APRIL 2012 QST Vol 96 No 4

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

April 2012 WWW.ARRL.ORG

South of Sixty South: The VP8ORK DXpedition

QST reviews:

51 | ICOM IC-9100 MF/HF/VHF/UHF Transceiver

Inside:

$4.99 US $6.99 Can.

19260 04

0 843655 9

Visit the ARRL Web site at www.arrl.org

Official Journal of ARRL The national association for AMATEUR RADIO

The radio YAESU...

The Dawn of a New Era

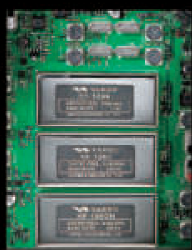
Dynamic Range 112 dB/IP3 +40 dBm

The New Premium HF/50 MHz Transceiver

FT DX 5000 Series

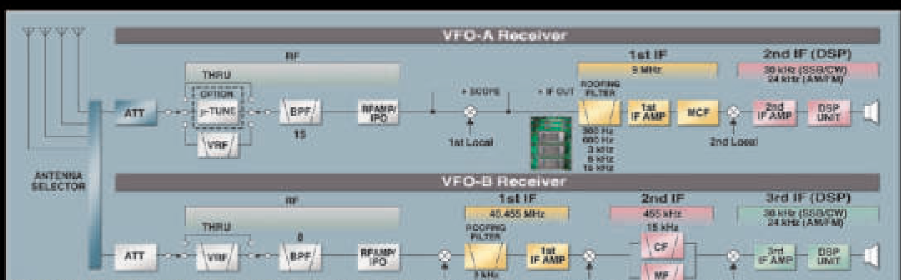
Two Totally Independent Receivers - The VFO-A/Main Receiver utilizes Super Sharp Roofing filters to give you the highest performance and best flexibility

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

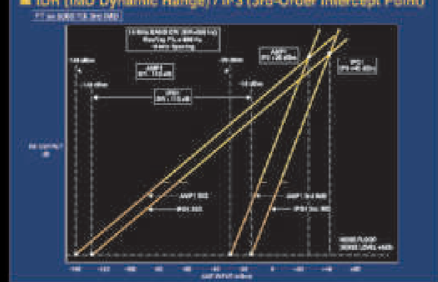


Superb 3rd-Order Dynamic Range and 3rd-Order Intercept Point (IP3)

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



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



■ IDR (IMD Dynamic Range) / IP3 (3rd-Order Intercept Point)

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.

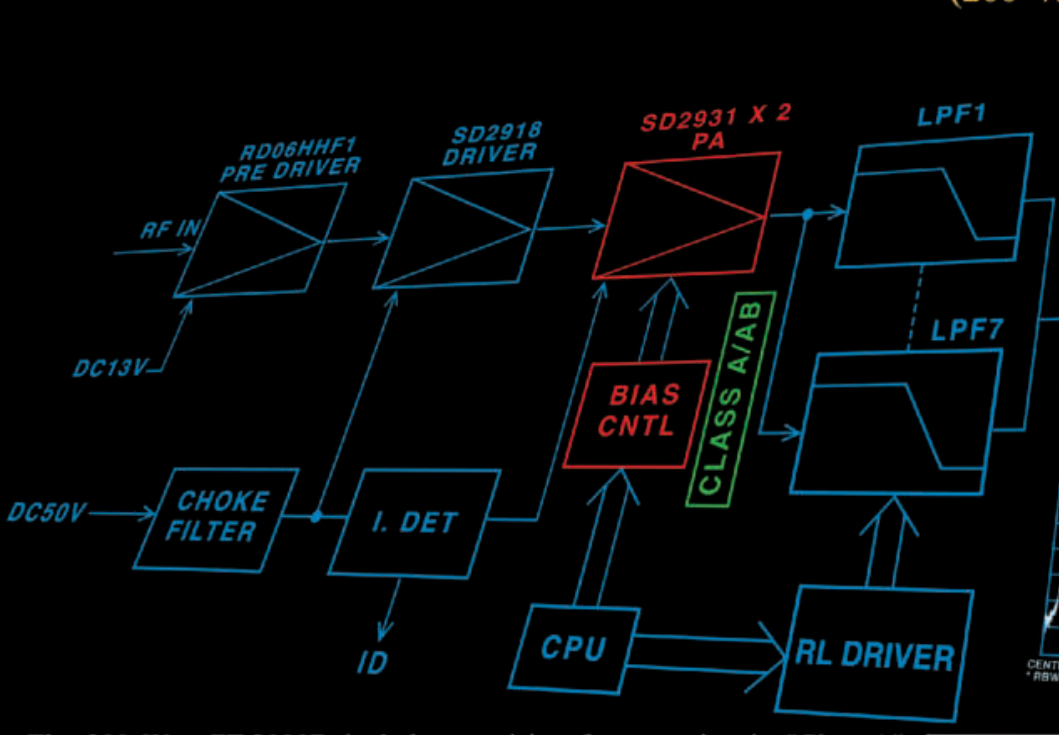
YAESU
Choice of the World's top DX'ers SM

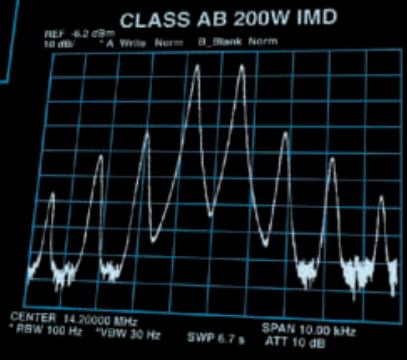
YAESU USA
6125 Phyllis Drive, Cypress, CA 90630 (714) 827-7600

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

Ultra-low Distortion Class-A Final Amplifier

(200-Watt FT-2000D version)





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

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

HF/50 MHz Transceiver

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

FT-2000 100 W Version (Internal Power Supply)

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

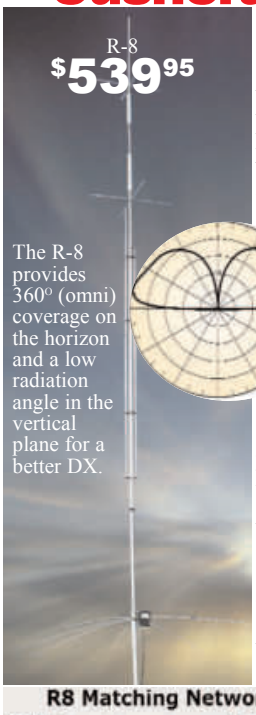
Specifications subject to change without notice. Some accessories and/or options may be standard in some areas. Frequency coverage may differ in some countries. Check with your local Yaesu dealer for specific details.

YAESU
Choice of the World's top DX'ers

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!

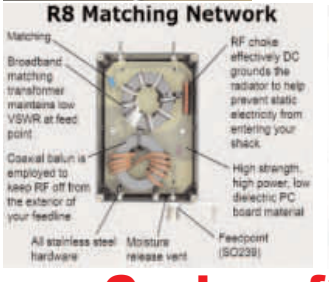
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

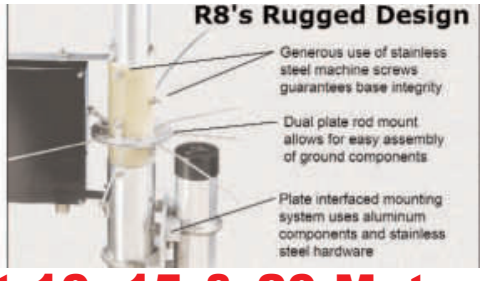
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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.





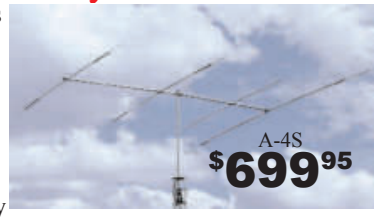
MA-5B *5-Band* Beam

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.

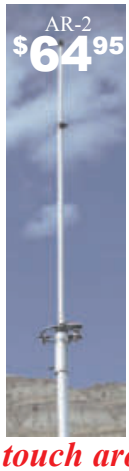
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

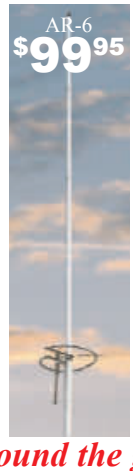
Cushcraft Dual Band Yagis

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

April 2012 Volume 96 Number 4

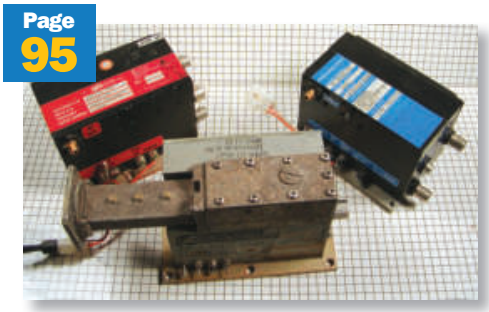
Technical

News and Features

Our Cover
An international group of 13 operators headed down to the South Orkney Islands in January 2011 to activate VP8ORK. This was the Microlite Penguins DXpedition Team's fourth time activating an entity in the Antarctic region and its fifth DXpedition overall. Turn to page 66 for the story of the VP8ORK DXpedition by Michael Mraz, N6MZ. Main photo: Members of the VP8ORK team bring their equipment onto Signy Island. Photo by John Sluymer, VE3EJ. Second photo: When all was said and done, the team logged almost 64,000 QSOs on SSB, CW and RTTY on 160-10 meters. Photo by Lewis Sayre, W7EW.

Radiosport

Page 95



Page 93

Page 63

Columns

Departments

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

April 2012
Volume 96 Number 4

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 $5.

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**

See page 14 for detailed contact information.

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

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

2 m MONO BAND

Commercial Grade Field Radio Submersible Construction

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

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

YAESU

Choice of the World's top DX'ers

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

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 **Foot stand**

NEW **Illuminated Key buttons**

NEW **Classically Designed Main Dial and Knobs**

NEW **300 Hz/500 Hz/2.4 kHz CW IF Filters**

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

YAESU
Choice of the World's top DX'ers™

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

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.

Field Gear That Goes The Distance!

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

FT-857D
The World's Smallest HF/VHF/UHF Mobile Transceiver

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

FT-897D
HF/VHF/UHF Portable Operation Powerful Transceiver

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

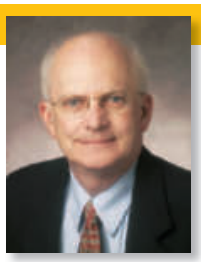
FT-817ND
The Ultimate Backpack, Multi-Mode Portable Transceiver

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

YAESU
Choice of the World's top DX'ers℠

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

http://www.yaesu.com



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

A New Band is Born!

"In February 2012, at the World Radiocommunication Conference (WRC) of the International Telecommunication Union (ITU), a new worldwide frequency band for the amateur service was born: 472 to 479 kHz, destined to be known as the 630 meter band."

One hundred years ago, when spark was king and the properties of the ionosphere were unknown, it was assumed that the way to maximize the range of radio communication was to operate on as low a frequency — that is, on as long a wavelength — as possible. This led to radio amateurs being "relegated" to wavelengths of 200 meters or less, in order to keep the supposedly more valuable wavelengths free for commercial and military purposes. Stations on land could be as big as budgets would allow, but of course stations on ships were constrained by the size of the vessels.

The wavelength of 600 meters — that is, 500 kHz — was chosen as the principal maritime calling channel and ultimately became an international calling and distress frequency for radiotelegraphy. So it remained for as long as Morse code was a communications medium of choice between ships and coast stations. That era came to an end at the 2007 WRC, where the provisions for the use of 495 to 505 kHz for maritime calling and distress were deleted and the band became simply a mobile allocation, limited to radiotelegraphy but with no specific purpose defined.

Seeing an opportunity to regain access to a part of the spectrum from which radio amateurs had been excluded for a century, amateurs in Germany persuaded their administration to propose at WRC-07 that the next WRC — initially scheduled for 2011 but later shifted to 2012 — "consider an allocation of about 15 kHz in parts of the band 415-526.5 kHz to the amateur service on a secondary basis, taking into account the need to protect existing services." The proposed agenda item gained enough support to be accepted.

Then the real work began. The International Amateur Radio Union (IARU) is an active and respected member of the ITU community, both as an international organization and as a member of the Radiocommunication and Telecommunication Development Sectors. From 2008 to 2010 IARU volunteers worked with supportive telecommunications administrations to prepare studies showing how an amateur allocation could be accommodated without causing harmful interference to the incumbent services. Initially the focus was on 495-510 kHz, but the maritime mobile service developed its own concept for the future use of this band and it soon became clear that we would have to look elsewhere — specifically, below the NAVTEX frequency of 490 kHz. This put us into conflict with non-directional beacons (NDBs) operating in the aeronautical radionavigation service. While NDBs are seldom used by aircraft except in remote areas and for backup, they are still in operation and their proponents were understandably anxious to avoid any new sources of interference. Maritime mobile interests also remained protective of all of their allocations in this frequency range, not just 495-510 kHz.

At the Conference Preparatory Meeting in February 2011 three methods of satisfying the agenda item were crafted: a secondary allocation of 472-487 kHz, a secondary allocation in two separate segments of 461-469 and 471-478 kHz, and no change — the last meaning that there would be no amateur allocation. Further work among European administrations resulted in a compromise proposal for an allocation of 472-480 kHz. At the beginning of WRC-12 each of the four approaches had its supporters. The challenge was to come up with a common position that could be accepted by all of the administrations, even those opposed to an amateur allocation.

It wasn't easy, but that's what eventually happened. The task of reconciling the disparate proposals was entrusted to a Sub Working Group (SWG) chaired by ARRL Chief Technology Officer Brennan Price, N4QX, in his capacity as a member of the US delegation. Brennan's SWG spent the first week of the conference in furious debate. Eventually the pro-allocation administrations and regional telecommunications organizations were able to combine their proposals into a single common proposal for 472-479 kHz with footnotes to provide protection for aeronautical radionavigation. However, some opponents remained intransigent and it was not until the issue went through its assigned Working Group and into Committee 4 — the last real opportunity to reach consensus — that they agreed to accept the adequacy of the footnote provisions.

Once the proposal of Committee 4 went through the Editorial Committee and was presented in Plenary on Friday afternoon, February 10, it was briefly derailed as a result of well-meaning efforts by some administrations to make editorial improvements. Fortunately, the proposed changes were able to be incorporated into a revised document that was presented in Plenary on the following Tuesday morning and sailed through without further comment, other than a pre-coordinated addition of one country name to one footnote. Thus the amateur service received a nice Valentine's Day present: a new opportunity to explore propagation and signal detection techniques in a historically significant portion of the radio spectrum. Of course we will have to wait for national regulations to be revised before amateurs can use the 630 meter band, but we are hopeful that the FCC will act promptly to implement the new allocation.

Many people deserve to be recognized for significant contributions to this success, including a number of professionals with national administrations who are not licensed radio amateurs but who nonetheless worked hard on our behalf. That recognition will have to wait for the next issue of *QST*.

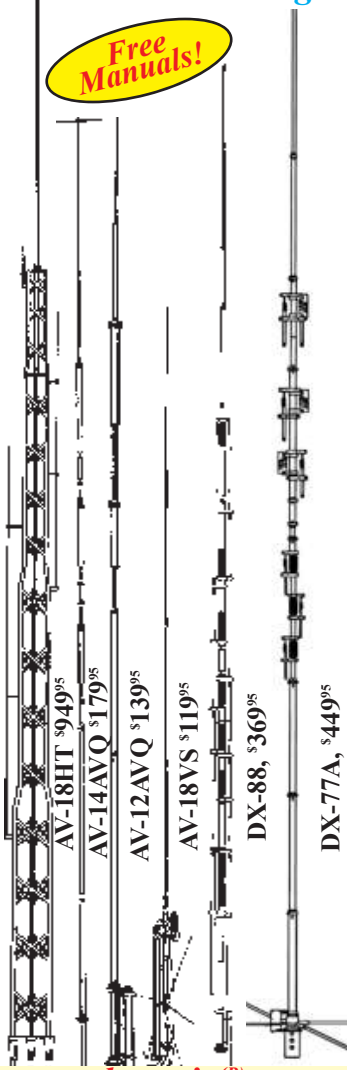
There is much more to come about WRC-12. Indeed, it can be argued that there were even greater achievements for Amateur Radio at the conference. Stay tuned!

David Sumner, K1ZZ

hy-gain® HF VERTICALS

Self-supporting -- no guys required . . . Remarkable DX performance -- low angle radiation, omnidirectional . . . 1500 Watts . . . Low SWR . . . Aircraft quality aluminum tubing . . . Stainless steel hardware . . . Recessed SO-239 connect . . . Two year limited Warranty . . .

Free Manuals!



hy-gain® Classics

All hy-gain multi-band vertical antennas are entirely self supporting -- no guys required.

They offer remarkable DX performance with their extremely low angle of radiation and omnidirectional pattern.

All handle 1500 Watts PEP SSB, have low SWR, automatic band-switching (except AV-18VS) and include a 12-inch heavy duty mast support bracket (except AV-18HT).

Heavy duty, slotted, tapered swaged, aircraft quality aluminum tubing with full circumference compression clamps is used for radiators.

Includes all stainless steel hardware. Recessed SO-239 prevents moisture damage.

Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low.

Two year limited warranty.

AV-18HT, $949.95. (10,12,15,20,40,80 M, 160, 17 Meters optional). 53 ft., 114 lbs.

Standing 53 feet tall, the famous *Hy-Gain HyTower* is the world's best performing vertical! The AV-18HT features automatic band selection achieved through a unique stub-decoupling system which effectively isolates various sections of the antenna so that an electrical 1/4 wavelength (or odd multiple of a 1/4 wavelength) exists on all bands. Approximately 250 kHz bandwidth at 2:1 VSWR on 80 Meters. The addition of a base loading coil (**LC-160Q, $109.95**), provides exceptional 160 Meter performance. **MK-17, $89.95**. Add-on 17 Meter kit. 24 foot tower is all rugged, hot-dip galvanized steel and all hardware is iridited for corrosion resistance. Special tilt-over hinged base for easy raising & lowering.

AV-14AVQ, $179.95. (10,15,20,40 Meters). 18 ft., 9 lbs. **The** Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

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

AV-18VS, $119.95 (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

DX-88, $369.95. (10, 12, 15,17,20,30,40,80 Meters, 160 Meters optional). 25 ft., 18 lbs.

All bands are *easily* tuned with the DX-88's *exclusive* adjustable capacitors. 80 and 40 Meters can even be tuned from the ground without having to lower the antenna. Super heavy-duty construction. DX-88 OPTIONS: 160 Meter add-on kit, KIT-160-88, $199.95. Ground Radial System, GRK-88, $99.95. Roof Radial System, RRK-88, $99.95.

DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.

No ground radials required! Off-center-fed Windom has 55% greater bandwidth than competitive verticals. Heavy-duty tiltable base. Each band independently tunable.

Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$949.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$179.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$139.95	10,15,20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$119.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

Hy-Gain 160-6 Meters Self-Supporting Vertical

Full 1500 Watts, 43 feet, includes base mount

New! AV-6160 **$399.95** UPS SHIPPABLE

Operate all bands 160-6 Meters at full 1500 Watt with this self-supporting, 43 feet high performance vertical! It assembles in less than an hour and its low profile blends in with the sky and trees -- you can barely see it . . .

Exceptional Performance

The entire length radiates to provide exceptional low angle radiation 160-20 Meters and very good performance on 17-6 Meters. You can shorten it by telescoping it down for more effective low angle radiation on higher bands.

Just talk with automatic tuner!

A wide-range automatic or manual antenna tuner *at your rig* easily matches this antenna for all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up!

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than 1/2 dB 60-6 Meters and less than 1 dB 160-80 Meters with good quality, low-loss coax).

Extremely low wind loading

With just 2 square feet wind load, the AV-6160 has the lowest wind-loading and lowest visibility of any vertical antenna! The key is a six foot section of tapering diameter *stainless steel* whip that flexes in strong wind instead of stressing the bottom sections. Its 2-inch O.D.and .120 inch thick walled tubing bottom section makes it incredibly strong.

Just 20 lbs., uses super-strong *6063 aircraft aluminum tubing.* Stainless steel hardware.

Assembles in an hour

Ground mounting lets you hide antenna base in shrubbery. Requires ground system -- at least one radial. More extensive ground work better.

Stealth Operation

Low profile. Hide behind trees, fences, buildings, bushes. Use as flagpole. Easily telescopes down during the day.

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

Celebrate Spectacular Spring Savings at HamPROS

Over 250 Years of Combined Service!

This month we are featuring our Ohio Store...

Universal Radio, Inc.
Our 70th Year!
800-431-3939
Local (614) 866-4267
FAX (614) 866-2339
6830 Americana Pkwy.,
Reynoldsburg, Ohio 43068
www.universal-radio.com

YAESU
Choice of the World's top DX'ers℠

Coupons good through March 26, 2012.

$70 Coupon

FTDX-5000/D/MP Series
Shown above withSM5000 Station Monitor (optional on some versions).

$40 Coupon

FT-2000/FT-2000D
HF,6M, 100W/200W

$30 Coupon

FT-950
100 Watts of power output on SSB, CW, and FM (25 Watts AM carrier).

$20 Coupon

FTM-350AR
2M/440 50W
220MHz 1W
APRS & WIRES Ready
GPS (optional)

FT-450D
state of the art IF DSP technology, world class performance, easy to use

FT-897D
HF/6/2/440 all mode Portable 100W HF/6, 50W 2M, 20W, 440MHz

FT-817ND
HF/6/2/440

$20 Coupon
FREE YSK-857 Remote Kit with Purchase

FT-857D
HF/6/2/440 all mode

FREE MH-68B6J DTMF hand mic

FTM-10R
144/440MHz 50/40W

FREE YSK-8900 Remote Kit with Purchase
$30 Coupon

FT-8800R
2M/440MHz

FREE YSK-8900 Remote Kit with Purchase

FT-8900R
10M/6M/2M/440MHz

$15 Coupon

FT-1900R
144-148MHz

$25 Coupon

FT-2900R
2 meter transceiver

FREE YSK-7800 Remote Kit with Purchase

FT-7900R
Dual bander

VX-8DR

FT-250R
2 Meter

FT-270R
2M 5W

$20 Coupon
NEW!

