Maryland-DC: James E. Cross III, WI3N, 16013 Dorset Rd, Laurel, MD 20707-5314 (301-725-6829); **wi3n@arrl.org**
Northern New York: Thomas Dick, KF2GC, 11 Jenkins St, Saranac Lake, NY 12983 (518-891-0508); **kf2gc@arrl.org**
Southern New Jersey: George Strayline, W2GSS, 10 E Pacific Ave, Villas, NJ 08251-2630 (609-741-8322); **w2gss@arrl.org**
Western New York: John Mueller, K2BT, 2011 E Main St, Falconer, NY 14733 (716-489-7001); **k2bt@arrl.org**
Western Pennsylvania: John Rodgers, N3MSE, 803 S Main St, Butler, PA 16001 (724-287-0424); **n3mse@arrl.org**

Central Division (IL, IN, WI)

Illinois: Tom Ciciora, KA9QPN, 1887 Irene Rd, Sandwich, IL 60548 (815-498-4929); **ka9qpn@arrl.org**
Indiana: Lou Everett Sr, WA5LOU, 11909 Cardis Ct, Cumberland, IN 46229 (317-622-1130); **wa5lou@arrl.org**
Wisconsin: Donald Michalski, W9IXG, 4214 Mohawk Dr, Madison, WI 53711 (608-274-1886); **w9ixg@arrl.org**

Dakota Division (MN, ND, SD)

Minnesota: Richard H. "Skip" Jackson, KSØJ, 1835-63rd St E, Inver Grove Heights, MN 55077 (651-260-4330); **ks0j@arrl.org**
North Dakota: Lynn A. Nelson, WØND, 6940 4th St SW, Minot, ND 58701 (701-839-8200); **w0nd@arrl.org**
South Dakota: Chris Stallkamp, WØADZ, PO Box 271, Selby, SD 57472-0271 (605-870-1784); **w0adz.arrl.org**

Delta Division (AR, LA, MS, TN)

Arkansas: Dale Temple, W5RXU, 5200 Timber Creek Circle, North Little Rock, AR 72116 (501-771-1111); **w5rxu@arrl.org**
Louisiana: James M. Coleman, AI5B, 1530 Military Rd, Bogalusa, LA 70427-2901 (985-516-2632); **ai5b@arrl.org**
Mississippi: Malcolm Keown, W5XX, 64 Lake Circle Dr, Vicksburg, MS 39180 (601-636-0827); **w5xx@arrl.org**
Tennessee: Keith E. Miller Sr, N9DGK, 1635 Jarratt Dr, Rockvale, TN 37135 (615-631-9952); **n9dgk@arrl.org**

Great Lakes Division (KY, MI, OH)

Kentucky: Jim Brooks, KY4Z, 7099 Louisville Rd, Cox's Creek, KY 40013 (502-349-2099); **ky4z@arrl.org**
Michigan: Larry Camp, WB8R, 71 Oakdale Lane, Coldwater, MI 49036 (517-278-0406); **wb8r@arrl.org**
Ohio: Frank J. Piper, KI8GW, 496 Hillview St, Pickerington, OH 43147-1197 (614-589-4641); **ki8gw@arrl.org**

Hudson Division (ENY, NLI, NNJ)

Eastern New York: Pete Cecere, N2YJZ, 329 W Saugerties Rd, Woodstock, NY 12498 (845-246-4359); **n2yjz@arrl.org**
NYC-Long Island: Jim Mezey, W2KFV, 38 Appletree Ln, Carle Place, NY 11514-1336 (516-315-8608); **w2kfv@arrl.org**
Northern New Jersey: Richard Krohn, N2SMV, 23 Sweetmans Ln, Manalapan, NJ 07726; **n2smv@arrl.org**

Midwest Division (IA, KS, MO, NE)

Iowa: Tom Brehmer, NØLOH, 1114 East Tenth St, Muscatine, IA 52761 (563-263-3097); **n0loh@arrl.org**
Kansas: Ronald D. Cowan, KBØDTI, PO Box 36, LaCygne, KS 66040 (913-757-3758); **kb0dti@arrl.org**
Missouri: Dale C. Bagley, KØKY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org**
Nebraska: Art Zygielbaum, KØAIZ, 6601 Pinecrest Dr, Lincoln, NE 68516-3573 (402-421-0839); **k0aiz@arrl.org**

New England Division (CT, EMA, ME, NH, RI, VT, WMA)

Connecticut: Betsey Doane, K1EIC, 92 Mohegan Rd, Shelton, CT 06484-2448 (203-929-7759); **k1eic@arrl.org**
Eastern Massachusetts: Phil Temples, K9HI, 125 Coolidge Ave, Apt 803, Watertown, MA 02472-2875 (617-331-0183); **k9hi@arrl.org**);
Maine: William Woodhead, N1KAT, 68 Madison St, Auburn, ME 04210 (207-782-4862); **n1kat@arrl.org**
New Hampshire: Alan K. Shuman, K1AKS, PO Box 681, New Boston, NH 03070-3520 (603-487-3333); **k1aks@arrl.org**
Rhode Island: Bob Beaudet, W1YRC, 30 Rocky Crest Rd, Cumberland, RI 02864 (401-333-2129); **w1yrc@arrl.org**
Vermont: Paul N. Gayet, AA1SU, 11 Cherry St, Essex Junction, VT 05452 (802-878-2215); **aa1su@arrl.org**
Western Massachusetts: Ed Emco, W1KT, 37 Bullard Ave, Worcester, MA 01605 (508-853-3333); **w1kt@arrl.org**

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

Alaska: Jim Larsen, AL7FS, 3445 Spinnaker Dr, Anchorage, AK 99516-3424 (907-345-3190); **al7fs@arrl.org**
Eastern Washington: Mark Tharp, KB7HDX, PO Box 2222, Yakima, WA 98907-2222 (509-965-3379); **kb7hdx@arrl.org**
Idaho: Edward Stuckey, AI7H, 2300 W Polo Green Ave, Post Falls, ID 83854-9680 (208-457-0354); **ai7h@arrl.org**
Montana: Doug Dunn, K7YD, 216 Fiddle Creek Rd, Livingston, MT 59047-4116 (406-686-9100); **k7yd@arrl.org**
Oregon: Bonnie Altus, AB7ZQ, 7770 Harmony Rd, Sheridan, OR 97378 (971-237-0711); **ab7zq@arrl.org**
Western Washington: Monte L. Simpson, K2MLS, 2523 N Wycoff Ave, Bremerton, WA 98312-2711 (360-373-3095); **k2mls@arrl.org**

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

East Bay: James Latham, AF6AQ, 1798 Warsaw Ave, Livermore, CA 94550-6140; (925-447-6136); **af6aq@arrl.org**
Nevada: Joe Giraudo, N7JEH, 720 Holyoke Dr, Spring Creek, NV 89815-5306 (775-738-7110); **n7jeh@arrl.org**
Pacific: Bob Schneider, AH6J, PO Box 131, Keaau, HI 96749-0131 (808-966-8146); **ah6j@arrl.org**
Sacramento Valley: Ronald D. Murdock, W6KJ, 998 Bogue Rd, Yuba City, CA 95991-9221 (530-674-8533); **w6kj@arrl.org**
San Francisco: Bill Hillendahl, KH6GJV, PO Box 4151, Santa Rosa, CA 95402-4151 (707-544-4944); **kh6gjv@arrl.org**
San Joaquin Valley: Dan Pruitt, AE6SX, 4834 N Diana St, Fresno, CA 93726 (559-779-2974); **ae6sx@arrl.org**
Santa Clara Valley: Brandon Bianchi, NI6C, 1154 Trivoli Way, Salinas, CA 93905 (559-313-3373); **ni6c@arrl.org**

Roanoke Division (NC, SC, VA, WV)

North Carolina: Bill Morine, N2COP, 101 Windlass Dr, Wilmington, NC 28409-2030 (910-452-1770); **n2cop@arrl.org**
South Carolina: Marc Tarplee, N4UFP, 4406 Deer Run, Rock Hill, SC 29732-9258 (803-327-4978); **n4ufp@arrl.org**
Virginia: Carl Clements, W4CAC, 4500 Wake Forest Rd, Portsmouth, VA 23703 (757-484-0569); **w4cac@arrl.org**
West Virginia: L. Ann Rinehart, KA8ZGY, 1256 Ridge Dr, South Charleston, WV 25309 (304-768-9534); **ka8zgy@arrl.org**

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

Colorado: Jack Ciaccia, WMØG, PO Box 21362, Boulder, CO 80308-4362 (303-587-0993); **wm0g@arrl.org**
New Mexico: Bill Kauffman, W5YEJ, 1625 36th St SE, Rio Rancho, NM 87124-1719 (505-349-0460); **w5yej@arrl.org**
Utah: Mel Parkes, NM7P, 2166 E 2100 North, Layton, UT 84040 (801-547-1753); **nm7p@arrl.org**
Wyoming: Garth Crowe, N7XKT, 1206 Avalon Ct, Gillette, WY 82716-5202 (307-686-9165); **n7xkt@arrl.org**

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

Alabama: David Drummond, W4MD, 5001 Lakehurst Dr, Northport, AL 35473 (205-339-7915); **w4md@arrl.org**
Georgia: Gene Clark, W4AYK, 1604 Lynwood Lane, Albany, GA 31707 (229-888-1090); **w4ayk@arrl.org**
Northern Florida: Paul L. Eakin, KJ4G, PO Box 625, Panacea, FL 32346 (850-591-0442); **kj4g@arrl.org**
Puerto Rico: Rene Fonseca, NP3O, HC 67 Box 15593, Fajardo, PR 00738 (939-579-4134); **np3o@arrl.org**
Southern Florida: David Fowler, K4DLF, 2702 Starwood Ct, West Palm Beach, FL 33406-5145 (561-676-3007); **k4dlf@arrl.org**
Virgin Islands: Fred Kleber, K9VV, PO Box 24275, Christiansted, VI 00824-0275; **k9vv@arrl.org**
West Central Florida: Dee Turner, N4GD, 10132 64th St N, Pinellas Park, FL 33782 (727-548-7474); **n4gd@arrl.org**

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

Arizona: Thomas J. Fagan, K7DF, 10650 E Bridgeport St, Tucson, AZ 85747-5925 (520-574-1129); **k7df@arrl.org**
Los Angeles: David Greenhut, N6HD, 5260 Darro Rd, Woodland Hills, CA 91364-1933 (818-992-5507); **n6hd@arrl.org**
Orange: Carl Gardenias, WU6D, 20902 Gardenias St, Perris, CA 92570 (951-490-2270); **wu6d@arrl.org**
San Diego: Stephen M. Early, AD6VI, 4724 Maple Ave, La Mesa, CA 91941 (619-461-2818); **ad6vi@arrl.org**
Santa Barbara: Robert Griffin, K6YR, 1436 Johnson Ave, San Luis Obispo, CA 93401-3734 (805-543-3346); **k6yr@arrl.org**

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

North Texas: Walt Mayfield, KE5SOO, 305 Broken Arrow, Krum, TX 76249-7502 (940-368-4659); **ke5soo@arrl.org**
Oklahoma: Kevin O'Dell, NØIRW, 1405 N 7th St, Perry, OK 73077-2206 (580-220-9062); **n0irw@arrl.org**
South Texas: Lee H. Cooper, W5LHC, 2507 Autrey Dr, Leander, TX 78641 (512-260-7757); **w5lhc@arrl.org**
West Texas: Bill Roberts, W5NPR, 34 Sunny Glen, Alpine, TX 79830 (432-837-2741); **w5npr@arrl.org**

AMERITRON *True Legal Limit*™ Tuner

Easily handles 1500 Watts continuous carrier even on 160 Meters . . . High-current edge-wound silver plated Roller Inductor . . . Two 500 pf high capacitance tuning capacitors with 6:1 vernier reduction drives . . . 3 core choke balun . . . Six position antenna switch . . . True peak reading Cross-Needle SWR/Wattmeter . . .

Call your dealer for your best price!

AMERITRON ATR-30

$599.95

Suggested Retail

- ***Handles 1500 Watts carrier***
- ***Super High Current edge-wound silver plated Roller Inductor***
- ***500 pf tuning capacitors with 6:1 vernier reduction drives***
- ***3 core choke balun***
- ***6 position antenna switch***
- ***True peak reading meter***

AMERITRON's ATR-30 *True Legal Limit*™ roller inductor antenna tuner is ham radio's toughest! It'll handle 1500 Watts *continuous carrier output* on *all* modes and *all* HF bands into most antennas -- even on 160 Meters where most antenna tuners fail.

It's perfect for Ameritron's most powerful amplifiers where the ATR-30 just loafs.

All band coverage lets you operate 1.8-30 MHz including all MARS and WARC bands.

Super High Current Roller Inductor

You'll see Ameritron's new *super high current* air core roller inductor. It's *edge wound* from a thick solid copper strip and silver plated. This produces a large surface area and a massive conductor. It can carry huge circulating RF currents and withstand tremendous heat that'll melt or burn ordinary roller inductors.

A gear driven turns counter and crank knob gives you precise inductance control.

Two 500 pf Tuning Capacitors

Two 500 pf -- *the highest of any antenna tuner* -- variable transmitting capacitors give you no-arc wide range impedance matching for true high power performance.

6:1 vernier reduction drives makes capacitor tuning smooth and easy.

Super Balun, 6 position Antenna Switch

Super heavy duty three core choke balun lets you match virtually any balanced feedline antenna without core saturation.

A 6 position antenna switch lets you select your desired operating antenna.

Read *true* Peak Power

Ameritron's active electronic *true* peak reading meter accurately reads forward and reflected power and SWR *simultaneously* on a lighted Cross-Needle meter.

Roomy Cabinet maintains High-Q

Roomy extra-strong .080 inch thick aluminum cabinet gives highest efficiency and lowest loss. 13¼Wx5⅝Hx17½D inches.

AMERITRON ATR-20 Antenna Tuner

ATR-20, $459.95 Handles a full 1.2 kW SSB and 600 Watts CW. It's designed to safely handle the full SSB power of Ameritron's AL-811/811H/80B, ALS-500M/600 and other 1.2 kW SSB amplifiers.Has vernier reduction drives.

Ameritron has the best selection of *True Legal Limit*™ HF Amplifiers

AMERITRON's legal limit amplifiers use super heavy duty Peter Dahl Hypersil(R) power transformer capable of 2500 Watts!

Ameritron's *most powerful* Amp

with 3CX1500/8877 ceramic tube

AL-1500F

$3295

3CX1500 tube

AL-1500

$4195

Eimac(R) tube

TrueLegalLimit™

Ameritron's *most powerful* amplifier uses the *herculean* 3CX1500/8877 ceramic tube. 65 Watts drive gives you full output power -- and it's just loafing because the power supply is capable of 2500 Watts PEP. All HF bands, all modes. 77 lbs., 17Wx10Hx18½ in.

Ameritron's *toughest* Amp

with Eimac(R) 3CX1200A7 toughest tube

AL-1200

$3795

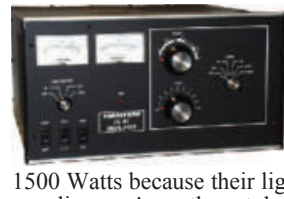
Suggested Retail

TrueLegalLimit™

Get ham radio's *toughest* tube with AL-1200. The *Eimac*(R) 3CX1200A7 has a 50 Watt control grid dissipation and the lowest history of field replacement of any modern transmitting tube that we use. 90 Watts in gives you full power out. All HF bands, all modes. 76 pounds, 17Wx18½Dx10H in.

Ameritron's *classic* Amp

with 2 graphite plate classic (R) 3-500G tubes



AL-82

$2745

Suggested Retail

TrueLegalLimit™

Most linears using 3-500Gs *can't* give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential. AL-82 is ham radio's *only* super 3-500G amp! 100 Watts in gives you full power out. All HF bands, all modes. Hefty 76 pounds, 17Wx10Hx18½D inches.

Desktop Kilowatt

with classic 3-500G tube

AL-80B, $1495. Gives you full kilowatt SSB PEP output (85 Watts in) from a whisper quiet compact desk-top linear. 14Wx8½Hx 15½D inches. Plugs into 120 VAC outlet. Graphite plate *genuine* 3-500G tube. Nearly 70% efficiency. Weighs 48 lbs.

AMERITRON no tune Solid State Amplifiers

500 Watt Mobile Amp

ALS-500M, $899. 500 Watts PEP/400W CW output, 1.5-22 MHz, instant bandswitching, no tuning, no warm-up. SWR, load fault, thermal overload protected. Remote on/off control. DC amp meter. Extremely quiet fan. 13.8 VDC. 9W x3½Hx15D in., 7 lbs. **ALS-500RC, $49,** Remote Head.

600 Watt FET Amp

ALS-600, $1499. ***No tuning****, no fuss, no worries -- just turn on and operate.* 600 Watts PEP/500W CW, 1.5-22 MHz, instant bandswitching, SWR protected, extremely quiet, SWR/Wattmeter, ALC control. 120/220 VAC. Inrush protected. 9½Wx6Hx12D in. **ALS-600S, $1599,** ALS-600 with 10 lb., very low RF noise switching power supply.

Flat Mobile SWR/Wattmeter

AWM-35, $159.95. 1⅝ inch thick, flat mounts on dashboard. Remote sensor, 25 ft. thin cable. True peak reading. Cross-needle, lighted. 1.5 kW, 1.8-30 MHz. *High-SWR* LED.

Call your dealer for your best price!

Free Catalog: 800-713-3550

AMERITRON®

. . . the world's high power leader!

116 Willow Road, Starkville, MS 39759

TECH (662) 323-8211 • **FAX** (662) 323-6551

8 a.m. - 4:30 p.m. CST Monday - Friday

For power amplifier components call (662) 323-8211

http://www.ameritron.com

Ameritron . . . the world's high power leader!

Array Solutions Your Source for Outstanding Radio Products

Professional Grade Equipment from Array Solutions

NEW! *FCC Certified*

Introducing the OM Power OM2500...

OM2500A (automatic) and OM2500HF (manual tune)

- Frequency coverage: All amateur bands 1.8 – 29.7 MHz
- Power output: 1500 W PEP All modes - no time limit
- Fully Automatic bandswitching and tune up
- Integrates with all popular transceivers
- Maximum output SWR: 2:1
- SWR protection: automatic switching to STBY
- Tube: GU84b Ceramic tetrode
- Power supply: 240 V - single phase

Introducing the ACOM 1500

- Frequency coverage: All amateur bands 1.8 – 54 MHz
- Power output: 1500W PEP SSB, 1200W all other modes
- Manual band switching and tune up
- 3 antenna outputs
- Maximum output SWR: 3:1
- SWR protection: automatic switching to STBY
- Tube: 4CX1000 Ceramic tetrode
- Power supply: 240V - single phase

NEW! *FCC Certified*

NEW!

Announcing the New

AS-419 "Bandpasser" Economical Integrated Bandpass Filter System.

The AS-419 bandpass filter unit provides bandpass filters for 160, 80, 40, 20, 15, and 10 meters. Each filter can be selected manually through the use of convenient pushbuttons per band. The Bandpasser can also be controlled automatically via our 4-wire network or through a sourcing band decoder.

New from Array Solutions

4-square Vertical Array System

NEW!

New pushbotton

Integrated Controller

NEW!

For 8-pak and 4x8-pak systems.

Introducing the

VNA *uhf* two-port Vector Network Analyzer

NEW!

Expanded frequency coverage to over 1 GHz – see our web page for details

AS-309-H Surge Arrestor

NEW!

For use with open wire / ladder line feeders and long wire antennas. See also our AS-303 and AS-302 coaxial arrestors and our AS-XSP control cable arrestors as well as the complete line of Hofi professional arrestors.

Check our webpage for more new products!

Other top-quality brands represented by Array Solutions...

ACOM · AY · Custom Metalworks · FRITZEL · hofi · M² · OM Power · OPTIBEAM · PHILLYSTRAN · Pro.Sis.Tel. · REX · SSB · W3NQN

ARRAY SOLUTIONS

www.arraysolutions.com

Sunnyvale, Texas USA
Phone 214-954-7140
sales@arraysolutions.com
Fax 214-954-7142

Array Solutions' products are in use at top DX and Contest stations worldwide as well as commercial and governmental installations. We provide RF solutions to the DoD, FEMA, Emcomm, UN, WFO, FAA and the State Dept. for products and installation of antennas systems, antenna selection, filtering, switching and grounding. We also offer RF engineering and PE consulting services.

ELECRAFT KX3

- 160-6 m (internal 2 m option planned)
- SSB/CW/AM/FM/DATA modes
- 10 W output (100 W with KXPA100 amp)
- World-class receive performance
- Built-in advanced 32-bit DSP
- Supports PC-based remote control and logging; SDR applications via RX I/Q outputs; simple firmware updates
- Factory-assembled or easy-to-build, no-soldering kit; manual written with first-time HF users in mind
- 1.7" x 3.5" x 7.4" (4.3 cm x 8.9 cm x 18.8 cm) 1.5 pounds (less options and internal batteries)
- Current drain as low as 150 mA; 9-15 V DC

The Revolutionary KX3 All-Band/All-Mode Transceiver

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

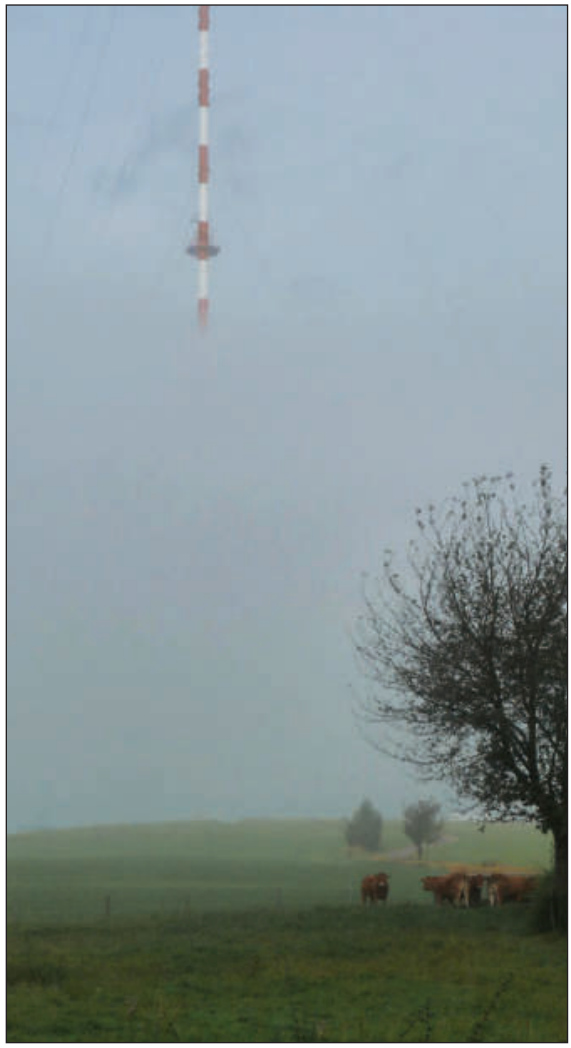
ELECRAFT®

For complete features and specifications, go to www.elecraft.com

Steve Ford, WB8IMY, upfront@arrl.org

Radio Rises from the Fog

Rob Aartman, PA3GVI, took a break from operating while in Luxembourg for a 2 meter competition with the PA1TK contest team. As he strolled through the fields, the 1100 foot Radio Télévision Luxembourg tower seemed to rise out of the morning fog and pose for this impressive photograph.



Hams on Wheels

Eli Blanco, N4ELI, shows off the three wheeled, 2 meter FM equipped motorcycle that he used to shadow the more than 600 bicyclists who showed up for the Mount Dora, Florida, Bicycle Festival October 12-14, 2012. Eli was part of the Lake County ARES (LCARES) team that provided communications support during the three day event.

The LCARES mobile communications trailer in downtown Mount Dora.

The LCARES group had 23 volunteer radio operators helping to keep the riders safe and secure by manning rest areas and providing mobile patrol vehicles. Mobile units and radio operators at rest areas were able to communicate with the command center using the LCARES repeater at 147.000 MHz. They also used the Automatic Packet Reporting System (APRS) to track several of the mobile radio operators when they were out on the course.

Leaving Their Marks

Kay, KE4TCH and Dave, N4XYZ, Knight were heading home to Virginia Beach after an RV trip to the Grand Canyon when they stopped at the Cadillac Ranch in Amarillo, Texas. Originally created in 1974, the huge art installation consists of Cadillac automobiles half buried nose first in the ground at angles that allegedly match those of the Great Pyramid of Giza in Egypt.

Visitors are encouraged to add graffiti to the cars, so Kay and Dave decided to continue the tradition by spray painting their respective call signs.

The Elecraft K-Line

A powerful performance you won't want to miss

Elecraft's world-class trio is now complete. It all started with the K3 transceiver, which tops the charts in nearly every receive category. Then we added an exciting visual dimension with the versatile P3, our fast, full-color panadapter. And now, we're proud to introduce the KPA500: a 500-watt solid-state amp that's so well-integrated you'll think it's reading your mind.

The KPA500 features 160-6 m coverage, instant RF-based band switching with any radio, alphanumeric status display, bright LED bar graphs, and a rugged, built-in linear supply. The amp's manual band switches can be used to change bands on the K3. The K3 can even select per-band amplifier drive levels automatically when the amp is placed into operate mode, so you'll rarely need to adjust power output.

The K3 already gives you the competitive edge, with its optional high-performance sub receiver, roofing filters as narrow as 200 Hz, new audio peaking filter (APF), and one of the cleanest SSB signals around. Adding the P3 and KPA500 will take you, and your station, to the next level.

ELECRAFT®

www.elecraft.com • 831-763-4211
P.O. Box 69, Aptos, California 95001-0069

West Mountain Radio

STAY ON THE FAST TRACK

Use Promo Code: QSTFAST
when ordering and receive
FREE Ground Shipping

Computerized Battery Analyzer

$159.95

Check the health of your battery!

Find the actual capacity of the battery!

Test how long your "full charge" will last!

NEW! - Solar Panel Characterizing over various loads!

No need to dump good batteries!

- PC Connection and easy-to-use software
- Works with any battery types such as Lead Acid, Lithium-Ion or Alkaline - ***Perfect for Hand-held Batteries!***
- Overlay multiple test results to compare battery performance over lifetime and generate charts and labels
- Ability to test power supplies with a constant load

$79.95

15W Speaker

Improve communication in a noisy truck or car!

Minimize distortion at high sound levels!

- High Power 15 watt RMS linear power amplifier.
- Adjustable gain control.
- Sharp bandpass filter with 300 Hz to 3.2 kHz pass band attenuates unneeded bass and treble sounds.
- Plugs into radio's speaker or headphone jack.

262-522-6503
Sales x35

www.westmountainradio.com
sales@westmountainradio.com

I love my AA-54

- 0.1 to 54 MHz
- Graphical display
- Hand-held design
- Connection to a personal computer

Antenna Analyzers

Worldwide Distributors

Array Solutions
www.arraysolutions.com

Rig Expert Canada
www.rigexpert.net

Ham Radio Outlet
www.hamradio.com

KMK UK Limited
www.mixw.co.uk

リグエキスパート ジャパン
www.ja1scw.jp/shop

Юником
www.unicom.ru

www.rigexpert.com

letters@arrl.org

Letters from Our Members

The Ideal Operator in Times of Emergency

While reading the comments made by ARRL Emergency Preparedness Manager Mike Corey, KI1U, on the response to Hurricane Isaac [**www.arrl.org/news/voip-hurricane-net-provides-support-during-hurricane-isaac**], I wondered, "Do contesters really make the best operators in an emergency?" I'm really not sure. I see the point that contesters have many excellent skills, including being able to sit at the desk for hours on end and operate, plus being able to copy individual signals in a pileup.

But how well can they deal with low power or conserving their batteries? Can they keep track of the off-frequency stations in a complex net? Do they know the standard procedure for relaying accurate messages? Do they have the flexibility to route traffic expediently through voice and CW nets, NTSD, peer-to-peer radio e-mail, packet, telnet or landline telephone as the situation changes? Do they have the tenacity to track an addressee down to deliver some critical information? Traffic handlers know how to do all these things.

I'm thinking the ideal operator in an emergency would have a contester's iron pants, a QRP operator's ear, a traffic handler's organization, an orator's voice, an engineer's nose for equipment and a developer's knack with software. This operator would be a well-rounded ham, able to be flexible and to strategize. Maybe we should *all* be cross-training more.

Kate Hutton, K6HTN
ARRL Los Angeles Section Traffic Manager
Pasadena, California

Amateur Actions

According to my copy of *Webster's New Collegiate Dictionary*, an "amateur" is defined as, among other things, "one lacking in experience and competence in art and science." I find the word "amateur" in "Amateur Radio" offensive, and in my opinion, ham radio is certainly a combination of art and science. I've been licensed and continuously active since 1950; I have found that the majority of hams are individuals who act professionally. They certainly do not lack experience or competence in ham radio operations.

I am considering sending a proposal to the FCC, asking it to change the term "Amateur Radio operator" to "licensed radio operator." We can't use the term "professional radio operator," because my dictionary defines "professional" as, among other things, as "one who receives financial return." According to FCC regulations, hams are prohibited from using ham radio for financial gain.

Nunzio Addabbo, W4VYD
Tucson, Arizona

Finding Your Niche

Discussion of just what makes a proper contact — be they ragchewers, contesters or DXers — is summed up nicely by Scott Schultz, NØIU ["Correspondence: In Pursuit of Friendship," Dec 2012, page 24]. As Scott states, "there is no wrong way to do Amateur Radio." Also, there is no *perfect* way to do Amateur Radio. Amateur Radio has many facets. For years, I have been saying that there is room for all, regardless of one's interest. My interests are varied, but there are parts of Amateur Radio that I hold no interest in pursuing. Whatever the next fellow desires to do is his business and none of mine. Our time as radio amateurs would be better and wiser spent if we pursued our interests and at the same time, offered support to others, no matter their interest.

Ray Husher, W5EW
ARRL Life Member
Houma, Louisiana

Not for Young Ears

Recently I was in the shack showing my 10-year-old son how Amateur Radio works, when I happened to scroll past 14.313 MHz — just in time for us to get an earful of quite a few vulgar swear words. Imagine my horror as I had to explain to my son that there are people in the ranks of the Amateur Radio Service who use repulsive language. With all of the direction finding technology out there, I can't believe that the FCC hasn't identified, and stepped in to take significant enforcement action against, the individuals who are responsible for these vulgar and disgusting transmissions. It's truly a shame that I have to be fearful of what my child will hear on the amateur bands.

Dom Theodore, K8HHL
Mecosta, Michigan

In Honor of Silent Keys

Aside from all the fun and satisfaction we hams have working with equipment, overcoming technical and propagation challenges, performing public service functions and making distant contacts, the real happiness that many of us have found in Amateur Radio comes from all the wonderful people we have had the privilege to meet, both face-to-face and on the air. They have changed and enriched our lives in so many ways. Some of the great radio amateurs we have known — both young and old — have become Silent Keys and we miss them all.

To honor former club members who have become Silent Keys and to make sure they are not forgotten, the Park County Radio Club in Colorado has created a page on its website with pictures of, and comments about, those who have passed on before us. There are other SK lists and registries, but doing something on a more local and personal level, complete with pictures and comments, seemed more relevant for our needs.

We thought other clubs might be interested in what we have done, and perhaps in doing something similar in their own local areas. You can find the Park County Radio Club's homage to its Silent Keys at **www.ab0pc.org/silent_keys.php**.

Daniel Hazen, NØBN
Bailey, Colorado

Finding Fault With the FCC

I read ARRL Regulatory Information Manager Dan Henderson's, N1ND, interview with FCC Special Counsel Laura Smith ["An Interview with FCC Special Counsel Laura Smith," Dec 2012, pages 59-60] and became incensed at Ms Smith's dismissive attitude toward the amateur community. I feel that it was especially shortsighted of her to refer to "the true meaning of Amateur Radio…to have fun!" Has she forgotten, or is she too young to remember, that the backbone of the military communications service was formed by American radio amateurs when World War II began? Is she unaware of the significant amount of research continually carried on by radio amateurs? Yes, we do enjoy ham radio. Very few of us would continue to participate if we didn't enjoy it, but Ms Smith must remember that our love of ham radio includes the fulfillment of our desire for building upon and improving ham radio.

Her answer to the question about the resolution of serious pending cases — that "administrative due process" must be followed — is, in my opinion, a political non-answer that prompts me to ask "What happened to cease and desist?" In cases of obvious transgression, can the FCC not direct those radio amateurs who are involved in an ongoing investigation to close their stations or cease using any frequency? I wish I had more faith in the FCC to protect Amateur Radio. I often feel that the FCC comes up short when it comes to protecting this valuable segment of American life.

Jerry Patrick, KB4FP
Fairfield, Virginia

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

Celebrating 10 Years!

It began with a dream,
turned into a hobby project
and evolved into a global company.
FlexRadio Systems is now celebrating 10 years
with thousands of loyal customers who share in that
original dream. You, our customers, caught hold of and
promoted the vision that Software Defined Radio would change
ham radio forever. When we first started few had ever heard of SDR - now
few haven't. That's all because of you, our customers.

There is an old saying that, "You can tell pioneers by the arrows in their backs." In the early days
there were those of you who were experimenters and early adopters. You caught the vision and helped to
build and promote this new and evolving technology by building a network of Elmers to help newcomers and
each other through the infancy and growth of the original SDR-1000. As our software and hardware products matured,
some of you went on to create your own experimental SDR communities. We are proud to have played our small part
in the beginning of those communities that fulfill one of the key tenets of the Amateur Radio hobby -
"To advance the radio art".

As we grew with the release of the FLEX-5000, FLEX-3000 and FLEX-1500, thousands of you have joined us not as
experimenters but simply because you enjoy using our radios. You became loyal advocates and supporters, even giving
yourselves the name, "Flexers". You are great about helping newcomers to our community feel welcome and learn how
to use their new radios. You give us true joy when you share your excitement and enthusiasm for our products and
company.

We have made so many friends over these last 10 years. Whether this is your first time to
own a FlexRadio product or you've been with us from the start or anytime in
between, our company wouldn't be what it is without your support. From
the bottom of our hearts -- Thank you!

73,

Gerald, K5SDR
President & CEO

Thanks for 10 years!

FlexRadio Systems®
Software Defined Radios

facebook.com/groups/flexradio twitter@flexradiosystem

4616 W. Howard Lane, Ste. 1-150, Austin, TX 78728. - Phone: +512-535-4713 - www.flexradio.com

HIGH SIERRA
COMMUNICATIONS PRODUCTS

More than 700 Products at www.hamcq.com

Just What the Doctor Ordered!

Andy Crimp Pro Deluxe Tool Set
The Best Powerpole and Coax Connector Crimp Set
The only professional tool set for Powerpoles, Molex and Coax Connectors.
Regular Separate $275
Online Sale $129.73

Antenna Mount
Super Strong Horizontal Clamp
3/8-24 Thread With Coax Connector
Regular $50
Online Sale $25.73

Slip...NOT!! Rope Tensioner
Rope won't slip, easily adjusted
Regular $15
Online Sale $4.73

HF Antenna Mount for 2 Inch Receiver Hitch
Works great with antennas that have 3/8-24 thread.
Very limited quantity.
Regular $100
Online Sale $49.73

Andy Crimp Pro
Professional crimper for 15, 30, 45, 50 & 75 amp Powerpole connectors and Molex connectors.
Regular $100
Online Sale $49.73

High Sierra Rangler Rope

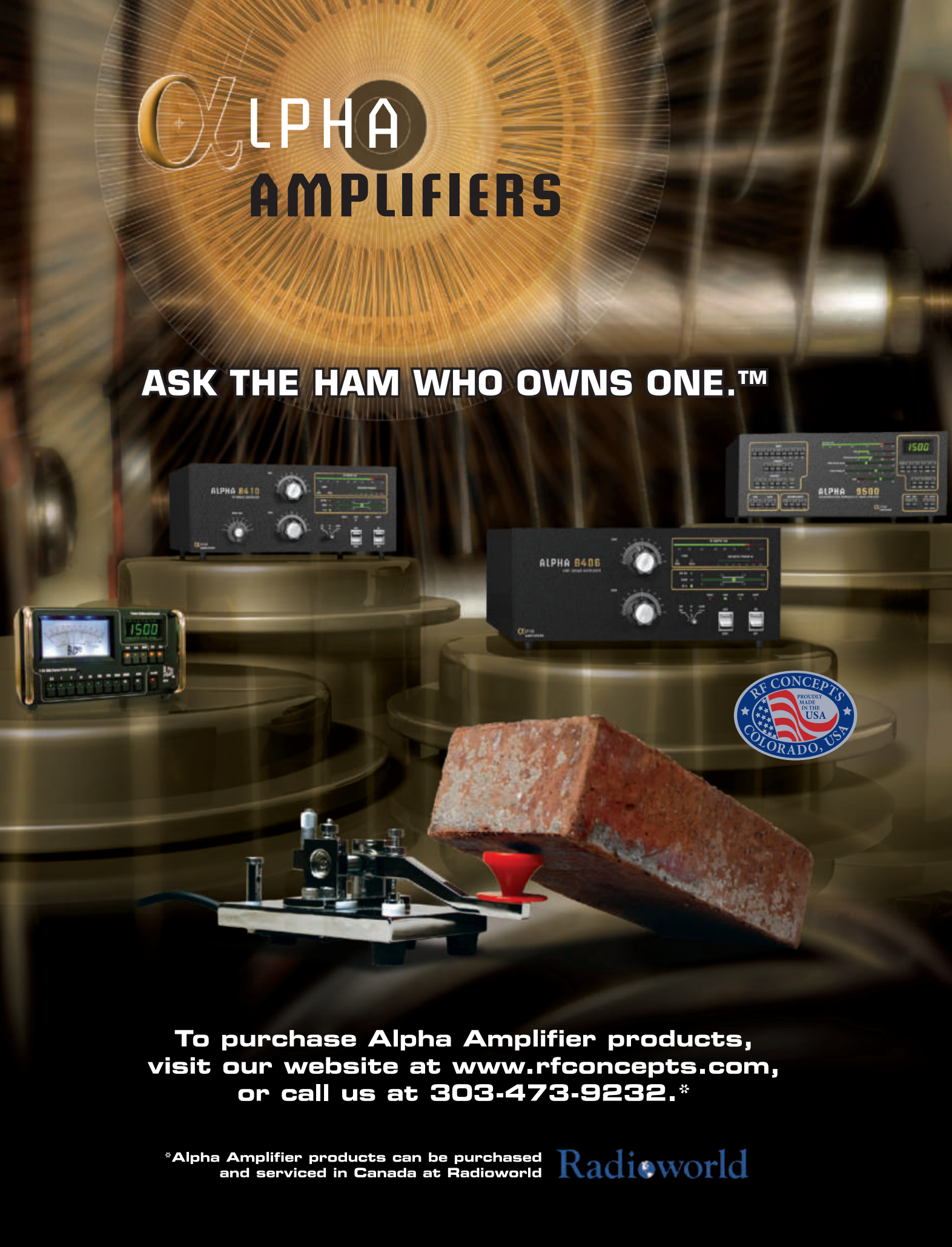
Rangler Rope
Won't stretch. UV resistant.
Dacron polyester.
Super strong.
The best rope for antennas.
100 feet 3/16 inch
Regular $30
Online Sale $19.73

Monster Snap On Ferrite Bead
High Power, Very Effective For RG213, LMR400, RG8 etc.
Regular $6
Online Sale $4.73

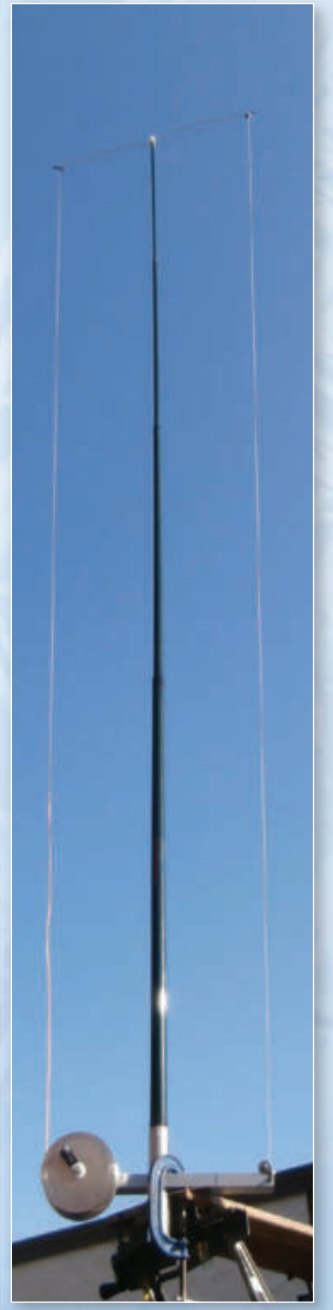
Raincoat Tape
Amazing new tape, self-fusing, 300% stretch, the answer for sealing coax connections.
Regular $10
Online Sale $5.73

Screwdriver Set
33 Pieces with Soft Grip Handles
Regular $25
Online Sale $9.73

SIGN UP for Our Special Deals Club at www.hamcq.com


ALPHA
AMPLIFIERS
ASK THE HAM WHO OWNS ONE.™
ALPHA 8410
ALPHA 9500
ALPHA 8406
RF CONCEPTS
PROUDLY MADE IN THE USA
COLORADO, USA
To purchase Alpha Amplifier products,
visit our website at www.rfconcepts.com,
or call us at 303-473-9232.*
*Alpha Amplifier products can be purchased and serviced in Canada at Radioworld
Radioworld

Introducing the CrankIR Vertical*



CrankIR
40m-2m Vertical

Imagine the possibilities!

- Lightweight and extremely portable, the CrankIR is also a great option for stealth installations (CC&R) or for the ham that is on a budget
- Install and break down in minutes!
- Continuous coverage on all frequencies within specified range
- 2000 watt power rating
- Patented folded design allows for 40% shorter element with only 0.3dB reduction in gain compared to a full length vertical
- Ideal for DXpeditions, hiking, Field Day, boating or home QTH use
- No power required—completely self contained
- Portable elevated radial system available—adjusts effortlessly and stores in seconds
- 20m-2m CrankIR weighs approximately 5.5 lb
- 40m-2m CrankIR weighs approximately 8.5 lb

Crank Assembly Detail

Why settle for compromises?

You can have high performance AND portability with the CrankIR Vertical!

Mike, K7IR with the CrankIR

The CrankIR will be available in Spring 2013

StepplR

2112 116th Ave NE Suite 1-5
Bellevue, WA 98004
Tel: (425) 453-1910 Fax: (425) 462-4415

Don't forget to check out our NEW WEBSITE!

*(International patent pending)

www.SteppIR.com

Escape with the TM-281A

On or off the road, Kenwood's TM-281A is a mobile radio you can always count on.

As tough as nails, this MIL-STD-compliant transceiver delivers powerful performance, excellent audio clarity, and a host of advanced features. It offers superb operating ease day or night thanks to the large backlit LCD and illuminated keys. So the next time you take off, take the TM-281A.

KENWOOD

Customer Support: (310) 639-4200
Fax: (310) 537-8235

www.kenwoodusa.com

JQA-1205
ISO9001 Registered
Professional Systems Business Group
JVCKENWOOD Corporation

ADS#46612

Scan with your phone to download TM-281A brochure.

A Three to One Dummy Load

This flexible dummy load can also check your SWR meter's accuracy and exercise your antenna tuner.

Mike Bryce, WB8VGE

I was ready to button up a radio on the workbench. The only thing left was to calibrate the internal SWR meter. The directions in the manual were clear. Adjust R2 for a 3:1 SWR indication while the output of the radio is being fed into a known 3:1 load. Right!

Not so fast. I had no easy way of generating a 3:1 SWR. The only way I could come up with it was to squirt some RF into an antenna tuner that went to a 50 Ω load and adjust the tuner for a 3 to 1 SWR. Even if I did that, the calibration would only be as good as the calibration of the meter I used to set the antenna tuner. Most amateur SWR meters are reasonably well calibrated at a 1:1 SWR, but provide less accurate readings at a higher SWR.

Standing Wave Ratio

This is one subject that will instantly generate a conversation on the HF bands. Mention SWR and you'll get a dozen hams explaining the ins and outs of SWR and how and why it is — or isn't — important.

Some hams insist that unless you have a perfect 1:1 SWR, life will end. Others suggest that some SWR reading is necessary to ensure you're putting out a signal. (They counter that a 50 Ω dummy load is a perfect 1:1 and therefore does not radiate.) I don't fret about SWR. If the SWR on any of my antennas is 2.5:1 or lower I'm happy.

Why a Perfect SWR?

If the antenna we are trying to run RF into presents a load impedance to the transmitter that's different from the nominal 50 Ω, then some of the RF we send out is reflected to the transmitter. This results in standing waves on the line and a standing wave ratio — the ratio of maximum to minimum voltage along the length of the line. The power reflected is not actually lost, but is re-reflected back toward the antenna. There are, however, a few negative aspects to a high SWR.

The RF output of modern solid state transceivers is designed to be terminated by a 50 Ω load. If the actual load impedance is different from that, the transmitter will likely reduce power to avoid damage from the higher-than-designed-for antenna current or voltage that results from the higher SWR.

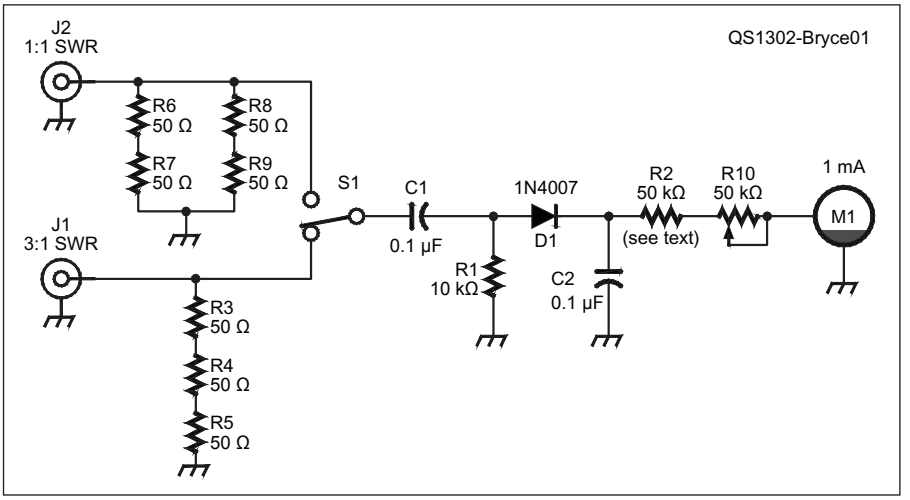


Figure 1 — Schematic diagram and parts list of the 3:1 dummy load. Mouser parts are available at **www.mouser.com**.

C1,C2 — 0.1 µF, 1 kV ceramic disc capacitor.
D1 — 1N4007 silicon diode.
J1, J2 — SO-239 UHF panel mount socket.
M, J2 — Panel meter, 50 µV or 1 mA full scale (see text).
R1 — 10 kΩ, ½ W resistor.
R2 — 50 kΩ, 1 W resistor (two 100 kΩ, ½ W resistors in parallel).
R3-R9 — 50 Ω, 100 W, 1% noninductive resistor (Mouser electronics 684-MP9100-50).
R10 — 50 kΩ, linear potentiometer.
S1 — SPDT switch.

Many radios start doing this with an SWR as low as 1.5:1 or 2:1. This is called *foldback*, a good protective feature — except you end up with less power than your radio is supposed to put out.

How Do We Make a 3:1 SWR?

It's not my goal to delve into great detail on the finer points of SWR, but rather to show that I can create a 3:1 SWR by making an appropriate resistive load. One could also change the SWR by changing inductance or capacitance. Changing the resistance value is more useful, since the SWR will be constant over frequency — not the case if inductance or capacitance is changed.

Plug In the Soldering Iron

To calibrate the SWR meter, I needed a dummy load that produces an SWR of 3:1. I decided to incorporate a standard 50 Ω dummy load as well. Both are rated to dissipate 100 W. [The wattage rating is at a case temperature of 25° C and should be derated according to the curve shown in the Caddock specification sheet, available at **www.caddock.com/Online_catalog/Mrktg_Lit/MP9000_Series.pdf**. — *Ed.*] A simple RF detector is included to provide visual indication of power being applied to either dummy load. The schematic for the 3:1 dummy load is shown in Figure 1.

While the primary reason for the 3:1 dummy load is to calibrate SWR meters, it can do more. I use it to check for proper transmitter foldback, for example. If you have an automatic antenna tuner, this dummy load will verify that the tuner can match a 150 Ω load to a 50 Ω load. While some auto tuners state they can match up to a 10:1 SWR, many are rated to work with a 3:1 SWR or less.

This 3:1 dummy load consists of three circuits, 50 Ω and 150 Ω, 100 W, dummy loads and an RF detector to provide a relative voltage indication at the selected dummy load.

A 3:1 load can be a purely resistive load of 16.7 Ω or 150 Ω. Either will result in the desired SWR of 3:1. It was easier for me to build a 150 Ω load than a 16.7 Ω load. All I needed was a resistor that was purely resistive and that could handle 100 W of RF. Caddock manufactures the right part. Their MP9100 is rated at 100 W and is noninductive. Best of all, 50 Ω is a stock value.

I raided the junk box and took out a 7 × 7 × 2 inch aluminum chassis, a 1 mA meter, a huge extruded finned aluminum heat sink and two SO-239 UHF type sockets. This project is not hard to build and can be assembled in about an hour or so. Most of the complexity comes from the mechanical assembly of the load resistors.

The Load Resistors

To achieve the 150 Ω needed for the 3:1 load; three 50 Ω resistors are connected in series (see Figure 2). You could also use the three 50 Ω resistors in parallel to achieve 16.66 Ω. The result will still be a 3:1 SWR. I found it easier to series-connect the three resistors than to try to come up with a low inductance method to connect them in parallel. Since the three resistors will share the 100 W equally, they could have a rating as low as 34 W, however, I found it easier to obtain and use the same 100 W units for each resistor.

The 50 Ω load consists of two 50 Ω resistors in parallel, which results in a resistance of 25 Ω. Then two of these paralleled resistors are connected in series to produce 50 Ω (see Figure 3). The result is a 50 Ω, 200 W load. I rate the 50 Ω load at 100 W with a 200 W rating for 15 seconds.

All I wanted was 150 Ω and 50 Ω loads, however, the concept can easily be extended to other combinations, if desired. By using the same 50 Ω resistor load modules, two can be used to provide a 2:1 SWR at 25 Ω and 100 Ω, or four can make 4:1 loads at 12.5 Ω or 200 Ω.

Keeping Things Cool

The secret to this project is proper heat sinking of the resistors. The resistors come in a TO-247 case that has a single mounting hole. I screwed my large heat sink to the back of the chassis (see my note later about mounting the resistors directly to the heat sink). A big glob of thermal grease was sandwiched between the two to help transfer heat.

All the Caddock resistors are mounted to the chassis with #6-32 hardware. I drilled and tapped the holes for a stainless steel #6-32 screw. The resistors were mounted using thermal grease. The mounting screws were long enough to pull the heat sink tight against the chassis at the load resistor locations. [The mounting screw should be torqued to 8 in-pounds to avoid damaging the ceramic package. — *Ed.*]

The RF detector is built on a multilug soldering strip (see Figure 4). A two pole rotary switch selects the dummy load connected to the RF detector. A panel mounted potentiometer is used to adjust the meter sensitivity. I just set the meter at full scale for 100 W. In that way when I select the 3:1 load, the meter should fall showing me that the transmitter did fold the output power back. The detector circuit is an optional junk box project. Use what you have lying around. I used a 1 kV ceramic disk capacitor I found in my junk box for C1. I suspect the usual 50 V cap won't withstand much RF.

Normally, a small signal diode such as a

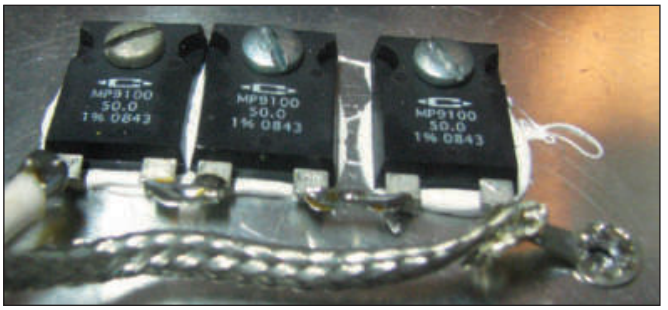


Figure 2 — The three 50 Ω resistors daisy chained in series to make one 150 Ω resistor. Notice how I used the leads of the resistors as the connections, keeping lead length at a minimum.

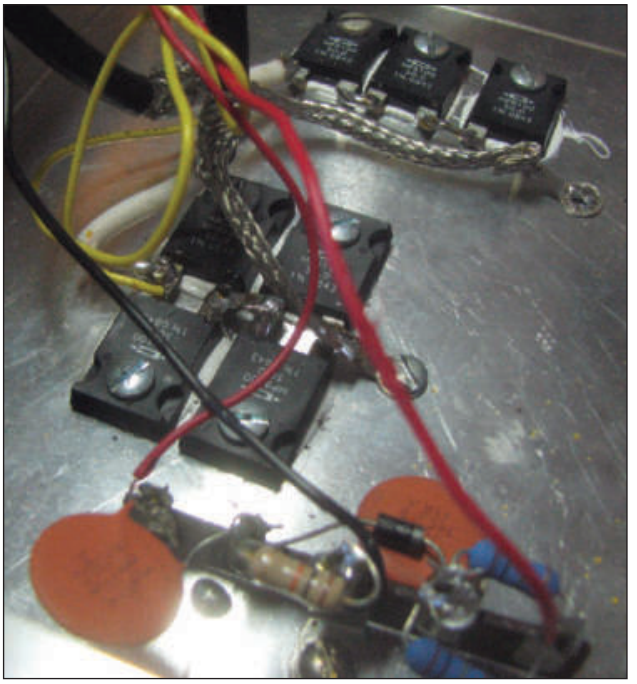


Figure 3 — The four resistors in the center are the 100 W, 50 Ω dummy load while the resistors at the top of the chassis form the 150 Ω, 100 W, 3:1 load.

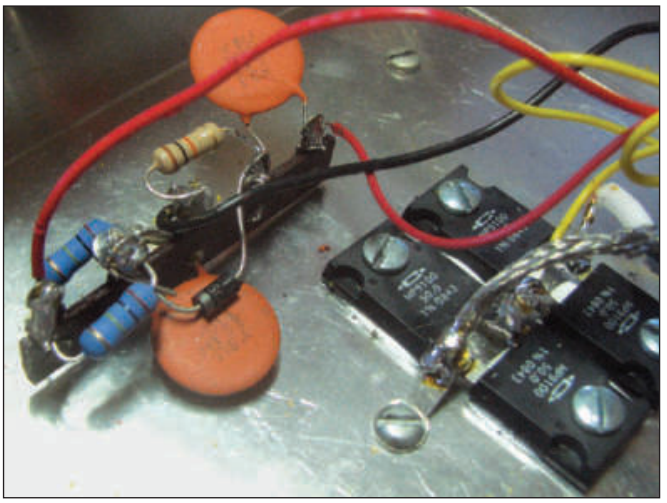


Figure 4 — This is the RF pickup circuit wired onto a solder strip. You can see the two 100 kΩ resistors in parallel to make up the 50 kΩ I required.

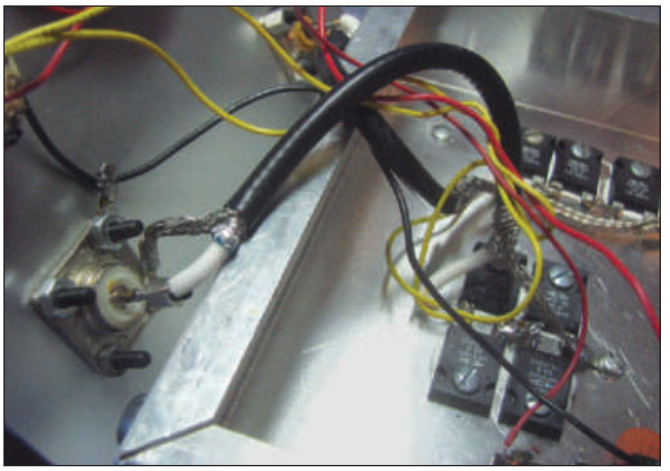


Figure 5 — A short run (less than 6 inches) of RG-58 from one connector to each bank of resistors.

1N60 would be a good choice, but I found a 1N4007 seemed to handle the voltage better. I went through several 1N4002s before I changed to the higher voltage 1N4007. That being said, if you want to use this meter for low power levels, then perhaps the 1N60 might be a better choice.

I couldn't find a rotary switch hearty enough to handle the RF output power of a standard 100 W rig. Instead, I used two SO-239 connectors and I have to switch the coax from one to the other. I guess an outboard RF switch would work equally well if you don't mind running two lines to the meter.

Some Odds and Ends

The hardest part of this project is keeping the resistors cool. Having some second thoughts about the heat sinking method I used, I think I may have to remove the aluminum chassis by cutting the area around the resistors and mounting the resistors directly to the heat sink. At 100 W of RF they get mighty warm. Keep your transmission times short till you get a handle on how well you managed to move the heat from the load resistors to your heat sink. Although not in my design, a small dc powered fan might be a good idea if you plan on running either dummy load at maximum dissipation for extended periods.

The value of R2 was chosen by trial and error. Since my junk box had a 50 kΩ potentiometer, I jiggled the value of R2 to suit the needs of my meter movement and the value of R10. As a matter of fact, R2 consists of two 100 kΩ, ½ W resistors in parallel.

The connections from the RF connectors to the load resistors should be as short and direct as possible to minimize stray capacitance and inductance, which will increase the SWR. Use heavy gauge wire to keep inductance down. I ended up using short runs (less than 6 inches) of RG-58 between the SO-239 connectors and the load resistors (see Figure 5).

There's no need to have the RF detector and the meter, but what fun would that be? If you want to run QRP power levels, then the 0-1 mA meter may be a too much. A 0-50 µV meter would be a better choice. Keep your eye out for surplus tuning meters from FM stereos and defunct CB radios.

So how did it work? Great! I was surprised that the old TEN-TEC Omni C I was working on was spot on the money when the 3 to 1 SWR dummy load was used. I did find that one of my other rigs showed an SWR of 9 to 1 when pumping RF into the 3 to 1 SWR meter. Egads — yet another project!

Photos by the author.

ARRL member Mike Bryce, WB8VGE, has written many *QST* articles and is the author of the ARRL book *Emergency Power for Radio Communications*. You can reach him at 955 Manchester Av SW, N Lawrence, OH 44666 or at **prosolar@sssnet.com**.

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

Feedback

■ The author of "Distracted Driving and Amateur Radio—A Civil (Law) Perspective" [Nov 2012, pp 81-82] has sent us an update regarding his article. The article includes the statement: "In Illinois, an effort by ARRL officials quickly convinced the legislature to adopt a blanket exemption for Amateur Radio from the measures being considered." The final legislation (Public Act 97-828) that was adopted does not appear to contain the blanket exemption for Amateur Radio. The blanket exemption has been amended onto another bill that remains in committee and is unlikely to be passed this session but could be reintroduced next year.

■ In "Boat Anchor Buddy" [Nov 2012, pp 53-56] some builders have experienced excess current and heat in the NE555 timer IC. Lower current operation will be achieved by removing R6 from the + 12 V line and inserting it between pin 3 of U1 and the base of Q4. A revised layout drawing is on the *QST* in Depth website at **www.arrl.org/qst-in-depth**.

■ In "Have Fun Building the Simplest Transmitter" [Nov 2012, pp 46-48] the value of R1 is not shown. The correct value is 100 kΩ, 1 W.

■ In "Life Members Elected" [Dec 2012, p 60] Brad R. Woodward, KG4FUS, was included in the list in error.

■ A number of errors crept into "Cheap and Easy SDR" [Jan 2013, pp 30-35]. Please see the revised schematic and additional part information posted on the *QST* in Depth web page.

■ In "Hands-On Radio" [Jan 2013, pp 63-64] the output connection in Figure 3 (B) should be to the normally open (N.O.) relay contact.

A Remotely Band Switched Tower Shunt Feed for 160 and 80 Meters

If you have a tower, you may have almost all you need for an effective low band antenna.

Steve Lawrence, WB6RSE

Your tower can be made into a vertical antenna. In order to transmit efficiently, it has to be tuned to the desired frequency and excited with RF. I used the remotely switched matching system at the tower base, as shown in Figure 1, to accomplish this. Figure 2 shows the mechanical details of my shunt feed system. Note capacitors C1 and C2. In its simplest form, a gamma rod or wire is offset from a tower leg and attached at a point up the tower that provides the best match when fed at its base through a series capacitor, C1. Changing the distance of the gamma rod from the tower leg, the attach point along the length of the tower and the value of C1, tunes the frequency and match. This is a classic gamma match.

A shunt capacitor, C2, at the junction of C1 and the base of the gamma rod to ground, converts the gamma match into an omega match. The advantage of an omega match is that adjustment of C1 and C2 provide a practical way of tuning without the mechanical complications of changing the upper attach point to the tower or the distance of the gamma rod from the tower leg.

Building the Vertical

I had two requirements for the gamma rod. First, the distance from the tower leg would be 15 inches, roughly the maximum space available. Second, the upper attach point would be at the top of the bottom section of a freestanding crank up tower. Referring again to Figure 2, a 1 ½ × 21 inch piece of 3⁄16 inch flat steel was bent at a right angle at the 3 inch point. Before bending, a ¾ inch hole was drilled in the 3 inch section so the bracket would fit over one of the existing tower-to-base attachment bolts with an additional ¾ inch nut and lock washer. This bracket provides a common ground point at the tower base, a support for the housing containing the variable capacitors and a ceramic standoff at the bottom end of the gamma rod. The end of the bracket is covered with a PVC cap for safety. A piece of PVC pipe was cut to fit underneath one of the enclosure to bracket attachment bolts to provide support.

Another bracket, shown in the upper section of Figure 2, is made from a piece of 30 × 1 ×

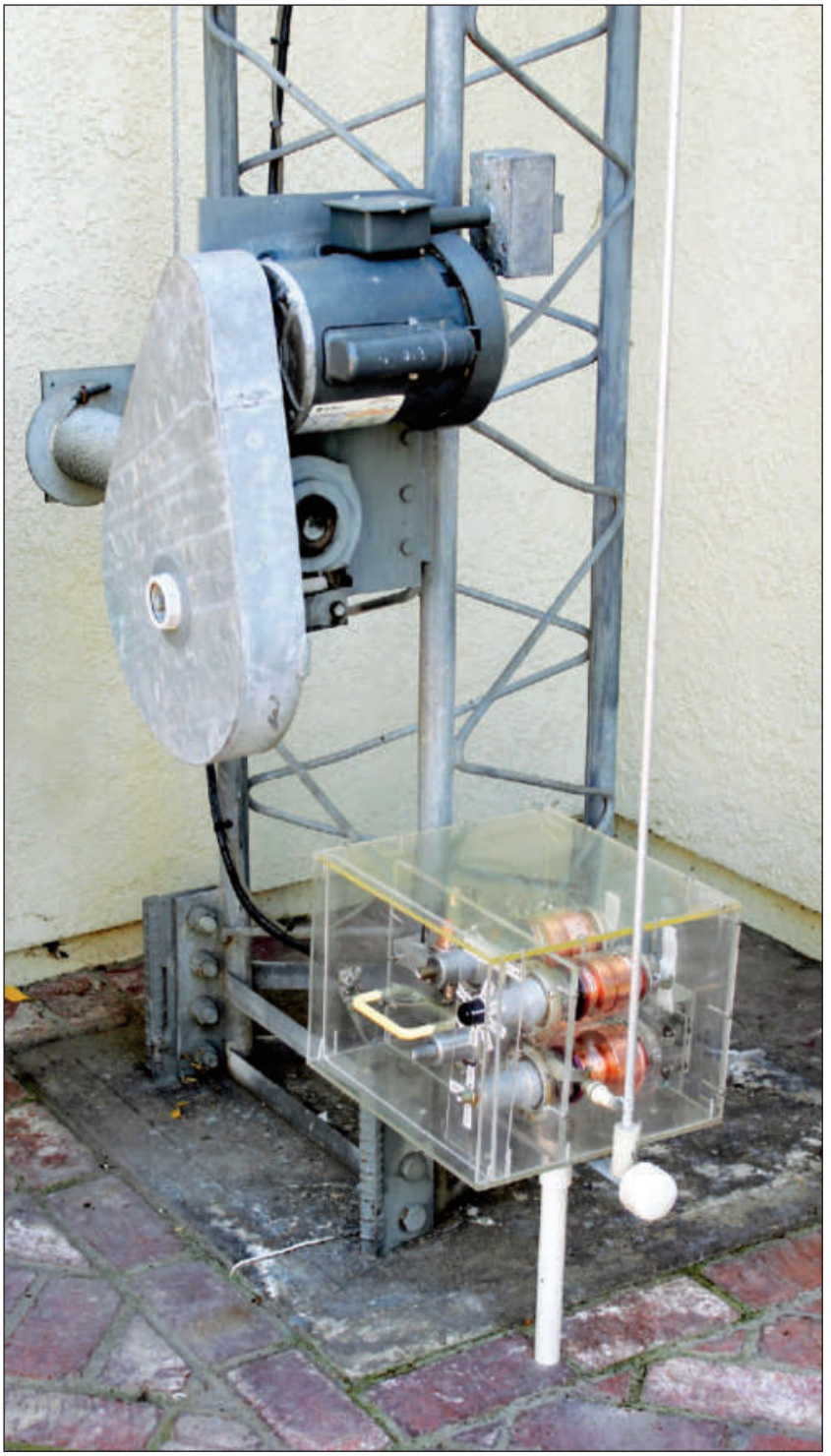


Figure 1 — Remotely switchable shunt feed at tower base.

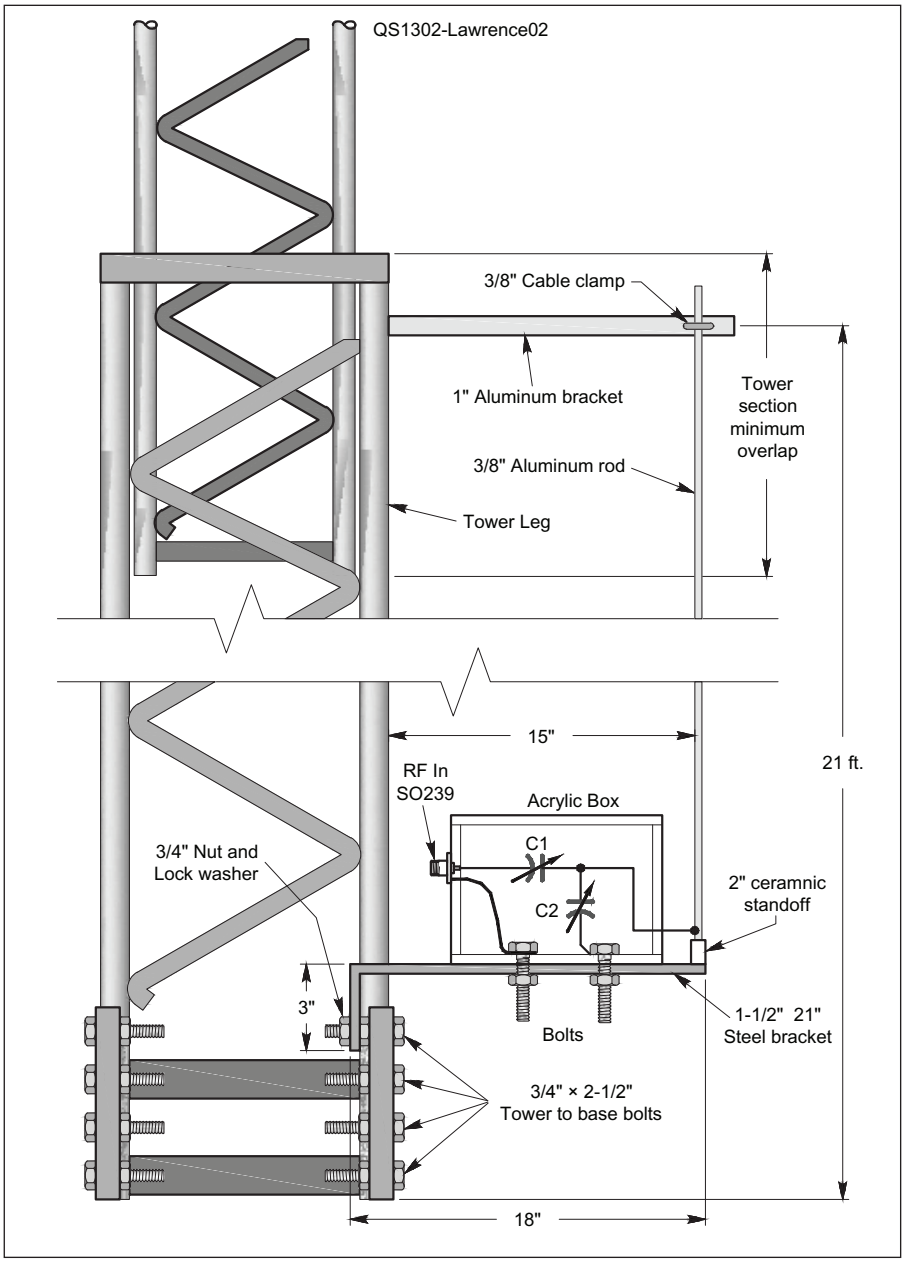


Figure 2 — Mechanical layout.

Figure 3 — Upper bracket and gamma rod.

1/16 inch flat aluminum and bent at a 60° angle to avoid the side of the tower over which the tower pull-up cables run. It's attached to the top of the bottom tower section using two stainless steel hose clamps inserted through slits cut in the aluminum.

Two 3/8 inch solid aluminum rods were each threaded at one end with a 3/8-16 die and joined with a 3/8-16 coupling nut to achieve the required length to reach the top of the tower's bottom section. The upper end of the rod is attached to the bracket with a small stainless steel cable clamp, approximately 21 feet from the ground.

The bottom end of the rod is drilled and tapped to match the screw thread at the top of a 2 inch ceramic standoff mounted on the lower bracket. This solid rod, versus a wire attached higher up the tower, doesn't droop when the tower is retracted. Figure 3 shows the upper bracket.

CAUTION! When climbing a crank up tower to install the top bracket, make sure that the tower sections are blocked or otherwise locked. The bracket must be carefully installed above the point of minimum tower section overlap. These precautions are critical to prevent binding, damage to the tower and serious personal injury!

Capacitor Selection

Initial capacitor values can be determined with an antenna analyzer, some fixed value capacitors and clip leads. Several 20, 50, 100 and 200 pF capacitors in combination should be sufficient to determine what values of variable capacitors you'll ultimately need. You can use air variable capacitors. They require careful adjustment as you can easily overshoot the target frequency and match.

My values for C1/C2 were 75/150 pF for 75 meters, 75/190 pF for 80 meters, and 450/585 pF for 160 meters. (The 80 meter shunt capacitor is paralleled with additional capacitance for 160 meters.) Your exact values are certain to be different. I use vacuum variable capacitors, since they solve two problems.[1] First, they have a built-in vernier adjustment capability that makes precise tuning very smooth and repeatable. Second, high power is required on the low bands from the West Coast if DXing is your primary interest. Available 10 to 20 kV vacuum capacitors handle the very high RF voltages that can develop along the gamma rod at high power where even wide spaced transmitting air variables can break down and arc.

While expensive, vacuum capacitors are definitely worth considering. Air variables

[1]Notes appear on page 36.

capacitors may work well if you're not running legal limit power. Fixed value ceramic button capacitors may also be all that's necessary at your particular installation and power level.

CAUTION! Be careful to keep people and pets away from the base of your tower while operating due to the high RF voltages present during transmit.

Enclosure

The vacuum capacitors are mounted in a homemade box (9½ × 12½ × 12 inches HWD) made of ¼ inch acrylic thermoplastic sheet. The capacitors are installed on a ⅜ inch thick piece of thermoplastic drilled to accommodate the variable capacitor mounting flanges. The scrap bin at a local thermoplastic supply store yielded plenty of material for the box.

The box is not sealed. There are deliberate air gaps and moisture drain holes. Connections are made to the flange side of the capacitors via solder/crimp lugs under the flange mounting screws. The bell end connections are made with flat ground braid and stainless steel hose clamps. The thermoplastic keeps the capacitors clean and protects them from damage. The box has held up very well outdoors for over 10 years.

Band Switching

When the setup was first installed, I'd go outside to the base of the tower to switch bands. Even though this took less than a minute, after a few seasons, it became obvious that remote switching was a necessity. The tower negatively interacts with my receiving flag on 160 meters when its feed point is close to in-plane with the tower.[2]

Figure 4 is the schematic of the remotely switchable omega match, including the dc power supply used to operate the band switching relays. A heavy duty ceramic 4P3T RF switch adds additional capacitance to switch from 75 to 80 meters or to 160 meters.[3] Note the relay contacts that are used to remotely switch between 80 and 160 meters.

Since the thermoplastic housing was already built, I added a small thermoplastic doghouse to hold two Jennings SPST ceramic latching relays.[4] Latching relays are not continuously powered to maintain state. The relays can be seen in Figure 5 along with the band switch. The relays' normally open contacts are wired across the connections on the band switch that add the additional capacitance for 160 meters. The band switch is left set to 80 meters.

The relay coils are pulsed with 26.5 V dc using momentary pushbutton switches that also switch the ac to the power transformer, so a separate power switch is not necessary. The coils are designed for pulsed operation only.

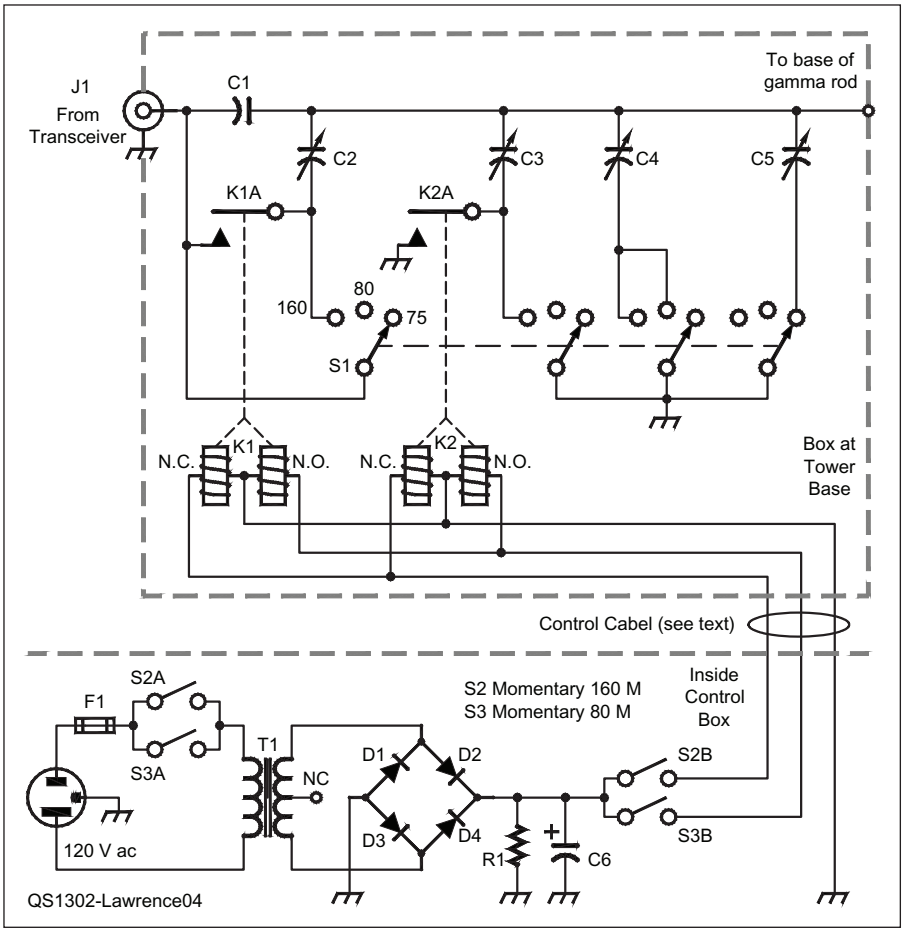


Figure 4 — Remote switchable omega match and power supply.

C1 — 75 pF vacuum capacitor.
C2, C3 — 500 pF vacuum variable capacitor.
C4, C5 — 300 pF vacuum variable capacitor.
C6 — 1000 µF, 50 V electrolytic capacitor.
D1, D2, D3, D4 — Rectifier diode, 100 V. 1 A or greater.
F1 — ½ A fuse.
J1 — SO-239 UHF chassis mount connector.
R1 — 10 kΩ, ½ W resistor.
RY1, RY2 — Jennings RF4B-26N578 latching relays.
S1 — Ceramic RF wafer switch, 4P3T.
S2, S3 — Double pole, normally open, momentary pushbutton switch.
T1 — 120 V to 24 V, 2 A transformer (Thordarson 23V478) or equivalent.

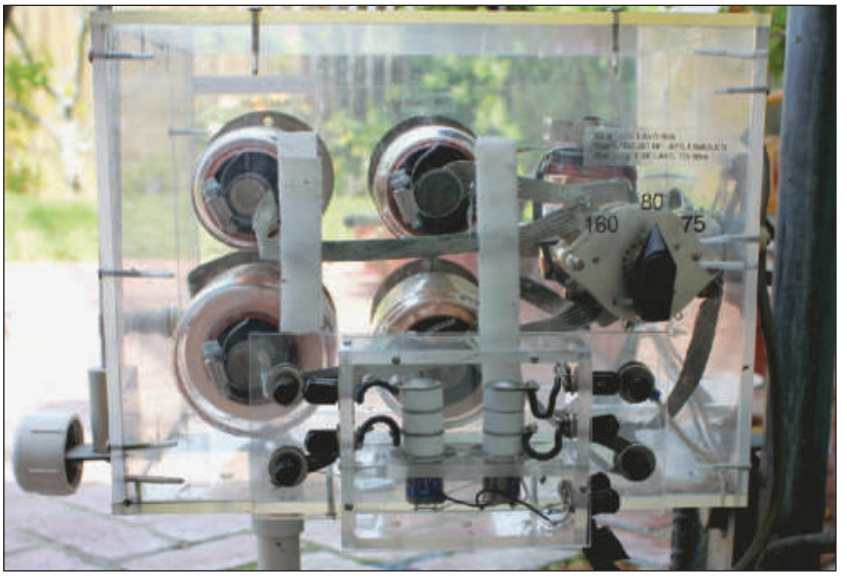


Figure 5 — Latching relays and band switch.

Do not hold down the pushbuttons or the relay coils will burn out. The switch control box is located at the operating position and is connected to the relays with a 50 foot length of eight conductor rotator cable.

Two #18 AWG wires, along with three #22 AWG wires connected in parallel, make up the three conductors required to operate the relays. The dc power supply and relays were bench tested with the full length of control cable to verify that any voltage drop at the relay coils would not affect operation.

The tower is detuned when receiving with the flag antenna on 160 meters, by using the 80 meter pushbutton. When it's time to transmit on 160 meters, the amplifier provides a convenient reminder if the shunt feed hasn't been switched back to 160 meters! On the rare occasions that I operate 75 meters, the relays are set for 80 meters and the band switch outside is set to 75 meters. Even at close proximity to the tower, there is no interaction with the receive flag on 75/80 meters.

Top Loading and Radials

The HF antenna stack stretches along about 12 feet of mast that extends out from the top of the tower with a 30, 17 and 12 meter tribander, a 40 meter rotatable dipole, and a 20, 15 and 10 meter tribander. That's more than sufficient capacitive top loading.

Two 8 foot ground rods were connected to the tower base when the tower was installed. There are no radials though. There's just no place for them on my small city lot. [While ground rods work, there is no question that a more substantial ground system will work better, if room is available, as discussed in a recent *QST* article.[5] — *Ed.*]

Bandwidth

On 160 meters I can easily operate across the bottom 50 kHz at a 2:1 SWR with a single setting of the omega capacitors. On 80 meters, the 2:1 SWR points yield a 25 kHz bandwidth, sufficient for the low end of the band. The 80 meter shunt capacitor can be adjusted in advance for a station expected further up the band. In Figure 6 you can see the scales used to manually adjust the frequency when needed on both 80 and 160 meters.

Enhancements, Experiments and Notes

Many vacuum variables come mounted on assemblies with integrated motor drives. Design a remote control tuning circuit for wide range frequency adjustment from your operating position.

Model the shunt feed to optimize your initial build. Modeling and analysis references are available on the ARRL website. Search the Top Band Reflector and the Internet for additional information on shunt feeds and antenna modeling.[6]

Use an alternate attachment point for the gamma wire that is higher along the tower if the droop of the wire when the tower is retracted is not an issue or if your tower is a fixed height. You can tune the feed by sloping the gamma wire away from the tower. It doesn't necessarily have to be vertical. Changing these parameters will affect your match and bandwidth.

Use high-speed vacuum relays, when the shunt feed must be detuned during receive, to facilitate full break-in (QSK) CW operation.

Add additional relays and switching to remotely select 160, 80 or 75 meters and eliminate the manual band switch entirely.

Adjust the omega match for 60 meters to get on our newest amateur band.

The fifth edition of *ON4UN's Low-Band DXing: Antennas, Equipment and Techniques for DXcitement on 160, 80 and 40 Meters* by John Devoldere, ON4UN, features new and updated material. It's a wealth of information and deserves careful study if you plan any serious operation on the low bands.[7]

Does it work?

I decided to build the shunt feed with a few construction constraints and see how it performed. Even without radials at the tower base, I managed to work DXCC on 160 meters from a small city lot on the US West Coast and I'm well on my way to 200 countries worked on Top Band. Shunt feeding your tower may just be your window into the excitement available on the "low bands."

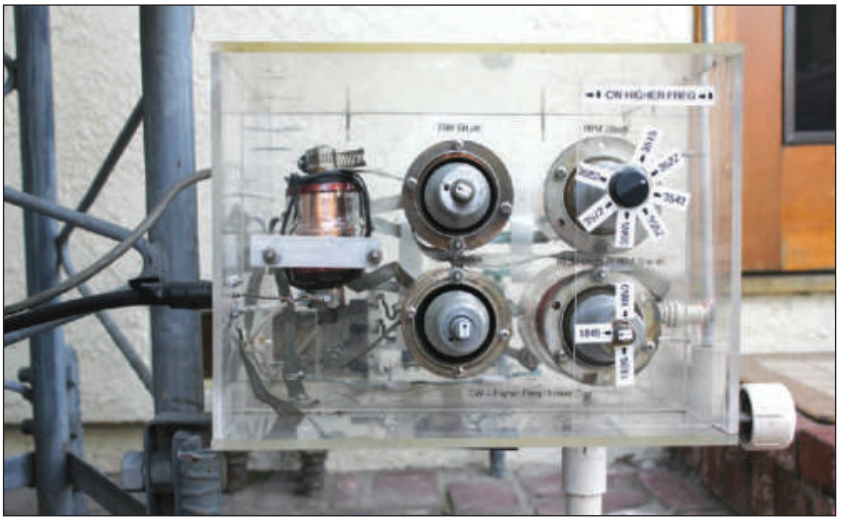


Figure 6 — 80 and 160 meter shunt capacitor adjustment calibration scales. C1, a 75 pF vacuum capacitor, is mounted vertically on the left.

Notes

[1]Vacuum capacitor, latching relay and RF switch are available from Max-Gain Systems at **www.mgs4u.com**, Surplus Sales of Nebraska at **www.surplussales.com** or Fair Radio Sales at **www.fairradio.com**.

[2]S. Lawrence, WB6RSE, "A Roof Mount for a Rotatable 160 Meter Receiving Loop," *QST*, Mar 2011, pp 40-42.

[3]**www.arrl.org/antenna-modeling**

[4]See Note 1.

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

[6]**lists.contesting.com/archives//html/topband**

[7]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

Photos by the author.

Steve Lawrence, WB6RSE, is an ARRL Life Member and was first licensed in 1959 as a novice with the call sign WV2GWG. He holds an Amateur Extra class license and received his current call in 1965 after moving to the West Coast. He holds a BS in Physics from UCLA and an MSEE from USC. He retired from Hughes Electronics/Boeing Satellite Systems as an engineering manager in 2002. He coordinates the annual Top Band Dinner at the International DX Convention each April in Visalia, California. He's at the top of the mixed and phone DXCC Honor Rolls and needs only P5 to have worked them all on CW. He often refers to 160 meters as "the cruel band." You can contact him at 3642 Coolidge Av, Los Angeles, CA, 90066-3310 or at **wb6rse1@mac.com**.

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

Q and the Energy Stored Around Antennas

How to find the Q of a golf ball or planet Earth — or even the surprisingly huge stored energy surrounding some transmitting antennas.

Kazimierz "Kai" Siwiak, KE4PT

A simple measurement of antenna bandwidth, along with an appreciation of the concept of Q (reactive quality factor), gives us all we need to estimate the stored energy surrounding our transmitting antennas. In some cases the results can be impressive. The concept of Q originated in 1914 (then dubbed *K*) and first appeared in print in 1923 as Kenneth S. Johnson used it to represent the ratio of reactance to resistance as a "figure of merit" for inductors.[1]

We will use an exactly equivalent, but much more general definition of Q, stated as the ratio between 2π times the stored energy, and the energy dissipated in one alternating current cycle. Since Johnson's first use in electrical networks, this ubiquitous factor has been applied to the realm of mechanical devices, golf balls, sharpness of resonance in electrical networks, atomic clocks and somewhat whimsically to the planet Earth (see the sidebar, "The Q of Everything"). We will use the concept of Q to find the amount and distribution of stored energy around a transmitting antenna.

Measuring Q of Antennas

To find the stored energy we first need to know the antenna *Q*. The Qs of our ham antennas can range from about 7 for a fat dipole to 20 for a thin wire dipole and to over 1000 for small HF loops. Q can be easily measured, or calculated, in several equivalent ways. If you have an antenna analyzer that can display the antenna impedance $Z = R + jX$, find the lower bandwidth frequency F_L and the upper bandwidth frequency F_U for which R equals the magnitude of X. This can also be approximated as the frequencies at which return loss is 7 dB or the SWR is 2.62. The measured Q is the geometrical center frequency F_M, square root of $[F_U \times F_L]$, divided by the bandwidth $[F_U - F_L]$ as shown in Figure 1.

Where Your Antenna Stores Energy

The stored or reactive energy resides in the near fields and the resonating structures of antennas. If we were to enclose the antenna inside a sphere (see Figure 2), the radiated

[1]K. Johnson, "Electrical Network," US Patent 1,628,983, Filed July 9, 1923, issued May 17, 1927.

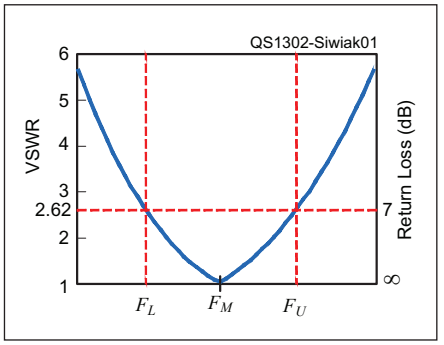


Figure 1 — An antenna analyzer or SWR meter can be used to determine antenna system Q.

The Q of Everything

Q has about as many different uses as there are different, but exactly equivalent, ways of expressing its value. As a damping factor in oscillating circuits, Q emerges as π divided by the logarithmic decrement of the current or voltage waveform.[A] Q can also be expressed as the ratio of the geometrical mean frequency to the 3 dB bandwidth of a resonant circuit.

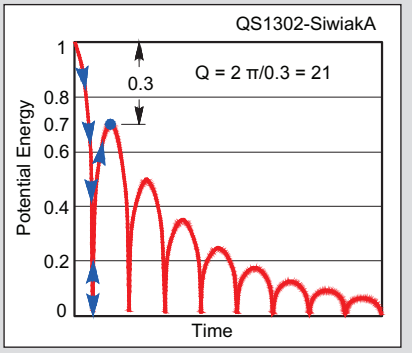


Figure A — Follow the bouncing golf ball.

Let's put our definitions to work and estimate the Q of some systems. Drop a golf ball from some height onto a rigid surface and measure the fraction of height lost after the first bounce. The height of the golf ball is proportional to the stored potential energy (this is a clue as to which formula we use for Q). The energy lost is proportional to the lost height. So, the Q = 2π/(*Fraction of Height Lost*). My golf ball bounced to a height that was 30% lower than the original height, so the Q is about 21 (see Figure A). More Qs are shown in Table 1.

What about planet Earth? No, we don't have to bounce the Earth. The Earth's rotational rate has decreased about a millisecond in the last 60 years. As a matter of academic interest, we can compute the rotational energy as well as the change in rotational energy to get a Q of 6×10^{12}. The rotational decrease is, of course, neither monotonic nor constant, but the exercise points out that over the long term, the Earth is a high Q system, and hence a good timekeeper.

Today's industrial and commercial time standards based on atomic transitions are achieving Qs of between 10^{12} and 10^{13}, while the best primary standards have exceeded a Q of 10^{16}. We look at all these and many more mechanical and atomic examples to get an appreciation of the concept of Q (see **www.arrl.org/qst-in-depth**). It's all about how energy is *stored* and *dissipated*.

[A]K. Siwiak and Y. Bahreini, *Radiowave Propagation and Antennas for Personal Communications, 3rd Edition*, Norwood, MA, Artech House, 2007, Chapter 11.

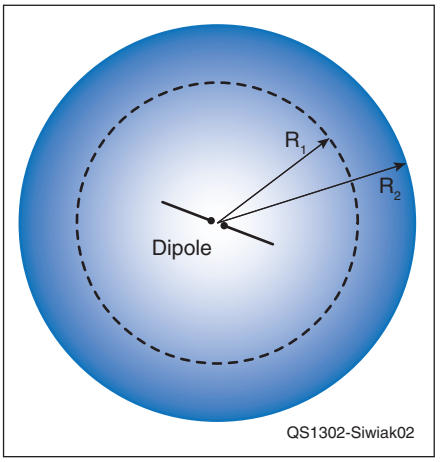


Figure 2 — If we were to enclose an antenna inside a sphere, the radiated energy remains constant and equal to the transmitter energy, but the reactive energy decreases with radius as shown in Figure 3.

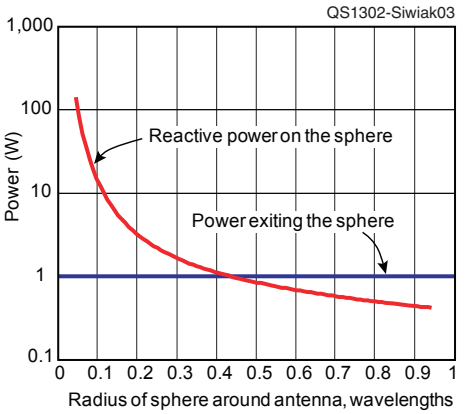


Figure 3 — The reactive power as a function of distance from the sphere surrounding the antenna.

Table 1
Qs Encountered In Nature

System	Range of Q
Water (at resonance)	0.8
Golf ball	21
Antennas	7 – 1000
Piano strings	1200
Quartz resonator	$10^5 – 3 \times 10^6$
Planet Earth	6×10^{12}
Spectral lines	$10^{12} – 10^{18}$

energy remains constant and equal to the transmitter energy no matter how big we make the sphere. The stored reactive energy on the other hand decreases inversely with the radius of the sphere, so the stored energy is disproportionately greater close to the antenna. That energy continuously swaps between the near electric and near magnetic fields while a fraction, which is replenished by the transmitter, leaks out as radiation.

The energy lost per cycle in an antenna includes dissipative losses plus the energy emitted as radiation. It is easier and more intuitive to relate to power, which is frequency times energy in a cycle. The power lost is of course replenished by the transmitter. Inverting the energy formula for Q and using power quantities, the *stored power* (volt-amperes or VA reactive) is Q times the power lost divided by 2π.

An HF dipole with a Q of 20, radiating 1000 W has $(1000 \times 20)/2\pi$ or about 3200 VA reactive power in the stored fields surrounding the antenna. The stored reactive power contained in the sphere exceeds the radiated power out to a distance of 0.45 wavelengths from the dipole (see Figure 3). A small HF loop with a Q of 800 that radiates 100 W has nearly 13,000 VA of stored reactive power surrounding the loop. The stored energy exceeds radiated energy out to a half wavelength from the loop. No wonder the small loop has a reputation for coupling to everything in sight that isn't nailed down!

In Summary

The concept of Q has many uses such as, here, showing us the way to estimate the huge reactive fields surrounding our antennas. You can shrink the antenna as much as you want, but nature still demands her full space for the stored energy.

Amateur Extra class licensee Kai Siwiak, KE4PT, is an avid DXer and member of the South Florida DX Association. He operates a 100 W station with an indoor antenna. He is an ARRL member, Technical Advisor, RF Safety Committee member, and a member of QRP-ARCI and ARES/RACES.

You can reach Kai at 10988 NW 14th St, Coral Springs, FL, 33071-8222 or at **k.siwiak@ieee.org**.

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

New Products

RF and Microwave Components from Bracke Manufacturing

Bracke Manufacturing offers more than 9000 off-the-shelf RF and microwave components such as connectors, adapters, cable assemblies, waveguide, attenuators, tools and many other products. Product specifications and other application information are available. For more information, visit **www.brackemfg.com**.

National Radio Club AM Radio Log

The 33rd edition of the NRC's *AM Radio Log* is a comprehensive source of information about AM radio stations in the US and Canada. This new edition contains 274 pages of data and cross references and 18 pages of instructions. The book is published in 8 ½ × 11 inch, three hole punched, loose leaf format — you provide a three ring binder. The new edition is said to contain more than 6000 updates from the previous version. Also included are call letters of FM simulcasts, listings of regional radio station groups and stations licensed for IBOC digital audio, and listings of FM translators that are now simulcasting with AM broadcasters. Price (postpaid): USA NRC members, $22.95; USA nonmembers, $28.95; Canada, $32; International orders, $36. USA add $3.50 for Priority Mail. For more information, or to order, visit **www.nrcdxas.org**.

Kurt N. Sterba Antenna Book from Palomar Engineers

Kurt Speaks Out from Palomar Engineers contains 50 of Kurt N. Sterba's Aerials columns published in *Worldradio* from 1990 to 2006. These columns cover antennas, grounds and feed lines and provide non-mathematical, practical explanations. Price: $15.95. For more information, or to order, visit **www.palomar-engineers.com**.

The Penticton Solar Flux Receiver

Here's where we get the solar flux data for predicting HF propagation.

John White, VA7JW, and Ken Tapping

The attraction and challenge of HF communications, especially DX operations, comes from the need to deal with the vagaries of the ionosphere. Although much of the underlying physics is understood, there are complexities in ionospheric behavior that make the ionosphere's most effective use a combination of science and art based upon extensive experience.

Two of the factors contributing to this complexity are the total amount of ionization and how that ionization is distributed with height. Generally the higher the degree of ionization, the higher the maximum usable frequency (MUF), which is of critical importance as it opens up the higher frequency bands (20 through 6 meters) and greatly enables amateurs to work worldwide paths.

HF Propagation and the Sun

The upper atmosphere, in the region of 50 to 400 km above the Earth, is primarily ionized by the ultraviolet (UV) radiation produced by the Sun. For two reasons it is our very good fortune that the upper atmosphere absorbs this solar UV. First, if this radiation were to arrive at the Earth's surface unattenuated, life on Earth would be untenable. Second, the absorption of the UV in the upper atmosphere leads to ionization and the production of free electrons. This complex layer of ionization is known as the ionosphere.

Ionospheric Refraction

The electrons in the ionosphere move with the electric fields in the radio waves, extracting energy from them, and then as they move, they re-radiate the signals. Gradients in electron concentration with altitude, and the effect of a negative index of refraction, have the ability to refract radio waves, thus bending upward propagating electromagnetic radiation back down to the Earth's surface.

On the other hand, too much ionization will result in ionospheric absorption which can render the communications path useless. X-rays will enhance the level of ionization throughout the ionosphere, however, they are more penetrating than the UV. The X-rays get down to *D region* heights boosting the electron density in the lower ionosphere. This is bad, because the actual percentage of ionization compared with the particle density is relatively low, and the electrons that extract energy from the radio waves collide with the neutrals. This renders the motions of the electrons incoherent so that when they re-radiate the radio emission, the contributions are randomly phased and cancel out.

We call this *collisional absorption*. It's not a critical frequency issue; it is a dissipation issue. Amateurs operating HF will recognize this phenomenon as a blackout, which is well correlated to solar X-ray flares and results in the sudden loss of signals on the band.[1] Since the Sun is the engine driving the ionosphere, understanding the ionosphere and attempting to predict its behavior starts with keeping a stethoscope on the Sun.

Not a New Idea

Back in the 17th Century, Galileo Galilei, Christoph Scheiner and others noticed spots on the Sun. Over most of the time since then, people have counted them. One thing that

[1]Notes appear on page 45.

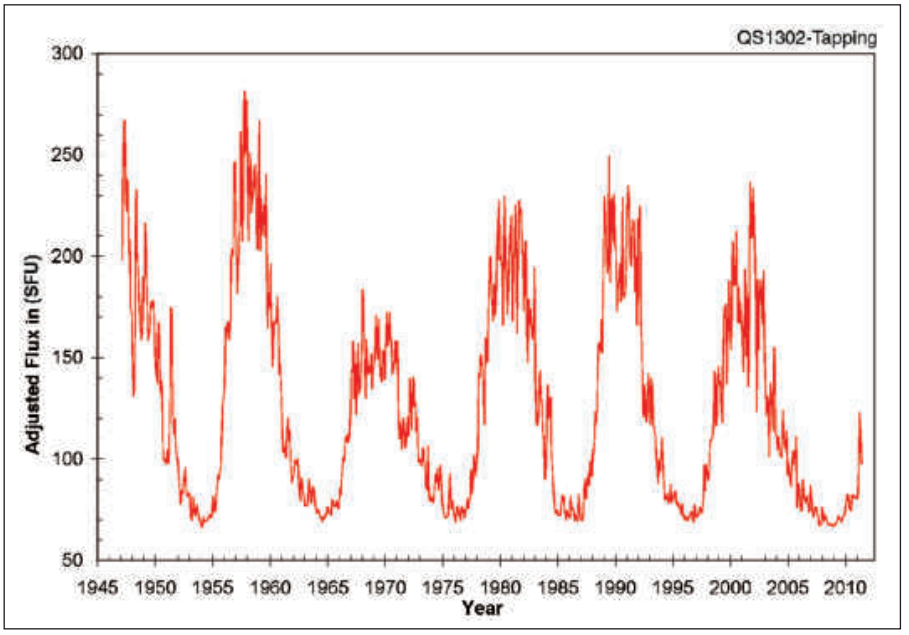


Figure 1 — Historical solar flux data.

appeared very soon is that the counts of sunspots visible on the Sun rise and fall over a 10 to 13 year cycle. We now know that the rise and fall of the sunspot number is just one manifestation of what is now known as solar activity. This rhythm of solar activity, together with intervals of high-amplitude short-term activity, affects radio communication. This is because the changes in activity level produce changes in the flux of ionizing radiation sustaining the ionosphere. This cyclic activity is important because the peak of solar activity is when the ionosphere is most highly ionized, and HF propagation opens up worldwide possibilities. At the solar minimum, things get pretty quiet on HF, as we have lately experienced.

Taking the Ionospheric Pulse

It would be a great advantage if we could directly measure the UV flux as it varies during the solar activity cycle, because this would be a direct indicator of what is driving the ionization. Such measurements, however, have to be made in space — consistently and accurately over decades. It is very difficult to do this. Therefore we fall back on proxies — ground-based measurements that can be used as indicators of the UV flux.

We use these proxies to predict when, and at what frequencies, HF path openings are likely to occur. Fortunately there are a number of such predictive tools available to amateurs just for this purpose.[2] These predictions are based upon solar activity information that is consistently available, and of consistent quality. This in essence means measurable from the ground.

The Solar Flux Index — What is it?

The *Solar Flux Index* (SFI) is known more widely as the 10.7 centimeter solar radio flux, or *F10.7*. It is a measurement of the total amount of solar radio emission in a 100 MHz wide band, centered on a frequency of 2800 MHz (a wavelength of 10.7 centimeters). This is just a sampling of the strength of solar electromagnetic emission at one part of the spectrum.

The UV emissions do not reach the ground, but there are other emissions that do, such as the solar radio emissions in the centimeter wavelength range. Fortunately these emissions are unaffected by the ionosphere and penetrate down to the ground level. Radio signals with wavelengths in the range of 6 to 12 centimeters respond most strongly to changes in the level of solar activity.

The program of monitoring the solar radio flux at 10.7 centimeter wavelength arose quite serendipitously. In 1946, Arthur Covington made Canada's first radio telescope out of bits of old radar equipment, which happened to operate at a frequency of 2800 MHz — a wavelength of 10.7 centimeters.

The only cosmic radio emission that this crude (by modern standards) and relatively insensitive radio telescope could detect were the emissions given off by the Sun. So Covington and his colleagues concentrated on those, and discovered the emissions varied with the level of solar activity. These measurements, which have now been made for more than 60 years, are an effective index of the general level of solar magnetic activity. Since that time, records of solar flux have been kept as shown in Figure 1.

Solar UV flux measurements suffer from two problems. First they have to be made above the atmosphere from spacecraft. This leads to the second problem: a long time-series of absolute measurements is very hard to make from satellite platforms. An unexpected failure or a launch delay with the next satellite is enough to render the data much less useful. If we plot the available UV flux measurements against F10.7, however, we see the two quantities are highly correlated.

This does not mean they are necessarily physically connected, just that they are both similarly affected by the rise and fall of solar activity. We can fit some easily used equation to the plot. Then by putting the current value of F10.7 into that equation we can get an estimate for the UV flux we would observe at that time. This in turn can be used to calculate the rate of ionization in the ionosphere

Flux Monitor System Requirements

The need to provide accurate and consistent measurements of the solar radio flux and CR data with the minimum of human intervention imposes severe requirements on the system. The detailed requirements are listed below.

- *Antenna Tracking Accuracy*. The antennas have beam widths of about 4°, in order to "see" the solar disc with uniform sensitivity. The antenna bore sight has to remain within 0.05° of the solar disc center from sunrise to sunset.
- *Linearity and Dynamic Range*. To measure solar flux with high accuracy and to record strong solar bursts imposes significant restrictions on the receiver design including 40 to 50 dB of dynamic range without automatic gain control (AGC). The problem with AGC is the exact nature of the gain compression is not known well enough to get back to the original signal value with sufficient accuracy for the flux determination.
- *Stability*. Each flux determination takes an hour, and the gain of the system must remain essentially constant during that time. Over a day the situation is a little less stringent, but not much.
- *Calibration*. The system needs to be calibrated sufficiently often to monitor any system performance changes, and needs an external standard.
- *Availability*. The requirement is that the system be available 24/7/365. Availability is increased by duplication. There are two receivers on each flux monitor. There are two independent flux monitors and two duplicate data distribution systems. Each flux monitor has its own uninterruptible power supply that can keep the instruments running for 15 to 20 minutes, which is far more than is needed for the observatory's backup generator to automatically start up.

Figure 2 — The solar radio flux monitors at Dominion Radio Astrophysical Observatory near Penticton. Flux monitor 1 is on the left; flux monitor 2 is on the right.

and thence the degree of ionization (electron density).

The other highly used index of solar activity is the *sunspot number* (SSN, also known as *Z* and *R*). These are counts of sunspots made using appropriately equipped optical telescopes. Sunspots were probably first observed by the Chinese more than 2000 years ago but it was Galileo who started observing the Sun with his invention of the telescope, from about 1610 onward. These data have been collected over more than 300 years. Using some partially empirical procedures to deal with sunspot groups and the inevitable differences between observers and observatories, the result has been a remarkably consistent and durable index of solar activity.

Sunspot number and F10.7 are highly correlated with one another, so one can be a proxy for the other. For example, F10.7 can be estimated from sunspot number using the relationship F10.7 = 73.4 + 0.62 N. This produces poor values at low levels of solar activity, however, such as those we experienced during the last solar minimum. This article focuses on the 10.7 centimeter solar radio flux and how it is measured.

Measuring the SFI, or F10.7

The 10.7 centimeter solar radio flux was originally measured in the Ottawa area, first at sites south of the city. This is how it got the name *Ottawa Flux*. Later measurements were made at the Algonquin Radio Observatory in the province of Ontario in Canada. The closure of the Algonquin Radio Observatory and the transfer of the Herzberg Institute of Astrophysics (the organization responsible for the solar flux measurements) to British Columbia led, in 1990, to the Solar Radio Monitoring Program at the Dominion Radio Astrophysical Observatory (DRAO). DRAO is located near Penticton, in the southern interior of British Columbia. The site is exceptionally radio quiet. The two solar radio telescopes called *flux monitors* are shown in Figure 2.

The Penticton Hardware Suite

The measurements are made using these two small radio telescopes. Both flux monitors operate simultaneously, with one acting as a hot backup for the other. The primary instrument, designated flux monitor (FM) 2, is located on the tower on the right. FM1, on the left, is operated as backup. Each instrument is autonomous. Each flux monitor has additional redundancy by being fitted with two independent systems. The receivers, backends and control arrangements are in the hut between the antennas.

Each day, as soon as the Sun is high enough above the horizon, the two flux monitors acquire it and track it, recording the total strength of the solar radio emissions. In addition, three times each day (noon –3 hours, noon, and noon +3 hours in summer, and noon –2 hours, noon, and noon +2 hours in the winter), precision measurements of the solar flux are made. These measurements are the distributed values of the SFI, or F10.7. The recordings of the solar emission from sunrise to sunset are stored as *continuous record* (CR) files, and are used for the detection of radio bursts (such as those from flares). On average, the errors in the flux determinations are 1% or one solar flux unit, whichever is the biggest.

The need to provide accurate and consistent measurements of the solar radio flux and

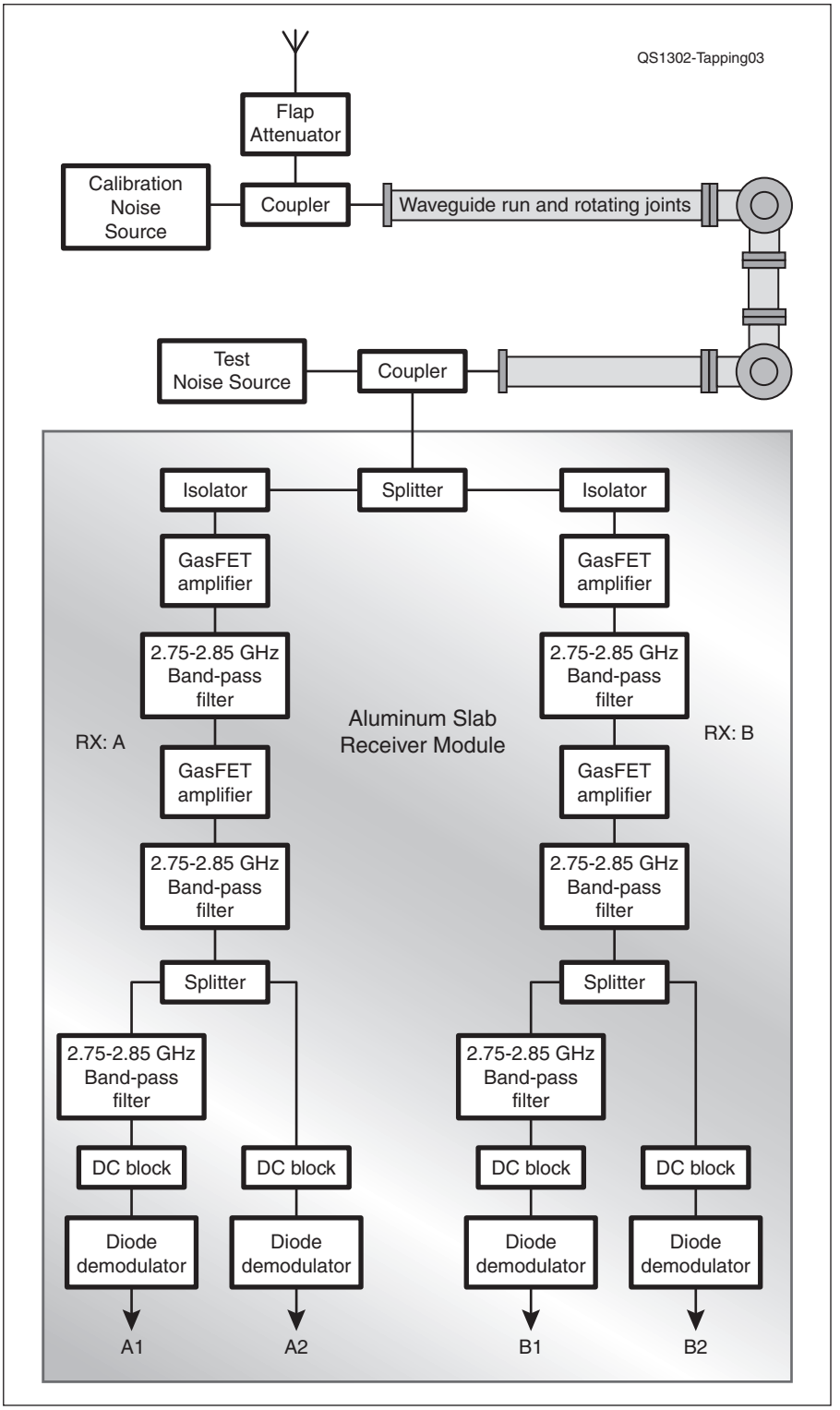


Figure 3 — Block Diagram of RF components.

CR data with the minimum of human intervention imposes severe requirements on the system. The detailed requirements are listed in the sidebar, "Flux Monitor System Requirements."

Antenna System

There are two parabolic dish antennas each 1.8 meters in diameter, pointing and tracking the center of the solar disc to better than 2 arc-minutes. The antennas are on polar (also known as *equatorial*) mounts, commonly used in astronomy. Imagine an az-el (azimuth-elevation) mount tilted back so that the azimuth axis points at the Pole Star, that is, it is parallel to the Earth's axis of rotation. This offers two huge benefits. First, tracking an astronomical object across the sky requires only driving the antenna in one plane (using just one motor), and second, it only needs to be done at a constant rate. The antennas are driven by stepping motors with drive belts that are meant to sacrifice themselves if anything jams. The antenna positions are monitored using 14-bit absolute position encoders.

The dishes each have gain of about 30 dB and a corresponding beam width of about 4°. Since the Sun has an apparent angle of about 0.5°, the antenna sees the complete solar disc with almost equal gain. It also sees the dark cold sky surrounding the solar disc.

The feed is a simple pyramidal horn. There is no preamplifier at the antenna. A run of WR284 waveguide with two rotating joints provides reasonably low loss transmission from the antenna to the receivers in the shack, about 10 meters away.

The biggest problem is snow on the antennas, which reduces their gain and makes garbage of the flux measurements. During the working week it is no problem to ensure that snow is promptly removed. In the winter, when the site might be unattended or only used by research astronomers (who are not qualified to climb on antennas), we use a webcam that can be accessed from home. This is essential, because the weather in the Okanagan Valley maybe very different from that in the White Lake Basin, which is where DRAO is located.

Receiver

The receiver is known as a *TRF*, that employs tuned radio frequency stages that simply amplify signals within a defined passband of 2.75 to 2.85 GHz, as can be seen in Figure 3. It is not a superheterodyne as might be expected, as the problems with local oscillators, mixers and down conversion complexities outweigh any advantages for this application.

The RF section of the radio employs three stages of amplification at 2800 MHz with 100 MHz band-pass filters at each stage. The amplifiers are microwave devices available from Miteq. Each one has about 35 dB of gain for an overall RF gain of about 105 dB. The noise figure of these individual amplifiers is about 1.8 dB and the point at which linearity begins to degrade, that is, 1 dB of compression, is about +10 dBm.

Each flux monitor has two receivers, designated A and B. The signal from the antenna is split between them. There are two outputs,

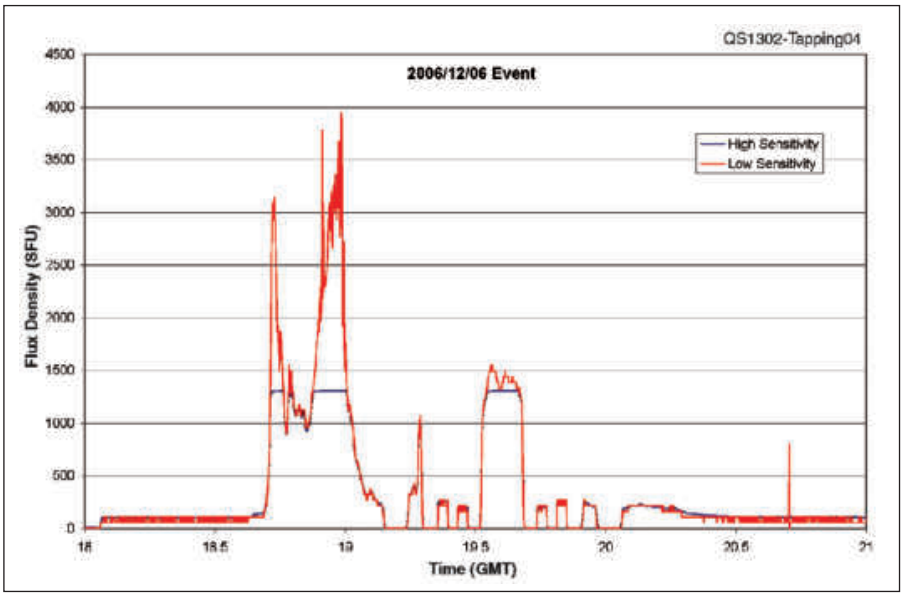


Figure 4 — Dual channel requirement for large solar flare bursts.

Figure 5 — The aluminum boxes contain the RF components for the A and B receivers.

Figure 6 — A view in through the door of the solar hut. The FM1 rack is on the left, and the FM2 rack is on the right.

one taken before the last amplifier stage and the other after. This provides a high sensitivity output and a low sensitivity output that is about 20 dB less sensitive than the other. The low sensitivity output provides a means to accommodate large bursts without overloading. Figure 4 illustrates this requirement.

The Figure 4 recording shows the radio emission from a large solar burst that occurred on December 6, 2006. This measurement involves moving the antenna on and off source and firing calibration devices. The measurement was rather messed up by a large solar flare, which started around 1840 GMT. The high sensitivity channel (dark line) overloaded, whereas the low sensitivity channel did not. The two records correspond extremely well up to the overload point.

Large dynamic range can be obtained using logarithmic detectors. The outputs would have to be delogged before processing, however. Errors in the log law could create bigger calibration issues than using a conventional diode as an approximation to square law detection, so conventional diodes are used. HP microwave detectors were chosen, and have now worked without any problems at all for more than 25 years. The dc output is filtered with a circuit having a 2 second time constant so that the random noise fluctuations are attenuated to a level suitable for processing.

Stability is obtained by embedding the components for both receivers in a 60 × 60 × 8 cm aluminum slab. Holes and slots are machined for the receiver components and cables. This puts the receivers within a waveguide way below cutoff, which reduces feedback. The large thermal mass cannot vary in temperature very quickly. To further reduce temperature variations, the slab is in an enclosure to minimize drafts and in a temperature regulated building. The components run on isolated grounds.

There are great advantages in keeping the receivers in one unit. Figure 5 shows the aluminum slab containing the RF and demodulation components for FM2. The gray box above it contains its power supplies. Note the plastic sheet so that there is no electrical contact between the power supply box and the receiver slab. The wooden box with Perspex® (Plexiglas®) windows is for suppressing drafts resulting in a very large thermal time constant.

A directional coupler and noise source provide a test signal for testing for degradation of the waveguide run and the rotating joints. The receiver output for this noise source is compared with the receiver output produced by the primary calibration noise source, which is close to the antenna feed.

Figure 6 shows the view looking directly in through the door of the solar hut. The rack for FM1 is on the left and the rack for FM2 is on the right. Directly in front, on the floor are two computers, both in aluminum cases to stop them radiating RF and causing interference. FM1, visible in Figure 7 is the original rack, dating back to chart recorders and vacuum tubes. The rack contains power supplies, antenna control equipment and post demodulation signal processing equipment. The chart recorders are not used any more, but removing them would leave unsightly holes in the rack. The FM2 rack is similarly equipped.

Demodulation

At the time these receivers were built (1980s), digital demodulation for such a high frequency was not an option, and down conversion would complicate the design and invoke more subtle linearity and dynamic range issues.

Calibration

The amount of power appearing at the input to the receiver is easily calibrated using a solid state noise source. Because the solar emission is broad band noise that is filtered by the passband of the RF section of the receiver, and the calibration noise is similarly

Figure 7 — The original rack, dating back to chart recorders and vacuum tubes.

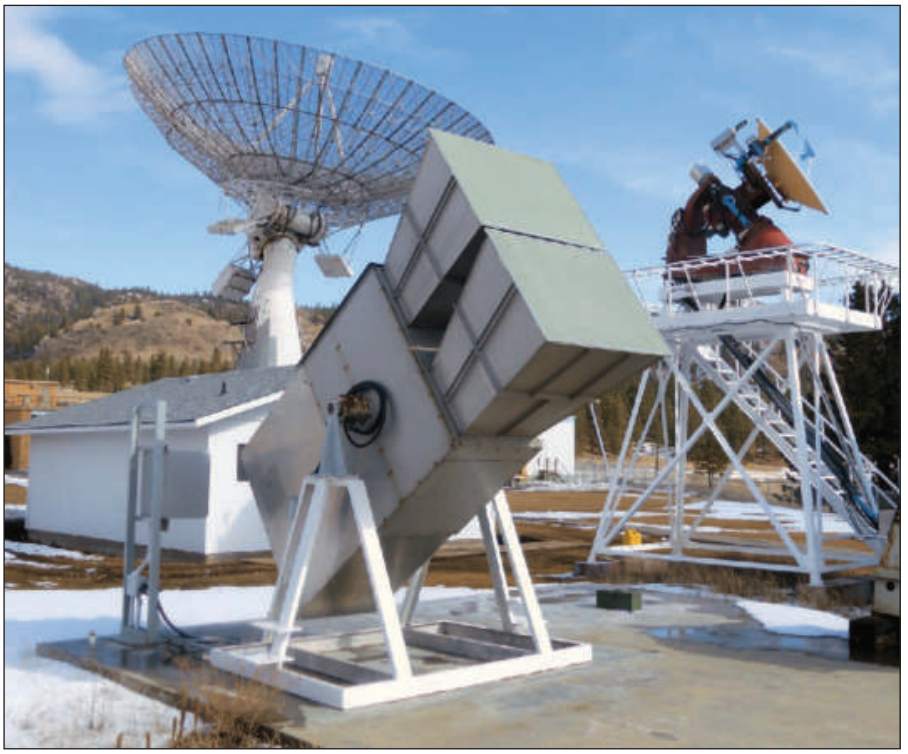


Figure 8 — The dual horn calibration antenna in the foreground.

filtered, we know that the calibration signal has the same character as the received signal. This would not be the case if we were to use a signal generator producing CW, or a narrowband modulated signal.

The difficulty is relating the signal strength collected by the antenna to what is measured at the receiver output. This requires that we know the precise gain of the antenna, or, as expressed in radio astronomy, the effective collecting area of the antenna in square meters. The relationship between effective collecting area and gain (expressed as a pure ratio — not in dB), is $A_{EFF} = (\lambda^2/4\pi) \times G$, where G is the gain of the antenna.

The gain of a parabolic dish is dependent on several factors making the absolute gain difficult to determine. These factors include the beam width of the feed, the quality of the dish surface and whether the phase center of the feed is precisely at the focus and that the bore sight direction of the feed lies exactly on the bore sight of the antenna. What is done in the case of the flux measurements is to position the feed as precisely as possible, and to fix it there as rigidly as possible, and then calibrate using an external standard.

Large horns are not used very much as stand alone antennas because there are ways to get similar gains using smaller antennas of other types. From the measurement point of view, however, they have a very important property, particularly for horns that taper gently — you can calculate the precise gains of these antennas from their physical dimensions, using basic electromagnetic theory.[3] Because the horns are large and unwieldy, however, parabolic dish antennas are used for making the F10.7 observations, and the horns used as calibration standards.

As shown in Figure 8, two identical F10.7 horns are used, mounted piggy back on the same mount. The horns have apertures of 3 × 4 feet and are about 12 feet long to the probe used to pick up the signal. The horns are mounted on an elevation only mount that makes it possible to scan the horns up and down the meridian. The antenna to the right is one of the flux monitors (FM 2), and in the background is the 26 meter radio telescope dish.

Calibration runs are made by doing a series of horn measurements over at least several days, usually in the summer while the Sun is at a higher elevation and clear, cloudless days are common, and then comparing the horn measurements with the measurements made by the flux monitors.

At a more superficial level, indications of data quality are obtained by comparing the measurements made by the two receiver channels on a given antenna, and then comparing the data between the two flux monitors. Since these are independent systems they provide a data check, although when the numbers differ, unless one set of measurements is clearly wrong, other work is needed to find out which values are correct.

Data Management and Distribution

The 10.7 centimeter solar radio flux shares with sunspot number the distinction of being the most widely used indices of solar activity. Values of F10.7 are to be found in databases around the world, and many users need data promptly. This imposes serious requirements on the program and the data handling arrangements.

Since the first commandment is to make sure the data gets out, we have two autonomous data distribution systems. The primary one tells the secondary one if it is not needed. When this NOT NEEDED signal does not arrive, the secondary system can take over. The data are e-mailed out to the high priority users, such as the Space Environment Center. The data are also copied to data services centers, such as the Data Portal of the Canadian Geospace Monitoring Programme and the **www.spaceweather.gc.ca** website.

Because of the duplication of the data among many databases, and the need to keep all these data in step, changes are minimized. For example, even though we can now calculate the gain of a horn antenna far more accurately today, we retain the model we have always used.

Summary

You now have a much better knowledge of what the solar flux is, where it is measured and how it is received and processed. Measuring the absolute value is not easy, but Penticton DRAO and Dr Tapping do a fine job. Think of them the next time you look at your SFI index along with the *A* and *K* solar activity indices, hoping for a DX opening.

Notes

[1]One of many sources of real time solar information is at **http://dx.qsl.net/propagation/propagation.html**.

[2]Some popular applications are *W6EL*, the *DX Atlas* suite, *IONCAP* and others.

[3]Jasik, *Antenna Engineering Handbook*, Chapter 15-1.

[4]J. Kraus. W8JK (SK), *Antennas*, Second Edition, McGraw-Hill, New York, 1988, Chapter 17, p 775.

Photos courtesy of the authors.

Dr Ken Tapping is an astronomer and Head of the Solar Radio Monitoring Programme at the Herzberg Institute of Astrophysics at Dominion Radio Astrophysical Observatory. Ken's main research interest is the processes of solar activity and their effects on the Earth and our activities. You can reach Ken at **ken.tapping@nrc-cnrc.gc.ca**.

International member John White, VA7JW, has been licensed since 1959 and has been active throughout these years. As a retired electrical engineer, he enjoys HF DXing, contesting and general ham contacts. HF propagation is of special interest. You can reach John at 344 Oxford Dr, Port Moody, BC V3H 1T2, Canada or at **va7jw@shaw.ca**.

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

New Products

ARRL and TAPR Digital Communications Conference Video from HamRadioNow.tv

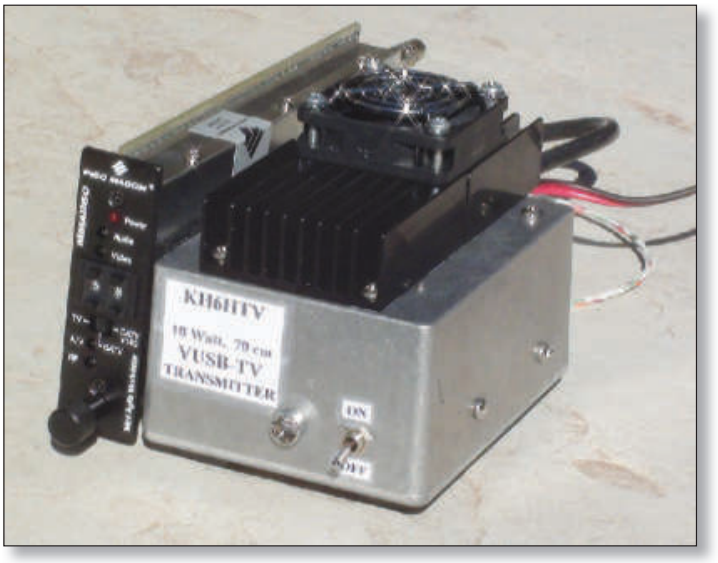
Video programs of the 2012 ARRL and TAPR Digital Communications Conference (DCC) appear online on the HamRadioNow podcast channel. The DCC is a three day conference, held this time in Atlanta in September 2012. It features technical and operational talks focused on Amateur Radio digital communication. HamRadioNow recorded all 16 main talks (each running about 45 minutes), the Saturday night banquet featuring Bdale Garbee, KBØG, and the four hour "Deep Dive" into GNU Radio with Tom Rondeau, KB3UKZ. The video programs, all produced in high definition, are free to watch online, although HamRadioNow accepts viewer contributions. To view the videos, visit **www.HamRadioNow.tv**.

DX Engineering Telescoping Fiberglass Tubing Kit

DX Engineering's FTK50 telescoping fiberglass tubing kits are constructed from seven pieces of telescoping fiberglass tubing tapering from 2.0 to 0.5 inches OD. Each section of the extruded fiberglass tubing is 96 inches long with a ⅛ inch thick wall. The lower six sections have slits for securing the joints with compression clamps (included), and top section has no slits. When fully assembled, the FTK50 telescoping fiberglass tubing kit can reach up to 50 feet in height. Elements can be telescoped or removed for shorter masts. The kit can be used to make vertical antennas or provide support for light duty dipoles. Price: $138. For more information, or to order, visit **www.dxengineering.com**.

Modern ATV System Design

Amateur television has come a long way — here's an update.



Jim Andrews, KH6HTV

Early ATV had a lot in common with early amateur voice communication — double sideband, full carrier was the mode in use. All of the reasons that made most hams migrate to single sideband, suppressed carrier apply to ATV. In fact, the improvement in efficiency is even more significant because TV receivers mainly receive just one sideband; the other doesn't contribute much to the process.

Why Not Go to SSB?

For hams transmitting video, particularly on the popular 70 centimeter band, a case can be made that we should migrate from DSB AM to the narrower bandwidth, vestigial upper side band (VUSB) modulation to conserve spectrum.

For the transmission of commercial analog, US standard NTSC (National Television Systems Committee), television signals, either via broadcast or cable, the FCC many years ago mandated that VUSB be used within a 6 MHz channel bandwidth. Newer digital TV transmissions must also stay within the same 6 MHz channel bandwidth. Figure 1 shows a typical over the air, commercial broadcast spectrum with 6 MHz TV channels.

The bandwidth of an analog, standard definition (480i), NTSC video signal is 4.2 MHz. For VUSB, the video carrier and the entire 4.2 MHz upper sideband are transmitted along with 750 kHz of the lower sideband. The video carrier is located 1.25 MHz above the lower band edge. The FM audio subcarrier, located 4.5 MHz above the video carrier, is also present in the 6 MHz channel.

Hardware Choices

Current practice among many TV hams is to use low cost, conventional AM-TV transmitters on the 70 centimeter band. This is no doubt because the only 70 centimeter ham TV transmitters that have been offered commercially for sale are AM-TV. Figure 2 shows the typical ham AM-TV spectrum. Compare this to the broadcast spectrum in Figure 1. With this very wide spectrum, it is impossible for other hams to operate on other 70 centimeter TV channels without co-channel interference. The wide spectrum also causes potential interference to hams operating other modes.

Single Channel Sideband Filters

The solution that has been used for many years by spectrum conscious TV hams has been to add a 6 MHz VUSB, band-pass channel filter to the output of their AM-TV transmitters. These filters are available from DCI, Digital Communications (**www.dci.ca**). They have several disadvantages, most significantly that operation is restricted to a single channel, but they also tend to be expensive, large, heavy and have an insertion loss of 1 to 2 dB. Size and weight are definite issues for ARES® or other backpack portable field operations.

Synthesized Single Channel Modulators

Fortunately, there is a modern solution to generating a VUSB ATV signal. We can capitalize on the equipment used by the cable TV (CATV) industry. In the head ends of CATV distribution systems are large banks of VUSB modulators designed to insert video signals onto the cable as RF on individual cable channels. Because every channel is used in a cable system, the RF spectrum coming out of each modulator must be ultra-pure and not extend beyond the allocated 6 MHz channel. This is true whether the modulator is creating an analog channel or a digital channel.

These modulators are synthesized and capable of putting out a TV signal on any CATV channel from 2 to 135. Cable Channels 57 through 61 happen to be in the amateur 70 centimeter band. For example, cable Channel 57 extends from 420 to 426 MHz. The output from these modulators is typically of the order of 0 dBm (1 mW). To create a fully synthesized amateur VUSB-TV transmitter requires just the CATV modulator followed by an ultra-linear power amplifier.

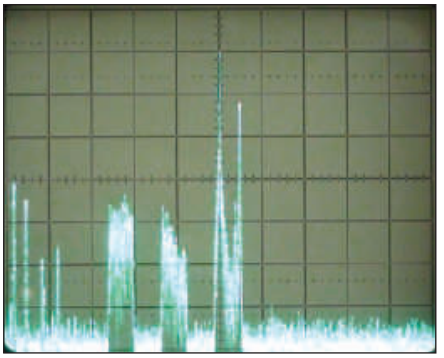


Figure 1 — Typical over the air broadcast spectrum from 150 MHz to 250 MHz. Scale, all plots: vertical axis,10 dB/div; horizontal axis 10 MHz/div. The signal in the center is a channel 11 NTSC analog TV station. Also seen are DTV stations on Channels 7 and 9. The Channel 9 spectrum is distorted due to multi-path.

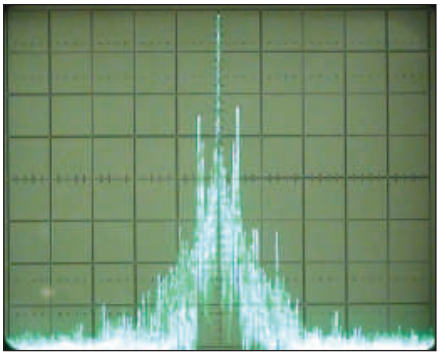


Figure 2 — Spectrum of a typical, commercially available, ham, 70 centimeter, 1 W, AM TV transmitter operating on Channel 60 (439.25 MHz).

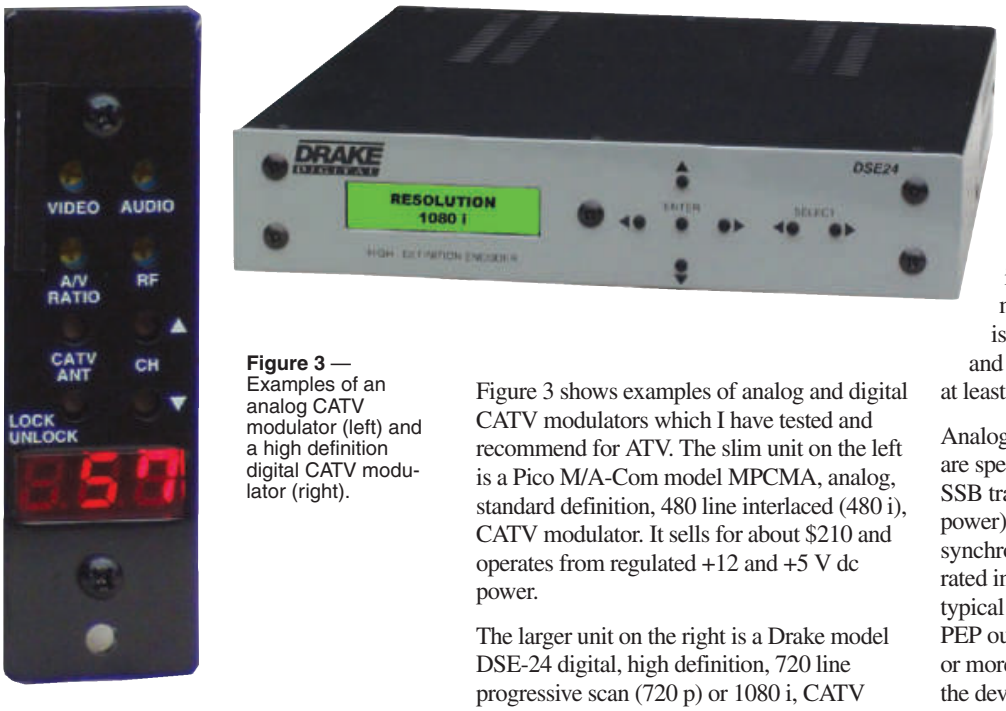


Figure 3 — Examples of an analog CATV modulator (left) and a high definition digital CATV modulator (right).

Figure 3 shows examples of analog and digital CATV modulators which I have tested and recommend for ATV. The slim unit on the left is a Pico M/A-Com model MPCMA, analog, standard definition, 480 line interlaced (480 i), CATV modulator. It sells for about $210 and operates from regulated +12 and +5 V dc power.

The larger unit on the right is a Drake model DSE-24 digital, high definition, 720 line progressive scan (720 p) or 1080 i, CATV modulator. The DSE-24 accepts component, HDMI or computer VGA as video inputs. It puts out an unencrypted digital TV (DTV) signal using QAM-64 modulation. QAM-64 is the modulation scheme used by the cable companies that modern, digital/analog home TV receivers can receive without requiring any cable converter box. Thus, a digital ATV signal from this modulator transmitted on the 70 centimeter band can also be received directly by most current home TV receivers. The DSE-24 sells for about $1200. Both modulators are available from wholesale video dealers such as ATV Research (**www.atvresearch.com**).

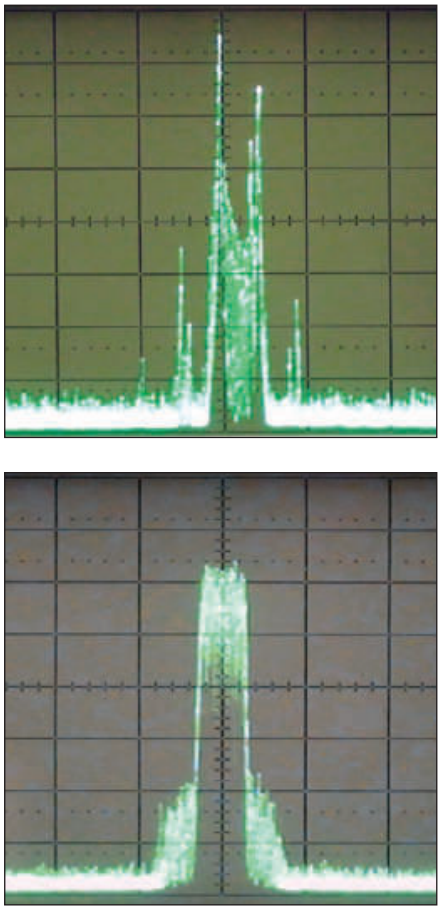


Figure 4 — Typical spectrum analyzer plots for a well adjusted analog, VUSB-TV, ATV transmitter (top) (LSB/USB = –30dB) and a high definition, QAM-64, DTV transmitter (bottom) (MER = –40dB).

Making More Power

The harder problem is to find a suitable linear amplifier. For VUSB, and especially for QAM-64 DTV, the amplifier must be ultra-linear. Any distortion introduced by the amplifier will cause rapid growth of the undesired lower sideband in the VUSB signal and increased error rate in the DTV signal. A key measure of distortion in a DTV signal is the MER (modulation error ratio). It is similar to our more familiar signal to noise ratio, but is appropriate for a digital system. As the MER degrades, noise sidebands start to occur outside the allocated 6 MHz DTV channel.

Linear amplifiers that have been used for AM ATV service in the past are unsatisfactory for VUSB-TV and DTV. The most popular power amplifier modules have been the Toshiba S-AU4 and the SAU83L. Neither is suitable for VUSB-TV or DTV.

After considerable research, I have found the Mitsubishi RAxxH4047 family of RF MOSFET, high power amplifier "brick" modules perform well for VUSB-TV or DTV service. Another excellent brick for a very linear 1 W amplifier is the RFHIC, RFC041. These amplifiers typically require drive levels of around +10 dBm. Since the output of a CATV modulator is typically at 0 dBm or less, an intermediate driver amplifier is also required. A small monolithic microwave integrated circuit (MMIC) is sufficient. It must also be very linear and should have an output power rating of at least +20 dBm.

Analog VUSB-TV transmitter output powers are specified in the same manner as for an SSB transmitter, as PEP (peak envelope power). The peaks occur on the tips of the synchronization pulses. DTV transmitters are rated in terms of their average power. For a typical VUSB-TV transmitter, the maximum PEP output power is typically set to be –3 dB or more below the maximum output power of the device. For a DTV transmitter, the average output power is typically set 10 dB below the maximum output power of the device.

It is extremely important not to overdrive any TV linear amplifier. Doing so will degrade the linearity. The best tool for properly adjusting the drive levels is a spectrum analyzer that can monitor the growth of the undesired lower sideband on a VUSB-TV signal or the out of channel noise sidebands on a DTV signal. Figure 4 shows the spectral plots for well adjusted analog and digital ATV transmitters.