VX-8GR
Full 5 watts

VX-3R
2M/440MHz

VX-7R/RB
Triple Band

VX-6R

$120 Coupon

FTDX-9000MP/D/Contest
400 watts, dual analog meter sets, LCD display, memory card installed, main and sub receiver

KENWOOD

Coupons good through April 30, 2012.

$175 Coupon

TS-B2000
Suitable for mobile applications with the use of the optional RC-2000 Mobile Controller.

TH-F6A
Compact 144/220/440MHz Transceiver/ Receiver

$250 Coupon

TS-480HX/TS-480SAT
HF/6M

$15 Coupon

TM-V71A
1000 Alpha Memories, Dual Display

$200 Coupon TS-2000S
$250 Coupon TS-2000X

TS-2000S/TS-2000X
High performance true IF/stage DSP on main band.

$40 Coupon

TM-D710A
2M/70cm Mobile 50W/50W, Optional Voice Synthesizer,

NEW!

TH-K20A
RF Output, Backlit LCD, Weather Alert, Keypad Entry

TS-590S
160-6 meters, Noise Reduction

NEW!

TM-281A
2M, FM Mobile Transceiver, 200 memory channels

$25 Coupon

$25 Coupon

TH-D72A
144/440 MHz 5W HT/ GPS/TNC

ICOM

Contact your HamPROS dealer for the latest Icom promotions.

D-STAR ★ Compatible

IC-2820H

IC-2300H
144-148 MHz
NEW!

IC-7200 –
HF/6 100W

IC-7410
HF/6M 100W

IC-7000

NEW!

ID-31A
440MHz HT
D-Star Ready

IC-V80
2M 5.5W

IC-T70A
2M/440MHz

IC-7700

IC-7600

We also carry many other products and products manufactured by...

RCC Coaxial Cable and Connectors
COMET
Princeton Antennas
HEIL SOUND
LDG ELECTRONICS
W5YI
MFJ samlexamerica
ALINCO
ASTRON CORPORATION

MasterCard VISA DISCOVER

Prices, products and policies may vary between dealer locations. Not all dealers have all product lines. All prices and products subject to change. Not responsible for typographical errors.

Lentini Communications, Inc.
Our 58th Year!
800-666-0908
Local (860) 828-8005
FAX (860) 828-1170
221 Christian Lane – Unit A
Berlin, CT 06037
www.lentinicomm.com

Austin Amateur Radio Supply
Our 32nd Year!
800-423-2604
Local (512) 454-2994
FAX (512) 454-3069
5325 North I-35
Austin, Texas 78723
www.aaradio.com

Radio City, Inc.
Our 30th Year!
800-426-2891
Local (763) 786-4475
FAX (763) 786-6513
2663 County Road I
Mounds View, MN 55112
www.radioinc.com
Find us on Twitter:
twitter.com/mnradiocity

Associated Radio
Our 67th Year!
800-497-1457
Local (913) 381-5900
FAX (913) 648-3020
8012 Conser
Overland Park, KS 66204
www.associatedradio.com

HamPROS • HamPROS • HamPROS

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

In Brief

- The Amateur Radio Service came away with a new band at the World Radiocommunication Conference (WRC-12). Details are in It Seems to Us and Happenings, this issue.
- Discussion of a new amateur service secondary allocation will be on the WRC-15 agenda.
- Effective September 1, the RAC Ontario section will be split into four separate sections.
- 2012 Field Day packets are available for download from **www.arrl.org/field-day**.
- The effective date for new FCC rules expanding the existing MedRadio Service secondary allocation in parts of the 70 cm band was February 27.
- The new 60 meter rules went into effect March 5. See the article on page 74.
- On February 13, eight student-built MicroSats and CubeSats were launched from Kourou, French Guiana.
- The first CQ award to be supported by the ARRL's Logbook of the World electronic confirmation system will be the CQ WPX award.
- The Republic of South Sudan has been assigned the prefix Z8.
- The FCC has denied a waiver request from the Anchorage VEC. Details appear in Happenings, this issue.
- The winner of the *QST* Cover Plaque Award for January is Ralph Taggart, WB8DQT, for his article, "Vintage Low Power Radios."

Media Hits

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

- January saw Muskegon County ARES folks score two TV stories about Amateur Radio in the Western Michigan area. Not only did the reporters interview them, but they were invited to the WZZM TV-13 stations to do more. Meanwhile, their fellow hams over in Kalamazoo also scored with a nice segment on WMUK Radio, the local NPR affiliate.
- Newspapers are not the only print media that matter. Blogs and corporate newsletters get more attention that many people realize. There were several of these alternative media stories that were well done in January. "The Skinny on Ham Radio: Getting Licensed" by "Master Po" appeared in *The Survival Mom*. "Ham Radio — Getting the message through even in the worst of times" was written by our own SM Paul Eakin, KJ4G, for the *DEM News -Florida Division of Emergency Management. ABC Newsletter*, the weekly newsletter of the trade organization America's Blood Centers, had Dr Kenneth Nollet, a transfusion specialist who was working in Japan during the earthquake/tsunami citing Amateur Radio working when other systems were destroyed. Outstanding Achievement & Leadership award recipient Fred Barth, W2FMB, was applauded in *BlueSky Executive Aviation News*.
- One social media outlet that is very important is Twitter. You can follow us @ARRL and @ARRL_PR. But it really got our attention to see a message that went to thousands of people being posted by @CraigatFEMA — that's Craig Fugate! He tweeted, "Amateur Radio, part of the emergency team, follow them at @arrl, the national association for Amateur Radio, arrl.org."
- While too many hams are passive about promoting Amateur Radio or believe that someone else will always be there to do it for them, many others take a very active role in advancing and protecting our activities. Don Pritchard, W6ZPC, does a lot and has been showing the DIY video four times a week since its release on Ste Genevieve Community Access Television in Ste Genevieve, Missouri. Peter Miller, W1AMJ, is another regular contributor as shown in "D-STAR radio has loyal ham following in CT" appearing in *The Examiner* (CT).
- *Newsday* (NY) reported how at age 13, with pink earrings dangling near her shoulders and a glistening smile, Jennifer Melfi, KC2TMA, stood out at a convention in the story "Babylon girl, 13, honored for Irene help."
- The greatest percentage of January hits were about hams' Do It Yourself type projects! Dan Romanchik, KB6NU, wrote "Ham radio finally jumps on the maker bandwagon" for EDN.com while *HDTV Magazine* had Peter Putman explaining "a technique I've used for years on ham radio antennas" in "HDTV Expert - Useful Gadgets: Super-Flat Indoor TV Antennas" Our own Director David Norris, K5UZ, wrote "Calling out around the world — and even out of it" appearing in *The Batesville Daily* (AR). "We can throw a wire in a tree and communicate on a number of frequencies and have contact at any time of day."
- YouTube.com videos also got attention. Besides the views on the DIY Magic of Amateur Radio postings there (there are several of them in all sorts of places), Erin King, AK4JG, had a great video titled "MIT'16 EA Tube goes to Near Space" about her record setting balloon launch.
- Got a project of your own that you would like to talk about? We'll be having a series of short "show and tell" presentations for Makers, Hackers and Kit-builders at the PR booth at Dayton. There are still limited slots open! Interested? E-mail me at **apitts@arrl.org**.

At the WRC-12 Final Plenary: IARU Vice President Ole Garpestad, LA2RR; ARRL Chief Executive Officer David Sumner, K1ZZ, and IARU Technical Representative Ken Pulfer, VE3PU, on the final day of the World Radiocommunication Conference, February 17. [ANDY CLEGG, W4JE]

Colin Thomas, G3PSM, a member of the IARU Region 1 Executive Committee who served as CEPT Coordinator for Agenda Item 1.23 at WRC-12. [GEORGE PETERSEN, PA5G]

Tough Duty

Last April, the Puerto Rico Amateur Radio Operators were on the air with the call sign NP3PR to commemorate World Amateur Radio Day. The group operated three battery-powered stations from the beach at Levittown, Toa Baja. Two verticals and a horizontal antenna were strung between two palm trees. This year's World Amateur Radio Day takes place April 18. — *Jimmy Drowne, KP3BR*

PRARO used a field station near the beach as well as this Emcomm station by Dennis Perez, KP3CB. [COURTESY JIMMY DROWNE, KP3BR]

The NP3PR operation used this homebrew vertical for 10-15-20-40 meters. [COURTESY JIMMY DROWNE, KP3BR]

Inside HQ

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

How I Earned 5B DXCC

If I can do it, you can, too.

The ARRL issued over 11,000 DXCC Awards in 2011. 230 of those were 5 Band DXCC awards and I was one of them. If I can do it, any ham can.

When I started pursuing this award, my station consisted of an "entry level" 100 watt transceiver and a 40 meter dipole at 35 feet. I live on a small lot in the center of town and I can see all of my neighbors' houses. A tower was out of the question.

The toughest band for me, and most everyone else, is 80 meters, because unless you have plenty of room you cannot erect a 132 foot dipole. I realized that I needed a new plan if I was ever going to confirm 100 countries on 80. I spoke with my tree guy who said that he could erect a 102 foot G5RV dipole between two trees. The flattop would be skewed, but it would fit. He got the G5RV up about 45 feet. Now I had a decent 80 meter antenna.

Since I'm mostly a CW op, I upgraded to a transceiver that had DSP CW filters. That helped. I also began uploading my logs to Logbook of the World, studying propagation and monitoring the DX spotting clusters. I learned that accurate record keeping is essential. My logging software helps but it does not indicate LoTW confirmations, so I manually "back filled" new confirmations from LoTW to my log.

Within a few years, I had DXCC on the four other bands and, by operating on 80 meters almost exclusively during contests, I confirmed about 75 entities on 80 meters. Then I hit a wall. I was not breaking through the pileups and some of the entities I had worked were difficult to confirm. So I bought a linear amplifier. It's only 600 watts, but it sure helps! Now my signal was about an S unit and a half louder. With the amp online, and by getting up at 5:30 AM, while it was still dark, I worked another 30 or so entities on 80. Of course, the trick is to confirm the QSO, and LoTW really helped. Some DX clusters now indicate if a station uses LoTW, so I kept an eye out for them. I also sent paper QSLs to new entities with the necessary "green stamps" enclosed.

By December 2011, I had worked 102 entities and confirmed 98 on 80 meters. My final two paper confirmations that arrived at the end of 2011 were from Peru and New Zealand. I walked my cards down the hall to our DXCC Branch (okay, not everyone can do that!) and the staff tallied up my count. When they realized that I finally had the award, they gave me a round of applause, since they had been following my progress.

I don't pretend to be the world's greatest CW op. I don't own a $10,000 transceiver. I have only wire antennas. As I said earlier, if I can do it, you can as well.

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* Archive and Periodicals Search** – **www.arrl.org/qst**
  Browse ARRL's extensive online *QST* archive (1915-2008). 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/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**, Web site – **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

Media and Public Relations Manager
Allen Pitts, W1AGP

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
(301-292-6263); **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
640 Josephine Dr, Batesville, AR 72501
(870-793-6431); **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

Joyce Birmingham, KA2ANF
235 Van Emburgh Ave, Ridgewood, NJ
07450-2918 (201-445-5924); **ka2anf@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 Allen Pitts, W1AGP, Media Relations manager, use **w1agp@arrl.org** or **apitts@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: **Grant Hopper, KB7WSD**
PO Box 3318, Everett, WA 98213
(425-238-1433); **kb7wsd@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: **Andrea Hartlage, KG4IUM**
PO Box 608, Grayson, GA 30017
(404-509-4054); **kg4ium@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: Steve Ryan, N2ITF, 3036 Route 394, Ashville, NY 14710-9734 (716-763-7555); **n2itf@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: John Poindexter, W3ML, 204 S Main St, Knox, IN 46534-1620 (574-772-2772); **w3ml@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, KS0J, 1835-63rd St E, Inver Grove Heights, MN 55077 (651-260-4330); **ks0j@arrl.org**
North Dakota: Lynn A. Nelson, W0ND, 6940 4th St SW, Minot, ND 58701 (701-839-8200); **w0nd@arrl.org**
South Dakota: Scott Rausch, WA0VKC, 15362 Canyon Trl, Piedmont, SD 57769-7286 (605-787-7566); **wa0vkc@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: Mike Lisenco, N2YBB, 1635 E 46th St, Brooklyn, NY 11234-3604 (917-865-3538); **n2ybb@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, N0LOH, 1114 East Tenth St, Muscatine, IA 52761 (563-263-3097); **n0loh@arrl.org**
Kansas: Ronald D. Cowan, KB0DTI, PO Box 36, LaCygne, KS 66040 (913-757-3758); **kb0dti@arrl.org**
Missouri: Dale C. Bagley, K0KY, PO Box 13, Macon, MO 63552-1822 (660-385-3629); **k0ky@arrl.org**
Nebraska: Art Zygielbaum, K0AIZ, 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: Jim Pace, K7CEX, PO Box 1602, Centralia, WA 98531 (360-508-8437); **k7cex@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: Phil Steffora, K6TT, PO Box 657, Los Altos, CA 94023-0657 (650-793-4970); **k6tt@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, WM0G, 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: Roberto Jimenez, KP4AC, PO Box 360536, San Juan, PR 00936-0536 (787-567-7373); **kp4ac@arrl.org**
Southern Florida: David Fowler, K4DLF, 2702 Starwood Ct, West Palm Beach, FL 33406-5145 (561-676-3007); **k4dlf@arrl.org**
Virgin Islands: John Ellis, NP2B, PO Box 24492, Christiansted, St Croix, VI 00824 (340-773-9643); **np2b@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 (951-443-4958); **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, N0IRW, 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 . . . 800 Watts . . . $949!

More hams use Ameritron AL-811/H amplifiers than any other amplifier in the world!

Only the Ameritron AL-811H gives you four *fully neutralized* 811A transmitting tubes. You get absolute stability and superb performance on higher bands that can't be matched by un-neutralized tubes.

AL-811H
$949
Suggested Retail
4-Tubes, 800 Watts

AL-811
$799
Suggested Retail
3-Tubes, 600 Watts

You get a quiet desktop linear that's so compact it'll slide right into your operating position -- you'll hardly know it's there . . . until QRM sets in. And you can conveniently plug it into your nearest 120 VAC outlet -- no special wiring needed.

You get all HF band coverage (with license) -- including WARC and most MARS bands at 100% rated output. Ameritron's *Adapt-A-Volt*™ hi-silicon core power transformer has a special buck-boost winding that lets you compensate for high/low power line voltages.

You also get efficient full size heavy duty tank coils, slug tuned input coils, operate/standby switch, transmit LED, ALC, dual illuminated meters, QSK with optional QSK-5, pressurized cooling that you can hardly hear, full height computer grade filter capacitors and more. 13¾Wx8Hx16D inches.

AL-811, $799. Like AL-811H, but has three 811A tubes and 600 Watts output.

AMERITRON *no tune* Solid State Amplifiers

ALS-500M 500 Watt Mobile Amp

ALS-500M
$899
Suggested Retail

500 Watts
PEP/400W CW output, 1.5-22 MHz, instant bandswitching, no tuning, no warm-up. SWR, load fault, thermal overload protected. On/Off/Bypass switch. Re-mote on/off control. DC current meter. Ex-tremely quiet fan. 13.8 VDC. 9Wx3½Hx15D in., 7 lbs. **ALS-500RC, $49,** Remote Head.

ALS-600 Station 600 Watt FET Amp

ALS-600
$1499
Suggested Retail

***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. switching power supply.

Desktop Kilowatt Amplifier

AL-80B
$1495
Suggested Retail

Whisper quiet *desktop* amp plugs into 120 VAC to give *full* kilowatt SSB PEP output. Ameritron's exclusive *DynamicALC*™ doubles average SSB power out and *Instantaneous RF Bias*™ gives cooler operation. All HF bands. 850 Watts CW out, 500 Watts RTTY out, extra heavy duty power supply, 3-500G tube, 70% efficiency, tuned input, Pi/Pi-L output, inrush current protection, dual Cross-Needle meters, QSK compatible, 48 lbs. 14Wx8½Hx15½D in. **Two-year warranty.**

ALS-1300 Solid State 1200 Watt Amp

ALS-1300
$2899
Suggested Retail

Ameritron's *highest power* solid state FET no-tune amplifier gives you instant bandswitching, no tuning, no warm-up, no tubes to baby and no fuss! Outstanding reliability is insured by using eight rugged MRF-150 power FET's mounted on the dual heavy duty heat sink. Run up to 1200 Watts of clean SSB output power (just 100 Watts drive gives full rated power) for continuous coverage between 1.5-22 MHz. Compact 10Wx6½Hx18D in.

Near Legal Limit ™ Amplifier

AL-572
$1795
Suggested Retail

New class of *Near Legal Limit*™ amplifier gives you 1300 Watt PEP SSB power output for *60%* of price of a full legal limit amp! 4 rugged 572B tubes. Instant 3-second warm-up, plugs into 120 VAC. Compact 14½Wx 8½Hx15½D inches fits on desktop. 160-15 Meters. 1000 Watt CW output. Tuned input, instantaneous RF Bias, dynamic ALC, parasitic killer, inrush protection, two lighted cross-needle meters, multi-voltage transformer.

HF Amps with Eimac *3CX800A7*

Suggested Retail

AL-800
$2595
1 *Eimac*(R) tube, 1250 W

AL-800H
$3895
2 *Eimac*(R) tubes, 1.5 kW *Plus With Imported Tube*

AL-800F, $1995
AL-800HF, $2745

These *compact* desktop amplifiers with 3CX800A7 tubes cover 160-15 Meters including WARC bands. Adjustable slug tuned input circuit, grid protection, front panel ALC control, vernier reduction drives, heavy duty 32 lb. silicone steel core transformer, high capacitance computer grade filter capacitors. Multi-voltage operation, dual lighted cross-needle meters. 14¼Wx8½Hx16½D in.

AMERITRON *full legal limit* amplifiers

AMERITRON legal limit amps use a super heavy duty Peter Dahl Hypersil(R) power transformer capable of 2.5 kW!

Most powerful -- *3CX1500/8877*

AL-1500
$3795
Eimac(R) Tube

AL-1500F
$3195
Imported tube

Suggested Retail

Ameritron's *most powerful* amplifier uses the herculean 3CX1500/8877 ceramic tube. 65 watts drive gives you full legal output -- it's just loafing with a 2500 Watts power supply.

Toughest -- *3CX1200A7*

AL-1200
$3459
Suggested Retail

Get ham radio's *toughest* tube with the Ameritron AL-1200 -- the *Eimac*(R) 3CX1200A7. It has a 50 Watt control grid dissipation. What makes the Ameritron AL-1200 stand out from other legal limit amplifiers? The answer: A super heavy duty power supply that loafs at full legal power -- it can deliver the power of more than 2500 Watts PEP two tone output for a half hour.

Classic -- *Dual 3-500Gs*

AL-82
$2745
Suggested Retail

This linear gives you full legal output using a *pair* of *genuine* 3-500Gs. Competing linears using 3-500Gs *can't* give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential.

Call your dealer for your best price!

Ameritron *brings you the finest high power accessories!*

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

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

ADL-1500 Dummy Load with oil . . . $74.95

Oil-cooled. 50 Ohms. 1500 Watts/5 minutes. SWR< 1.2 to 30 MHz. Low SWR to 400 MHz.

ADL-2500 fan-cooled Dry Dummy Load, $209.95

Whisper quiet fan, 2.5kW/1 minute on, ten off. 300W continuous. SWR< 1.25 to 30 MHz.<1.4 to 60 MHz.

ATP-100 Tuning Pulser . . . $69.95

Safely tune up for full power, best linearity. Prevents overheating, tube damage, power supply stress, component failure.

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!

PowerMaster II

- New Larger, Sharp & Fast LCD Display
- Reduced Energy consumption
- USB and RS-232 interface built-in
- Best accuracy in the ham radio market
- New - Both 3kW and 10kW couplers on one display - switched
- Supports 2 like couplers simultaneously (3kW & 3kW, 3kW & V/UHF, 10kW & 10kW)
- SWR Threshold Protection (with amp PTT bypass)
- Hi / Lo Power Level Monitoring
- Single and Dual Rack Mount available
- New "Power Master Basic" Software - Free!

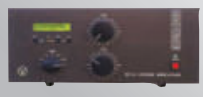
AIM *uhf* Analyzer

- Frequency range from 5 kHz to 1 GHz.
- Data plots include SWR, RL, R + X, series and parallel, magnitude, phase, and more.
- Dual Smith charts with rotation and 20 markers.
- Plots and calibration files can be saved and used anytime in CVS and dynamic formats.
- AIM 4170C is still in production covering 5kHz to 180 MHz.
- New TDR functionality

ACOM – Outstanding HF Power Products

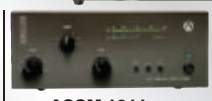
ACOM 2000A

The ACOM 2000A Automatic HF Linear Amplifier is the world's most advanced legal-limit HF amplifier designed for amateur use. (160 thru 10m) (2x 4CX800A Tubes)

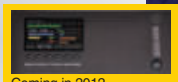


ACOM 1000
160-6m Amplifier
The world's best value in an amateur HF & 6m amplifier. Delivers 1000 watts output on all bands
(Single 4CX800A tube)

ACOM 1010
160-10m Amplifier
Economical 800 watt output 160-10m
(Single 4CX800A Tube)



ACOM 1011
160-10m Amplifier
Fast 30 second warm-up, 700 w output, 160-10m.
(2x 4CX250B Tubes)



Coming in 2012 ..
ACOM 800S Solid State Amplifier
160 through 6 M, 800 W from 1.8 to 54 MHz, no time limit
This Device has NOT been approved by the F.C.C. and my not be offered for sale or lease until approval of the F.C.C. has been obtained.
The information shown is preliminary and may be subject to change without notice or obligation.

OptiBeam
We are proud to be the Official North American Dealer of OptiBeam Antenna Technologies

OptiBeam Antennas

OptiBeam antennas are the best antennas you can buy. Whether it is an array of mono-banders or a multi-monobander antenna, you will more likely be first through a pileup with an OptiBeam. An OptiBeam is...

- Antenna Technology
- Technical Qualities
- Electrical Properties
- Mechanical Quality Throughout
- Physical Properties
- Avoiding Disadvantages of Other Antenna Systems

RigExpert AA-1000 Antenna Analyzer

NEW!

RigExpert AA-1000 is a powerful antenna analyzer designed for testing, checking, tuning or repairing antennas and antenna feedlines.

Vector Network Analyzer Model VNA 2180

Measures impedance magnitude, phase and transmission parameters for antennas, filters, and discrete components - using one or two ports.