Photos courtesy Jim Andrews, KH6HTV.

Jim Andrews, KH6HTV, is an ARRL member and holds an Amateur Extra class license. He was first licensed in 1965. He has BS, MS and PhD degrees in electrical engineering from the University of Kansas and is a Fellow of the IEEE. Jim is the founder and former president (now retired) of Picosecond Pulse Labs in Boulder, Colorado. He has been active in ATV and ARES since the mid '70s and he is the trustee for the BCARES TV repeater, WØBCR. In retirement, Jim and his wife, Janet, are snowbirds spending their summers in Boulder and the winters in Maui, Hawaii. In Boulder, Jim mainly operates 2 meter FM and UHF and microwave ATV. On Maui, Jim operates strictly on HF voice and PSK31. Jim may be reached at 150 Puukolii Rd, Condo 55, Lahaina, HI 96761 or at **kh6htv@arrl.net**.

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

The Considerate Operator's Frequency Guide

The following frequencies are generally recognized for certain modes or activities (all frequencies are in MHz) during normal conditions. These are not regulations and occasionally a high level of activity, such as during a period of emergency response, DXpedition or contest, may result in stations operating outside these frequency ranges.

Nothing in the rules recognizes a net's, group's or any individual's special privilege to any specific frequency. Section 97.101(b) of the Rules states that "Each station licensee and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies. No frequency will be assigned for the exclusive use of any station." No one "owns" a frequency.

It's good practice — and plain old common sense — for any operator, regardless of mode, to check to see if the frequency is in use prior to engaging operation. If you are there first, other operators should make an effort to protect you from interference to the extent possible, given that 100% interference-free operation is an unrealistic expectation on today's congested bands.

Frequencies	*Modes/Activities*
1.800-2.000	CW
1.800-1.810	Digital Modes
1.810	CW QRP calling frequency
1.843-2.000	SSB, SSTV and other wideband modes
1.910	SSB QRP
1.995-2.000	Experimental
1.999-2.000	Beacons
3.500-3.510	CW DX window
3.560	QRP CW calling frequency
3.570-3.600	RTTY/Data
3.585-3.600	Automatically controlled data stations
3.590	RTTY/Data DX
3.790-3.800	DX window
3.845	SSTV
3.885	AM calling frequency
3.985	QRP SSB calling frequency
7.030	QRP CW calling frequency
7.040	RTTY/Data DX
7.070-7.125	RTTY/Data
7.100-7.105	Automatically controlled data stations
7.171	SSTV
7.285	QRP SSB calling frequency
7.290	AM calling frequency
10.130-10.140	RTTY/Data
10.140-10.150	Automatically controlled data stations
14.060	QRP CW calling frequency
14.070-14.095	RTTY/Data
14.095-14.0995	Automatically controlled data stations
14.100	IBP/NCDXF beacons
14.1005-14.112	Automatically controlled data stations

Frequencies	*Modes/Activities*
14.230	SSTV
14.285	QRP SSB calling frequency
14.286	AM calling frequency
18.100-18.105	RTTY/Data
18.105-18.110	Automatically controlled data stations
18.110	IBP/NCDXF beacons
21.060	QRP CW calling frequency
21.070-21.110	RTTY/Data
21.090-21.100	Automatically controlled data stations
21.150	IBP/NCDXF beacons
21.340	SSTV
21.385	QRP SSB calling frequency
24.920-24.925	RTTY/Data
24.925-24.930	Automatically controlled data stations
24.930	IBP/NCDXF beacons
28.060	QRP CW calling frequency
28.070-28.120	RTTY/Data
28.120-28.189	Automatically controlled data stations
28.190-28.225	Beacons
28.200	IBP/NCDXF beacons
28.385	QRP SSB calling frequency
28.680	SSTV
29.000-29.200	AM
29.300-29.510	Satellite downlinks
29.520-29.580	Repeater inputs
29.600	FM simplex
29.620-29.680	Repeater outputs

ARRL band plans for frequencies above 28.300 MHz are shown in *The ARRL Repeater Directory* and on **www.arrl.org**.

Strays

FT-817 Satellite Interface Now Available as a Kit

The satellite computer-aided tuning interface described in October 2012 *QST* (pp. 40-43) for use with *SatPC32* software and the Yaesu FT-817 transceiver is now available for sale by the ARRL Education & Technology Program (ETP). The interface was created by Mark Spencer, WA8SME, as part of resource development for the ARRL ETP.

You can order the board and the programmed PIC at a cost of $20; the complete kit is priced at $35. Earnings from the sales of these kits will be used to cover development costs, plus a donation to AMSAT.

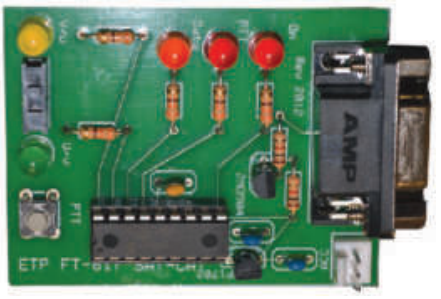
To order, send a check or money order payable to ARRL ETP to:

ARRL Education Services
ATTN: Amy Strickland
225 Main St
Newington, CT 06111

Please include the following information:

- Your name and shipping address
- Telephone number and e-mail address
- The items you are requesting

If you have questions concerning your order, e-mail Amy in ARRL Education Services at **astrickland@arrl.org**. For technical questions e-mail Mark Spencer at **mspencer@arrl.org**.



The complete kit is available from the ARRL.

US Amateur Radio Bands

US AMATEUR POWER LIMITS

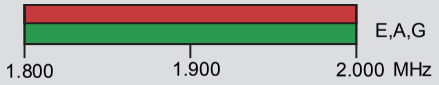
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

Effective Date March 5, 2012

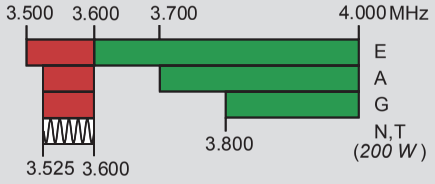
Published by:
ARRL The national association for AMATEUR RADIO®
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494

160 Meters (1.8 MHz)

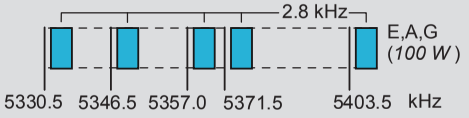
Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



80 Meters (3.5 MHz)

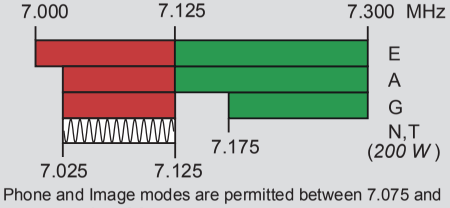


60 Meters (5.3 MHz)



General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5358.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.

40 Meters (7 MHz)

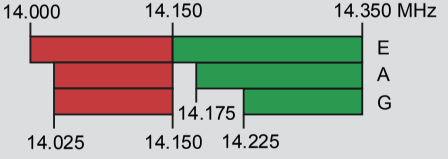


Phone and Image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11).
Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental US.

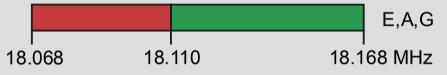
30 Meters (10.1 MHz)

Avoid interference to fixed services outside the US.

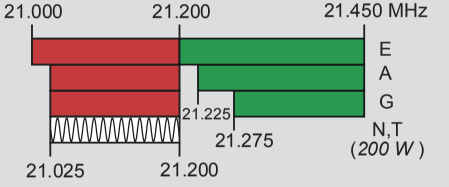
20 Meters (14 MHz)



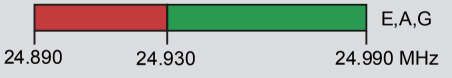
17 Meters (18 MHz)



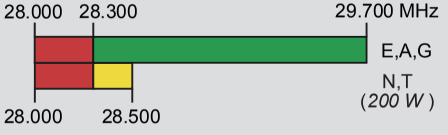
15 Meters (21 MHz)



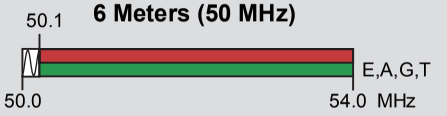
12 Meters (24 MHz)



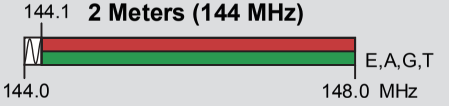
10 Meters (28 MHz)



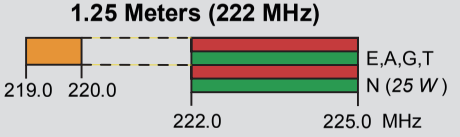
6 Meters (50 MHz)



2 Meters (144 MHz)

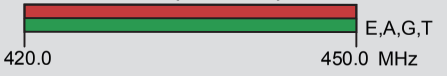


1.25 Meters (222 MHz)

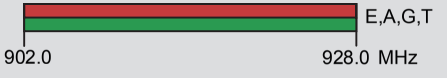


*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

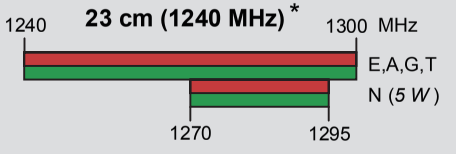
70 cm (420 MHz)*



33 cm (902 MHz)*



23 cm (1240 MHz)*



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz *	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

* No pulse emissions

KEY

Note:
CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW *only*
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems *only*

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See *ARRLWeb at www.arrl.org* for detailed band plans.

ARRL
We're At Your Service

ARRL Headquarters:
860-594-0200 (Fax 860-594-0259)
email: hq@arrl.org

Publication Orders:
www.arrl.org/shop
Toll-Free 1-888-277-5289 (860-594-0355)
email: orders@arrl.org

Membership/Circulation Desk:
www.arrl.org/membership
Toll-Free 1-888-277-5289 (860-594-0338)
email: membership@arrl.org

Getting Started in Amateur Radio:
Toll-Free 1-800-326-3942 (860-594-0355)
email: newham@arrl.org

Exams: 860-594-0300 email: vec@arrl.org

How High Should You Hang that Wire Antenna?

The more you pull, the higher it goes — and the more likely it will come down!

Joel R. Hallas, W1ZR

There's an old Amateur Radio adage: "If your antenna didn't fall down — you didn't put it up high enough!" There is some truth to this, especially among amateurs known for trying to squeeze out the last decibel (or nickel) from every project.

You Don't Have to Guess

The information needed to figure out how tight to pull your antenna halyards is available in *The ARRL Antenna Book*.[1] We will expand on it a bit here. Supporting a wire from its ends results in a *catenary* shape, common in other architectural structures, as shown in Figure 1. If the only weight that the wire is supporting is the wire itself, as in an end fed wire, or a center fed dipole with an intermediate support, the sag shown in Figure 1 can be determined from the nomograph in Figure 2. See the sidebar for instructions on using the nomograph.

Note that the amount of sag is a function of the tension and the weight of the wire. If you want less sag, you can add tension or use lighter wire.

Wire Tension

Adding tension, of course, can result in wire

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

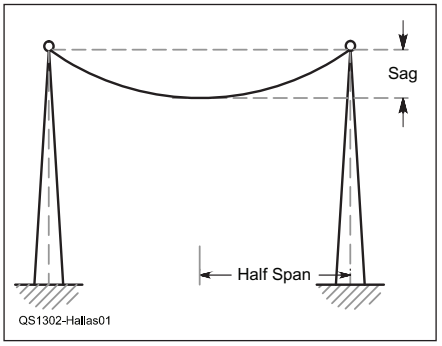


Figure 1 — The half span and sag of a supported wire antenna. Note that all the calculations assume that the supports don't move — we're not talking trees here!

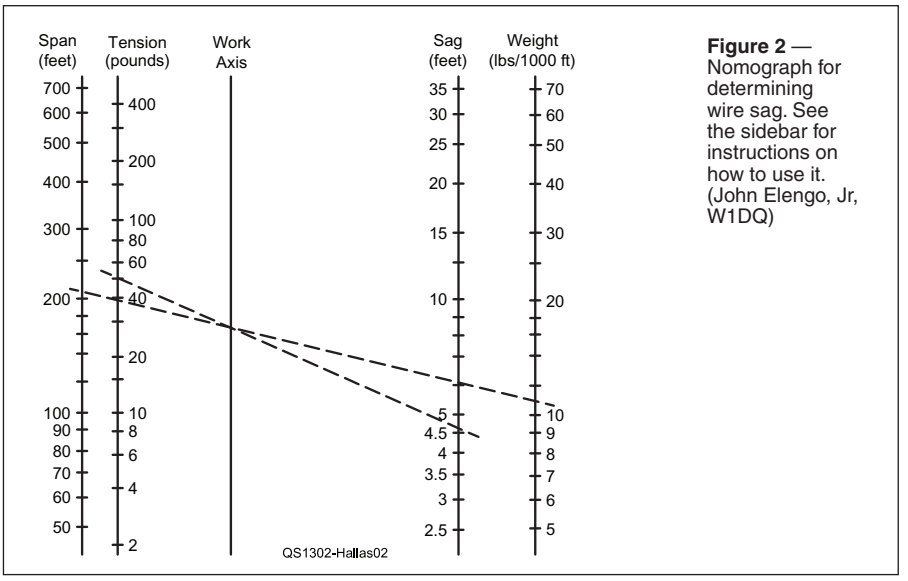


Figure 2 — Nomograph for determining wire sag. See the sidebar for instructions on how to use it. (John Elengo, Jr, W1DQ)

Instructions for Using the Nomograph

1) From Table 1, find the weight (pounds/1000 feet) for the particular wire size and material to be used.

2) Draw a line from the value obtained above, plotted on the weight axis, to the desired span (feet) on the span axis of Figure 2. Note in Figure 1 that the span is one half the distance between the supports.

3) Choose an operating tension level (in pounds) consistent with the values presented in Table 1 (preferably less than the recommended wire tension).

4) Draw a line from the tension value chosen (plotted on the tension axis) through the point where the work axis crosses the original line constructed in Step 2, and continue this new line to the sag axis.

5) Read the sag in feet on the sag axis. Example: Weight = 11 pounds/1000 feet, Span = 210 feet, Tension = 50 pounds, Answer: Sag = 4.7 feet.

Table 1
Stressed Antenna Wire

Size (AWG)	Recommended Tension[1] (pounds)		Weight (pounds per 1000 feet)	
	Copper clad steel[2]	*Hard drawn copper*	*Copper clad steel*[2]	*Hard drawn copper*
10	120	52	28.8	31.4
12	75	32	18.1	19.8
14	50	20	11.4	12.4
16	31	13	7.1	7.8
18	19	8	4.5	4.9
20	12	5	2.8	3.1

[1] Approximately 1/10 the breaking load. Might be increased 50% if end supports are firm and there is no danger of ice loading.
[2] Copperweld,™ 40% copper.

breakage. Table 1 provides the recommended tension, as well as the weight for two popular types of antenna wire — hard drawn copper and copper clad steel 1/10 the breaking load, a reasonable safety margin.

These calculations do not take into account the weight of a feed line supported by the antenna wire. A rough approximation of the effect of a hanging transmission line would be to add the weight of the suspended portion of the transmission line to the wire weight.

What About Trees?

All that we have discussed has assumed fixed supports. There is no question that those are the best for such a system, however, few amateurs put up towers to support their wire antennas. A sad fact of life is that trees move in the wind and wind happens. (As we write this, we are in recovery mode from Hurricane Sandy — our antennas survived!)

If it happened that the trees on each end of your wire antenna moved the same amount and in the same direction with the wind, the effect would be negligible. Unfortunately, neither of these is generally true, and swirling wind currents can make both trees move in opposite directions.

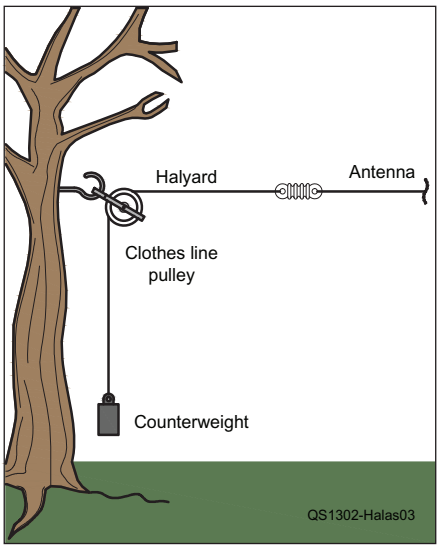


Figure 3 — Pulley and counterweight system to maintain tension and still allow tree to move without breaking wire.

Do some research and estimate how far the trees will move at the attachment point during high winds. To be safe, after calculating the desired sag and tension, add enough halyard length at each tree to allow the tree to move without exceeding your design goals. If the adjusted sag is not acceptable, use a pulley and counterweight system as shown in Figure 3 to provide the desired tension while allowing the tree to move.

Alternately, if you are good at watching the forecast, you can reduce the tension prior to anticipated storms. This obviously works best if you are home more than away.

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

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

Sean's Picks

Sean Kutzko, KX9X, kx9x@arrl.org

- **State QSO Parties this month:** British Columbia, Delaware, Louisiana, Minnesota, Mississippi, New Hampshire, North Carolina, Vermont
- **QRP contests this month:** FYBO Winter QRP Field Day (Feb 2), ARS Spartan Sprint (Feb 5), NAQCC Monthly QRP Sprint (Feb 13), Flying Pigs Run for the Bacon (Feb 18), Colorado QRP Club Winter QSO Party (Feb 25)
- **XE International RTTY Contest (Feb 2-3):** 24 hours of RTTY fun, hosted by our friends at FMRE. Everybody works everybody, with extra points for working XEs; their 32 states are special multipliers, too.
- **North American Sprint, CW (Feb 3):** Hailed by many serious CW contesters as one of the purest events on the calendar. Four hours of fast paced CW with mandatory QSY rules. If you love CW, you owe it to yourself to try this one.
- **RSGB 160 Meter Contest (Feb 9-10):** How many UK Districts can you work on 160 meters? There are 124 of them! Test your 160 meter skills with our RSGB friends this weekend and see!
- **ARRL DX CW Contest (Feb 16-17):** The oldest CW contest in the world! DX works only US and Canada, Canada and US work only DX. Great pileups, lots of DX; what more can you ask for?
- **CQ WW 160 Meter Contest, SSB (Feb 22-24):** One of the great Top Band events, sponsored by *CQ* Magazine. How much DX can you work on 160 meter SSB? Plenty!
- **North American QSO Party, RTTY (Feb 23-24):** This 12 hour RTTY event focuses on, obviously, North America. It's tons of fun and leaves lots of time in the weekend for other activities. The exchange is simply your name and US state, Canadian province or North American DX country. A 100 W power limit keeps the event friendly for casual ops, too! If you're new to RTTY this contest is a great introduction!

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

TEN-TEC Model 418 100 W HF and 6 Meter Linear Amplifier

Give your QRP transceiver a boost.

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

TEN-TEC's new linear amplifier is designed to boost the power output of the popular 5 W class low power (QRP) radios to 100 W over the 160 to 6 meter amateur bands, including the 60 meter channels. Switchable input attenuators are provided to allow radios with power outputs of up to 20 W to operate with the amplifier without overdriving the input. While the 418 is clearly designed as a companion to the TEN-TEC model 539 Argonaut VI QRP transceiver (announced, but not available as we write this), it can work equally well with most other QRP rigs.

Back to the Future

This amplifier follows in a long tradition of TEN-TEC QRP radios starting with the original TEN-TEC 5 W Argonaut transceiver introduced in 1971. The following year, TEN-TEC introduced the model 405, a 5 W in, 50 W out amplifier, designed to follow the Argonaut. It was offered at $149, equivalent to $821 in 2012.[1]

The proliferation of "amateur" 10 meter linear amplifiers marketed to CB operators at truck stops and other retailers resulted in the FCC ruling that amplifiers requiring less than 50 W drive for rated output were illegal, effectively outlawing external amplifiers for QRP transceivers. Recent FCC rule changes have made them available again, but only if they include a means to ensure that they cannot amplify any signals on frequencies between 26-28 MHz.[2] The use of internal frequency counters and processors makes this more feasible than in the past.

As anyone who has operated with QRP knows, radios at 5 W or even much less can be surprisingly effective. Many hams enjoy taking compact QRP transceivers on hiking or camping trips, along with temporary wire antennas. Operating QRP from home stations with permanent antennas is even more effective. Still, there are times when conditions require higher power than 5 W to overcome noise or interference at the far end. This amplifier will provide a 13 dB boost to a 5 W transceiver, an increase of more than two S units, making the signal sound as strong as the typical home station transceiver.

So What's it Do?

The earlier model 405 amplifier had a BAND switch, TR DELAY control and POWER ON/OFF button along with analog meters showing output power and SWR on its front panel. It was essentially just an amplifier and a few relays inside a box. The Model 418, in common with most current amplifiers at any power level, is a marvel of modern microprocessor based control and indicator functionality.

Display

The display includes bar graphs for forward power output to 100+ W and SWR up to 3:1. In addition to rapidly following the output power on a voice syllable or CW element basis, the forward power bar graph includes a "hanging" dot that indicates peak power — very handy. There are also OVERDRIVE and FAULT indicators that show up only when appropriate, with the nature of the fault indicated. The display can be backlit by red, blue or green LEDs that can be independently adjusted.

Also on the front panel are numerical displays of final amplifier collector current (I_C) and heat sink temperature — handy for keeping track of what's happening inside.

Front Panel Controls

Pushbutton controls are provided for setting the input attenuator (ATTN), changing band (see below), selecting HF antenna outputs ANT 1 or ANT 2, setting TR delay (DLY), changing display background color and intensity, and turning power ON or OFF.

Either of the two HF antenna ports can be used on 160 through 10 meters, while a third port is dedicated to, and automatically selected for, 6 meters. This is a perfect arrangement if your 6 meter antenna is the usual monoband Yagi. It's not as handy if you are using a wire antenna and tuner on all bands, or if you have an antenna that operates on 6 meters along with other bands, such as my coupled resonator 6 meter add-on to a triband Yagi.[3] The folks at

Bottom Line

The TEN-TEC model 418 linear amplifier can provide a handy 13 dB (about two S unit) boost to low power radios if used where enough dc power is available. While the model 418 is designed as a companion to the soon to be released Argonaut IV 5 W transceiver, it can also operate seamlessly with other transceivers of the same power class.

[1] **www.bls.gov/data/inflation_calculator.htm**
[2] Code of Federal Regulations, Title 47, §97.317, Standards for certification of external RF power amplifiers.

TEN-TEC announced a production change that allows 6 meter output to go to the ANT 1 or ANT 2 ports if desired, while leaving the dedicated 6 meter port for those who can make use of it. This change went into effect with software version 418V1b203 and is included with amplifiers shipping November 5, 2012 and later. If you have an earlier version of the 418 and need a combined HF/6 meter antenna port, contact TEN-TEC to arrange for a firmware upgrade.

The transceiver I used with this amplifier was intended to operate at 10 W output, so this provided a good test of the input attenuator function. Using the 4 dB setting worked fine, as expected. The attenuator can also be used to reduce power for antenna tuner adjustment, for example, if the transceiver doesn't offer easy power adjustment.

Band switching is accomplished by pushing a dedicated front panel pushbutton for each band. If you forget to change bands at the amplifier, the frequency counter included to restrict CB operation will note the discrepancy and change bands automatically, as long as the drive level is 200 mW or higher.

Rear Panel Connectors

The rear panel (Figure 1) includes four UHF (SO-239 type) sockets, one for RF input (INPUT) and three for RF output (HF ANT 1, HF ANT 2 and ANT 6M ONLY). The dc power connector is a pair of Anderson Powerpoles, oriented in the now standard configuration. A 25 A automotive type fuse is available directly on the rear panel and is replaceable without opening covers. The amplifier keying loop (see below) is supported by a single ⅛ inch stereo jack — tip for KEY IN, ring for KEY OUT.

TEN-TEC thoughtfully provides a mating cable that splits out the functions to two RCA type plugs. In addition, there is an accessory socket (ACC 1) that is an eight-pin DIN type socket (mating connector and cable supplied). This connector includes amplifier keying capability and other functions identified for use with TEN-TEC's future Argonaut VI transceiver— CLOCK INPUT, ENABLE INPUT and DATA INPUT.

Full Break-In CW Operation

Successful full break-in CW (QSK) operation, in which transmit-receive (TR) switching occurs between dots and dashes to allow listening in between code elements, requires careful control of TR switch sequencing. As a part of the TR process with QSK, there must be a delay in the generation of RF until the amplifier is ready to transmit. Likewise, the switchover back to receive must be delayed to make sure that no RF will still be coming from the transmitter or amplifier while the amplifier relays are in the process of switching. This could quickly burn up the TR relay contacts. Lab measurements indicated that our sample amplifier switches to transmit about 5.5 ms after the KEY IN is closed, and is back off about 9 ms after KEY IN is opened.

Semi break-in, in which the switchover back to receive is delayed so it doesn't occur between code elements, is automatically protected from this kind of problem because the longer switchover delay sidesteps the issue. Many CW operators prefer semi break-in for casual operation to avoid distractions, while QSK is quite popular with DXers, contesters and traffic handlers.

The 418 can support full QSK operation in a number of different ways. The amplifier is equipped to support the unique TEN-TEC keying loop, in which the KEY line in the transceiver doesn't actually key the transceiver directly. The KEY line first comes to the amplifier to key it, and then is fed to the transceiver. This feature need not be used, and in fact won't be supported by most transceiver brands other than TEN-TEC. Reportedly, the TEN-TEC Argonaut IV

Figure 1 — The TEN-TEC 418 rear panel connections.

Table 1
TEN-TEC, 418, serial number 3053051430

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz and 50 to 54 MHz.	As specified.
Power output: 100 W ±1 dB; SSB/CW continuous service; AM/FSK/PSK, 50% duty cycle.	As specified.
Driving power required: 1 to 20 W.	As specified. Up to 20 W with built-in attenuator.
Spurious and harmonic suppression: HF, –50 dBc; 6 Meters, >–60 dBc.	HF, –52 dBc worst case*; typically –60 to –64 dBc. 50 MHz, –64 dBc. Meets FCC requirements.
Third order intermodulation distortion (IMD): 30 dB below PEP.	3rd/5th/7th/9th: 37/38/47/57 dB below PEP (14 MHz, 100 W PEP output).
Power requirements: 13.8 V dc at 17 A.	At 13.8 V dc, 17 A transmit (100 W PEP output), 0.2 A standby.
Size (height, width, depth): 3.6 × 6.5 × 7.6 inches; weight, 5.4 lbs.	
Price: $785.	
*30 meters, at maximum output.	

[3]J. Hallas, W1ZR, "Add 6 Meters to Your Triband Yagi," *QST*, Sep 2011, pp 40-43.

will support the TEN-TEC keying loop.

For transceivers that don't support the keying loop, a single amplifier keying line will be used, as with most other amplifiers. Without the keying loop to keep timing under control, sequencing can be accomplished by inserting sufficient delay in the switchover from the transceiver for the leading edge and delaying the response in the amplifier for the trailing edge.

Some transceivers have the capability to delay RF transmission until the amplifier is switched, but minimalist portable QRP rigs may not support this. I thought the amplifier's DLY control might serve this purpose, but its delay in the first step above 0 is longer than that desired for full QSK, perhaps oriented more for semi break-in or SSB operation. By setting the DLY to 0, the amplifier will operate in full QSK mode, under the assumption that the transceiver can manage the required delay.

Another option is to use your external keyer or hand key to key the amplifier using the KEY IN line and use the KEY OUT line to key the transceiver. This puts the timing back under control of the amplifier, but has an additional advantage. By keying in this manner, the amplifier can be used with transceivers that don't include provision for keying an amplifier, a feature that is not always provided in compact portable radios.

On the Air

For on the air testing, I used the 418 with the Elecraft KX3 that I reviewed in *QST* for the December 2012 Product Review.[4] It's an interestingly serendipitous arrangement — we are in a short segment of the space-time continuum in which TEN-TEC has their amplifier available but not their companion transceiver, while Elecraft offers their transceiver but not their amplifier. Perhaps by the time you read this, all four units will be available. In a way, this makes for an interesting test, since many buyers will choose this amplifier to use with other brands of QRP transceivers.

The amplifier worked with the KX3 without any difficulty. While the KX3 is a nominal 10 W unit, I could choose to reduce power either from the KX3 or by using the amplifier attenuator. I chose the latter so that if I wanted to operate with just the KX3 I wouldn't need to remember to change its settings.

I used the single KEY OUT line from the KX3 to control TR switching by connecting it to the amplifier's KEY IN line. It worked well on voice, using VOX or PTT. Using CW in semi break-in mode, it worked fine with barely noticeable relay noise.

I also tried QSK, but with the output power turned down to avoid damaging relays, since the KX3 does not offer adjustable delay. As noted in its *QST* review the KX3's output is delayed by about 15 ms. While that would be fine on the leading edge, the radio could still be putting out RF as the amplifier switched back. Following completion of the review, TEN-TEC made me aware of a previously unpublished feature. The 418 includes built in hot switching protection for the trailing edge of each pulse. If the key down line is opened after it has been transmitting RF, the 418 will not switch back to receive until the RF has disappeared. This prevents the TR relays from trying to switch high levels of RF, avoiding this concern. This description is now included in the manual. It was interesting to note that in the review of the LNR Precision FX-2, the switching time was shown as about 2 ms, so these little radios may switch faster than many we're used to — watch out![5]

I found the relay noise to be just noticeable with the amplifier quite close and while listening using a loudspeaker. The sound of the sidetone was significantly louder, so with that on, it was not an issue.

Documentation

The TEN-TEC 418 comes with a 16 page instruction manual that does a good job describing setup and operation. There are good illustrations of the controls, indicators and connection points. A block diagram is provided, but there is no schematic diagram included in the manual. The TEN-TEC website provides a nice seven page schematic diagram package for those who would like that information; it's useful for troubleshooting, or just to better understand the functionality. The manual is also available on their website, so you can look that over to help you decide if it's the amplifier for you.

Manufacturer: TEN-TEC, Inc, 1185 Dolly Parton Parkway Sevierville, TN 37862, tel 800-433-7373; **www.tentec.com**.

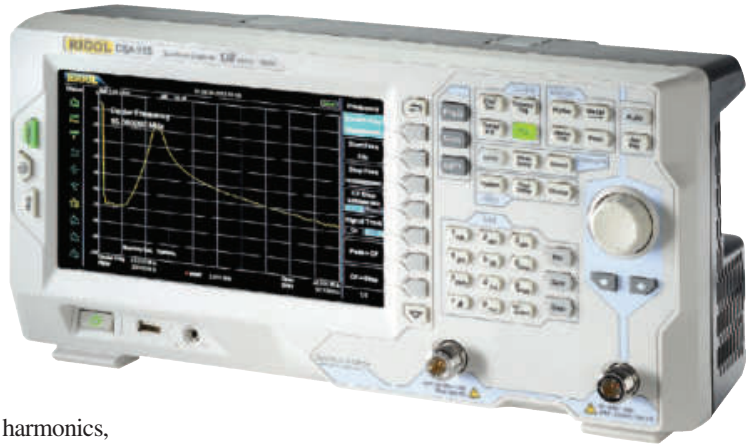
[4]J. Hallas, W1ZR, "Elecraft KX3 HF and 6 Meter QRP Transceiver," Product Review, *QST*, Dec 2012, pp 39-44.

[5]C. Skolaut, KØBOG, "LNR Precision FX-2 40/30 Meter QRP CW Transceiver," Product Review, *QST*, Jan 2013, pp 54-56.

See the Digital Edition of *QST* for a video overview of the TEN-TEC 418 solid state linear amplifier

Rigol Technologies DSA815-TG Spectrum Analyzer

Reviewed by Bob Allison, WB1GCM
ARRL Test Engineer
wb1gcm@arrl.org



A spectrum analyzer is a test instrument that measures RF signal level versus frequency, referred to as measurements in the *frequency domain*. Unlike an oscilloscope that measures in the *time domain*, a spectrum analyzer can easily be used to detect and observe frequency, power level, harmonics, bandwidth and other signal parameters.

One of the key tests I perform at the ARRL Lab is the emission standards evaluation of transmitters and amplifiers in which the levels of all harmonics and spurious emissions are compared to the fundamental (carrier) signal. Typically this measurement is performed with our calibrated Agilent/HP 8563E spectrum analyzer, which covers 9 kHz to 26.5 GHz. The HP 8563E is an accurate, laboratory grade professional instrument, but it is cost prohibitive for most radio amateurs and experimenters. A *used* laboratory grade spectrum analyzer such as the HP 8563E can cost tens of thousands of dollars, and one of these instruments is overkill for most amateur experimenters.

Headquartered in China, Rigol (pronounced "regal") is an established manufacturer of test equipment that is distributed worldwide. Rigol recently introduced the DSA815, a 9 kHz to 1.5 GHz spectrum analyzer with a starting price of $1295. Rigol has been advertising the DSA815 in *QST* and demonstrating it at ham conventions. ARRL members inquired about the unit, feeling that "it was too good to be true." As a test engineer, I was curious too, so our Product Review editor ordered the DSA815-TG, the model with a factory installed tracking generator, for $1495.

Overview

The Rigol DSA815 is compact unit that sports a handle and weighs in at a mere 9.4 pounds, suitable for both laboratory and portable operation. The 8 inch diagonal colorful LCD screen dominates the front panel and has a resolution of 800 × 400 pixels. Anyone who is familiar with the operation of spectrum analyzers will have no trouble understanding the basic functions, as most of the controls are the same as on other, more expensive units.

A USB computer connection and a PRINT button allow display and setup data to be retrieved without the typical GPIB interface seen on many older spectrum analyzers and other professional test equipment. (GPIB — the General Purpose Interface Bus — is also known as IEEE 488. Rigol offers a USB to GPIB adapter as an option.) I like the flip-up front feet that enable ergonomically friendly desktop operation. The DSA815-TG is vented from the sides with a very quiet fan.

Type N connectors on the front panel are used for RF INPUT and GEN OUTPUT (tracking generator output). Both are 50 Ω. Along with the 120 V ac power connection, the rear panel jacks are for USB and LAN connections, BNC 10 MHz in/out reference connections, and a BNC connection for the trigger input. The outside looks neat and modern; but what about the inside?

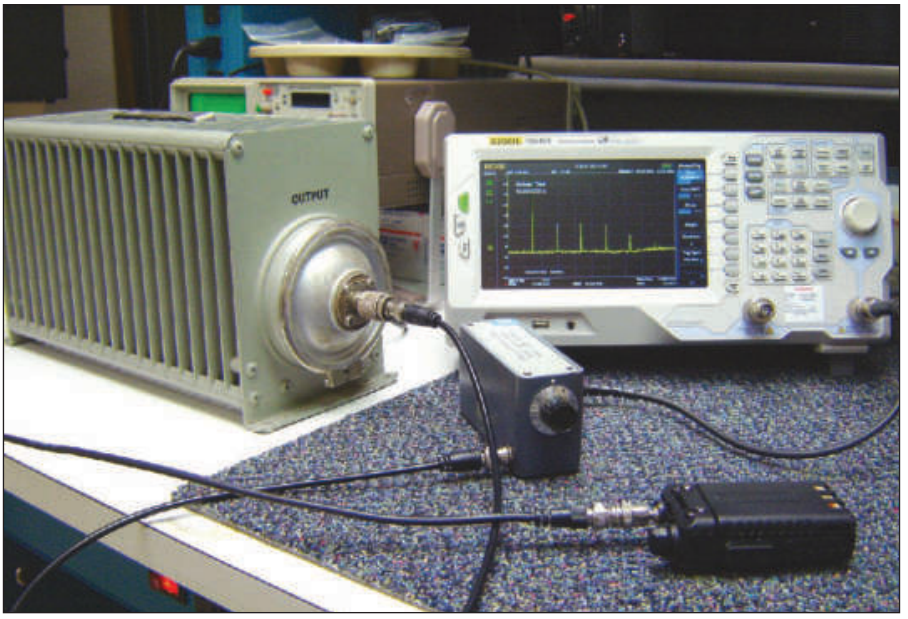


Figure 2 — In the Lab we use one or more high power attenuators and a step attenuator to bring the power of a transmitter under test down to a safe level for the input of test equipment (usually we shoot for around 1 mW). Here the DSA815-TG is used to observe the fundamental signal and harmonics of a 2 meter handheld.

Bottom Line

The Rigol DSA815-TG is a lightweight, portable spectrum analyzer that is affordable for serious experimenters and self employed service technicians. It has many uses in the amateur workshop.

Table 2
Rigol Technologies Spectrum Analyzer, Model DSA815-TG, s/n DSA8A142400036

The following manufacturer's specifications have been determined to be "as specified" by Essco Calibration Laboratories, of Chelmsford, Massachusetts.

Frequency range: 9 kHz to 1.5 GHz.
Frequency resolution: 1 Hz.
Internal frequency reference: 10 MHz.
Temperature drift, 20° to 30° C: <2 ppm.
Marker resolution: Span / (sweep points – 1).
Marker frequency counter resolution: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz.
Frequency span: 0 Hz, 100 Hz to 1.5 GHz.
SSB phase noise, carrier offset, 10 kHz: <–80 dBc/Hz.
Resolution bandwidth (RBW), (–3 dB): 100 Hz to 1 MHz, in 1-3-10 sequence.
RBW, (–6 dB) (Option): 200 Hz, 9 kHz, 120 kHz.
RBW uncertainty: <5%, nominal.
Resolution filter, shape factor (60 dB:3 dB): <5, nominal.
Video bandwidth (–3 dB): 1 Hz to 3 MHz, in 1-3-10 sequence.
Amplitude measurement range: 10 MHz to 1.5 GHz, displayed average noise level (DANL) to +20 dBm; 100 kHz to 10 MHz, DANL to 0 dBm.
Maximum rated input level, dc voltage: 50 V.
CW RF input power (with RF attenuation = 30 dB): +20 dBm (100 mW).
Maximum RF input level before damage: +30 dBm (1 W).
Displayed average noise level (DANL), with 0 dB RF attenuation, RBW=VBW=100 Hz, sample detector, trace average = 50:
Preamplifier off: 100 kHz to 1 MHz: <–90 dBm, typical –110 dBm; 1 MHz to 1.5 GHz, <–110 dBm + 6 × (f/1GHz) dB, typical –115 dBm.
Preamplifier on: 100 kHz to 1 MHz, <–110 dBm, typical –130 dBm; 1 MHz to 1.5 GHz, <–130 dBm + 6 × (f/1 GHz) dB, typical –135 dBm.
Level display range: log scale, 1 dB to 200 dB; linear scale, 0 to reference level.
Number of points: 601; number of traces: 3+ math trace.
Trace detector: Normal, Positive-Peak, Negative-Peak, Sample, RMS, Voltage Average, Quasi-Peak (optional).
Trace functions: Clear Write, Max Hold, Min Hold, Average, Freeze, Blank.
Scale unit: dBm, dBmV, dBµV, nV, µV, mV, V, nW, µW, mW, W.
Frequency response, 10 dB RF attenuation, relative to 50 MHz, 20° to 30° C:
(Preamplifier off), 100 kHz to 1.5 GHz, <0.7 dB;
(Preamplifier on),1 MHz to 1.5 GHz, <1.0 dB.
Input attenuation setting range: 0 to 30 dB, in 1 dB steps.
Reference level range: –100 dBm to +20 dBm in 1 dB steps.
Resolution: log scale, 0.01 dB; linear scale, 4 digits.
RF input VSWR, 10 dB RF attenuation, 1 MHz to 1.5 GHz: <1.5.
Intermodulation, second harmonic intercept: +40 dBm; third-order intercept, fc >30 MHz, +10 dBm.
1 dB gain compression, total input power of mixer, fc = 50 MHz, preamplifier off: >0 dBm.
Note: Mixer power level (dBm) = input power (dBm) – input attenuation (dB).
Spurious responses: image frequency, <–60 dBc; intermediate frequency, <–60 dBc; spurious response, inherent, <–88 dBm, typical.
Sweep time range: 100 Hz =Span= 1.5 GHz, 10 ms to 1500 s; zero span, 20 µs to 1500 s.
Sweep mode: continuous, single.
Trigger source: free run, video, external. External trigger level: 5 V TTL level.
Tracking generator (TG) (DSA815-TG) frequency range: 9 kHz to 1.5 GHz.
TG output level: –20 dBm to 0 dBm, in 1 dB step.
TG output flatness: 1 MHz to 1.5 GHz, referenced to 50 MHz: ±3 dB.
Input/output RF impedance: 50 Ω. Connector: N-type, female.
TG output impedance: 50 Ω. Connector: N-type, female.
10 MHz REF IN/10 MHz REF OUT/external trigger in connector: BNC female.
10 MHz REF IN amplitude: 0 dBm to +10 dBm.
10 MHz REF OUT amplitude: +3 dBm to +10 dBm.
Display type: TFT LCD. Resolution: 800 × 480. Size: 8 inch. Colors: 64 k.
Printer protocol: PictBridge.
Remote control: USB, USB TMC, LAN 10/100 Base-T, RJ-45, LXI-C Class, IEC/IEEE BUS (GPIB) with USB-GPIB interface converter option IEEE 488.2.
Power supply input voltage range, ac: 100 V to 240 V, nominal, 45 Hz to 440 Hz.
Power consumption: typical 35 W, max 50 W with all options.
Operating temperature range: 5° to 40°C; storage temperature range: –20° to 70°C.
Dimensions (HWD): 7.0 × 14.2 × 5.0 inches; weight, with tracking generator: 9.4 lbs.
Price: DSA815-TG, $1495; DSA815 (without tracking generator), $1295.

While I dared not open it up to take a peek (this voids the calibration), Rigol explains, "The DSA815 uses digital IF technology (DSP), that enables smaller bandwidth settings which reduces the average noise level." The narrowest filter bandwidth setting of this model is 100 Hz. The use of this technology reduces the complexity of the hardware and also explains its compact size. The frequency range of this unit is 9 kHz to 1.5 GHz, reasonable for measurements of most amateur equipment. Other Rigol models offer frequency coverage to 3 GHz, greater sensitivity and narrower resolution bandwidth.

In the ARRL Lab, our RF shielded screen room and instruments are set up for the testing of typical Amateur Radio equipment, not for testing other laboratory instruments. To verify whether or not the DSA815 performs as specified in Rigol's literature, I sent the unit to the lab that annually calibrates our test equipment — Essco Calibration Laboratory of Chelmsford, Massachusetts. Essco checked all specifications, and soon afterward it arrived back at the ARRL Lab sporting a calibration sticker. Table 2 lists Rigol's key specifications for the DSA815-TG, and Essco confirms that the test results are "as specified."

Applications

The user of the DSA815 and all other spectrum analyzers must pay close attention to the power levels at the input. With the Rigol, any power level greater than +20 dBm (100 mW) will lead to an expensive repair and recalibration, so a power attenuator and step attenuators are always used between the device under test and the spectrum analyzer. In the Lab for safety's sake and to avoid overload leading to measurement errors, we use an input signal no greater than 1 mW and use attenuation as needed to get to that level. Figure 2 shows a typical Lab setup for testing a transmitter. For more information on how we use spectrum analyzers during various tests we perform on Amateur Radio equipment, please check out the ARRL Lab's *Procedure Manual* online.[6] *The ARRL Handbook* also explains the use of spectrum analyzers in its Test Equipment and Measurement chapter.[7]

[6] *The ARRL Lab Test Procedures Manual* is available for download from **www.arrl.org/product-review**.

[7] *The ARRL Handbook*, 2013 edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 4050. Telephone 860-594-0355, or toll free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**. Chapter 25, Test Equipment and Measurements, explains the use of spectrum analyzers.

In the Field

Our DSA815-TG was quickly pressed into service at the ARRL National Convention at Pacificon in Santa Clara, California, last October. There, yours truly set up a booth with the Rigol spectrum analyzer, power and step attenuators, and a Bird 43 power meter (Figure 3). I tested hundreds of VHF and UHF handheld transceivers, each owned by a ham eager to see if his or her unit met the FCC spectral purity requirements (Part 97.307e). The Rigol never skipped a beat during the entire event, unlike some of the handhelds I tested that didn't make the grade. The LCD screen was easily seen by all who visited my booth, despite the bright overhead fluorescent lighting.

In the ARRL Lab

Back at the ARRL Lab, I put the DSA815-TG through its paces, performing some of the same tests I normally do for transceiver testing. I also found the DSA815-TG's tracking generator very useful while sweeping some of the band-pass filters I use during amplifier tests. Figure 4 shows the response of a band-pass filter with the tracking generator level set to –20 dBm, with a start frequency of 0 MHz and a stop frequency of 30 MHz. I was then able to use the storage function to transfer a CSV file (comma separated values with the X and Y axes) of the band pass filter plot to a flash drive. From that file, I used *DPlot* plotting software to create the chart shown in Figure 5. Look closely: our filter has an attenuation of 5 dB at 4 MHz and will attenuate a signal at the high end of the 75 meter band (that's good to know!).Though our own HP 8563E spectrum analyzer does not have the tracking generator option, I used our analyzer and our IFR 2040 signal generator to measure the same band-pass filter at several frequencies; the measurements were virtually the same as those made with the Rigol DSA815-TG. For basic measurements, it appears the Rigol unit does just about everything a more expensive spectrum analyzer can do within its frequency range. The more expensive instrument will have a greater frequency range and will have better resolution while looking at chunks of spectrum spanning 1 MHz or less. That translates to more data points along the spectrum. Table 3 compares the capability of the DSA815 and HP 8563E, showing the smallest resolution bandwidth setting available versus the amount of swept frequency.

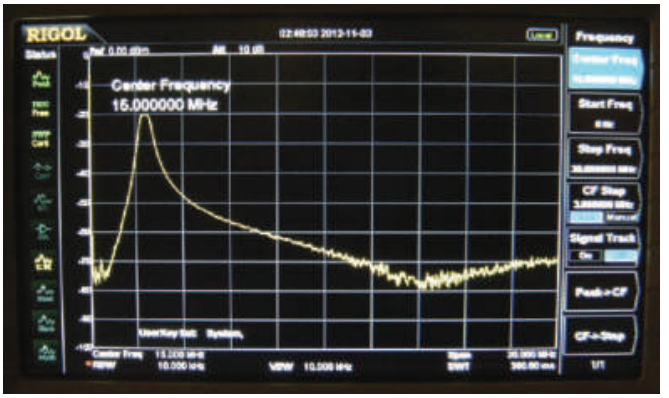


Figure 4 — The DSA815-TG's built-in sweep generator is handy for testing filters. Here is the frequency response of an 80 meter band-pass filter.

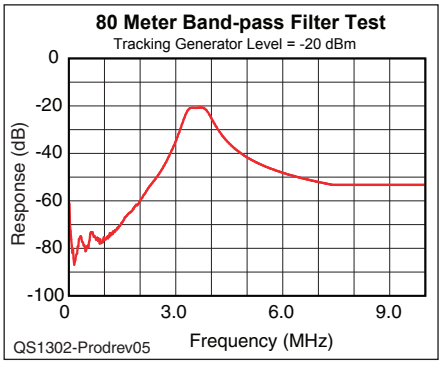


Figure 5 — This chart was made by saving the data from the filter sweep shown in Figure 4 to a CSV file, which was then imported into *DPlot* graphing software to take a close look at the filter's response from 1 to 10 MHz.

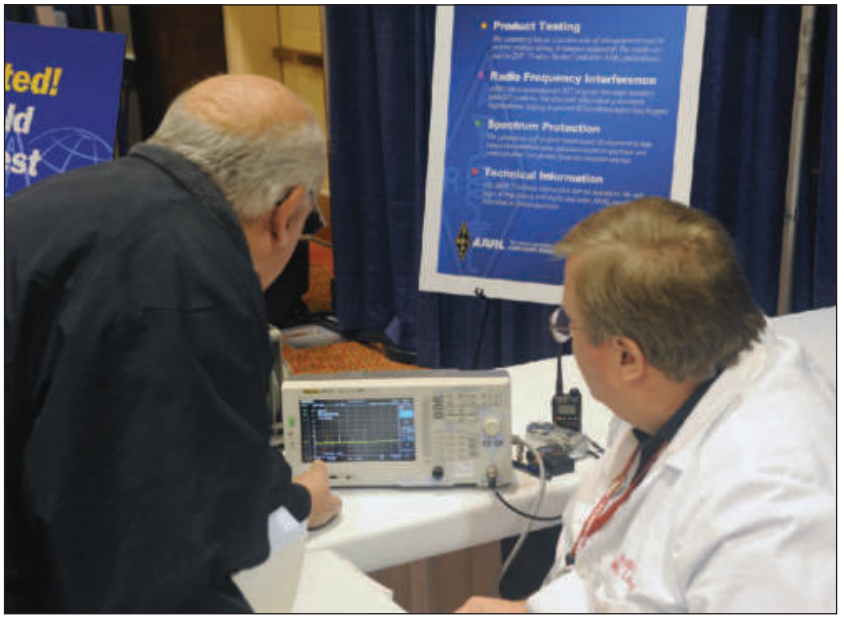


Figure 3 — Bob Allison, WB1GCM (in the white coat), checked the spectral purity of handheld radios for visitors at the ARRL National Convention at Pacificon last November. Most radios met FCC requirements, but there were a few surprises.

More Features

The DSA815-TG has the ability to search and display the input signal of an unknown frequency by pressing the AUTO button. I did this repeatedly with a handheld transceiver connected through an attenuator and sure enough, the carrier would appear in the center of the screen and with the signal level auto scaled. I also connected a VHF/UHF ground plane at the input and pressed the AUTO button. Not surprisingly, the DSA815 showed local FM broadcast stations to be the strongest received signals at our location.

Most spectrum analyzers have a headphone jack, and the Rigol has one too. This allows the user to hear AM or FM analog stations via a headphone jack while using a demodulator. After some adjustments, I got the Rigol to play music from an FM broadcast station, but the audio was disappointingly low.

I did encounter a problem when adjusting resolution bandwidth, frequency span and demodulation time in rapid succession

Table 3
Display Frequency Width versus Resolution Bandwidth (RBW)

Sweep Width (MHz)	Minimum RBW (Hz) Rigol DSA815	HP 8563E
1000	1000	10,000
100	300	3000
10	100	1000
1	100	10
0.1	100	10
0.01	100	10
0.001	100	10

— the Rigol display froze up. The instrument usually recovered from my demanding requests within a few seconds, but once I had to power down and power up again to let it reboot.

Accessories

The DSA815-TG comes with a printed *Quick Guide* and a CD-ROM with a more detailed *User's Guide* and *Programming Guide*. You'll need to supply cables and attenuators suitable for the measurements you want to make.

Rigol offers a number of optional accessories for the DSA815, including a USB to GPIB converter, rack mount, carrying bag and attenuator. Other options include a VSWR measurement kit, an EMI/quasi peak detector kit, and an advanced measurement kit for evaluating parameters such as adjacent channel power, occupied bandwidth, emission bandwidth, harmonic distortion and third order IMD. A utility kit with a variety of cables, adapters and antennas is available as well.

One feature I would like to see is the option to power the DSA815 from an internal rechargeable battery, a feature I've seen on some other portable spectrum analyzers and storage scopes. That would make this compact unit even more attractive for measurements in the field.

In Summary

A spectrum analyzer is a valuable tool for anyone who enjoys building, modifying or evaluating oscillators, amplifiers, filters, transmitters and other RF equipment. In the not too distant past, most spectrum analyzers that amateurs could afford for home use were old, surplus professional units that had seen better days. Often they were long out of calibration and difficult, if not impossible, to repair if anything went wrong. More recently, hams paired fairly simple hardware with PC-based sound cards and software to make RF spectrum analysis available at a reasonable price.[8] The Rigol DSA815 takes the next step, using DSP technology to make an affordable, standalone, accurate test instrument.

Overall, I was pleased with the DSA815-TG's performance and ease of operation. It looks sharp, and its small size makes a great addition to any test bench.

US Distributor: Rigol Technologies Inc., 7401 First Place, Suite N, Oakwood Village, OH 44146; **www.rigolna.com**; tel 877-474-4651; fax 440-232-4488.

[8]G. Steber, WB9LVI, "Experimenter's RF Spectrum Analyzer," *QST*, Oct 2008, pp 36-40.

See the Digital Edition of *QST* for a video overview of the Rigol DSA815-TG spectrum analyzer.

New Products

DxSpot App for iPad, iPhone and iPod Touch from Green Creek Technology

DxSpot from Green Creek Technology is available from the iTunes store for iPhone, iPad and iPod touch (IOS 3.2 or later). This app provides mobile access to the Amateur Radio DX cluster network, and its database contains the connection parameters for more than 300 Internet DX clusters. Connection parameters can be customized to access new or private clusters. Other features include automatic cluster logon with optional password entry, telnet access to the cluster console and the ability to enter cluster commands. *DxSpot* monitors DX spots in real time, creating formatted table displays. Other displays include colorized WWV propagation data, users currently connected to the cluster, and cluster announcements. The app also provides automatic QRZ.com web page search by DX, spotter or user call signs. Another screen displays detailed information about ARRL DXCC entities, including name, prefix, flag, continent, CQ/ITU zones, latitude/longitude and UTC time offset. This application is for licensed Amateur Radio operators and a valid call sign is required for use. Price: $3.99 from the iTunes app store. For more information, visit **www.greencreek technology.com**.

High Power VHF/UHF Amplifiers from Lunar-Link International

The Lunar-Link amplifier business has been acquired from the estate of the late Steve Powlishen, K1FO, by Louis Parascondola, W1QJ, and Steve Simons, W1SMS. Lunar-Link International will offer legal limit output VHF/UHF linear amplifiers, accessories, technical support, repairs and replacement parts. These amplifiers and accessories are intended for use in demanding applications including EME, contesting and digital modes. Deliveries were expected to begin in the first quarter of 2013. For more information, or to order, visit **www.lunarlink.com**.

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

How much power do I need to run my radio?

Q Dave, K6VML, asks: About three years ago I bought a 1 kW portable generator with the intention of using it to power my HF rig in the field. Shortly thereafter I had to move and the project was put on hold.

Now settled in, and having turned my attention to portable operation once again, I am embarrassed to admit I may not have adequately thought this through. The generator does not have a regulated dc output, it only provides 120 V ac. Its rated output current is only 7.5 A, while my 100 W output HF transceiver needs a 20 A power supply. Am I right in thinking this generator does not have enough current to run this rig in the field?

A No, you will have plenty of power available from your generator. The 7.5 A rating is at 120 V ac. That equates to a maximum power capability of 900 W. You will need a dc power supply between the generator and your transceiver to run your HF rig, perhaps the same one you use at home. Depending on how large your home station supply is, you may want to leave it at home and get one of the small and lightweight units available that may be handier in the field.

Your dc requirement, assuming the usual 13.8 V dc power supply, would be 13.8 V × 20 A, or 276 W (see Figure 1). If the supply were 100% efficient, it would draw 276/120 or 2.3 A at 120 V ac during times that the transceiver is putting out its maximum peak power. Of course, power supplies are not quite that efficient. The typical 20 A, 13.8 V dc supply probably draws about 2.5 to 3 A while the transmitter is putting out 100 W. Thus, you will have enough capacity left over to run some lights and a PC.

Q Rene, K5JX, asks: I have often read that one should take antenna measurements at the feed point of an antenna. How is this done from a practical standpoint if you want to measure the antenna in its permanent position? For example, how do you get to a dipole or inverted V with a feed point 30 feet above ground? Even if it is an antenna that you can reach, won't the proximity of your body affect the readings? Is the length of the coaxial jumper cable between your antenna analyzer and the antenna feed point critical?

A This is an important consideration. If you are just interested in SWR, you can make measurements at the end of the cable and they will be close. Yes, your body will likely change the readings, so even if you can get there, you probably don't want to.

If you want to know the actual impedance, and what's actually happening at the antenna feed point, you need to transform the impedance that you measure at the end of the transmission line to determine what it was at the feed point. In order to do so, you need to know the length of line and its characteristics.

With that information, and your end of cable measurements, you can determine the feed point information. This can be done with a Smith chart, but the easy way is to use *Transmission Line for Windows* (*TLW*) software that comes with *The ARRL Antenna Book*.[1] In 2007 I wrote a one page *QST* article on how to do it.[2]

Another possibility is to use a carefully measured ½ wave (or multiple) transmission line. This will repeat the impedance at the feed point. This length is best measured using your antenna analyzer with the far end shorted. Trim for an impedance measurement of 0 + *j*0 at the other end. Note that this technique only works at the single ½ wave frequency. Frequently, it is desired to know the characteristics over a range of frequencies.

Q Quentin, KC7VOU, asks: My antenna tuner, transceiver and artificial ground all have ground terminals. Do I need to ground them all to Mother Earth separately? Can I use the shield of my coax between my transceiver and my antenna tuner as a ground connection, or do I need a separate wire from chassis to chassis?

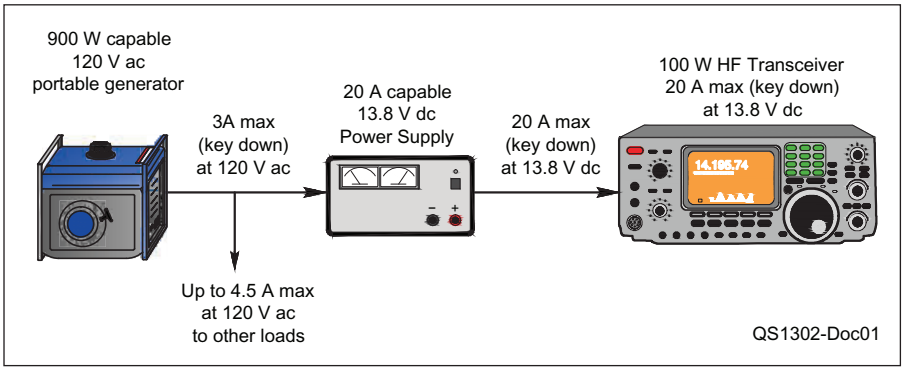


Figure 1 — Illustration of voltage, current and power relationships with systems at different supply levels.

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

[2] J. Hallas, W1ZR, "I Know What's Happening at the Shack -- What's Happening at the Other End of my Feed Line?" *QST*, Feb 2007, p 63. (available on the ARRL website's *QST* archive).

A The best way is to connect each of the ground terminals to a single ground point in the station with short heavy connections and then run a wire or strap to the station ground connection. The coax shields may provide that connection, but they aren't always there, so it's best to have dedicated heavy grounding conductors. The station ground should also be bonded to the power system utility ground.

Q Cliff, KB7RS, asks: I have put up a 40 meter sloper (sloping monopole, see Figure 2) with the tower being one of the legs and the other half extending out from the tower at some angle that looks good. I have made some contacts with it, and note a reasonable SWR across the band but don't have any info on the optimum angle from between the tower and the wire, or information on what the pattern should be like. My sloper is 33 feet long and leaves from 47 feet up the tower. Can you help?

A Well, I haven't tried one of these myself, so I turned to *EZNEC* for a simulation.[3] I modeled your tower as a three legged affair and varied the included angle and looked at the elevation pattern at each step. The results are shown in Table 1. Note that while the gain and angle of peak elevation do change somewhat, the gain at a low angle (I picked 15°) doesn't change as much, so the angle does not appear terribly critical. A plot of the elevation pattern at a wire angle of 45° is shown in Figure 3, with the azimuth pattern at the peak angle shown in Figure 4. The front-to-back ratio doesn't change much with the wire angle either.

My model did not indicate a particularly good match in this configuration. Another possibility that will fit in the same spot, work better and provide a better match is a center-fed half wave sloping dipole (on the right in Figure 2). It will be at a wire angle of about 45° and will provide a peak gain of 2 dBi at 33° elevation. Its gain at 15° is 0.6 dBi, or more than 3 dB higher than the quarter wave.

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

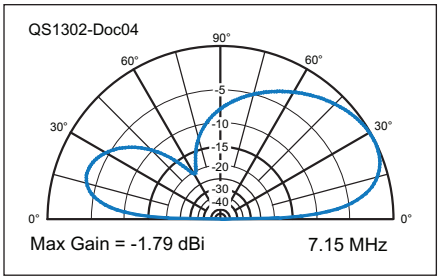


Figure 3 — The elevation pattern of the quarter wave sloper with a wire angle of 45°.

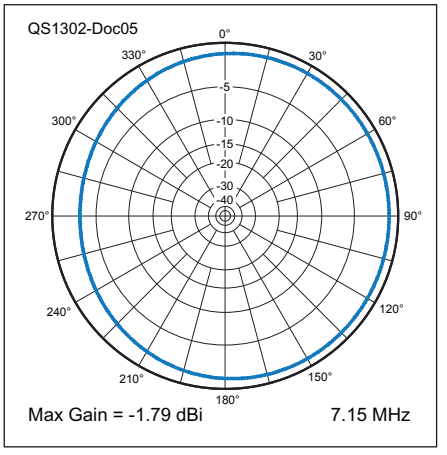


Figure 4 — Azimuth pattern of the quarter wave sloper at the elevation angle of peak gain.

Table 1
Performance of Quarter Wave Sloper as a Function of Included Angle

Included Angle (°)	Max Gain (dBi)	Peak Elevation (°)	Gain at 15° (dBi)
10	–3.1	24	–3.9
20	–2.4	25	–3.3
30	–2.0	25	–3.0
35	–1.9	26	–2.9
40	–1.8	27	–2.8
45	–1.8	27	–2.8
50	–1.8	27	–2.9
55	–1.8	28	–2.9
60	–1.9	28	–3.0

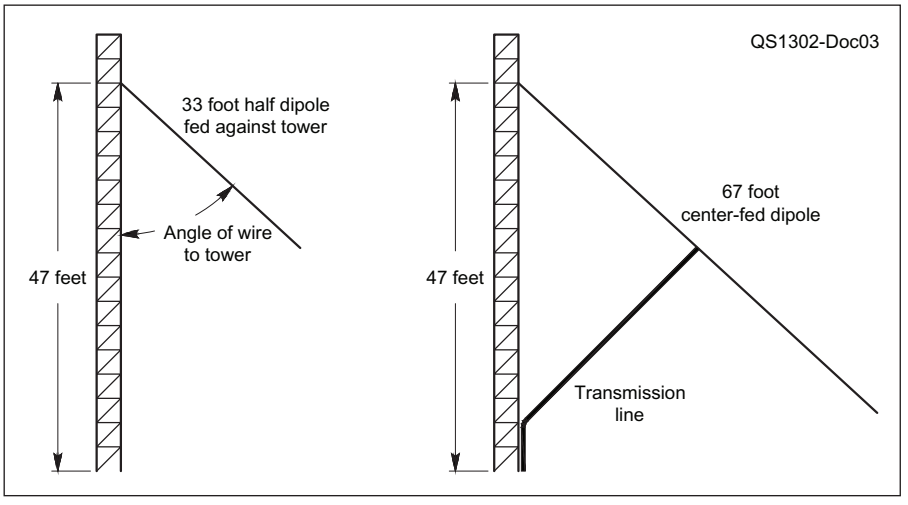


Figure 2 — On the left, an illustration of the quarter wave sloper. The coax feed line is attached to the top of the antenna with the shield tied to the tower at the same point. On the right, a sloping half wave dipole that will fit in the same spot and provide improved performance.

Bob, K1AO, offered a comment on my discussion in the November 2012 column of the use of computer headsets with electret microphones. He notes that in his experience virtually all have unshielded conductors attached to the microphones. This is the reason that some hams find that they are getting RF in their audio. There is probably some RF bypassing in their rig's audio input but, in many cases, it is not enough, especially if there is some RF floating around in the shack from inadequate grounding. He has had good luck bypassing the electret element at its terminals with a 0.001 µF disc ceramic capacitor and putting a ferrite bead on the hot lead right at the element. He then uses shielded cable, such as RG-174 miniature coax, from the element out.

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

Arrow Antenna GP146/440 Ground Plane

With so many dual-band 2-meter/70-centimeter transceivers on the market, there is strong demand for simple dual-band antennas. By "simple" I mean antennas that work on both bands without the hassle of running two separate coaxial lines all the way back to the radio. "Simple" also means antennas that are easy to set up with little, if any, tuning required.

For casual applications, as well as public service use, it is often best to rely on an omnidirectional antenna that radiates a reasonably uniform pattern to all points on the compass. For VHF/UHF work, one of the most popular designs is the venerable *ground plane* — an antenna with a vertical radiating element and several horizontal elements below it that form the RF ground plane, hence the name.

Most ground plane designs are limited to a single band, but the Arrow Antenna GP146/440 manages to support operation on 2 meters and 70 centimeters simultaneously. All that's needed is a single coaxial cable to connect to your transceiver.

The Arrow GP146/440

The GP146/440 works its magic with two vertical elements. The longest element is "hot" and the other is at ground potential. The success of the design depends on the interaction between the vertical elements, which results in the antenna providing a 50 Ω impedance match to a single feed line over a substantial portion of each band.

The GP146/440 is made of solid aluminum elements with stainless steel nuts and bolts.

I managed to assemble the ground plane in less than 15 minutes with nothing more than a crescent wrench.

The antenna uses a unique method of securing the radials; they are sandwiched between two pieces of aluminum plate. You insert the radials and gradually tighten the three bolts that hold the plates together. As the nuts and bolts tighten, the plates grab and clamp the radials in place.

The package includes saddles and mounting bolts that will allow you to clamp the antenna onto masts up to 1.25 inches in diameter. The coaxial cable connection is made to an SO-239 socket.

For this review I mounted the GP146/440 onto a 15-foot PVC pipe and fed it with low-loss coax. The setup was smooth and quick, especially considering the fact that I didn't have to tune the antenna.

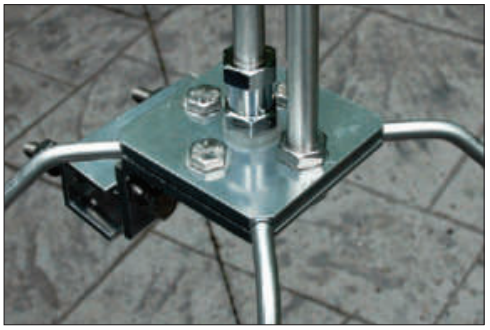
With the GP146/440 at the ready, it was time to sweep it with an analyzer. On 2 meters the antenna presented a reasonably flat 1.7:1 SWR across the band. On 70 centimeters there were some peaks and valleys with peaks as high as 2.5:1 at the band edges and as low as 1.5:1 elsewhere.

On the Air

The GP146/440 turned in reliable performance, even after being on the receiving end of a particularly nasty blast of rain and high winds. I enjoyed consistently good reports while making contacts through distant repeaters (on both bands). The antenna also acquitted itself well on simplex, including a remarkable tropo band opening when I was heard on 146.52 MHz at a distance of 400 miles. The GP146/440 isn't intended for satellite operating, but I couldn't resist the temptation to give it a shot. I made a number of contacts on the OSCAR 27 and OSCAR 50 satellites and also used the GP146/440 to monitor 70 centimeter CubeSat downlinks (despite not having a preamp at the antenna).

At just under $40, the Arrow Antenna GP146/440 is a good value, especially if you're looking for a dual-band antenna that you can essentially install and forget. And with its quick assembly in mind, the GP146/440 is also an excellent candidate for public service applications.

Manufacturer: Arrow Antenna, 911 East Fox Farm Rd, #2, Cheyenne, WY 82007; tel 307-222-4712; **www.arrowantennas.com**. *$39*



The top side of the GP146/440 base with the dual radiating elements and three bolts that secure the radial "sandwich" plates.

The underside of the GP146/440 showing the SO-239 coaxial connector.

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #121

Transient Protection

Last month's column dealt with ways to prevent damage to equipment if power were applied with voltage polarity reversed.[1] That is a pretty common problem, so it's good to protect against it — called *mitigation* — whether from a human caused accident or a wiring fault. Another class of problems also exists but isn't talked about much within the ham community — *transients*.

A transient, by definition, "…refers to momentary overvoltages or voltage reductions in an electric power system…" (*CRC Electrical Engineering Dictionary*) Just because a transient is momentary doesn't mean it can't cause harm. As you'll see in the following description of transients found in vehicles, they can be plenty damaging.

Table 1
Typical Vehicle Transients

Type	Voltage (V)	Energy (Joules)	Duration	Occurs
Load Dump	<125	>10	200-400 msec	Infrequently
Field Decay	–100 to +40	<1	200 msec	At turn off
Inductive	–300 to +80	<1	<320 µsec	Often
Mutual Coupling	<200 V	<1	1 msec	Often

Automotive Transients

You might think with power supplied by a battery, a vehicle's dc power system is reasonably well behaved. Unfortunately from an electronics view, that's not true, as you can see in Figure 1. The voltage in vehicles that use a *starting battery* as the energy source varies between 10.5 V (a discharged battery) to more than 15 V during heavy charging. The typical 13.8 V ±15% input voltage specification corresponds to a fresh battery during normal charging. The subject of this column, though, is not the dc supply voltage.

There are numerous ac and transient signals superimposed on that dc supply voltage — for example, the rapid current switching in the vehicle's alternator creates sharp (short duration) transients on the *power bus* (the heavy wiring that distributes power within the vehicle). If not adequately filtered by the radio, the result is a high pitched *alternator whine,* which follows the engine speed and is added to both receive and transmit signals.

SAE (Society of Automotive Engineers) Standard J1113, "Immunity to Conducted Transients on Power Leads," describes transients encountered on a vehicle's power bus such as these common occurrences:

- *Load Dump* — occurs when a loose battery connection opens up during charging and the alternator's energy is "dumped" on the power bus with no battery to hold down the voltage.
- *Alternator Field Decay* — occurs every time the vehicle is turned off and the alternator's stored energy has to be dissipated via the power bus.
- *Inductive Load Switching* — the kick back voltage from an inductive load (such as an electric window motor) being turned off.
- *Mutual Coupling* — transient energy that is coupled between conductors in a wiring harness.

Table 1 summarizes the electrical characteristics of these transients. There are quite a few more transients that are described in SAE Standard J1113 but these are common and cover the range of voltage and energy amplitudes that vehicle electronics have to deal with.

Obviously, some of those transients are pretty severe — such as the big load dump transient in Figure 2. It's a wonder anything survives being plugged into a vehicle. Your electronics are not going it alone, however, as the vehicle's manufacturer has built in some transient protection for you. As explained in the Littelfuse application note *Suppression of Transients in an Automotive Environment*, vehicle electronics are already protected by a *central suppressor* in the vehicle, usually located as close to the master control computer module as possible.[2] There are usually suppressors in other modules around the vehicle, too. This helps limit the voltage and energy levels to which your gadgets and radios are exposed. Nevertheless, it's a good idea to provide some limited protection.

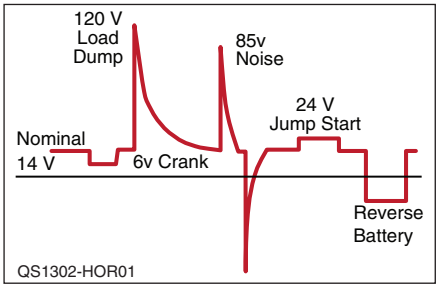


Figure 1 — Typical vehicle power system voltage levels. (Data courtesy of Littelfuse Corp.)

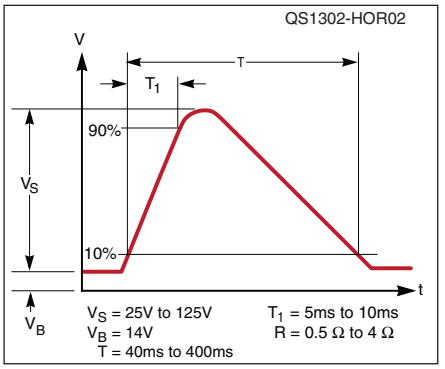


Figure 2 — The load dump transient that occurs when the connection between a battery and the alternator opens during charging. (Data courtesy of Littelfuse Corp.)

Electrostatic Discharge and Lightning

Another source of transients, well known to inhabitants of areas with dry weather, is *electrostatic discharge* or *ESD*. A sudden discharge of static electricity by a spark,

such as from walking across a carpet then touching a grounded surface, is a typical example of ESD. In fact, the standard ESD test generator uses a finger shaped probe.

There can be enough energy in an ESD to destroy semiconductors or scramble the operation of a circuit. A typical ESD transient lasts for less than 50 µsec but can generate voltages up to 15 kV. ESD transients can appear on power and signal wiring, connectors, controls and switches, displays — anything a finger can touch, even metal enclosures.

Lightning can obviously generate pretty significant transients though we aren't addressing protection from a direct strike in this column. An indirect or nearby strike can generate fast rising transients with energy levels equal to or larger than the automotive inductive transient and with voltages nearly as high as an ESD pulse.

Protective Components

There are several ways to protect electronics against transients — block them, route them away from the circuitry or dissipate their energy as heat. The goal is to limit the resulting voltage to levels the electronics can handle. Several different types of protective components have been developed to handle transients:

- *MOV (metal oxide varistor)* — partially conductive powder pressed into a disc or cylinder so that it is nonconductive up to its *clamping voltage*.[3] At voltages (of either polarity) higher than the clamping voltage, its resistance drops, limiting the voltage by dissipating energy as heat. MOVs are generally connected between the circuit being protected and ground so that the lower resistance causes the MOV to absorb the transient's energy and keep voltage at a safe level. After repeated transients, MOVs generally fail in a low resistance state.

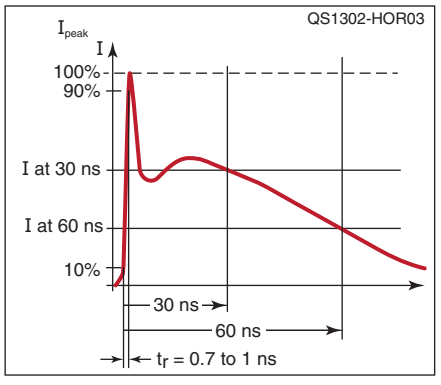


Figure 3 — ESD Transient waveform. (Data from standard IEC 61000-4-2.)

- *Transient Voltage Suppressor (TVS) Diode* — a special type of Zener diode that offers more precise clamping action.[4] Two TVS diodes back to back in a single package make a bipolar clamp that has similar characteristics to an MOV. Unless overloaded, TVS diodes can handle repeated transients without changing their characteristics.
- *Diode Clamps* — Most effective for ESD and fast transients, clamping diodes route energy away from the protected circuit into the power supply where it is absorbed by the filter components.[5,6] This limits the circuit voltage to one forward voltage drop beyond the power supply voltage.
- *RC Pulse Filtering* — Useful for both RFI and ESD, a series resistor followed by a capacitor to ground act as a low-pass filter, smoothing out transient voltages and dissipating some of the energy as heat.

Testing and Using Protective Components

You can observe the protective action of these components and methods on the workbench by constructing the test circuit in Figure 4. The input test signal is either variable dc (0 to 12 V) or a pulse train (square wave generator with a series dc blocking capacitor). You will also need a +6 V dc supply which can be made from batteries if you don't have a second power supply. The 1 kΩ resistor limits the current through the protective components.

Here are some typical components to use — feel free to substitute:

- MOV: V8ZA05P — clamps at 6 V.
- TVS: 1.5KE8.2CA — clamps at ±8.2 V (bipolar).

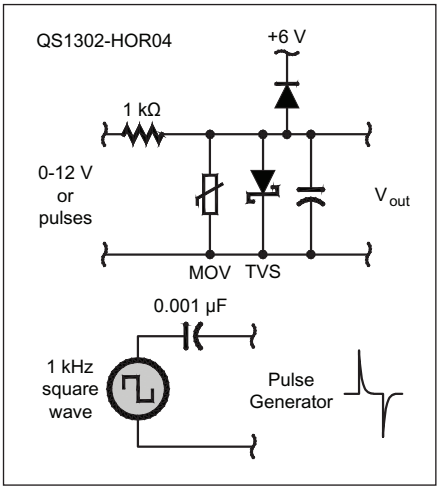


Figure 4 — Test circuit for observing the voltage clamping effects of different protection components.

- A 1N4001 general purpose silicon diode can be used for the clamping diode in this test.

Begin by connecting the MOV to the 1 kΩ resistor and monitor V_{OUT} with a voltmeter. Slowly increase the input dc voltage until the MOV begins to conduct, at which point the output voltage will increase more slowly than the input voltage. Take several measurements and make a graph of V_{OUT} versus V_{IN}. Replace the MOV with the TVS diode and repeat the experiment, plotting the input and output voltages on the same graph. Disconnect the TVS diode and connect the clamping diode from V_{OUT} to the 6 V supply and repeat the measurement and graph of input and output voltage. Observe and compare the different shapes of the clamping action by each device.

Disconnect the input dc voltage and the clamping diode. Create a pulse generator by connecting a series 0.001 µF capacitor in series with the output of a square wave generator. Set the square wave generator to approximately 1 kHz and a peak to peak output of at least 1 V. Connect the pulses to the circuit's input and observe them at V_{OUT}. Now connect a pulse filtering capacitor (use 0.001, 0.01, 0.1 and 1 µF capacitors) to the resistor and observe the effects of each capacitor in limiting the pulse peak voltage and lengthening it.

Summary

This short discussion just scratches the surface of transient protection. The referenced application notes can provide a lot more information — Littelfuse offers many application notes on its website and references such as Standler's book on transients is excellent and detailed.[7] In the meantime, considering adding protection to your circuits and equipment, especially mobile stations.

References

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

[2]Littelfuse, *Suppression of Transients in an Automotive Environment*, AN9312.5, 1999, **www.littelfuse.com/data/en/Application_Notes/an9312.pdf**.

[3]**www.resistorguide.com/varistor**

[4]**www.semtech.com/images/promo/What_are_TVS_Diodes.pdf**

[5]Littelfuse, *ESD Protection Design Guide*, **www.littelfuse.com/data/en/Applications/Littelfuse_ESD_System_Level_Guide.pdf**

[6]Littelfuse, *Tips for Enhancing ESD Protection*, **www.littelfuse.com/data/en/Application_Notes/Littelfuse-Tips_for_Enhancing_ESD_Protection.pdf**

[7]R. Standler, *Transient Protection of Electronic Circuits*, Dover.

Steve Ford, WB8IMY, wb8imy@arrl.org

PAR Electronics OA-50 6-Meter Antenna

If you're searching for a horizontally polarized omnidirectional antenna for VHF and above, you are bound to encounter a lot of loops. You'll see them cropping up in the form of circular "halos" or square "squalos." Both are essentially half wavelength dipoles that have been shortened and formed into loops. They work well, although the resulting radiation pattern can sometimes deviate from being truly omnidirectional and the 2:1 SWR bandwidth tends to be restricted as well.

The PAR Electronics OA-50 takes a different approach. The Omniangle antenna, as it is called, is actually longer than a half wavelength and rather than being a shaped into a circle or square the elements take the form of a triangle. The result is a more uniformly omnidirectional radiation pattern and a wider SWR bandwidth. This gives the OA-50 the ability to perform well across much of the "bottom end" of the 6 meter band.

Assembly

The PAR OA-50 is almost ridiculously easy to assemble. All you need is a Phillips head screwdriver. An impedance transformer mounts at the center of the triangle "base" with the help of two stainless-steel bolts. Next, you simply insert the two remaining 5/16-inch diameter aluminum tubes and gently bend them so that they mate with the plastic-shrouded tip assembly. Total time: less than 10 minutes.

What you have in the end is a triangle antenna that's 44 inches long at its longest point and about 41 inches wide. It is lightweight at only 1.5 pounds.

The reason for the impedance transformer, by the way, is because the Omniangle design is not resonant. That is, it doesn't present a 50-Ω impedance at the feed point. That being the case, the transformer's job is to convert the existing impedance to 50 Ω to match your coaxial cable (the transformer includes an SO-239 jack). The transformer is rated for 160 W continuous power.

Set Up and Test

To initially tune the OA-50 I attached it to a 10 foot fiberglass pole. After making my first sweep with the antenna analyzer, I discovered that the desired 2:1 SWR bandwidth was below the bottom edge of 6 meters. Not a problem. You tune the antenna by gently sliding the 5/16 inch tubes in or out of the main radiating element in equal measures. A quick adjustment of the tubes resulted in a 2:1 SWR bandwidth between 50.000 and 50.700 MHz with the SWR dipping to 1.2:1 at 50.250 MHz.

Although the OA-50 is less affected by ice and rain detuning compared to traditional VHF loops, PAR advises you to tweak the antenna to achieve a low SWR point about 50 to 100 kHz above your "favorite" frequency. The SWR will be only slightly higher and will "move" downward when the antenna becomes wet or icebound.

The transformer at the Omniangle feed point.

Mechanical tension keeps the angled aluminum tubes firmly in place. Even so, you can reduce the tension and slide them in and out for easy tuning.

On the Air

The OA-50 turned in an outstanding performance, despite the fact that I had it mounted only 15 feet above ground. I consistently enjoyed SSB contacts with stations 150 miles away and was able to work several grid squares more than 1000 miles distant during Sporadic E band openings.

I was particularly fascinated at how well the OA-50 worked for weak-signal JT65 and FSK441 meteor scatter. An omnidirectional pattern is hardly ideal when every bit of signal energy counts, but the OA-50 measured up to the challenge, giving me successful contacts out to 1200 miles in one instance. I'm eager to see what will happen with the OA-50 if we get some more F2 openings on the "Magic Band" during what remains of the current solar cycle peak.

Manufacturer: PAR Electronics, PO Box 645, Glenville, NC 28736; tel 828-743-1338; **www.parelectronics.com**. *$99.*

Steve Ford, WB8IMY, wb8imy@arrl.org

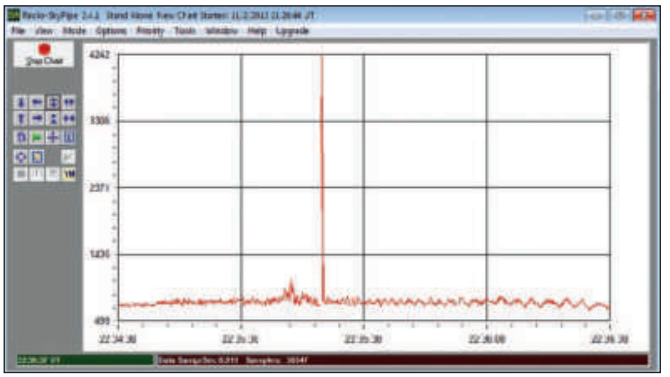
Watching Meteors — Among Other Things

We tend to associate meteors with annual meteor *showers*. The showers take place when our planet plows through streams of debris left behind by passing comets. As the rocks streak into our atmosphere at hypersonic velocities, they leave trails of hot plasma in their wakes. If a meteor is large enough, its trail is visible as a brilliant streak across the heavens.

Radio signals, especially those between about 28 and 150 MHz, can be reflected from these plasma trails and received quite far away (1500 mile paths are not uncommon). This type of signal propagation is known as *meteor scatter*.

But you don't have to wait for a meteor shower to explore meteor scatter. The truth is, meteors are plunging into our atmosphere constantly. As you read this sentence, tiny meteors are vaporizing miles above your head, leaving plasma trails as they go. Most of these trails are very short lived, but they all have the potential to reflect radio signals.

You've probably heard meteor scatter without realizing it. Perhaps you were tuning your transceiver above the top end of the 6 meter band, just exploring. Suddenly you heard a burst of noise, or maybe a brief chirp. You paused. What was *that?*



Using *Radio-SkyPipe* to monitor Channel 2 DTV pilot signal pings.

A meteor flashes across the sky during the November Leonid shower. [Photo courtesy of NASA]

There is a fair chance that what you heard was a signal that reached your antenna via meteor scatter. Television stations broadcasting on Channels 2 through 6 use frequencies that range from just above 6 meters to just below the FM broadcast band. You may have heard a "ping" from a Channel 2 ATSC digital TV pilot carrier at 54.310 MHz, for example. Since television stations radiate powerful signals 24/7, they are ideal beacons for detecting meteor scatter.

Tony Bombardiere, K2MO, pointed me toward a neat piece of *Windows* software that he has been using to keep an eye on meteor scatter activity as it varies over hours and even days. Known as *Radio-SkyPipe*, the software simulates an old fashioned paper strip chart, the kind you might see on a seismograph or lie detector. The software samples the output of your computer sound card (or external sound device/interface) and shows the result in a continuously scrolling display. With the audio output of a receiver or transceiver connected to your computer, *Radio-SkyPipe* will create a detailed visual recording that you can easily save to your hard drive for later examination — even after hours of monitoring.

If you have an Internet connection, *Radio-SkyPipe* also allows you to share your results with others online, or even stream live data to multiple recipients. The basic version is available free at **www.radiosky.com/skypipeishere.html** and the full-featured "Pro" version costs $49.95.

In addition to monitoring pilot carrier bursts from TV stations on Channels 2 through 6 (see Table 1), I have also been listening on the low end of the FM broadcast band. I select a standard broadcast frequency that appears to be unoccupied, turn on *Radio-SkyPipe* and let it run for an hour or so. When I review the results I almost always see a few pings. Many of these are courtesy of meteor scatter, but with an active air corridor overhead some are probably reflections from high flying aircraft, which is a pretty interesting phenomenon by itself.

If you want to try making some pings of your own, the next stop is *WSJT*, the free software suite by Joe Taylor, K1JT. You'll find it at **http://physics.princeton.edu/pulsar/K1JT/**. With 100 W on 6 meters to a loop antenna I can make meteor scatter contacts at just about any time of the day or night!

Table 1
Low VHF Digital TV Pilot Carriers

If monitoring in Lower Sideband (LSB), tune 1 kHz *above* the frequency shown.

Channel	Pilot Carrier (MHz)
2	54.310
3	61.250
4	67.250
5	77.250
6	83.250

Steve Sant Andrea, AG1YK, hk@arrl.org

Splicing Tubing, Retiring #47 Lamps and Watch Which Rotary Switch

Splicing Antenna Elements

For my V/UHF operations I frequently use an Arrow Antenna, model OSJ 146/440 (**www.arrowantennas.com**) solid aluminum rod J-pole, but I find the 5 foot length to be inconvenient when packing for travel to RACES or ARES® events. After some searching and minor fabrication with simple tools, I found a nice solution. If you have a similar antenna or just need to splice broken antenna elements, you may find this idea useful.

Arrow offers a version of the antenna with the longest element in two pieces that screw together, but that is not the version I have. So what to do? Since the antenna elements are ⅜ inch diameter, I looked for a ⅜ inch shaft coupler for a reasonable price, say $10 or less, but wasn't able to find one. The reasonably priced shaft couplers I found online were flexible couplers. One type had insulators between the two shafts being spliced. Clearly the antenna coupler must be conductive. The other type of flexible coupler was conductive from one end to the other, but was spiral cut so it looked like a coil. I believed a coil at the center of the element would probably ruin the desired antenna characteristics.

I thought that the coil effect would be at a maximum if the element rod ends were inserted the minimum distance into the coupler and at a minimum if the elements were butted up against each other inside the coupler. I tried this flex coupler type anyway and, using a DG8SAQ Vector Network Analyzer, found no difference in VSWR in either configuration. That was a pleasant surprise, but the amount of flexing was a real concern to me. The top element swayed considerably. I was concerned that this might set up an undesirable mechanical resonance with the entire antenna. I started looking for a better, non-flexing solution and found it at a local hardware store.

The solution was a hollow round aluminum tube with an inside diameter of ⅜ inch — a perfect fit. The minimum purchase was 3 feet, so I had to buy a much longer length of tube than the 2 inches I needed, but it was inexpensive.

So the plan was to cut the longest element in two and use a short section of the ⅜ inch tube as a collar to splice the pieces together. My feeling is that this makes for a stronger joint than the manufacturer's method since no material has to be removed from the element. The splicing tube is permanently attached to the upper element, allowing half the length of the splice to serve as a socket for the lower portion of the element. Some means of hand tightening the lower section to the tube is needed too.

There are many ways to solve these issues. My method is shown in Figure 1. I cut the longest element so the detached section was the same length as the remaining J-pole assembly: about 33 inches. I attached the tube to the upper element with four Allen screws (6 × 32) to discourage removal (see Figure 2). These bolts just happened to be in my junk box. It would be just as easy to use two longer screws that would pass through the splice and element, and secure them with a nut on the other side.

The lower section is held in place by an 8 × 32 eyebolt, which is easily turned by hand. I drilled through the splicing tube and element and then threaded the splicing tube for the eyebolt so no nut is needed. The eyebolt is attached to the upper section by a piece of flexible plastic cut from the lid of a food container. Now there is no loose hardware to drop and potentially lose.

The modified antenna received and transmitted successfully on both bands and an antenna analyzer sweep showed no meaningful difference in VSWR before and after the modification.

Another antenna system feature that I find very convenient is visible in Figure 1. The wooden dowel clamped at the bottom of the J-pole allows me to install the antenna into the mast sections I use for both portable and home operation. There's no need to tighten any nuts since gravity keeps the antenna securely in the mast. This makes for a true grab-and-go installation. There are wing nuts holding the dowel in place, so no tools are needed to remove the dowel if circumstances require. — *73, Doug Hart, AA3S, 6289 Beechwood Dr, Columbia, MD 21046,* **aa3s@arrl.net**

Figure 1 — The disassembled antenna ready for compact storage. Also note the wooden dowel that can slip into a mast. The antenna will then be held in place by gravity with no nuts and bolts required, which helps you get on the air more quickly. [Doug Hart, AA3S, photo]

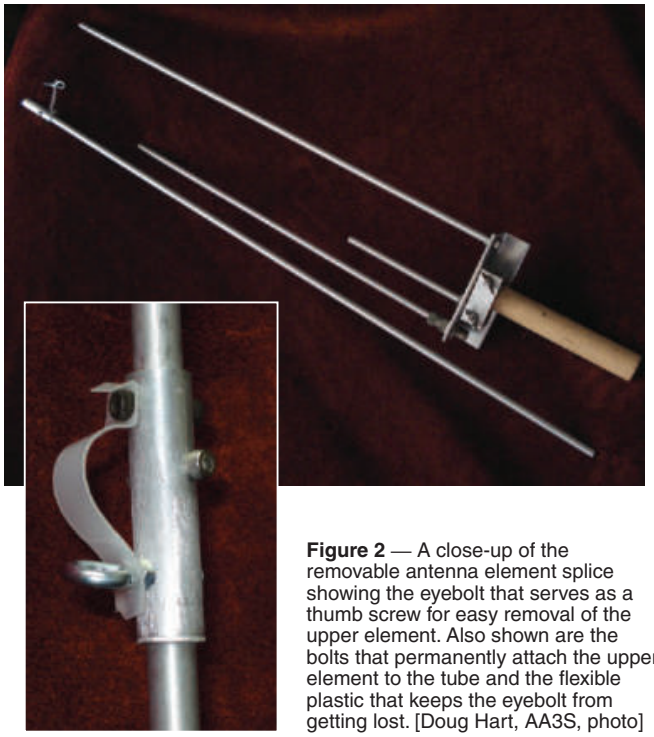


Figure 2 — A close-up of the removable antenna element splice showing the eyebolt that serves as a thumb screw for easy removal of the upper element. Also shown are the bolts that permanently attach the upper element to the tube and the flexible plastic that keeps the eyebolt from getting lost. [Doug Hart, AA3S, photo]

LED Upgrade for L-1500 #47 Lamps

There are still a great many pieces of equipment out there using the old #47 lamp or one of its cousins. My Ameritron AL-1500 is one of them.

I discovered a nice white LED at RadioShack (part number 276-0024) that I have been using to replace some of the old incandescent bulbs in my equipment. A similar part is available from Mouser (part number 749-R20WHT-F-0160). Mouser's price is much lower per unit, but for a small quantity the RadioShack price is competitive when you consider the shipping cost and delay.

If you have tried to use a more conventional bullet shaped LED to illuminate a dial or meter the result is typically a bright spot of light on part of the face with the rest dark. This is due to the narrow viewing angle of most LEDs. These new LEDs emit a white light with a wide viewing angle of about 160°. This makes them an excellent choice for back or side lighting meters.

Unlike the incandescent lamps used in my Ameritron, LEDs need a series resistor to limit the current flow. My replacement uses two LEDs per meter to duplicate the original two lamps. I was going to give each LED its own limiting resistor but decided that it would be easier to put two LEDs in series with a single resistor. This worked just fine; I couldn't see any difference in brightness when using separate limiting resistors or with two LEDs in series with a single resistor.

The LED has a recommended forward current (I_f) of 20 mA and a forward voltage drop (V_f) of 3.5 V. To compute the limiting resistor value (R_L), simply subtract the V_f from the supply voltage (V) and then divide by the forward current. I used two LEDs in series so the LED V_f needed to be doubled. The general formula for this is:

$$(V - (2 \times V_f)) / I_f = R_D$$

This is the minimum value of the resistor. You might want to experiment with the resistor value to adjust the illumination level. I found a 560 Ω resistor worked in my AL-1500.

***Warning**: This is a high voltage amplifier. Even though we are working in the low voltage section, this amplifier can kill! Be sure to unplug the amplifier and discharge the high voltage before doing anything else. [Refer to the AL-1500 manual and the "Safety" and "Power Supply" chapters of the* Handbook *for more information on high voltage safety. —* Ed.*]*

In my AL-1500 amplifier (**www.ameritron.com**) the incandescent bulbs are held in place above the meters by little 3AG fuse clips. Figure 3 shows the mounting clips holding the LED replacements. I fashioned a small mounting from a piece of prototyping board by cutting it to fit between the clips. This is about 2.5 inches.

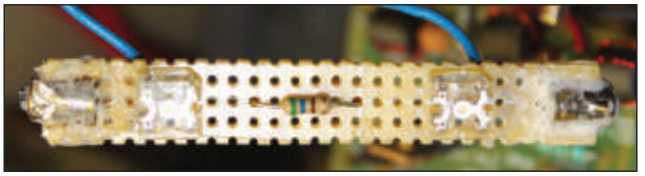


Figure 4 — This is the completed LED assembly. Note the pilot lamp bases glued to the board ends for mounting and the single resistor wired in series with the two LEDs. [Alfred Yerger II, K2ATY, photo]

The spacing between the pins on the LEDs is 0.3 inches so I cut the board 0.4 inches wide. I then broke away the glass on the old bulbs, leaving only the metal base. [Wrap the bulbs in a piece of cloth when breaking the glass to prevent injury from flying chips. — *Ed.*] I cut a slot in each end of the board large enough to hold the lamp base and then glued them in place.

I mounted two LEDs on the board, one near each end with the series resistor in the center (see Figure 4). I connected the wire from ground to the cathode of one LED and the supply voltage to the anode of the other LED. The assembly then simply snaps in place over the meters. I repeated the process for the other meter and — presto — once again I had illuminated meters. Additionally, the power for the grid current meter light comes from the high voltage delay relay circuit. The grid meter LEDs illuminating indicate that the high voltage has been applied and the amplifier is ready to operate.

I think the color and intensity of the LEDs look better than the original lamps and I am expecting a much longer life from the LEDs. Since all of the Ameritron amplifiers in this series are constructed essentially the same way, I am sure this modification will work for any of these amplifiers. These LEDs can also be easily adapted to replace the lamps in almost any piece of equipment. *Note*: if your equipment uses low voltage ac to power the lamps you will need to include a rectifying diode as the LEDs have a very low reverse breakdown voltage and cannot handle ac. *— 73, Alfred T. Yerger II, K2ATY, 1312 Union Ave, Newburgh, NY 12550-8907*, **k2aty@arrl.net**

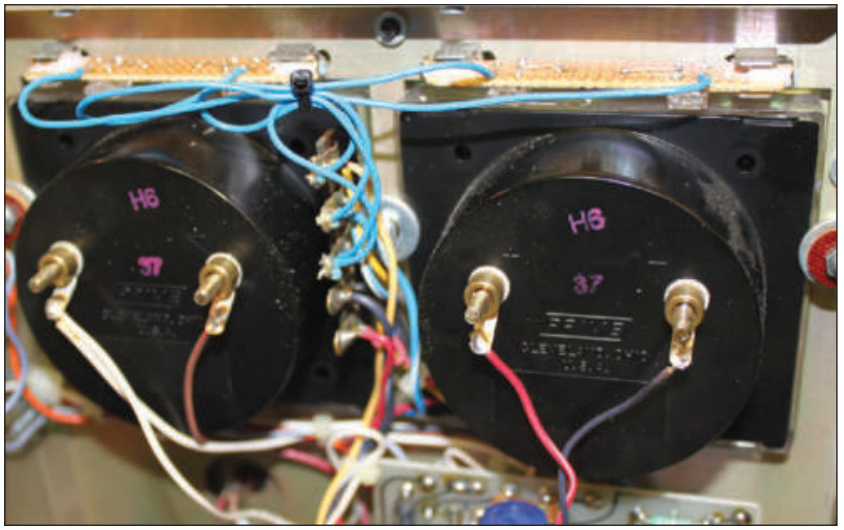


Figure 3 — Here are the LED boards mounted above the meters. The pilot lamp bases are used to secure the board to the old lamp clips. [Alfred Yerger II, K2ATY, photo]

Make Before Break Can Break What You Make

I toiled for hours crafting a new chassis for an oscillator module to act as a precision time base. It required several voltages to operate and since it was mounted on a shelf attached to a 19 inch rack mount faceplate, there was room for some of the power cubes in my junk box. There was ample space on the faceplate to add a voltmeter to monitor the supply voltages. Next to the voltmeter I mounted a wafer switch to switch the meter between the 15 V and 5 V dc supplies. I tested all of the equipment prior to assembly

and the wiring was checked before powering up the chassis.

The meter came to life when I turned on the power and it measured both voltages accurately. Unfortunately, I heard a small arc-like "pop" when I rotated the switch between the two voltages. Then the oscillator module failed to generate a signal and I realized that something had gone wrong.

I thought back to the "pop" I heard and unplugged the oscillator module from the chassis. While rotating the wafer switch very slowly I noticed the voltage change abruptly from one value to the other with no zero voltage indication between. I realized the wafer switch had a "make before break" wiper. Such switching has its place in keeping a circuit loaded while selecting various outputs (switching speakers), but not in switching between voltages to be measured or supplied.

As I switched from 5 V to 15 V there was a momentary connection of the two separate power sources placing 15 V on the 5 V line. This damaged all the digital logic. Don't repeat my mistake. Check those rotary switches before use and remember that they come in "make before break" and "break before make" varieties. My belated solution was to move the voltage sources to nonadjacent positions placing a dead zone between them. — *73, Den Nendza, W7KMV, 4219 E Oxford Dr, Tucson, AZ 85711*, **w7kmv@arrl.net**

Cardboard Wire Separator

I needed to replace a failed power transformer. I wanted to bench test the replacement before installing it. To keep the numerous leads from touching one another, I cut a 2 inch wide strip of corrugated cardboard so as to expose the individual cells. Then I slid the wires into the cardboard cells (but not far enough for them to contact each other) to keep them separated. To prevent wire slippage or movement I taped the wires where they entered and exited the cardboard separator. In addition, you can make notes or measurements on the cardboard. — *73, Roy Lehner, WA2SON, 5464 Oakwood Dr, North Tonawanda, NY 14120,* **wa2son@toast.net**.

E-mail Alerts

Many Amateur Radio websites can be set up to send you an e-mail when something happens. For example, **www.dxmaps.com** can be configured to send an e-mail alerting you to 6 meter propagation.

Receiving an e-mail at your computer is nice, but what if you are away from it when there's that big opening? Why not have a text message sent to your cell phone instead? You may not be aware that your cell phone probably has an e-mail address. If you have e-mail service on your cell plan, create another login to those websites and use your cell phone e-mail address. Your cell phone will display a text message whenever an e-mail is sent to your cell phone's e-mail address.

Most of the time, a cell phone's e-mail address is **yourphonenumber@yourcarrier.com**, but please check with your carrier to verify this.

Another method is to set up your e-mail client to forward a copy of these ham radio related e-mails to your cell phone's e-mail address. — *73, Sebastian Acosta, W4AS, 19340 Franjo Rd, Cutler Bay, FL 33157-8818*, **w4as@arrl.net**

Easy Rotator Correction Calculator

Many hams have antennas with rotators that don't point in the direction the indicator shows. It is a big job to climb up the tower and reposition the mast to the correct bearing, especially in bad weather. Large arrays tend to be shifted out of calibration frequently due to their high wind loads.

I devised a solution to this problem. My M^2 KT-34 (**www.m2inc.com**) was pointing south when the rotator indicated it was somewhat north. Rather than doing the tower chore again, I made up this error calculator so that I know where to point the beam from the shack.

All that is required is a common CD and CD case. Turn the CD over so that the *data* side is facing out and fix it back in the case. Using labels or a fine felt marker, label it N, S, E and W, and add some tick marks for intermediate bearings. Do this about an inch from the CD's outer edge.

Then do the same on the outside of the clear CD case, at about the level of the CD's edge (see Figure 5).

To use the calculator, first aim the beam at any of the four main bearings according to the rotator's indicator. Then go outside and see where the beam is actually pointing. Open the CD case and rotate the CD to coincide with the direction the rotator says. The calculator is now ready for use.

Let's say the beam is facing south when the indicator shows north. You want to work VP6T on Pitcairn, which is more or less southwest from you. The rotator calculator now shows you must turn the beam to northeast on the indicator.

If you can't climb the tower to readjust your beam, just adjust the calculator to the current beam heading and you are good to go. — *73, Pat Bunsold, WA6MHZ, 1615 La Cresta Blvd, El Cajon, CA 92021-4072*, **wa6mhz@cox.net**

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

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

Figure 5 — If you're having problems keeping your beam aligned, this handy calculator will help keep your aim true even if your rotator indicator isn't. [Pat Bunsold, WA6MHZ, photo]

A Professional Approach to Amateur History

The Historical Preservation Committee is working to save Amateur Radio's past for future education and enjoyment.

Michael Marinaro, WN1M

In my last *QST* article, I wrote about the efforts of the ARRL® staff and volunteers to preserve and conserve the ARRL's many historical artifacts.[1] Judging from the responses to the article, many League members appreciate these efforts.

The ARRL's Historical Collection contains numerous material items concerning the history of Amateur Radio and the ARRL. The Historical Preservation Committee (HPC) has made significant progress in the past year toward its objective of properly safeguarding the extensive heritage represented in these materials.

At the March 2012 meeting of the ARRL Board, President Kay Craigie, N3KN, appointed International Affairs Vice President Jay Bellows, KØQB, as chair of the HPC.[2] Mr Bellows and the Committee were given the responsibility of developing contemporary "Terms of Reference" for the maintenance and usage of the ARRL's collection of documents and artifacts. Under Mr Bellows' guidance and leadership, the Committee prepared a comprehensive document that the Board of Directors accepted at the July 2012 meeting. What follows is from the preamble to the HPC's charter:

ARRL Historical Committee Collections Policies and Terms of Reference

Introduction

The core purpose of ARRL is "to promote and advance the art, science and enjoyment of Amateur Radio." The historical collection is one of many ARRL activities maintained to further the Association's core purpose. The Collection provides a record of significant activities, contributions and accomplishments of ARRL and amateurs fostering a better understanding and appreciation of amateur radio's origin and development over the years.

ARRL Historical Collection Statement of Purpose

The ARRL Historical Collection seeks to collect, identify, preserve, conserve documents, objects and images significant to the history of ARRL and amateur radio, particularly in the United States, and to facilitate their use in understanding the history and importance of amateur radio and ARRL over time.

Although the HPC's activities have always been conducted in accordance with recognized professional standards and practices, the charter provides us with a comprehensive document that directs the mission and presents formal guidelines for the accession, care and deaccession of documents, images and artifacts.

The Collections

The complete Historical Collection is currently comprised of 14 individual collections. The largest of these individual collections is the archive of paper documents (Collection C). The other 13 collections, numbered I-XIII (see Table 1), include a wide range of paper, photographic and audio/visual materials and equipment (see Figures 1 and 2). The collections are active and open ended. New in-house discoveries and outside contributions frequently result in additions to them all.

Currently, each of the 14 collections has its own database, accessible only from an in-house computer at HQ. Each database contains identifying information, pertinent descriptive information and the location of each item, whether it is on display or in storage. Soon these catalogs will be folded into an overall master database program — most likely Microsoft *Access*. This will be the next step toward the ultimate goal of making the archive database available on the ARRL website and will provide ready access for the ARRL Centennial planners.

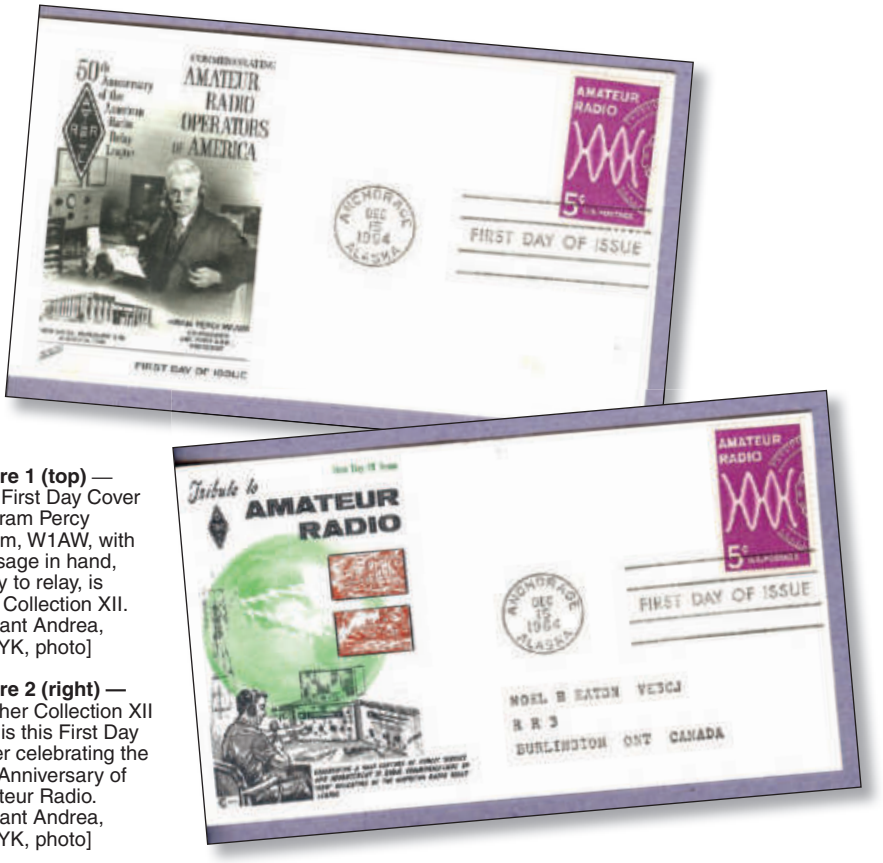


Figure 1 (top) — This First Day Cover of Hiram Percy Maxim, W1AW, with message in hand, ready to relay, is from Collection XII. [S. Sant Andrea, AG1YK, photo]

Figure 2 (right) — Another Collection XII item is this First Day Cover celebrating the 50th Anniversary of Amateur Radio. [S. Sant Andrea, AG1YK, photo]

[1]Notes appear on page 71.

Figure 3 — The HQ museum contains a range of equipment covering nearly 100 years of radio technology.

Table 1
The ARRL Historical Collections

Collection Number	Title
C	Paper Document Archive
I	Antique Books and Pamphlets
II	ARRL Early Publications
III	Foreign Journals and Booklets
IV	*QST* Plate Negatives
V	Video Tapes
VI	ARRL Lending Library — Film and Tape Media
VII	ARRL Training Aids
VIII	ARRL Annual Reports
IX	Early Call Books and Station Listings
X	ARRL Slide/Cassette Programs
XI	Single Cassette Tapes
XII	Stamps and First Day Covers
XIII	Equipment

We will shortly add Collection XIV, which will consist of scanned images that appeared in *QST* in the 1950s, '60s and '70s. The HPC will select black and white print images with particular historic value, each original print image will be scanned, the scanned image will be added to an online image archive and then the original print will be preserved using accepted archiving methods.

Preserving Our Paper Past

A major future undertaking for the HPC is the digitization of the paper document archives. These files are currently housed in file cabinets and organized by topic, and a computerized directory of these files has been completed. Their digitization will require the design of an organizational plan for the Collection with a dedicated staff archivist to manage it. The staffing of an archivist will require additional funding. An application plan for funding is being formulated.

From Spark Gaps to Superhets

Of note is the fact that the ARRL Laboratory staff has undertaken responsibility for Collection XIII; that is, the hardware, equipment and related artifacts that show the march of technological progress in radio for the past 100 years. Laboratory Manager Ed Hare, W1RFI, and Test Engineer Bob Allison, WB1GCM, assisted by volunteer Jonathan Allen, K2KKH, are accumulating and inventorying items from various storage locations. The many pieces of vintage equipment on display at HQ as well as the approximately 450 items that are stored in our warehouses comprise Collection XIII. As a demonstration of the value of this effort, the Laboratory personnel have set up an historical exhibit in an area adjacent to the Lab for visitors to HQ to view (see Figure 3). Included in this display of vintage equipment are a large breadboard spark gap transmitter and two working stations — a 1950s era

Figure 4 — The fully operational AM station the ARRL Lab crew has set up in HQ's new museum area. The station uses a Johnson Viking Valiant transmitter, National NC-303 receiver and a Millen 92200 transmatch.

Figure 5 — The ARRL Lab crew also assembled this 1960s era Novice station that includes a Drake R-4A receiver, a Hallicrafters 2/6 meter AM transmitter and a homebrew 50 W AM transmitter.

50 Years of OSCAR

One year ago the ARRL's OSCAR 1 was featured on the front cover of this magazine, in celebration of 50 years of Amateur Radio in Space.[3] The OSCAR 1 story continues, thanks to a donation of historical artifacts made by Lance Ginner, K6GSJ, one of the satellite's key builders. Not long after the story was published a 41 pound box arrived at the ARRL Lab, containing documents, test data, reception reports and media — all evidence of the pioneering work of Project OSCAR. Thanks to the work of our dedicated volunteers, Volunteer Custodian Michael Marinaro, WN1M, and Jonathan Allen, K2KKH, this archive of unique material is cataloged and preserved for future historians. Visitors to the ARRL Laboratory can see and hear the ARRL's OSCAR 1 prototype (one of three built) at the entrance to the Lab's Vintage Equipment Exhibit. Transmitting on 145.080 MHz (into a 50 Ω resistor), OSCAR sends the word "HI" in Morse code continuously, as its pioneering space traveling brother did in 1961. An adjacent modern 2 meter transceiver pipes in OSCAR's chirpy signal, which is truly a one of a kind experience. — *Bob Allison, WB1GCM, Historical Preservation Committee Staff Liaison*

A delight-filled moment while viewing the Lance Ginner, K6GSJ, OSCAR Archive. Left to right: Mike Marinaro, WN1M, holding a vintage OSCAR Locator; Jonathan Allen, K2KKH; ARRL Test Engineer Bob Allison, WB1GCM, holding the March 1962 *QST* Cover Plaque Award presented to Edgar Hilton, W6VKP, for his article on locating OSCAR and W1AW Station Manager Joe Carcia, NJ1Q. [S. Khrystyne Keane, K1SFA, photo]

AM station and a 1960s era Novice station (see Figures 4 and 5). Learn more about the museum and see photos and a video tour at **www.arrl.org/arrl-vintage-amateur-radio-equipment-exhibit**.

The members of the HPC have great ambitions for this project as we work to preserve a century of radio history. We gratefully acknowledge the generosity of The YASME Foundation (**www.yasme.org**) and others whose support has enabled our progress. The Historical Preservation Committee consists of only a few staff members and volunteers dedicated to preserving the heritage of Amateur Radio for the edification of the amateur community and the enlightenment of the public. As we publicize our 2014 Centennial, the ARRL Historical Collection will spotlight the contributions Amateur Radio has made to the many forms of electronic communication we enjoy today.

Raise the Tower

In order for us to continue to preserve the ARRL's vast collection of historic material, we need the support of you, our members. If you would like to support our efforts please contribute to this project. For information please contact Chief Development Officer Mary Hobart, K1MMH, at **mhobart@arrl.org**, or go directly to the online donation form at **www.arrl.org/arrl-donation-form** to make your tax deductible contribution to the Historical Preservation Fund.

Notes

[1]M. Marinaro, WN1M, "Ham History SOS," *QST*, Dec 2011, pp 58-60.

[2]"Minutes of ARRL Executive Committee, Number 496, St Louis, Missouri, March 24, 2012," Minute 2.

[3]B. Allison, WB1GCM, "Project OSCAR," *QST*, Feb 2012, pp 80-81.

Michael W. Marinaro, WN1M, an ARRL member, was first licensed in 1952 as KN2CRH. He has been licensed continuously since then and holds an Amateur Extra class license. Michael graduated from the City University of New York and worked in the financial industry until his retirement. He has a master's degree in History from Central Connecticut State University. Michael has three stations, one a Collins S-Line, which he uses to operate CW and RTTY on all HF bands. Michael is currently the ARRL's volunteer custodian working to organize and preserve the history of ham radio as told by the League's extensive collection. He can be reached at PO Box 404, 250 Cold Brook Rd, S Glastonbury, CT 06073-0404, **wn1m@arrl.net**.

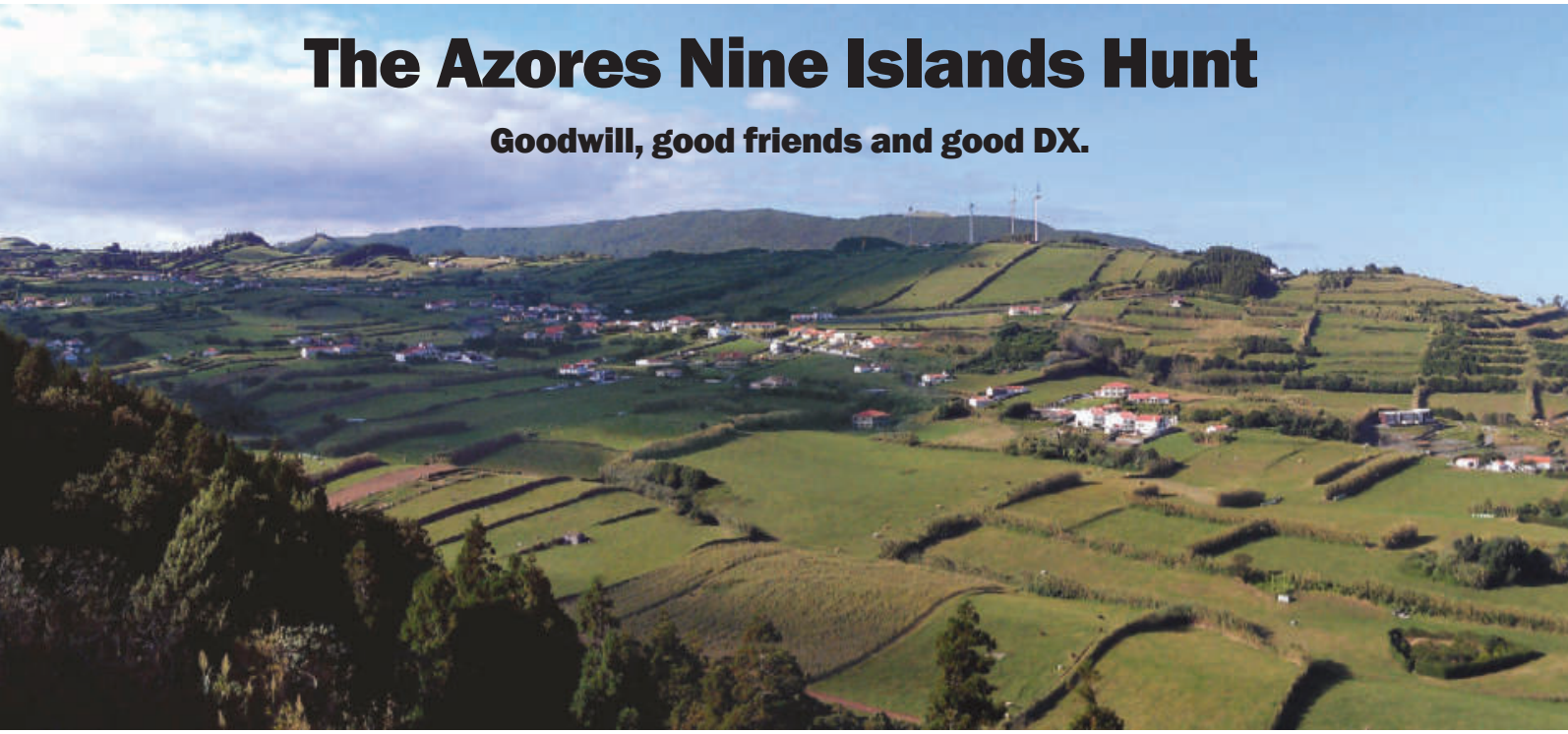
New Products

Frequency Synthesizer Kits from Reactance Labs

OpenSynth frequency synthesizer kits from Reactance Labs are intended for use as local oscillators in microwave radio projects and as beacon transmitter sources. Kits are available for 1152, 2160, 2556 and 3312 MHz, as well as customized versions that cover select narrow bands in the 400 to 3500 MHz range. The OpenSynth is an open source design, meant for modification and customization by the builder. The OpenSynth measures 1.5 × 2 inches and requires 12 V at 140 mA. An onboard microcontroller sends commands to a PLL module that is powered by two low noise voltage regulators. The output is buffered with a wideband gain stage and features a user selected attenuator to set a desired output level. Price: $150. For more information, or to order, visit **www.reactancelabs.com**.

The Azores Nine Islands Hunt

Goodwill, good friends and good DX.



This panoramic view to the west from the CU7CRA club station on Faial includes four wind turbines on the hill to the left of the terraces.

Mike Corey, KI1U

Often we hear of DXpeditions to far off places with no Amateur Radio population or in some cases with no population at all. The goal is usually to get there, make as many contacts as possible and make it back home safely. Occasionally we hear of "seed planting" DXpeditions that have an added goal of increasing the resident amateur population. Then there are the vacation and work expeditions where contacts take second priority to relaxation or a specific job. Each of these types of DXpedition are great in their own right, but there is yet another type — the tourism DXpedition.

In 2012 the Azores-Finland Friendship Consortium, Azores Tourism and the Amateur Radio associations of the Azores developed an operating event that sought to promote Azores tourism, help strengthen Amateur Radio in the Azores, promote the use of Amateur Radio during emergencies and put all nine islands of the Azores on the air during a 24 hour period. The project was called the Azores Nine Islands Hunt (**azores-islands-hunt.com**) and was on the air September 28-30, 2012.

The Azores

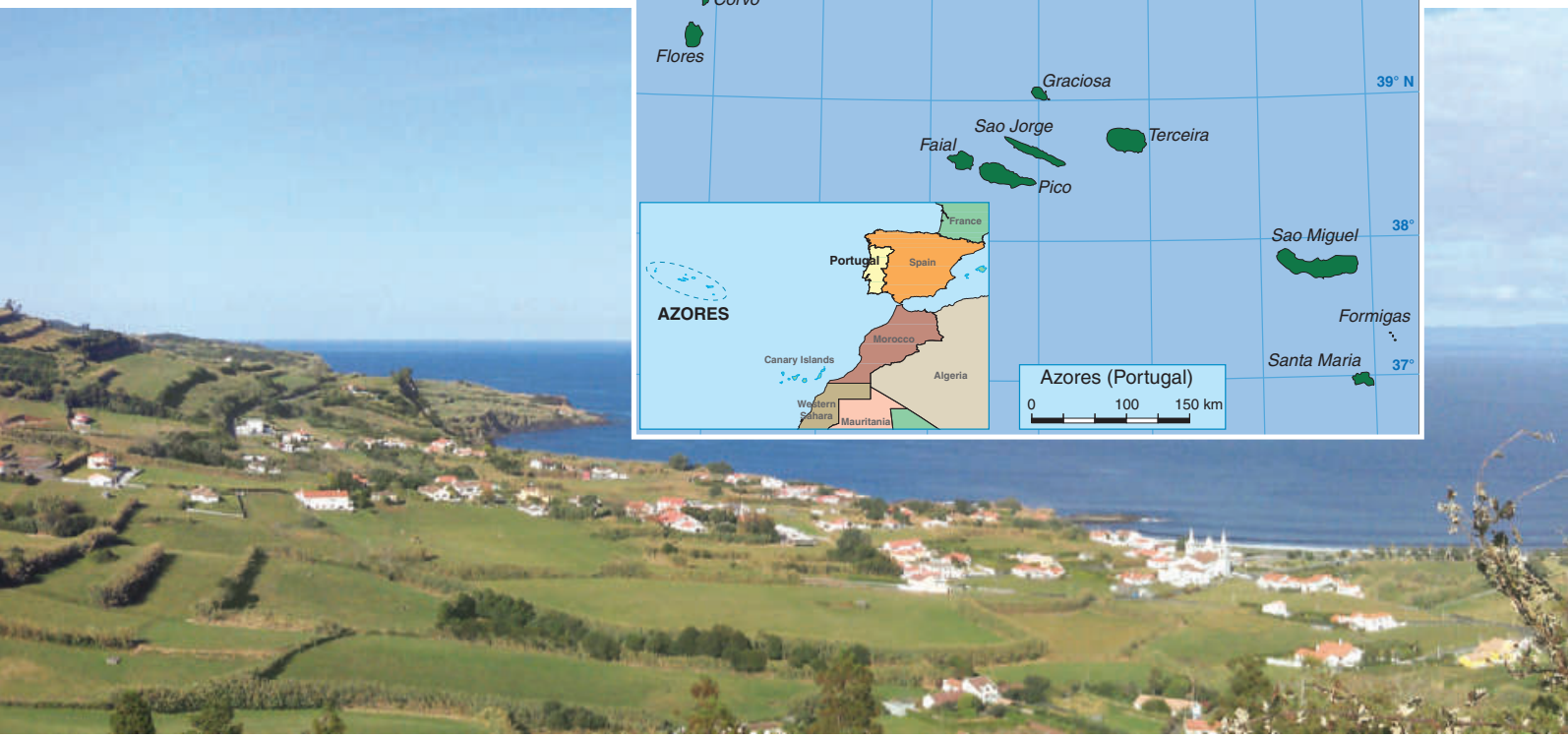
The Azores are a chain of nine volcanic islands in the Atlantic Ocean that lie about 1500 km west of Lisbon. They are the farthest western point of Europe. The Azores, like Madeira, are an autonomous region of Portugal. The landscape, which is lush and green, is dominated by the remnants of the island's volcanic past. The Amateur Radio prefixes for the islands are CU1-9; the number in the prefix identifies the island the station is on. Visiting amateurs use CT8/home call.

Background

Many amateurs active on the HF bands and during contests have logged many contacts with the Azores. Super contest stations CU2A and CR2X are regular participants in major HF contests. These stations are the work of the Azores-Finland Friendship Consortium, which consists of Fernando Tavares, CU2BV; Jose Melo, CU2CE; and Francisco Gil, CU2DX; and from Finland Martti Laine, OH2BH/CU2KG; Toni Linden, OH2UA/CU2KI; and Juha Hulkko, OH8NC/CU2KH. The idea of a nine islands hunt originated with this group of amateurs.

A significant amount of work had to be done to pull off such an operation. The event would

This is the view of Mt Pico on the neighboring island of Pico as seen from the town of Horta in Faial. At 2351 meters, Mt Pico is the highest point in Portugal.



need sponsorship, local hosts had to be found, coordination amongst Azorean hams was needed, a team of operators had to be gathered and a budget planned. The organizers divided up these tasks; CU2BV served as chairman, CU2CE coordinated the amateurs on the nine islands, CU2DX worked with the Azorean airline SATA and Azorean Tourism, and OH2BH took care of bringing in an international team of operators.

Here is Rich, KE3Q, in front of the CU7CRA club station in Horta.

The Operators and Hosts

The operators who were invited to participate represented eight countries and included 18 amateurs (see Table 1). Also invited to participate were representatives of both the Amateur Radio and local press. Attending were Alex Strutzke, DH9AS, from *CQ DL;* Adelino Francisco, CT1AL, the director of Portugal's *QSP* magazine; and Fernando Abreu the director of the newspaper *Notícias de Viseu*. Each team of two operators was assigned to a different island. Local amateurs served as the teams' hosts and also participated in the event.

I am certain that I can speak for the members of the eight other teams when I say that the hospitality shown by our local hosts was beyond compare. Local amateurs took time away from their jobs, families and daily life to host the teams. They worked with the organizers long before the teams arrived, participated in pre-event activities on São Miguel and made sure the teams were taken care of during the operating event. The local hosts deserve high praise for their work, generosity and true spirit of international goodwill.

Gathering at São Miguel

During the week before the Azores Nine Island Hunt weekend the teams, hosts and organizers met in Ponta Delgada on the island of São Miguel. This was a chance for us all to meet one another before heading to our respective islands. The arrival of the teams was staggered due to different departure cities and the American teams were delayed by 12 hours due to hurricane Nadine, which was tracking near the islands.

Our team arrived late on Tuesday, September 25. CU2BV met us and shuttled us to our hotel for a nice dinner and some rest. On Wednesday and Thursday we had a chance to see some of the sights of São Miguel including Sete Cidades, a walking tour of Ponta Delgada, a whale watching boat ride and Furnas. We also had a chance to gather at Associação de Radioamadores dos Açores (CU2ARA) headquarters for a reception on Wednesday evening and to participate in a panel discussion about the event and emergency communications on Thursday evening. Group lunches and dinners offered the teams additional opportunities for fellowship.

On to Our Islands

On Friday the teams departed to their respective islands. My teammate Rich Boyd, KE3Q,

Table 1
Islands, Teams and Hosts

Island	Prefix	Club	Call	Host	Team	Operators
Santa Maria	CU1	Associação Radiomadores Marienses	CU1ARM	Sergio, CU1AAD	Finland	Juha, OH8NC Kimmo, OH9MDV
São Miguel	CU2	Associação Radiamadores dos Açores	CU2ARA	Guilherme, CU2IF	Norway	Marius, LB3HC Ghis, ON5NT
Terceira	CU3	União Radiamadores dos Açores	CU3URA	Domingos, CU3BS	USA 1	George, N2GA Diane, K2DO
Graciosa	CU4	Associação Radiamadores da Graciosa	CU4ARG	Guilherme, CU4AB	Germany	Franz, DJ9ZB Richard, DF9TF
São Jorge	CU5	No Club	CU5AM	Jose, CU5AM	Canada	Yuri, VE3DZ Ed, VE3FWA
Pico	CU6	Grupo Radioamadores do Pico	CU6GRP	Jorge, CU6AB	Denmark	Alex, OZ7AM Kenneth, OZ1IKY
Faial	CU7	Clube Radioamadores do Faial	CU7CRA	Manuel, CU7CA	USA 2	Mike, KI1U Rich, KE3Q
Flores	CU8	Associação Radioamadores das Flores	CU8ARF	Frederic, CU8AAE	Belgium	Carine, ON7LX Claude, ON7TK
Corvo	CU9	No Club	CU9AC	Joao, CU9AC	Great Britain	Nigel, G3TXF Michael, G7VJR

and I along with USA Team 1, George Tranos, N2GA, and Diane Ortiz, K2DO, left São Miguel. Our first stop was Terceira, which was where George and Diane would operate. Rich and I went on to Faial.

The city of Horta on Faial is a well known stop for mariners. The walls of the port are covered in paintings from folks who have stopped there and the walls and ceilings of Peter's Café are decked out in flags from seafarers who have stopped in.

Our local host, Manuel Bettencourt, CU7CA, picked us up and brought us to his home a couple of miles from the airport. There we met his family and had a nice lunch at a café. Manuel's daughter Vanessa, CU7CE, also served as our host and translator. After a little sightseeing near the island we made our way to the CU7CRA club station.

Here is the Faial team, from the left: Christ Trensen, ON7TC; Rich Boyd, KE3Q; Manuel Bettencourt, CU7CA; Vanessa Bettencourt, CU7CE; Mike Corey, KI1U; Gerald Kropp, DL8HAG, and his spouse, and Jose Barcelos, CU7MD.

Once we arrived, we began setting up and testing antennas. I made some test contacts signing CT8/KI1U. Operating on 10 meters I contacted quite a few new Technicians, which was as much a thrill for me as for them. Once everything was set up and tested, we called an "All Islands" net on 40 meters. This was a test to see how well the nine islands could communicate using Amateur Radio during an emergency. Since each team's setup was different, ranging from club station with Yagis to DXpedition style, this had a certain realistic quality to it. CU7CRA served as net control as each island checked in and reported the condition of their station, basic weather data and some unique facts about the island they were on.

Another unique operating event on Friday was an attempt at making satellite contacts via the FM bird AO-27. I operated from a ridge overlooking the city of Horta with clear views to the west. Back in Connecticut, outside ARRL® HQ, Sean Kutzko, KX9X, was ready and looking to the east. AO-27 only made it 7 degrees above the horizon on my side in Horta but a quick contact was made. It was amazing to span such a distance with only 5 W and a handheld transceiver.

On Saturday at noon the Nine Islands Hunt began. We had two stations set up; an Elecraft K3 transceiver running 100 W to a 40 meter dipole and a Yaesu FT-950 running 100 W to an Optibeam. Despite being plagued by technical glitches we managed just over 1600 contacts. Also operating from CU7CRA was José Barcelos, CU7MD, and Gerald Kropp, DL8HAG. Gerald just happened to be on a cruise that stopped in Horta and was brought to the station by José.

The event wrapped up at noon on Sunday. After packing everything up and checking out of the hotel, we went back to Manuel's home for a farewell lunch. The few hours we were

The town of Sete Cidades near Ponta Delgada on the island of Sao Miguel is built at the bottom of a volcanic crater.

A group photo of the entire Azores Nine Islands Hunt group at taken in the rear of CU2ARA headquarters.

While at Furnas we stopped for lunch. The Azores are volcanic islands and at Furnas the volcanic heat is used to cook meals. It is the Azorean equivalent of a barbeque. Here our meal is pulled from the ground after being "cooked" by the volcanic heat. It then goes to the restaurant's kitchen for final preparation.

Table 2
Contacts by Country

Country	Contacts
USA	5438
Germany	4669
Finland	1917
England	1744
European Russia	1455
Portugal	1276
Italy	1028
Spain	929
Ukraine	888
Czech Republic	878

Table 3
Contacts by Continent

Continent	Contacts
Europe	22,363
North America	6465
Asia	875
South America	371
Oceania	172
Africa	143
Antarctica	1

able to spend with Manuel, Vanessa and their family before departing were a highlight of the trip. I will always appreciate their hospitality and friendship.

Back to Terceira and the Final Report

We departed Faial for Terceira on Sunday. We had a one night stay there and a little bit of time to do some sightseeing and souvenir shopping before departing for the return flight to Boston.

The final count for all nine islands was over 30,000 contacts with 119 DXCC countries (see Tables 2 and 3). More important than the contact total were the new bonds formed between the team members and Azorean amateurs. We all learned a great deal about these islands in the middle of the Atlantic and the part they have played in history. Many times when we explain why Amateur Radio is so important we think of emergency communications, technology and engineering, but often overlook the role the amateur plays in promoting international goodwill. I once heard it said that "all it takes for a friendship to begin is a ham radio call sign." My experience in the Azores shows that this is true.

All photos by Mike Corey, KI1U.

Mike Corey, KI1U, is the ARRL Emergency Preparedness Manager. He can be reached at **ki1u@arrl.org**.

The Power of Starting Small

One ham's first foray into board etching provides a lot of knowledge and confidence.

Matt Severin, N8MS

I enjoyed ARRL's® new DIY (Do It Yourself) campaign and short video (**www.youtube.com/watch?v=vlDwVhx7miQ&feature=plc**), which was released at the end of December 2011. It prompted me to start surfing the web to find an idea for my next project. At *MAKE* Magazine's website (**makezine.com**). I found many interesting small projects ranging from robots to pumpkin throwing trebuchets. I found my inspiration when I saw footage of a preteen girl explaining how to etch a circuit board.

Next, I needed a circuit to etch. After a little more surfing I settled on creating a theremin (the instrument that makes *Star Trek*-like sounds when you wave your hands above it — search the Internet for it if you've never seen one; they are very interesting). My version would be much simpler, modeled after a RadioShack weekend project called "Light Theremin" (**www.radioshackdiy.com/project-gallery/snap-circuits-optical-theremin**) that uses variations in light intensity to control the sound. I also decided to tweak the design and replace the 555 timer with a Picaxe microcontroller (**www.picaxe.com**). My students are participating in a new balloon project that uses the Picaxe microcontroller and this seemed like a good opportunity for me to learn more about this device too.

After building my prototype on a breadboard, I downloaded *Express PCB* (**www.expresspcb.com**) and started laying out the components, pads and traces to make my circuit board. I printed an image of the circuit layout and transferred the image to an overhead transparency using a copy machine. I placed the transparency on the copper side of the copper-clad printed circuit board (PCB) and used an iron to transfer the inked image to the copper surface. I carefully peeled the transparency away leaving the circuit layout on the PCB. The ink lines covering the copper surface prevent the etchant from dissolving the copper below them. I dropped the board into a bath of PCB etchant solution and waited for it to dissolve the unprotected copper.

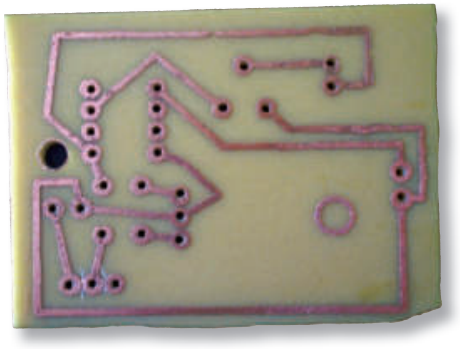


Figure 1 — Here is the etched and drilled PC board. Note the weak trace at the top. The broken area would need to be bridged with a short wire.

Once all of the unprotected copper had dissolved, I rinsed the remaining etchant from the board and checked the copper traces for continuity. Of course, there were gaps where the copper of the trace had been etched away (see Figure 1). I went back to the drawing board to thicken all of the lines and make sure all were solid and dark enough to guarantee there would be no gaps in the traces on the second attempt.

The Component Side

After redoing the board, it was time to mount the components. I drilled holes for the parts using a flex-shaft drill with a .040 inch jewelry bit. (The smallest drill bit in most drill sets is much too big for this type of project.) With the holes drilled I added the components and soldered them into place. Once I had the power section of my circuit on board, I checked the voltages to make sure everything was up and running correctly — it wasn't.

It only took a few seconds to realize I had missed a ground trace, so with a new hole and a few additional copper wires soldered to the board, I was able to bypass my mistake. The theremin powered up as expected and the rest of the project assembled without incident (see Figure 2).

I enjoyed building this project from start to finish. While my wife agrees the completed theremin is just a little box that makes an annoying sound, it has given me the confidence to try other projects. I now know that I won't be limited by the lack of a circuit board.

DIY Pointers

I leave you with a few lessons learned from this project. Hopefully, they will help you avoid some pitfalls:

Figure 2 — Here is the completed theremin and battery all in an Altoids case.

1. Double check your circuit before you go to print. This saves the time and effort needed to bypass mistakes later.

2. When etching your circuit board, the traces and pads need to be *fat*. *ExpressPCB* uses a default trace width of 1/10 of a millimeter, which is too thin for home production methods. In my experience, a width of 3/4 of a millimeter is necessary.

3. The etchant solution, ferric chloride, turns things a funny brown color — wear gloves.

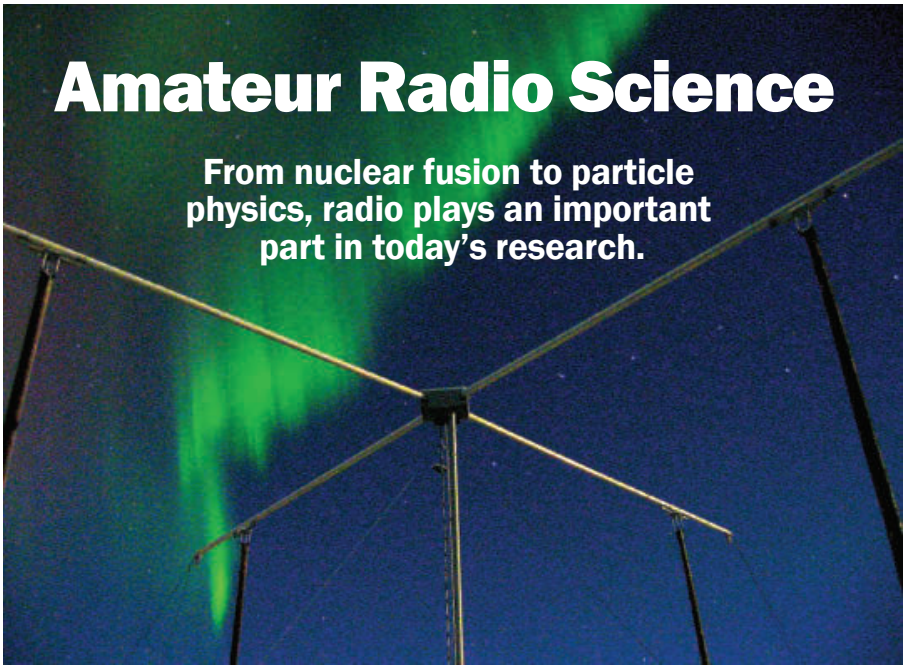
4. While an Altoids tin is a cool project box, eating all the mints in one day is not recommended.

Photos by the author.

Matt Severin, N8MS, an ARRL member, is the principal of Dowagiac Middle School in southwest Michigan serving over 550 students in grades 6 through 8. Matt has incorporated Amateur Radio into his classroom since 1999 when he first earned his Amateur Radio license. He has worked with students ranging from grade 3 to 12 and has found ways to integrate Amateur Radio at all levels. Matt has been licensed for 12 years and holds an Amateur Extra class license. He can be reached at 7555 E Main St, Eau Claire, MI 49111-9664, **n8ms@arrl.net**.