- Frequency range is 5KHz to 180MHz.
- Data plots include: impedance, SWR, return loss, S11 and S21.
- Plots can be saved for before and after comparisons.
- New TDR functionality

AIM 4170C Antenna Lab RF Analyzer

The AIM 4170C antenna analyzer measures the complex impedance (magnitude and phase) at each frequency of interest in the range of 5KHz to 180 MHz. A PC is used to calculate all RF parameters, including R +/-X, Magnitude and Phase, SWR, Return Loss, line loss, and more and plot the results in an easy to read graph and interactive Smith Chart.

- New TDR functionality

Other Quality Products from Array Solutions...

ACOM
Sales and Service for Amplifiers and Accessories

Phillystran, Inc.
Official Worldwide Phillystran Distributor

RigExpert
Analyzers and Interfaces

Prosistel Rotators
Strongest Rotators on the Market

OptiBeam Antennas
German Engineering means High Performance

Hofi®
Surge Arrestors & Antenna Switches

SSB Electronics
VHF, UHF, & SHF Preamps and Switching Systems

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.

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®

Elecraft is a registered trademark of Elecraft, Inc.

www.elecraft.com • 831-763-4211

P.O. Box 69, Aptos, California 95001-0069

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

Navy MARS Day Out

Al Zuck, KJ7UI

I am a member of Navy Marine Corps MARS. In order to foster emergency portable operation, on March 19, 2011 MARS held an exercise called MARS Day Out where stations operate portable in the field for a day.

I wanted to participate but needed a location. I had found a website listing past naval communication stations and discovered that one of the bigger shore stations on the West Coast was located on Bainbridge Island, Washington. Further research revealed another station located nearby on an old Army Coast Artillery Post, an intelligence intercept receiving station established about 1939. It was top secret and used the guise of a code school to cover its mission of gathering intelligence from Japanese fleet transmissions and embassy communications.

Al Zuck, NNNØLDI/KJ7UI, in front of Building 11 Station "S" and Parade Grounds.
[KEN GIBSON, NNNØHWY/N7ELF]

Our operating position located inside the van.

Station "Sail," shortened to "S," was also the main net control for a network of High Frequency Direction Finding (HFDF) or Huff Duff stations on the West Coast and around the Pacific. Network stations would get a bearing on radio transmissions from Japanese vessels, send them to "S" where the transmitting vessel was pinpointed. Ultimately, the intercepts and positions were sent to Washington, DC by a teletype circuit.

With the escalation of Japanese expansion throughout Asia and the Pacific, US interest in Japanese intelligence grew. Testing showed that the Bainbridge Island site worked well for that purpose and it was transferred to the Navy in 1939. Rhombic antennas were erected and the PX building was converted to house the receiving intercept station. A code school was started as a cover for its intelligence mission. It intercepted instructions for ending talks with the US, plans to announce war to its embassy and attack plans for what would become Pearl Harbor.

Bainbridge Island/P

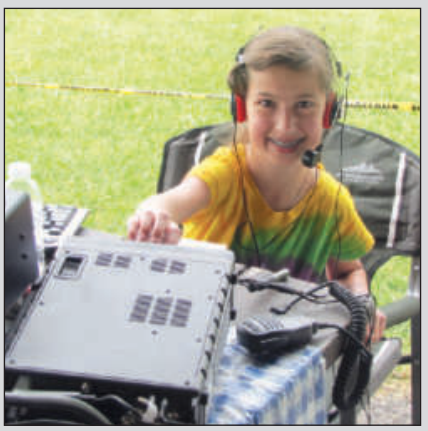
With the approval of the park staff, I decided to operate from the World War II Naval Radio Transmitting Station site, now Battle Point Park. The Station had a very extensive antenna system consisting of four 300 foot towers and one 800 foot tower.

I met my friend and Navy MARS member Ken Gibson, N7ELF/NNNØHWY, and his son Colin and we headed to Bainbridge Island. We set up a 4000 W generator and my ICOM IC-706 transceiver with a computer and SignaLink USB interface for MT63 1K, a staple Navy MARS mode. I set up a new ICOM AH4 tuner to an end-fed wire antenna. This worked on the lower bands but for more long-distance contacts we used Ken's portable vertical with a tapped loading coil and an ICOM AT-180 tuner. We worked quite a few MARS stations but more importantly, we got to test my portable setup.

Ken Gibson, NNNØHWY/N7ELF, erecting his vertical for the higher bands.

We took a few pictures and headed home having enjoyed a great day of operating from the field. We had seen what caught my interest the most, the historic Navy Intercept Station "S" and Navy Radio Transmitter Station at Bainbridge Island. Someday I will go back and explore the old Coast Artillery portion of Fort Ward State Park.

Photos by Al Zuck, KJ7UI, except as noted.



One of last year's best: At Field Day 2011, a newly licensed ham has just made her first contact.
[FRED HERBS, WB2PEM]

Enter the 7th Annual Photo Contest

Have you ever wanted to see a photo of yours in *QST*, the annual ARRL Amateur Radio Calendar or another ARRL publication? Well, here's your chance!

If you're among the winners, not only will your photographic skill be propagated far and wide, but we're offering $100 as the First Prize. The winning photo and three runners-up will be published in *QST*. All submitted photos will also be considered for the 2013 ARRL Calendar. For this purpose, landscape format is preferred.

Deadline: Photos must be received at ARRL HQ by May 31, 2012.

Subject: Must be directly related to Amateur Radio, and be in good taste. Extra points will be awarded for photos showing ***a unique or enjoyable club activity***. Photos will be judged on overall quality and composition.

Requirements: Digital images or color prints accepted. (A digital image printed on photo paper doesn't usually work as well as a high-resolution file attachment to an e-mail message, however.) A digital image up to 8 MB in size can be e-mailed to **upfront@arrl.org**, subject line "2012 Photo Contest." An image may also be burned to a CD and mailed to ARRL Photo Contest, 225 Main St, Newington, CT 06111. All entries must include caption information describing where the photo was taken, along with a description of the subject of the photo as well as the names and call signs of any persons shown. If you entered last year's contest, please do not resend the same photo for this year's contest. One entry per person.

Miscellaneous: All decisions of the judges, composed of *QST* editorial and production staff, are final.

ABR Industries · 8561 Rayson Rd. Ste A · Houston, TX 77080
www.abrind.com · 713-492-2722

Do You Want Your Station Operating at Peak Performance?

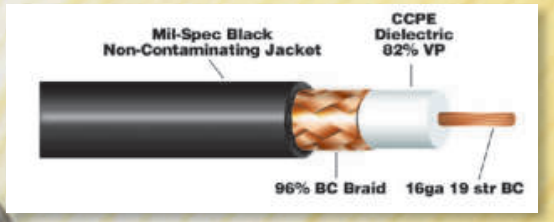
Buying lower quality (translation: lower cost) coax, connectors and other items you need to make your station work may seem like a good idea at the time. After all, they're not the most expensive part of your station. but make no mistake, they are critical components. And not buying high quality components will cost you. Maybe not in dollars but in transmission and reception loss—especially at VHF and higher.

— Not All Cable Assemblies are Created Equal... See the ABR Difference. —

2213A RG213/U MIL-SPEC
Non-contaminating Direct-Burial Ultra-Violet Resistant Jacket.
W/SILVER-TEFLON PL259 & WEATHERPROOF HST each end.

Attenuation per 100ft	Power Rating	Efficiency%
• 0.6dB @ 10MHz	3.43kW	87%
• 1.0dB @ 30MHz	1.95kW	79%
• 1.4dB @ 50MHz	1.5kW	73%

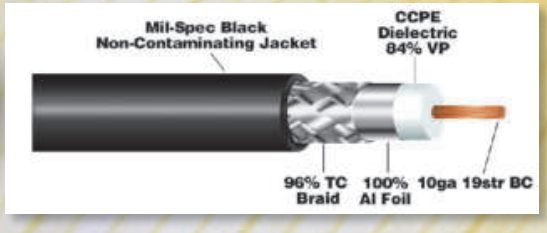
Part #	Length/Ft	Price/ea
2213A-PL-3	3	$11.95
2213A-PL-6	6	$14.95
2213A-PL-50	50	$57.95
2213A-PL-75	75	$80.95
2213A-PL-100	100	$99.95
2213A-PL-150	150	$144.95



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

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

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



25400F 400-FLEX (RG8/U TYPE) FLEXIBLE LOW LOSS
Non-contaminating Direct-Burial Ultra-Violet Resistant Jacket.
W/SILVER-TEFLON PL259 & WEATHERPROOF HST each end.

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

Part #	Length/Ft	Price/ea
25400F-PL-3	3	$11.95
25400F-PL-6	6	$14.95
25400F-PL-18	18	$26.95
25400F-PL-35	35	$43.95
25400F-PL-50	50	$58.95
25400F-PL-75	75	$83.95
25400F-PL-100	100	$100.95
25400F-PL-150	150	$158.95

Prices subject to change without notice or obligation.

VISA DISCOVER

Free Shipping
on Orders of $75.00 or more!

Made in USA

Follow us on Twitter #abrind

ABR INDUSTRIES™
American Built & Reliable

Are you ready for Mother Nature?

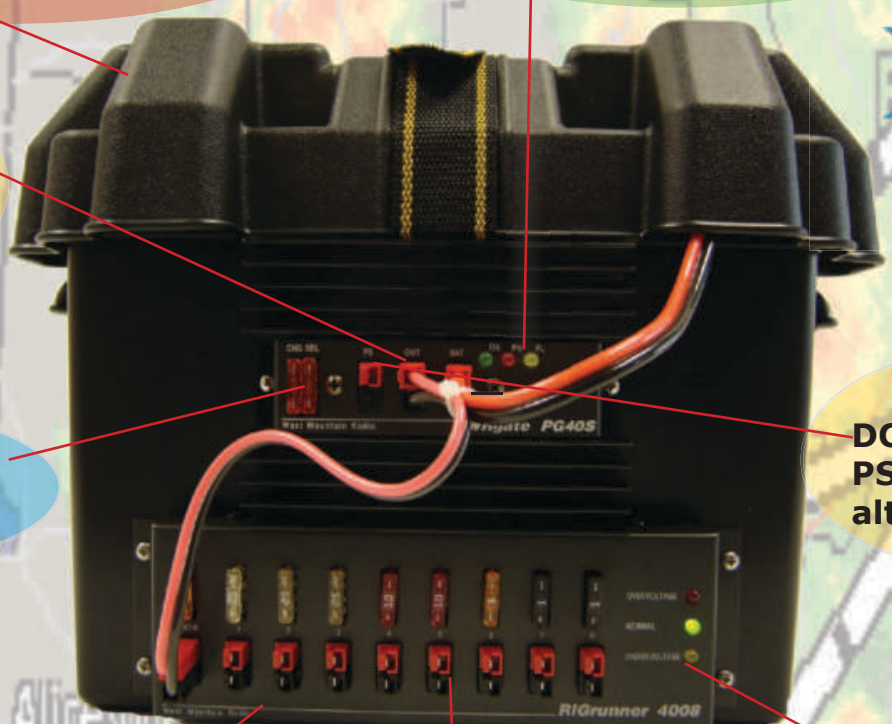
Tough ABYC spec Battery Box for Group 24 AGM or Gell Cells

PWRgate PG40S 4 Stage Smart Charger with Float

Special Offer $249.95

Individual Product-
DC to Go $134.95
PG40S $139.95

Instant Switch-over to Battery on Loss of AC Line Voltage



Adjustable charge rate up to 10A

DC Input from PSU or vehicle alternator

ARES Standard Anderson Powerpoles®

8 Fused Outlets 40 A Max

Low voltage LED & Buzzer indicates Over Discharge

PSU/Alternator must provide 14.5V dc to fully charge AGM batteries

TEN-TEC Makes Radio More Fun

- You can't work 'em if you can't hear 'em – TEN-TEC rigs feature legendary receiver performance.

TEN-TEC EAGLE
Advanced Signal Reception™
Beats Rigs Costing Thousands More

- TEN-TEC means outstanding audio on both receive and transmit.

TEN-TEC OMNI VII
Easy-to-Use, Most Internet-ready HF

- You deserve superior service and support. TEN-TEC owners talk directly with hams who design, build and service their radios.
- TEN-TEC radios are easy to use and don't compromise on features or performance.

TEN-TEC ORION II
Highest-Performance,
Customizable DSP transceiver

You deserve great value. Save money – buy TEN-TEC factory-direct.
Building world-class radios in Sevierville, Tennessee since 1968.

RISK-FREE: 30-day Money-Back Guarantee. Try it in your shack, using your antennas.
Ask your friends how your new TEN-TEC sounds. Don't like your new radio?
Just send it back. No restocking fee. Financing available.

We've updated our Website!
Check us out – www.tentec.com

TEN-TEC

1185 Dolly Parton Pkwy., Sevierville, TN 37862. Sales: (800) 833-7373, sales@tentec.com. Office: (865) 453-7172. FAX: (865) 428-4483.
Service: (865) 428-0364, service@tentec.com M-F 8 AM-5 PM (Eastern Time). We accept Visa, MC, American Express and Discover.
All TEN-TEC radios come with our 30-day money-back guarantee.

qst@arrl.org

Letters from Our Members

A Meeting of the Minds

Was it just coincidence that the two letters — one from Alan Swinger, K9MBQ ["Grooming Quality Hams," Feb 2012, page 24] and the other from Bo Budinger, WA1QYM ["Cluing in the Clubs"] — appeared in the same issue?

I agree with Alan that the increased numbers in the amateur ranks is a very good thing; however requiring a demonstration of operating skill before you can upgrade, not so much. First, who would deem what is "good operating"? Second, passing another test no more guarantees good operating skills than getting your driver's license guarantees you have good driving skills. Good skills come from guidance and experience. Bo presents a valid observation on the "graying" and loss of membership in many Amateur Radio clubs.

Let's see, we have one group looking for Guidance and Experience, and another Full of Experience looking for Youth and Enthusiasm. Cue the local radio club! This sounds like a good fit to me. And it's a natural. There is a good chance these new or inexperienced hams came through a local radio club's classes.

So what happens to them *after* they get their license? Do we say "Congratulations!" and move on to the next group? Or do we make an active effort to engage these new people into the club? You need people; they need your knowledge and experience. Make the effort to engage them, invite new licensees and non-member hams to your meetings and Field Day. Get them involved. Help them get on the air, and teach them how to operate. We all learn best from doing. You want hams with good operating skills on air, so do they. Show them how it all works and teach them. Remember the thrill of your First DX Contact, or your road to the DXCC Honor Roll? Pass it on! Share your stories and experiences. While you help them with their "first contact jitters," they just might introduce you to a new mode or be willing and able to help you with that antenna project you've needed a hand for.

Michael Haack, WB9B
Villa Park, Illinois

Let's Hear it for Good Ears!

Over the weekend of January 15, I enjoyed working QRP in the North American QSO Party (NAQP). In more than 40 instances, I completed a QSO on the very first call. I even reduced the power to 0.1 W on several occasions and still got through to stations in North Dakota and New Brunswick from my Florida station.

During non-contest days, a QRP station can try many times to answer a CQ and not be recognized. So what's the difference? It seems that while working to improve station efficiency — such as better transmission lines or a better antenna system — it is the grey matter between the other op's ears that really makes the difference. During a contest, many of those on-the-air are seasoned contesters and all have the incentive to pull in even the weakest of signals.

I would like to take this opportunity to thank all those ops who take the time to pull in our tiny QRP signals. We can only go so far to enhance what goes out over the air, but even the weakest mW signal can be heard thousands of miles away. It all depends on you! A great QRP contact is not a victory just for the QRP op, but far more for the ham on the receiving end who has great ears.

Dennis Lazar, W4DNN
Port Charlotte, Florida

Digitally Speaking

After viewing the column by ARRL Chief Operating Officer Harold Kramer, WJ1B ["Inside HQ: Changes Are Coming to *QST*," Mar 2012, page 13], I have a question: Why are you spending ARRL resources on a digital edition of *QST* when it is not necessary, just because it can be done? Because I am computer literate does not mean that I want to convert everything to digital mode — and I am not willing to do so with this or the many other publications that have lined my shelves over the years.

Robert D. Vitullo, K9TWK
Arlington Heights, Illinois

***Harold Kramer, WJ1B, responds**: We have no plans to eliminate the print edition of* QST. *We are creating the digital edition primarily for the ability to expand the print content and the multimedia content. This would include being able to publish expanded articles that we now put on our website. We are also offering the digital version for those members who do not or cannot receive* QST *on a timely basis, such as our international members. And for those members who prefer to receive only the digital edition, we will offer them the choice to opt-out of the print edition.*

Communicating to the Max

We who have studied and enjoyed ham radio with both CW and SSB for many years are now losing the dignity of the Amateur Extra class license, which carries with it the highest mark of ham radio licensing. We haveenjoyed the hobby with CW capabilities and know the power of CW communications over SSB when conditions dictate. But now that Morse code is not required for this highest class of license, we are denied the dignity of holding the most prestigious license class, which should be reserved for only those who can utilize all forms of communications of the hobby.

As an alternative, perhaps we can set the highest Amateur Radio class license to be Maximum Communicator or something similar, and automatically change the class of those Extra class hams before the beginning of no-code licensing to MaxCom class. Then, if an Extra class ham without examination credit for Morse code wants to learn the code and reach the top, he or she can apply to the ARRL and be tested at 20 words per minute for the MaxCom class. In this scenario, examination would be administered only by licensed volunteers of the ARRL. That would relieve FCC from having to be bothered with code testing. Hopefully, we can band together to preserve a unique class that is at the top and requires proof of ability to qualify for such standing.

Ted Jefferies, ND4K
ARRL Life Member
Inglis, Florida

Mixed Signals

I would like to point out that the premise made by Bruce Prior, N7RR, is faulty ["Op-Ed: CS — A New Signal Reporting System," Feb 2012, page 77]. Good amateur operating procedures preclude any need to change; the current signal reporting system functions well, if used properly.

If I give you a 5×9 signal report, this should convey to you that your transmission is perfectly readable and that your signal is very strong. If, on the other hand, I give you a 2×2, it should be clear to you that your readability is very poor and so is your signal.

A good operator should understand this has little to do with actual S-meter readings, unless I also, for example, note a +20 at the end of your 5×9. Only in such a case is an actual meter reading involved. It should be pointed out that all meter readings are subjective, as would the meter-based system suggested by Prior. I think it is inaccurate to say that the RST system is based on a meter reading, as the author suggested.

David Grimes, KI4NVK
Jacksonville, Florida

Send your letters via e-mail to qst@arrl.org. You can also submit letters by fax at 860-594-0259, or by postal mail to ARRL, 225 Main St, Newington, CT 06111. 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.

Download Your Next Radio From FlexRadio Systems

New RF Tracking Notch Filter Provides Revolutionary Capability!

Tracking Notch Filter™ (TNF)

FlexRadio Systems has developed a revolutionary new tool in the never ending fight against foreign broadcast carriers, "birdies", narrowband noise sources, and local shack interference: Infinitely adjustable RF Tracking Notch Filters. TNF gives the FlexRadio user the ability to have up to 18 frequency locked notches active in the receiver passband at the same time and the ability to memorize any number of notches across all bands. This includes the MultiRX™ mode second audio passband plus the FLEX-5000's RX2 second receiver.

How TNF Works

Since FlexRadio Systems' Software Defined Radios (SDRs) are based on software and digital signal processing, the math to create a single fixed audio notch such as "Automatic" notch filters (ANF) is a very simple process. Even fixed DSP radios can do this today. The challenge comes when the radio is tuned to keep a notch tracking the desired frequency. FlexRadio approached this from a different angle by developing a mathematical method to change the IF frequency of the notch as the radio is tuned in real time. Because this method is done in the digital SDR domain away from any analog component variations, notch tracking and repeatability problems are virtually eliminated. Best of all, if one tracking notch filter can be created, it's straightforward to create as many as needed. The result is a virtually unlimited number of stable, frequency locked, tracking notch filters.

How to Use TNF

The reason TNF works so well is the intuitive graphical user interface for adding, adjusting, and deleting TNF notches. TNF notches are added with a click of the mouse then dragged over the offending signal. A visual TNF ZOOM - TUNE mode allows for precise positioning and bandwidth control of the TNF notch. This combined with instant audio feedback allows you to optimize each TNF to remove just the offender while leaving your wanted signal in the passband. If the offending carrier is too strong for a NORMAL notch, right click the TNF notch and set it to DEEP or VERY DEEP to remove even the strongest interfering signals. When the TNF notch is properly adjusted you can easily make the TNF permanent. Tune away and come back, the TNF notch is there. Change bands and come back, TNF is on the frequency where you need it. You can even power down the radio and come back next week. Still there!

When to Use TNF

Some examples of when to use TNF are to remove constant DSL and environmentally generated birdies. Or spend a few minutes on 40 meters to magically remove those annoying AM carriers that appear across the band. Additionally, you can use TNF to temporarily block strong adjacent CW and digital signals.

Remember, you can only get TNF on PowerSDR™ for FlexRadio Systems products. To learn more check out our whitepaper or watch the TNF YouTube™ video. You can find these at http://www.flexradio.com/TNF.

Note to FlexRadio Owners

To download the revolutionary TNF feature for your FLEX-Series radio today, just visit www.flexradio.com for the latest version of PowerSDR™.

If you are not yet a FlexRadio owner, check out TNF and all the other revolutionary features that make the FlexRadio Systems SDRs the most amazing radios on the air!

4616 W. Howard Lane, Ste. 1-150, Austin, TX 78728
sales@flexradio.com / 512-535-4713
--
www.flexradio.com

FlexRadio Systems®
Software Defined Radios

High Sierra

www.hamcq.com

Our secure online ordering gives you updates via email, notification of shipment, tracking numbers and lower prices.

Now More than 625 Products on the Website!

Kontester's Keyboard

Neat little keyboard with full size keys.
It is just 11 by 4.75 by .25 inches.
Regular $30
Online Sale $19.73

Andy Crimp Pro Deluxe Tool Set

The Best Powerpole and Coax Connector Crimp Set
The only professional tool set for most Powerpole, Molex and coax connectors.
Regular Separate $275
Online Sale $129.73

Andy Crimp Pro

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

Slingshot Antenna Launcher

With wrist support for greater distance
Regular Price $15
Online Sale $5.55

Slip...*NOT!!* Rope Tensioner

Regular Price $15
Online Sale $4.44

PL259 Silver & Gold Teflon Insulator

The Best Quality for RG213, RG8 and LMR400
Regular Price $3.50
Online Sale $2.50

SO239 Silver Plated Teflon Insulator

The Best Quality
Regular Price $3.50
Online Sale $2.50

Coax Stripper for RG213, RG8, LMR400

3 Cutting Blades
Regular Price $30.00
Online Sale $15.73

PL259 Crimp Type Silver Plated Teflon Insulator

The Best Quality for RG213, RG8 and LMR400
Regular Price $3.50
Online Sale $2.50

19 Range Digital Multimeter

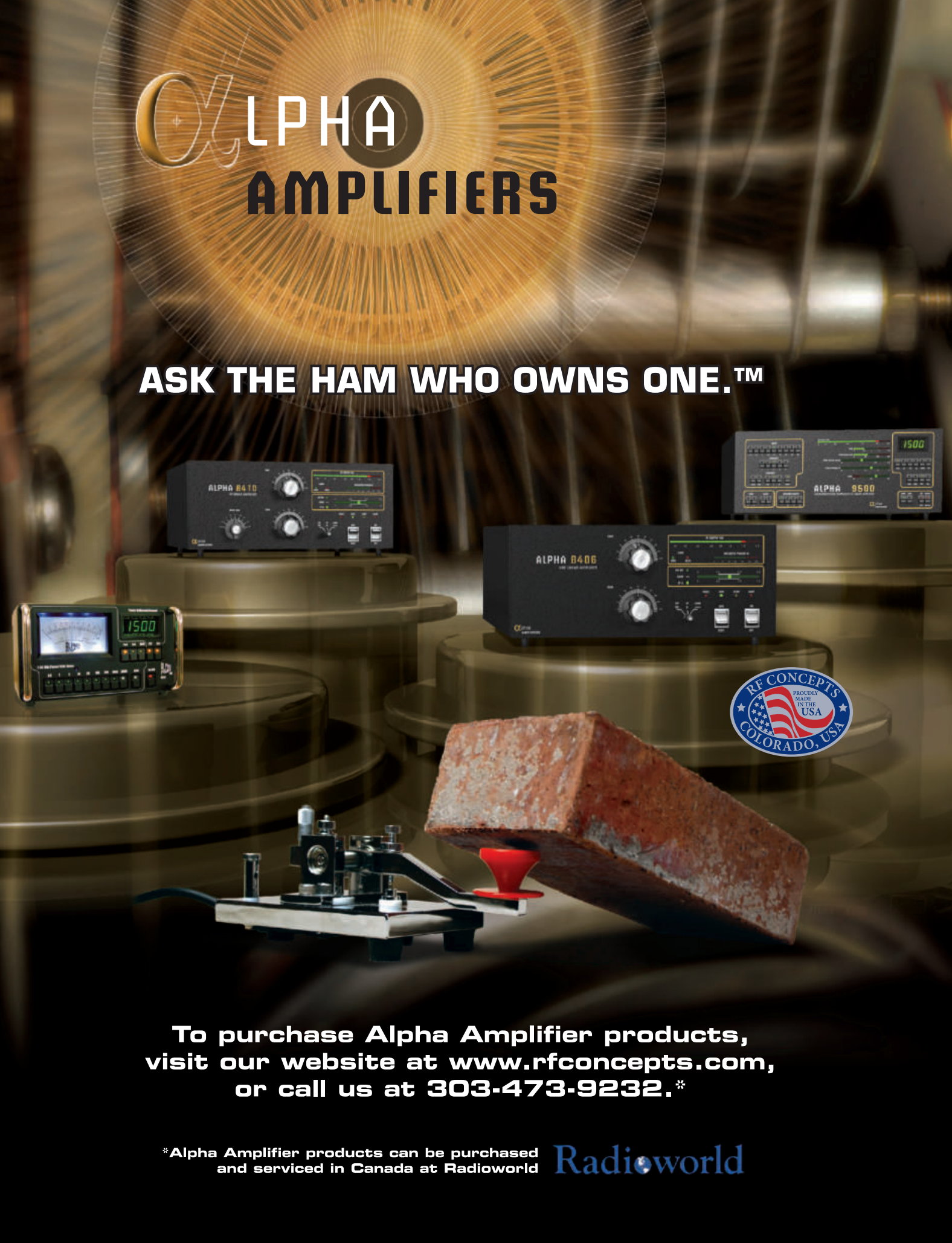
3 1/2 Digit Readout
Details on the Website
Regular Price $12.00
Online Sale $3.73

RG8X Coax

Top Quality
Online Sale
$.35 per Foot

Limited Quantities

SIGN UP for Our Special Deals Club on the Website


ALPHA
AMPLIFIERS
ASK THE HAM WHO OWNS ONE.™
ALPHA 8410
ALPHA 8406
ALPHA 9500
1500
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

Big, Small, or Tall...

Work 'em on the very First Call!

SteppIR

Don't forget to check out our NEW WEBSITE!

www.SteppIR.com

Research Products, Purchase Antennas, Parts and Accessories, Questions Regarding Support, Find out about the very latest Updates from SteppIR!

DB42, 4E Yagi - K7IR (Left)
DB11 Stack - W6JZH (Middle)
BigIR Vertical, VU7LD - Laccadive (Right)

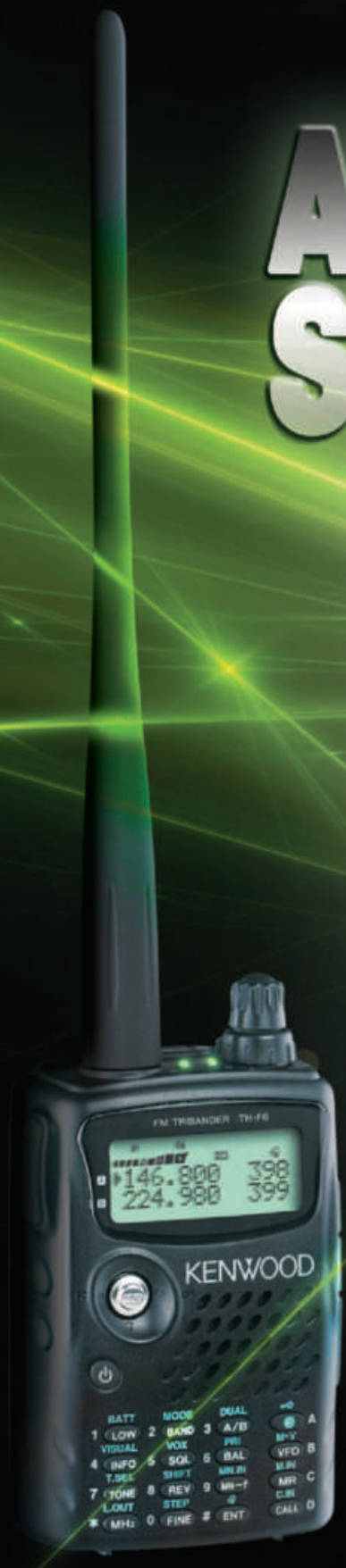
SteppIR
2112 116th Ave NE Suite 1-5
Bellevue, WA 98004
www.steppir.com
Tel: (425) 453-1910 Fax: (425) 462-4415

AIRWAVE SUPERIORITY

Never before has a compact HT offered as many features, and such high powered performance as the TH-F6A. Arm yourself with one today and gain your own airwave superiority.

- Triband 144/220/440 MHz all at 5W
- Receives 2 frequencies simultaneously even on the same band
- 0.1~1300MHz high-frequency range RX (B band)[1]
- FM/FM-W/FM-N/AM plus SSB/CW receive
- Bar antenna for receiving AM broadcasts
- Special weather channel RX mode
- 435 memory channels, multiple scan functions
- 7.4V 2000mAh lithium-ion battery (std.) for high output[2] and extended operation
- 16-key pad plus multi-scroll key for easy operation
- Built-in charging circuitry for battery recharge while the unit operates from a DC supply
- Tough construction: meets MIL-STD 810 C/D/E standards for resistance to vibration, shock, humidity and light rain
- Large frequency display for single-band use
- Automatic simplex checker
- Wireless remote control function
- Battery indicator • Internal VOX • MCP software

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



TH-F6A
TRIBANDER

KENWOOD

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

www.kenwoodusa.com

ISO9001 Registered
Communications Equipment Division
Professional Systems Business Group
JVC KENWOOD Corporation

ADS#52711

Scan with your phone to download TH-F6A brochure.

Radio's Role in the *Titanic* Disaster

It's been 100 years since the most famous maritime disaster of the 20th century — a good time to look back at the heroism of its two radio operators.

Commander Richard Paton, USCGR (Ret)

The *Titanic* disaster took place 100 years ago on April 14 and 15, 1912. On a dark, clear night, with flat calm seas, the ship traveling at 21.5 knots in an area of known hazard, struck an iceberg despite multiple prior warnings (transmitted by radiotelegraphy and Morse lamp) of dangerous ice fields nearby. The ship sank with catastrophic loss of life, notwithstanding ample time (two hours and forty minutes) to gather and evacuate as many passengers as the lifeboats could hold, even given the inadequate number of the boats provided.

That evening, there were 2223 passengers and crew onboard with total lifeboat capacity for only 1178, a mere 53% of the persons onboard. To make matters worse, the lifeboats were launched while filled to only 63% of their rated capacity. Only 712 people survived, 32% of those onboard. One of the two Marconi Company operators survived. Both were recognized as two of the true and worthy heroes of the *Titanic* disaster, but neither was a member of the *Titanic*'s crew.

The Marconi Wireless Telegraph Company, Ltd was a vendor to the White Star Line (and many others). It provided the most advanced and powerful Marconi radio equipment available, along with two operators aboard both the RMS *Olympic* and her sister ship RMS *Titanic*. Harold Bride and John "Jack" Phillips were assigned to the new *Titanic*.

Above: *Titanic* under sail. At 882 feet 9 inches, she was the largest passenger steamship in the world when she left Southampton, England, for New York on April 10, 1912. The 4 wire antenna strung between *Titanic*'s masts can be seen in this photo.
[STEAMSHIP HISTORICAL SOCIETY ARCHIVES, **WWW.SSHSA.ORG**]

More on the Titanic, Phillips and Bride

- John "Jack" Phillips celebrated his 25th birthday on the second day of the ill-fated voyage. It was to be his last.
- The radio equipment operated into a 4 wire antenna suspended between the ship's two masts, some 250 feet above the sea. There was also a battery powered emergency transmitter. [**www.hf.ro**]
- Bride reported later that Phillips had stayed at the key even after Captain Smith had relieved them of duty as the *Titanic* was about to sink. Both of them managed to find lifeboats, but Phillips died of exposure before he could be rescued.
- The final transmission from the *Titanic* read:

C/O SOS SOS CQD CQD – MGY
WE ARE SINKING FAST PASSENGERS
BEING PUT INTO BOATS
MGY
[www.nationalarchives.gov.uk/]

- Once aboard *Carpathia*, despite frost-bitten feet that made it impossible for him to walk, 22 year old Harold Bride worked tirelessly to pass emergency traffic describing the ship's position and the condition of the rescued passengers onboard. [There's more on the *Carpathia*'s role in the disaster in the Vintage Radio column elsewhere in this issue. — *Ed.*]
- A robust congressional investigation in the wake of the disaster led, in part, to the passage of the Radio Act of 1912. Among other things, it mandated that seagoing ships have two radio operators onboard, and that the wireless apparatus be operational continuously.
- Although there is no record of his having held a call sign, rumors persist that Harold Bride was an active ham in Scotland later in life. He died in 1956.

The equipment provided aboard these two ships was far more advanced than the typical Marconi marine installations aboard most merchant ships of the day. The *Olympic*, in service a year before, carried the most advanced equipment, initially a 5.0 kW plain spark installation. Radio equipment on almost all other merchant ships of the day consisted of a less powerful 1.5 kW installation. *Titanic*'s radio equipment, installed by Marconi operators only days before the ill-fated voyage, consisted of a 5.0 kW set with a more advanced synchronous, rotary spark discharger.

Limited Range

Marine installations of the time had very limited ranges, about 250 miles during daylight hours and in *Titanic*'s case up to 2000-plus miles at night. There was heavy reliance on messages being relayed by other ships. *Titanic*'s call sign was MGY, with the M signifying a Marconi Company installation.

The Marconi rooms were located on the boat deck just aft of the bridge and officers' quarters. Two rooms were required, one for

Steamship Historical Society

This article was contributed by The Steamship Historical Society of America, a membership organization serving amateur and professional historians interested in the history and development of steam navigation, past and present. SSHSA members include maritime collectors and artists, current and former crew members, historians and students, genealogists, SCUBA divers, cruise travelers, ship engineers and architects, and maritime history enthusiasts. For more information, visit **www.sshsa.org**.

transmitting and one for receiving. They were connected to the purser's office below by pneumatic tubes in which private messages written by passengers would be received for radio transmission after the appropriate fees were collected by the purser's staff. The rooms consisted of a small office with adjoining sleeping quarters and an adjacent silent room, soundproofed to house the noisy transmitter.

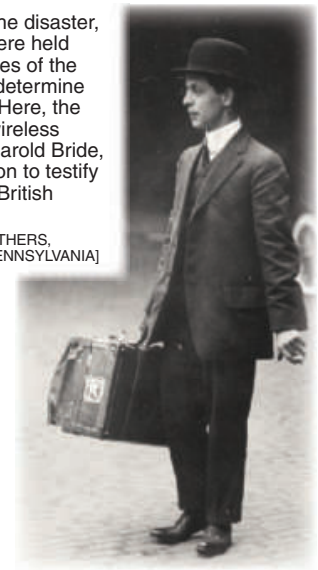
The day of the collision with the iceberg, Sunday, April 14, 1912, the *Titanic*'s radios were out of service for more than seven hours, while Phillips worked tirelessly to repair a burned out and grounded secondary transformer. According to Bride, "The lucky thing was that the wireless broke down early enough for us to fix it. We found a secondary burned out, at last and repaired it just a few hours before the iceberg was struck."[1] The backlog of outgoing messages was overwhelming as the two operators tried to catch up in their transmissions to the Marconi station at Cape Race, Newfoundland.

Incoming message traffic consisted of many ship to ship messages warning of ice fields in the area. These were duly passed to the bridge. A message from the SS *Mesaba* at or about 2140 warning of an enormous ice field directly in *Titanic*'s intended path never reached the bridge due to the backlog of outbound message traffic handled by the Marconi operators. This information was never to reach the ship's officers before the collision two hours later, at 2340. Worse yet, *Titanic*'s actual position (computed after the collision) was some 20 miles in advance of the dead reckoning position. This actual position was the "amended position" transmitted to *Carpathia*, the ship that rescued the survivors.

Carpathia on the Way

In an incredible coincidence, Second Officer Charles Lightoller and Senior Marconi Operator Phillips found themselves on the same upturned collapsible lifeboat. Although Phillips died within hours, he was able to tell Lightoller that the *Carpathia* was on its way to rescue them. He also spoke of the *Mesaba* message, which he admitted to placing under a paperweight at his elbow while in the rush of transmitting the large backlog of messages caused by the earlier failure of the radio equipment. For that reason, it had apparently never been delivered to the bridge.

The controversy exists to this day, as the mystery of the *Mesaba* message continues. Was it received on the bridge or not, and could the disaster have been avoided? The ship's radio communications without question still saved hundreds of lives. What would have happened if the wireless had not been repaired before the sinking?



Following the disaster, inquiries were held on both sides of the Atlantic to determine the cause. Here, the surviving wireless operator, Harold Bride, visits London to testify before the British inquiry.

[BROWN BROTHERS, STERLING, PENNSYLVANIA]

[1]H. Bride, "Thrilling Story by *Titanic*'s Surviving Wireless Man," *The New York Times,* Apr 19, 1912, in Winocour, J., Ed., *The Story of the Titanic as Told by Its Survivors,* New York: Dover Publications, 1960, p 314.

Senior wireless operator John "Jack" Phillips, who died of exposure in an overturned lifeboat following the sinking of RMS *Titanic*.

[BROWN BROTHERS, STERLING, PENNSYLVANIA]

The only known photo of the *Titanic*'s radio room was taken by prolific photographer Father Frank Browne, an Irish priest whose high-quality photos were unearthed in a Dublin basement in 1985. The photo, a ghost image, shows junior operator Harold Bride at the controls.

[THE FATHER BROWNE PHOTOGRAPHIC COLLECTION; USED BY PERMISSION]

Commander Paton is the East Coast Vice President of The Steamship Historical Society of America and a member of the Titanic Historical Society. He served on active duty and as a reserve officer in the Coast Guard as a Marine Inspector, Investigating Officer and Deputy US Shipping Commissioner, Commanding Officer and Reserve Group Commander. He is a graduate of Maine Maritime Academy (BS Marine Engineering) and Rensselaer Polytechnic Institute (MS Engineering Science, MBA) and served as a Merchant Marine Officer. He spent his civilian career in risk management and as an international insurance executive. He is retired but works as an adjunct professor at the University of Connecticut and Ethics Commissioner of the Mohegan Tribe. He has lectured extensively on the *Titanic* Inquiries. He can be reached at **atlanticshipping08@sbcglobal.net**.

Homebrew Challenge III – And the Winner Is...

This was our toughest challenge yet. Still, we had a clear winner and a nice honorable mention — here's a quick summary.

Joel R. Hallas, W1ZR

Our previous challenges have been to build a 5 W PEP 40 meter sideband and CW transceiver (Homebrew Challenge I) and then a 50 W linear amplifier to follow it (Homebrew Challenge II).[1,2] This third challenge moved up the spectrum into frequencies that might be of interest to Technician class amateurs — 10 and 6 meters.[3]

The Challenge

There were two separate entry categories for this challenge — single band or multiband. The single band unit could have been for either 10 or 6 meters and had to output 25 W PEP on SSB and CW with a cost target of $150. The multiband unit had to put out the same power on both bands and be built for under $200 of parts. Each entry category had detailed requirements for receiver and transmitter performance. The FCC requirements for transmitter spurious response of –43 dB on 10 meters and particularly the –60 dB on 6 meters were expected to be tough. The first category had a prize of $200, while the second offered $300.

The FCC requirement for transmitter spurious response of –60 dB on 6 meters was expected to be tough to meet.

The Entrants

While we heard from others who expected to participate, two entriants brought or sent us working transceivers by the November 1, 2011 deadline.

Jim Veatch, WA2EUJ

Jim Veatch, WA2EUJ, is no stranger to this competition, having been a winner in both HBC I and HBC II.[3,4] His current entry (see photo above) is a compact competent transceiver that covers 12 meters as well as 10 and 6 in a professional looking package that offers features well beyond the requirements. Jim made his DSP-610 for a total parts cost of $198.30. This remarkable radio is a dual conversion, downconverting superhet design that uses the latest digital signal processing technology from the second IF on. Bandwidth is selectable in eight steps from 0.4 kHz to 2.4 kHz and tuning is via a DDS synthesizer designed for low phase noise.

Jim elected to make the DSP-610 on a single circuit board (see Figure 1). This arguably makes the development more difficult than had he elected to use a modular approach, but for our readers it makes duplicating the project much easier. Populate the board and fire it up!

Jim was declared the sole winner of HBC III. Congratulations, Jim! A detailed article describing his transceiver will be in an upcoming issue.

[1]Notes appear on page 33.

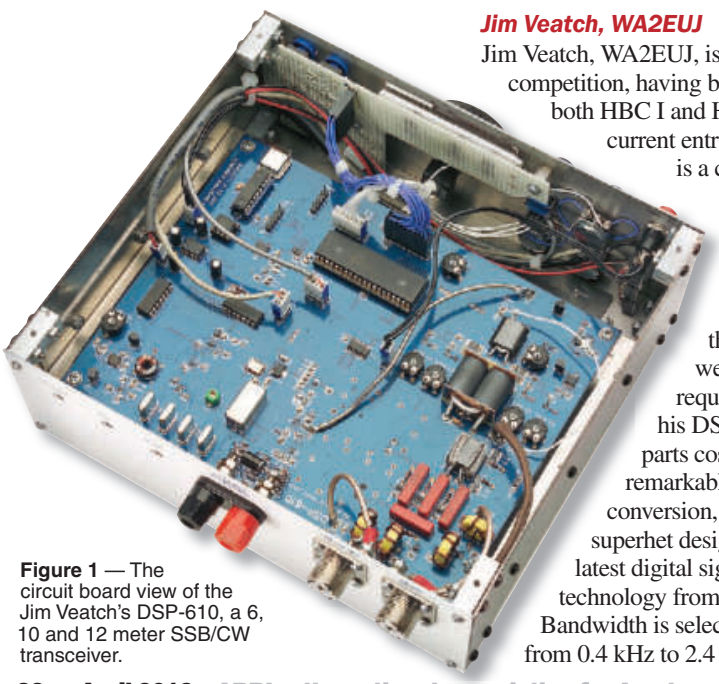


Figure 1 — The circuit board view of the Jim Veatch's DSP-610, a 6, 10 and 12 meter SSB/CW transceiver.

Figure 2 — Greg Charvat, N8ZRY, in the ARRL headquarters lobby with his HBC entry.

Figure 3 — The front panel of Greg Charvat's entry has an appealing retro military look.

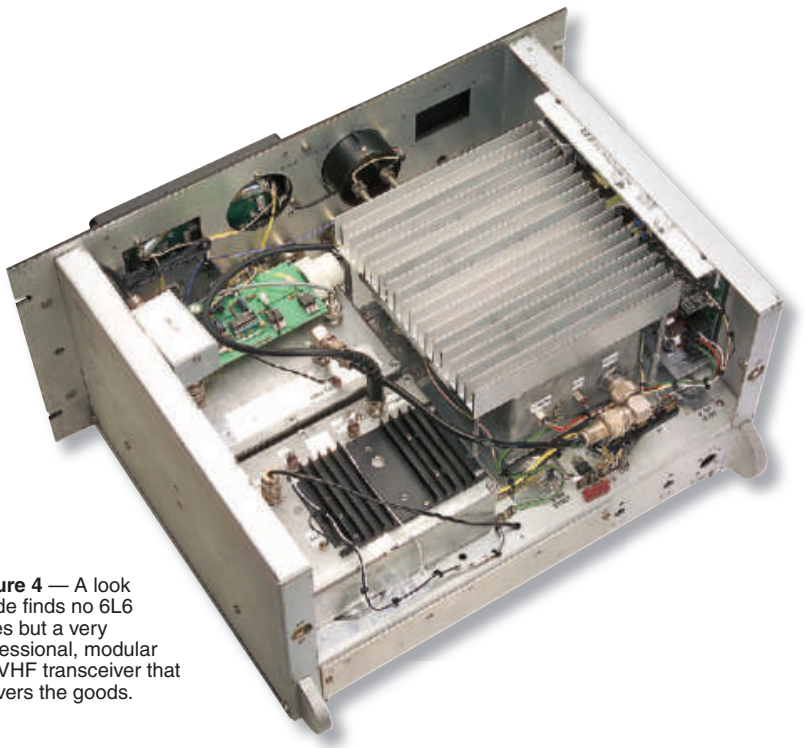


Figure 4 — A look inside finds no 6L6 tubes but a very professional, modular HF/VHF transceiver that delivers the goods.