Amateur Radio Science

From nuclear fusion to particle physics, radio plays an important part in today's research.



An aurora illuminates one of the eight crossed dipoles at HIPAS Observatory near Fairbanks, Alaska.

Eric P. Nichols, KL7AJ

Most of the universe interacts with radio in one way or another. In fact, it's almost entirely by radio that scientists are able to probe the farthest reaches of the universe and the smallest building blocks of matter. As radio amateurs, we have access to unbelievable wonders of nature that very few "civilians" can even dream of. We have a vast unexplored playground and you don't need a PhD to enter, just some curiosity and a willingness to look beyond routine radio.

When we look at Amateur Radio strictly as a means of DXing, contesting or chewing the rag, we limit the size of our radio universe. One of the reasons Amateur Radio exists is to "contribute to the radio art." To do that, first we need to know what people *outside* of Amateur Radio are doing with radio. We need to know what kinds of questions they are asking and we need to find innovative ways of answering those questions. As hams step into radio research we may discover the answers to as yet unasked questions. Researchers will find that hams have information useful to their investigations.

A Lab Without Walls

One of the areas to which every ham can contribute is ionospheric research, which is more than predicting propagation paths for the next DXpedition. Scientists are interested in the ionosphere because it may hold valuable information related to sustained nuclear fusion and other fields. The ionosphere is composed of plasma, a prime component of the universe, and is considered a fusion lab without walls. Few hams have access to a plasma chamber or a Tokamak but every ham has access to the ionosphere. The ionosphere places the universe right in your backyard and you don't need a space probe to explore it — all you need is your radio.

Keeping good records and being alert for anomalies may be the key to the next advance in plasma physics. You don't need a research grant to do this; just good lab discipline of the sort you learned in high school.

What you observe in your shack is probably of interest to a physicist somewhere and may be of interest to scientists *everywhere*. You don't need an advanced degree; you just have to be in contact with someone who does — someone who might be able to *use* what you observe.

From DC to Daylight

Radio amateurs have frequency allocations practically from dc to daylight. We have 12 microwave bands that are virtually unused. I frequently hear that these bands are "useless" for Amateur Radio. However, for doing radio science, they're a priceless resource.

Each of these bands has incredible scientific potential; each is uniquely suited to a different aspect of radio science — science that *hams* should be doing. One such investigation with these bands would be to set up networks of *channel probes*, which are nothing more than matched pairs of beacons and receivers, scattered across the country or even the planet.

Be Part of Particle Physics

These channel probes could contribute to one of the major thrusts of modern science — looking for rare new particles. Some are created artificially, some occur naturally, but very rarely. Many of these particles pass through our atmosphere and there's increasing evidence that some occasionally pass right through the *Earth*. When and if they do this, they leave artifacts — primarily in the form of ionization trails or "splashes." These splashes would be detectable by radio and many of the predicted radio signatures fall inside the amateur microwave bands. Wouldn't it be just a *little* exciting if one of *your* channel probes caught one of these rare events?

The fact is, there aren't enough physicists or labs to do this sort of science properly. Physicists can't be everywhere at once, but hams *can*! In order to help, you need to know what the scientists are doing. If the scientific research community became convinced that hams understood these phenomena, we could become a significant asset to their research.

To get you started, here are a couple of great sites that will show you what scientists are doing with radio: **www.agu.org/journals/rs**, **www.vlf.it** and **www.physics.ucla.edu/~moonemp/radhep/workshop.html.**

The last one, RADHEP, was a conference that concerned high energy particle detection with radio techniques. Remember, these are almost all techniques that *you* can do with the hardware you have.

This subject is too extensive to describe in this short article. Hopefully, I've sparked your interest in this new world of radio research. You *can* go boldly where no man has gone before, without even leaving your shack.

Eric Nichols, KL7AJ, an ARRL® member, has written numerous articles for many Amateur Radio and electronics experimenter publications over the past 30 years. He worked as a broadcast engineer for a quarter century, later applying his radio experience to experiments conducted at High Power Auroral Stimulation (HIPAS) Observatory and the High Frequency Active Auroral Research Program (HAARP), as well as designing instrumentation for the UCLA Plasma Physics department.

Eric has published two books, *Plasma Dreams* and *The Opus of Amateur Radio Knowledge and Lore*. His latest book, *Radio Science for the Radio Amateur* will be available at the ARRL store this spring. Eric can be reached at PO Box 56235, North Pole, AK 99705, **kl7aj@arrl.net**.

Disaster on Long Island

These amateurs had to rely on more than their radio skills in the wake of Hurricane Sandy.

Bob Myers, K2TV

Hams were out in force throughout New York, New Jersey and Connecticut in the aftermath of Hurricane Sandy last October. Individuals and clubs reached out to their communities and put their talents to excellent use. One outstanding example was the Great South Bay Amateur Radio Club on the south shore of Long Island, an area that took the full brunt of the storm.

The Town of Babylon Amateur Radio Emergency Service (ARES®), which is closely associated with the club, took to the airwaves immediately. They performed shelter communications duty, damage assessment and much more. As the storm passed and the full scope of the damage became known, hams took to the debris-strewn streets, creating a vital ad-hoc radio network throughout the area.

Wherever there was a need, amateurs stepped up to the challenge. The simple act of finding fuel for vehicles and emergency generators, for example, quickly became a critical issue. Most gasoline stations had no power and the few that did ran out of fuel within the first 24 hours. Hams used their emergency nets to locate and coordinate any remaining gasoline supplies.

More Than Radio Work

Amateurs did much more in Sandy's aftermath than provide communications. Radios were important tools, but hams also had much to offer through sheer muscle and dedication.

One of the Great South Bay club members, 17 year old Kristi Melfi, KC2TMB, organized a distribution center for food, clothing and supplies. Kristi, along with her mother Michelle, sister Jennifer, KC2TMA, and grandmother Judy Skillen worked with the First Presbyterian Church in Babylon to make the church hall their base of operations. Word went out via Facebook, Twitter, Cablevision's "News 12 Long Island" and, of course, Amateur Radio. The response was enormous with local people contributing tons of supplies.

Club members helped deliver supplies to people in the affected areas. Deliveries were coordinated over one of the club's UHF repeaters. John Smale, K2IZ, did double duty as net

This boat was carried blocks inland and ended up resting against a house. [Bob Myers, K2TV, photo]

W2HCB's mobile barbeque helps feed flood victims while News 12 Long Island broadcasts the story. [Bob Myers, K2TV, photo]

George Swanson, KC2UJA (left), John Cresson, W2JGH (center) and John Melfi, W2HCB (right) coordinate deliveries with a volunteer at the First Presbyterian Church. [Bob Myers, K2TV, photo]

Seventeen year old Kristi Melfi, KC2TMB, organized a distribution center for food, clothing and supplies [John Melfi, W2HCB, photo]

Volunteering soon became a family affair. From left to right: Cathy Paluch, Walt Paluch, KA2CAQ, John Melfi, W2HCB and Jennifer Corkins. [Bob Myers, K2TV, photo]

control and greeter at the distribution center.

Once the flood waters receded, John Melfi, W2HCB, mounted a barbeque grill in the back of his pickup truck and, along with several members of the West Babylon Music Parents Association and Great South Bay club members, drove through the hardest hit areas. There was no natural gas or electricity in those neighborhoods, so residents were thrilled to be able to cook their rapidly thawing food on John's grill.

Amateurs also packed other vehicles with cases of drinking water and brought them into the neighborhoods. Individual cases of water were hand carried to each house.

It was so sad to see the horrible damage that the storm inflicted near the Great South Bay. A few houses had caught fire and the flooding was so deep that fire departments could not reach them. As a result, these homes burned to the water line. Amateurs often reported seeing huge piles of ruined furniture and belongings outside of what was left of someone's home.

The Amateur Radio crews witnessed the bewildered and confused looks on the faces of these people that were trying to salvage what was left of their lives. The supplies the amateur crews delivered often brought the only bits of comfort in what was otherwise a waking nightmare.

John Cresson, W2JGH, and Walt Paluch, KA2CAQ, brought down their respective vehicles with flatbed trailers to help transport supplies. Some of the families of radio club members arrived to help sort groceries and clothing. George Swanson, KC2UJA, brought portable water pumps for those that needed to pump out flooded homes. Ed Felix, KD2ADC, and his wife donated still more supplies and secured much needed cleaning kits.

A Superb Effort

The response from the ARES group, the Great South Bay Amateur Radio club members and other amateurs was gratifying. In as much as many of the members suffered extensive storm damage to their own homes and vehicles and obviously could not participate, we had an excellent turn out. There were so many hams that helped with this endeavor; if I listed them it would fill an entire page.

Of course, we were not alone in our relief efforts. We heard from many other amateur groups throughout the tri-state region who were doing similar work. Ours is but one example among many, but it is a powerful testimonial to what Amateur Radio can do in times of crisis. Our communication skills bridged gaps that were not being filled by commercial and government networks. (For details, see the "Public Service" column in this issue.) And best of all, our camaraderie brought us together to help our community.

Hams serving hot food to residents. [Bob Myers, K2TV, photo]

An ARRL Life Member, Robert (Bob) Myers has been licensed since January 1960 and originally held the call WA2JZX with a General class licensee. In 1976 he earned his Amateur Extra license and changed his call to K2TV. His interest in Amateur Radio led him to a 42 year career in radio and television broadcasting, of which almost 40 years had been with the CBS Television Network. Now retired, he operates CW, SSB and digital modes on all bands 160 through 6 meters and 10, 6, 2, 1.25 and 70 centimeters FM voice and packet. You can contact Bob at 317 Kensington Court, Copiague, NY 11726-4524; **bob.k2tv@gmail.com**.

Digital Detective

Discover the secret of those auditory mysteries coming from your headphones.

Steve Sant Andrea, AG1YK

It's February and the turning point of winter is upon us. Cold days and frigid nights prompt many a ham to tune the bands, phones on their heads and steaming mugs in their hands. As you tune around you can run across a variety of strange sounds. Some are melodious and others raucous. They all seem to come from some sci-fi future that's very different from our sound modulated past.

With your mic in hand you think "digital mode" and move on down the band for some DX or a chew. Yet, the sound lingers in your head. There seems to be such a variety of sounds ranging from musical to mysterious. It's hard to believe these pings, rings, ticks and hisses actually have something to say.

Today, there are more than 16 digital modes (not including the many mode "flavors") in use — and that's just on the ham bands. If you listen outside our bands, even more strange modes are chirping and warbling about. So as you tune around its hard not to wonder: "What was that, exactly?" After some listening your curiosity gets the better of you. "Digital mode" just isn't enough.

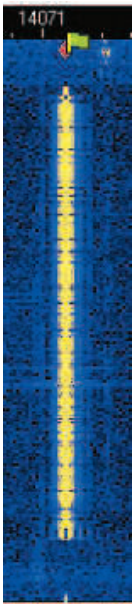
Clues

Whether you have gotten the digital itch and are already watching the waterfall or are just starting to get curious, there are resources available to satisfy your craving for data on the digital din. Although a digital setup for your rig (digital software and a sound card interface) will provide you with both visual (a waterfall display) and auditory clues to help identify the computerized culprit, you can do so just by ear.

This is also true outside the ham bands, where you will run across many digital modulations that can be identified but not decoded and some that are a complete mystery.

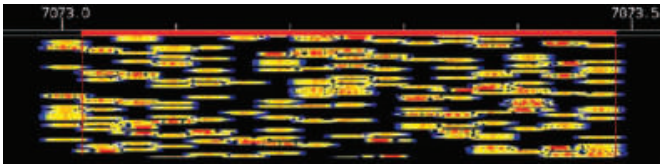
Positive ID

Each digital mode has certain unique characteristics that result in a specific visual and/or auditory fingerprint. Just as human fingerprints are identified by comparing them to a database, so to must these digital fingerprints be compared to samples of the various modes for a positive ID.



This is a waterfall "fingerprint" for PSK31, one of the most common of the digital modes found on the ham bands.

Start your sleuthing at the **wb8nut.com/digital** page, which lists digital modes that are used on the ham bands. This informative page gives a general description of each mode and a link to a sound file of a typical transmission. This is probably a good place to start when trying to identify a particular sound. Another useful list of digital sound files can be found at **www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=4657**. This page contains a mixture of about 40 ham and nonham modulation sound files.



This waterfall waveform represents a typical Olivia signal. Olivia is not as popular as RTTY or PSK31 but has advantages over both in noisy conditions.

If you have a waterfall display to work with, **www.w1hkj.com** is a great place to start your search. Click on the "Sights and Sounds of Digital Signals" link to open a page containing both waterfall waveforms and sound bites of 11 different ham digital modes. These fingerprint files include many of the most popular flavors of the different modes totaling 56 different digital fingerprints to help you pin down your suspect. A link at the bottom of each mode page leads to a description of the mode's modus operandi.

Niche modes that you might hear prowling around the VHF bands are high speed CW (HSCW) and FSK441. Both are primarily used for meteor scatter communications. With HSCW, a standard CW message is sent in a burst that is accelerated by the HSCW software to speeds of over 1000 WPM. FSK441 is a digital mode that is part of the *WSJT* sofware suite. You can hear some of these *very* short sound files at **www.qsl.net/dk3xt/msound.htm**.

The Rest of the Gang

Digital communications goes well beyond those forms that we hams use. Commercial, government, military and scientific organizations also employ many different forms of digital modulation that you might chance upon when venturing outside our bands. A variety of digital data flows by radio using modulations from DES Encryption, which is a digital voice encryption system used by many government agencies from the Federal level down to local police; to WeFax, a facsimile format used to transmit weather maps to ships at sea. (If you think back to the movie *The Perfect Storm*, several scenes showed different captains receiving critical WeFax weather photos of the storm.)

An extensive collection of these nonham modes (with some ham modes thrown in) can be found at **www.kb9ukd.com/digital**. This site includes over a hundred different digital modulation sound samples covering everything from aircraft telemetry to railroad crossing signal data. Of particular interest to hams is the sound file for BPL. While we all hope this file will soon be of only historical interest, there are still some systems in operation. Also of note on this site is a sound file for SSTV. Again, not strictly a "digital" mode, SSTV does fall into the "What's that?" category of sounds you might hear in your headphones.

Another interesting site that goes beyond the digital world is **www.dxzone.com/cgi-bin/dir/jump2.cgi?ID=8861** Click on the "transmission modes" link for a listing of sound files that not only includes many ham and nonham digital modes but also sound files of ham contacts involving aurora, EME, the ISS, meteor scatter, satellites, SuitSat and good old SSB and CW.

Now when you hear a strange squeak or creak on the bands that piques your interest, put on your deerstalker and hunt down the auditory culprit.

All photos by Steve Sant Andrea, AG1YK.

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

Philip J. McGan Memorial Silver Antenna Award

Make a nomination to honor an individual's efforts in Amateur Radio publicity.

Throughout the year hundreds of ARRL Public Relations Coordinators and Officers, as well as other public relations volunteers, keep Amateur Radio visible in their communities by publicizing special events, writing press releases and creating media for radio, websites and television, and so much more. If you know of someone who achieved public relations success on behalf of Amateur Radio, nominating that individual for the McGan award is the perfect way to say "thank you."

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

The late Philip J. McGan, WA2MBQ, served as the first chairman of the ARRL's Public Relations Committee. In honor of Phil, his friends in the New Hampshire Amateur Radio Association joined with the ARRL Board of Directors to pay a lasting tribute to the important contributions he made on behalf of Amateur Radio. The 2013 McGan award will go to that ham who has demonstrated success in Amateur Radio public relations and best exemplifies the great volunteer spirit of Phil McGan.

The ARRL Public Relations Committee will review all nominations and notify the ARRL Board of Directors of a recommended winner to be approved by the ARRL Board at its July meeting.

McGan Award recipients:

1992	James Heil, KB5AWM (first winner)
1993	Gary Pearce, KN4AQ
1994	Joe Phillips, K8QOE and Michael Karp, AF2L
1995	Len Winkler, KB7LPW
1996	Bob Josuweit, WA3PZO
1997	James Biddle, WB3DCL and Beverly Priest, N8VZV
1998	Stephan Anderman, K2SMA
1999	Peter Coffee, AC6EN
2000	Diane Ortiz, K2DO
2001	Bill Morine, N2COP
2002	Sherri Brower, W4STB
2003	Tim Lewallen, KD5ING
2004	Mike Duff, KG4SLH
2005	Jerry Martin, KC9BDA
2006	Dee Logan, W1HEO
2007	Dan McMonigle, N3IXQ
2008	Walt J. Palmer, W4ALT
2009	Nate Brightman, K6OSC
2010	Norm Lauterette, WA4HYJ
2011	Angel Santana, WP3GW.
2012	John T. Luebbers, K1AYZ

Call for Nominations

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

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

(3) *Anyone* may make a nomination.

(4) Deadline: **Nominations must be received at ARRL HQ in Newington by 5 PM May 25, 2013.** Nominations arriving after the deadline or without an entry form cannot be considered.

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

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

To obtain the required entry form, go to **www.arrl.org/phil-mcgan-award**, or e-mail **apitts@arrl.org**. Ask for an official 2013 Philip J. McGan Memorial Silver Antenna Award entry form.

(7) Return the completed entry form and supporting materials to:

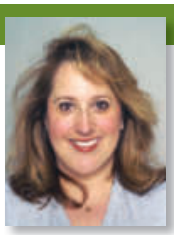
Philip J. McGan Memorial Silver Antenna Award,

Public Relations Dept

ARRL

225 Main St

Newington, CT 06111



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

ARRL Files *Petition for Rulemaking* with FCC to Create New MF Band at 472-479 kHz

The FCC must approve the secondary allocation of 472-479 kHz — granted at WRC-12 — before radio amateurs in the US can use it.

At the 2012 World Radiocommunication Conference (WRC-12), delegates approved Agenda Item 1.23: a 7-kilohertz-wide secondary allocation between 472-479 kHz for the Amateur Radio Service, with a power limit of 5 W EIRP (or 1 W EIRP, depending on location). Before this portion of spectrum is made available to radio amateurs in the US, the FCC must first approve its use and amend its rules to reflect the change. As such, the ARRL filed a *Petition for Rulemaking* on November 29, asking the FCC to amend Sections 2 and 97 of its rules and create a domestic Amateur Radio allocation at 472-479 kHz, conforming to the allocation status and limitations set forth in the International Radio Regulations.

"The subject of a low-frequency (LF) allocation, and/or a medium-frequency (MF) allocation in the lower portion of that range for the Amateur Radio Service has a long history at the Commission," the ARRL pointed out in its *Petition*. "As yet, however, the Commission has not created either one." Presently, the lowest domestic frequency allocation for the Amateur Service — and the only MF allocation — is at 1800-2000 kHz. It is now timely, in response to actions taken at the 2012 World Radiocommunication Conference to create a new, domestic MF allocation at 472-479 kHz for the Amateur Radio Service."

Background

The issue of a domestic LF and/or low MF allocation for the Amateur Radio Service first formally arose in connection with the FCC's preparation for the 1979 World Administrative Radio Conference (WARC-79), with the FCC establishing an advisory committee for Amateur Radio, relative to WARC-79 preparations. In December 1978, it released a *Report and Order* that concluded that the 160-190 kHz band could not be made available to the Amateur Radio Service due to concerns of interference to power line carrier (PLC) systems.

In October 1998, the ARRL filed a *Petition for Rulemaking*, seeking LF allocations for the Amateur Radio Service at 135.7-137.8 kHz and 160-190 kHz. The *Petition* noted, with respect to the 135.7-137.8 kHz band, that radio amateurs in other countries had already been accommodated in that segment, and other countries at the time permitted Amateur Radio experimentation at LF via special or experimental authority. The justification for the proposed allocation of 160-190 kHz in the ARRL's *Petition* was the fact that numerous radio amateurs and experimenters were already using that band pursuant to Part 15 rules, which allows operation in that band at up to 1 W input power, but with significant antenna size restrictions that severely restricted antenna efficiency and compromising most experimentation in that band.

In May 2002, the FCC issued a *Notice of Proposed Rulemaking* in response to the ARRL's *Petition* and found that that "...this allocation appeared to be acceptable because the incumbent use of the 135.7-137.8 kHz band appeared to be very light, and thus a secondary Amateur Service allocation in this band would likely raise few interference concerns." Because of concerns related to potential interaction between PLC systems and amateur stations, the FCC did not propose to allocate the 160-190 kHz band to the Amateur Radio Service, and ultimately, in May 2003, the FCC declined to create the secondary allocation proposed by ARRL in *either* LF band.

472-479 kHz and WRC-12

The ARRL pointed out in its current *Petition for Rulemaking* that "[n]one of the Commission's past concerns with Amateur Radio interaction with PLC systems operating at 160-190 kHz or 135.7-137.8 kHz — however valid those concerns might have been at the time — applies or has applied to the band 450-490 kHz." An international allocation to the Amateur Radio Service at 472-479 kHz was adopted at WRC-12 with of 5 W EIRP for most of the world, and the Final Acts of WRC-12 became effective on January 1, 2013.

"The allocation was made in fulfillment of WRC-12 Agenda Item 1.23, considering a secondary allocation to the Amateur Radio Service in the range 415-526.5 kHz," the ARRL stated. "Studies conducted in support of the Agenda Item considered present and future uses by incumbent services (mobile, including maritime mobile and aeronautical radiolocation). Several frequency ranges for the allocation were considered. Ultimately, WRC-12 concluded that the range 472-479 kHz offered maximum protection to existing and future applications in these services, consisting primarily of broadcast data transmissions in the maritime mobile service and aeronautical non-directional beacons in the aeronautical radiolocation service. Several administrations — including Germany, Sweden, the Netherlands, New Zealand and Monaco — have already authorized Amateur Radio Service operation on the 472-479 kHz band beginning on or in advance of the January 1, 2013 implementation date of the WRC-12 Final Acts."

In the United States, the 472-479 kHz band is part of the larger segment 435-495 kHz that is allocated on a primary basis to the Maritime Mobile Service (federal and non-federal users), and on a secondary basis for

federal government aeronautical radionavigation. The ARRL stated in its *Petition* that it is not aware of any domestic assignments that would conflict with the allocation of the band 472-479 kHz to the Amateur Radio Service, and there is almost no PLC operation in this band segment.

The ARRL has sponsored an extensive course of experimentation in the MF spectrum near 500 kHz since 2006. In September 2006, a group of 23 amateur stations — using call sign WD2XSH — scattered throughout the US were permitted to operate in the band 505-510 kHz for a course of experimentation with propagation and interference testing. During the course of this experiment, the number of participating amateur stations increased to 42, and includes all geographic areas of the US, including Alaska and Hawaii. The frequency bands utilized were modified to include the entirety of 461-478 kHz and 495-510 kHz, with emissions at power levels up to 20 W ERP. This experiment is scheduled to continue through the end of the current license term, August 1, 2015. No reports of interference have been received. This is a disciplined program of experimentation with regular reports and analyses of interference potential to other services (including PLC systems) and experimentation with equipment and antennas.

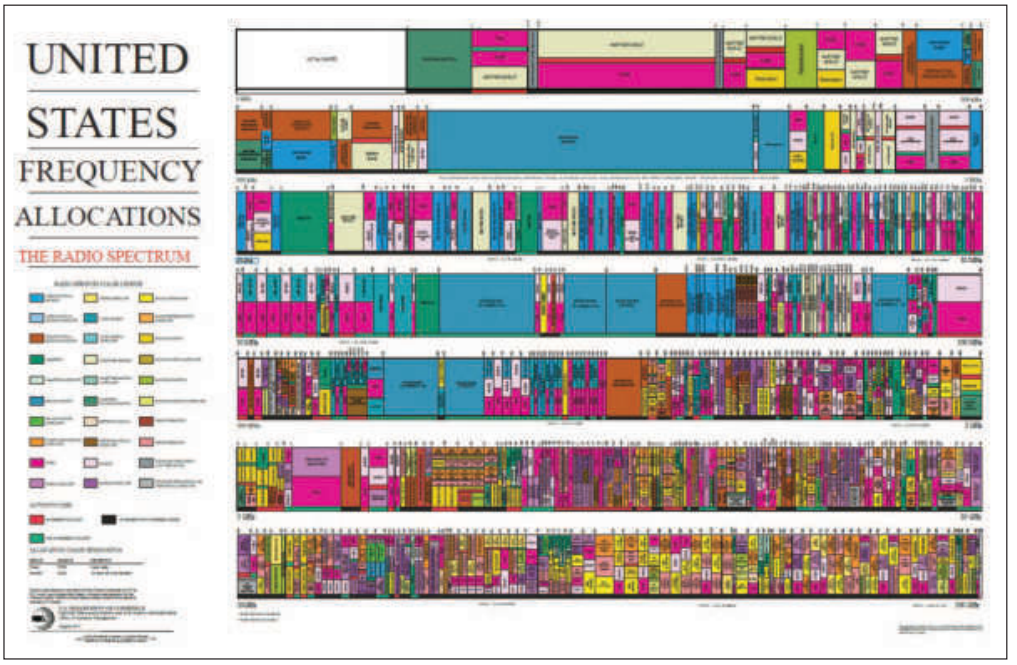
FCC Seeks to Assign Primary Status of the Entire Amateur Portion of 160 Meter Band to Amateur Radio Service, and Proposes New LF Amateur Band at 135.7-137.8 kHz

On November 20, the FCC released a *Notice of Proposed Rulemaking* (ET Docket No. 12-338) that proposed to amend Parts 1, 2, 74, 78, 87, 90 and 97 of the Commission's rules. Part 97 governs the Amateur Radio Service. These changes will implement allocation decisions from the 2007 World Radiocommunication Conference (WRC-07), including changing the allocation to the amateur portion of the 160 meter band and reallocating the 1900-2000 kHz segment to the Amateur Radio Service on a primary basis, allocating a new Amateur Service band at 135.7-137.8 kHz and cleaning up the rules for the 10.0-10.5 GHz band.

In the *NPRM*, the FCC noted that "the ARRL has identified the 160 meter band and the amateur HF bands as '[b]y far, the heaviest-used [Amateur Service] allocations.'" Historically, the 1715-2000 kHz band was allocated exclusively to the Amateur Service. In 1953, the FCC removed the 1715-1800 kHz segment from the Amateur Radio Service and allocated the 1800-2000 kHz band to the Amateur Service on a shared basis with the Radionavigation Service. Thirty years later, the FCC allocated the 1800-1900 kHz band to the Amateur Service on an exclusive basis and the 1900-2000 kHz band to the Radiolocation Service on a primary basis for federal and non-federal use and to the Amateur Radio Service on a secondary basis. Currently, federal use of the 1900-2000 kHz segment is light, with only 10 assignments authorized to operate in this segment. "A single federal assignment authorizes land and mobile stations in the Radiolocation Service to transmit on 1922 kHz using a necessary bandwidth of 600 Hz within a protected radius of 193 kilometers centered on San Diego, California," the FCC noted in the *NPRM*. "All other federal assignments in the 1900-2000 kHz band are for unallocated uses, and thus, these assignments operate on an unprotected and non-interference basis."

The FCC is proposing to amend the US Table of Allocations and remove the federal and non-federal Radiolocation Service allocations from the 1900-2000 kHz band and then raise the secondary Amateur Radio Service allocation to primary status because "there appear to be few (if any) Radiolocation Service stations operating in this band," it said. "In addition, we note [from WARC-79] that 'this [Radiolocation Service] allocation was made for reaccommodation purposes and not to provide additional spectrum for radiolocations needs,' that the Commission has concluded its AM Expanded Band proceeding that would have prompted non-federal RLS licensees to relocate to the 1900-2000 kHz band and that this band was historically allocated to the Amateur Service on an exclusive basis."

For information on the new proposed LF allocation and the proposed "clean-up" of 10.0-10.5 GHz band rules, please visit **www.arrl.org/news/fcc-seeks-to-assign-entire-amateur-portion-of-160-meter-band-to-primary-status-to-amateur-radio-serv**.



This chart shows the frequency allocations to the radio spectrum in the US. View the chart online at **www.ntia.doc.gov/files/ntia/publications/spectrum_wall_chart_aug2011.pdf**.

FCC Denies ARRL *Petition* to Deny ReconRobotics Licenses, But Limits Devices to 100 kHz Bandwidth

On November 14, the FCC issued an *Order on Reconsideration*, dismissing a March 2010 *Petition for Reconsideration* filed by the ARRL that asked the Commission to deny pending Public Safety Pool license applications associated with the ReconRobotics Video and Audio Surveillance System; however, in doing so, the FCC made it clear that the devices may not exceed 100 kHz of bandwidth. The Recon Scout — manufactured by ReconRobotics — is a remote-controlled, maneuverable surveillance robot that transmits real-time video surveillance data that operates by FCC waiver in the 70 centimeter band.

In its March 2010 *Petition for Reconsideration*, the ARRL argued that the FCC should reverse its *Application Order* and rescind all of the licenses granted by that order because, in the ARRL's view, "every one of the [84] pending applications contains serious technical errors and none is grantable, and the signal emission designators in every one of the applications is incorrect." The license applications all specified an emission designator that represents a bandwidth of 100 kHz. The ARRL pointed out that this is incorrect, because the necessary bandwidth is approximately 5.75 MHz. In its *Petition for Reconsideration*, the ARRL maintained that the "emission designator that shows a 100 kHz bandwidth for a full NTSC [National Television Standards Committee] video signal cannot be correct because the FCC rules base emissions designators on the necessary bandwidth of an emission, not a measurement made under a single set of test circumstances."

The FCC, in its *Order on Reconsideration*, stated that it did not agree with the ARRL's arguments, but emphasized that the bandwidth used by the ReconRobotics devices may not exceed 100 kHz. "The factual predicate for the ARRL's claim is that the ReconRobotics device will conform to NTSC standards and thus will necessarily exceed 100 kHz," the FCC said. "But according to ReconRobotics, their devices do not conform to NTSC standards and the necessary bandwidth for their operations is 100 kHz. We thus reject the ARRL's argument on the basis that **ReconRobotics is bound by its representation and the relevant licensees are limited to 100 kHz. If a licensee exceeds 100 kHz, it is in violation of the terms of its license** [*emphasis added*]."

The Recon Scout — manufactured and marketed by ReconRobotics — is a remote-controlled, maneuverable surveillance robot designed for use in areas that may be too hazardous for human entry. In 2010, ReconRobotics was granted a waiver by the FCC for the device to operate between 430-448 MHz, a portion of spectrum available to the Amateur Radio Service on a secondary basis.

The ARRL maintained that ReconRobotics had not measured its emissions in a manner that complies with Commission rules. "According to the ARRL, the Commission's rules distinguish between 'necessary bandwidth' and 'occupied bandwidth' and ReconRobotics incorrectly uses 'occupied bandwidth,'" the FCC stated in its *Order on Reconsideration*. "ReconRobotics disputes this and assert that it uses a procedure for measuring 'necessary bandwidth' appropriate for a non-NTSC signal. We conclude that ReconRobotics uses an appropriate methodology for measuring 'necessary bandwidth' for non-NTSC signals, and that the ARRL's objection is based on the mistaken assumption that the Recon Scout uses an NTSC signal."

In its *Order on Reconsideration*, the FCC also took the opportunity to again remind applicants who wish to utilize the Recon Scout "that if they receive licenses and commence operations, they must record all Recon Scout use, including the date of operation, start/stop times, location of operation, frequency segment of operation, reason for use and a point of contact. Licensees must provide this information to the Commission or to the National Telecommunications and Information Administration upon request of either agency. Moreover, as we stated previously in the *Application Order*, licensees that operate the Recon Scout in an unauthorized manner are subject to Commission enforcement action, including possible license revocation."

Former "How's DX?" Conductor Rod Newkirk, W9BRD (SK)

Rod Newkirk, W9BRD/VA3ZBB, of Ottawa, Ontario, Canada — who penned the *QST* column "How's DX?" from 1947-1978 — passed away on November 19 after a long illness. Newkirk was credited with coining the term "Elmer" and known for taking a humorous look at DX in his column.

The term "Elmer" — meaning someone who provides personal guidance and assistance to would-be hams — first appeared in *QST* in Newkirk's March 1971 "How's DX?" column, where he wrote that "[t]oo frequently one hears a sad story in this little nutshell: 'Oh, I almost got a ticket, too, but Elmer, W9XYZ, moved away and I kind of lost interest.' Sure, the guy could have burned through on his own, maybe, but he, like others, wound up an almost-ham. No more Elmer. We need those Elmers. All the Elmers, including the ham who took the most time and trouble to give *you* a push toward your license, are the birds who keep this great game young and fresh." Newkirk was probably not trying to coin a term at the time, but the name stuck, becoming a general term for the mentors Newkirk called "the unsung fathers of ham radio."

In March 1991, then-Associate Editor Jim Cain, K1TN, profiled Newkirk in "How's Rod?" in the pages of *QST*. "Newkirk wrote 'How's DX?' through the Korean War, through the Fabulous '50s, the Vietnam war, incentive licensing and the W9WNV DXpedition controversy," Cain wrote. "While six American presidents moved in and out of the White House, 'How's DX?' documented the rise of SSB in Amateur Radio and DXing, saw the birth of DX lists and nets and the growing number of 2 meter spotting groups." First licensed in 1937 as W9BRD at 14, Newkirk was involved with radio all his life. In 1997, he married Betty, VE3ZBB, and moved to Canada, where he got the matching Canadian call sign VA3ZBB.

Logbook of The World Web Page Features Daily and Hourly Status Updates

The ARRL has created a new informational page at **www.arrl.org/logbook-of-the-world** to issue daily status updates and information of interest to the Logbook of The World (LoTW) user community. These updates will include planned downtime and changes that will impact LoTW operations. In addition, LoTW's processing queue is now updated hourly, telling how many logs and QSOs have been uploaded to the LoTW system and are awaiting processing; find this page at **www.arrl.org/logbook-queue-status**. New hardware that will improve LoTW's throughput is on order and is expected to be running in February 2013.

Rick Murphy, K1MU, and Dave Bernstein, AA6YQ, have been charged with rebooting the Trusted QSL open source project. If you have demonstrably strong *C++* development skills that you're interested in applying toward improving LoTW's usability and efficiency, please contact Bernstein via e-mail at **aa6yq@ambersoft.com**. We appreciate the user community's patience while we work to bring LoTW's performance to an acceptable level.

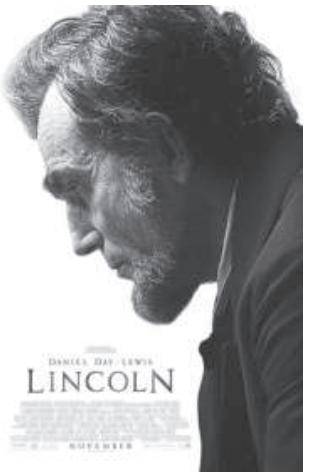
Morse Code Plays Role in New Spielberg Movie

Producer Steven Spielberg has used Amateur Radio or Morse code in three of his last four movies: *Super 8* (2011), *The Adventures of Tintin* (2011) and *Lincoln* (2012). Members of the Morse Telegraph Club (MTC) — an association of retired railroad and commercial telegraphers, historians, radio amateurs and others with an interest in the history and traditions of telegraphy and the telegraph industry — played an integral part in the production of *Lincoln*.

According to International President of the Morse Telegraph Club James Wades, WB8SIW, several MTC members provided telegraph instruments to equip the 16 operating positions portrayed at the War Department set. Jim Wilson, K4BAV, worked with production staff and the actors to explain telegraph technology and the role of the telegrapher in the 1860s.

"Nine of the 16 telegraph positions depicted in the War Department were fully operational," Wades said. "These instruments could be operated in any combination through the use of a specialized computer program and custom built terminal units for the process. When necessary, a hand key could be inserted in the individual telegraph loops so messages could be improvised."

Wades, who was employed as a Technical Advisor for the production, worked with set designers over a period of months to develop the War Department telegraph scenes, coordinating the process of procuring the necessary instruments and serving as an historical consultant as the telegraph scenes were developed. He also worked with the producers to develop historically appropriate message traffic that fit the sequence of the script; however, as the movie was edited, he explained that the final product evolved into a more generic facsimile of Morse traffic. "Those with a background in landline telegraphy will hear the occasional snippet of message traffic in the audio track of the movie," he said. "We are very pleased that Mr Spielberg and his staff took the time to treat the telegraph with dignity and respect. It is a pleasure to be associated with a high quality motion picture that can genuinely be classified as not just entertainment, but as a work of art."



Section Manager Election Notice

To all ARRL members in Maryland/DC, Nebraska,* Nevada, New Hampshire, New York City-Long Island,* Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

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

We suggest the following format:

(Place and Date)

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

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

(Signature_____ Call Sign_____ City___ ZIP__)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 8, 2013. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2013, to full members of record as March 8, 2013, which is the closing date for nominations. Returns will be counted May 21, 2013. Section Managers elected as a result of the above procedure will take office July 1, 2013.

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

***SM Nomination Petition Resolicitation**: Since no nomination petitions were received for the Nebraska and New York City-Long Island Section Manager Elections by the nomination date of September 7, 2012, nominations are hereby resolicited. See the above for details.

Rick Palm, K1CE, k1ce@arrl.org

Hurricane Sandy Debriefing

From Delaware to Massachusetts, ARES and RACES meet challenges presented by Hurricane Sandy.

Hurricane Sandy ravaged the Caribbean, skipped past the traditional punching bag of Florida and pummeled the eastern seaboard in late October. As of this writing (November 2012), some areas are still reeling from its effects. Sandy was the largest Atlantic hurricane ever recorded and the second most costly of all time. More than 250 people died.

The storm effects were especially severe in densely populated New Jersey and New York. Sandy's storm surge rolled through New York City on October 29, flooding the tunnels and subway lines. In the ensuing turmoil, ARES® members stood in harm's way to provide emergency and disaster response communications from all impacted areas. Many reports were published in the November issue of the League's *ARES E-Letter*, but many areas were not represented as operations were still underway and/or their ARES leaders continue to compile after-action reports for the various authorities, including ARRL Headquarters. Early reports, along with lessons applied from past storms and lessons learned for future events, can be found here: **www.arrl.org/ares-el?issue=2012-11-21**.

What follows is the report of Bob Myers, K2TV, concerning one Long Island (NY) ARES group's response to Sandy's aftermath.

Great South Bay ARES Responds to Horror with Help and Honor

The South Shore of Long Island was hit hard, as the storm surge and hurricane force winds destroyed several thousand homes on the ocean and the Great South Bay. Our local Town of Babylon ARES deployed and we had three different nets going on Great South Bay Amateur Radio Club (ARC) repeaters W2GSB/R and W2TOB/R. One was for shelter communications, one for damage assessment and one for operator check-in, communications with surrounding towns and operator deployment.

In addition, we had a packet radio link on 145.070 MHz simplex from the shelter to the Town of Babylon EOC. An HF station at the EOC provided access to the New York State RACES net on 75 meters, if needed (see Figure 1). To provide communications to various NTS nets from my station, K2TV, I ran an emergency power generator for 7 days and provided Winlink, PACTOR, SSB and CW links.

The net control was located at the Town of Babylon EOC. All of our repeaters — one 2 meter and two 70 centimeter repeaters — worked perfectly, switching to emergency backup power when the mains were lost. All of our ARES operators have emergency power capability, but some were without power for more than 10 days and others had their homes destroyed.

There was no cellular service, power, landline telephone, cable TV or Internet service during and after the storm. Anyone contemplating using IRLP, EchoLink or D-STAR systems using Internet VoIP should count them out for a storm of Sandy's magnitude as well as the Nor'easter that followed on her heels. At the time of this writing, some of our IRLP links are still out, so putting together reliable stand alone, commercial power and Internet *independent* repeaters with emergency power is the way to go. Battery backup alone is not enough for any length of time unless there is a way to recharge the batteries. Generator or solar backup power are the best solutions for outages lasting several days or weeks.

Lessons Learned

We didn't have much welfare traffic out of the shelters. [Just one outgoing welfare message has the potential for heading off potentially dozens of incoming inquiries from distant families and friends. — *Ed.*] The problem with the lack of welfare traffic is multifaceted, but it starts with the evacuation shelters. Shelter (ARES/RACES) operators need an easy to use system with which evacuees can compose outgoing welfare messages. NTS and ARES officials need to get together to solve this problem.

In our town's ARES operation, we had one operator at the shelter doing 12-15 hour shifts in a net, communicating with the EOC. The long shifts were necessary since it was impossible to travel once the winds rose above 50 mph. Falling trees and flying debris made travel unsafe. During the storm, one of our operators risked his life to get to a shelter with equipment.

Every emergency is different and each requires a customized response. The main advantage of Amateur Radio is that we understand radio communication and can adjust our response quickly to the situation. — *Bob Myers, K2TV, Assistant Emergency Coordinator, Babylon Town ARES and Vice President, Great South Bay Amateur Radio Club, Long Island, New York.*

Figure 1 — Walter Paluch, KA2CAQ, at the EOC HF station position as part of the Great South Bay Hurricane Sandy response. [Robert Myers Sr, K2TV, photo]

Elsewhere, Lessons Learned

Eastern Massachusetts

Eastern Massachusetts ARES was put to work on October 26, 2012, reported Eastern Massachusetts Section Emergency Coordinator Rob Macedo, KD1CY. The City of Boston EOC requested support as did the Red Cross for several regional shelters. Cape Cod ARES supported their shelters and hospitals. The Massachusetts Emergency Management Agency (MEMA) Region Two Office in Bridgewater was active as WC1MAB and so was the National Weather Service office (Taunton) Amateur Radio SKYWARN station, WX1BOX. The operators handled several hundred reports of wind damage (including reports of roof structural damage as well as many trees and wires down), wind measurements, rainfall measurements, storm surge and urban flooding reports from heavy rainfall.

What Worked: There was significant, important reporting of conditions across the region from Amateur Radio operators including those embedded with Emergency Management and other agencies as well as from APRS-enabled home weather stations. On air operations were professional and efficient. There was seamless transfer of information from the local to regional to national levels as seen in reports from southern New England making it into National Hurricane Center advisories. There was strong contact with MEMA and the emergency management agencies of the section's cities and towns.

What Needs Improvement: Several agencies waited until the last minute to request Amateur Radio operators unlike during Hurricane Irene when these agencies made requests up front. This may have been due to the lack of hurricane warnings issued up the coastline. This could potentially be addressed via tabletop exercises with various agencies. The number of operators needed to create depth for multiple shifts for a situation lasting more than 24 hours remains an issue. This will be addressed through more aggressive recruitment and training programs. Finally, embedding SKYWARN spotters with EM officials to safely observe storm surge areas for near real-time reporting is a goal.

Connecticut

Many things went right for Connecticut SM Betsey Doane, K1EIC, SEC Wayne Gronlund, N1CLV, and their ARES program, starting off with 80 stations checking into the planning net held prior to the arrival of major storm effects there. Check-ins were briefed and operators were recruited for specific assignments. Doane was able to meet all served agency requests. Gronlund worked from a regional Division of Emergency Management and Homeland Security (DEMHS) Headquarters and conducted ARES leadership nets every 2 hours, with reps from other DEMHS regional HQ stations. Situation Reports (SITREPS) were shared efficiently and effectively.

SKYWARN worked well, with Assistant DEC for SKYWARN Jim McBride, KD1LD, keeping the nets updated on conditions. SKYWARN guru Roger Jeanfaivre, K1PAI, coordinated 10 weather nets for Hartford County. Craig Lang, W1MHZ, had to be evacuated, so he ran a net while camped out at his neighbor's home. In general, repeaters went down, but backup power and equipment quickly restored communications.

Operators served the needs of the American Red Cross office and cities like Stamford where operators not only provided shelter communications, but also manned Stamford's Citizen Service Line, answering evacuation questions from citizens. Those manning the shelters did everything from intake to cooking to support for the elderly and infirm. Many operators stood by appropriately; many others took part actively across the entire section.

Southern New Jersey

Southern New Jersey's Assistant SM Gary Wilson, K2GW, reported that Ocean County ARES conducted SITREP nets on the WA2RES repeater twice each day during the emergency and response phases. The Ocean County EOC requested support for each Red Cross and municipal shelter, the requests being met by EC Robert Murdock, WX2NJ, with SEC John Zaruba, K2ZA, arranging for ARRL HQ to send six go-kits to the ARES group under the Ham Aid program (**www.arrl.org/ham-aid**). Zaruba was also the Incident Commander for this event. He polled other counties in the section for mutual aid for Atlantic county to relieve weary operators there. Wilson said planning, regular monthly tests and dedication paid off in this major communications emergency.

Delaware

Delaware Section Manager Frank Filipkowski, AD3M, said ARES/RACES was tasked with providing backup communications for the State EOC in Smyrna, each of the three county EOCs, the City of Wilmington and several small towns in Sussex County. Message reports of local road and weather, high water, downed trees and power outages were sent. There was the exchange of local welfare information on open shelters and updates were communicated to the National Hurricane Center station. Filipkowski managed his team from the State EOC.

Sussex County ARES provided communications at two shelters housing over 500 residents. For many, this was their first opportunity to operate during an emergency and each of them stepped up. Net discipline was greatly improved. "With our training emphasis and the criticality of the situation at hand, chatter and general comments were kept to a minimum," said Filipkowski. A "pre-net" offered an opportunity to announce and discuss final plans.

Permanent antennas at shelters and hospitals are essential, as Filipkowski summarized: "The marginal communications attained with portable J-poles and jury rigged solutions stands in stark contrast to the success we had with the permanent antennas at Nanticoke Memorial hospital." Also, Winlink 2000 was available at the hospitals and EOC, but none of the shelter operators had this capability. The goal is to have Winklink 2000 capability at each served location in the future.

The initial NCS operator was on duty for 12 hours. After that, with the addition of two more operators, shifts were 6 hours. "This still proved to be too long, so in the future we will use 3 hour shifts so operators do not become fatigued," reported Filipkowski. He also said that operators did a better job in reporting than was the case for Hurricane Irene.

During the storm, ARES received an inquiry from the Delaware State Police asking for support if it became necessary. "The storm concluded without our activation, but we were pleased to be considered as a potential resource," said Filipkowski. Shelter managers helped the ARES teams find operating areas that were separate from the actual shelter areas. This marked an improvement over the situation that developed during Hurricane Irene.

Excellence in ARES

As I said in the final remarks of the November issue of the *ARES E-Letter*: ARES and Amateur Radio emergency/disaster response communications have evolved exceptionally well in this post 9/11 and Katrina era. ARES has kept pace with the emergency management community at large as we have embraced digital modes, new technology and especially more and better training, professionalism and maturity as a critical component of the overall radio communications emergency support function. We should be proud of our efforts that have produced a better, more valuable service for our neighbors and communities, our served agencies and indeed our own Amateur Radio community.

2012 ARRL 10 GHz and Up Contest Results

Get outdoors with ham radio — be a microwaver!

Bruce Richardson, W9FZ, w9fz@w9fz.com

The ARRL 10 GHz and Up contest took place August 18-19 and September 15-16, 2012. Amateur Radio operators active on the microwave bands look forward to these two weekends each year. Most make treks to scenic locations across North America to make contacts. While the locations are a joy to view, the long horizons of mountaintops or shorelines are particularly good for launching microwave signals. While weather sometimes brings operating challenges, microwavers know the joys of mixing their ham radio interests with the beautiful out-of-doors.

Mt. Washington (FN44ig) can be a crowded place during a microwave contest! Trying for maximum distance are (L-R) W1EX, W1FKF, N1JEZ, W1AIM, K1LPS, and KA1ZD (with K1ZZ). [Grant Taylor, W1AIM, photo]

2012 Contest Highlights

This year, the longest distance 10 GHz contact was 652 km by both Rex, KK6MK and Ron, K6GZA. But on the East Coast, Dale, AF1T; Joe, WA3PTV; and John, W3HMS achieved a similar distance at 650 km. Ron, K6GZA, and Rex, KK6MK, were on Mt Vaca (CM88wj) between California's Bay Area and Sacramento. They worked Robin, WA6CDR and Mel, WA6JBD, who were on Mt Potosi (DM25gw) in southern Nevada. Midway between the two peaks lies the impediment of the Sierra Nevada mountain range (e.g. Yosemite), but signals were Q5 on SSB and contacts completed in short order.

10 GHz Only Category

For the second year in a row, Gary, WBØLJC led all 78 operators in this class with a score of 75,333. The husband/wife duo of Chris, NØUK and Holly, KØHAC came in 2nd and 3rd. The Top Ten scores in this category were split between 6-land and Ø-land. Activity levels remain healthy in both areas. Many Ø-land operators took part, along with some VE and 8-landers, in an expedition to Lake Superior.

Participation by Call Area

Call Area	# of Entries
6	31
1	19
8	14
0	13
VE	10
4	10
9	6
7	5
3	5
2	2
5	0
DX	0

Nationwide, average distances per contact were above 200 km! In the northeast US, (1, 2 and 3-land), the average was higher, trending above 250 km per contact.

10 GHz and Up Category

Jon, WØZQ took top honors this year with 76,506 points. Lars, AA6IW and Ron, K6GZA came in 2nd and 3rd. The Top Ten scores reflect activity across the nation. Almost all of the 37 logs in this category showed activity on 24 GHz. Only four logs showed activity on 47 GHz. Surprisingly, no submitted logs showed operations on 78 GHz. One submitted log showed "light" activity above 300 GHz. Loaner rigs are starting to be available for 24 GHz — see if some are available in your area to use for your first steps on your next new band.

Humidity has a detrimental impact on 24 GHz signals and up. Despite this, several operators worked multiple 180 km shots across Lake Superior. Out in California with dry valley air, Ron, K6GZA, completed the longest DX on 24 GHz this year at 360 km. Mike, N1JEZ, completed the longest 47 GHz QSO at 88 km. Ron, K7RJ, completed the longest "light" contact at 156 km using a modulated LED transmitter.

More to See and Do!

Want to take your 10GHz fun even higher? Try operating from a new location! Also, be sure to read the 10 GHz Contest Expanded Results online at **www.arrl.org/contests** for more analysis and information.

Looking Ahead

Put this event on your calendar for August 17-18, 2013 and September 21-22, 2013. I propose a nationwide goal of 125 submitted logs. Reach out to new operators and make sure that all loaner rigs get on the air!

Top 10 QSOs Completed

10 GHz Only	QSOs	10GHz and Up	QSOs
WBØLJC	351	WØZQ	336
NØUK	305	AA6IW	308
KØHAC	282	K6GZA	254
KD6W	262	K9PW	235
NØAKC	256	N6RMJ	202
KØCQ	239	WB8TGY	162
KCØP	232	AF1T	143
N6NU	231	W1MKY	132
WA2VOI	226	WA8VPD	129
KØMHC	222	KC6QHP	121

Top 10 Scores

10 GHz Only	Score	10 GHz and Up	Score
WBØLJC	78233	WØZQ	76506
NØUK	71078	AA6IW	68446
KØHAC	64168	K6GZA	62992
KD6W	62505	K9PW	47477
NØAKC	58931	N6RMJ	38551
K6ML	55490	AF1T	35712
N6NU	55438	WB8TGY	35102
KØCQ	54801	W1MKY	31021
WA2VOI	51167	WA8VPD	26593
KK6MK	50196	W6QIW	25349

Frequency Measuring Test (FMT) Results for November 2012

A signal measured 'round the world.

Connie Marshall, K5CM

A few days before the FMT, Earth was being pelted with M-class solar flares. Luckily, old Sol gave us a break and the geomagnetic field's K index settled down to a level of 1 [meaning quiet conditions — *Ed.*] by the time the November FMT started. Most participants reported that signals were good but not necessarily strong.

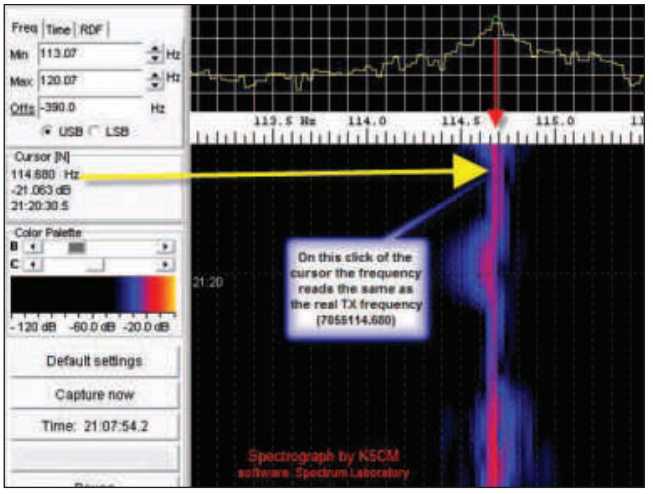
The Receivers

Some stations reported 40 meters "going long" with a skip zone approaching 600 miles. It seems long skip was good for at least one participant. Costas Krallis, SV1XV, in Athens copied both the K5CM and W8KSE 40 meter signals, reporting the frequencies of each with better than 1 Hz accuracy.

Speaking of long distance reports, in the April running Hisami Dejima, 7L4IOU, in Japan reported a measurement of the K5CM 20 meter signal with better than 1 Hz accuracy. Outdoing everyone for both distance and accuracy, Manfred Mornhinweg, XQ6FOD, in Temuco, Chile made the "Green Line" by reading all eight of April's FMT transmissions at better than 400 millihertz! ["Green Line" refers to the listing of the most accurate stations on the FMT results website at **www.b4h.net/fmt/fmtresults201211.php** — *Ed.*] Simply making the "Green Line" can be a challenge, but doing it from over 6000 miles away is a real accomplishment. At least one does not have to worry about being inside the skip zone at that distance.

The Transmitters

On the transmit side of the FMT, everything seemed to work reasonably well. The only excitement concerned Mike, WA6ZTY, who operated the 40 meter FMT station. Mike was in the middle of a move as the event approached and at the same time had major problems with his oven controlled master oscillator. Mike managed to disassemble, test and reset the temperature control system with just a day to go!



According to the various participants' reports, Doppler shift seemed to have been modest during the November FMT as confirmed by this spectrograph of Mike's, WA6ZTY, 40 meter signal. [Connie Marshall, K5CM, photo]

There was more excitement — Mike's antenna did not go up until the day of the FMT. Then at almost the last minute he realized he hadn't brought a hand key to his new shack. A quick trip to a neighbor saved the day. Mike plans to have his station ready for action on all three bands by the time the November 2013 FMT rolls around.

The Standards

Although many participants now use GPS based frequency standards, good results can still be had by relying on simple WWV or CHU calibration, especially if calibration is done during the daytime when Doppler shift in the ionosphere is at a minimum. As an example of what can be accomplished, read the comments James, K7TT, or James, N2ADR, submitted with their results on the FMT website. Both stations made accurate readings, with N2ADR easily making the Green Line.

If you are thinking about participating in the next FMT, Connie and his merry metrologists have something new planned for April. Watch *QST* and the ARRL's® Frequency Measuring Test website (**www.arrl.org/frequency-measuring-test**) for future FMT announcements. — *Connie Marshall, K5CM*, **k5cm-2@suddenlink.net**

Table 1
Green Line Stations

Green Line participants submitted measurements of all four FMT stations (K5CM, W8KSE, W6OQI and WA6ZTY) with an accuracy of 1 Hz or better:

AB1IX, AB4RS, K5CM, K5RKS, K6APW/7, K6BZZ, K7HIL, KM6QX, N2ADR, N4AU, N5LBZ, N8OQ, N9YKE, NF6Z, VE3OAT, W2FD, W3JW, W4ARYF, W4JLE, W4UK, W6IHG, W6OQI, W7PUA, W8XN, W9ZB, WA6UAT

Strays

I would like to get in touch with...

…anyone who exchanged QSLs with Don Brown, W1JSM, (SK). I would like to have his QSL (or copy, if you prefer) and yours. His daughter wants to restore his collection, which was not preserved in his estate. Steve Brown, N6OE, PO Box 21, Morro Bay, CA 93443; **steveb54321@gmail.com**

…ham radio operators who knew Gerry Fischer, the original W2DXW. I am in touch with Gerry's son, Richard, who would like to hear a few stories about his dad and Amateur Radio. Mark Murray, **w2or@arrl.net**

QST Congratulates...

Robert Henry Caverly, WB4PWZ, who has been named an IEEE Fellow. He was recognized for contributions to modeling and design of radio frequency switching devices.

Contest Corral – February 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	0200Z	1	0300Z	1.8-14 / -	SNS and NS Weekly Sprints	CW	Serial, name and S/P/C	www.ncccsprint.com
2	0000Z	3	2400Z	3.5-28 / -	EPC WW PSK Contest	Dig	RST and serial	www.epcwwdx.srars.org/index.php/contest-rules.html
2	0000Z	3	2400Z	1.8-28 / 50,144	Vermont QSO Party	Ph CW Dig	RS(T) and VT county or S/P/C	www.ranv.org
2	0001Z	3	2359Z	28 / -	Ten-Ten Winter Phone QSO Party	Ph	Call sign, name, QTH, 10-10 number	www.ten-ten.org
2	1200Z	3	1159Z	1.8-28 / -	Black Sea Cup International	Ph CW	RS(T) and HQ ID, member nr or ITU zone	www.bscc.ucoz.ru
2	1400Z	2	2400Z	1.8-28 / -	FYBO Winter QRP Field Day	Ph CW	RS(T), S/P/C, name, power, temp in deg F	www.azscqrpions.com
2	1400Z	2	2400Z	1.8-28 / 50+	Minnesota QSO Party	Ph CW Dig	Name and MN county or S/P/C	www.w0aa.org
2	1600Z	2	1900Z	3.5 / -	Straight Key Party	CW	RST, serial, category, name, age	www.agcw.de
2	1600Z	3	0400Z	1.8-28 / -	British Columbia QSO Party	Ph CW Dig	RST and BC district or S/P/Territory or DX	orcadxcc.org
2	1700Z	3	2359Z	1.8-28 / 50+	Delaware QSO Party	Ph CW Dig	RS(T) and DE county or S/P/C	www.fsarc.org
2	1800Z	3	1759Z	3.5-28 / -	XE Int'l RTTY Contest	Dig	RST and XE state or serial	www.fmre.org.mx
3	**0000Z**	**3**	**0400Z**	**3.5-14 / -**	**North American Sprint**	**CW**	**Both call signs, serial, name and S/P/C**	**www.ncjweb.com**
4	1600Z	4	See web	3.5 / 50, 144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
5	0200Z	5	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
8	1400Z	10	0200Z	1.8-28 / -	YL-OM Contest	Ph CW Dig	Call sign, RST, serial and S/P/C	www.ylrl.org
9	0000Z	10	2359Z	1.8-28 / -	YLISSB QSO Party	CW	Call sign, RS(T), ISSB number	www.ylsystem.org
9	0000Z	10	2400Z	3.5-28 / -	CQ WW RTTY WPX	Dig	RST and serial	www.cqwpxrtty.com
9	1100Z	9	1300Z	7,14 / -	Asia-Pacific Sprint	CW	RST, serial	jsfc.org/apsprint/aprule.txt
9	1200Z	10	1200Z	1.8-28 / -	Dutch PACC Contest	Ph CW	RS(T) and Dutch province or serial	www.dutchpacc.com
9	1500Z	10	0300Z	3.5-28 / -	Louisiana QSO Party	Ph CW Dig	Call sign, RS(T), LA parish or S/P/C	laqso.w5yl.org
9	1500Z	10	1500Z	3.5-28 / -	OMISS QSO Party	Ph	RS, S/P/C and OMISS nr or "DX"	www.omiss.info
9	1600Z	10	0400Z	1.8-28 / -	New Hampshire QSO Party	Ph CW Dig	RS(T) and NH county or S/P or "DX"	www.w1wqm.org
9	1700Z	9	2100Z	3.5-28 / -	FISTS CW Winter Sprint	CW	RST, S/P/C, first name, FISTS nr or power	www.fists.org
9	2100Z	10	0100Z	1.8 / -	RSGB - First 1.8 MHz Contest	Ph CW	RST, serial, UK district	www.rsgbcc.org
9	2300Z	10	2300Z	1.8-14 / -	AM QSO Party	Ph	RS, name and S/P/C	www.antiquewireless.org
10	1400Z	11	0800Z	1.8-28 / 50,144	Classic Exchange	Ph	RST, QTH, model of rcvr and xmtr	www.classicexchange.org
10	1900Z	10	2130Z	- / 50-440	Milwaukee FM Simplex Contest	Ph	Call sign and grid square	www.w9rh.org
10	1900Z	10	2300Z	- / 144	Maine 2m FM Simplex Challenge	Ph	Call sign, power, city name	www.qsl.net/ws1sm/contest.html
11	**1300Z**	**15**	**2359Z**	**1.8-28 / 50+**	**School Club Roundup**	**Ph CW Dig**	**RS(T), Class, S/P/C**	**www.arrl.org/school-club-roundup**
13	0130Z	13	0330Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C and NAQCC mbr nr or power	naqcc.info
13	1300Z	7	See web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
14	8 PM	15	2 AM	1.8-7 / -	PODXS Valentine Sprint	Dig	Name, OM or YL, S/P/C	www.podxs070.com
15	2100Z	16	2100Z	1.8-28 / -	Russian WW PSK Contest	Dig	RST and oblast code or serial	www.qrz.ru/contest/detail/384.html
16	**0000Z**	**17**	**2400Z**	**1.8-28 / -**	**ARRL Int'l CW DX Contest**	**CW**	**RST, state/province or power**	**www.arrl.org/contests**
16	2000Z	16	2200Z	1.8-28 / -	Feld-Hell Annual WAS Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
18	0200Z	18	0400Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
20	1900Z	20	2030Z	3.5 / -	Semi-Automatic Key Evening	CW	RST, serial, first year of bug use	www.agcw.de
22	2200Z	24	2200Z	1.8 / -	CQ WW 160 Meter SSB	Ph	RST and state/province or CQ zone	www.cq160.com
23	0600Z	24	1800Z	3.5-28 / -	REF Contest	Ph	RS and French dept or serial	concours.ref-union.org/contest
23	1300Z	24	1300Z	3.5-28 / -	UBA Contest	CW	RS, serial and ON province	www.uba.be/en/hf/contest-rules
23	1500Z	24	0300Z	3.5-28 / 50-432	Mississippi QSO Party	Ph CW Dig	RS(T) and MS county or S/P/C	www.arrlmiss.org
23	**1800Z**	**24**	**0600Z**	**3.5-28 / -**	**North American QSO Party-RTTY**	**Dig**	**Name and S/P/C**	**www.ncjweb.com**
24	1500Z	25	0059Z	3.5-28 / 50, 144	North Carolina QSO Party	Ph CW	RS(T) and NC county or S/P/C	www.ncqsoparty.com
25	0100Z	25	0259Z	3.5-14 / -	CQC Winter QSO Party	Ph CW	RS(T), S/P/C, name, CQC nr or power	www.cqc.org

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates. No contest activity occurs on the 60, 30, 17 and 12 meter bands. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity. XE = Mexican state. Publication deadline for Contest Corral listings is the first day of the second month prior to publication date (February 1 for April *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.

Bernie McClenny, W3UR, w3ur@arrl.org

A DX Legend Closes His Log

One of the DX world's most beloved journalists is now QRV in that undiscovered entity.

On November 19 the DX community received the sad news of the passing of former "How's DX?" columnist Rodney H. Newkirk, W9BRD/VA3ZBB, (see Figure 1) who had been living in Ottawa, Canada since the late '90s. If you ask any old time DXer the first thing that comes to mind when hearing "How's DX?" the reply you'll most likely get is "Rod Newkirk, W9BRD!"

Rod was actually the third editor of this column, following in the footsteps of the late great Byron H. "By" Goodman, W1DX (ex W1JPE, W6CAL), who started the column in 1936 and was followed by Joseph E. Grahn's, W1CH, short stint as editor. W9BRD began his 30 year reign at "How's DX?" in December 1947 by saying "Having been allowed to attempt to fill the auspicious galoshes of such illustrious predecessors as W1CH and W1DX, I hope you'll bear with me in helping to keep things hopping in this department, gang. Me, not even DXCC, yet! Oh, I've tried using an antenna. But I notice that in these parts the boys are stringing them up *outside*."[1] Rod wasn't a DXer at that time but then ARRL® Communications Manager Ed Handy, W1BDI, realized the gift that he had for writing and asked him to take over as the "How's DX?" editor.

Rod continued to inform us of the How, When, What, Where, Whence and Tidbits for more than three decades — until February 1978. He had a wonderful sense of humor and I suspect no one could ever forget the annual May issue of the "DX Hoggery and Poetry Depreciation Society" and the many Jeeves cartoons done by Phil "Gil" Gildersleeve, W1CJD (see Figure 2). DXers all around the globe read Rod's column as it was the main source of DX news until the DX newsletters came along — and even after that he still had a very loyal following. "Rod Newkirk was the "How's DX?" editor of *QST* during the significant growth of DXing in the 1950s and a role model for me during my tenure as DX Editor," remembers Ellen White, W1YL/4, another former "How's DX?" columnist.

We of the DX community wish you, Rod, great propagation, no QRM and the very best DX.

Figure 1 — Here is Rod, W9BRD, in his Norridge, Illinois shack in 1991. [James Cain, K1TN, photo]

Figure 2 — Rod's sense of humor mixed well with the cartooning talents of Phil "Gil" Gildersleeve, W1CJD.

[1]R. Newkirk, W9BRD/1, "How's DX?," *QST*, Dec 1947, p 51.

How's DX? Family in Dominica

Your editor, W3UR; his wife Becky, N3OSH; his dad Tony, N3ME, and his mom Claudia are heading to the Caribbean island of Dominica for some casual operating on all bands and modes between January 22 and February 12 from the Sea Cliff Cottages on the northeast side of the island. Tony has requested the call sign J76A and I have requested J77A. Each number in the call signs represents the year we were first licensed. Tony plans to operate in the CQ World Wide RTTY WPX Contest (**www.cq-amateur-radio.com**) over the February 9-10 weekend. QSL J76A via N3ME and J77A via W3UR either direct, via the W3 QSL bureau (**www.ncdxa.org/qsl.shtml**) or LoTW (Logbook of The World).

DX News from Around the Globe

5X — Uganda

Members of the Provins ARC (F6KOP) have announced plans for a DXpedition to Uganda February 6-18. This is the same group that staged the following past DXpeditions: 5V7C, 5H1C, XT2C, J5C, TK7C, TS7C, TM7CC, ISØR, TJ9PF and most recently PJ4C. The team includes team leaders: Franck, F4AJQ; Seb, F5UFX, and Alain, F6ENO. Other team members are: Stephane, F5UOW; Dave, K4SV; Michel, FM5CD; Gerard, F2JD; Uwe, DL8OBF; Francois, ON4LO; Flo, F5CWU; Jean Jacques, F5NKX; Norbert, DJ7JC; Eric, ON7RN; Michel, F5EOT; John, F5VHQ; Jean-Paul, F8BJI; Gerard, F2VX; Hans, DL1YFF; Valery, RG8K; Patrick, F2DX;

Mike, UA9KGH; Jean-Marc, F8IXZ; Lars, DF1LON, and Jean-Louis, F5NHJ. The team will be QRV as 5X8C from the beach of Lake Victoria operating 160-10 meters on CW, SSB, RTTY and PSK on the frequencies listed in Table 1.

To comply with the 40 meter IARU band plan, they will operate RTTY and PSK between 7040 and 7042. They will have a number of stations and amplifiers running Spiderbeams, verticals and Four Squares on 40 and 30 meters. Andre, V51B, will be the pilot station. Check out the 5X8C website at **www.5x2013.com**. QSL via F1NGP either direct, OQRS, the French REF bureau or LoTW.

Table 1
5X8C Operating Frequencies (kHz)

Band	CW	SSB	RTTY	PSK
10	28,024	28,480	28,082	28,122
12	24,892	24,960	24,922	24,920
15	21,024	21,295	21,082	21,072
17	18,074	18,140	18,102	18,100
20	14,024	14,145	14,082-90	14,072
30	10,104	—	10,142	10,140
40	7024	7075	7042	7040
80	3524	3785	3585	3570
160	TX 1826.5 RX AS/OC 1821.5 RX EU/NA 1834.5	1850	1842	—

9U — Burundi

Starting February 14th through the 23rd a Belgian and Dutch team will be operating 9U4U from Hotel Club du Lac Tanganyika, just south of the Bujumbura Airport, Burundi. Complete details of this one are expected shortly. Their website, **www.9u4u.be**, will soon be open to the public and they are already on Twitter (**twitter.com/9U4U**). QSL via MØURX.

CEØY — Easter Island

Look for XRØYG to be QRV from Easter Island March 20-27. As of press time details were just starting to come out. The team will include Michael, G7VJR; Nigel, G3TXF; John, G4IRN; Bob, MDØCCE, and Martin, G3ZAY. They will be using Club Log (**https://secure.clublog.org/charts/?c=XR0YG**).