Greg Charvat, N8ZRY

Unlike Jim, Greg was a new face when he arrived on our doorstep with his entry under his arm (see Figure 2). Greg made a professional quality transceiver that met all requirements except the parts cost limitation. With his background in military radar systems, Greg took a different approach to his development and construction. Greg built his transceiver from modular elements, allowing him to easily work on and finalize one section at a time.

Greg's transceiver is a full size unit with the appearance of retro military gear (see Figure 3). A look inside provides the tipoff that this is not a radio from a WW II bomber, but a modern HF transceiver built using the latest technology (see Figure 4). Greg's design incorporated some design techniques not commonly found in the homebrew community including current feedback op-amps for RF and IF amplifiers, the Si570 PLL IC for the VFO, high performance audio-derived AGC and a modern LDMOS RF power amplifier transistor. His design is capable of operating on all HF and VHF bands just by adding the appropriate filters. The down side of this technology and flexibility was a total parts cost of $543.80, putting his transceiver out of contention for an official award. Still, it is a great transceiver and will result in an Honorable Mention certificate and an article in an upcoming issue of *QST*.

Notes

[1]J. Hallas, W1ZR, "ARRL Homebrew Challenge!" *QST*, Aug 2006, p 20.
[2]J. Hallas, W1ZR, "Announcement — Second ARRL Homebrew Challenge," *QST*, Feb 2009, p 75.
[3]J. Hallas, W1ZR, "Announcing — ARRL Homebrew Challenge III," *QST*, Nov 2010, p 47.
[4]J. Veatch, WA2EUJ, "The TAK-40 SSB CW Transceiver," *QST*, May 2008, pp 33-36.
[5]J. Veatch, WA2EUJ, "A Multiband 50 W Linear Amplifier," *QST*, Aug 2010, pp 35-37.

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

New Products

70 CM ATV Transmitter from KH6HTV Video

◊ KH6HTV Video offers a line of digital and analog ATV transmitters for the 70 cm band. All transmitters use frequency synthesizers and operate on cable TV channels 57 through 61 which cover the amateur 70 cm band. The analog TV transmitters transmit standard definition (480i) NTSC video using the broadcast industry standard, vestigial upper sideband with a 6 MHz channel bandwidth. The digital TV transmitters transmit high definition (720p or 1080i, 16:9) video using the CATV industry standard 64QAM modulation, also with a 6 MHz channel bandwidth. The signals from either the analog or digital transmitters can be received directly on consumer analog/digital TV receivers without requiring a separate converter box. For analog TV, the available RF power output levels are 1, 5, 10 and 25 W PEP. For digital TV, the available powers are 250 mW and 1, 2 and 5 W. For more information, specifications, pricing and application notes, visit **www.kh6htv.com**.

Adventures in Adaptive Mobile Operations

Where you put your antenna is important, but where you put your car may matter more.

Chris Blake, NX4N

The Hook is Set

After being mostly inactive for the past 15 years, the old ham-bug struck fiercely after a visit from contesting friends Doc, N4WW, and Dan, K1TO, who encouraged me over dinner to get active again (see Figure 1). Up went a hidden backyard vertical in my deed-restricted lot along with some attic dipoles.

It was natural that I gravitated back to my first love — contesting — which in turn led to an ad-hoc attempt as a HF rover station in the popular Florida QSO Party (FQP) last April.[1] I had never participated in the FQP before, but even as a casual rover operation with my wife/driver Lili and dog/log-checker Hannah, I was hooked! My FQP mobile station was a hodgepodge of cigarette lighter power, ancient trunk lip mounted Hustler antennas for 40 and 20 meter that supported stationary operation only, a notebook PC and a GPS. It was a family-fun oriented operation — driving country back roads, stopping for breakfast, exploring a state park and then catching a quick lunch before heading home.

Of course, we also had a few stops for Hannah to do her doggie thing and me to operate. From a ham perspective it was a blast! I made several hundred contacts from 11 different counties with plenty of pileups. How could one be such "rare DX" from places like Sarasota County? We thoroughly enjoyed ourselves.

Like all ham-mania, this fun episode led to big dreams of the ultimate mobile station: 40 over S9 pileups by next FQP for a more serious operation. I had a whole year to plan and execute. I also had a secondary reason for a better mobile setup. My commute to work is a long one — 1 hour each way daily, but that pain is largely offset for me as both a driver and a ham by having about half of that commute across beautiful Tampa Bay with salt water on both sides. Imagine — DX and dolphin watching at the same time. That's what really moved this project forward.

Figure 1 — N4WW, NX4N and K1TO enjoying a keylime rotator control.

A Scheme is Hatched

Now properly motivated, I started learning about mobile operations from *The ARRL Handbook* and a simply wonderful website about mobile operations by Alan, KØBG, both of which answered my many basic questions.[2] The last time I was HF mobile I drilled a hole in mom's car to mount the antenna and operated a suitcase size Heathkit HW-100 HF transceiver while she drove, since I was too young to do so. Things have changed a bit indeed!

My 10 year old IC-706 HF/VHF transceiver was the perfect size for mobile operations so my primary focus would be on choosing and optimizing an antenna system. I am, if nothing else, a lazy ham. My daily commute is nearly all highway mileage and I had no intentions of having to pull over and fiddle with the antenna to change bands. Furthermore, I wanted band changes to be smooth and nearly instantaneous — 1 or 2 seconds tops (an important factor for contesting and DXing). My aforementioned laziness also drove the need for easy servicing of the antenna system. Finally I wanted the antenna system to be as efficient as practical,

[1]Notes appear on page 37.

since my busy schedule mandated that I'd be spending a lot more time operating my mobile station than my one at home.

While mulling over my options, one idea that came to mind was to use an automatic antenna tuner. While not the most efficient solution because it is effectively base loading, this option provides several very nice advantages over other solutions:

- They provide nearly instantaneous hands-free antenna matching while changing bands.
- They have a low profile so the antenna element itself constitutes virtually all of the total antenna height and wind load.
- With a decent ground plane in place one can quickly interchange and instantly match a wide variety of antennas on multiple bands without Smith charts, SWR analyzers or other apparatus.

The more I thought about using an automatic antenna tuner the better I liked it. I then devised a practical enhancement: Why not mount the antenna matcher and antenna mount to an aluminum plate that could be removed from the roof of my SUV for easy servicing?

By now my brain was humming with overzealous excitement. I had dreams of 15 meter Japanese pileups responding to my mobile CQs along with a possibility of instant band change to 75 meter SSB to catch Heard Island, all while watching the sunrise on my way to work — ahem, back to reality.

The Endeavor Begins — Vehicle Cut and Paste

Phase I of NX4N/mobile soon materialized over the month of July. With the help of excellent tips from KØBG's website, my antenna system and rig were in place. I mounted an automatic antenna tuner and antenna mount to an 18 × 24 inch hardened aluminum diamond plate. The aluminum plate was then hard bolted to the roof of my Suburban SUV in four places with 2 × ⅝ inch metal spacers, making for a nice removable platform that has low inductance to the roof that serves as the main ground plane. Now, I know that drilling on your vehicle can be a life-altering event (especially for spouses), but if you want the "Big D" (as in dB) in your signal then drilling is the way to go — low inductance, low resistance ground connections really make a difference when using short radiators.

I mounted the plate directly behind and aligned to the driver's seat, and set back to the second row of the vehicle (see Figure 2). I selected this location to:

- Keep the antenna in the center of the road where there are fewer trees and other obstacles,
- Allow the driver to know where the antenna was at all times and
- Enable easy access to the antenna system from the rear left door so antennas could be changed or removed quickly without the need for a ladder.

All mounting hardware was stainless steel. I applied anti-gall compound to ensure easy removal later. Three extra holes were drilled into the roof to mount weatherproof cable grips that routed the matcher control cable, main coax and spare coax lines into the main cabin. There have been no leaks at all after eight months of our notorious Florida afternoon showers.

The SUV was then prepped for mobile operation. The vehicle doors, hood, engine, tailpipe and hatchback were ground strapped (again, helps reduce ground losses) and power wiring was run directly from the battery to the radio, which was placed under the second row seat behind the driver. My initial antenna was a stainless steel 102 inch whip with a spring and brass quick disconnect. After cutting it down a bit to make it street legal in Florida (many states have 13.5 to 14 feet maximum vehicle height), the total height above ground was approximately 13.5 feet. See Figures 3 through 9 for details of the antenna mounting system and radio layouts.

First Results — The Good, the Bad and Not Too Ugly!

Initial results were excellent. First, both transmit and receive signals were quite respectable for a mobile and these results have been confirmed as typical over time. All continents can be worked weekly including regular Australia and New Zealand contacts most morning on 40 meters. I have also worked into Japan and the Philippines on that band. I am confident enough to enter DX pileups and I usually get through (on the day I wrote this I worked TF3Y on 17 meter CW on the fifth call). Europe is downright easy to work on all bands, stations often answering my CQs and I can regularly work the Middle East and Africa as well.

My coolest contact to date — working VK2KM via long path on 20 meters on my

Figure 2 — Top view of mounting. The plate location aligns with second row seats just behind driver seat.

Figure 3 — Mounting service plate that holds the automatic antenna tuner and antenna mount.

Figure 4 — Same mount, different tuner. It took about 45 minutes to swap.

Figure 5 — Close-up of RG-58 entering cabin via waterproof cable grips. Note the application of RTV sealant.

Figure 6 — I nicknamed this antenna experiment My Favorite Martian.

Figure 7 — ICOM IC-706 body and power distribution, located behind the driver under the second row seats of the SUV.

way home the day I wrote this. I'm not much of a low band guy, but I have made a few US contacts on 80 meters. It should be noted that I am primarily a mobile CW operator, so doing this well on phone may not be as easy. That said, I have made my share of phone contacts worldwide with regular success.

The keys to success are antenna mounted as high as possible, radiator as long as possible, and most importantly, solid connections to as big a ground structure as possible. I must also mention that there were a few weeds in my antenna garden. Some minor ignition noise was present but was easily eliminated with the radio's noise blanker. A good spot to mount the IC-706 control panel could not be found for several months and I have not had time to install it, so meanwhile I just place it on the armrest near my paddle.

Overall, I was very pleased with the performance. Do I miss my four element 20 meter Yagi at 100 feet and my legal limit amplifier? Indeed I do, but I am still having a ball with this setup every day. It sure makes the commute more enjoyable.

But Wait — There's More

Phase 2 of NX4N/m evolved over the next several months of regular weekday operating during my commute and was my first foray into what I call *adaptive mobile* operations. Over time I eventually noticed a trend that signals improved when I transitioned from regular land-locked highway to the long Tampa Bay Causeway with salt water on both sides. This got me thinking how I could easily measure the signal difference as the ground beneath the vehicle changed (see lazy comments above).

Luckily I remembered that my friend Chris, WF3C, previously taught me about the ability to monitor one's signal strength from remote spots using **www.ReverseBeacon.net** (see Figure 9 for an example).

This was a new technology since the last time I was active as a ham; what a cool tool! So, I began a two month long experiment each day during my work commutes by calling CQ de NX4N on all bands while on the regular highway, and switching my CQs to NX4N/M while surrounded by salt water. I tried to keep my saltwater vs non-saltwater CQs within 10 to 15 minutes of each other on a given band for a reasonable comparison. At the end of each day I would search **ReverseBeacon.net** for NX4N and NX4N/M and record all the signal levels from the spots. I averaged all of the results collected over time to smooth the many variations of propagation, HF band, vehicle orientation and antenna orientation resulting from vehicle.

My analysis showed a whopping 5 to 6 dB average improvement when I was driving the causeway with saltwater on both sides versus regular highway driving. The results really hit me — this meant I could implement the equivalent of turning on a 400 W amplifier, or adding a Yagi for free, just by driving to better ground conditions near the beach! If you think about it, many of us dream about having a station on saltwater for the same reason — big signals. This has certainly been the case of many portable Caribbean contest expeditions leveraging their beach-mounted antennas with much success.

Now realizing that ground conductivity can also significantly affect mobile stations, I have had some fun experimenting with this on the air. One morning while tooling along my route I found a Japanese station calling CQ on 40 meters. He could just barely hear me call him in the noise and I soon gave up and forgot about him — for about 10 minutes. By then I had entered the saltwater zone with its improved ground conductivity and subsequent signal boost. It took me a couple of calls but now the Japanese station could hear me and could even copy my name, location and signal report. I have done this type of experiment time and again with many different stations on several different bands.

Leveraging the Adaptive Mobile Concept for your Station Site

Finally, Phase 3 of NX4N/m involves improving one's actual antenna radiator depending on the surrounding environment. An opportunity to apply what I had learned on the road revealed itself as I prepared for the November ARRL CW Sweepstakes. I was planning to operate from home for the contest and I decided I needed at least a minimal 80 meter antenna to pick up certain multipliers. Implementing an effective 80 meter antenna on a small, lightly treed, deed restricted lot is just plain no fun. But an easy solution was parked right in my driveway!

I bought several sized extension rods for my

Figure 8 — Paddle and radio remote control panel located on driver's armrest.

Figure 10 — Chris, NX4N, and wife Lili, ready for the Florida QSO Party!

showing spots for DX call: NX4N*
search spot by callsign **search callsign:** DX DE
wildcard * allowed

de	dx	freq	cq/dx	snr	speed	time
VE2WU	NX4N/M	14029.2	CQ	22 dB	24 wpm	2146z 22 Mar
NC7J	NX4N/M	14029.1	CQ	7 dB	24 wpm	2146z 22 Mar
W3LPL	NX4N/M	14029.2	CQ	17 dB	24 wpm	2146z 22 Mar
WZ7I	NX4N/M	14029.2	CQ	32 dB	24 wpm	2146z 22 Mar
NC7I	NX4N/M	21016.6	CQ	8 dB	24 wpm	2143z 22 Mar
W0MU	NX4N/M	21016.6	CQ	11 dB	24 wpm	2143z 22 Mar
WA7LNW	NX4N/M	21016.7	CQ	23 dB	24 wpm	2143z 22 Mar
N6EV	NX4N/M	28019.1	CQ	11 dB	23 wpm	2140z 22 Mar
N7TR	NX4N/M	28019.0	CQ	28 dB	23 wpm	2139z 22 Mar
N7TR	NX4N/M	14024.1	CQ	21 dB	25 wpm	2126z 22 Mar
VE2WU	NX4N/M	14024.2	CQ	29 dB	25 wpm	2126z 22 Mar
N4ZR	NX4N/M	14024.2	CQ	27 dB	25 wpm	2126z 22 Mar

Figure 9 — Example of **www.reversebeacon.net** results.

Hustler mobile antenna mast and soon had a 20 foot stationary vertical mounted on my SUV roof (see Figure 6). Three 66 foot elevated radials were connected to the aluminum mounting plate on the roof to augment the vehicle's ground plane during the weekend and I let the auto antenna tuner perform its matching wizardry. Ta-da! My 80 meter signal during that contest will not go down in history as the K3LR signal of the South but it was good enough for 77 search and pounce contacts including several needed multipliers.

Other adaptive antennas I have either used or thought of trying to enhance my signal include raising or lowering the mounting of my ground plate depending on the quality of the ground, a seawater filled kiddy-pool ground plane in the back of a pickup truck or under a vehicle, tape measures bonded to the aluminum ground plate for instantly deployable elevated radials (especially useful for poor ground), the monster capacitance hat shown in the previous photos (this idea came from KØBG's website) and even installing a full-size quarter-wave 40 meter vertical wire that I supported with a collapsible fiberglass mast ground-mounted adjacent to the vehicle.

While the focus of this article has been on mobile antennas, it is all equally adaptable to portable and fixed antenna systems as well. It's important to understand the strengths and weaknesses of your physical environment and optimize your antenna system to leverage the former and minimize the effects of the latter. I would be delighted to hear from you regarding your own endeavors!

Notes
[1]**www.floridaqsoparty.org**
[2]**www.k0bg.com**

Photos by the author.

ARRL Life Member and Amateur Extra class licensee Chris Blake, NX4N, was first licensed in 1971 as WN4YFF, then WB4YFF and finally NX4N. He holds a BSEE degree from the University of Florida and an MS from the Florida Institute of Technology. As a registered Professional Engineer in Florida, he has worked as both an engineer and manager for Lockheed Martin, Motorola and Honeywell. He holds a US patent.

A native Floridian, Chris is a long-time contest operator at N4WW and especially enjoys CW. While not on the air he enjoys spending family time with his wife, Lili, kids Rod, Chelsea and Doug as well as his brother Matt (his lifelong tower climber). He is a proud member of the Florida Contest Group, Tampa Amateur Radio Club and a former member, assistant Ham-Cation chairman and Field Day chairman for the Orlando Amateur Radio Club. He can be contacted at 19311 Seacove Dr, Lutz, FL 33558 or at **cqdenx4n@gmail.com**.

Level Converter to Allow Full Control of Peripherals by Computer or Radio

Aid in communication within your station as well as to outside.

Eric Keerbs, AD7HM

When I was first licensed in 2005, my primary HF interest was in phone operation. My first station included a handheld VHF/UHF transceiver and an ICOM IC-746PRO HF/VHF transceiver. An external tuner soon followed, and I added portable operation to my list of activities. About 3 years ago, I was given a Rohn 25G tower that I helped to remove from its former installation — on the condition that I would put it to use.

An ensuing change of location (along with the addition of my wife to the Amateur Radio ranks) allowed me to include tower plans into the design of our new home. Over the course of 18 months, from developing the house plans to tower completion, I also acquired a used four element SteppIR HF Yagi antenna, which included the radio interface for control of the antenna elements.

After completing my tower project, everything was working blissfully until I made the fateful decision to expand into digital modes. I added a SignaLink USB sound card interface and *fldigi* software to my equipment list and was ready to join the digital world. As I gained familiarity with *fldigi*, I learned that the software has the ability to both control and read information from my transceiver. This spurred my interested in the idea of having my radio and computer talk to each other. My goal was to have *fldigi* control my radio while I was operating in digital modes and, if I were working on phone on the higher HF bands, the radio would control the SteppIR.

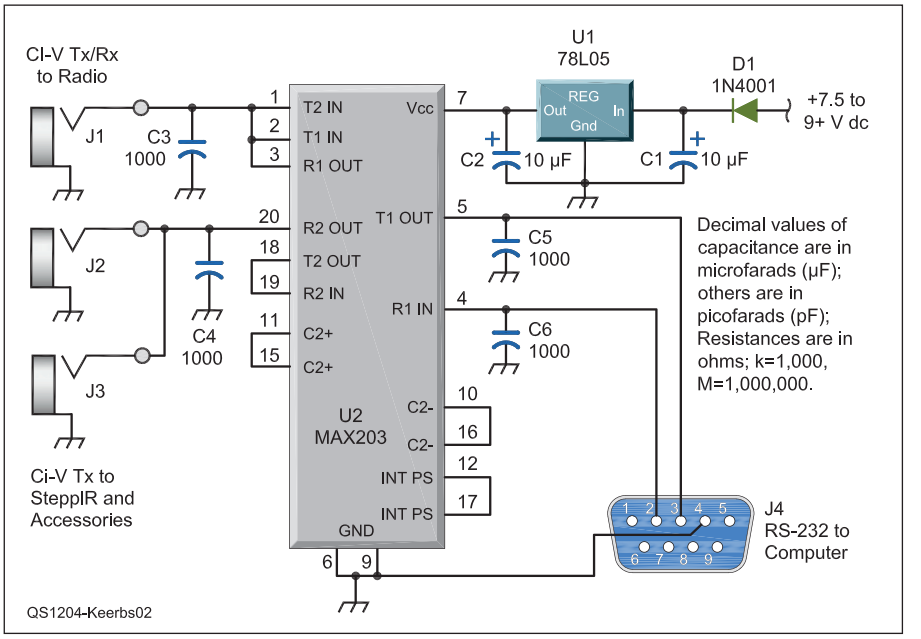


Figure 2 — Schematic diagram and parts list of final version of the interface. Digi-Key parts are available from **www.digikey.com**.

C1, C2 — 10 µF, 16 V electrolytic capacitors (Digi-Key ECA-1CM100 or equivalent).
C3-C6 — 1000 pF, 1 kV disk ceramic capacitors (Digi-Key 445-2725-ND or equivalent).
D1 — 1N4001 diode (Digi-Key 1N4001FSCT-ND or equivalent).
J1-J3 — ⅛ inch mono jacks (Digi-Key SC238-ND or equivalent).
J4 — DB-9 male panel mount connector (RadioShack 276-1537 or equivalent).
U1 — 78L05 voltage regulator (Digi-Key MC78L05ACPFS-ND or equivalent).
U2 — Maxim MAX203 RS-232 level converter (Digi-Key MAX203CPP+G36-ND).
Pair of #4-40 jack screws with hardware (Digi-Key 7231-5K-ND or equivalent).
Experimenter's circuit board (RadioShack 276-150 or equivalent).
Enclosure (Digi-Key 377-1724-ND or equivalent).

Of course, if everything had worked, there would not be a reason for me to write about my interface.

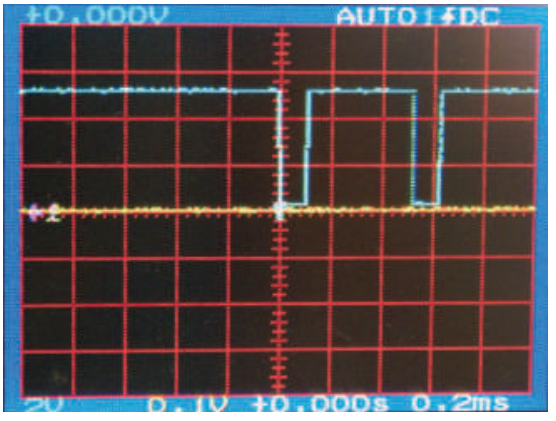


Figure 1 — Oscilloscope view of the healthy TTL signal waveform.

It Seemed Simple

Some basic research revealed that the SteppIR controller's DATA OUT port could be connected to a computer RS-232 serial port using a null modem cable, so I purchased a cable and plugged everything together. Alas, Murphy had other ideas — connecting my computer to the SteppIR controller stopped *all* control of the SteppIR antenna from the radio. Rather than admit defeat, I decided to do a little research and determine if anyone else had created an interface to connect the ICOM CI-V data format to a RS-232 port. At this stage, I assumed that there was something amiss with the SteppIR controller. It would take further experimentation to reveal that the problem lay elsewhere.

An Internet search yielded several interface designs, all very similar and based on a commercially available TTL logic level to RS-232 level serial interface chip. From here, I deduced that an interface design would be defined by whichever chip was available. A search on the Digi-Key website

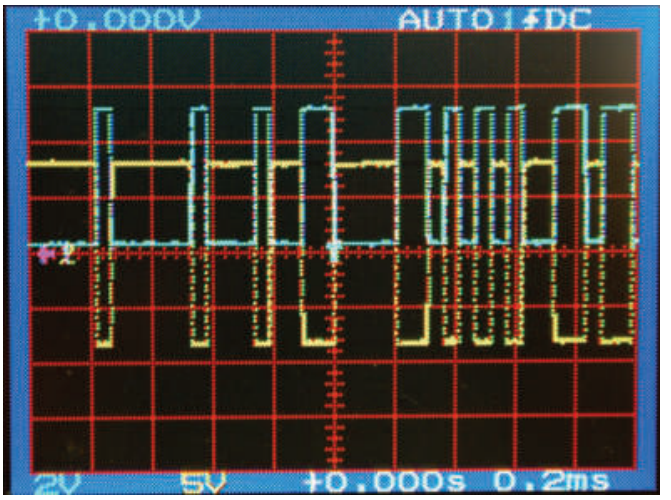


Figure 3 — Scope trace showing TTL signal (blue) and RS-232 signal (yellow).

(**www.digikey.com**) yielded the Maxim MAX203 (about $8 in single quantities) integrated circuit as a readily available chip for the heart of my interface.

I ordered the parts, and over the course of a couple of weekends, I assembled the interface on an experimenter's PC board, using only one of the two TTL to RS-232 transceivers in the chip. Of course, if everything had worked, there would not be a reason for me to write about my interface. Murphy appeared for the second time, however, and I was very frustrated when I obtained the same results from the home-built interface as I did with the SteppIR controller.

Scoping Out the Situation

I had acquired a used oscilloscope from a friend. Until this project I had not encountered a reason to power up the scope. I was determined to find a solution that met my needs, however, and this seemed like the right time to learn how to use the scope. I reassembled the interface onto an experimenter's breadboard, connected a 9 V battery as the power source, and connected the scope probes to the interface.

It was at this point that I made a surprising discovery — as long as the SteppIR and radio were connected, with the MAX203 chip unpowered, there was a healthy TTL signal (see Figure 1), with the binary zeros checking in at a signal level of 5 V. As soon as the serial interface chip was powered, the signal from the CI-V port dropped to 0 V!

I suspect that the parallel impedance of the serial interface chip and SteppIR controller was low enough to appear as a short circuit. This, in turn, suggested that isolating the radio from the SteppIR controller might be a solution. At least it would keep me busy for another hour or two.

My first attempt to resolve the situation used only one transmitter and one receiver in the MAX203 chip, with an SN7407 hex buffer inserted between each CI-V device. However, I quickly determined that the hex buffer did not provide the necessary isolation for these devices.

I then decided to use both of the transmitter/receiver pairs in the MAX203 chip, with the radio connected to both of the TTL to RS-232 TX inputs and to the RS-232 to TTL RX output for the first receiver. The final circuit, using the MAX203 chip, is shown in Figure 2. The first transmitter and receiver pair (pins 2 and 5) is connected to the computer via the RS232 serial connection. The second transmitter and receiver pair (pins 1, 18, 19 and 20) is set up so that the RS232 transmit signal is looped back to the RS232 receive input, with the TTL output from the RS232 receiver connected to accessory devices.

As seen in the second scope trace (see Figure 3), the interface provides a faithful copy of the TTL signal to the RS-232 serial port. The blue trace shows the TTL signal voltage, with binary zeros at 5 V and binary ones at 0 V, while the yellow trace shows the RS-232 signal with binary zeros at –8 V and binary ones at +8 V. This trace was generated by changing the tuning dial on the '746PRO.

Design and Assembly Notes

I chose an experimenter's circuit board and a plastic project box for my interface (see Figure 4). A metal enclosure might offer more protection from RF interference, if that is an issue at your location. I have not been able to identify any stray RF from this circuit in my station, unlike my front-loading washing machine, which clobbers all HF bands with S9+ noise.

With my completed interface, my computer can now control my rig and SteppIR and I've been able to ditch my paper logbook for phone modes.

I chose to power my interface using a spare wall wart providing a 9 V dc output, although this circuit could also be powered using a battery pack or 12 V dc power supply. During breadboarding, I used a rechargeable 9 V battery for testing. Since the MAX203 chip requires a minimum source voltage of +4.75 V, and the 1N4001 diode has a +0.7 V forward voltage drop, the minimum supply voltage should be +7.5 V. The diode can be removed if you are sure that you will never, ever connect the supply backwards.

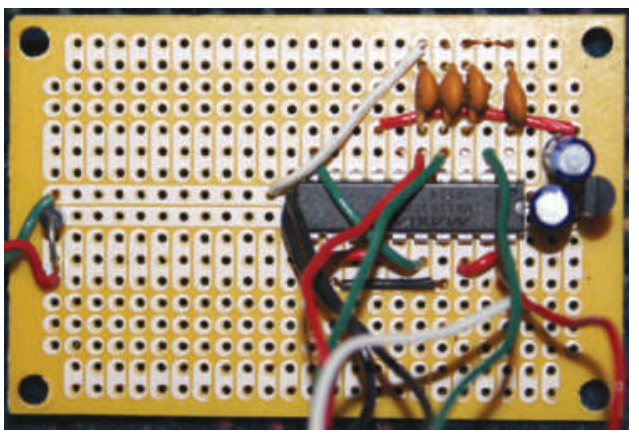


Figure 4 — The completed interface circuit board.

Hamspeak

Null modem — A device, usually a cable, to interconnect two devices both wired as DCEs or DTEs in EIA RS-232-C interfacing, back-to-back DB25 connectors with pin-for-pin connections except that RECEIVED DATA (pin 3) on one connector is wired to TRANSMITTED DATA (pin 4) on the other.

Some implementations of this interface use the RS232 port's DSR (data set ready) and DTR (data terminal ready) lines to power the MAX203 chip. I chose not to do this because I am not using these lines for control of push-to-talk (PTT) — that's being handled by the SignaLink interface and because I use a USB-to-RS232 converter between my computer and interface.

Alternative chips to the MAX203 in this Maxim chip series include the MAX201, MAX202, MAX207 and MAX208. The other chips require external 0.1 μF electrolytic capacitors for the voltage converters inside the chip, as compared to the jumpers that need to be installed on the MAX203 chip. The schematic will thus need appropriate modification if an alternative chip is used.

The MAX203 chip proved rather resilient to incorrect connections. I accidentally cross-connected the +10 V dc and –10 V dc sections of the chip while building this circuit, and did not spot the error for the better part of 15 minutes. After I located my assembly errors and corrected them, the chip worked flawlessly.

Figure 5 — The completed interface.

Effortless Control

With my completed interface, my computer can now control my rig and SteppIR when using *fldigi* software for digital modes, and my radio can still control the SteppIR when I am using phone. In fact, I've been able to ditch my paper logbook for phone modes as well, as *xlog* is able to read the mode and frequency information from my radio using the *hamlib* radio interface.

Photos by the author.

ARRL member and Amateur Extra class licensee Eric Keerbs, AD7HM, was first licensed in 2005, and is still teased by some of his fellow hams about passing Elements 1, 2, 3 and 4 at a single VE session. He earned a BSEE degree from UCLA in 1989 and a Master of Engineering Management degree from Washington State University, Vancouver, in 1995. He manages an engineering team at Daimler Trucks North America that is responsible for improving the integration of electronic control systems on heavy-duty trucks, and for the computer systems that configure these electronic control systems. When he's not involved in a ham radio-related volunteer activity, he enjoys working DX and special event stations on SSB phone and digital modes. You can reach Eric at 2705 NW 14th St, Battle Ground, WA 98604 or at **ekeerbs@pcez.com**.

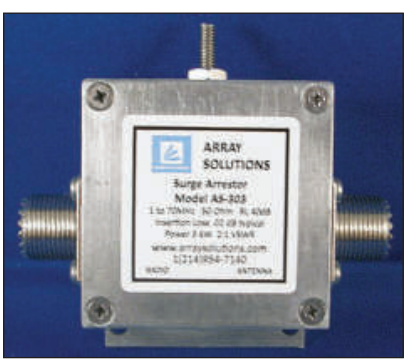
New Products

The Worldwide Listening Guide from Master Publishing

The Worldwide Listening Guide by John Figliozzi is now in its 5th edition and covers listening options from traditional shortwave to WiFi radio and Internet listening. It contains more than 4000 program listings from around the world, with a comprehensive cross reference by program type. New this year is a link to a website designed to keep the listings up-to-date, with blog-style postings by the author containing his perspective on changes to the international broadcasting scene. Price: $24.95. Available from The W5YI Group (**www.w5yi.org**), local Amateur Radio dealers or **www.amazon.com**.

Coaxial Surge Arrestor from Array Solutions

The Array Solutions AS-303 coaxial lightning arrestor is designed to protect radio equipment attached to antennas. The device protects against static buildup from sand, rain or snow, as well as providing protection from nearby and overhead lightning strikes. Based on the design by Industrial Communications Engineers (ICE) 300 series coaxial arrestors, these devices are said to be improved in performance, packaging and mounting hardware. These arrestors are dc blocked and include static and dc discharge capability just like the ICE arrestors. They also include rated gas discharge tubes (GDT) that can be replaced with simple tools. The enclosures are machined aluminum blocks with a removable bracket to screw the device to a plate. Array Solutions also offers a mounting bracket system to mount directly to ground rods, plates inside enclosures or a wall plate located at a coaxial cable entrance. Power rating is 3 kW continuous with antenna systems having a 2:1 SWR and 5 kW with a 1.2:1 SWR. Frequency range is 1-70 MHz with rated insertion loss of 0.2 dB and SWR les than 1.05:1. Price: AS-303U (UHF connectors), $58; AS-303N (N connectors), $65; AS-300SB bracket, $22. For more information, or to order, visit **www.arraysolutions.com**.



Using Your Meter from Master Publishing

Using Your Meter by Alvis J. Evans shows the reader the correct use of a multimeter. The book explains fundamental concepts of electricity including conventional and electron current and series and parallel circuits. It teaches how analog and digital meters work and tells what the voltage, current and resistance measurements mean. Then it provides fully illustrated, step-by-step instruction on using a meter in practical applications in the home, workshop, automotive and other settings. It is intended as a learning tool and reference for the hobbyist and ham. Price: $24.95. Available from The W5YI Group (**www.w5yi.org**), local Amateur Radio dealers or **www.amazon.com**.

A Tube Tester for High Power Transmitting Tubes

Make sure that "hamfest special" or tube that has been sitting on your shelf for years doesn't ruin your amplifier.

John Mathis, WA5FAC, and Max Landey, KM4UK

Most ham radio operators who use a vacuum tube power amplifier either have spare tubes sitting on their shelves or have contemplated buying one (new or used) at a hamfest. That used tube (and even a new one that has been sitting for a long while) constitutes a real risk to your amplifier the first time it is installed and turned on. Shorted or gassy tubes can create huge loads on the amplifier power supply and any other components that are in the conduction path and literally destroy transformers, diode chains and capacitors. That hamfest "deal" can cost your hundreds of dollars and many hours of grief.

A bargain tube loses its luster if it blows up your amplifier.

Even new tubes that have been sitting patiently on the shelf for years, ready to jump into action when the primary tube finally fails in the middle of a DX contest, can easily cause the same problems due to minute outgassing that can occur over time.

High power tubes have traditionally been hard to test without a method of applying actual filament and plate voltages — just what you want to avoid in your amplifier if the tube is indeed bad. This was our challenge, too. We had accumulated many tubes over the years that were sitting as backups including pulled tubes from magnetic resonance scanners for years while 3-500Z, 3CX-800 and 3CX-1500 (8877) tubes were in common service. Subsequently, we built or modified amplifiers that used the 3-500Z and 3CX-1500 (8877) tubes.

Both authors have experienced tube arcing at startup due to the very problems described above. In several cases we needed to replace substantial power supply components due to these catastrophic tube conductions.

A nice article appeared in *Electric Radio* by Tom Marcellino in 2009 describing a homemade high power tube tester.[1] The intent of his article was to evaluate the output quality of his specific tubes of interest and grade their performance. We were not interested in the tube types chosen for his tester and we didn't need to test for output, but rather to insure we would not injure our amplifier when a "new" tube was first introduced. If the tube doesn't hurt the amplifier, it is then easy to use the amplifier as the best test of actual tube quality and output.

Marcellino's article did stimulate our thoughts as to how we could achieve our intended goal. We discussed what we needed to accomplish and then began to pull parts from our combined "junk boxes."

This project is probably not one that every amateur will or can embrace. However, we believe this tester has resulted in an extremely useful device that would make a wonderful project for a club or group of like minded amateurs. Combining resources can also make this a fun and useful project and one that can be achieved with existing parts.

Design Goals

Our amplifiers were using only 3-500Z, 3CX-1500 (8877) and 811A/572B tubes. The 811A/572B tubes can be tested in good quality tube testers (for shorts and conduction). The 3-500Z and 3CX-1500s are not testable by the average ham with available equipment (short of the "plug it into your amplifier" trick). So, we decided to focus on these tube types. This tester was therefore designed and built to deal only with our specific tube needs.

As our amplifiers use tubes common in

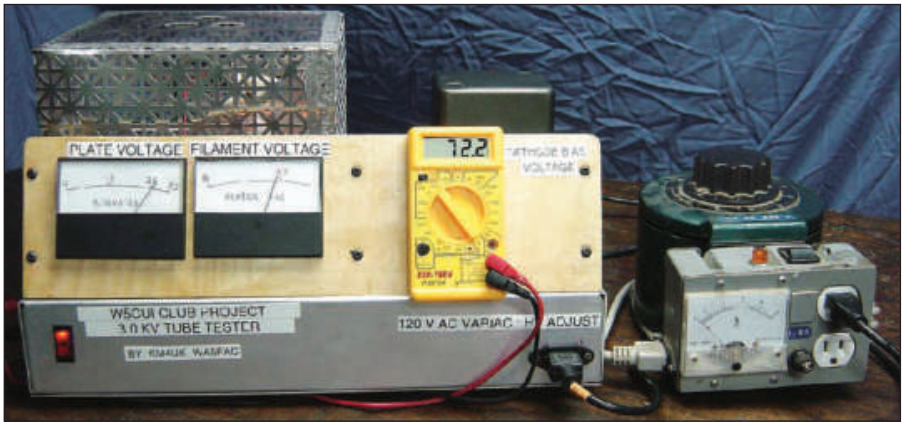


Figure 1 — The completed high power tube tester in use. The Variac to the right is used to incrementally increase the plate voltage and view the line current in the event there is a short or too high a current draw for a particular setting. The switch on the left below the meters separately turns on the filament voltage and fan.

[1]Notes appear on page 45.

amateur service, this tester will cover the needs of a large percentage of hams. Your needs may be different, but slight modifications to the filament supply design and the installation of appropriate tube sockets can allow you to do the same tests with just about any tube. We had a real advantage with the two tubes we needed to test, in that both use 5 V filaments.

The kinds of problems we needed to test for (and therefore might encounter as tube failures) would include open elements (which will not generally cause a catastrophic event) and shorted or gassy tubes (which can create an interesting and exciting display if the test is not controlled). Once again, since we did not plan to test output or transconductance, we could design and build a much simpler tester.

We wanted separate filament and plate voltage control. This allows one to energize the filament circuit with no voltage on the plate. This provides for filament warm up, which is required by some external anode tubes, or to allow long term filament heating, which is useful in some minimally gassy tubes to activate the internal getter to remove gas.

We provided not only separate turn-on of the plate supply but also incremental plate voltage increase. In shorted or gassy tubes this would allow us to be able to watch the current draw in the plate circuit and interrupt the process if abnormal current was being initially drawn. This was to be accomplished by controlling the plate voltage with an external Variac (see Figure 1). However, we still needed to build in some means to handle a dead short that might develop during tests. This can be caused by sagging tube elements during heating or by gas conduction that could develop in an avalanche fashion as plate voltage was increased. We addressed this issue with appropriate fusing of the various supply voltages and inrush power resistors in the plate supply line.

We wanted a tester that would be as safe as possible to use. The voltages employed in our linear amplifiers and in this tester can easily kill. Therefore, we wanted visual and physical safety methods to be employed that would protect us during these tests.

Our final goal was to build this tester out of existing "junk box" parts. We are both long-time amateurs so we had a good supply of "junk." However, some of our parts will be seen by the engineers in our midst as less than optimal. Please don't write us and tell us how we can use better parts. We are very happy with our result and it works great. Make those changes to your own tester and share them with your friends. As this is a "junk box" project, you may find that your existing parts may differ from ours but work just as well with some modifications to the circuit suggestions we have provided.

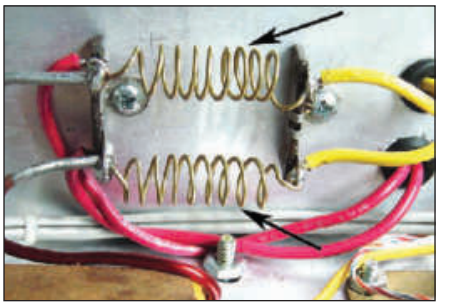


Figure 3 — Brass wire, size #18 AWG used in the filament leads to the 8877 (black arrows) to add additional resistance and bring the voltage down to 5 V ac.

Circuit Development

The tube tester circuitry logically divides into portions for the filament and the plate.

Filament Circuit

As previously stated, both of the tubes we wanted to test (3-500Z and 3CX-1500) use a 5 V filament supply. A spare filament transformer from a Drake L4B linear amplifier was available. It was capable of over 30 A at 5 V, intended to supply two 3-500Z tubes in the Drake amplifier. This transformer was a conservative choice. Being good stewards of our amplifier tubes and knowing that these tubes should never be run at higher than rated filament voltage, you will see some added resistance in the filament circuit primary (see Figure 2) that limits voltage to no more than 5 V ac on the 3-500Z. (You may need to modify the actual values for your area line voltage.)

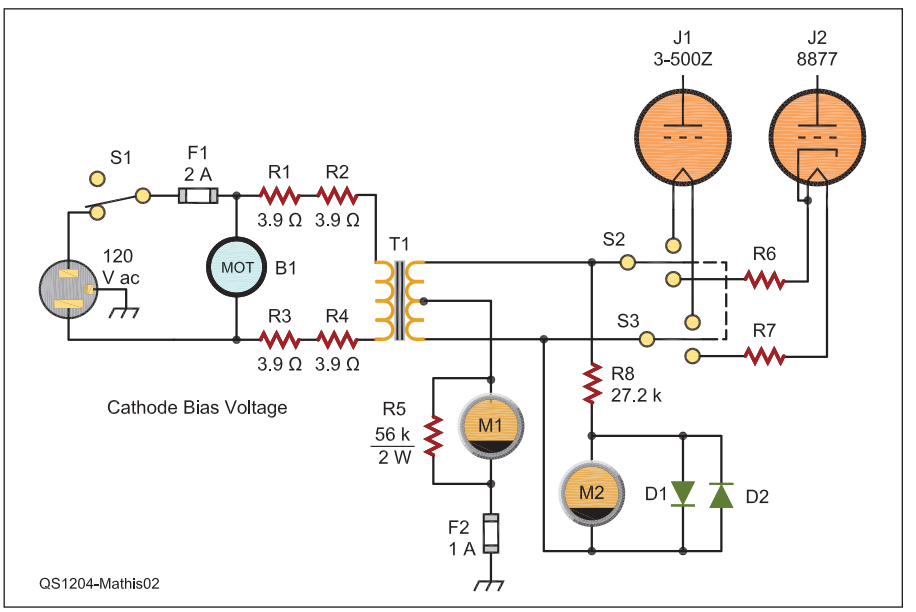


Figure 2 — Filament circuit schematic and parts list

B1 — Blower fan adequate to tubes under test.
D1, D2 — Silicon 1 A diodes, 1N4007 or equivalent.
F1 — 2 A, fast blow fuse.
F2 — 1 A, fast blow fuse.
J1 — Air system tube socket for test sample, 3-500Z, in this case.
J2 — Air system tube socket for test sample, 8877, in this case.
M1 — Panel meter to allow reading cathode current (see text).
M2 — Panel meter 5.5 V ac full scale made from surplus VU meter (see Figure 5 and text).
R1-R4 — 3.8 Ω, 4 W wirewound resistors.
R5 — 56 kΩ, 2 W resistor.
R6, R7 — Filamemt dropping resistors as needed (see text). Made from #18 AWG brass wire, 8" typical.
R8 — 27.2 kΩ, ½ W resistor.
S1 — SPST toggle switch, 250 V, 1 A.
S2 — DPDT toggle switch, 25 V, 15 A.
T1 — Filament transformer, 120 V primary, 5 V CT secondary at 15 A.

Hamspeak

Getter — Reactive material left inside vacuum tube to remove residual gas following evacuation. In many tubes the material is released following sealing by use of RF induction heating, in a process known as *flashing* the getter.

Transconductance — Parameter used to characterize vacuum tubes. The transconductance, abbreviated g_m, is the ratio of the change in current flow in the plate circuit to voltage change in the grid circuit. It is a measure of how the tube will operate in amplifier service.

Variac — Trade name of a kind of variable autotransformer that can provide voltage between 0 and typically 150 V ac from a nominal 120 V line.