H44 — Solomon Islands

Phil, G3SWH, and Jim, G3RTE, have announced plans to be QRV from Honiara, Guadalcanal (OC-047) in the Solomon Islands starting February 18. They will operate CW only on 3.5 through 28 MHz until February 28. There are no plans for 160, 60, 6 meters or EME activity. H44 ranks #81 in Europe and #77 in North America on Club Log. They will have two stations and they "plan to make at least 15,000 QSOs." There is more information at **www.g3swh.org.uk/h44kw.html**, which will be updated from time to time. QSL via G3SWH, either via the OQRS facility on Phil's website **www.g3swh.org.uk** (recomended), direct with SAE and adequate return postage or via the traditional bureau route.

HA3AUI Heading Back to West Africa

Peter, HA3AUI, will be back in West Africa January 17-March 10. He'll go between Senegal as 6W2SC and Guinea-Bissau as J5UAP during this period including possible side trips to two IOTAs. Peter will have an Elecraft K3 transceiver and a 500 W amplifier driving a Spiderbeam and verticals, on 40-10 meters, mostly CW and digital, other modes by request. QSL direct to HA3AUI or on OQRS when he's back home in Hungary (**cqafrica.net**).

VP8 — South Shetland Islands

Oleg Neruchev, UA3HK (ZS1OIN), is heading back to the Antarctic starting March 2013 through March 2014 (see Figure 3). He's heading to the Russian Bellingshausen Base on King George Island in the South Shetland Islands (VP8/h) and will be QRV as RI1ANU. Oleg's past experiences include 4K1A (81-83) and 4K1HK (84-86) from the Molodezhnaya Base in Antarctica. Oleg will be QRV on 1.8-28 MHz on CW and SSB running an FT-1000MP transceiver and Acom 2000A amplifier driving a SteppIR 3 element Yagi up 12 meters and an 18 meter vertical. For receiving he will have 350 meter Beverages aimed at North America and Europe.

XT — Burkina Faso

The Italian DXpedition Team (IDT) is heading back to Africa. This time the team's members will be QRV as XT1T from Burkina Faso. The exact dates have not been announced as of press time; however the team's website (**www.i2ysb.com**, click on the IDT logo) says it will be in the February-March time frame and will last for about 15 days. By the time you read this you should be able to look up the exact dates either on the team's website or via your favorite DX outlet. The XT1T team will include I1HJT, I2YSB, IK1AOD, IK2CIO, IK2CKR, IK2DIA, IK2HKT and IK2RZP. Plans are to be on all bands and modes. Equipment will include three Elecraft K3 transceivers and three KPA500 amplifiers. For antennas they will be using two Spiderbeams for 30-10 meters, a Yagi for 20-10 meters, two verticals for 40 and 80 meters, an inverted L for 160 and a 3 element cubical quad for 50 MHz activity. The XT1T website will have a log search during the DXpedition and already has a survey for those who need XT1 on a certain band or mode. QSL direct to I2YSB (with three US dollars for return postage), via the bureau to IK2CIO or via LoTW and OQRS.

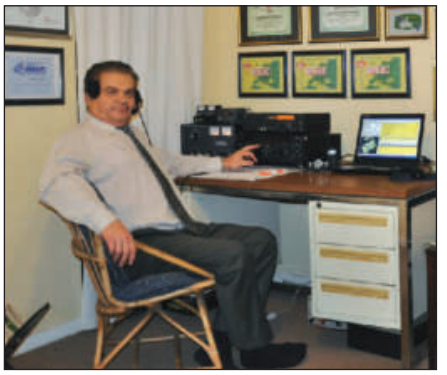


Figure 3 — Oleg Neruchev, UA3HK (ZS1OIN), will be heating up the South Shetland Islands for a year starting in March 2013. [Photo courtesy Oleg Neruchev, UA3HK]

A second group is also planning to be QRV from Burkina Faso at about the same time. The Kwansei Gakuin University CRIOR field work team (Centre de recherches sur la cooperation internationale pour la promotion de l'utilisation des ondes radio en Afrique de l'Ouest — Research center on international cooperation for the promotion of the use of radio waves in West Africa) and Japanese Amateur Radio operators JA3VWT, JH3AEF, JA3IVU and JA1CJA will be back in Burkina Faso from February 22 to March 2. Listen for XT2VWT, XT2AEF, XT2IVU and XT2CJA to be QRV on 3.5-28 MHz using SSB, CW and the digital modes. QSL to their respective home calls.

Wrap Up

That's all for this month. Thanks this month go to **DX-World.net**, G7VJR, and *The Daily DX*. Don't forget to send your DX news, photos, club newsletters and whatnots to **w3ur@arrl.org**. Until next month, see you in the pileups! — *Bernie, W3UR*

Jon Jones, NØJK, n0jk@arrl.org

High Northern DX

A 6 meter contact scrapes along the Arctic Circle.

Interest is high concerning everything involving the state of Alaska and the Canadian Yukon. *The Discovery Channel* features the popular "Gold Rush Alaska" while *National Geographic* has "Alaska State Troopers." Ham radio too has some "Alaska sized" activity in the High North. On October 13, 2012 at 0628 UTC, Ron, KL7YK, in Anchorage, Alaska was excited to make his first ever 6 meter DX contact with David, VE8DAV (CP65) via Aurora sporadic E (E_s). Here is the story of his VHF activity from the 49th state:

> It was a normal Friday night net. All the usual suspects doing the usual activities when Tom, NL7OW, down in Clam Gulch, Alaska announces that he was hearing 6 meter beacons out of Canada.
>
> Well, that may not sound like earth-shaking news to many of you folks who are used to hearing 6 meter traffic, but, for those of us not blessed with high gain gear, we look for any chance to work something new.
>
> I promptly jump up to 50.125 MHz USB and listen for a bit, but I don't hear anything. I continue to listen and start hearing some light traffic. On a lark, I throw out a few CQs from "KL7YK BP51" expecting to hear static for the effort. Then, very lightly, I start hearing someone returning to the BP51 station. I look at *DX Spotter* and I see a KL7*KY* spotted in Canada. What is the chance there is actually a KL7*KY* on the same time I am? Not realizing that KL7KY was also active, I think "none" and continue calling in the belief that the VE8 just misunderstood my call.
>
> I throw out my call again and hear his reply but his signal is light with QSB and I can't quite pull it out. Another station Eric, N6SPP/KL7, who also lives here in Anchorage, tells me he hears the VE8 station replying to me, but I can't quite make contact. Eric tries, works him and turns it back to me. By now David, VE8DAV, is a good 5/5 so I try again and hear David's reply. Conditions slowly improved over the next few minutes until we were 5/9 both ways (see Figure 1).
>
> There was heavy aurora activity in the Northwest Territories at the time, which was helping of course. After years of fruitless efforts on my part I had just logged my *first* 6 meter contact outside of Alaska. Yes, others do this far more than I do and are used to these things. Even in Alaska others work 6 meters on occasion to distant lands. [KL7NO and KL7KY are in, on occasion, to the lower 48 states via E_s and aurora E_s on 6 meters — *Ed.*] However, for me, this was a most exciting 6 meter contact.
>
> I was using my trusty FT-950 transceiver running 80 W into first, a G5RV, and then a 6 meter loop *in the attic*. Both worked, but the loop was far better. In fact, that was my first contact of any kind on the loop. For me, at least, it proves the theory that an attic loop can be effective.
>
> Am I hooked? You betcha! I have worked everything from 160 meters to 33 centimeters but 6 has been an operating void for too long.
>
> What's the message here? Watch those DX spots on the web and listen for the beacons. When you're not using your radio for contacts, monitor 6 meters just in case. All you need is a short wire, a small loop — or both!
>
> BP51 Anchorage Alaska to CP65 Norman Wells, Northwest Territory, Canada is 748 miles as the crow flies. Maybe that's not a record for the 6 meter big guns, but for this peanut station it's amazing!

Figure 1 —This 6 meter contact between BP51 and CP65 spanned 748 miles using only 80 W and an attic loop.

Ron made his contact with VE8DAV via "aurora E_s." This mode was also used by K1TOL and others to work MMØAMW and OH7TE on 6 meters on November 14. It is similar to, but different from, the "sporadic E" you may encounter during the summer months.

Radio aurora and sporadic E occur at approximately the same 100-120 km altitude. Radio aurora propagation takes place when your signal is reflected from an intense band of aurora ionization. It is a "backscatter" mode. Typically, signals are very distorted with a "buzz" or "hiss" on 50 MHz. On higher VHF and UHF bands, signals spread out wider with Doppler shift at times. SSB sounds like someone is gargling steam.

There are times, more commonly later during an aurora, when suddenly the signals become crystal clear. Bands of E-layer ionization can form under the aurora curtain and refract signals just as typical sporadic E. Sometimes these bands are higher than regular sporadic E clouds. Sometimes, signals can be ducted between the aurora curtain

and these layers for thousands of kilometers with little loss.

Aurora E_s has occurred on 144 MHz but is most commonly encountered on 50 MHz. Some typical 50 MHz Aurora E_s paths are from New England to Central and Western Canada; the upper Midwest, Pacific Northwest and Great Lakes region to the North West Territories, and Alaska and New England to Greenland, Iceland and northern Europe. Look for aurora E_s after an intense aurora has been in progress for awhile or when it is breaking up.

On the Bands

50 MHz

Solar cycle 24 was flat during most of the month of November. There was discussion among NASA scientists that cycle 24 may be even weaker than previously thought. The sunspot number was around 120 with the solar flux ranging between 125 and 140, which is too low for direct F2 for North American stations. **Spaceweather.com** asked "is this the peak of cycle 24?" However, solar cycles are notoriously variable, so the sunspot counts could rise rapidly, perhaps by the time you read this.

There were a number of E_s openings reported during the month. Those toward the end were likely the first of the winter E_s season. There was some DX for alert stations. Kelley Sprout, KB3LR, who is a blind ham in EM85, reported hearing WZ8D/b (EM89) and worked Gary, W4CBX (EM86) November 4 on a homebuilt 2 element Yagi via tropo. On the 5th VE2XK (FN07) spotted Midwest beacons such as NØLL/b (EM09) and WBØRMO/b at 1643 UTC. OA4TT/b (FH16) was 599+ for W9DR (EL86) at 2254 UTC on the 7th, possibly via direct F2.

The geomagnetic field was unsettled that day with a K of 4 [The K index is the amount of fluctuation in the geomagnetic field over a 3 hour interval, 0 is quiet conditions and 9 being major geomagnetic storm conditions. — *Ed.*]. An aurora opening took place the 14th. This was due to a Coronal Mass Ejection impact at 2300 UTC November 12. The K_p [a planetary average of all the K index values measured globally. — *Ed.*] reached a maximum of 6. K1TOL, worked OH7TE, via AU-E_s at 0117 UTC November 14. MMØAMW (IO75) logged N1BUG and VE3MMQ. WW2DX (FN22) worked WØANH in rare grid EN47 via aurora at 0128 UTC.

Most of the aurora contacts reported were along the US — Canadian border and farther north. The Argentinean station LU5FF worked Japan via F2/TEP at this time. LU5FF logged JA2FGL "599 FB" at 0122 UTC along with JG3LEB and JP1LMD.

An E_s link or direct TEP opening occurred from Florida to South America on the 16th. AC4TO (EM70) worked ZP5SNA at 0123 UTC. Earlier both AC4TO and K4RX (EM70) logged LU5FF and CE2AWW at 0050 UTC. KE4WBO (EL96) spotted PR8ZIX/b, PY7RB and LU6EE/b. St Peter and St Paul Rocks, PTØS, was active on 6 meters at this time and spotted by PY2OC at 0101 UTC "CQing CW" on 50.110 MHz (see Figure 2). I did not see any stateside stations spotting PTØS.

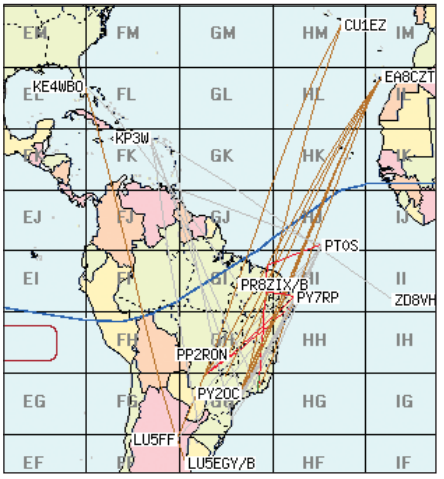


Figure 2 — St Peter and St Paul Rocks, PTØS, was active on 6 meters during the November 19 opening. [DXMAPS.COM]

A weak E_s opening between the Midwest and Florida occurred on the 19th. NWØW (EM47) and NØJK (EM28) heard W4CHA/b (EL88) at 1730 UTC (see Figure 3). I worked Peter, PP5XX, at PTØS on 10 meter SSB at this time and asked him about 6, wondering if some sort of E_s link may be present but none was. PTØS made 1129 contacts on 6 meters in 38 countries with 47 North American contacts.

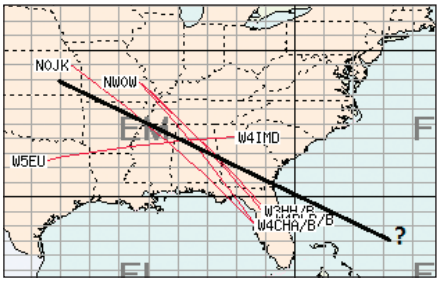


Figure 3 — This map describes the weak opening that occurred on the 19th. The black line represents a potential path to PTØS via E_s link.[DXMAPS.COM]

N7DB heard XE2K/b on the 21st at 1655 UTC. KH7Y heard ZD8W working South American stations on the 26th. He could not break the pileup. KH7Y sent some pictures of the KH6HME beacon site (see Figures 4 and 5).

There was E_s between W5KI (EM36) and K7TNT (DN74) at 0443 UTC. K7TNT (DN74) also worked KF6A (EN73).

Perhaps the best E_s opening of the month was on the 27th. Six meters opened that morning and many contacts were spotted from the New York / Great Lakes region to Florida, between the Gulf Coast and Ohio, and the Midwest to Florida (see Figure 6). KF6A (EN73) spotted C6AFP/b (FL16), WB5LLL/b (EM40) and W5ZPA (EL49) around 1600 UTC. WFØN and NØJK in EM28 both worked N3LL (EL86) at 1702 UTC. XE2JS (DL68) added some DX spice for KF4WE (EM56) at 1700 UTC. KØGU (DN70) worked KJ4E (EL98) at 1710 UTC.

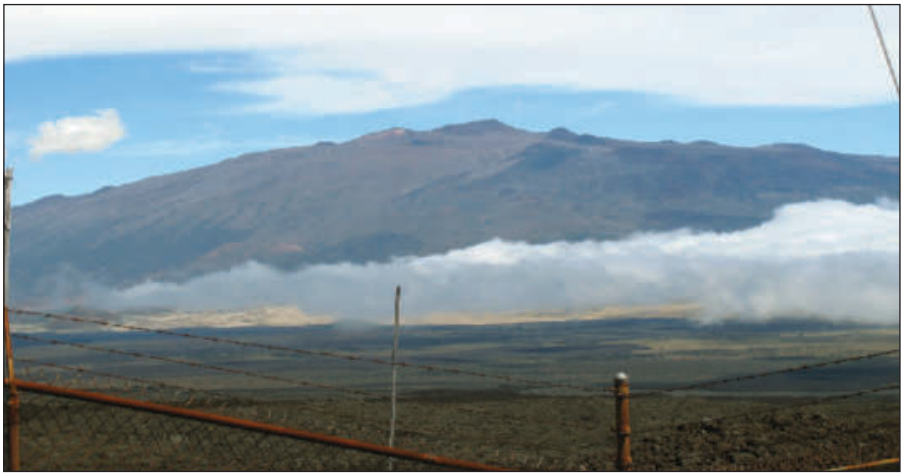


Figure 4 — This is the view from the KH6HME beacon site looking north to Mauna Kea 13,796 feet above sea level. [Fred Honnold, KH7Y, photo]

Figure 5 — This is the KH6HME beacon's 2 meter 7 element stack pointed at the USA mainland. [Fred Honnold, KH7Y,photo]

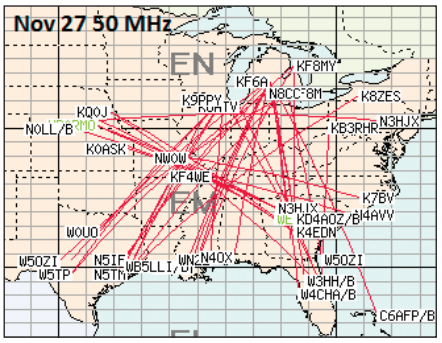


Figure 6 — The best opening of the month occurred on the 27th with propagation ranging from the Great Lakes to the Gulf. [DXMAPS.COM]

The opening drifted west and N7DB in Oregon heard WØMTK/b at 1844 UTC and worked WØALC (DM68) at 1847 UTC. The month closed out with sporadic E from North Dakota (NDØB) and Wyoming (K7TNT) to the Midwest. KG9D (EM66) and KF4WE (EM56) logged NDØB (EN07) at 1525 UTC Nov 30.

144 MHz

An impressive tropo opening took place on November 12 from TX to KY and TN. N4QWZ (EM66) worked W5MRB (EM35), KC5GTT (EL09), W3XO/5 (EM00), K5VH (EM00) and KC5ADG (EM12) along with closer-in stations between 1300-1500 UTC. A wave cyclone weather pattern may have caused this tropo opening.

There was a strong Midwest tropo opening associated with a high pressure system on the 21st. I was operating portable in EM28 and heard Jay, W9RM (EN52) with a very loud signal at 1500 UTC. Bob, W9EWZ (EN52) made 36 contacts on 2 meters. He noted "Very strong tropo into OK, AK, MO and KS this morning (11-21-12) with signals up to 30 over 9. It lasted well into the morning." Bob's best DX was W5LDA (EM16). N9OLT (EN64) logged KØASK (EM28), NØIRS (EM29) and NØMUA (EM27). (Thanks *205MorningReport.*)

NØIRS (EM29) found signals were very loud. "I managed to work Bob, W9EWZ (EN52) from both home and on my way to work from my mobile." W5MRB (EM35) was pleased to work WB9LYH (EN54) at 1329 UTC. You shouldn't quit operating an opening too soon. After I shut down, W8MIL (EN74) showed up and worked WFØN (EM28), W5QBF (EM36), K5SW (EM25) and W5KI (EM36) around 1630 UTC over 1100 km paths. The weather system moved east and strong coastal tropo was reported along the Eastern Seaboard the morning of the 23rd from North Carolina to Nova Scotia. Ron, WZ1V (FN31) heard W3CCX/b (FM29) 599 at 1345 UTC. On 144 MHz EME, VE1KG (FN84) worked SV6KRV (KM09) on Nov 24. NY2NY (FN30) worked VE1SKY (FN74) on tropo the same day (Thanks *205MorningReport.*) November 25 Dick, K5AND, worked KD4ESV (EL87) and N3LL (EL86) from EM00 in Texas.

222 MHz

Jay, NY2NY (FN30) made his first ever 222 meteor scatter contact during the Leonid meteor shower on November 18 with AA9MY in EN50 at 1434 km. Jay was using *WSJT* software, running 120 W into a single 10 element Yagi. He sent a screen shot showing a large long burst at 0445 UTC. These are the top three North American records for meteor scatter on 222 MHz (courtesy Al Ward, W5LUA):

2153 km K5VH (EM00xe)
— VE3AX (FN02cw) 19-Nov-2002

2102 km K1WHS (FN43mj)
— W7XU (EN13lm) 13-Dec-1998

2089 km K5LLL (EM10kf)
— VE3AX (FN02cw) 18-Nov-2001

432 MHz and Up

NØJK (EM28) worked W9RM (EN52) on 432 MHz. K5SW (EM25) logged W9ZIH (EN52) and N9OLT (EN64) worked NØIRS (EM29) for a new grid on 432 on the morning of November 21. K5SW tried with W9ZIH on 1296 MHz. He could hear W9ZIH but was unable to complete the contact. JD, NØIRS, observed "432 MHz was strong and there was quite the pileup of folks working each other on 432.1 MHz. The radar sweeps on 1296 MHz were very strong, the strongest I heard this year."

1296 MHz

Sam, K5SW, said Dick, K5AND (EM00) TX was loud on 144 MHz November 12. "I had him listen for my 'W5VHF code wheel' on 1296.1 MHz. Dick heard it 579. We went to 1296.1 MHz and worked easily at 406 miles. I was his 'first out of state 1296 MHz contact.'" Sam runs 34 W to a 55 element loop Yagi at 75 feet with ⅞ inch Heliax feed line and a tower preamp.

Here and There

This is the correct link for NDØB's Dayton presentation of "EME on a shoestring:" **www.youtube.com/watch?v=uIQqZL_3xR0**

It looks like Lance, W7GJ, will be going on the Cordell Expeditions Clipperton TX5K DXpedition in March. He thanks those who contributed to make his trip possible. He will be working EME as well as terrestrial modes on 6 meters, keeping a close watch for F2 and E_s. He operated as E6M from Niue September 7-21, 2012 on 50 MHz EME. He made 46 EME contacts and 33 terrestrial. The smallest EME station worked was N3CXV with a single M^2 6M5X Yagi. Lance used the Elecraft K3 transceiver, M^2 6M8GJ Yagi and a M^2 6M-1000 amplifier. He will probably use a similar setup for Clipperton.

Vince, KØSIX, has an early news release of a rare grid activation next summer. "Several of us will be activating grid EN48oc (Gunflint Lake, MN) under the special event call sign WØW during the June, 2013 VHF QSO Party. Operating on 50 and 144 MHz CW, digital and SSB." More information at **www.k0six.com/w0w**.

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 12, 1400Z-2000Z, W4FFC, Port Saint Joe, FL. Gulf Amateur Radio Society. State of Florida 175th Constitution Convention Commemorative Special Event. 28.375 21.375 14.275 7.177. QSL. Norm Bixler, 2003 Cypress Ave, Port Saint Joe, FL 32456. **www.gulfars.net**

Jan 12-Jan 25, 0000Z-1800Z, N4D, Hatillo, PR. Caribbean Amateur Radio Group. ARRL Puerto Rico State Convention. 28.350 21.350 14.260 147.550. Certificate & QSL. Caribbean Amateur Radio Group, HC4 Box 43014, Hatillo, PR 00659. *This is the first ARRL Puerto Rico State Convention.* **wp4crg1@yahoo.com** *or* **www.arrlpr.org**

Jan 14-Jan 22, 0000Z-0000Z, W3A, Washington, DC. District of Columbia Amateur Radio Society. Inauguration of Barack Obama. 14.200. QSL. Eric Rosenberg, 3511 Patterson St NW, Washington, DC 20015.

Jan 23-Jan 24, 1400Z-2000Z, W4BKM, Macon, GA. Macon Amateur Radio Club. Stratford Academy Radio Days. 14.250 7.250. QSL. Charles Kight, 319 Weatherford Pl, Macon, GA 31210. *We plan to operate about 20 minutes each hour during school hours only. Talk to students and encourage Amateur Radio!* **cekight3@yahoo.com**

Jan 26, 1600Z-2100Z, KSØKS, Olathe, KS. Santa Fe Trail Amateur Radio Club. 2013 Kansas Day at Santa Fe Trail Stage Coach Stop. SSB/CW 10 15 17 20 40 m; 28.320 21.320 14.250 10.115 7.250. QSL. KSØKS, PO Box 3144, Olathe, KS 66063; *eQSL*, *LoTW KSØKS*. **ks0ks@arrl.net**

Feb 1-Feb 2, 1300Z-2100Z, W5NAC, Nacogdoches, TX. Nacogdoches Amateur Radio Club. Shuttle *Columbia* Ten Year Anniversary Memorial Event Station. 28.300 21.300 14.260 7.250. Certificate & QSL. Nacogdoches Amateur Radio Club, 167 CR 2093, Nacogdoches, TX 75965. *Remembering the loss of the Shuttle* Columbia *over East Texas on February 1, 2003, and the many Radio Amateurs who provided countless hours of communications assistance in recovering thousands of pieces of debris from the shuttle.* **w5nac.com**

Feb 1-Feb 4, 0400Z-1500Z, W5B, Lubbock, TX. Lubbock Amateur Radio Club. Buddy Holly Memorial, 54th Anniversary of the Death of Buddy Holly. 18.150 14.260 7.260 3.860. QSL. W5B, 109 N Pontiac Ave, Lubbock, TX 79416. **www.amcrc.com/w5b**

Feb 2, 1400Z-2100Z, K3HWJ, Punxsutawney, PA. Punxsutawney Area Amateur Radio Club. Commemorating Groundhog Day. 14.330 7.138 3.845 147.390 PL 173.8. Certificate. Punxsutawney Area Amateur Radio Club, PO Box 3, Punxsutawney, PA 15767. **www.punxyclub.com**

Feb 2, 1700Z-2200Z, WE7GV, Tubac, AZ. Green Valley Amateur Radio Club. 19th Annual Santa Cruz Valley Collector Car Show. 14.246 14.244 14.242. Certificate & QSL. Green Valley Amateur Radio Club, 601 N La Canada Dr (SAV), Green Valley, AZ 85614. **tlang1080@gmail.com** *or* **gvarc.us**

Feb 6-Feb 10, 1200Z-1500Z, W3C, Washington, PA. Washington Amateur Communications Inc. Washington County Sportsman Show. 21.250 18.130 14.260 7.220. QSL. Bill Steffey, NY9H, Radio Hill, 401 Bells Lake Rd, Prosperity, PA 15329. *Note: This was rescheduled from Jan 31-Feb 6.* **wacomarc.org**

Feb 8-Feb 28, 0000Z-0000Z, KB9GSY, Hammond, IN. In Memory of JY1, The Late King Hussein of Jordan. 14.250 14.027 10.103 3.938. QSL. Ayman J. Azar, 4421 Clark Ave, Hammond, IN 46327. *Bands and modes are 80-10 M. CW-SSB-RTTY and all digital modes.* **kb9gsy.weebly.com/jy1.html**

Feb 9, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. Women Marines Birthday, Boy Scouts of America Founded 1910. SSB 14.320 7.250 PSK31 14.070 DSTAR 012C. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Feb 9-Feb 10, 1400Z-2000Z daily, NI8G, Milan, OH. Thomas Edison Memorial Radio Club. Thomas A. Edison's Birthday. 28.370 21.370 14.270 7.270. Certificate & QSL. Thomas Edison Memorial Radio Club, 13113 River Rd, Milan, OH 44846. *E-QSL available.* **ni8n1@yahoo.com**

Feb 14-Feb 17, 1800Z-0300Z, KØESU, Emporia, KS. Emporia State University Amateur Radio Club. 150th Anniversary of Emporia State University. 14.270 7.250. QSL. Max McCoy, Campus Box 4019, 1200 Commercial St, Emporia, KS 66801. **emporia.edu/150**

Feb 16, 1300Z-2100Z, W8VP, Cambridge, OH. Cambridge Amateur Radio Association. Astronaut and former Senator John H. Glenn, Jr, Local Hero. 14.260 7.135. Certificate & QSL. Cambridge Amateur Radio Association, PO Box 1804, Cambridge, OH 43725. *2nd Special Event in CARA's year-long 100th Birthday Celebration. QSL. Certificate available for anyone who works all 12 of CARA's monthly Special Events of 2013.* **www.w8vp.org**

Feb 16, 1400Z-2200Z, WØEBB, Leavenworth, KS. Kickapoo QRP Amateur Radio Club. 9th Annual "Freeze Your Keys" Winter Operating Event. 14.320 14.060 7.285 7.035. QSL. Gary Auchard, WØMNA, 34058 167th St, Leavenworth, KS 66048. **w0mna74@gmail.com** *or* **www.qrz.com/db/w0ebb**

Feb 16, 1500Z-2100Z, K8BF/various, Kent, OH. Portage County Amateur Radio Service. 8th Annual Freeze Your Acorns Off. General portions 10-80 meters, all modes; EchoLink on K8IV repeater. Certificate. Send QSL information to **wb8lcd@portcars.org**. *Club members will operate from both club station and home stations.* **www.portcars.org**

Feb 18-Feb 24, 0000Z-2359Z, WAP. Worldwide Antarctic Program. Antarctic Activity Week — 10th Edition. 28.450 21.350 14.250 7.150. Certificate & QSL. *WAP Reference Numbers Worked. This is an all bands, all modes worldwide event celebrating the international scientific work in Antarctica. Certificates may be obtained from the WAP, and QSLs from the WAP-Referenced Numbered stations worked. Questions in US* **kb0mzf@arrl.net**; *details* **waponline.it**

Feb 22-Feb 23, 0001Z-0200Z, WS7G, Moses Lake, WA. Columbia Basin DX Club. George Washington's Birthday. 18.135 14.250 3.880. QSL. Brian J. Nielson, 11650 Road 1 SE, Moses Lake, WA 98837. *Celebrating from the city of George in the state of Washington.* **cbn.homestead.com/ws7g.html**

Feb 23, 1400Z-2300Z, W7ZA, Aberdeen, WA. Grays Harbor Amateur Radio Club HAM Days 2012 — Hamfest and Emergency Services Fair. 14.260. QSL. Les Morgan, N7GH, 109 N Newell St, Aberdeen, WA 98520. **www.gharc.org**

Feb 23-Feb 24, 0000Z-2359Z, KB6NU, Ann Arbor, MI. Rotarians on Amateur Radio. Rotarians on Amateur Radio End Polio Now. 28.390 21.290 14.290 7.190. Certificate & QSL. Dan Romanchik, KB6NU, 1325 Orkney Dr, Ann Arbor, MI 48103. **www.ifroar.org**

Feb 23-Feb 24, 1430Z-0500Z, K7D, Apache Junction, AZ. Superstition Amateur Radio Club. 2013 Lost Dutchman Legend Celebration. 28.470 21.425 18.135 14.325. Certificate & QSL. K7D – 2013, Superstition ARC, PO Box 21522, Mesa, AZ 85277. **wb7tjd.org/wiki/K7D**

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 **Apr** *QST* would have to be received by **Feb 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 December 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

February 2013 W1AW Qualifying Runs

W1AW Qualifying Runs will be held at 7 PM EST Wednesday, February 6 (0000Z February 7) and at 4 PM EST (2100Z) Thursday, February 21. The West Coast Qualifying Runs will be transmitted by station K9JM at 3590 and 7047.5 kHz at 9 PM PST on Wednesday, February 13 (0500Z February 14). Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

John Dilks, K2TQN, k2tqn@arrl.org

A Great Station from the Past

This vintage 1957 station is straight from the pages of *QST*.

A photo recently surfaced on the Internet boat anchor forums. It showed an outstanding 1950s station built into an equally outstanding console. There were many questions and guesses about every aspect of the photo. It attracted my attention and I decided to see what I could dig up. The station belonged to William "Bill" Vandermay, W7DET, of Seattle, Washington. Looking further, I found it had been featured in the July 1957 QST.[1] *The following is from that* QST *article:*

W7DET's beautiful console from 1957. [William Vandermay, W7DET, photo]

W7DET Seattle, Washington

THAT W7DET has trouble convincing people this is a home-built station, not commercially assembled (except for the receivers), is easy to understand. W7DET reports that he was a year and a half in putting it together, doing all his own work in a very modestly-equipped basement workshop. We don't plan to go into extensive detail on the circuit details, which are more or less standard, but we do believe that there are many mechanical ideas here that some of you might find interesting enough to incorporate in your own layouts. What follows is a very brief description of the various units, and the photographs will tell the rest of the story.

William (Bill) Vandermay, W7DET, W7ZZ. [Joel Miller, W7PDX, photo]

The complete station, pictured above, is built into a specially constructed desk top console, fabricated from stock angle iron and aluminum. The power supplies and modulator...are attached behind the desk and may be serviced either through the desk's knee well or from the rear. The station operates on all phone and c.w. bands from 80 through 10 meters.

At the operating position, the 75A-2 is directly in the center of the layout, with the exciter to the left and the final at the right. Just below the exciter is a strip of control switches and fuses controlling the entire station and auxiliary functions, while directly below the final amplifier panel is a strip accommodating the electronic key, a Variac for controlling the p.a. high voltage, overload relay indicators and resets, and an a.c. outlet. On the second "deck" are a spare receiver, LM frequency meter, monitor scope, s.w.r. meter, running time meter, plate voltage meter, modulator plate meter, and local time clock. At the very top is a Navy type clock (normally kept on GMT) and a speaker. In other words, everything is right at his fingertips, making operating a pleasure.

The Exciter

The r.f./audio exciter unit is a complete c.w./phone rig built around a Collins 70E8. It uses the p.t.o, with a 6AK6 buffer, bandswitched and tracked 6AQ5 multipliers, and a 6146 in the output. Screen grid control is used to vary the output drive to the p.a. There is also included on the chassis a sidetone c.w. monitor. The audio gear includes a 6AN8 with two inputs, 12AU7, 6AL5 clippers, 6C4, and 6B4 drivers. The chassis is copper plated and Vector sockets were used to concentrate the components in each stage. Extensive use was also made of terminal boards and cabling in order to produce a neat lay-out. The meters are illuminated and there is a special gear take-off from the p.t.o. shaft to the multiplier capacitor gang.

The Final

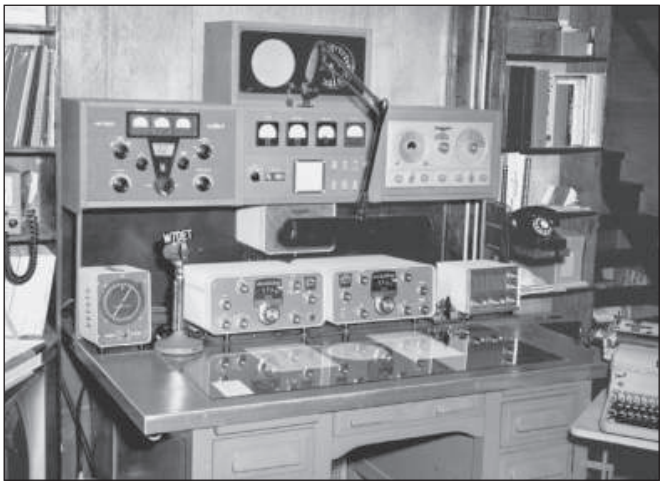
The final amplifier...uses a single 4-400A with the customary air system socket, forced air cooling, and a vacuum-variable for the pi-network tank. The top view shows the shielded meter enclosure, the B&W inductor, and the other major components, while the underneath view again illustrates the use of terminal boards and neat layout. A low-pass filter is also included under the chassis, together with the antenna relay. No effort has been spared to de-TVI the rig. The main antenna is a multiband beam of the W3DZZ type, home built, on a 55' tower. Separate antennas are available for 75 and 40 meters.

The individual antennas can be selected for use by means of push-button control at the operating position.

Keyer

A further example of neat construction is [the] electronic key built by W7DET,

[1] R. L. Baldwin, W1IKE, "W7DET, Seattle, Washington," *QST*, Jul 1957, pp 74-75.



The console as it evolved through the 1960s and '70s. [Joel Miller, W7PDX, photo]

Bill's last station in July 2002. [Joel Miller, W7PDX, photo]

patterned after the one described in *QST* by W6OWP. The keyer control head is a separate plug-in unit, of chrome-plated steel and Plexiglas, and includes a straight key alongside the paddle. W7DET being a DX man, when not building new equipment (172 confirmed on c.w.), he finds the straight key a "must" under certain conditions. This key unit fits in the slot provided in the console panel for easy accessibility.

Modulators

The modulator uses p.p. 100THs in class B, with high level clipper and filter.

The modulator and the power supplies are mounted here behind the operating position, easily accessible for service yet not dangerously exposed. Here again, extensive use of cabling presents a neat appearance to even the most critical eye. Labeled terminal blocks used throughout the installation permit easy identification and tracing of circuits.

W7DET has a station of which he can well be proud. — R. L. B.

One of Bill's no-nonsense QSL cards. [Joel Miller, W7PDX, photo]

Bill later was licensed W7ZZ after he moved. His story continues in his obituary:

William "Bill" Vandermay W7DET/W7ZZ

Radio/Television Pioneer Engineer Navy Officer Veteran Died June 6th In Portland, Oregon.

Bill Vandermay, a pioneer Radio and Television engineer and a Navy reserve retired officer has died at the age of 86 from cancer.

He was born near Blaine, WA, the youngest of three brothers and three sisters. Raised in Lynden, WA, he attended Lynden High School and later the University of Washington, He was an athlete in Track & Field and set many records in the high-jump event, including a Washington state high school record that stood for 23 years and a U of W record that stood for 27 years, plus a number of other records. He was a member of the Sigma Alpha Epsilon Fraternity.

His career in Radio started in 1934 as an engineer for KOMO-KJR radio in Seattle, later with KOMO and at the start-up of KOMO-TV and for many years as chief operations engineer. In 1961 he was transferred to Portland to become pioneer Chief engineer and manager of engineering for KATU where he was responsible for the supervision and installation of the original studio and transmitter facilities and for the engineering staff and organization when KATU went on the air in 1962. He was involved in station engineering operations for many years until his retirement in 1984. His duties included many ABC network activities, and was a venue engineer for the 1984 Olympics. His association with Fisher Broadcasting covered a span of 50 years until his retirement.

At age 15, he began a lifelong hobby as an Amateur Radio operator with a call sign W7DET, later to become W7ZZ. As a prominent "Ham" operator he specialized in world-wide communications (DX).

During his entire technical years he designed and constructed many pieces of radio and communications equipment. [He published several articles. — *Ed.*]

At the start of WW2 he was commissioned an Ensign in the U.S. Navy. His duties started as Communications Officer for Navy Air Station, Seattle, eventually being assigned to the European theatre with duties as a communications officer in London, during the blitz, as well as a number of assignments leading to the D-Day Normandy invasion. He became the Communications Officer for the "Mulberry" artificial harbors project off Omaha beach during the D-Day invasion. He was later designated as Electronics Officer for France for the U.S. Navy, stationed in Paris for 14 months. He participated in many reserve post-war duties until his retirement as a Commander in the U.S. Navy Reserve.

He was twice married. He lived alone in his home in Mt. Tabor area. He was a world-wide traveler and had many hobbies and projects as a genuine handyman. As an ardent animal and bird lover he was always seen with a faithful dog at his side. His lifetime motto was "never a dull moment."

Published in print on 6/19/2003 — *Seattle Times*

Thanks to Mike Steussy, AE4R; Ed Sieb, VA3ES; **www.ve3orf.ca**, and Joel Miller, W7PDX, for contributions. Additional photos are available in the original 1957 *QST* article.

Does anybody still build consoles like this? I'd like to hear from you. — *K2TQN*

Too Young for Ham Radio?

The licensing of a 6 year old child raises questions.

Jim Crosby, K4JEC

Readers of the December 2011 *QST* learned that Priscilla Harder, KDØPLJ, age 6, from Newton, Kansas, earned her Technician class license at the Kansas State Convention in Salina that August.[1] She has apparently grown up in an Amateur Radio household with a licensed mother, Dana, KBØRAT, and father, Kent, NØXOS. Her age would make Priscilla either a first or second grader depending on where her birth date falls on the calendar.

As one who has worked with first through fifth graders in an elementary school setting, I am wondering just how much this youngster can know about Amateur Radio — the inherent danger, the civic responsibility and legal liability facing Amateur Radio licensees. Have we set the bar so low as to be meaningless?

I am proud of the youngster for meeting the current demands of the Technician test and mean no disrespect to her or her parents. They certainly deserve to be honored for this accomplishment.

I am concerned that in the rush to grow the ranks of amateurs across the country we have lowered the knowledge requirements, not to mention reasonable age limits, far below the level necessary to ensure basic competency of operators to meet the mandates of *FCC Part 97 — Amateur Radio Service* regulations.

To quote the ARRL in their 13th Edition of the *FCC Rules and Regulations for the Amateur Radio Service*, "It's the Federal Communication Commission's responsibility to see that amateurs are able to operate their stations in a manner consistent with the objectives outlined for the Amateur Radio Service. The FCC must also ensure that hams have the knowledge and ability to operate powerful and potentially dangerous equipment safely without causing interference to other amateurs and to other radio services."[2]

...we have lowered the knowledge requirements...far below the level necessary to ensure basic competency of operators...

Considering the knowledge, life experience and maturity of judgment of a 6 year old child, I believe the FCC license is inviting this child to participate in an activity that could subject her to serious harm or inadvertently cause harm to others.

In my experience, I know that a 6 year old can be taught an enormous amount of material that they can commit to memory, enabling them to pass a test on that subject matter. However, that is in no way a test of their ability to analyze this knowledge and reflect an acceptable level of mature judgment in its use. Teachers of 6 year olds go to great effort to protect their charges from harm generated by their lack of mature judgment.

Teachers of 6 year olds go to great effort to protect their charges from harm generated by their lack of mature judgment.

My other concern is just how the FCC would seek to prosecute a 6 year old for a violation of the commission's rules where the penalties could run into thousands of dollars.

The FCC licensing of a 6 year old could be likened to the DMV licensing the child to operate a motor vehicle. You must realize that many 6 year olds could pass the written test to operate an automobile and demonstrate a competence in actually driving an automobile. Does that mean they should be issued a license?

Jim Crosby, K4JEC, an ARRL® member, is president of the Albemarle Amateur Radio Club based in Charlottesville, VA and served his first term as president when the club was selected as the Club-of-the-Year for 2011 by the Dayton Hamvention Awards Committee. Jim holds a General class license and is a member of the Quarter Century Wireless Association and the Virginia Fone Net. His wife, Pat, holds the Technician class license K4PMC. Jim is a retired outdoor writer/photographer. He can be reached at 5571 Brookwood Rd, Crozet, VA 22932-9370, **k4jec@arrl.net**.

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 or slander 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).

[1] J. Kleinman, N1BKE, "Kansas 6 Year Old Is Now KDØPLJ," *QST*, Dec 2011, p 13.

[2] Available from your ARRL dealer, or from the ARRL Store, ARRL order no. 1173. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Arizona (Tempe) — Mar 9 R T V
6 AM-noon. *Sprs:* ARCA and Scottsdale ARC. SRP PERA Club, 1 E Continental Dr. *TI:* 147.18 (162.2 Hz). *Adm:* Free. Tables: $10. Ed Nickerson, WU7S, 902 N 73rd Pl, Scottsdale, AZ 85257; 480-949-5162; fax 480-292-8789; **enickerson427@aol.com**; **scottsdalearc.org**.

ARIZONA STATE CONVENTION

February 15-16, Yuma
D F H Q R S T V
Spr: Yuma AR Hamfest Organization (9th Annual Yuma Hamfest) Yuma County Fairgrounds, 2520 E 32nd St. Friday noon-5 PM, Saturday 8 AM-5 PM. $50 by Feb 1; $60 Feb 1 and after; additional tables $5 in advance, $10 at the event, tailgating $10 by Feb 1; $15 Feb 1 and after. *TI:* 146.84 (88.5 Hz). *Adm:* is $5 (under 13 free). Roger Hunt, K7MEX, Box 1843, Yuma, AZ 85366; 928-305-1034; **info@yumahamfest.org**; **www.yumahamfest.org**.

ARKANSAS STATE CONVENTION

February 16, Hoxie
D F H R S V
Spr: Lawrence County ARC. Hoxie Community Service Center, 500 SW Lawrence St. Setup Friday 5-10 PM and Saturday 6:30-7:30 AM; public 8 AM-1 PM. *TI:* 147.045. *Adm:* is $5 (age 10 and under free with paying adult). Tables $7 (flea market), $10 (dealers). Glendal Floyd, W5WEC, 104 N Larkspur Ln, Walnut Ridge, AR 72476; 870-886-1360; **w5wec@suddenlink.net**; **www.w5wra.org/**.

Arkansas (Russellville) — Mar 2
D F H Q R S T V
8 AM-1 PM. *Spr:* Arkansas River Valley AR Foundation. Hughes Community Center, 1000 E Parkway. *TI:* 146.82 (131.8 Hz). *Adm:* $5. Tables: $10. Andy Anders, KE5YGA, 303 River Oaks Ln, Russellville, AR 72802; 479-967-5484; **aanders@suddenlink.net**; **www.arvarf.com**.

Colorado (Loveland) — Jan 19 D H R S V
8:30 AM-1 PM. *Spr:* Northern Colorado ARC. The Ranch, 5280 Arena Cir. *TI:* 145.115 (100 Hz). *Adm:* $5. Tables: advance $12, door $17. Jerry Reynolds, NØUI, 1710 Grove Ct, Longmont, CO 80501; 720-340-4966; **n0ui@comcast.net**; **www.ncarc.net/node/250**.

Florida (Punta Gorda) — Mar 9 D F H R T
8 AM-2 PM. *Spr:* Peace River Radio Assn. Tropical Gulf Acres Clubhouse, 28268 Pasadena Dr. *TI:* 147.255 (136.5 Hz). *Adm:* $5. Tables: $20. Geahardt Woster, K7CXW, 1510 Aqui Esta Dr, Punta Gorda, FL 33950; 941-575-9210; **k7cxw@arrl.net**; **www.w4dux.net**.

Florida (Sebring) — Feb 16 D F H R T
8 AM-2 PM. *Spr:* Highlands County ARC. First Baptist Church of Lake Josephine, 111 Lake Josephine Dr. 20th Annual Hamfest. *TI:* 147.045 (100 Hz). *Adm:* $5. Tables: $10. John Bliss, KF4IZT, 615 N Roberts Rd, Avon Park, FL 33825; 863-452-6600; **kf4izt@hotmail.com**; **strato.net/~hamradio/**.

Florida (West Palm Beach) — Mar 9
D F H Q R S T V
8 AM-2 PM. *Spr:* Palms West ARC. Fraternal Order of Police Lodge #50, 885 N 62nd Dr. *TI:* 147.045 (110.9 Hz). *Adm:* $5. Tables: $10 each (tailgate spaces $5 each). Rob Pease, KS4EC, 11894 Brierpatch Ct E, Wellington, FL 33414; 561-358-9999; **ks4ec@att.net**; **www.palmbeachradiofest.com**.

Florida (Zephyrhills) — Mar 2 D F H R T
8 AM-1 PM. *Sprs:* East Pasco ARS and Zephyrhills Area ARC. Zephyrhills Lions Club, 5827 Dean Dairy Rd. *TI:* 147.135. *Adm:* $2. Tables: $10 (includes 1 admission); tailgate spaces $5 each (includes 1 admission). Charles Nelson, KE7UTH, c/o ZAARC, Box 1534, Zephyrhills, FL 33540; 813-395-6329 or 813-344-9969; **greygoose4@aol.com**; **zaarc.org**.

Illinois (Sterling) — Mar 3 D F H R V
7 AM-2 PM. *Spr:* Sterling Rock-Falls ARS. Challand Middle School, 1700 6th Ave. 53rd Annual Hamfest. *TI:* 146.625 (114.8 Hz). *Adm:* advance $5, door $6. Tables: $7. Paula Portner, KC9FQK, 1302 W 2nd St, Dixon, IL 61021; 815-284-5650; **pportner@comcast.net**; **w9mep.org**.

Indiana (Brownsburg) — Feb 16 D F R
Set up Friday 2:30-8:30 PM; public Saturday 6 AM-2:30 PM. *Spr:* Hendricks County ARS. American Legion Post 331, 636 E Main St. *TI:* 147.015. *Adm:* $5. Tables: $10 ($15 with power). Wayne Fox, KE9P, 1612 S County Rd 525 E, Avon, IN 46123; 317-204-2725; **hcars46122@gmail.com**; **www.hcars.org**.

Indiana (LaPorte) — Feb 23 D F H R
7 AM-1 PM. *Spr:* LaPorte County ARC. LaPorte Civic Center, 1001 Ridge St. Cabin Fever Hamfest. *TI:* 146.61 (131.8 Hz). *Adm:* $5. Tables: $12. Clarence Rozinski, N9CJR, 307 Scott St, LaPorte, IN 46350; 219-380-9684; **n9roh@csinet.net**; **lpcarc.org**.

Iowa (McClelland) — Mar 2 D F
8 AM-noon. *Spr:* South West Iowa ARC. McClelland Town Hall, 107 Main St. *TI:* 146.82. *Adm:* $4. Tables: $5. Greg Ross, NØGR, 22106 320th St, Minden, IA 51553; 712-566-2698; **n0gr@arrl.net**.

Kentucky (Cave City) — Mar 2 D F H R T V
7:30 AM. *Spr:* Mammoth Cave ARC. Cave City Convention Center, 502 Mammoth Cave St. 37th Annual Cave City Hamfest. *TI:* 146.94. *Adm:* $6. Tables: $8. Larry Brumett, KN4IV, 108 Withers Dr, Glasgow, KY 42141; 270-651-2363; **lbrumett@glasgow-ky.com**.

LOUISIANA SECTION CONVENTION

March 8-9, Rayne
D F H Q R S V
Spr: Acadiana ARA. Rayne Civic Center, 300 Frog Festival Dr. Friday 5-8 PM, Saturday 8 AM-3 PM. *TI:* 146.82 (103.5 Hz). *Adm:* $4 in advance, $5 at the door. Tables $5. Herman Campbell, KN5GRK, 416 Dale St, Lafayette, LA 70501; 337-234-5364; **kn5grk@lusfiber.net**; **www.w5ddl.org/hamfest/**.

Maine (Augusta) — Feb 2 D F H Q R V
8 AM-noon. *Spr:* Augusta ARA. Le Club Calumet, 334 W River Rd. *TI:* 146.67 (100 Hz). *Adm:* $5. Tables: Free. Bill Crowley, K1NIT, 150 Maple St, Farmingdale, ME 04344; 207-512-0312; **k1nit@arrl.net**; **www.w1tlc.com**.

Michigan (Hazel Park) — Jan 20 D H Q R
8 AM-noon. *Spr:* Hazel Park ARC. Hazel Park High School, 23400 Hughes Ave. 47th Annual Hamfest. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $15. Bernie Hildebrand, W8NBC, 21518 Dequindre Rd, Apt 201, Warren, MI 48091; 248-499-2075; **w8nbc@arrl.net**; **www.hparc.org**.

Michigan (Livonia) — Feb 17 D F H R
8 AM-noon. *Spr:* Livonia ARC. Livonia Civic Park Seniors Center, 15218 Farmington Rd. *TI:* 145.35 (100 Hz), 146.52. *Adm:* $5. Tables: advance $16, door $20. Michael Rudzki, N8MR, Box 51532, Livonia, MI 48151; 734-941-5043; **k8uns@arrl.net**; **www.livoniaarc.com/swap.htm**.

New Jersey (Gloucester City) — Feb 23
D F H R V
6 AM-3 PM. *Spr:* Gloucester City ARC. Pine Grove Fire Assn Firehall, 827-829 Jersey Ave. *TI:* 447.775 (146.2 Hz). *Adm:* $5. Tables: Free. John Goheen, KB2ADL, c/o Gloucester City

Coming ARRL Conventions

January 15-25
Quartzfest, Quartzsite, AZ*

January 18-19
North Texas Section, Fort Worth*

January 19
Southern Florida Section, Fort Myers*
Georgia ARES, Forsyth*

January 25-26
Mississippi State, Jackson*

January 26-27
Puerto Rico State, Hatillo*

February 2
South Carolina State, North Charleston*
Virginia State, Richmond*

February 8-10
Southeastern Division, Orlando, FL*

February 15-16
Arizona State, Yuma

February 16
Arkansas State, Hoxie

February 23
Vermont State, South Burlington

March 8-9
Louisiana Section, Rayne
Oklahoma Section, Claremore

March 16
Nebraska State, Lincoln
West Texas Section, Midland

March 23
South Texas Section, Rosenberg
MicroHAMS Digital, Redmond, WA

March 29-30
Maine State, Lewiston

March 30
North Carolina State, Raleigh

*See January *QST* for details.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Fire HQ, 1 N King St, Gloucester City, NJ 08030; 856-397-3703; **kb2adl@comcast.net**; **nj2gc.org**.

New Jersey (New Providence) — Feb 22 F R
Sellers only 5:30 PM; public 7 PM. *Spr:* New Providence ARC. New Providence Municipal Center, 360 Elkwood Ave. Auction. *Tl:* 147.255 (141.3 Hz). *Adm:* $5. Barry Cohen, K2JV, 39 Cromwell Ct, Berkeley Heights, NJ 07922; 908-464-1730; **bgcohenusa@verizon.net**; **www.nparc.org/auction.htm**.

New Mexico (Albuquerque) — Jan 26
D F H R T
Sunrise-noon. *Spr:* 146.580 Simplex Group. Transcore-Amtech Technology Center, 8600 Jefferson St. 18th Annual Winter Tailgate. *Tl:* 145.33 (100 Hz). *Adm:* Free. Tom Ellis, K5TEE, 912 Lomas Ct NE, Albuquerque, NM 87112; 505-291-8122; **k5tee@arrl.net**.

New York (Hicksville) — Mar 3 D F H Q R V
9 AM-2 PM. *Spr:* Long Island Mobile ARC. Levittown Hall, 201 Levittown Pkwy. *Tl:* 146.85 (136.5 Hz). *Adm:* $6. Tables: $20 (plus admission). Richard Cetron, K2KNB, 198 Haypath Rd, Old Bethpage, NY 11804; 516-694-4937 (phone and fax); **k2knb@arrl.net**; **www.limarc.org**.

North Carolina (Concord) — Mar 8-9
D F H Q R S V
Friday 4-8 PM; Saturday 8:30 AM-5 PM. *Spr:* Mecklenburg ARS. Cabarrus Arena and Events Center, 4751 Hwy 49 N. *Tl:* 146.655. *Adm:* advance $7, door $10. Tables: $20. Mary Hunt, N4MH, 16007 Wynfield Creek Pkwy, Huntersville, NC 28078; 704-948-7373; **fleamarket@w4bfb.org**; **www.charlottehamfest.org**.

Ohio (Brookville) — Feb 23. Robert Howard, KD8IVF, 937-765-2105; **kd8ivf@yahoo.com**; **www.kd8knx.org**.

Ohio (Mansfield) — Feb 17 D F H Q R S V
7 AM-3 PM. *Spr:* Intercity ARC. Richland County Fairgrounds, 750 N Home Rd. *Tl:* 146.94 (71.9 Hz). *Adm:* advance $5, door $6. Tables: $15. Danny Bailey, KB8STK, 70 Euclid St, Shiloh, OH 44878; 419-896-3603; **kb8stk1@hotmail.com**; **www.w8we.org**.

OKLAHOMA SECTION CONVENTION

March 8-9, Claremore
D F H Q S V

Spr: Green Country Hamfest, Inc. Claremore Expo Center, 400 Veterans Pkwy. Setup on Friday at noon and Saturday at 7 AM; public Friday 5-9 PM, Saturday 8 AM-3 PM. *Tl:* 147.09. *Adm:* $8 in advance (by Feb 23), $10 at the door (under 13 free). Tables are $10 in advance (by Feb 23), $15 at the door (electricity $25; cords not provided). Merlin Griffin, WB5OSM, Box 470132, Tulsa, OK 74147; 918-520-7668; **wb5osm@sbcglobal.net**; **greencountryhamfest.org**.

Oklahoma (Elk City) — Mar 2 F H V
8 AM-5 PM. *Spr:* West Central Oklahoma ARC. Community Civic Center, Rte 66 E. *Tl:* 146.76. *Adm:* $5. Tables: $5. Earl Bottom, N5NEB, Box 2023, Elk City, OK 73648; 580-821-0633; **n5neb@waywireless.com**.

Oklahoma (Mooreland) — Feb 2 D F R S T
8 AM-2 PM. *Spr:* Tri-State AR Group. Mooreland Community Center, 115 SE 6th. Hamfest and Computer Show. *Tl:* 146.52. *Adm:* $2. Tables: Free (first come, first served). Jay Kruckenberg, K5GUD, 40028 S CR 214, Mooreland, OK 73852; 580-216-4190; **k5gud@tsarg.org**; **www.tsarg.org**.

Pennsylvania (Castle Shannon) — Feb 24
D H Q R
8 AM-3 PM. *Spr:* Wireless Assn of South Hills. Castle Shannon VFD Memorial Hall, 3600 Library Rd (Rte 88). WashFest 2013. *Tl:* 146.955 (131.8 Hz). *Adm:* $5. Tables: $10 ($15 with electricity). Carol Danko, KB3GMN, 4246 Seton Dr, Pittsburgh, PA 15227; 412-884-1466; **n3sbf@comcast.net**; **n3sh.org**.

Pennsylvania (Harrisburg) — Jan 19
F H Q R V
8 AM-noon. *Spr:* Harrisburg RAC. HACC Campus Cooper Student Union South Hall, 1 HACC Dr. *Tl:* 146.76 (100 Hz). *Adm:* $3. Tables: Free. Terry Snyder, WB3BKN, Box 355, Halifax, PA 17032-0355; 717-896-0256; **terry@djterry.com**; **w3uu.org**.

Tennessee (Tullahoma) — Mar 9
D F H R S T V
Set up Friday 5-8 PM; public Saturday 8 AM-2 PM. *Spr:* Middle Tennessee ARS. First Methodist Church Center, 208 W Lauderdale St. *Tl:* 146.70 (114.8 Hz). *Adm:* $5, under 16 free. Tables: 6-ft $10, 8-ft $15. Michael Glennon, KB4JHU, 302 Twelve Oaks Rd, Tullahoma, TN 37388; 931-461-3037; **kb4jhu@arrl.net**; **www.qsl.net/mtars/**.

Texas (Irving) — Mar 9 D H R V
8 AM-2 PM. *Spr:* Irving ARC. Betcha Bingo Hall #1, 2420 W Irving Blvd, #125. 11th Annual Hamfest. *Tl:* 146.72 (110.9 Hz). *Adm:* advance $3 (by Mar 4), door or after Mar 4 $4. Tables: $8 by Mar 4, $10 at door or after Mar 4. Coleta Taylor, KD5QFH, 107 E 7th St, Irving, TX 75060; 972-579-9089; **coleta.mt@verizon.net**; **www.irvingarc.org**.

Texas (Orange) — Feb 23 D F H R S T V
8 AM-2 PM. *Sprs:* Orange ARC and Jefferson County ARC. VFW Hall Post #2775, 5303 N 16th St. *Tl:* 147.18. *Adm:* $5. Tables: $15. Rocky Wilson, N5MTX, Box 232, Orange, TX 77631-0232; 409-988-8906; **rockygwilson@hotmail.com**; **www.qsl.net/w5nd/**.

VERMONT STATE CONVENTION

February 23, South Burlington
D F H Q R S T V

Spr: Radio Amateurs of Northern Vermont. Holiday Inn Convention Center, 1068 Williston Rd (I-89, Exit 14). 8 AM-2 PM. *Tl:* 145.15 (100 Hz), bulletins on 146.67. *Adm:* $6 in advance (by Feb 14), $8 at the door (under 13 free); early admission at 6 AM is $12 in advance (by Feb 14), $15 at the door. Tables: Free (first come, first served). Mitch Stern, W1SJ, 802-879-6589; **w1sj@arrl.net**; **www.ranv.org/hamcon.html**.

Virginia (Annandale) — Feb 24
D F H Q R T
8 AM-1:30 PM (tailgating 6 AM). *Spr:* Vienna Wireless Society. Northern Virginia Community College – Ernst Community Cultural Center (Annandale Campus), 8333 Little River Turnpike. Winterfest 2013. *Tl:* 146.91. *Adm:* $6. Tables: $25 (tailgate spaces $15). Jack Welch, AI4SV, 3925 Wilcoxson Dr, Fairfax, VA 22031; 314-266-8426; **dhakajack@gmail.com**; **www.viennawireless.org/winterfest.php**.

Washington (Elma) — Feb 23 D F H R S V
8:30 AM-4 PM. *Spr:* Grays Harbor ARC. LDS Church, 702 E Main St. Special Event Station, blood drive, food drive. *Tl:* 147.16 (88.5 Hz). *Adm:* Can of food at the door. Tables: small $5, double $10 (others by arrangement). Les Morgan, N7GH, 109 N Newell St, Aberdeen, WA 98520; 360-280-6412**; n7gh@arrl.net; gharc.org**.

Washington (Puyallup) — Mar 9 D F H R V
9 AM-3 PM. *Spr:* Mike and Key ARC. Puyallup Fair and Events Center, Pavilion Expo Hall, 110 9th Ave SW. 32nd Annual Electronics Show. *Tl:* 146.82 (103.5 Hz). *Adm:* $8. Tables: $32. Michael Dinkelman, N7WA, 22222 148th Ave SE, Kent, WA 98042; 253-631-3756; **n7wa@arrl.net**; **www.mikeandkey.org/flea.htm**.

Wisconsin (Brookfield) — Feb 16 F H R
8 AM-noon. *Sprs:* Milwaukee RAC and Milwaukee Area ARS. Milwaukee Public Television Auction site, 12560 W Townsend St. *Tl:* 145.39 (127.3 Hz). *Adm:* advance $4, door $5. Tables: advance $10, door $12. David Schank, KA9WXN, 5943 W Edgerton Ave, Greenfield, WI 53220; 414-944-1036; **ka9wxn@gmail.com**; **www.w9rh.org**.

Wisconsin (Eau Claire) — Mar 9 H
8 AM-2 PM. *Spr:* Eau Claire ARC. Grace Lutheran Church, 202 W Grand Ave. 26th Annual AR Equipment Auction. *Tl:* 146.91 (110.9 Hz). *Adm:* $5. Jon Case, KE9KW, 2113 W Mead St, Eau Claire, WI 54703; 715-834-1540; **jecase@charter.net**; **www.ecarc.org**.

Wisconsin (Fitchburg) — Feb 9 F H R
9 AM-1 PM. *Spr:* New Era Repeater Technocrats. Memorial United Church of Christ, 5705 Lacy Rd. Capital City Hamfest. *Adm:* $5. Tables: $10. Steve Johnston, WD8DAS, 2309 Tulare St, Fitchburg, WI 53711; 608-276-5581; **wd8das@arrl.net**; **www.wd8das.net/hamfest.html**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **February 1** to be listed in the **April** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

75, 50 and 25 Years Ago

Al Brogdon, W1AB

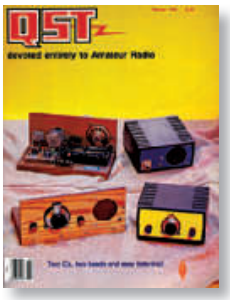
February 1938

- The cover photo shows three antenna wranglers working on a big antenna atop a tall tower.
- The editorial notes, regretfully, that no audio recordings were ever made of the early ham bands with their awful spark signals and bloopy CW signals. It goes on to announce that the well-known Ross Hull has been promoted to be the new editor of *QST*.
- In "The First Interamerican Conference," K. B. Warner, W1EH, reports that the Habana conference showed its support of amateur radio, and also standardized our 'phone bands.
- Vern Chambers, W1JEQ, describes "A Low-Cost 100-Watt Transmitter" that uses a tube lineup of 6L6–6L6–pair of 809s.
- Malcolm Gager and Arthur Graham present "A Regenerative Receiver with High Audio Selectivity."
- Douglas Smith, W2BZR, had a good antenna location 200 feet from his shack. Open-wire feeders didn't work well. Manufactured coaxial cable cost as much as $1 per foot. He bought brass tubing and Isolantite insulating beads to support a center conductor. A lot of hard work later, he had his 200 feet of homebrew coax!
- The "28-Megacycle Preselection" problem with most receivers was solved by James Millen, W1HRX, and Dana Bacon, W1BZR. They built an outboard two-stage amplifier that amplified incoming signals while rejecting image signals.
- Fred Sutter, W8QBW, builds "The 'QSL Forty'," a compact and inexpensive rig for 80 and 40 meters that runs 40 watts, using a 6L6 crystal oscillator.
- Marshall Wilder, W2KJL, discusses "Sweep Circuit Considerations in the Television Receiver."

February 1963

- The cover photo shows WA6LXX, WA6HUB, and W6TQH inspecting an emergency generator — Field Day isn't far away….
- The editorial discusses the matter of "Restricted Voice Bands Again." After 10 years of General Class licensees having full access to our ham bands, most amateurs want a return to incentive licensing.
- Ernest Adolph, K8WYU, tells about building "An Interlaced Quad Array for 50 and 144 Mc."
- Nicholas Richards, W3ZVN, and Walter Painter present a "High-Quality Speech Compressor."
- Robert Guba, W1QMN, and John Zimmer, W2BVU, give us food for thought, in Part I of "Pulse: A Practical Technique for Amateur Work."
- "The RCC 230-L Amplifier," by J. L. Copeland, W5SQT, uses a pair of 807Ws to provide 230 watts on 80 and 40 meters.
- John Troster, W6ISQ, pokes fun at the plethora of operating awards being offered nowadays, in "WASP Discontinued; New WORM Award Announced." No short description does it justice; you must read it yourself.
- Lew McCoy, W1ICP, appeals to our frugal nature, with "Putting the ARC-5/T18 on 160 and 80 Meters."

February 1988



- The cover photo shows several physical versions of a receiver design, described in this issue, that covers two bands with two ICs and a few other components.
- The editorial discusses the plague of rumors spread by ill-informed hams about what's going to happen in Amateur Radio.
- John Dillon, WA3RNC, describes "The Neophyte Receiver" (the cover article) that provides big results in a small package.
- Paul Pagel, N1FB, tells us about a weekend project, "Power Supplies — Quick and Easy!" The small package provides +5, +12, and -12 volts output (with respect to ground).
- Doug DeMaw, W1FB, gives us "Some QRP-Transmitter Design Tips."
- "Product Review," by Paul Pagel, N1FB, provides a look at the "Heath SB-1000 HF Linear Amplifier."
- Jeff Kilgore, N1FGB, discusses "1987: A Year of Change and Challenge for Amateur Radio."
- Steve Place, WB1EYI, urges us to consider becoming a Boy Scout merit badge counselor for the new Radio Merit Badge, in "Radio for 1,000,000 Scouts."

Field Organization Reports

NOVEMBER 2012

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this web page: **www.arrl.org/public-service-honor-roll**.

624
K7BDU
515
W5KAV
410
KT2D
330
NX8A
310
KØIBS
305
KB2ETO
300
WB9YBI
299
WB8R
288
WB8RCR
256
WB9FHP
250
KC5ZGG
N1UMJ
245
WE2G
238
WM2C
234
N8OSL
230
K2TV
223
WD8USA
220
K8RDN
210
K2HAT
205
K2ABX
KA2ZNZ
204
W2MTA
200
W4SEE
195
VE7GN
189
AG6EF
188
KK4BVR
185
KE5HYW
183
WA2BSS
180
W5DY
KB2BAA
177
WS6P
175
KT5SR
170
WB9WKO
167
W7FQQ
166
KB2KOJ
165
K7OAH
160
KGØGG
W9BGJ
K6FRG
W4DNA
155
N5NVP
151
WØRJA
150
K6HTN
KD8HSV
WA3EZN
WK4P
N8FVM
145
WB4ZIQ
142
N2GJ
141
KK5NU
KB2RTZ
140
K7BFL
WB2FTX
WØLAW
KK4F
KB1RGQ
KB8RCR
138
W7JSW
AF9W
135
N8IO
KF5IOU
N7CM
W3YVQ
130
K9LGU
N9VC
W8DJG
K6JT
K4IWW
WI2G
KW1U
W7EKB
129
K4BEH
127
KF7PDV
126
KJ4G
125
K1PJS
AG9G
N2JBA
K7EAJ
120
NN7H
KE4CB
NC3F
KA4FZI
K4GK
KØLQB
AK4RJ
NM1K
NA7G
WB8WKQ
119
KE5YTA
118
KA9ZGY
115
KD8QPF
113
W2DWR
W3CB
110
W7QM
N7EIE
NX9K
W7GB
WA5LOU
K4BG
WB6OTS
W7QM
KC5OZT
KA1G
N9MN
N7XG
N7YSS
W2EAG
N1IQI
K1YCQ
AA3SB
KB1NMO
107
W9WXN
105
KJ6IJJ
KF7GC
K4JUU
103
WB8YYS
100
KØVTT
K4SCL
WØCLS
NØMEA
WAØVKC
KB5SDU
W8CPG
KB5KKT
N1JX
N2WGF
WB8HHZ
KA8IAF
WG8Z
WB8SIQ
N3SW
W3TWV
N5OUJ
AA2SV
WA2NDA
KC2PDO
KI4AAN
NU8K
KJ4RUD
W4TTO
N2WKT
N1TF
WB4FDT
K3IN
KB3LNM
K1HEJ
N7IE
KD8CYK
K8VFZ
WB6UZX
KØPTK
99
AD4BL
98
KC2SFU
96
KJ7NO
95
K5AXW
KD2AXP
KK7TN
94
N2DW
93
N3RAY
91
N3RB
W2CC
N2RTF
90
N3KB
WA1STU
WD8DHC
WA4BAM
KB8HJJ
WB4BIK
WAØCGZ
KA5AZK
KC2EMW
N4ELI
W3GQJ
KJ4HGH
W8IM
KJ4JPE
N1LKJ
W4OTN
WB3FTQ
N3ZOC
KC8BW
WB8TQZ
87
AE5VY
KB9KEG
86
AL7N
N2VC
85
K7MQF
N8CJS
WDØGUF
84
K7FLI
83
WB6N
N8SY
81
K2GW
80
KØDEU
NIØI
NØMHJ
KFØXO
KCØZDA
WA9QIB
N2GS
W8MAL
W8DIP
KB7RVF
KD7OED
KZ8Q
N2RAI
K8KV
WB4RJW
KF4OCU
KC8YVF
KAØDBK
78
KS4PG
77
N5MBQ
76
KB8VXE
WJ3P
75
KC4PZA
KD8AAD
74
N9WLW
KC5MMH
AA5VZ
71
KD8OEE
W5XX
70
KDØAYN
KØDLK
NØDUW
NØDUX
WØFUI
N3NTV
KØPTK
KØRXC
KD7ZUP
WØDHG
N2YJZ

The following stations qualified for PSHR in previous months, but were not recognized in this column yet. (Oct) K8RDN 300, WB8R 294, K2TV 280, WB8RCR 266, WD8USA 243, KØLQB 214, KD8QPF 180, N8FVM 176, KB8RCR 175, K7OAH 165, KC5ZGG 162, N8OSL 143, KF7PDV 139, W7JSW 137, N5ASU 136, WB8WKQ, KD8CYK, WB6OTS 120, KC8QWH 107, AF9W 106, NX8A, KF7GC 105, N2WGF 100, K8VFZ 96, KD8EBY 93, K7FLI 91, KC8BW 85, KB7RVF 80, K8KV 80, WB8TQZ 80. (Sept) KE5HYW 165, KF5IOU 100.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IL, IN, LA, LAX, MDC, ME, MI, MN, NE, NFL, NNJ, NTX, NC, OH, OK, OR, ORG, SD, SJV, SNJ, STX, TN, UT, VA, WI, WCF, WMA, WNY, WPA, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: ENY, IA, ID, IN, LAX, MDC, MI, MN, MO, ND, NM, NTX, NV, OH, OK, STX, SV, WV, WTX.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

NX9K 2933, WB9FHP 2063, KK3F 1392, K6HTN 1341, WØRJA 1063, N9VC 907, K9BDU 773, K6FRG 767, W9WXN 731, N1IQI 726, KW1U 572, K6JT 546, WA4BAM 513, WB8WKQ 507. (Oct) WB6OTS 1050, KB8RCR 767, WB8WKQ 669, KD8CYK 565. (Sept) K6JT 633.