Figure 4 — Cathode bias meter. This shows a 22 V dc drop across the cathode bias resistor while testing a 3-500Z tube at over 3000 V dc plate potential. The cathode bias drop will be different for different tube types and will rise as plate voltage is increased to effectively limit plate current.

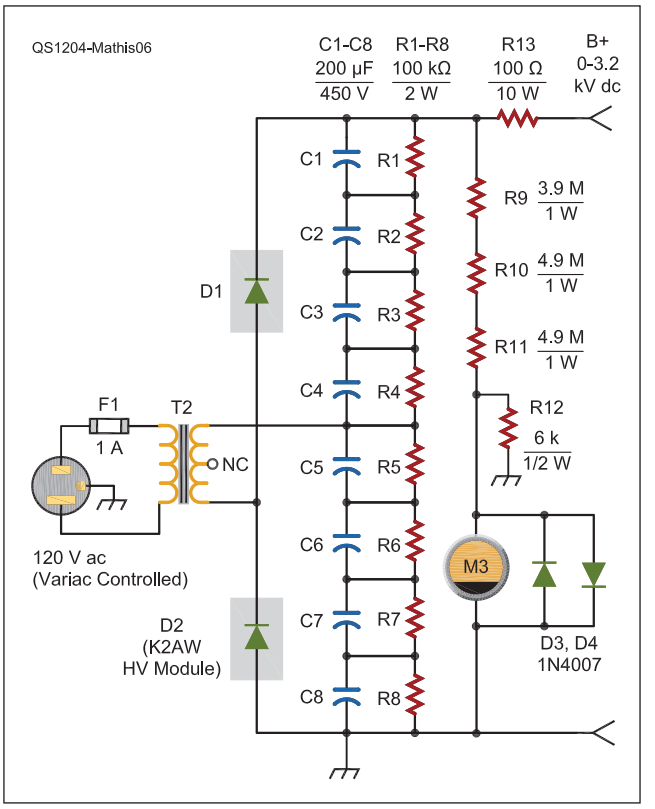


Figure 6 — Schematic diagram and parts list for plate supply circuit.
C1-C8 — 200 µF, 450 V electrolytic capacitors.
D1, D2 — High voltage rectifier diodes, see text.
D3, D4 — Silicon 1 A diodes, 1N4007 or equivalent.
F1 — 1 A, fast blow fuse.
M3 — Panel meter to measure plate voltage (see text).
R1-R8 — 100 kΩ, 2 W resistors.
R9 — 3.9 MΩ, 1 W resistor.
R10, R11 — 4.9 MΩ, 1 W resistors.
R12 — 6 kΩ, ½ W resistor.
R13 — 100 Ω, 10 W wirewound resistor.
S1 — SPST toggle switch, 250 V, 10 A.
T2 — Plate transformer, 120 V primary, 1500 V secondary at 0.5 A, or as available.

The 3-500Z is rated at 14.5 A while the 3CX-1500 uses 10.5 A. This difference will result in a different filament voltage for the 3CX-1500 unless additional resistance is added to its filament supply (beyond that found in the primary circuit). This was developed using #18 AWG brass wire. Eight inches of this wire was placed in each leg of the 3CX-1500 filament lead to limit the voltage to the desired value (see Figure 3). Obviously, this is an empiric amount of resistance but easily adjusted to your needs. The primary of this transformer is fused with a 1 A fast blow fuse.

This tester develops over 3000 V dc on the plate and therefore some form of bias is needed to insure that the idling current to each tube is limited. We selected a simple cathode bias arrangement that places a large cathode resistor in the center tap (return lead) of the filament transformer. This insures that the cathode is forced to have a positive potential (with reference to the grounded grid) as current is drawn by the plate (with increasing plate voltage). An external voltmeter (M1) was placed across the cathode bias resistor to monitor the pinch off voltage and indicate the voltage drop as the plate voltage is increased. This gives an indirect measure of cathode to plate current with increasing plate voltage.

Figure 4 shows a 22 V potential across the cathode bias resistor while testing a good 3-500Z at 3000 V dc. This bias limits the plate current to a minimal and safe level even at the 3000 V potential. (M1 was chosen as we did not have in our junk boxes a third VU meter of the type used in M2 or M3. This inexpensive meter was expedient and works well. All the metering could be accomplished with similar meters that are obtainable for as little as $5 at hamfests or online.)

The metering circuit for the filament supply (M2) uses a 200 µA (VU) meter movement with the full wave internal bridge left in place. A series 27.2 kΩ resistor was used to establish a 5.2 V ac full scale reading. I replaced the scale with a hand drawing but

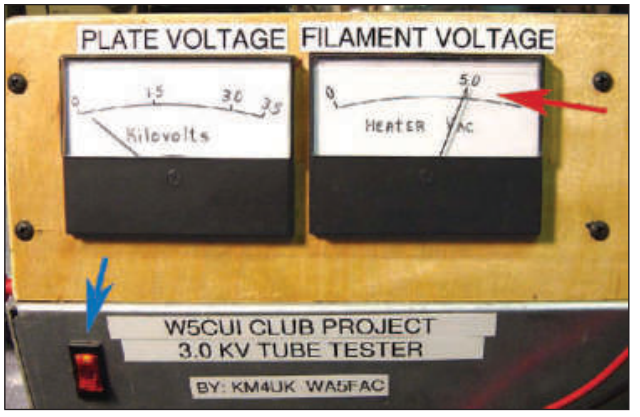


Figure 5 — The filament supply is turned on by the switch on the left bottom (blue arrow) and allows independent activation of the filament supply (red arrow) without turning on plate voltage.

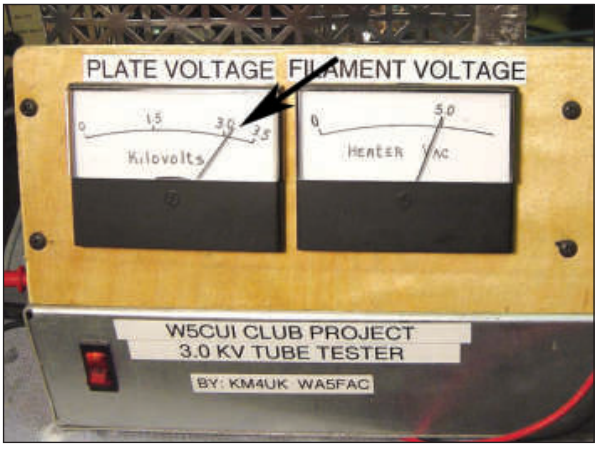


Figure 7 — The black arrow indicates full plate potential (3.2 kV). This has been incrementally activated by the Variac control and is completely separate from the filament supply.

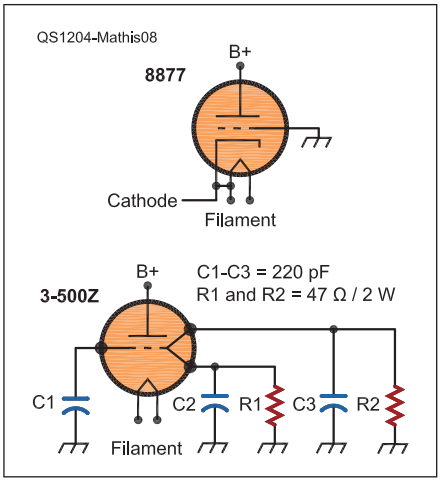


Figure 8 — Schematic diagram and parts list for tube socket connections.
C1-C3 — 220 pF ceramic capacitors.
R1, R2 — 47 Ω, 2 W resistors.

recommend you consider using software such as that available from Tonne Software (**www.TonneSoftware.com**) for their *Basic Meter* program, which is free to hobbyists.

Both M2 and M3 have double reversed diodes installed across their contacts. This is a trick described years ago in an article by Battishill and McCoy from *CQ* magazine that outlines several design faults found in the Heathkit SB-220 (as well as numerous other amplifiers).[2] When a tube short occurred it would commonly destroy the meters as they were part of the conduction path. The double reversed diodes protected the meters from this fault. We continue to incorporate this protection and recommend it to all amplifier builders or restorers.

The fan is wired in parallel with the filament primary (before the dropping resistors) and therefore comes on whenever the filament circuit is activated. A Dayton 4C4004A blower was available from a prior amplifier project. It provides forced air into the chassis base. As two tube sockets are installed into the chassis, each must hold a tube (one not electrically connected) or alternate methods must be used to insure that adequate forced air is injected around the tube under test.

The filament is activated separately from the plate supply (see Figure 5). This provides for both filament warm-up and separate control of the plate supply.

Plate Circuit

The plate circuit needs a high potential, similar to that experienced in the actual linear amplifier circuits, to adequately test for internal shorts and gas conduction. However, the cathode bias is set to keep cathode to plate current pinched to a minimal amount. The plate transformer needs to be capable of developing a reasonable voltage but can have a very low current rating. Our junk box transformer was rated at 1100 V ac at 0.25 A. We therefore elected a voltage doubler circuit (see Figure 6) and basically copied the arrangement from a Heath SB-220 manual. Equalizing resistors of 100 kΩ at 2 W were placed in parallel with each capacitor (200 µF, 450 V dc). The original diode chain used in the SB-220 was replaced with a single diode module (K2AW HV 6-1) in each leg of the doubler. This module is popular in amplifier circuits and advertised in *QST*. It handles 6 kV at 1 A and was in the junk box. The primary is fused with a 1 A fast blow fuse. A 100 Ω, 10 W, wire wound resistor is placed in series with the plate supply to limit current in the event of a flash over.

This circuit develops 3200 V dc (see Figure 7). It is continuously variable from zero to maximum with the Variac control. A three prong "computer style" chassis plug was installed for hookup of the Variac to the tester. This allows the Variac to be used for the plate supply, connected with a standard computer power cord, without committing it permanently to the tester. Metering on the Variac allows constant monitoring of the current drawn in this circuit with incremental increases in plate voltage. The voltage is monitored with the plate metering circuit. This again is a 200 µA (VU) meter (M3) with the internal full wave bridge removed. This meter circuit was copied from the SB-220 manual and is calibrated for 3.5 kV full scale.

Tube Sockets

Standard tube sockets specified for each type tube should be used. We set up our chassis to allow forced air to enter each socket from below. Therefore, appropriate chimneys for each tube are also needed to direct the airflow as designed.

The actual electrical hookup of each socket was copied from amplifier circuits currently in use for the 3-500Z (Heath SB-220) or for a homebrew 3CX-1500 amplifier (see Figure 8).

Safety Features

As stated above, this tester develops potentially lethal voltages. Therefore, several features were developed to add as much personal safety as possible. First, a removable cage was made that sits over the tubes during testing to avoid inadvertent contact with the plate voltage leads. Secondly, plate voltage metering is provided by the meter on the front panel of the unit. This allows the operator to check for existing voltage on the capacitor bank or tube plate.

Metering is simply not enough, however, to insure zero potential (as meters and associated circuits can fail). Therefore, we built in a manual discharge system (shorting tower) out of a piece of Corian. This is easy to cut and drill and serves as an adequate standoff insulator. The shorting tower (see Figure 9) lets the operator short the plate to ground through a 1.8 kΩ, 10 W resistor, discharging any residual voltage on the capacitor bank without having to interact with the tube plate. Use the shorting stick, sometimes called a "chicken stick," shown in Figure 10 to make sure any remaining voltage is discharged to ground.

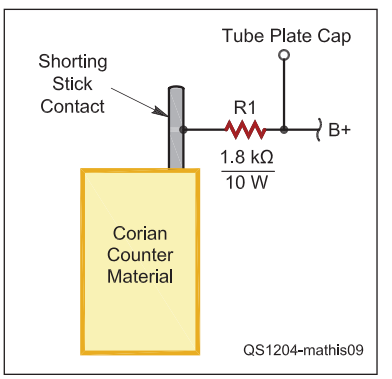


Figure 9 — Shorting tower construction diagram.

Using the Tester

This tester has now been in use for over a year. It allows basic testing of 3-500Z, 3-400, 4-400 and 3CX-1500 (8877) tubes. We have discovered tubes with open filaments, shorted elements and gas intrusion that created cathode to plate shorts. The shorted or gassy tubes can easily damage an amplifier and this problem is avoided with this simple tester.

The independent filament and plate controls allow both tube warm up (filament only) and slow incremental increase of plate voltage while monitoring tube operating conditions. As the plate voltage is increased, the cathode bias voltage will also slowly increase to limit cathode to plate current to a low value. Normally functioning tubes will show this slow cathode bias rise while abnormal tubes will not. The amount of cathode bias will vary with different tube types.

Shorts or gas discharge can be observed at relatively low plate voltage and the test interrupted as necessary. If gas discharge is found, then a period of filament-only activation, or plate voltage below gas discharge and conduction, can be tried to see if small amounts of gas can be eliminated.

Tubes that have only a small amount of gas will show abnormal color (usually a blue or blue-violet) and a rapid and abnormal plate current rise on the Variac meter with rela-

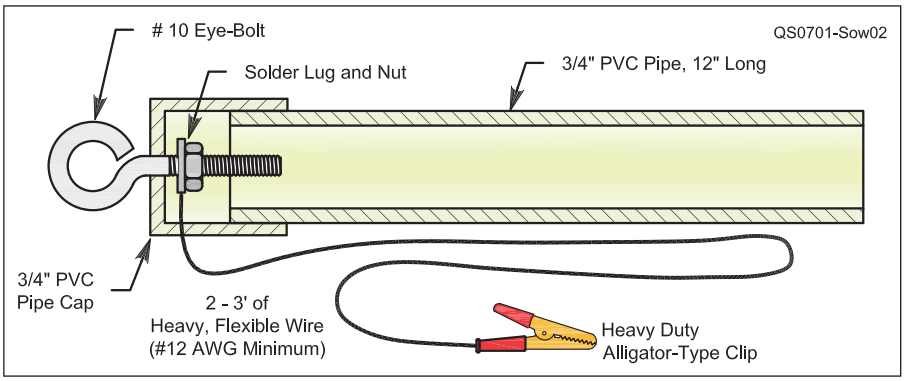


Figure 10 — This "chicken stick" can be used to verify that any remaining high voltage has been dissipated to ground. The alligator clip is attached to a ground point. While gripping the insulated shaft, touch all potential danger areas with the eyebolt.

tively small amounts of plate voltage. It is important to have these tubes not conduct at a near short circuit in your amplifier when you first turn it on.

A considerable amount has been written about tube restoration methods to eliminate very small quantities of gas.[3] It may be possible to use the tester to effect such a cure in some (but certainly not all) of these gassy tubes.

These high power tubes all have an internal device called a *getter* that is used in tube manufacturing to eliminate small amounts of residual gas left after the envelope is sealed. These getters are different from the ones used in small transmitting and receiver tubes. In the small tubes, a silver appearing deposit is seen on the inside of the glass envelope when the getter is activated (called a flash getter) by external RF energy. This material is usually made of a barium compound that interacts with the residual gas molecules to capture and eliminate them.

The getter used in high power tubes is a non-evaporative alloy that is made primarily of zirconium. This special alloy is used to coat a tube element and is activated by high temperature. It is not a single use material and therefore there is some potential for it to clear out minute amounts of gas that can migrate into the tube over time. It cannot heal a large leak, however.

In minimally gassy tubes recovery can often be affected. We have accomplished this, but here are some caveats. First, the getter material is not always deposited on the same element within the tube. Typically, external anode tubes such as the 3CX-1500 have the getter applied to the filament. Therefore, running the tube with filament voltage only applied may significantly activate the getter and reduce accumulated gas molecules. In some internal anode tubes (of which the 3-500Z is an example), the getter is usually applied to the plate. Running the filament in this case may do little to activate the getter and trap gas molecules. Nevertheless, we have definitely seen some tubes that initially were gassy but recover even in the internal anode category.

This tester has been very useful for testing high power tubes and preventing amplifier damage. It was a fun project for our small club. See if you can make your own, using available materials or high quality, well engineered substitutes. This is only a template for construction, but allows one to be able to test, with this or a modified tester, almost any high power tube that you or your friends may be using.

Switch to Safety!

Before you get your screwdriver out it is important to review and then follow a few basic rules. While working with high voltage equipment, safety should be in your thoughts at all times.

Always keep a mindset that lethal voltages are present in high power amplifiers. Many of us who grew up in the solid-state generation are not familiar with working around high voltages. An attitude adjustment is in order — you cannot be too cautious when working with lethal voltages!

- Never work on the unit when it is connected to a source of electricity.
- Use a "chicken stick" (see Figure 10) to make sure every contact that you intend to touch or could accidentally touch with your hands is not "alive." This is especially important around the high voltage section where electrolytic capacitors could still be charged.
- Do a second grounding check with the chicken stick to verify that there are no voltages present around the working area.
- Wear rubber-soled shoes so that your feet are not grounded.
- Never stand on wet surfaces.
- If possible use only one hand, keeping the other in your pocket.
- Never work on amplifiers if you are tired, or after cocktail hour. — *W1ZR*

Notes

[1]T. Marcellino, "A Power Pentode, Tetrode and Triode Tube Tester," *Electric Radio*, Issue 245, Oct 2009.

[2]D. Battishill, L. McCoy, W1ICP (SK), "Save-a-Buck Modifications for Heathkit Power Amplifiers," *CQ*, Sep 1992.

[3]J. Stokes. 70 *Years of Radio Tubes and Valves: A Guide for Engineers, Historians and Collectors,* Vestal Press, 1982.

Photos courtesy of the authors.

ARRL member and Amateur Extra class licensee John Mathis was licensed as WA5FAC in Pittsburg, Texas in 1960. He received a BS in Physics, MS in Radiological Physics and MD with fellowship training in Interventional Neuroradiology. He taught at The University of Maryland and Johns Hopkins Medical Institutions and now lives and practices in Roanoke, Virginia where he grows goats, chickens and antennas.

He is trustee of W5CUI, a memorial club dedicated to his original mentor who helped him get started in ham radio when he was 9 years old. This small club is dedicated to friendship and exploring the art and science of radio communications. Information about WA5FAC/W5CUI is on **QRZ.com** and John can be reached at 6270 Mount Chestnut Rd, Roanoke, VA 24018 or **jmathis@rev.net**.

ARRL member and Advanced class licensee Max Landey, KM4UK, was first licensed in 1980. He is a retired physician/radiologist. He has enjoyed audio experimentation for decades and has applied his considerable tube knowledge to this project. A founding member of the W5CUI club, he is commonly found around 7.137 MHz in the afternoons discussing technical issues of audio and Amateur Radio with ham buddies. Max can be reached at 3453 Farmington Dr, Roanoke, VA 24018-3845 or at **max33v@verizon.net**.

Balanced Line SWR Measurement

A look at what is really going on with your balanced line.

Paul Danzer, N1II

In the past few years several articles in *QST* as well as a number of questions in "The Doctor is In" column, have discussed the use of window or open wire line to feed a dipole. Despite the fact that losses in transmission line go up with SWR, the low matched SWR of window line keeps the total losses low, usually lower than matched coax. A dipole fed with window line is a very efficient and easily constructed multiband antenna. For example, an 80 meter dipole fed with a 100 foot run of window line will have less than 0.6 dB of loss an all bands from 80 through 6 meters.

I have exactly that situation at my home station. My transceiver includes an automatic antenna tuner — a 10 foot piece of coax feeds a balun on the wall of the shack and a window line connects the balun to my 80 meter dipole. My antenna tuner does not have enough range to match this setup for 160 meters, but many available tuners might be able to make this a full 160 to 6 meter setup.

So How High is the SWR?

Although I understood the ladder line losses were low even with a high SWR, being a ham I was curious — just what was the SWR as measured on the ladder line for the various HF bands? Commercial SWR bridges are designed for unbalanced coax only. But I remembered reading how years ago open wire balanced line and TV type 300 Ω twinlead were commonly used as feed lines. The OTs (old timers) used various incandescent and neon bulbs to give them an idea of what was going on.

With help of Jim, WB2TPS, and George, K1EHW, we found the 1947 *QST* article, "The Twin Lamp," which describes a directional coupler for balanced lines.[1] The estimated construction time is perhaps 10 minutes — I could not resist (see Figure 1).

Neither this article in *QST* nor its later version in the 1956 edition of *The ARRL Radio Amateur's Handbook* identified the type of bulbs to use. Fortunately, at that time there were only one or two common radio bulbs. They were used as the pilot or dial lights in the common household ac-dc radios called the "All American Five." These bulbs were rated at 6 to 9 V at 150 mA. An OT will recognize that designation as "brown bead."

My test version (Figure 2) using 18 inches of window line worked as expected. Unfortunately it is impractical to derive any real numbers from judging bulb brightness.

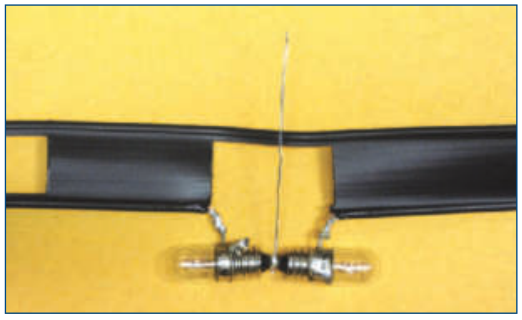


Figure 2 — A 2011 rebuild of the 1947 circuit. The window line section is 18 inches long.

[1]Notes appear on page 47.