The following station qualified for BPL with Originations plus Deliveries: KJ4HGH 121, NM1K 110, K8LJG 103. (Oct) K8LJG 114.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

N1DNO **Gillig**, Philip, Delray Beach, FL
♦WA1HGE **Wiederhold**, Louis, Francestown, NH
♦W1HHR **Sullivan**, John C., Columbia, CT
♦K1KYI **Fairweather**, Richard B., Pawtucket, RI
K1MAR **Georgis**, Nicholas J., Huntington, CT
W1QO **Kirshner**, D. R., Sudbury, MA
W1RGG **Fadden**, Eric G., Tallahassee, FL
WH2ABO **Schraml**, Joseph W. Jr, San Jose, CA
AD2AM **Wade**, Adam M., Albany, NY
W2CIY **Creuz**, Walter R., Chatham, NJ
ex-W2DVI **Barnett**, John W. Sr, Newport, NJ
K2HWE **McCune**, Donald A., Spokane, WA
WA2HZE **Clark**, Richard, New York, NY
KC2IET **Carris**, Charles E., Port Byron, NY
KG2K **Spencer**, Frederick W., Lebanon, NJ
W2OCZ **Ashburn**, Robert A., Astoria, NY
♦N2ODG **Le Fevre**, Charles W. Jr, Elmira, NY
N2OG **Gardner-Stocum**, Emma J., Pine City, NY
KA2QJD **Di Carlo**, Yvonne, Convent Station, NJ
NZ2S **Stone**, James R. III, Rhinebeck, NY
WA2UJG **Sturtevant**, Karl, Saranac Lake, NY
KB2VO **Wesley**, George, Deerfield Beach, FL
WB2WFZ **Tripoli**, Carmine, Harriman, NY
W2WRC **Shedd**, Owen E., Syracuse, NY
K2ZRJ **Buchert**, Gordon, Pleasantville, NJ
KA2ZUV **Latham**, Robert R., Edison, NJ
K3ECV **Swayze**, Richard A., Phoenixville, PA
♦W3FG **McGugan**, Walter R. Jr, Crownsville, MD
N3IL **Wilkin**, Neil D. Sr, Brinklow, MD
W3KOD **Thomas**, Harry L. Jr, Wilkes Barre, PA
N3LQQ **Richardson**, David Ron, Baltimore, MD
WA3PSG **Lawson**, Raymond C., Corry, PA
W3RIH **Sellers**, Russell I., Chambersburg, PA
KA3RPH **Walborn**, Madaline P., Cabot, PA
W3TER **Moore**, Daniel R. Jr, Phoenixville, PA
K3UMY **Fehr**, Carolyn L., Nazareth, PA
♦W3ZLP **Sundra**, Joseph J., Granite Falls, NC
W4AXK **Roosa**, Kenneth L., Bronson, FL
W4DGP **Watson**, Jerry, Taylors, SC
♦WD4FJP **Hendrix**, Edward, Iowa, LA
K4GHH **Stone**, Herman G., Hendersonville, NC
AE4HA **Metzler**, Douglas H., Hendersonvlle, NC
KF4LQI **Brown**, Anthony L., Sarasota, FL
KC4MOS **Parr**, Larry E., Blountsville, AL
KA4MPP **Morris**, James I. Jr, Woodleaf, NC
KI4MQQ **Skowron**, Walter J., Clarksville, TN
KA4NDD **Frazier**, William D., West Columbia, SC
KD4RKJ **Finchum**, David L., Louisville, TN
N4RRR **Krane**, Harry, Boynton Beach, FL
KC4RRU **Keitz**, Robert J. Jr, Cary, NC
♦W4TA **Blackburn**, Bruce B. Jr, Saint Petersburg, FL
N4TEZ **Caldwell**, Ann E., Newnan, GA
N4VFN **Bowerman**, Lucille J., Oneonta, AL
W4VMV **Ramsey**, Alva P. Jr, Smyrna, GA
N4WT **Roach**, Charles D. Jr, Hixson, TN
W4YND **Schaeffer**, Harden, Goldthwaite, TX
KC5BVE **Kretzschmar**, Elmer W., Cheyenne, WY
W5CLM **Massa**, Carol L., Hazlehurst, MS
KE5DQ **Newell**, Peter Warren Sr, Arvada, CO
K5HVM **Ferguson**, George A., San Antonio, TX
♦K5IJX **Fillingane**, John M., Hattiesburg, MS
N5QEL **Patti**, Doris H., Boerne, TX
W5TU **Jones**, Robert C., Richardson, TX
W5VPQ **Munsch**, George F., San Antonio, TX
KC5VTQ **Gambill**, William D. Jr, Jackson, MS
KD6B **Lakin**, Kenneth, Redmond, OR
W6ELZ **Skvarek**, Anthony J., Pomona, CA
KB6FHP **Campbell**, Catherine J., Santa Maria, CA
K6MEA **Schultz**, Emil E., Monrovia, CA
W6QXN **Hoyt**, Dennis J., Carson City, NV
W6RUD **Richards**, John T., Newport Beach, CA
W6UDU **Landry**, Ney R., Castro Valley, CA
KF6ZDW **Flaherty**, L. J., Auberry, CA
KA7IOB **Thompson**, L. E., Portland, OR
AL7JG **Smith**, Harrison J., Hillsboro, OR
AL7NK **Beller**, Joan E., Ferndale, WA
KC7PKY **Kolar**, Christine A., Dillon, MT
♦W7TZ **McCully**, Steve, Grays Harbor, WA
KY7X **Beeson**, Don, Yuma, AZ
WA8CWF **Hunt**, Jerold W., Sylvania, OH
WA8DWM **Johnson**, Eunice L., Bessemer, MI
W8EQY **Auda**, Alexander A., Milford, MI
W8GYV **Kryskalla**, Paul L., Detroit, MI
♦K8KB **Briggs**, Karen A., Stuart, FL
N8NLH **Quinn**, Michael, Kenton, OH
K8TEB **Brendel**, Herbert O., Amherst, OH
KB8UDA **Davis**, George D., Salem, OH
W8UMA **Wakeman**, Ralph E., Ashtabula, OH
N8USI **Herrig**, William, Tiffin, OH
N8WNY **Limpach**, Cletus G., Ottawa, OH
W9BPR **Zavodnik**, Martin E., Milwaukee, WI
♦W9DU **Minaga**, Yuki, Wisconsin Dells, WI
N9EVT **Hartley**, Clinton E., Lawrenceville, IL
WB9NDU **Weaver**, Hilda A., Citrus Springs, FL
KB9PQZ **Spicuzza**, Theodore F., Milwaukee, WI
W9RPY **Peterson**, John A., Des Plaines, IL
N9RXE **Murphy**, Rob J., Waukesha, WI
K9SWY **Jack**, Vernon E., Sullivan, IL
ex-N9WSJ **Povalski**, Eugene A., Sheboygan Falls, WI
W9ZGU **Taylor**, Carl R., Pembroke Pines, FL
KAØAEY **Snover**, Ralph H., North Bend, NE
WAØCVR **Brown**, Robert E., Liberty, KS
NØFKF **McKay**, Keith L., Battle Lake, MN
NØFND **Richards**, Walt, Riley, KS
WØGYS **Moore**, Richard K., Lawrence, KS
NØIHX **Stoakes**, Gary, Sioux Falls, SD
AAØIM **Adams**, Robert A., Fort Scott, KS
KØMTG **George**, Neal, Janesville, IA
WBØOAO **Zeltner**, James W., Pratt, KS
WØOSP **Stiles**, John E., Sherwood, ND
KBØRSF **Perkey**, Richard W., Centralia, MO
♦WØWB **James**, John W., Mahtomedi, MN

The December 2012 *QST* Silent Key column listed Milt Fingerman, N5NO, and Thomas Tuner, Jr, W5EZ. We're happy to report that both are alive and well. We apologize for the error.

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111.

New Products

DX Engineering 160 Meter Vertical Antenna

The DX Engineering DXE-160VA-1 is a slow taper, 55 foot high monoband vertical antenna with capacitance hat for 160 meters. The antenna has a 40 kHz bandwidth, putting operation on the most popular CW and phone DX frequencies within range of typical antenna tuners without changes at the antenna. Power rating is 5 kW on SSB or CW. The antenna includes a stainless steel pivot fixture for ease of assembly and adjustments. Steady state wind survival is rated in excess of 50 mph without guys. Price: $839.95. Optional DXE-VRW-1 manual winch for raising and lowering by one person, $169.95. For more information, or to order, visit **www.dxengineering.com**.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Bl., 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between
S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jerry, N5MCJ, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Bill, KA3IXF, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave., 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave. & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr.
22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

12 STORE BUYING POWER

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

HRO mobile app available for Android & Apple
Download app at Google Play & Apple App Store

YAESU
The radio

#1 Yaesu Dealer Worldwide

FT-897D VHF/UHF/HF Transceiver

- HF/6M/2M/70CM • DSP Built-in
- HF 100W (20W battery)
- Optional P.S. + Tuner • TCXO Built-in

Call Now For Our Low Pricing!

FT-950 HF + 6M TCVR

- 100W HF/6M • Auto tuner built-in
- 3 roofing filters built-in
- DMU-2000 compatible

Call Now For Low Pricing!

FT-8800R 2M/440 Mobile

- V+U/V+V/U+U operation
- V+U full duplex • Cross Band repeater function
- 50W 2M 35W UHF
- 1000+ memory channels • WIRES ready

Call Now For Low Pricing!

FTM-350AR 2M/440 Dualband

- 50W 2m/440 - 1 watt 220Mhz
- TNC built-in, Bluetooth capable
- Band scope built-in • 500 Memories

FTDX5000MP 200W HF + 6M Transceiver

- Station Monitor SM-5000 (Included)
- 0.05ppm OCXO (Included)
- 300Hz, 600Hz & 3KHz Roofing filters (Included)

VX-7R/VX-7R Black

50/2M/220/440 HT
- Wideband RX - 900 Memories
- 5W TX (300mw 220MHz)
- Li-Ion Battery
- Fully Submersible to 3'
- Built-in CTCSS/DCS
- Internet WIRES compatible

Now Available in Black!

VX-6R 2M/220/440HT

- Wideband RX – 900 memories
- 5W 2/440, 1.5W 220 MHz TX
- Li-ION Battery - EAI system
- Fully submersible to 3 ft.
- CW trainer built-in

New Low Price!

VX-8DR/VX-8GR

50/144/220/440 (VX-8DR)
2M/440 w/built-in GPS (VX-8GR)
- 5W (1W 222 MHz VX-8DR only)
- Bluetooth optional (VX-8DR only)
- Waterproof/submersible (3' for 30 min)
- GPS/APRS operation optional
- Li-ion Hi-capacity battery
- Wide band Rx

FTDX-3000 New!

- 100 Watt HF/6 Meters
- Large and wide color LCD display
- High Speed Spectrum Scope built-in
- 32 bit high speed DSP /Down Conversion 1st IF

Call For Low Pricing!

FT-857D Ultra Compact HF/VHF/UHF

- 100w HF/6M, 50W 2M, 20W UHF
- DSP included • 32 color display
- 200 mems • Detachable front panel (YSK-857 required)

Call For Low Price!

FT-7900R 2M/440 Mobile

- 50W 2M, 45W on 440MHz • Weather Alert
- 1000+ Memories • WIRES capability
- Wideband receiver (cell blocked)

Call Now For Your Low Price!

FT-450D HF + 6M TCVR

- 100W HF/6M • Auto tuner built-in
- DSP built-in • 500 memories
- DNR, IF Notch, IF Shift

Call Now For Pricing!

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Come visit us online via the Internet at http://www.hamradio.com

#1 in Customer Service

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest to You!

12 STORE BUYING POWER

HAM RADIO OUTLET

WORLDWIDE DISTRIBUTION

HRO mobile app available for Android & Apple. Download app at Google Play & Apple App Store

World's LARGEST HAM RADIO INVENTORY in stock for quick delivery

DISCOVER THE POWER OF DSP WITH ICOM!

$300 INSTANT SAVINGS!

IC-9100 The All-Round Transceiver

• HF/50MHz 144/430 (440) MHz and 1200MHz*1 coverage • 100W on HF/50/144MHz, 75W on 430 (440) MHz, 10W on 1200MHz*1 • Double superheterodyne with image rejection mixer

IC-7000 All Mode Transceiver

• 160-10M/6M/2M/70CM
• 2x DSP • Digital IF filters
• Digital voice recorder
• 2.5" color TFT display

DSP INSTALLED Included with your purchase

IC-718 HF Transceiver

• 160-10M* @ 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories

$10 INSTANT SAVINGS!

IC-V8000 2M Mobile Transceiver

• 75 watts • Dynamic Memory Scan (DMS) • CTCSS/DCS encode/decode w/tone scan • Weather alert • Weather channel scan • 200 alphanumeric memories

$25 INSTANT SAVINGS!

IC-2820H Dual Band FM Transceiver

• D-STAR & GPS upgradeable 2M/70CM • 50/15/5W RF output levels • RX: 118-173.995, 375-549.995, 810-999.99 MHz** • Analog/digital voice with GPS (optional UT-123) • 500 alphanumeric memories

D-STAR optional

IC-7800 All Mode Transceiver

• 160-6M @ 200W • Four 32 bit IF-DSPs+ 24 bit AD/DA converters • Two completely independent receivers • +40dBm 3rd order intercept point

$100 INSTANT SAVINGS!

IC-7600 All Mode Transceiver

• 100W HF/6m Transceiver, gen cov. receiver • Dual DSP 32 bit • Three roofing filters- 3, 6, 15khz • 5.8 in WQVGA TFT display • Hi-res real time spectrum scope

IC-7700 Transceiver. The Contester's Rig

• HF + 6m operation • +40dBm ultra high intercept point • IF DSP, user defined filters • 200W output power full duty cycle • Digital voice recorder

IC-2300H VHF FM Transceiver

• 65W RF Output Power • 4.5W Audio Output • MIL-STD 810 G Specifications • 207 alphanumeric Memory Channels • Built-in CTCSS/DTCS Encode/Decode • DMS

$25 INSTANT SAVINGS!

IC-92AD Analog + Digital Dual Bander

• 2M/70CM @ 5W • Wide-band RX 495 kHz - 999.9 MHz** • 1304 alphanumeric memories • Dualwatch capability • IPX7 Submersible*** • Optional GPS speaker Mic HM-175GPS

D-STAR ready

$25 INSTANT SAVINGS!

IC-7200 HF Transceiver

• 160-10M • 100W • Simple & tough with IF DSP • AGC Loop Management • Digital IF Filter • Digital Twin PBT • Digital Noise Reduction • Digital Noise Blanker • USB Port for PC Control

ID-880H Analog + Digital Dual Bander D-STAR

• D-STAR DV mode operation • DR (D-STAR repeator) mode • Free software download • GPS A mode for easy D-PRS operation • One touch reply button (DV mode) • Wideband receiver

D-STAR ready

ID-51A† VHF/UHF Dual Band Transceiver

• 5/2.5/1.0/0.5/0.1W Output • RX: 0.52–1.71, 88–174, 380-479 MHz** • AM/FM/FM-N/WFM/DV • 1304 Alphanumeric Memory Chls • Integrated GPS • D-STAR Repeater Directory • IPX7 Submersible

D-STAR ready

IC-V80 2M Handheld Transceiver

• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation

$10 INSTANT SAVINGS!

IC-80AD Analog + Digital Dual Bander D-STAR

• D-STAR DV mode operation • DR (D-STAR repeater) mode • Free software download • GPS A mode for easy D-PRS operation

D-STAR ready

$45 INSTANT SAVINGS!

ID-31A UHF Digital Transceiver

5W Output Power • FM Analog Voice or D-STAR DV Mode • Built-in GPS Receiver • IPX7 Submersible • 1,252 Alphanumeric Memory Channels

D-STAR ready

ICOM®

†This device has not been approved by the Federal Communications Commission. This device may not be sold or leased, or be offered for sale or lease, until approval of the FCC has been obtained.
*Except 60M Band. **Frequency coverage may vary. Refer to owner's manual for exact specs. ***Tested to survive after being under 1m of water for 30 minutes. *1Optional UX-9100 required. ✦Instant savings expire 3/31/13. Contact HRO for promotion details. QST FEB 2013. The Icom logo is a registered trademark of Icom Inc. 70018

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you, if the first line you call is busy, you may call another.

West.....800-854-6046
Mountain.....800-444-9476
Southeast.....800-444-7927
Mid-Atlantic...800-444-4799
Northeast.....800-644-4476
New England..800-444-0047

#1 in Customer Service

Come visit us online via the Internet at http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Bl., 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jerry, N5MCJ, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102 94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Bill, KA3IXF, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy. 97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave., 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave. & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Bl., 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between
S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jerry, N5MCJ, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102
94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Bill, KA3IXF, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy.
97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave., 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave. & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr.
22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

12 STORE BUYING POWER

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

HRO mobile app available for Android & Apple
Download app at Google Play & Apple App Store

KENWOOD

Cool Winter Specials from Kenwood

*Kenwood instant coupons expire 02/28/13

TH-D72A 2M/440 HT with extended RX

- 5W TX, RX 118-524 MHz, VxU, VxV, UxU
- APRS w/built-in 1200/9600 TNC
- Built-in GPS, Built-in USB, digipeater
- Echolink® compatible,
- Mil-Spec STD810

Call For Special Low Price!

TH-F6A 2M/220/440

$25 KENWOOD COUPON

- Dual channel receive
- .1 - 1300 MHz (cell blocked) RX
- FM, AM, SSB
- 5W 2M/220/440 TX, FM
- 435 Memories
- Li-Ion Battery

Call For Low Price!

TH-K20A 2M Handheld

- 2M 5.5W
- VOX
- CTCSS/DCS/1750 Burst built-in
- Weather alert

Call For Special Low Price!

$40 KENWOOD COUPON

TM-D710A 2M/440 Dualband

- 50W 2M & UHF
- Optional voice synthesizer
- 1000 memories • Dual receive
- Advanced APRS Features
- Echolink® ready with 10 memories
- Built-in TNC • Sky Command II+
- GPS I/O Port
- Choice of green/amber LCD backlight

Call Now For Special Price!

$200 KENWOOD COUPON

TS-2000

TS-2000 HF/VHF/UHF TCVR

$250 KENWOOD COUPON

TS-2000X

- 100W HF, 6M, 2M • 500W 70CM
- 10W 1.2GHz w/opt UT-20 module
- Built-in TNC, DX packet cluster
- IF Stage DSP • Backlit front key panel

Call Now For Special Price!

$15 KENWOOD COUPON

TM-V71A 2M/440 Dual Band

- High RF output (50W) • Multiple Scan
- Dual receive on same band (VxV, UxU)
- Echolink® memory (auto dialer)
- Echolink® Sysop mode for node terminal ops
- Invertible front panel
- Choice of green/amber for LCD panel
- 104 code digital code squelch
- "Five in One" programmable memory
- 1000 multifunction memory

Call Now For Your Low Price!

$25 KENWOOD COUPON

TM-281A 2 Mtr Mobile

- 65 Watt
- 200 Memories
- CTCSS/DCS
- Mil-Std specs
- Hi-quality audio

Call Now For Special Low Price!

TS-480SAT/HX HF + 6M Transceiver

- 480HX 200W HF & 100W 6M (no tuner)
- 480SAT 100W HF & 6M w/AT
- Remotable w/front panel/speaker
- DSP built-in

$250 KENWOOD COUPON

TS-480SAT

Call Now For Low Price!

$250 KENWOOD COUPON

TS-480HX

TS-590S HF + 6M Transceiver

- 100W HF + 6M
- 500 Hz & 2.7 KHz roofing filter
- Built-in auto tuner
- Best dynamic range in class
- 32 bit DSP

Call Now For Low Price!

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Come visit us online via the Internet at http://www.hamradio.com

#1 in Customer Service

COAST TO COAST FREE SHIPPING
UPS - Most Items Over $100
Rapid Deliveries From The Store Nearest to You!

12 STORE BUYING POWER

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

HRO mobile app available for Android & Apple
Download app at Google Play & Apple App Store

TOKYO HY-POWER

Now with 12M and 10M built-in! Complies with new FCC rules!

HL-1.5KFX

- Fully Solid-state 1 KW HF 650W 6M
- Built-in power supply (110 or 220V)
- 2 Ant ports selectable
- Auto band switched with most ICOM/Kenwood/ Yaesu tcvrs

Call For Additional THP Products!

samlexamerica

SEC-1235M

- Advanced switch-mode technology
- Reliable power with minimum weight and size
- Input voltage can be set at 120VAC or 240VAC
- UL listed to both USA & Canadian safety standards

Call Now For Special Pricing!

SEC-1223

- Advanced switch-mode technology
- Reliable power with minimum weight and size
- Circuit innovations minimize output voltage ripple and RFI
- Input voltage can be set at 120VAC or 240VAC
- UL listed to both USA & Canadian safety standards

Call Now For Special Pricing!

REMOTE RIG

RRC-1258 MkII-S-Set

This set of interfaces allows remote control of your Amateur Radio Station via Internet in a user-friendly and cost effective way! RemoteRig gives you control of the radio coupled with crystal clear TX & RX audio and sending CW with your own Paddle!

New! Now Stereo Version for Dual Receiver radios.

Works with all Computer-controllable radios from:
Alinco - Elecraft - ICOM - Kenwood - Yaesu

For radios with detachable front panels no PC is required for:
TS-480HX/SAT; TS-2000 (RC-2000 req'd); IC-703/ Plus; IC-706 series; DX-SR8T; IC-2820H; IC-R2500

Just simply insert your control box in place of your front panel interconnect cable, place the body of the radio on the remote end and you are on the air as if you are there! Extra Controller and Remote interface units sold individually for multiple sites/users.

Now includes 12V power supply, $12.95 value!

Available exclusively from all HRO locations!

GEOCHRON®

Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.Continuously moving – areas of day and night change as you watch.

- Mounts easily on wall. Size: 34 1/2" x 22 1/2"

USI TOWER

MA-40

- 40' Tubular Tower

Call For Latest Pricing!

MA-550

- 55' Tubular Tower
- Handles 10 sq. ft. at 50 mph
- Pleases neighbors with tubular streamlined look

Call For Latest Pricing!

HRO Owned and operated by ACTIVE HAMS

TX-455

- 55' freestanding crank-up
- Handles 18 sq. ft. @ 50 mph
- No guying required
- Extra-strength construction
- Can add raising and motor drive accessory
- Towers rated to EIA specifications
- Other models at great prices!

Call For Latest Pricing!

All US Towers shipped by truck; freight charges additional.

BUY FROM HRO. The World's Largest US Tower Dealer

CALL TOLL FREE

Phone Hours: 9:30 AM – 5:30 PM
Store Hours: 10:00 AM – 5:30 PM Closed Sun.

Toll free, incl. Hawaii, Alaska, Canada; call routed to nearest store; all HRO 800-lines can assist you, if the first line you call is busy, you may call another.

West.....800-854-6046
Mountain.....800-444-9476
Southeast.....800-444-7927
Mid-Atlantic...800-444-4799
Northeast.....800-644-4476
New England..800-444-0047

#1 in Customer Service

Come visit us online via the Internet at http://www.hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

ANAHEIM, CA
(Near Disneyland)
933 N. Euclid St., 92801
(714) 533-7373
(800) 854-6046
Janet, KL7MF, Mgr.
anaheim@hamradio.com

BURBANK, CA
1525 W. Magnolia Bl., 91506
(818) 842-1786
(877) 892-1748
Eric, K6EJC, Mgr.
Magnolia between S. Victory & Buena Vista
burbank@hamradio.com

OAKLAND, CA
2210 Livingston St., 94606
(510) 534-5757
(877) 892-1745
Mark, WI7YN, Mgr.
I-880 at 23rd Ave. ramp
oakland@hamradio.com

SAN DIEGO, CA
5375 Kearny Villa Rd., 92123
(858) 560-4900
(877) 520-9623
Jerry, N5MCJ, Mgr.
Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

SUNNYVALE, CA
510 Lawrence Exp. #102 94085
(408) 736-9496
(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

NEW CASTLE, DE
(Near Philadelphia)
1509 N. Dupont Hwy., 19720
(302) 322-7092
(800) 644-4476
Bill, KA3IXF, Mgr.
RT.13 1/4 mi., So. I-295
delaware@hamradio.com

PORTLAND, OR
11705 S.W. Pacific Hwy. 97223
(503) 598-0555
(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit from Hwy. 5 & 217
portland@hamradio.com

DENVER, CO
8400 E. Iliff Ave. #9, 80231
(303) 745-7373
(800) 444-9476
John WØIG, Mgr.
denver@hamradio.com

PHOENIX, AZ
10613 N. 43rd Ave., 85029
(602) 242-3515
(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave. & Peoria
phoenix@hamradio.com

ATLANTA, GA
6071 Buford Hwy., 30340
(770) 263-0700
(800) 444-7927
Mark, KJ4VO, Mgr.
Doraville, 1 mi. no. of I-285
atlanta@hamradio.com

WOODBRIDGE, VA
(Near Washington D.C.)
14803 Build America Dr. 22191
(703) 643-1063
(800) 444-4799
Steve, W4SHG, Mgr.
Exit 161, I-95, So. to US 1
virginia@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

License Study Materials

Technician Class

Exam: 35-question Technician test (Element 2)
The ARRL Ham Radio License Manual—Revised 2nd Edition. Ham radio's most popular license manual! Organized in easy-to-understand "bite-sized" sections, this is all you need to become an Amateur Radio operator. **Includes practice exam software.**
Order No. 0977 ..... **$29.95**
ARRL's Tech Q & A—5th Edition. Order No. 0847 ..... **$17.95**
The ARRL Instructor's Manual for Technician License Courses.
Order No. 8737 ..... **$19.95**
Ham Radio for Dummies. Order No. 9392 ..... **$21.99**
Technician Class Flash Card Set. Order No. 1345 ..... **$24.95**

General Class (upgrade from Technician)

Exam: 35-question General test (Element 3)
The ARRL General Class License Manual—7th Edition. All the exam questions with answer key, for use through June 30, 2015. **Includes practice exam software.**
Order No. 8119 ..... **$29.95**
ARRL's General Q & A—4th Edition. Order No. 8089 ..... **$17.95**
General Class Flash Card Set. Order No. 1357 ..... **$39.95**

Extra Class (upgrade from General)

Exam: 50-question Extra test (Element 4)
The ARRL Extra Class License Manual—10th Edition. Achieve the highest level of Amateur Radio licensing! **Includes practice exam software.**
Order No. 5170 ..... **$29.95**
ARRL's Extra Q & A—3rd Edition. Order No. 4708 ..... **$17.95**
Extra Class Flash Card Set. Order No. 1366 ..... **$39.95**

Prepare for all 3 Levels

ARRL Exam Review for Ham Radio. CD-ROM, Ver 3.0
Order No. 4982 ..... **$39.95**
ARRL Exam Review for Ham Radio Download. Order No. 4982D **$39.95**

Operating and Reference

NEW! The ARRL Operating Manual for Radio Amateurs. 10th Edition.
Order No. 5965 ..... **ARRL Member Price $29.95** .... ~~$34.95~~
The ARRL Repeater Directory®. 2012/2013 Edition.
Pocket-sized. Order No. 5347 ..... **ARRL Member Price $10.95** .... ~~$12.95~~
Desktop Edition. Order No. 5485 ..... **ARRL Member Price $15.95** .... ~~$17.95~~
TravelPlus for Repeaters™ 2012-2013 Edition. CD-ROM, Ver 16.0.
Order No. 4678 ..... **$39.95**
TravelPlus Mobile GPS™ Download. 2012/2013 Edition.
Order No. 1371 ..... **$24.95**
NEW! Radios to Go! Order No. 3077 ..... **ARRL Member Price $15.95** .... ~~$17.95~~
The ARRL DXCC List. April 2012 Edition. Order No. 3862 ..... **$5.95**
ARRL's Hamspeak—A Dictionary for Radio Amateurs.
Order No. 8423 ..... **ARRL Member Price $15.95** .... ~~$17.95~~
DXing on the Edge. Order No. 6354 ..... **Closeout Special $19.95** ..... ~~$29.95~~
RF Exposure and You. Order No. 6621 ..... **$22.95**
50 Years of Amateur Radio Innovation. Order No. 0228 ..... **$39.95**
50 Years of Amateur Radio CD-ROM. Order No. 3558 ..... **$22.95**
Hints & Kinks for the Radio Amateur. 18th Edition.
Order No. 5200 ..... **ARRL Member Price $19.95** .... ~~$22.95~~
Low Profile Amateur Radio. 2nd Edition. Order No. 9744 ..... **$19.95**
The ARRL Field Day Handbook. Order No. 0885 ..... **$19.95**
FCC Rules and Regulations. 2nd Edition. Order No. 1173 ..... **$5.95**
Getting Started with Ham Radio. Order No. 9728 ..... **$19.95**
ARRL Software Library for Hams. CD-ROM, Ver 4.0
Order No. 4364 ..... **ARRL Member Price $19.95** .... ~~$22.95~~
ARRL Software Library for Hams Download. Order No. 4364D **$19.95**
Remote Operating for Amateur Radio. Order No. 0992 ..... **$22.95**
Amateur Radio on the Move. Order No. 9450 ..... **$19.95**
Storm Spotting and Amateur Radio. Order No. 0908 ..... **$22.95**
Your Introduction to Morse Code. Order No. 8314 ..... **$12.95**
Two-Way Radios & Scanners for Dummies. Order No. 9696 ..... **$21.99**
Pocket Ref (by Glover). Order No. 1148 ..... **$12.95**
Marine Amateur Radio. Order No. 9723 ..... **$12.95**
Shortwave DX Handbook. Order No. 9953 ..... **$34.95**
A Year of DX. Order No. 0040 ..... **$20**
The Complete DX'er. Order No. 9073 ..... **$19.95**

MAPS

ARRL Map of North America. 27" x 39". Order No. 8977 ..... **$15**
ARRL Map of the World (Azimuthal). 27" x 39". Order No. 7717 ..... **$15**
ARRL Map of the World (Robinson). 26" x 34.5". Order No. 8804 ..... **$15**
ARRL Worked All States (WAS) Map. 11" x 17". Order No. 1126 ..... **$3**
The Radio Amateur's World Atlas. Order No. 5226 ..... **$12.95**

RSGB Amateur Radio Operating Manual. Order No. 2300 ..... **$29.95**
RSGB Amateur Radio Mobile Handbook. Order No. 5225 ..... **$19.95**
RSGB IOTA Directory. 2011 Edition. Order No. 0032 ..... **$19.95**
RSGB 6 Metre Handbook. Order No. 0340 ..... **$24.95**
RSGB LF Today. 2nd Edition. Order No. 0220 ..... **$24.95**
RSGB Radio Orienteering. Order No. 0131 ..... **$19.95**
RSGB Prefix Guide. 10th Edition. Order No. 0147 ..... **$19.95**
RSGB Morse Code for Radio Amateurs. Order No. 0221 ..... **$15.95**
RSGB Computers in Amateur Radio. Order No. 0139 ..... **$24.95**
NEW! 2013 Super Frequency List on CD-ROM. Order No. 0050 ..... **$44.95**
NEW! 2013 Shortwave Frequency Guide. Order No. 0024 ..... **$59.95**

Antennas and Transmission Lines

The ARRL Antenna Book—22nd Edition. All the information you need for complete antenna systems—from planning, to design and construction. CD-ROM included! **New and Improved!** Includes a complete reorganization, new content, and exciting new antenna projects.
Softcover Antenna Book. Book with CD-ROM.
Order No. 6948 ..... **$49.95**
Basic Antennas. Order No. 9994 ..... **$29.95**
The ARRL Antenna Designer's Notebook.
Order No. 1479 ..... **$34.95**
NEW! Antenna Modeling for Beginners.
Order No. 3961 ..... **ARRL Member Price $34.95** ..... ~~$38.95~~
Short Antennas for Small 160 Meter Radio.
Order No. 5798 ..... **ARRL Member Price $19.95** ..... ~~$22.95~~
ON4UN's Low-Band DXing. 5th Edition. Order No. 8560 ..... **$44.95**
ARRL's Small Antennas for Small Spaces.
Order No. 8393 ..... **ARRL Member Price $22.95** ..... ~~$25.95~~
Antenna Towers for Radio Amateurs. Order No. 0946 ..... **$34.95**
The ARRL Guide to Antenna Tuners. Order No. 0984 ..... **$22.95**
ARRL's Yagi Antenna classics. Order No. 8187 ..... **$17.95**
Simple and Fun Antennas for Hams. Order No. 8624 ..... **$22.95**
ARRL's Wire Antenna Classics. Order No. 7075 ..... **$14**
More Wire Antenna Classics—Volume 2. Order No. 7709 ..... **$17.95**
More Vertical Antenna Classics. Order No. 9795 ..... **$17.95**
Vertical Antenna Classics. Order No. 5218 ..... **$12**
ARRL's VHF/UHF Antenna Classics. Order No. 9078 ..... **$14.95**
ARRL Antenna Compendium. Vol. 1. Order No. 0194 ..... **$20**
ARRL Antenna Compendium. Vol. 2. Order No. 2545 ..... **$14**
ARRL Antenna Compendium. Vol. 3. Order No. 4017 ..... **$14**
ARRL Antenna Compendium. Vol. 4. Order No. 4912 ..... **$20**
ARRL Antenna Compendium. Vol. 5. Order No. 5625 ..... **$20**
ARRL Antenna Compendium. Vol. 6. Order No. 7431 ..... **$22.95**
ARRL Antenna Compendium. Vol. 7. Order No. 8608 ..... **$24.95**
ARRL Antenna Compendium. Vol. 8. Order No. 0991 ..... **$24.95**
NEW! The Care and Feeding of Transmission Lines.
Order No. 4784 ..... **ARRL Member Price $24.95** ..... ~~$27.95~~
RSGB Practical Wire Antennas. Order No. R878 ..... **$17**
RSGB Practical Wire Antennas 2. Order No. 9563 ..... **$24.95**
RSGB Successful Wire Antennas. Order No. 0363 ..... **$24.95**
RSGB HF Antennas for Everyone. Order No. 0145 ..... **$24.95**
RSGB HF Antennas for All Locations. Order No. 4300 ..... **$34.95**
RSGB Antennas for VHF and Above. Order No. 0501 ..... **$29.95**
RSGB Building Successful HF Antennas. Order No. 0800 ..... **$34.95**
RSGB HF Antenna Collection. Order No. 3770 ..... **$34.95**
RSGB Stealth Antennas. Order No. 3208 ..... **$24.95**
RSGB Backyard Antennas. Order No. RBYA **$34.95**
RSGB Radio Propagation—Principles and Practice. Order No. 9328 ..... **$29.95**
Practical Antenna Handbook. Order No. 0371 ..... **$50**
Antenna Zoning. 2nd Edition. Order No. 1192 ..... **$49.95**
Antennas: Fundamentals, Design, Measurement. Standard Edition.
Order No. 0320 ..... **$99**
Antennas: Fundamentals, Design Measurement. Deluxe Edition.
Order No. 0175 ..... **$149**
NEW! Up the Tower. Order No. 1260 ..... **$35**
Tower Climbing Safety & Rescue. Order No. 1108 ..... **$29.95**
Electronic Applications of the Smith Chart. Order No. 7261 ..... **$85**
Radio-Electronic Transmission Fundamentals. Order No. RETF **$95**
Transmission Line Transformers. Order No. TLT4 ..... **$75**
Transmission Line Transformers. CD-ROM. Order No. 9088 ..... **$129**

CD-ROM/DVD Collections

***QST* on CD-ROM/DVD!**

NEW! 2012 Periodicals on DVD. Order No. 3152 ..... **$24.95**
2011 Periodicals on CD-ROM. Order No. 5651 ..... **$24.95**
2010 Periodicals on CD-ROM. Order No. 2001 ..... **$24.95**
2009 Periodicals on CD-ROM. Order No. 1486 ..... **$24.95**
2008 Periodicals on CD-ROM. Order No. 9406 ..... **$24.95**
2007 Periodicals on CD-ROM. Order No. 1204 ..... **$19.95**
2006 Periodicals on CD-ROM. Order No. 9841 ..... **$19.95**
2005 Periodicals on CD-ROM. Order No. 9574 ..... **$19.95**
2003 Periodicals on CD-ROM. Order No. 9124 ..... **$19.95**
2002 Periodicals on CD-ROM. Order No. 8802 ..... **$19.95**
2001 Periodicals on CD-ROM. Order No. 8632 ..... **$19.95**
1999 Periodicals on CD-ROM. Order No. 7881 ..... **$19.95**
1997 Periodicals on CD-ROM. Order No. 6729 ..... **$19.95**
1996 Periodicals on CD-ROM. Order No. 6109 ..... **$19.95**
NEW! Callbook CD-ROM. Winter 2013 Edition. Order No. 0010 ..... **$49.95**
HamCall™ CD-ROM. Order No. 8991 ..... **$49.95**

Continued on page 110

More Power to Your Antenna Means You Stand Out in the Pileups—Work More DX!

DX ENGINEERING

TOTALLY FREE SHIPPING ON COAX*

Always the Best Cable at the Lowest Price

High-Performance Cable, Made in the USA to DX Engineering's Rigid Specifications

Available in full spools or cut to your specified lengths.

Made in USA

Need Phasing Cables?

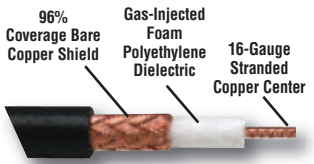
DX Engineering provides precision, electrically-tuned phasing lines for your 50 or 75 Ω applications. Choose from pre-manufactured four-square and two-antenna array cables or contact us with your custom application.

DX Engineering is now the #1 Place to Buy Coax!

Hand-Crafted, Fully-Tested Cable Assemblies

- Highest-quality DX Engineering workmanship
- Silver-plated, Teflon®-insulated connectors
- Hi-Pot, high-voltage tested
- Weatherproof, adhesive shrink tube seals connections

Complete information is available at DXEngineering.com. Contact DX Engineering Customer Support for your application.



UV-Resistant, Non-Contaminating, Black PVC Jacket

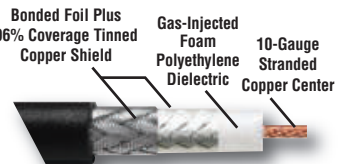
DXE-8X Low-Loss Foam Dielectric Cable (also known as RG-8X or Mini-8)

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

Cable Only		
DXE-8X	By the foot	$.31/ft.
DXE-8X-1000	1,000 ft.	$259.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft.	Price
DXE-8XDU003	3	$9.88
DXE-8XDU006	6	$10.88
DXE-8XDU012	12	$12.88
DXE-8XDU025	25	$17.88
DXE-8XDU050	50	$26.88
DXE-8XDU075	75	$35.88
DXE-8XDU100	100	$44.88
DXE-8XDU150	150	$62.88



UV-Resistant, Black PE Jacket

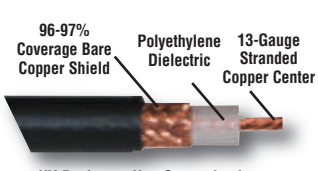
DXE-400MAX Low-Loss Cable

- Low-loss, gas-injected foam polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density polyethylene jacket is UV resistant, ideal for outdoor use
- Direct-bury

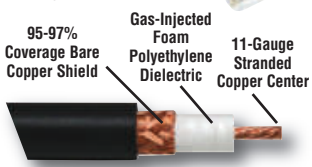
Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	6.9 kW	93%
0.5 dB @ 10 MHz	4.8 kW	90%
0.8 dB @ 30 MHZ	2.8 kW	83%
1.1 dB @ 50 MHz	2.1 kW	79%
1.8 dB @ 150 MHz	1.2 kW	65%
3.3 dB @ 450 MHz	0.7 kW	47%

Cable Only		
DXE-400MAX	By the foot	$.82/ft.
DXE-400MAX-500	500 ft.	$364.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft.	Price
DXE-400MAXDU003	3	$11.88
DXE-400MAXDU006	6	$14.88
DXE-400MAXDU018	18	$26.88
DXE-400MAXDU025	25	$33.88
DXE-400MAXDU050	50	$58.88
DXE-400MAXDU075	75	$83.88
DXE-400MAXDU100	100	$100.88
DXE-400MAXDU150	150	$158.88



UV-Resistant, Non-Contaminating, Black PVC Jacket



Black PVC Jacket

Gas-Injected Foam Won't Absorb Water.

DXE-213U MIL-Spec Cable

- .405" Type II jacket is non-contaminating and UV-resistant, suitable for outdoor use
- Direct-bury

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

Cable Only		
DXE-213U	By the foot	$.89/ft.
DXE-213U-500	500 ft.	$409.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft.	Price
DXE-213UDU003	3	$11.88
DXE-213UDU006	6	$14.88
DXE-213UDU012	12	$20.88
DXE-213UDU025	25	$33.88
DXE-213UDU050	50	$57.88
DXE-213UDU075	75	$80.88
DXE-213UDU100	100	$99.88
DXE-213UDU150	150	$144.88

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket
- Low-loss foam dielectric

Attenuation/ 100 ft.	Power Rating	Efficiency %
0.3 dB @ 5 MHz	5.4 kW	93%
0.5 dB @ 10 MHz	4.1 kW	90%
0.9 dB @ 30 MHZ	2.2 kW	81%
1.2 dB @ 50 MHz	1.8 kW	77%
2.2 dB @ 150 MHz	1.0 kW	60%

Cable Only		
DXE-8UDU	By the foot	$.79/ft.
DXE-8UDU-500	500 ft.	$359.99

Pre-cut Cable with Connectors		
Part Number	Length/Ft.	Price
DXE-8UDU002	2	$10.48
DXE-8UDU003	3	$11.48
DXE-8UDU006	6	$14.48
DXE-8UDU025	25	$30.48
DXE-8UDU050	50	$50.48
DXE-8UDU100	100	$90.48

**Your coax cable order is shipped free, via UPS ground, anywhere in the contiguous 48 United States.*

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-KIT1 Basic Coax Cable Prep Kit.....$99.95

DXE-UT-KIT2 Complete Coax Cable Prep Kit.....$174.95

Coax Prep Tools, see DXEngineering.com for details.

World-Class Products Shipped Worldwide, Every Day!

Thousands More Ham Products at

DXEngineering.com

1.800.777.0703

8:30 am to 4:30 pm ET
1230 to 2030 UTC (March-October)
1330 to 2130 UTC (November-February)

Tech/International: **330.572.3200** Country Code: **+1**
Sale Code: **1302QS**

Prices subject to change without notice.

Order by 4 pm ET (US) for Same-Day Shipping

We Will Beat Any Competitor's Price!

Continued from page 108

Practical Circuits and Design

NEW! The ARRL Handbook – 2013 Edition
The 90th Edition of Amateur Radio's Foremost Technical Resource! The Handbook is filled with essential information from across the expanse of radio communication fundamentals and practical applications. Clear explanations cover nearly every aspect of radio and antenna design, equipment construction, and station assembly.
BONUS! Get the Hardcover edition for the Softcover price when you order now or while supplies last.

Hardcover Handbook. Book with CD-ROM.
Order No. 4197 ..... **ARRL Member Price $49.95** ..... ~~$59.95~~
Softcover Handbook. Book with CD-ROM. Order No. 4050 ..... **$49.95**
Understanding Basic Electronics. 2nd Edition.
Order No. 0823 ..... **ARRL Member Price $29.95** ..... ~~$32.95~~
Basic Radio—Understanding the Key Building Blocks.
Order No. 9558 ..... **$29.95**
Digital Signal Processing Technology.
Order No. 8195 ..... **Closeout Special $34.95** ..... ~~$44.95~~
ARRL's Hands-On Radio Experiments. Order No. 1255 ..... **$19.95**
Hands-On Radio Parts Kit. Order No. 1255K **$79.95**
The ARRL RFI Book. 3rd Edition. Order No. 0915 ..... **$29.95**
Experimental Methods in RF Design. Revised 1st Edition.
Order No. 9239 ..... **$49.95**
ARRL's Pic Programming for Beginners. Revised 1st Edition.
Order No. 0892 ..... **ARRL Member Price $39.95** ..... ~~$44.95~~
ARRL PIC Programming Kit. Order No. 0030 ..... **$149.95**
ARRL Morse Code Oscillator Kit. Order No. 0022 ..... **$24.95**
Morse Code Key. Order No. 0242 ..... **$15.95**
Keyer Touch Paddle Kit. Order No. 0670 ..... **$49.95**
L/C/F and Single-Layer Coil Winding Calculator. Order No. 9123 ..... **$12.95**
ARRL's RF Amplifier Classics. Order No. 9310 ..... **$19.95**
ARRL's Low Power Communication. 4th Edition.
Order No. 5828 ..... **ARRL Member Price $24.95** ..... ~~$27.95~~
ARRL's Low Power Communication with Cub CW Transceiver Kit.
Order No. 5828K **$105.95**
MFJ 20-meter CW Cub Transceiver Kit. Order No. 0018 ..... **$89.95**
More QRP Power. Order No. 9655 ..... **$19.95**
QRP Romps. Order No. 0160 ..... **$18**
Do-It-Yourself Circuitbuilding for Dummies. Order No. 0015 ..... **$24.99**
Electronics for Dummies. 2nd Edition. Order No. 0196 ..... **$24.99**
Electronics Projects for Dummies. Order No. 9944 ..... **$24.99**
Practical Digital Signal Processing. Order No. 9331 ..... **$52.95**
Power Supply Handbook. Order No. 9977 ..... **$29.95**
Electromagnetic Compatibility Engineering. Order No. 0192 ..... **$120**
Discrete-Signal Analysis and Design. Order No. 0140 ..... **$125**
RF Components and Circuits. Order No. 8759 ..... **$50.95**
Practical Radio Frequency Test & Measurement. Order No. 7954 ..... **$66.95**
Wireless Receiver Design for Digital Communications. 2nd Edition.
Order No. 0080 ..... **$139**
HF Radio Systems & Circuits. Order No. 7253 ..... **$95**
Build Your Own Low-Power Transmitters. Order No. 9458 ..... **$54.95**
NEW! Build Your Own Transistor Radios. Order No. 1367 ..... **$50**
AC Power Interference Handbook. Order No. 1103 ..... **$34.95**
NEW! Batteries in a Portable World. Order No. 1156 ..... **$29.95**
Power Supply Cookbook. Order No. 8599 ..... **$63.95**
Instruments of Amplification. Order No. 9163 ..... **$19.95**
RSGB Radio Communications Handbook. Order No. 4450 ..... **$59.95**
RSGB Homebrew Cookbook. Order No. 0232 ..... **$24.95**
RSGB Elimination of Electrical Noise. Order No. 1082 ..... **$12.95**
RSGB International QRP Collection. Order No. 0020 ..... **$24.95**
RSGB Test Equipment for the Radio Amateur. Order No. 1027 ..... **$24.95**
RSGB Weekend Projects for the Radio Amateur. Order No. 0123 ..... **$24.95**
NEW! RSGB Valves Revisited. Order No. 0212 ..... **$29.95**

Digital Communications

ARRL's VHF Digital Handbook. Order No. 1200 ..... **$19.95**
Get on the Air with HF Digital.
Order No. 6016 ..... **ARRL Member Price $22.95** ..... ~~$25.95~~
The ABCs of Software Defined Radio.
Order No. 6320 ..... **ARRL Member Price $19.95** ..... ~~$22.95~~
VoIP: Internet Linking for Radio Amateurs. 2nd Edition.
Order No. 1431 ..... **$21.95**
GPS and Amateur Radio. Order No. 9922 ..... **$18.95**
Your Guide to HF Fun. Order No. 0153 ..... **$16**
RSGB RTTY/PSK31 for Radio Amateurs. Order No. 0329 ..... **$15.95**
Nifty E-Z Guide to PSK31 Operation. Order No. 0370 ..... **$12.95**
Nifty E-Z Guide to D-STAR Operation. Order No. 0125 ..... **$13.95**
Nifty E-Z Guide to EchoLink Operation. Order No. 1094 ..... **$13.95**

Public Service and Emergency Communications

NEW! The Amateur Radio Public Service Handbook.
Order No. 4845 ..... **ARRL Member Price $34.95** ..... ~~$39.95~~
The ARRL Digital Technology for Emergency Communications Course.
CD-ROM, version 1.0 Order No. 1247 ..... **$49.95**
The ARRL Introduction to Emergency Communication Course.
4th Edition. Order No. 7303 ..... **$24.95**
ARES Field Resource Manual. Order No. 5439 ..... **$12.95**
Emergency Power for Radio Communications. 2nd Edition.
Order No. 6153 ..... **ARRL Member Price $24.95** ..... ~~$27.95~~
Personal Emergency Communications. Order No. 0081 ..... **$14.95**
Eton Microlink FR160 Radio. Order No. 1150 ..... **$35**
Solar Crank Flashlight. Order No.0173 ..... **$40**
2 in 1 Flashlight/Lantern. Order No.0264 ..... **$20**
ARES Hat. Order No. 0099 ..... **$14.95**
ARES Mesh Vest. (M-3XL) Order No. 0128 ..... **$15.95**
ARES Solid Vest with Pockets. (M-3XL) Order No. 0136 ..... **$24.95**
PR-101 Course on CD-ROM. Order No. 0133 ..... **$19.95**
The DIY Magic of Amateur Radio. DVD. Order No. 6047 ..... **$10.95**

Space and VHF/UHF/Microwave Communications

The ARRL Satellite Handbook. Order No.9857 ..... **$24.95**
NOVA for Windows. CD-ROM. Order No. 8724 ..... **$59.95**
RSGB Radio Nature. Order No. 0240 ..... **$24.95**
RSGB Amateur Radio Astronomy. 2nd Edition. Order No. 0388 ..... **$32.95**
International Microwave Handbook. 2nd Edition. Order No. 0330 ..... **$29.95**
RSGB VHF/UHF Handbook. 2nd Edition. Order No. 1229 ..... **$29.95**
RSGB Microwave Projects. Order No. 9022 ..... **$29.95**
RSGB Microwave Know How. Order No. 0303 ..... **$21.95**

History and Adventure

The Secret Wireless War— Softcover Edition. Order No. 0262 ..... **$39.95**
Edgar Harrison. Order No. 0270 ..... **$29.95**
Hiram Percy Maxim. Order No. 7016 ..... **$19.95**
200 Meters and Down. Order No. 0011 ..... **$12**
The Gil Cartoon Book. Order No. 0364 ..... **$15.95**
The ARRL Film Collection. DVD. Order No. 3725 ..... **$15.95**
NEW! Riding the Shortwaves. Order No. 1210 ..... **$18.95**
The Story of W6RO and the Queen Mary. DVD. Order No. 1344 ..... **$15.95**
Crystal Clear. Softcover Edition. Order No. 0353 ..... **$39.95**
Don C. Wallace: W6AM, Amateur Radio's Pioneer. Order No. 0016 ..... **$29.95**
World War II Radio Heroes: Letters of Compassion. Order No. 1268 ..... **$15.95**
Perera's Telegraph Collector's Guide. Order No. 1277 ..... **$19.95**
Perera's Telegraph Collectors Reference CD-ROM. Order No. 1282 ..... **$15**
The Story of the Enigma CD-ROM. Order No. 1296 ..... **$15**
Inside Enigma. Order No. 0611 ..... **$19.95**
Keys II: The Emporium. Order No. 1372 ..... **$16**
Keys III: The World of Keys. Order No. 1381 ..... **$18**
Oscar's Amateur Radio Adventure. Order No. 0341 ..... **$19.95**
NEW! Mouse Code. Order No. 0116 ..... **$12.95**
Full Circle: A Dream Denied, A Vision Fulfilled. Order No. 0152 ..... **$13.95**
Frozen in Time. Order No. 0098 ..... **$14.95**
The Road Home. Order No. 0427 ..... **$12.99**
Where Discovery Sparks Imagination. Order No. 1660 ..... **$34.95**
NEW! Zone of Iniquity. Order No. 0243 ..... **$12.99**

Ordering Information

For a complete publications listing or to place an order, please contact us:

1. To order or obtain the address of an ARRL Dealer near you, call toll-free (US): **1-888-277-5289** (non-US call **860-594-0355**) 8 AM-5 PM Eastern time, Monday-Friday.
2. Fax **1-860-594-0303** 24 hours a day, 7 days a week.
3. By mail to: ARRL, 225 Main St, Newington CT 06111-1494
4. Visit our World Wide Web site: **http://www.arrl.org/shop**

Shipping and Handling Rates: Add the following amounts to your order to cover shipping and handling (S/H). US orders will be shipped via a ground delivery method. Orders outside of the US will be shipped via International Mail Services. Express delivery options are available. Please call, write or email for more information.
Sales Tax: CT add 6.35% state sales tax (including S/H). VA add 5% sales tax (excluding S/H). Canada add 5% GST (excluding S/H).

Order Value	US	International Economy 2-3 weeks delivery
Up to $20.00	$7.50	$25.00
$20.01 to $50.00	$10.50	$35.00
$50.01 to $250.00	$12.50	$45.00
Single CD-ROM	First Class Mail $2.75	n/a
Over $250	Contact ARRL for shipping options and rates: **orders@arrl.org**	

We accept the following major credit cards: American Express, MasterCard, Visa and Discover. Prices and product availability are subject to change without notice.

ARRL The national association for AMATEUR RADIO®

SHOP DIRECT *or call for a dealer near you.*
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 1-888-277-5289 (US)

DX ENGINEERING

Your Best Source for All Antennas and Antenna Building Parts

Our Clamps are Specified by Scientific, Military & Government Designers! Used by Antenna Builders: Both Commercial & Amateur!

Saddle Clamps with Cast Saddles

- Stainless steel flat washers, lock washers, nuts and bolts
- Corrosion-resistant aluminum saddles with as-cast rough finish for secure grip

U-Bolt Style, designed and sized to fit tubing

- Full 360° grip for specified tubing size

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-SAD-050A	0.50	1/4-20	**$5.25**
DXE-SAD-075A	0.75	1/4-20	**$5.65**
DXE-SAD-100A	1.00	1/4-20	**$6.05**
DXE-SAD-125A	1.25	1/4-20	**$6.85**
DXE-SAD-150A	1.50	1/4-20	**$7.75**
DXE-SAD-175A	1.75	1/4-20	**$8.90**
DXE-SAD-200A	2.00	5/16-18	**$10.05**
DXE-SAD-200B	2.00	3/8-16	**$11.25**
DXE-SAD-250A	2.50	5/16-18	**$12.05**
DXE-SAD-250B	2.50	3/8-16	**$13.55**
DXE-SAD-300A	3.00	5/16-18	**$13.60**
DXE-SAD-300B	3.00	3/8-16	**$15.25**
DXE-SAD-400A	4.00	3/8-18	**$34.70**
DXE-SAD-450A	4.50	3/8-16	**$39.95**

Dimensions in Inches.

V-Bolt Style, sized to accommodate ranges of tubing sizes

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-CAVS-1P	0.50 to 1.75	1/4-20	**$10.25**
DXE-CAVS-11P	0.50 to 1.75	5/16-18	**$10.75**
DXE-CAVS-2P	1.00 to 2.00	5/16-18	**$12.25**
DXE-CAVS-3P	2.00 to 3.00	3/8-16	**$15.25**

Dimensions in Inches.

Clamps with black powdercoated saddles are also available in U-Bolt and V-Bolt styles, designed and sized to fit ½" to 2" tubing.

Guy Rings

You can use DX Engineering's newly engineered Guy Rings to secure your rope guys and stabilize your DX Engineering, Hustler or other aluminum vertical antenna. They're also great for our Telescoping Fiberglass and Aluminum Tubing Kits.

These guy rings are super strong, virtually impervious to the elements and fit 0.75", 1.0", 1.25", 1.50" and 2.0" O.D. tubing. For all the specs, please visit DXEngineering.com.

DXE-GR-5P Guy Rings.....**$7.95 set of 5**

V-Bolt Style Saddle Clamps with Stainless Steel Saddles

- Stainless Steel Saddles, serrated to secure hard pipe surfaces
- Stainless steel V-bolts and hardware

Part number	Nominal Size	Price
DXE-SSVC-1P	.50 to .75	**$6.95**
DXE-SSVC-150P	1.00 to 1.50	**$9.95**
DXE-SSVC-2P	1.00 to 2.00	**$11.95**
DXE-SSVC-3P	2.00 to 3.00	**$14.95**

Dimensions in Inches.
Also available with a tab and 1/4" hardware for grounding as shown.

Coaxial Cable Grounding Brackets

- Stainless steel bracket supplied with stainless steel V-Bolt and hardware
- Welded 10-24 stud

DXE-CGB-150	Fits .50" to 1.50" O.D. tube	**$15.95**
DXE-CGB-200	Fits 1.00" to 2.00" O.D. tube	**$15.95**

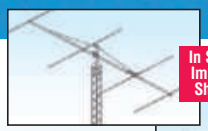
Connectors not included.
See website for complete selection.

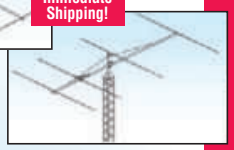
For a full selection of aluminum tube sizes and lengths, see DXEngineering.com

Telescoping Antenna Tubing Kits

Available in either fiberglass or aluminum, these kits contain several tapered sections of DX Engineering tubing and stainless steel band camps, allowing you to build your own vertical antenna. You can design, experiment and create an adjustable setup tailored specifically to your specs. These kits contain almost everything you'll need, eliminating extra trips to the hardware store.

Part number		Price
DXE-FTK50	Fiberglass Antenna Tubing Kit, 50 Foot Max. Length	**$138.00**
DXE-ATK65	Aluminum Antenna Tubing Kit, 65 Foot Max. Length	**$194.50**





In Stock for Immediate Shipping!

DX Engineering now stocks all M2 Antennas

M2 Antennas offers a full line of antennas, components and accessories—including big HF Antennas and Small UHF Arrays. See much more in stock at DXEngineering.com.

MSQ-40M2L	HF 40 Meter Monoband Beam;	**$1,395.00**
MSQ-20M4DX	HF 20 Meter Monoband Beam;	**$1,004.00**
MSQ-15M4DX	HF 15 Meter Monoband Beam.....	**$801.00**
MSQ-10M4DX	HF 10 Meter Monoband Beam.....	**$700.00**
MSQ-KT34M2	HF Triband Beam, 4 Element.....	**$1,468.00**
MSQ-KT36XA	HF Triband Beam, 6 Element.....	**$2,037.00**
MSQ-1030LP8	HF 10-30 Meter Log Periodic ...	**$2,183.00**
MSQ-6M3	6 Meter Yagi, 3 element, 3 kW.....	**$180.00**
MSQ-6M3SS	6 Meter Yagi, 3 element, 500 W...	**$164.00**
MSQ-2M9SSBFM	2 Meter Yagi Antenna	**$220.00**
MSQ-2MHOLOOP	2 Meter Horizontal Loop Antenna;	**$87.00**
MSQ-2225SS	1.25 Meter Yagi, 5 Element	**$89.00**
MSQ-EB144RK2M	Eggbeater Satellite Antenna, 135-150 MHz	**$221.00**
MSQ-EB432RK70CM	Eggbeater Satellite Antenna, 420-450 MHz	**$180.00**
MSQ-SATPACK1	Eggbeater Satellite Antennas Package.....	**$378.00**
MSQ-44018	70cm Yagi Antenna.....	**$165.00**
MSQ-OR2800PX	Super-Duty HF Rotator Unit	**$1,592.00**
MSQ-OR2800PXAZ	Super-Duty HF Rotator Unit and Controller	**$1,906.00**

Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads.

- A356-T6 cast aluminum saddle, with rough, as-cast finish for high-torque grip on masts, etc
- Cast stainless reinforcement plate included
- Armor coated bolt sets sold separately

Part Number	Tube O.D.	Price
DXE-SDS-200P	2.00	**$34.00**
DXE-SDS-250P	2.50	**$41.00**
DXE-SDS-300P	3.00	**$51.00**

Dimensions in Inches.

Resin Support Blocks

Securely mount tubing to any flat surface. An insulated mount between tubing and plates, ideal for antenna construction and electrical applications.

- Optional stainless steel reinforcement plates available

World-Class Products Shipped Worldwide, Every Day!

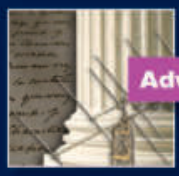
Thousands More Ham Products at
DXEngineering.com
1.800.777.0703

8:30 am to 4:30 pm ET
1230 to 2030 UTC (March-October)
1330 to 2130 UTC (November-February)

Tech/International: **330.572.3200** Country Code: **+1**
Sale Code: **13020S**
Prices subject to change without notice.

Order by 4 pm ET (US) for Same-Day Shipping

We Will Beat Any Competitor's Price!



Join or Renew!

Devoted Entirely to Amateur Radio

Includes QST

www.arrl.org/join

Membership Application

☑ Membership options (circle your choice/s)

	1 Year	2 Years	3 Years	
Regular	$39	$76	$111	Monthly *QST* via standard mail for US members
Canada	$49	$93	$132	Monthly *QST* via standard mail for Canadian members
International *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
International – no printed *QST*	$39	$76	$111	Digital *QST* only
Family	$8	$16	$24	Reside at the same address as the primary member, no additional *QST*. Membership dates must correspond with primary member.

Membership includes $15 per year for subscription to *QST*. Dues subject to change without notice and are nonrefundable.

Blind and youth rates are available. Contact ARRL for more details.

Additional membership options available online at www.arrl.org/join.

Name _____ Call Sign _____

Street _____ City _____ State _____ ZIP _____

E-mail _____ Phone _____

Family Member Name _____ Call Sign (if any) _____

☑ Payment Options

☐ Visa ☐ MasterCard ☐ Amex ☐ Discover ☐ Check Enclosed

Card Number _____ Expiration Date _____

Cardholder's Signature _____

☐ Total enclosed payable to ARRL $ _____

☐ I do not want my name and address made available for non-ARRL related mailings.

Join Now

ONLINE: **www.arrl.org/join** PHONE: **1-888-277-5289 (US)**
ARRL•225 Main Street•Newington, CT 06111-1494
Phone: 860-594-0338 • FAX: 860-594-0303

Source Code: QST 2/2013

DX ENGINEERING®

ICOM · Cushcraft Amateur Radio Antennas · hy-gain · CQ · HUSTLER · MFJ · AMERITRON · BELDEN · Tigertronics · VIBROPLEX · PLASTI DIP · The BetterRF Company · VECTRONICS ...World Class Quality · PolyPhaser · ROHN Products LLC · JSC WIRE & CABLE · LOCTITE · butternut · MIRAGE Communications Equipment · LDG ELECTRONICS · HEIL SOUND · DIAMOND ANTENNA · BENCHER, INC. · STI · RADIO · COMTEK SYSTEMS

And More!

Winter DX is Here—Upgrade Your Station Now!

Optimal Reception/Smallest Footprint.

100 kHz-30 MHz Receive Four-Square Packages

A patented*, sophisticated receiving system with time delay phasing for broadband performance. Optimized to produce wider and deeper rear nulls and a narrower main lobe. Noise and undesirable signals are greatly reduced by a superior front-to-rear ratio (F/R) and RDF. Better control of phase and currents provides a cleaner pattern than found on available TX four-square arrays.

- Less susceptible to high angle signals compared to EWE, Flag, Pennant, and K9AY antennas
- Excellent directivity with better signal-to-noise ratio, RDF
- Switchable in four 90 degree-spaced directions
- Usable over a very wide frequency range with DXE-ARAV3 active elements
- Requires less area than a Beverage antenna
- Active elements require minimal ground system
- Enhanced relay contact reliability

The complete system includes all electronics, four ARA active antennas, TVSU sequencer, 1,000 feet of F6 flooded cable, connectors, and assembly tools.

DXE-RFS-SYS-2P Controller and Switch only....**$389.95**
DXE-RFS-SYS-3P 160/80/40M Electronics.....**$799.00**
US Patent Number 7,423,588

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. 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**

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**

Ameritron Amplifiers

Ameritron gives you the ability to command consistent and reliable power using these rugged units. Match these amplifiers to your transceiver and achieve impressive power and clarity. DX Engineering even stocks export models. For more Ameritron products at incredibly low prices, visit DXEngineering.com.

AME-ALS-600
Only $1,269.00

AME-ALS-500M
Only $779.00

AME-AL-1200
Only $2,999.00
AME-AL-1500
Only $3,299.00

AME-AL-572
Only $1,679.00

AME-AL-811
Only $709.00

AME-AL-80B
Only $1,329.00

AME-ALS-600	600 Watt Solid State Amplifier	**$1,269.00**
AME-ALS-500M	500 Watt Solid State Mobile Amplifier	**$779.00**
AME-AL-1200	1,500+ Watt Single-Tube Amplifier	**$2,999.00**
AME-AL-1500	1,500+ Watt Single-Tube Amplifier	**$3,299.00**
AME-AL-572	1,300+ Watt 4-Tube Amplifier	**$1,679.00**
AME-AL-811	600 Watt 3-Tube Amplifier	**$709.00**
AME-AL-80B	1,000 Watt Single-Tube Amplifier	**$1,329.00**

Low Sale Price!

Made in USA

SignaLink™ USB Unit from Tigertronics

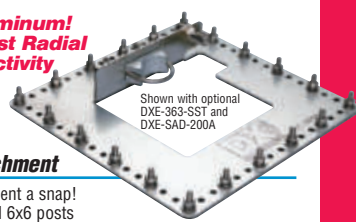
- Software included on CD ROM
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Easiest installation and setup—for Mac or PC
- Supports all sound card digital and voice modes, including MT63, EchoLink®, PSK-31, SSTV, CW and RTTY

TGR-SL-USB **$84.50**

- **Requires a radio interface cable**

Any radio interface cable is only **$12.95** when purchased with a SignaLink™ unit

Not Cheap Aluminum! Guarantees Best Radial System Conductivity Over Time



Stainless Radial Plate with Coax Attachment

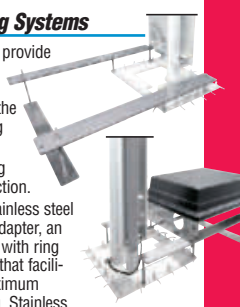
Makes radial attachment a snap!

- 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**

ATU-2 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**

TOTALLY FREE SHIPPING ON COMTEK BALUNS*

COMTEK W2FMI Series Baluns

Made in USA

Better Performance, Lower Prices!
From just $49.95

World-Class Products Shipped Worldwide, Every Day!

Thousands More Ham Products at
DXEngineering.com
1.800.777.0703

8:30 am to 4:30 pm ET
1230 to 2030 UTC (March-October)
1330 to 2130 UTC (November-February)

Tech/International: **330.572.3200** Country Code: **+1**
Sale Code: **13020S**
Prices subject to change without notice.

Order by 4 pm ET (US) for Same-Day Shipping

We Will Beat Any Competitor's Prices—Call Us for Details!

The #1 Line of Autotuners!

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!

1445 Parran Road, St. Leonard, MD 20685 **Phone 410-586-2177 • Fax 410-586-8475**

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

Don't Miss Out - Call or visit them TODAY!

Visit our website for a complete dealer list **www.ldgelectronics.com**

hy-gain® Rotators

. . . the first choice of hams around the world!

HAM-IV

HAM-IV
$649.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *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.**

http://www.hy-gain.com

Nearest Dealer, Free catalog, To Order . . .

800-973-6572

Voice: 662-323-9538 **Fax:** 662-323-6551

hy-gain®

Antennas, Rotators & Towers

308 Industrial Park Road,Starkville, MS 39759, USA

FREE GROUND SHIPPING!

On most orders $100 or more to the Lower 48 States

IC-V80 2M FM Handheld

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 5.5/2.5/0.5W • Memories: 207
- Comes with NiMH Battery and Wall Charger

IC-T70A 2M/440 FM Handheld

- TX: 144-148, 430-450 MHz • RX: 136-174, 400-479 MHz
- Power: 5/2.5/0.5W • Memories: 302
- Comes with NiMH Battery and Wall Charger

IC-V8000 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 75/25/10/5W • Memories: 207

IC-2300H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207

ID-880H 2M/440 FM & D-Star Mobile

- TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W
- Memories: 1052 • D-Star built-in ready to go!

IC-718 HF Transceiver

- TX: HF (except 60M) • RX: 0.03-30 MHz
- Power: 5-100W • Memories: 101 • DSP built-in
- SSB, CW, RTTY and AM (2-40W)

IC-7200 HF/6M Portable

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 201 • Rugged design for outdoor use
- 32-bit IF-DSPs + 24-bit AD/DA Converters
- USB Port for CI-V Format PC Control & Audio In/Out

IC-7410 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- 15kHz 1st IF filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
- Automatic antenna tuner • USB connector for PC control

IC-7600 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 101 • 5.8 inch color screen
- High-resolution real time spectrum scope using a dedicated DSP unit • Automatic antenna tuner

IC-9100 HF/6/2M/440 MHz All Mode

- TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
- Power: 2-100W HF/6/2M & 2-75W 440 MHz
- Memories: 297 • Optional D-Star Board • Auto Tuner
- USB Port for CI-V Format PC Control & Audio In/Out

AES
AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
800-558-0411
Service 414-358-4087
milwaukee@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
800-321-3594
cleveland@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
800-327-1917
orlando@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
800-634-6227
lasvegas@aesham.com

1-800-558-0411

aesham.com

Instant Coupons expire 3/31/2013

FOLLOW US ON TWITTER!
twitter.com/K9AES

TRADE UP TO ICOM
CALL AES NOW FOR A QUOTE!

Radios by ICOM

ARRL Membership Benefit

Get QST Wherever You Are!

All ARRL members have access to the digital edition of *QST*. Enjoy enhanced content, convenient access and a more interactive experience.

www.arrl.org/qst

Web Version

The digital edition is included with your ARRL membership. Access it from an Internet browser on nearly any online device, including desktop or laptop computer, smartphone, tablet and e-book reader. Download the entire issue to your computer or laptop.

QST App for Apple iOS Devices

ARRL Members can read and download the digital edition of *QST* on an iPhone, iPad and iPod touch. Read *QST* online or choose to download individual issues for offline reading. The *QST* app is FREE in the Apple App Store.

QST DIGITAL EDITION

Go Green! Go Digital-Only

ARRL Members may choose to opt-out of the mailed, print edition of *QST* at any time. Complete our online opt-out form available at **www.arrl.org/qst** or email **circulation@arrl.org**.

ARRL The national association for AMATEUR RADIO® | QST | www.arrl.org/qst

FREE GROUND SHIPPING!

On most orders $100 or more to the Lower 48 States

FT-270R 2M FM HT

- TX: 144-148 • RX: 136-174 • Power: 5/2/0.5W
- Memories: 200 • Extra large LCD display & speaker

VX-6R 2M/440 FM Dual Band HT

- TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
- Power: 5/2.5/1/0.3W (1.5W on 220) • Memories: 900
- Submersible 3 feet for 30 minutes

VX-8DR Quad-band FM HT

- TX: 50-54, 144-148, 222-225, 430-450 MHz
- RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
- Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
- Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand mic provides you with APRS® data

FT-1900R 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 55/25/10/5W • Memories: 221

FT-2900R 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 75/30/10/5W • Memories: 221

FT-8800R 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
- Crossband repeat • YSK-8900 included!

FT-8900R Quad-Band FM Mobile

- Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 included!

FT-857D 100W HF/VHF/UHF Mobile

- TX: HF/6M/2M/440 MHz • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200 • YSK-857 included!

FT-897D 100W HF/VHF/UHF Portable

- Same band coverage and power output as the FT-857D
- Can operate 20W using optional FNB-78 13.2V Ah NiMH battery packs

FT-950 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner
- 32-bit Floating Point DSP • Built-in high stability TCXO

FTDX-3000D HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 5-100W
- Large color display with high speed spectrum scope
- High end receiver based off the FTDX-5000
- Built-in USB interface • High speed auto tuner

FTDX-5000MP

Covers HF and 6M; Three different configurations all running 10-200W on CW, SSB, FM, RTTY and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" also comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000 - Basic Model & ±0.5ppm TCXO
FTDX-5000D - With Station Monitor & ±0.5ppm TCXO
FTDX-5000MP - With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

AES
AMATEUR ELECTRONIC SUPPLY

5710 W. Good Hope Rd.
Milwaukee, WI 53223
414-358-0333
800-558-0411
Service 414-358-4087
milwaukee@aesham.com

28940 Euclid Ave.
Cleveland, OH 44092
440-585-7388
800-321-3594
cleveland@aesham.com

621 Commonwealth Ave.
Orlando, FL 32803
407-894-3238
800-327-1917
orlando@aesham.com

4640 South Polaris Ave.
Las Vegas, NV 89103
702-647-3114
800-634-6227
lasvegas@aesham.com

1-800-558-0411

aesham.com

FOLLOW US ON TWITTER!
twitter.com/K9AES

TRADE UP TO YAESU
CALL AES NOW FOR A QUOTE!

Radios by YAESU

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

Like MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

MFJ-269PRO
$419.95

MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

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 up to 300 Watts PEP transceiver input power.

MFJ-949E **$179.95** dummy load through your MFJ-949E or direct to your transceiver.

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

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-901B **$99.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902 **$99.95**

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-16010 **$69.95**

MFJ-906/903 *6 Meter* Tuners

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-906 **$99.95**

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-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 **$109.95**

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

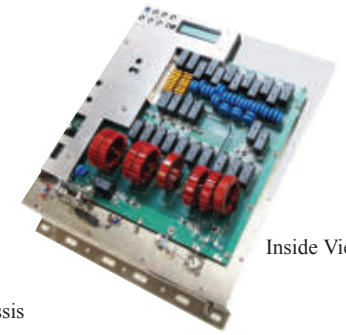
MFJ 1500 Watt *Remote* Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes -- greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$769.95

Bottom Chassis



Inside View

Tune your antenna AT your antenna!

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and *prevent tuning* caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive *StickyTune™ always* tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has *ceramic* feed-through insulator for wire antennas. 2 kV *Teflon*(R) insulated SO-239 -- prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at *full* 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ *InstantRecall*™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ *Intelli-Tune*™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ *AdaptiveSearch*™ searches *only* the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional MFJ-1316, $21.95. Weighs 9.5 lbs. 13 1/4Wx6 3/4Hx17 1/2D inches.

600W *Remote IntelliTuner™*

MFJ-994BRT
$399.95

MFJ-994BRT -- perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for outdoor use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet, 9 1/4Wx3Hx 14 1/4D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

300W *Remote IntelliTuner™*

MFJ-993BRT
$299.95

MFJ-993BRT handles 300 Watts SSB/CW and matches an *extra-wide* 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for remote outdoor or marine use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet measures 9 1/4Wx3Hx14 1/4D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

200W *Remote IntelliTuner™*

MFJ-926B
$279.95

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

200W *Remote Econo Tuner™*

MFJ-927
$259.95

MFJ-927, 200 Watts SSB/CW, 6-1600 Ohms, Coax/Wire antennas, 1.8-30 MHz. Weather-sealed, BiasTee. 7 1/2Wx5 1/4Hx8 1/2D in.

MFJ-2990
$359.95

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide-range *MFJ automatic tuners* at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you *simply put it up!* Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $34.95.** All band ground radial system.

***Free* MFJ Catalog**

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com

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.

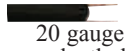
MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at mid-point 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.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . The World Leader in Ham Radio Accessories

MFJ *giant* 6.5 inch SWR/Wattmeter

World's *largest HF SWR/Wattmeter has giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868 **$149.95**

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5½Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

MFJ-891 **$109.95**

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 7¼Wx4½Hx4½D in.

MFJ *high-accuracy* Digital SWR/Wattmeter

MFJ-826B has a large high-contrast, high-accuracy *backlit* LCD display. Auto-ranging selects optimum full-scale range from 25W, 250W and 1500W ranges with full 10-bit resolution on each range. Covers entire amateur power spectrum. Built-in frequency counter selects frequency compensated data set to insure highest accuracy for each band. Displays frequency, provides digital read-out for older rigs and QRP rigs. *True* peak/average and forward/reflected power, SWR and frequency are *simultaneously* displayed. Select bargraphs to display forward/reflected power *or* forward /SWR *or* SWR only. MFJ's *PeakHold*™ freezes highest forward power displayed 1, 2 or 3 seconds. When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds. Use 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½Wx2⅝Hx6D inches.

MFJ-826B **$179.95**

www.mfjenterprises.com . . . World's largest selection of HF/VHF/UHF SWR Wattmeters!

MFJ-822 **$59.95**

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862 **$69.95**

Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864 **$99.95**

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C **$89.95**

Lighted 3" VHF SWR Wattmeter, 2M/C/N Meter, SWR/Watts, 1.8-30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B **$39.95**

Lighted 3" VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B **$149.95**

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403 **$119.95**

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

MFJ-1164B **$79.95**

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

MFJ-655B **$219.95**

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . The World Leader in Amateur Radio!

MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack*. Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$279.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

***Free* MFJ Catalog**

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com *for instruction manuals, catalog, info*

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver – it instantly displays CW in English! Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . . More!

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW. Digs out weak signals. Phase-Lock-Loop even tracks slightly drifting signals.

MFJ-461
$89.95

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable. A battery saving feature puts the MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery. Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny $2^{1}/_{4}$x$3^{1}/_{4}$x1 inches. $5^{1}/_{2}$ ounces.

Super easy-to-use! Just turn it on -- it starts copying instantly!

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $16.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ Morse Code *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-551, $39.95. RFI suppressed keyboard, a must to avoid RFI problems.

MFJ-464
$199.95
(Keyboard, paddle not included.)

MFJ Iambic Paddles

MFJ-564 Chrome
MFJ-564B Black
$69.95

MFJ *Deluxe Iambic Paddles*™ feature a full range of adjustments in tension and contact spacing. Self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. Works with all MFJ and other electronic keyers.

***Miniature* Travel Iambic Paddle**

MFJ-561, $24.95. $1^{3}/_{4}$W x $1^{3}/_{4}$D x $^{3}/_{4}$H inches. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

MFJ Code Oscillator

MFJ-557
$39.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. $8^{1}/_{2}$x$2^{1}/_{4}$x$3^{3}/_{4}$ inches.

MFJ-550, $14.95. Telegraph Key Only with adjustable contacts. Handsome black.

MFJ Deluxe CW Keyer

Deluxe MFJ Keyer has all controls on front panel for easy access -- speed, weight, tone, volume knobs, and tune, semi/auto, on/off push-buttons. You get all keyer modes, dot-dash memories, self completing dots/dashes, jam- proof spacing, sidetone, built-in speaker, type A /B keying. RF proof. Solid state keying. 7x2x6 inches.

MFJ-407D
$79.95

MFJ-401D, $69.95. Econo Keyer II has front-panel volume/speed controls (8-50 wpm), tune switch. Internal adjust weight, tone. Solid state keying. Tiny 4x2x$3^{1}/_{2}$ inches.

Keyer/Paddle Combo

MFJ-422D
$189.95

Best of all CW worlds -- a *deluxe MFJ Curtis*™ *keyer* that fits right on *Bencher paddle*! Adjustable weight and tone, front panel volume and speed controls (8-50 WPM), built-in dot-dash memories, speaker, sidetone, semi-automatic/tune or automatic modes. Use 9V battery or 110 VAC with MFJ-1312D, $15.95. $4^{1}/_{8}$x$2^{5}/_{8}$x$5^{1}/_{4}$ in.

MFJ-422DX, $99.95.

MFJ *Curtis*™ Keyer only, fits on your Bencher paddle or MFJ-564 (chrome) or MFJ-564B (black) paddles above.

MFJ *Pocket* Morse Tutor

Learn Morse code anywhere with this tiny *MFJ Pocket-sized Morse Code Tutor*™! Practice copying letters, numbers, prosigns, punctuations or any combination or words or QSOs. Follows ARRL/VEC format. Start at zero code speed and end up as a high speed *CW Pro!* LCD, built-in speaker.

MFJ-418
$89.95

MFJ *ClearTone*™ Speaker

MFJ-281, $12.95. Makes copying easier, enhances speech, improves intelligibility, reduces noise, static, hum. 3" speaker, 8 Watts, 8 Ohms.

MFJ 24/12 Hour Station Clock

MFJ-108B, $21.95. Dual 24/12 hour clock. Read UTC *and* local time *at-a-glance*. High-contrast 5/8" LCD, brushed aluminum frame. Batteries included. $4^{1}/_{2}$Wx1Dx2H in.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

MFJ . . . the world leader in ham radio accessories!

VECTRONICS RF Accessories

300 Watt Antenna Tuner

VC-300DLP
$179.95

VECTRONICS uses the finest components available to build the highest quality 300 Watt antenna tuner ever made.

You can tune any *real* antenna 1.8-30 MHz. Custom 48 position switched inductor and 1000 Volt variable capacitors provide arc-free operation. Handles 300 Watts PEP SSB, (150 Watts on 1.8 MHz).

8 position antenna switch, 50 Ohm dummy load, peak reading backlit Cross-Needle SWR Power meter, 4:1 balun for balanced lines. Scratch-proof Lexan front panel. 10.2x9.4x3.5 inches. 3.4 pounds.

300 Watt Mobile Tuner

VC-300M
$129.95

The VC-300M *Mobile* Antenna Tuner is compact, lightweight, easy-to-operate and is our most economical tuner.

It's compatible with *any* mobile antenna, any HF transceiver and fits in the smallest car. It can also be used at home with any coax fed antennas -- dipoles, vees, verticals, beams or quads.

Backlit Cross-Needle meter simultaneously monitors Forward/Reflected power and SWR. Covers 1.8 to 30 MHz.

Handles 300 Watts SSB PEP, 200 Watts continuous, (150 Watts on 1.8 MHz). 7.25x8.75x3.6 inches. 3.4 pounds.

SWR/Power Meters

PM-30
$89.95
PM-30UV
$99.95

PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front panel. Lamp switch. SO-239 connectors. 5.3x5.75x3.5 in.

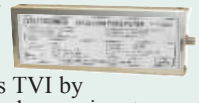
144/220/440 MHz, 30/300 SWR/Wattmeters
PM-30UV, $99.95, SO-239 connectors.
PM-30UVN, $99.95, N connectors.
PM-30UVB, $99.95, BNC connectors.

1.5 kW *dry* Dummy Load

DL-650M, $79.95
100 Watts continuous 1500 W/10 seconds to 650 MHz. *Ceramic* resistor. SWR less than 1.3. SO-239s. **DL-650MN, $84.95** has N connectors.

Low Pass TVI Filter

LP-30, $89.95
Eliminates TVI by attenuating harmonics at the source. Plugs between transmitter and antenna or tuner. Handles 1.5 kW.



High Pass TVI Filter

HPF-2, $34.95
Installs between VCR/TV and cable TV/antenna cable. Eliminates or reduces interference caused by nearby HF transmitters.

http://www.vectronics.com
Nearest Dealer, Free catalog, To Order . . .
800-363-2922
Voice: 662-323-5800 **Fax:** 662-323-6551

VECTRONICS®
300 Industrial Park Road,Starkville, MS 39759, USA
Prices/specs subject to change without notice/obligation ©2012 Vectronics

VECTRONICS . . . the finest amateur radio products made!

MIRAGE. . .160 Watts on 2 Meters!

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™. Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ in.

B-5018-G
$329

B-1018-G, $409. MIRAGE's most popular *dual purpose* HT/mobile/base amp. 160 Watts out/10W in. For 0.25-10W rigs.

B-2518-G, $329. Like B-5018-G but for 10-25 Watt mobile/base. 160W out/25W in.

RC-2, $49. Remote Control. On/Off, preamp On/Off, selects SSB/FM. 25 ft. cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	--	--
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

FCC Type Accepted

6 Meter Amplifier

A-1015-G, $389, *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 Watts out/10W in. For 1-15 W transceivers. 20 dB GaAsFET preamp.

300 Watts on 2-Meters, $739

3 models: 300 Watts out for 10, 25, or 50 Watts in. FM/SSB/CW. 15/20 dB gain, *GaAsFET* preamp.

Repeater Amps

11 models: *continuous* duty FM/SSB/CW *Repeater* Amps for 6, 2, 1¼ Meters, 70 cm, 450 MHz, ATV.

70 cm Amplifiers (420-450 MHz)

D-3010-N, $389 -- 100 W out/30W in. For 5-45 Watt *mobile/base.* **D-1010-N, $419**, 100W out/10W in. *Dual purpose* -- for handhelds or mobile/ base. **D-26-N, $299**, 60W out/2W in, for *handhelds.*

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount, $199.95*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

Accurate SWR/Wattmeters

Read SWR directly and Forward/Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

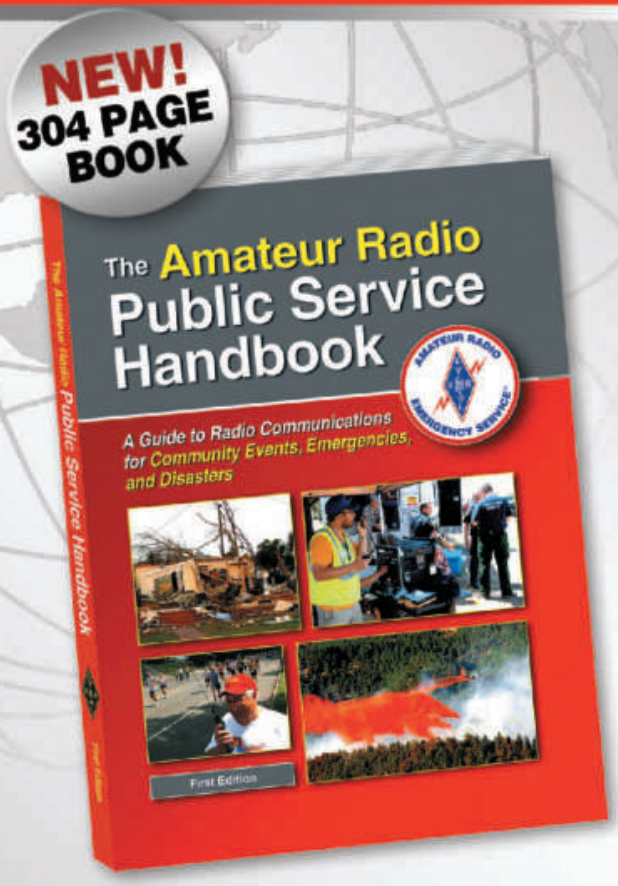
1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

http://www.mirageamp.com
Nearest Dealer, Free catalog, To Order . . .
800-647-1800
Tech: 662-323-8287 **Fax:** 662-323-6551

MIRAGE
300 Industrial Park Rd
Starkville, MS 39759
Prices/specs subject to change without notice/obligation ©2012.

Prepare for the Unexpected!



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.

The Amateur Radio Public Service Handbook is for all hams that volunteer their time and skill to serve their communities. It provides knowledge needed for communicating quickly and effectively during disasters, emergencies, and community events, as well as an opportunity to learn more about the Amateur Radio Service and its unique role in supporting the public.

Perfect for all public service and ARES® volunteers!

Topics Covered Include:

- **The ARRL & ARES**
  The role of these organizations in public service and emergency communications.
- **Served Agencies**
  The American Red Cross, the Salvation Army, SATERN, the National Weather Service and the National Hurricane Center and Local Emergency Management Agencies.
- **Training and Readiness**
  Leading and training volunteers, personal safety, basic radio science, and equipment considerations.
- **Nets and the National Traffic System**
  Nets, message handling, and network theory.
- **The Response**
  Response management and PIO considerations.
- **Public Service**
  Organizing Amateur Radio communications for a public service event.
- **Digital Modes**
  NBEMS, Echolink, Winlink 2000, and D-STAR.
- **Other Relevant Organizations**
  MARS, Handihams, and an international perspective on emergency communications.

ARRL Order No. 4845
Special Member Price!
Only $34.95* (retail $39.95)

Order Today! Online www.arrl.org/shop
or Toll-Free 1-888-277-5289 (US)

*Plus shipping and handling. Sales Tax is required for all orders shipped to CT, VA, and Canada.

ARRL The national association for AMATEUR RADIO®
225 Main Street, Newington, CT 06111-1494 USA
SHOP DIRECT *or call for a dealer near you.*
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 888-277-5289 (US)

QST 2/2013

HF

VHF

UHF

USB Control Audio

IC-7410 HF + 6m

100 Watt Output (40W AM)

RX: 0.030–60.000MHz*

32 Bit Floating Point DSP Unit

+30 dBm 3rd Order Intercept Point*

Double Conversion Superheterodyne System

Built-in 15kHz 1st IF Filter (Optional 3kHz/6kHz)

USB Port for PC Control and Audio In/Out

USB Control Audio

IC-7200 HF + 6m

100 Watt Output (25W AM)

RX: 0.030–60.000MHz*

32 Bit IF-DSP + 24 Bit AD/DA Converter

Digital Twin Passband Tuning

USB Port for PC Control and Audio In/Out

Flexible Selectable Filter Width and Shape

USB Port for PC Control and Audio In/Out

IC-7000 HF/6m/2m/70cm

100W (40W AM),
50W on 2M (20W AM),
35W on 70CM (14W AM)

RX: 0.03–199.999,
400–470MHz*

Digital IF Filters

Digital Voice Recorder

Front Panel Separation
with Optional 3.5m
or 5m Cable (As Shown)

USB Control Audio

IC-9100 HF + 6m + 2m + 70cm + 23cm[1]

100/100/100/75/10[1] Watt Output[3]

RX: 0.030–60.000[2], 136.000–174.000[2],
420.000–480.000[2], 1240.000–1320.000[2,3]MHz

AM[3], FM, SSB, RTTY, CW, & DV[1]

Satellite (Mode B/J/L[1])

+30dBm TOI[2]

Two Independent 32-bit DSP Systems

3kHz/6kHz 1st IF "Roofing" Filters[1] (HF/6m)

Double Conversion Superheterodyne
with Image Rejection Mixer

USB Port for PC Control and Audio In/Out

Information & Downloads

AMATEUR TOOL KIT | COMIC BOOKS | VIDEOS | WWW.ICOMAMERICA.COM

Electronic advertisements feature active links for each radio.

Official Amateur Radio Transceiver Supplier

BOY SCOUTS OF AMERICA®

ICOM®

*Frequency coverage may vary. Refer to owner's manual for exact specifications.
[1]Optional UX-9100 required. [2]HF (14MHz) [3]See manual for AM output power.

QST QuickStats

sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for November 2 through December 4, 2012.

Get on the web and vote today at **www.arrl.org/quickstats**!

How long do you keep your print editions of *QST*?

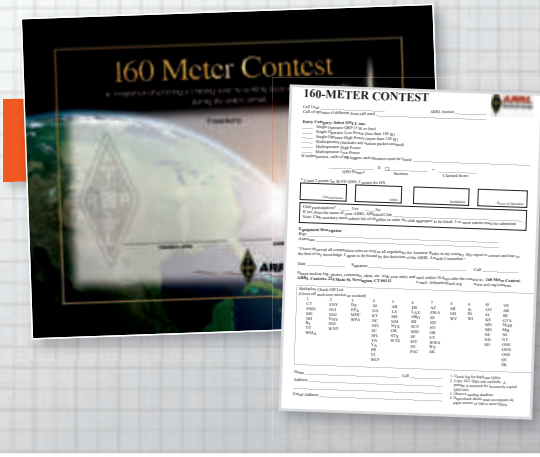
- Less than one month: **4%**
- Several months: **26%**
- Several years: **35%**
- I never throw them away: **34%**
- I only receive Digital *QST*: **1%**

How many computers do you own (desktop, laptop or tablet)?

- One: **5%**
- Two: **15%**
- Three: **20%**
- Four: **17%**
- Five or more: **43%**

Do you make a special effort to perform maintenance on your antenna system in preparation for winter?

- Yes: **45%**
- No: **55%**



Did you participate in the ARRL 160 Meter Contest on November 30?

- Yes: **22%**
- No: **78%**

160 Meter Contest

Send your voice to the world with a mobile radio.

Work a D-STAR repeater and you're tied in to worldwide communications, whether you're using a D-STAR mobile or handheld radio. Enjoy advanced digital communication with D-STAR transceivers.

IC-2820H
FEATURE-RICH 2m + 70cm MOBILE + OPTIONAL GPS RECEIVER

D-PRS™

D-STAR optional

- 50/15/5 Watt Output
- RX: 118–549.995, 118–173.995, 375–549.999, 810–999.990MHz*
- 522 Alphanumeric Memory Channels
- One Touch Reply Function
- Digital Voice/GPS (Optional UT-123 Required)
- Low Speed Data (Optional OPC-1529R Required)

ID-880H
ENTRY-CLASS 2m + 70cm DIGITAL MOBILE

D-STAR ready

- 50/15/5 Watt VHF/UHF
- FM, AM (Receive only), DV
- RX: 118–999.99MHz*
- 1052 Alphanumeric Memory Channels
- Free Programming Software!†

†*www.icomamerica.com/amateur/DSTAR for details about free software*

ID-1
GO DIGITAL ON 23cm

D-STAR ready

- 10 Watt on 23cm (FM, DV, DD)
- RX: 1240–1300MHz*
- 100 Alphanumeric Memory Channels
- USB Rig Control, Ethernet Plug for DD
- Black Box Operation
- Remote Control Head, Remote Speaker and Cables Included
- PC Software Included

NEW ID-51A
VHF/UHF + D-STAR IN THE PALM OF YOUR HAND!

D-STAR ready

- Dualwatch with AM/FM Receive
- Slim, Compact, microSD Ready
- Integrated GPS (Opt. microSD required)
- IPX7 Submersible

The ID-51A has not been approved by the Federal Communications Commission. This device may not be sold or leased, or be offered for sale or lease, until approval of the FCC has been obtained.

IC-80AD 2m + 70cm DUAL BANDER

D-STAR ready

- 5/2.5/0.5/0.1 Watt VHF/UHF
- FM, FM-N, AM (Receive only), WFM (Receive only), DV
- RX: 0.495–999.990MHz*
- 1052 Alphanumeric Memory Channels
- Li-ion Battery
- Free Programming Software†

†*www.icomamerica.com/amateur/DSTAR for details about free software*

IC-92AD
2m + 70cm MILITARY RUGGED AND SUBMERSIBLE

D-STAR ready

- 5/2.5/0.5/0.1 Watt Output
- RX: 0.495–999.990, 118–174, 350–470MHz*
- 1304 Alphanumeric Memory Channels
- Optional GPS Speaker Mic (HM-175GPS)
- IPX7 Submersible

ID-31A
UHF/70cm + D-STAR

D-STAR ready

- 5/2.5/0.5/0.1 Watt Output
- RX: 400–479MHz*
- 1252 Alphanumeric Memory Channels
- Built-in GPS Receiver
- IPX7 Submersible

Information & Downloads

AMATEUR TOOL KIT | COMIC BOOKS | VIDEOS | WWW.ICOMAMERICA.COM

Electronic advertisements feature active links for each radio.

Official Amateur Radio Transceiver Supplier

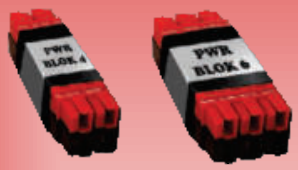
BOY SCOUTS OF AMERICA®

ICOM®

*Frequency specs may vary. Refer to owner's manual for exact frequency specs.

Quicksilver Radio

We Have Holiday Gifts to Fit Every Budget



Great New Items!

PWR-Blok™
4-6-8-10-12 Way
Powerpole Splitters

The Ultimate Powerpole *and* Coax Prep, Strip & Crimp Kit

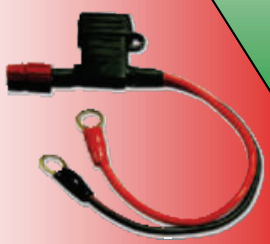
Full-cycle ratchet crimper with Andy-Crimp Pro™ die set, two coax die sets, coax strippers, wire strippers, and coax cutter, in a sturdy ABS case. Crimps 15-30-45-50-75A Powerpoles, Molex, insulated and uninsulated terminals, LMR-400, 9913, RG-8, RG-213, RG-8X, RG-58, RG-316, RG-174 and more. High quality N, PL-259, Mini-UHF, BNC, TNC and SMA connectors are always in stock.

On Sale $129.73

Andy-Crimp *Pro*™

15-30-45-50-75 Amp Powerpoles
***And* Many Other Connectors**

On Sale $49.73

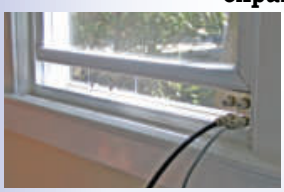


Fused Powerpole Cables
Many Types Available

Santa Shops Here!

Gadgets and Gizmos Galore

This is the place to find all the parts you need for your next antenna project. Low-loss coax and jumpers, LMR-400, Bury-Flex, ladder line, rope, pulleys, wire, baluns, and more, ready for immediate shipment. Check out our expanded selection of coax cable.



PaneRelief™ Coax Feed Through Panels

Get your feedline outside the easy way

We Have More Powerpole Stuff Than Anybody!

And we sell only *genuine* Anderson Powerpoles. No Chinese copies here!

Quicksilver Radio Products

Sign up on our Web Site for your free newsletter.
Ham Radio news, articles, & special discounts

www.qsradio.com

Quicksilver Radio

R&L Electronics®

1315 Maple Ave HAMilton, Oh 45011
http://randl.com sales@randl.com
Local/Tech 513-868-6399
Fax 513-868-6574
(800)221-7735

JETSTREAM

14 Gauge Stranded Antenna Wire

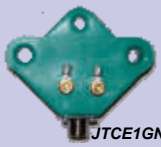
JT1450 *50 ft*	8.95
JT1475 *75 ft*	12.95
JT14100 *100 ft*	17.95
JT14125 *125 ft*	21.95
JT14150 *150 ft*	26.95
JT14200 *200 ft*	35.95

Center Insulators

SO239 type connector, will handle up to 2000 watts, Super Strong! Terminals are spaced for 450 ohm ladder line.


JTCE1BK2


JTCE1G2


JTCE1GN2


JTCE1W2

Your Choice of Colors

$14.95 each


WT-3102B


WT-3102S

Atomic Clock

10" Atomic Analog, 10" Plastic, Atomic Time, Updates for DST
WT-3102
$19.95

14.5" Atomic Analog, 14.5" Plastic, Atomic Time & Date, LCD Display, Indoor Temp.
WT-3145U
$28.95

12" Atomic Analog, 12" Stainless Steel, Atomic Time, Updates for DST
WT-3126B
$29.95

YAESU
The radio

FTDX3000D

Yaesu is pleased to announce the introduction of our FT-DX3000D 100W HF/50MHz Transceiver - the new Leader in the mid-price range of HF/50MHz radios. Continuing the proud Yaesu "FT DX" Legacy of Excellence established decades ago, the FT-DX3000D brings forward critical design concept advancements created for the FT-DX5000 and FT-DX9000. Yaesu's proved IF DSP package of features for effective and optimized QRM rejection make the FT-DX3000D a pleasure to use even on a crowded band.

DVS6 Digital Voice Memory Unit	65.95
FC40 Auto Tuner for Long Wires	304.95
MD100A8X Desk Top Mic	149.95
MD200A8X Desk Top Mic	389.95
SP2000 Ext Spkr w/Audio Filters	198.95
XF127CN 300Hz CW Filter	199.95

FT950

This superb radio features DSP filtering, 100 Watts of power output, factory installed antenna tuner and many of the outstanding ergonomic and performance features first introduced in our FTdx-9000 and FT-2000 flagship radios.

DMU2000 Data Management Unit	Call
FH2 Remote Keypad	95.95
MD100A8X Desk top mic	149.95
MD200A8X Desk top mic	389.95
SP2000 External Speaker	198.95
UTUNINGKIT A, B, or C model	Call

FT1900R

The ruggedly built yet compact new FT1900R 2m transceiver brings you Yaesu's legendary mechanical toughness along with outstanding receiver performance and 55 watts with crisp, clean audio that will get your message through!

JTPS14M Jetstream Power Supply	49.95
MLS100 External Speaker	47.95
MX2 Hustler 2m Mag Mount	32.95

FT8800R

If you're ready for the best in a Dual-Band FM Mobile Transceiver, the FT-8800R is ready for you! With easy operation, outstanding receiver performance, and crossband repeat capability, the FT-8800R is the new standard of comparison!!

ADMS2I Software and cable	39.95
JTPS14M Jetstream Power Supply	49.95
MLS100 External Speaker	47.95
MMB60 Quick Release Mobile Bracket	37.95
YSK8900 Separation Kit	45.95

FT7900R

Yaesu's economically priced One-Touch Operation FT-7900R Dual band FM mobile. Back-lit push button controls ensure extraordinarily easy and safe operation while driving at night. The exceptionally wide receiver coverage provides all sorts of additional uses!

ADMS2K Programming software and cable	39.95
MEK2 Microphone Extension Kit	47.95
JTPS14M Jetstream Power Supply	49.95
MLS100 External Speaker	47.95
MMB60 Quick Release Mobile Bracket	37.95
YSK7800 Separation Kit	39.95

TIMEWAVE TECHNOLOGY INC.

Available at:
- Universal Radio
- AES
- HRO
- Radio City
- R&L Electronics

New! - PK-232SC with Sound Card, Rig Control, USB - All built-in!

PK-232SC Multimode Data Controller*

Sound Card, Rig Control, USB, Pactor, RTTY, CW Packet & more!

100,000 sold - All-time top selling data controller!

New PK-232SC Now shipping!

- Single USB connection to computer
- USB Sound Card built-in
- 3-Way Rig Control built-in - logic level, RS-232 & USB!
- Computer isolated from radio

New Lower SC + DSP Upgrade Combo Pricing!

As Always- Upgrade any PK-232 ever made to the PK-232SC!

Customize your PK-232 with our complete line of upgrades and accessories.

The incredible PK-232SC again expands its role in your radio station. Now it connects to your computer with a single USB cable - no audio cables, no RS-232 cables! It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. The new logic level and RS-232 rig control is optically isolated for your Icom CI-V, Yaesu CAT, Kenwood and other radios. You never have enough downstream USB ports so we even added a pair for that new radio with USB rig control and other accessories.

Need Software? Check the new Ham Radio Deluxe & Radio Operating Center bundle!
Optimized for the PK-232SC and other Timewave/AEA TNCs ***www.ham-radio-deluxe.com***

Signal Processing, Antenna Analysis, Data & Remote Control

DSP-599zx Audio Signal Processor*

Now shipping with new bigger & brighter display!

Noise Reduction, precision highpass, lowpass, bandpass & notch filtering for audio, CW & data.

TZ-900 Antenna Analyzer

Once you use the TZ-900 - you'll never want to use any other!

Sweep and analyze antennas in seconds. Zoom, Compare & Store Data. Sunlight-visible color graphics, handheld, rechargable batteries, no computer required.

ANC-4 Antenna Noise Canceller

See & hear a demo on YouTube!

Kill Noise before it reaches your receiver! Great for supressing power line noise, plasma TV noise & many other local electrical noises.

DSP-232+ Multimode Data Controller*

Sound card interface, USB, Pactor, 1200/9600 Packet

PK-96/100 TNC - 1200/9600 Packet*

Available with USB or RS-232

HamLink™ Wireless and USB Remote Control & Audio

HamLinkUSB™ Rig Control Plus

C-IV, CAT, RTS (PTT, FSK or CW) for sound card software

PK-232 RS-232-to-USB Adapter*

Use the PK-232 with your new computer!

HamLinkBT-BTH+™ Bluetooth® Adaptor

Use a standard cellphone Bluetooth® headset to keep your hands free for driving and operating.
Includes USB rig control for your station.
Audio, VOX & PTT - Fixed & Mobile.

***From the Timewave Fountain of Youth** - Upgrades for many of our DSP & PK products. Call Us Now!*

Timewave Technology Inc.
27 Empire Drive, Suite 110
St. Paul, MN 55103 USA

www.timewave.com
sales@timewave.com

651-489-5080
Fax 651-489-5066

The Best in Radio Communications

Essential Publications for Every Ham!

90th Edition! It Just Keeps Getting Better!

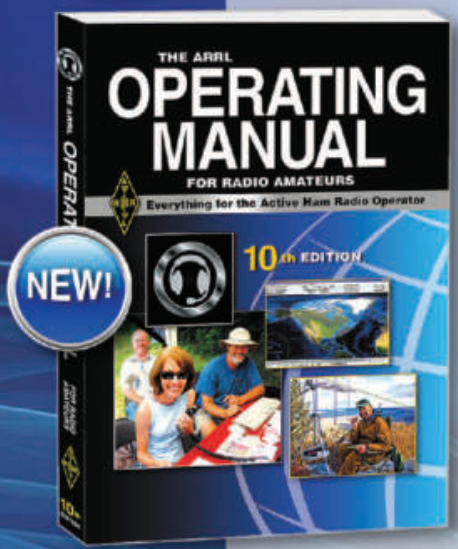
The ARRL Handbook—2013 Edition

The ARRL Handbook for Radio Communications is widely recognized as being the standard reference among radio amateurs and other technologists—experimenters, engineers and students. It's filled with essential information from across the expanse of radio communication fundamentals, covering nearly every aspect of radio and antenna design, equipment construction, and station assembly. CD-ROM included!

BONUS! Get the HARDCOVER edition for the Softcover price!

Hardcover. ARRL Order No. 4197.
Special Member Price Only $49.95* (retail $59.95) – while supplies last.

Softcover. ARRL Order No. 4050. Only $49.95*

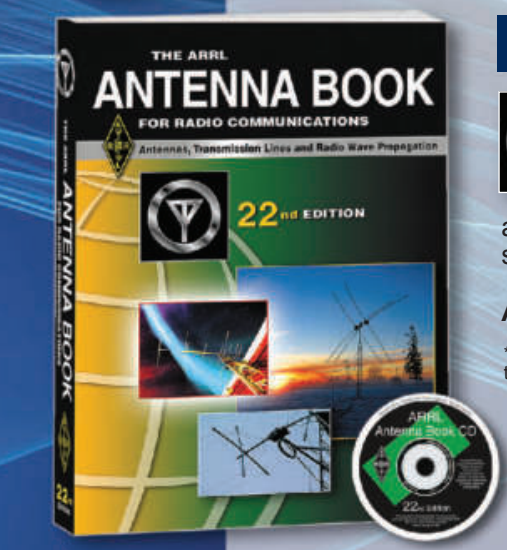


Everything for the Active Ham Radio Operator!

The ARRL Operating Manual—10th Edition

The ARRL Operating Manual for Radio Amateurs is the most complete guide to Amateur Radio operating. You'll find everything you need to know—from exploring the broad range of ham radio activities, to sharpening your on-air skills. It's filled with the information every ham needs, from newcomers who want to master basic operating techniques to more experienced hams looking for new things to do with their gear.

ARRL Order No. 5965.
Special Member Price Only $29.95* (retail $34.95)



Exciting Antenna Projects and Design!

The ARRL Antenna Book—22nd Edition

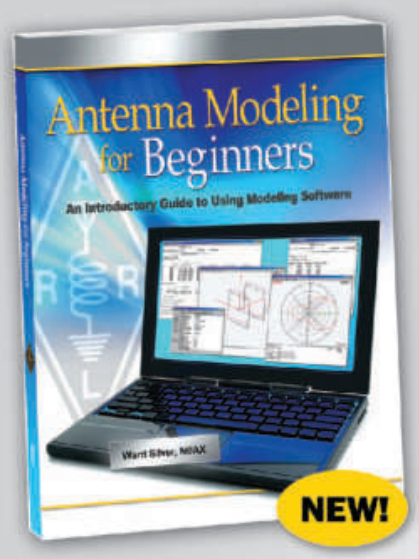
The ARRL Antenna Book for Radio Communications includes all of the information you need for complete antenna systems—from planning, to design and construction. It includes antennas from the HF low bands through VHF, UHF and microwave; fixed station, portable, mobile, maritime, satellite and more. CD-ROM included!

ARRL Order No. 6948. Only $49.95*

*Actual dealer prices may vary. Shipping and handling charges apply. Sales Tax is required for all orders shipped to CT, VA, and Canada. Prices and product availability are subject to change without notice.

ARRL *The national association for AMATEUR RADIO®*
SHOP DIRECT or call for a dealer near you.
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 888/277-5289 (US)

QST 1/2013



Antenna Modeling for Beginners

Ward Silver, NØAX

Modeling Made Easy!

Antenna Modeling for Beginners is an introductory guide to using modeling software for designing and evaluating antennas. It provides a detailed introduction to *EZNEC*, the most popular antenna modeling program used by radio amateurs today. You'll set up basic modeling software, evaluate and adjust pre-designed models, and create your own models. Step-by-step exercises and explanations will familiarize you with important functions and procedures along the way. As you progress, you'll discover antenna modeling is simple to learn and use!

Includes:

- Test Drive of EZNEC
- Patterns and Tables
- Building a Model – From the Dipole to Inverted V
- Modifying a Model
- Building a Model – Adding Ground
- Building a Model – VHF Vertical Ground-Plane
- Building a Model – Design Examples
- Developing Reliable Models
- Testing the Model

…and more!

ARRL Order No. 3961
Special ARRL Member Price!
Only $34.95 (regular $38.95)

*plus shipping and handling

ARRL *The national association for AMATEUR RADIO®*
SHOP DIRECT *or call for a dealer near you.*
ONLINE WWW.ARRL.ORG/SHOP
ORDER TOLL-FREE 888/277-5289 (US)

QST 11/2012

TOKYO HY-POWER

THP HF Solid State Amps and Tuners

HL-2.5KFX
HF Linear Amplifier

The HL-2.5KFX is the lightest and most compact self-contained 1.5kW output HF LINEAR amplifier in its class. The amplifier's decoder changes bands automatically with most modern ICOM, Kenwood, and Yaesu HF transceivers.

HL-2.5KFX
Protection Board

Now with ultra fast reacting protection circuit for open/short loads. Avoid damage to valuable FET finals from unexpected high antenna SWR.

Contact our tech service manager for installation of this new protection device for the earlier model version.

HL-45B
45W Linear

HF/50MHz for portable radio (best for FT-817ND)

HL-450B
350W (typ.) Out

80 thru 10m, Auto/manual band select

HL-1.5KFX
HF/50MHz Linear Power

This Solid State amplifier utilizes an advanced 16 bit MPU (microprocessor) to run the various high speed protection circuits such as overdrive, high antenna SWR, DC overvoltage, band miss-set etc.

HL-550FX
600W HF/50MHz Linear

The HL-550fx is the lightest 600W – 160m-6m HF/VHF amplifier on the market today, with a total weight of only 22.5 Lbs! This amplifier has been designed for the traveling operator such as DXpeditions, vacations, field day, camping, and for persons who simply want a light weight amplifier.

HC-200AT
HF/50MHz 200W Auto Antenna Tuner

Tunes with lightning speed of one second and a half (typ) or 4 sec. max. in the frequency range of 1.8~54MHz. 0.2 sec for memory mode.

Two antenna ports and user friendly analog SWR/POWER meter.

HC-200ATF
HF/50 MHz Band Remote Automatic 200W Antenna Tuner

Connect directly to 4 pin tuner socket of ICOM radios. Or add HTC-200ATF controller to connect to any HF radios.

Visit Our NEW Website:
www.tokyohypower.com

Exclusively available from
Ham Radio Outlet
www.hamradio.com

TOKYO HY-POWER LABS., INC. – USA
6046 FM2920 Rd. Suite 133
Spring, Texas 77379-2542
USA Factory Support Tel: 713-818-4544
USA Factory Email: thpsupport@airmail.net

TOKYO HY-POWER LABS., INC. – JAPAN
1-1 Hatanaka 3chome,
Niiza Saitama 352-0012
Phone: +81 (48) 481-1211
FAX: +81 (48) 479-6949
e-mail: info@thp.co.jp

HTC-200ATF
Optional Tuner Controller

NEW!

DX Hamvention® • Dayton 2013

"Every amateur should go at least once"

Is this your year to take the trip to Dayton?
We are gearing up for the biggest Hamvention yet.

Ticket Prices: $20 in advance, $25 at the door.
General Inquiry: Dayton Hamvention®
937.276.6930 P.O. Box 964 Dayton, OH 45401

www.hamvention.org

Buy your Tickets, Flea Market, and Inside Exhibit spaces online.
OR Send SASE with a check made out to Dayton Hamvention
To: Hamvention Tickets, P.O. Box 1446, Dayton, OH 45401

May 17-19, 2013 Hara Arena, Dayton, Ohio

75th Anniversary DAYTON 2013 W1AW – The Maxim Memorial Station

ARRL EXPO 2013

Your Hamvention admission includes entry to ARRL EXPO

Program Highlights

- Special Exhibits and Guests
- ARRL Bookstore
- Presentations
- DXCC Card Checking
- ARRL Youth Activities – friends, fun and food!
- Join or renew with ARRL – and receive a FREE GIFT

ARRL Project Building Booth

Instructors ▪ Teachers ▪ Club Leaders:

SAVE $5 on a KIT

with a copy of this ad

ARRL The national association for AMATEUR RADIO®

www.arrl.org/expo

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 January 16th through February 15th will appear in March *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.

Property/Vacation/Rentals

Aruba Radio Rental www.p49v.com

BELIZE VACATION QTH www.wishwilly.net

Caribbean DX! KL7JR@Yahoo.com

COLORADO CHALET with ham gear for weekly rental, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

Ham Cruise 2013 N5DSR info mypinmoneytravel@yahoo.com

HAWAII DX VACATION RENTAL STEPP-IR Antennas KH6RC. 808-929-7101 www.leilanibedandbreakfast.com

Pacific Ocean Front QTH in SW Washington very fine three bedroom 2.5 bathhouse No HOA. Tower, Beam, Vertical, Wire antennas in place. For more information see www.lemkestudios.com/beach or ad7af@yahoo.com

Paradise Antenna Farm. 40 acres. **Southern Arizona**, $360K, Large tall towers, many antennas, living area and ham shack. Remote control station via internet. Call for details 520-398-2722 **w7uo@hotmail.com**

QTH in the City of Boca Raton. 4 bedrooms 3 full baths, pool, 2 car garage. 2000+ sq ft. under air. New A/C, water heater, appliances. Remodeled kitchen. Large corner lot. No HOA. VHF & wire HF antennas currently in place. 3 miles to beach. Call John 561-376-3630.

VY2TT www.peidxlodge.com

wanna ham in the **CAYMAN ISLANDS?** Go to www.martykaiser.com/24a.htm

Antique/Vintage/Classic

ANTIQUE WIRELESS ASSOCIATION. The organization for all enthusiasts of antique and historical radio! Publishes THE AWA JOURNAL, covering vintage ham gear, keys, telegraphy, contests, broadcast receivers, vacuum tubes, historical, technical articles, restoration, and much more. AWA produces the famous annual Rochester, NY meet. Maintains world-famous historical radio-electronics communications museum. Membership only $25/year USA, $30 elsewhere. Antique Wireless Association, PO Box 421, Dept. 1, Bloomfield, NY 14469. Check our Website: http://www.antiquewireless.org

BUY-SELL-TRADE-ESTATE SALE HENRY RADIO SALES Henry Fehrmann-N4EDQ 708 N. Dixie Freeway (HWY US1) New Smyrna Beach, Florida 386.527.5159

CLASSIC REPAIR - Specializing in Collins, Drake and other fine tube radios. Steve, 661-822-6850. n6hk@hotmail.com

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

DISPLAY YOUR AMATEUR LICENSE on the wall in your shack with this beautiful holder. Visit www.fan--nanenterprises.com

ENGRAVING: Callsign/name badges by WØLQV. Send for price list. 8319 Marty St., Overland Park, Kansas 66212-1963. E-mail: w0lqv@arrl.net

Engraving, **QSL's** since 1962, Full Service Printing. Samples. WA2WAO@CornerPress.com [425] 286-5952

Get **Top Quality Full Color UV-Coated QSL Cards** direct from the printer. Chester QSL Cards is now Star Cards, Inc. Call (800) 748-7089 for info or visit www.star-cards.net

HANDCRAFTED OAK CALL SIGNS www.oakcallsigns.com 314-605-4971, KCØSDV

NAME CARD with "Amateur Radio Active" logo in the middle. Go to http://wwwhamradioid.com

NEED A RELIABLE QSL MANAGER details contact James E. Mackey k3fn@aol.com

OVERSEAS AIRMAIL POSTAGE plus complete line of airmail envelopes. Order directly from our web site - James E. Mackey, proprietor. www.airmailpostage.com

QSLKIT – CardBoxes – Dividers – MORE www.Ham-Stuff.com by W7NN

www.airmailpostage.com

General

73s: Join our hamradio social network! http://www.73s.com

ABR Industries is looking for Hamfest dealers. This is a limited distribution opportunity, w/a reasonable start-up investment. Serious inquiries only: 713-492-2722 or info@abrind.com

ALUMINUM CHASSIS AND CABINET KITS. UHF-VHF Antenna Parts, Catalog E-mail: k3iwk@flash.net or www.k3iwk.net

ANTENNA COMPARISON REPORT: TRIBANDERS K7LXC & NØAX test Hy-Gain, KLM, CC, Bencher, Force 12, Mosley and others. $17 + $4 s/h. More info at www.championradio.com 206-890-4188

ANTENNA COMPARISON REPORT: VERTICALS. K7LXC & NØAX test CC, Butternut, MFJ, Force 12, Diamond, Hustler, GAP and other. $17 + $4 s/h. More info at www.championradio.com 206-890-4188

APRS Link Cables - for Garmin/Kenwood products - http://stores.ebay.com/Jabber-Electronics WE6G 480-905-8484

BIGGEST on-line ham classifieds: http://swap.QTH.com

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

CRANK-A-WATT Power & More via KE5NYS. Visit www.FactorReady.com

Cushcraft: MA-5B 5 Band Beam Brand New Elements & Hdw $250.00 Hy Gain Rotator CD-4511-$225.00 phone 203-533-5189 cell 203-464-4327 k1seo@comcast.net

Custom Ham Maps by N1XFS!!! Customized azimuthal equidistant projection maps with beam headings and distances based on your QTH. Adds that special "wow" factor to your shack. Makes a great gift! Go to: **CustomHamMaps.com**

ELECTRIC RADIO MAGAZINE: America's popular monthly publication devoted entirely to vintage amateur radio, military equipment, restorations, and radio history. Samples $1. Electric Radio, P O Box 242, Bailey CO 80421, www.ERmag.com

"EVERYTHING FOR THE MORSE ENTHUSIAST." Morse Express. Keys, keyers, kits, books. 303-752-3382. http://www.MorseX.com

FAR CIRCUITS CD is available for $5.00 with orders or $8.50 including First Class shipping CD contains over 350 articles and additional project information.

FREE!!! Ham Radio and other CD-Roms & Software disk catalog. **MOM 'N' POP'S SOFTWARE**, P. O. Box 15003-HA, Springhill, FL 34604-0111. 1-352-688-9108. momnpop@momnpopsware.com

Ham Radio and Shortwave repair -any make HF/VHF/UHF- Bob, KF8IY 440-984-0084 (home) 440-653-1179 (cell) E: bobd@vasucom.com

Ham Radio is FUN again! http://HamRadioFun.com

HEATHKIT AMATEUR RADIO REPAIR by RTO Electronics, 601 E. 1st Street Calexico, CA 92231 269-468-7780. E-mail: hamtech@rtoham.com. www.rtoham.com

KENWOOD AMATEUR RADIO REPAIR by K3TEN 609-846-5190 Email roy@k3ten.com Web http://www.k3ten.com TS-830, TS-820 And All Kenwood Hybrids, plus the TS-930s, TS-940s, TS950s, TS-2000s, TS-430s, TS-440s, TS-450s, TS-690s, TS-850s. TL-922 Amplifier Upgrades and Repairs.

LEARN CODE by Hypnosis, www.success-is-easy.com 561-302-7731

Looking for the power connectors at the back of the following radios: IC735 and Kenwood TS44s. Either new or used would be acceptable. Anton T, KA1JSP att@megalink.net

MicroLog-By-WA0H .. Easy to use logging program .. Free download .. www.wa0h.com

OLD RADIO PARTS DIALCOVER.COM Tubes, Plastic-Glass Dial Covers Multisection Capacitors and Much More...

PRINTED CIRCUIT BOARDS for projects shown in QST, QEX, HR, ARRL HB, 73 and more. Custom boards available. FAR Circuits, 18N640 Field Ct, Dundee, IL 60118; fax/phone 847-836-9148; www.farcircuits.net; mail@farcircuits.net

Put the FUN back into ham radio! http://HamRadioFun.com

QRP KITS: Easy to build. Fun to use. www.breadboardradio.com

Rohn Tower, telescoping poles, tripods and antenna parts. www.antennapartsoutlet.com

St Petersburg FL has a store, Ralph's Hobbies and Amateur Radio Supply - 5208 66th St. N, Call 727-547-8607 - for directions.

TELEVISION TRANSMITTERS Digital Analog www.kh6htv.com

TELEVISION'S PIRATES -a HAM "novel" by "Coop" (K6EDX/ZL4AAA) at www.bobcooper.tv
C-BAND REMEMBERED ("A joy to read"; K9EID) at www.bobcooper.tv Archived
CATJ, CSD, SatFACTS and more, on DVD. All at www.bobcooper.tv

TOWER ACCESSORIES Gin Pole Kits - stand off brackets - antenna mounts - vehicle radio mounts for 30 years. IIX Equipment Ltd. 708-337-8172 www.w9iix.com

WANTED: September 1961 issue of Electronics World Ed, 724-628-2833

WE BUY/SELL RADIOS. **#1 IN ESTATES** – www.recycledradio.com (603) 942-7173

WOOD BADGES & LICENSE FRAMES - www.Gifts4Hams.com

www.HamPlaques.com -CNC router carved and laser engraved plaques-logos for 17 clubs

www.SecondHandRadio.com Electronic or Electrical - find it here, sell it here.

"YOU CAN check spots, log contacts: www.dxtreme.com"

AMSAT – WHO DECIDES THE FUTURE OF AMATEUR RADIO IN SPACE? YOU DO! For more than 30 years AMSAT has pioneered dozens of spacecraft that have brought operating enjoyment to thousands. Your membership in AMSAT will support exciting projects planned for launch in the years to come. In addition, you'll receive the bimonthly *AMSAT Journal* and substantial discounts on software distributed by AMSAT. Join now! Call 301-589-6062 or visit the AMSAT Web site at www.amsat.org. AMSAT®, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703.

GAIN THE EDGE WITH NARTE CERTIFICATION – NARTE gives you the competitive edge with individual certification in Electromagnetic Compatibility, Electromagnetic Discharge Control and Telecommunications. Industry-recognized certification required or desired by more than 400 corporations nationwide. Call 1-800-89-NARTE or visit www.narte.org. NARTE offers the premier EMC/EMI, ESD, Telecommunications and Wireless certification to professional technicians and engineers.

Advertising Department Staff:

Debra Jahnke, K1DAJ, Sales Manager, Business Services
Janet Rocco, W1JLR, Account Executive
Lisa Tardette, KB1MOI, Account Executive
Diane Szlachetka, KB1OKV, Advertising Graphic Design
Zoe Belliveau, W1ZOE, Business Services Coordinator

QST Index of

Your Customers are Reading...QST!

If your company provides products or services of interest to our Members, please contact the ARRL Advertising Department today for information on building your business.

Support those who support ARRL! Please patronize our ARRL Advertisers.

Contact Information:

Toll Free: 800-243-7768
Direct Line: 860-594-0207
Fax: 860-594-4285
E-mail: ads@arrl.org
Web: www.arrl.org/ads

Additional advertising information is available on the web at:
www.arrl.org/ads

Advertisers

QST Advertising Deadlines:

Issue	Reservation Date	Materials Due Date
March 2013	Wednesday, January 16, 2013	Friday, January 18, 2013
April 2013	Wednesday, February 13, 2013	Friday, February 15, 2013

For links to the Web sites of all ARRL advertisers, visit www.arrl.org/ads/adlinks.html

A Commitment to Leadership...
A Commitment to ARRL...

Hiram Percy Maxim displayed true leadership when he created the ARRL. Since 1914, we have endeavored to carry on his vision of ensuring that the ARRL remains the preeminent organization for Amateur Radio.

The ARRL Maxim Society was created to acknowledge individuals who have achieved a lifetime contribution level of $10,000 or more. These generous donors to the ARRL have provided financial resources to support the **Diamond Club**, the **Spectrum Defense Fund**, the **Education & Technology Program**, the **W1AW Endowment Fund** and more.

To date, **The Maxim Society** has welcomed nearly 120 members into this distinctive recognition group. ***Won't you join them?***

To learn more, please visit **www.arrl.org/maxim-society** or contact:

Lauren Clarke, KB1YDD
Individual Giving Manager
ARRL
225 Main Street
Newington, CT 06111-1494
860-594-0394
lclarke@arrl.org

powerwerx.com

wouxun

KG-UV3D

$119.99

Dual-Band Amateur

- 5 Watt VHF, 4 Watts UHF Power Output
- 128 Memory Channels
- Desktop Charger Included
- Wide Receive: 88-108/ 136-174/420-512 MHz
- PC Programmable
- 16-Key Pad plus Menu Button for Easy Operation
- 1700 mAh Li-ion Battery
- Built-in LED flashlight

KG-UV6X

NEW!

Dual-Band Commercial

- Commercial Handheld w/ 200 Memory Channels
- Wide Coverage: 136-174/400-512 MHz
- FCC 2013 Narrowband Compliant
- New! 2.5 KHz Channel Step
- 16-Key Pad plus Menu Button for Easy Operation
- Includes 2 ½ Hour Dual-Slot Desk Charger

See our complete new handheld and accessory line, visit powerwerx.com/wouxun

Wouxun Radio Accessories

Heavy Duty Radio Case

Heavy Duty Remote Speaker / Microphone

NEW!

Advanced PC Programming Software

Stubby Flexible Antenna

NEW!

Comfortable G-Hook Lapel Mic

30 Amp Desktop Power Supplies

- 14.1 VDC Output
- 25 Amps Continuous
- 30 Amps Surge
- Selectable Input 115/230 VAC
- Small 6 x 5 x 2.5" Footprint
- Quiet Internal Cooling Fan
- 3 Year Limited Warranty

$119.99

SS-30DV

NEW!

Variable Digital Supply 5-16VDC @ 24 Amps

powerwerx.com

Order online at powerwerx.com
Order toll free 888-321-0073

Follow us on Facebook
facebook.com/powerwerx

Follow us on Twitter
twitter.com/powerwerx

YOUR NUMBER FOR SAVINGS (800) 272-3467

US TOWER CORPORATION

TX SERIES

Heavy Duty Crankup towers, self-supporting heights range 38 to 106 feet. Supports up to 37 square feet of antenna wind load.

HDX SERIES

Extra heavy duty crankup towers. Self supporting heights from 38 to 106 feet. Support up to 70 square feet of antenna wind load.

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!

Universal

B-18 SERIES

Light duty aluminum self supporting towers. Five models rangeing from 30 to 50 feet in height, and support up to 12 square feet of antenna wind load.

CALL FOR MORE INFO!

B-26 SERIES

Medium duty aluminum self supporting towers. Thirteen models ranging from 30 to 90 feet and support up to 34.5 square feet of antenna wind load.

CALL FOR MORE INFO!

B-30 SERIES

Heavy duty aluminum self supporting towers. Nineteen models ranging from 40 to 100 feet, and support up to 34.5 square feet of wind load.

CALL FOR MORE INFO!

- Great Gear
- Great Deals
- Great Service
- Free UPS S/H!*

*On all radio orders shipped within the contiguous USA.

TEXAS TOWERS

Savings As Big As Texas!

Call for Our New Ham Radio Catalog!

M2

M2 ANTENNAS

6M3/6M3SS	$169/155
6M5XHP/6M7JHV	$349/369
2M3SS/2M4	$79/109
2M7/2M9FMSSB	$139/209
2M12/2M5WL	$229/339
2MCP14/2MCP22	$249/349
2MXP20/28	$269/409
440-6SS/420-50-11	$69/129
432-12EME/440-18	$139/155
432-9WL/13WLA	$219/329
436CP30/42UG	$279/339
KT34M2	$1349
KT36XA	$1849

M2 ANTENNAS IN STOCK!

TIMES LMR COAX

High performance coax cable. Lower loss than RG-213/U without the water displacement problems common to 9913 and 9086 types.

HUGE LMR STOCK, CALL!

ALUMINUM TUBING

O.D.	WALL	COST/FT.
6063-T832 DRAWN ALUMINUM TUBING		
.375"	.058"	$1.00
.500"	.058"	$1.10
.625"	.058"	$1.20
.750"	.058"	$1.30
.875"	.058"	$1.40
1.000"	.058"	$1.50
1.125"	.058"	$1.65
1.250"	.058"	$2.40
1.375"	.058"	$2.65
1.500"	.058"	$2.90
1.625"	.058"	$3.15
1.750"	.058"	$3.40
1.875"	.058"	$3.65
2.000"	.058"	$3.90
2.125"	.058"	$4.15

KENWOOD

KENWOOD TS-590S

All Mode HF/6m XCVR, 32-Bit IF-Level DSP, Narrow Band Roofing Filter, Automatic Tuner, CTCSS Encode/Decode, CW Memory Keyer, and More!

CALL FOR YOUR LOW PRICE!

KENWOOD TS-480SAT

All Mode HF/6m XCVR, 16-Bit DSP, Automatic Tuner, built-in PC interface, and More!

CALL FOR YOUR LOW PRICE!

ANTENNA ROTATORS

Hygain, CD-45II	$399
Hygain, Ham-IV	$589
Hygain, Ham-V	$989
Hygain, T2X	$699
Hygain, T2X Digital	$1099
M2, OR-2800PX	$1739
Yaesu, G-450A	$309
Yaesu G-550	$399
Yaesu, G-800SA	$399
Yaesu, G-800DXA	$499
Yaesu, G-1000DXA	$609
Yaesu G-2800DXA	$1349
Yaesu G-5500	$739

ROTOR CABLE IN STOCK!

YAESU

YAESU FT-DX5000
YAESU FT-DX5000D
YAESU FT-DX5000MP

New, All Mode HF/6m XCVR, 32-Bit DSP, Auto Tuner, Station Monitor (D & MP models), 200 W RF Output, More!

CALL FOR YOUR LOW PRICE!

YAESU FT-950

HF/6m XCVR, 32-Bit DSP, Auto Tuner, CW Keyer, and More!

IN STOCK—FAST DELIVERY!

YAESU FT-450D

HF/6m XCVR, IF-level DSP, Automatic Tuner, CW Roofing Filter, TCXO, and Much More!

IN STOCK—FAST DELIVERY!

YAESU FTM-350AR

2m/70cm FM Mobile XCVR for APRS, crossband repeat, CTCSS encode/decode, More!

IN STOCK—FAST DELIVERY!

TEXAS TOWERS

TOLL FREE **(800) 272-3467**

1108 Summit Avenue, #4 • Plano, TX 75074
Hours: M-F 9 AM–5 PM Central Time
Email: sales@texastowers.com

MASTERCARD
VISA • DISCOVER

Proudly Serving Ham Operators Since 1978!
Visit Our Website for More Great Deals:
http://www.texastowers.com

Introducing the Yaesu FT-950 transceiver for DX enthusiasts
Superb receiver performance
Direct lineage from the legendary FT DX 9000 and FT-2000

HF/50 MHz 100 W Transceiver

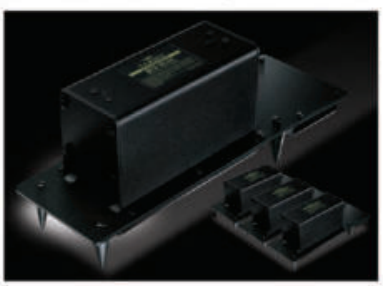
FT-950

- Triple-conversion super-heterodyne receiver architecture, using 69.450 MHz 1st IF
- Eight narrow, band-pass filters in the RF stage eliminate out of band interference and protect the powerful 1st IF
- 1st IF 3 kHz Roofing filter included
- High-speed Direct Digital Synthesizer (DDS) and high-spec Digital PLL for outstanding Local Oscillator performance
- Original YAESU IF DSP advanced design, provides comfortable and effective reception. IF SHIFT / IF WIDTH / CONTOUR / NOTCH / DNR
- DSP enhancement of Transmit SSB/AM signal quality with Parametric Microphone Equalizer and Speech Processor
- Built-in high stability TCXO (±0.5 ppm after 1 minute@77 ° F)
- Built-in automatic antenna tuner ATU, with 100 memories
- Powerful CW operating capabilities for CW enthusiasts
- Five Voice Message memories, with the optional DVS-6 unit
- Large Multi-color VFD (Vacuum Fluorescent Display)
- Optional Data Management Unit (DMU-2000) permits display of various operating conditions, transceiver status and station logging.
- Optional RF μ -Tune Units for 160 m, 80/40 m and 30/20 m Bands

Optional, YAESU Exclusive, Fully-Automatic μ -Tuning Preselector System!

Fully automatic, Ultra-sharp, External μ -Tuning Preselector (optional) features a 1.1" (28 mm) Coil for High Q

On the lower Amateur bands, strong signal voltages impinge on a receiver and create noise and intermod that can cover up the weak signals you're trying to pull through. YAESU engineers developed the μ (Mu) Tuning system for the FT DX 9000/FT-2000, and it is now available as an option for the FT-950. Three modules are available (MTU-160, MTU-80/40, MTU-30/20); these may be connected externally with no internal modification required! When μ -Tuning is engaged, the VRF system is bypassed, but the fixed Bandpass Filters are still in the received signal path.



Optional External Data Management Unit (DMU-2000) Provides Many Display Capabilities

Enjoy the ultimate in operating ease by adding the DMU-2000! Enjoy the same displays available with the FT DX 9000 and FT-2000: Band Scope, Audio Scope, X-Y Oscilloscope, World Clock, Rotator Control, Extensive Transceiver Status Displays, and Station Logging Capability. These extensive functions are displayed on your user-supplied computer monitor.

Shown with after-market keyer paddle, keyboard, and monitor (not supplied).

DMU-2000
Data Management Unit (option)

YAESU
The radio

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

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

KENWOOD

Majestic

Our new flagship model
that fans have been waiting for

TS-990S

HF/50MHz TRANSCEIVER

February 2013 debut

<Main functions of the TS-990S>

- Dual receiver that enables simultaneous reception in two different wavebands
- Newly developed mixer that helps to achieve +40 dBm IP3*
- Equipped with five newly developed 270 Hz–15 kHz roofing filters*
- Dedicated DSPs installed in bandscope, main and sub receivers
- Heavy-duty transmission capability allowing prolonged operation at full power
- Dual TFT display configuration allowing an intuitive grasp of conditions

*Only the main receiver is equipped.

[Other functions] •Newly developed dividing PLL that divides high frequencies and achieves a high C/N ratio •Device equipped with ±0.1 ppm TCXO, which has a high degree of stability yet still conserves energy •Advanced AGC combining digital and analog technology •Functions for eliminating various types of interference and noise •Built-in automatic antenna tuner that enables high-speed operation •Twin cooling system that circulates sufficient airflow to each unit

Kenwood U.S.A. Corporation
Communications Division Headquarters
3970 Johns Creek Court, Ste. 100 Suwanee, GA 30024, U.S.A.

*Alterations may be made without notice to improve the ratings or the design of the device. *The photographic and printing processes may cause the coloration of the device to appear different from that of the actual device.

www.kenwoodusa.com

ADS#56412