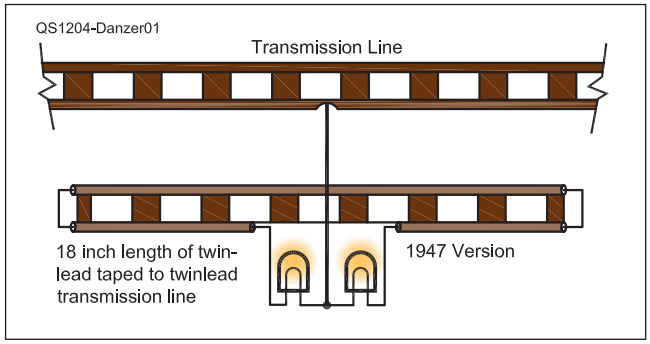


Figure 1 — 1947 version of *The Twin Lamp.*

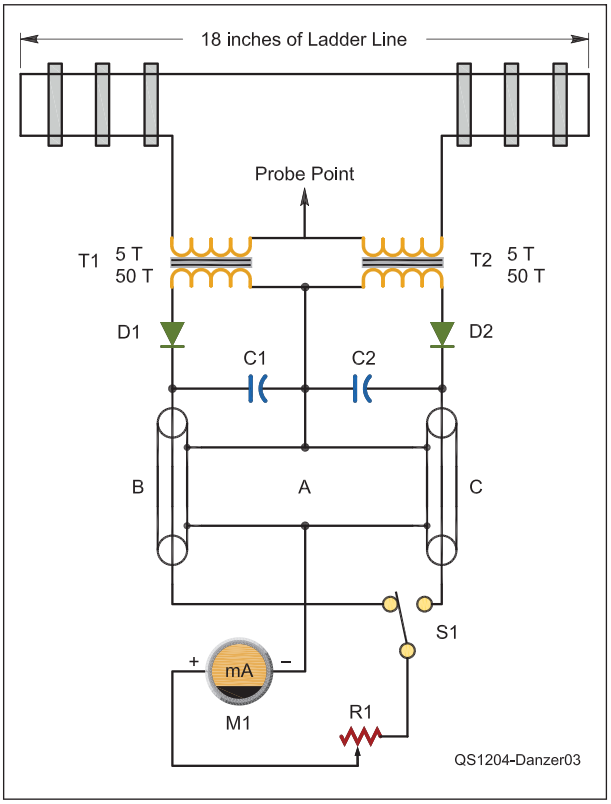


Figure 3 — The updated circuit and parts list using coupling transformers, rectifiers and a meter in place of the light bulbs. The probe wire is shown pointing up. Wires B and C are shielded wires, with their shields used as wire A.

C1, C2 — 0.001 µF, 50 V capacitor.
D1, D2 — Germanium diode, such as 1N34, if available. More common silicon switching diodes such as 1N914 or 1N4148 can be substituted at reduced sensitivity (see text).
M1 — 1 mA full scale meter.
R1 — 5 kΩ variable resistor.
S1 — SPDT switch.
T1, T2 — Toroid coupling transformer (see text) wound on Palomar (**www.palomar-engineers.com**) F50-2, mix 61, or equivalent.
Bulbs — RS 272-1128 (If you want to duplicate the 1947 version).
PC board such as RadioShack RS 276-168.
Window line, approximately 18 inches (see text). The smaller and softer the conductors in this length, the easier it will be to work with.

Winding on Ferrite Cores

Winding 50 turns of wire on a ferrite core can be tedious. One trick you can use is to first pull about 4 feet of wire through the core. Tape the end of this wire to a pencil and then roll up the wire flat on the pencil. Now pull the pencil around the core and back, taped end first, through three or four times to add three or four turns. Smooth down the turns and repeat until you have 50 turns.

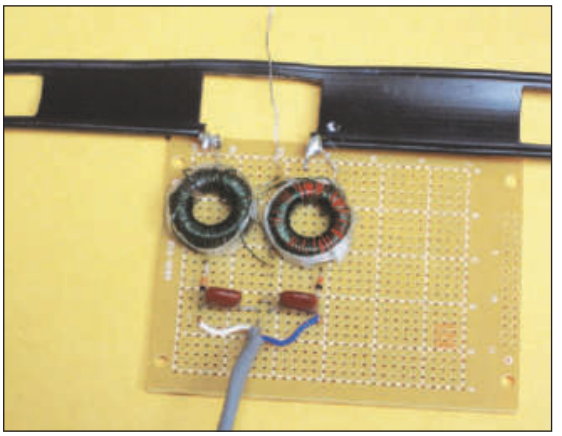


Figure 4 — The 2011 circuit mounted on a small universal PC board

Calculate the SWR

To calculate the SWR you do not need a full scale deflection of the meter as usual in most SWR instruments. Set R1 so you can read the values of V_F and V_R, then use the following two equations:

First calculate the reflection coefficient:

$\rho = V_R / V_F$

Next use ρ to calculate the SWR:

$SWR = (1+ \rho)/(1- \rho)$

Getting the Real Numbers

The circuit in Figure 3 replaces the bulbs with two transformers. The core material was picked to have a μ or ferrite mix value that was rated for the HF ham bands. The windings are #26 AWG enameled wire. The core size was picked to accommodate the five turn primary, the 50 turn secondary and a pencil. (See *Winding* sidebar). The circuit was mounted on a small RadioShack universal PC board (see Figure 4).

The secondaries of the transformers are connected to diodes D1 and D2 and two small filter capacitors (C1 and C2). The diodes in the parts list are readily available silicon diodes, but a better choice to increase sensitivity, would be germanium diodes such as the classic 1N34, which do seem to be available on the Internet.

This is not a critical choice since you can also increase sensitivity by increasing the length of the sampling ladder line from 18 to perhaps 24 inches.

Wire A is the common or ground connection, and wires B and C should be shielded with the shields as shown for wire A. Two separate wires could be used as shielded B and C, or a two-conductor shielded wire used for all three. S1 is any available SPDT switch. A 5 kΩ variable resistor and a 0-1 mA meter complete the circuit.

To use, tape the 18 inch line sampler to your transmission line. Make a small cut in the insulation on one side of the line and attach the probe point. J. R. Fisher, VE3ALQ, suggested using a pin for this probe. Getting the pin to penetrate and make good contact may be a bit of a problem, however.[3]

The term SWR is really an abbreviation of *standing wave ratio*, which in turn is an abbreviated form of *VSWR* or *voltage standing wave ratio.* Wires B and C allow you to calculate this ratio. Wire B represents *forward voltage (V_F)*, and wire C the *reflected voltage (V_R)*. There are two ways to find the SWR from these two readings.

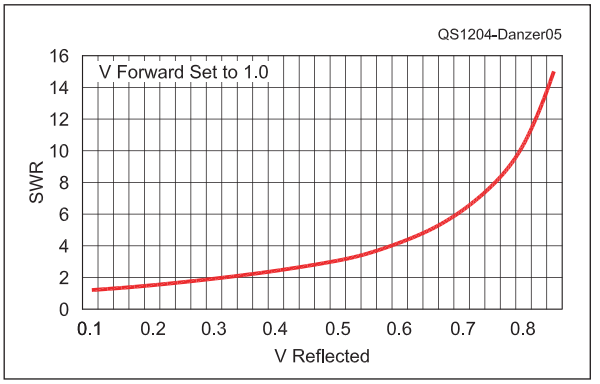


Figure 5 — With V_F set to 1.0 enter the value of V_R and read off your SWR from the plot.

If you like using graphs, flip switch 1 to wire B. Assuming you are using a 0-1 mA meter for M1, adjust R1 so the meter reads 1.0 for V_F. Flip the switch to wire C and find the meter reading for V_R (a value between 0 and 1) and use the plot in Figure 5 to determine the value of the SWR.

If you like using equations, you do not have to get full-scale deflection on the meter for V_F. Use any setting of the variable resistor R1 that lets you read two numbers and then use the equations in the sidebar to calculate the SWR.

This is not a precision device. Reginald Wood, K2BUZ, pointed out that you are sampling and inserting a small disturbance in one side of the line.[4] To eliminate this small unbalance he built two units with two sets of bulbs, thus introducing the same disturbance on both sides of the line. Just building one set, however, will give you enough information to provide the insight as to what is going on in your transmission line.

If you are using uninsulated open wire line, you can still use this device. Just make sure the measuring section of the device is insulated from your transmission line except at the probe point.

One word of caution: If you do decide to first test the device using bulbs, try very low power at first. It is very easy to burn out a bulb and then you will be wondering why one or the other never lights!

Thanks to ARRL Technical Advisor Dean Straw, N6BV, for his suggestions for calculating SWR.

Notes

[1]C. Wright, W4HVV, "The Twin Lamp," *QST,* Oct 1947, p 22.
[2]*The ARRL Radio Amateur's Handbook,* 1956 Edition, p 509.
[3]J. Fisher, VE3ALQ, "Hints and Kinks — An Improved Twin Lamp," *QST*, Oct 1949, p 114.
[4]R. Wood, K2BUZ, "The Balanced Twin-Lamp," *QST*, Nov 1956, p 38.

Photos by the author.

ARRL Member Paul Danzer, N1II, was first licensed in 1953, and holds an Amateur Extra class license. Paul has been operating 40 meter CW almost constantly since he first started. He uses his years of experience as an electronic engineer to design and build small, one-night, ham radio projects. Currently he is a Professor of Computer Science at Housatonic Community College in Connecticut. He can be reached at **n1ii@arrl.net**.

A Transceiver to Amplifier Interface

Use this interface to safely switch that older linear amplifier from your new transceiver.

Ed Toal, N9MW

If you have a recent design HF transceiver, it is likely that you discovered that the circuit used to switch ancillary equipment such as power amplifiers may be rated at a maximum of 16 V dc. Since your older trusty RF power amplifier probably has much higher voltages supplied to switch the unit into action when transmitting, something has to be done. The solution that usually comes to mind is to use a mechanical relay to interface the units.

A Better Solution

There is some irony in the fact that my career was with Ma Bell, the absolute master of relay technology, and that I don't like using relays unless all else fails. Relays are slow, can be noisy and are prone to contact failure or mechanical fatigue. Ted Gisske, K9IMM, came up with a simple transistor circuit that solves the problem for those using amplifiers that supply less than +300 V dc on the switching line. This includes amplifiers such as the Heath SB-220, Kenwood TL-922, Drake L4, Alpha's 76 and 77 and more.

In the circuit of Figure 1, Q1, a VN10LP, interfaces to the transceiver and removes cutoff bias in Q2, an IRF730, which when activated switches the amplifier into action. The IRF730 can handle switching up to + 300 V dc from the RF amplifier. Using two stages provides additional isolation between the circuits. Power is usually available from the transceiver at or near the same jack as the switching circuit. It is an aesthetically clean small box with one cable in and one or two cables out.

The TR relays in amplifiers probably have a reverse polarized diode across the coil. This is done to provide a path for the currents produced when the relay is deactivated. The voltage created is very large, possibly in excess of 1 kV, so those diodes must be in place to protect the IRF730.

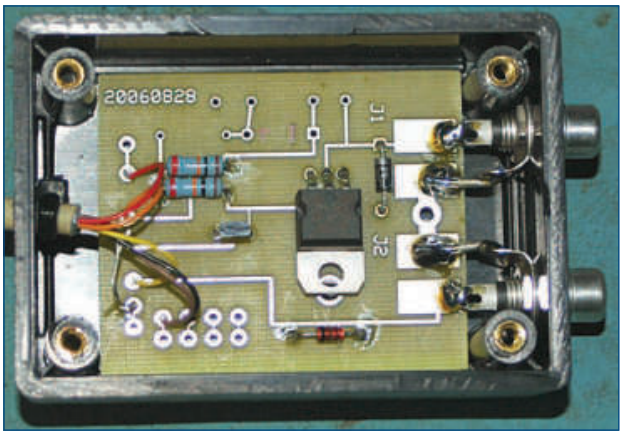


Figure 2 — A completed unit with the AGC line also continued through.

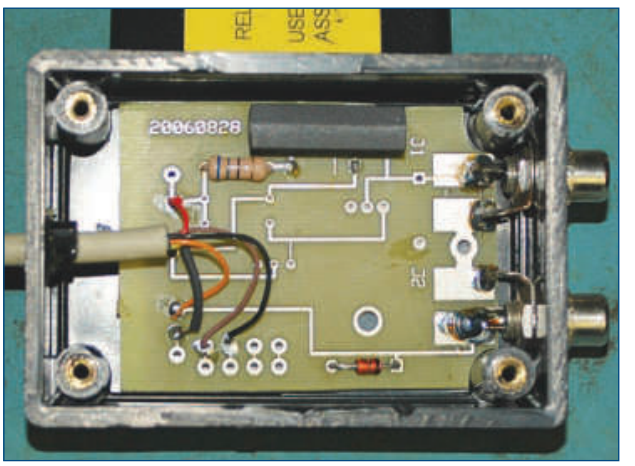


Figure 3 — A unit with a reed relay rather than transistors as switch elements. This is needed to switch negative or ac voltages with this circuit.

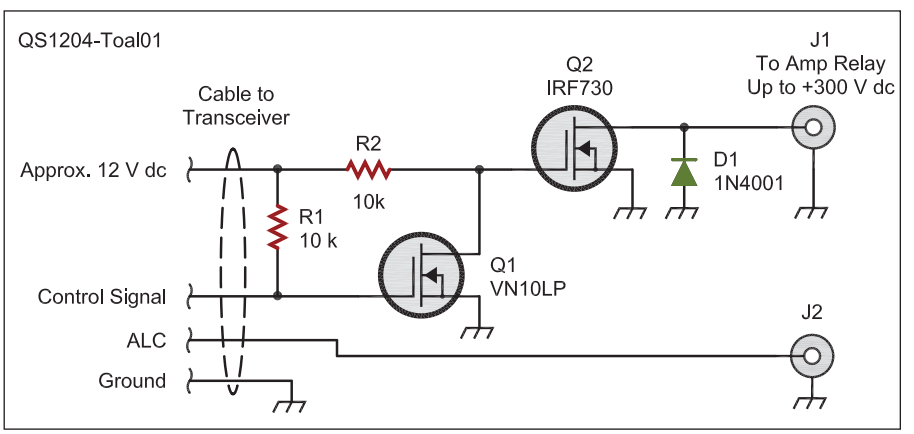


Figure 1 — The basic solid state amplifier interface circuit and parts list to replace a mechanical relay. The circuit is based on a design by K9IMM as modified by the author. To use with a reed relay, the relay should be connected from +12 V to the source of Q2. The ALC line through connection is only needed in this unit if it is in the same cable as the other leads.

D1 — 1N4001 silicon diode.
J1, J2 — RCA panel jack.
Q1 — VN10LP FET.
Q2 — IRF730 FET.
R1, R2 — 10 kΩ, ¼ W resistors.

I used *Express PCB* to lay out a board, in fact, two circuits per board to improve the cost ratio and have some spares. This circuit could also be easily constructed on perforated project board. Since a lot of space was available, I included provisions to use a reed relay instead of transistors just in case I happened onto an amplifier with negative or ac TR switching voltages. In addition, wire junction points were provided to access the other leads supplied on the transceiver jack. Figure 2 is a completed interface. A piece of a computer cable was sufficient for the lead to the radio. The board is held in place with double backed tape and the solder junctions to the output RCA connectors.

If your amplifier supplies a negative or ac

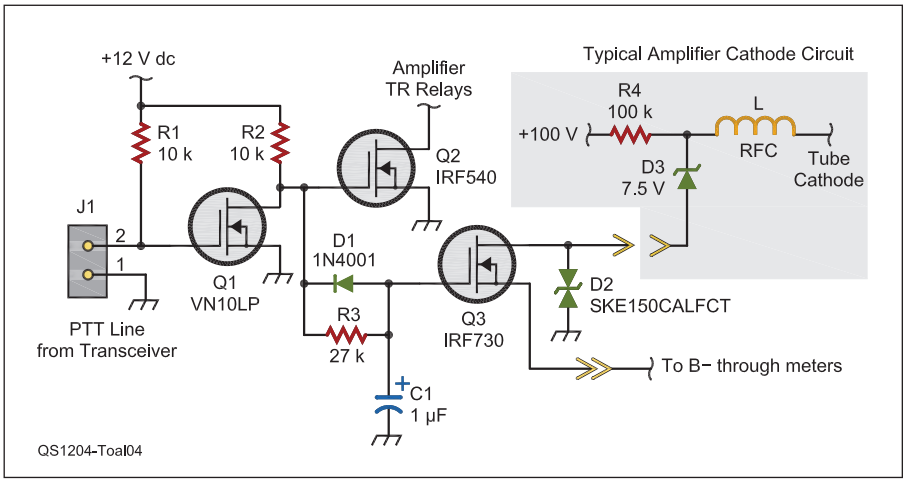


Figure 4 — Schematic and parts list of TR and bias switching circuit. The circuit is based on a design by K9IMM as modified by the author.

C1 — 1 µF, 25 V electrolytic capacitor.
D1 — 1N4004 silicon diode.
D2 — 1.5KE150CALFCT voltage protection diode.
D3 — Zener diode, 7.5 V NTE 5182A or equivalent.
J1 — Jack to match transceiver cable.
Q1 — VN10LP FET.
Q2 — IRF540 FET.
Q3 — IRF730 FET.
R1, R2 — 10 kΩ, ¼ W resistors.
R3 — 27 kΩ, ¼ W resistors.
R4 — 100 kΩ, ¼ W resistor.

voltage on its switch line, this circuit is not the solution. I would suggest you look at the variety of reed relays available. Reed relays are the fastest and most quiet type of relay, while being modestly priced. I have used Hamlin HE3351A1200 successfully, but you may have to find a similar unit at this time. Figure 3 shows the relay version.

More Possibilities

While I was laying out my homebrew HF amplifier, I planned to incorporate this circuit to switch the pair of 28 V dc vacuum relays that control the RF path through or past the amplifier. I wanted to delay the input relay until after the output relay was closed to avoid "hot switching" the output relay. I also was contemplating how I wanted to switch the tube's cutoff bias (+100 V dc), hoping to avoid a mechanical relay for that as well. Again K9IMM had the solution. He suggested the VN10 was capable of switching two stages, in this case an IRF540 and an IRF730. The IRF540 would switch the 28 V dc relays and the IRF730 would switch the cutoff bias. The IRF730 would switch the cutoff bias with a small delay (R3 and C1) so that there would then be no RF amplification until the vacuum TR relay contacts were fully made and the need to sequence the vacuum relays was eliminated. Figure 4 is the schematic for that circuit.

I've run a number of transceiver/amplifier combinations successfully with this circuit without failure.

Photos by the author.

ARRL member and Amateur Extra class licensee Ed Toal, N9MW, was first licensed in 1959 at age 15. Ed's primary interest is in working DX and he holds a Number 1 Honor Roll certificate. His electronics education came from his involvement with a high school radio club and self study with the help of his ham associates. Ed worked for 32 years for Wisconsin Bell Telephone (later Ameritech and ATT) as a manager in the Installation and Repair department. He served as EC and RACES Officer for Dane County (Wisconsin) for eight years and has also served as president of the Four Lakes Amateur Radio Club and the Madison DX Club. You can reach Ed at W8471 State Rd 39, Blanchardville, WI 53516 or at **ed@n9mw.com**.

In The March/April 2012 Issue:

■ Michael Hightower, KF6SJ, describes his "Simple SDR Receiver" project. This is a 3.5 to 18 MHz receiver built around a Cypress PSoC CY8C3866 IC that includes both analog and digital circuits. Operate the receiver through the *Ham Radio Deluxe* (*HRD*) program to receive just about any mode.

■ Rudy Severns, N6LF, begins a series of articles that provide us with "A Closer Look at Vertical Antennas with Elevated Ground Systems." Rudy will expand on the experiments that he reported on with his Jan/Feb 2009 through Jan/Feb 2010 *QEX* series. This time Rudy examines ideal elevated radial systems and then looks at the problems introduced by radial fan asymmetries. If you are interested in vertical antennas with elevated radials, you will not want to miss these articles!

■ Roger Traylor, ND7PA, introduces us to State Machine Diagrams to describe the operation of an iambic keyer in "An Open Source Keyer with Programmable Control Outputs." Roger uses an ATmega48 microprocessor to implement his iambic keyer design. His Assembly program code is available for download from the ARRL *QEX* files website.

■ Eugeniusz (Eugene) Woloszczuk, W6EAW, shows you how to "Stabilize Your Transceiver Frequency Using GPS and Rubidium Reference Sources." Eugene shows us how he used a Trimble Thunderbolt GPS disciplined clock and a Rubidium Programmable Frequency Standard FE-5680A oscillator module to produce very stable reference oscillator signal sources for his ICOM IC-7800 transceiver and his Yaesu FT-857D transceiver. As a bonus, he built a clock circuit that is controlled by the GPS time signals.

■ Ray Mack, W5IFS, continues to explore the Texas Instruments TMS320C5535 eZDSP board in his "SDR: Simplified" column. Ray explains how to use the *Code Composer Studio* that comes with this inexpensive DSP development platform. He describes how to create a new "project" in *CCS*, and then leads us through testing the operation of the AIC3204 codec IC on the eZDSP board as a sound card.

■ You will find all this and more in the March/April 2012 issue of *QEX*!

QEX is edited by Larry Wolfgang, WR1B, (**lwolfgang@arrl.org**) and is published bimonthly. The subscription rate (6 issues) for ARRL members in the US is $24. For First Class US delivery, it's $37; in Canada and internationally by airmail it's $31. Nonmembers add $12 to these rates. Subscribe to *QEX* today at **www.arrl.org/qex**.

Would you like to write for *QEX*? It pays $50/printed page. Get more information and an *Author's Guide* at: **www.arrl.org/qex-author-guide**. If you prefer postal mail, send a business-size self-addressed, stamped envelope to *QEX* Author's Guide, c/o Maty Weinberg, ARRL, 225 Main St, Newington, CT 06111-1494.

Steve Ford, WB8IMY, wb8imy@arrl.org

Xtal Set Society SADL RF Attenuator Kit

Rich Arland, K7SZ
k7sz@live.com

There are times that many of us need a step attenuator to accurately control the output of an RF generator during receiver alignment, or to reduce the output of a QRP transmitter for on-air testing. Let's not forget the need for a step attenuator for use in transmitter hunting, where you need to drop the input to your receiver to avoid overload as you approach the hidden transmitter.

There have been many articles detailing with how to build a step attenuator. The current *ARRL Handbook* has a construction project on how to fabricate one of these inexpensive pieces of test gear. The obvious hurdle to overcome is parts procurement. Also, most of the step attenuators are not constructed to handle more than a half watt of input, and then only for a very short time.

Thankfully the creative folks at the Xtal Set Society have overcome these obstacles and provide a nifty little kit, including a plastic enclosure, for the paltry sum of only $49.95 plus shipping/handling. The really sweet thing about this attenuator kit is that in addition to a built-in dummy load with LED indicator, it will handle a full 5 W of RF indefinitely, making it an ideal tool for the QRP workbench/shack. This kit can be ordered in three configurations: complete kit with case, kit without case and PC board only.

Building the Kit

My QRP SADL (complete) kit arrived from the Xtal Set Society in a small box. The PC board was very well done with all through-hole components, which makes an easy build for my old eyes. All components are of high quality. Instructions are very easy to follow and the total build time was just short of two hours.

The build went smoothly right up until the very last resistor, R15. The instructions and the parts list called for a 10 kΩ ¼ W resistor, but the kit was furnished with a 1 kΩ ¼ W. A quick look at the schematic showed that R15 was a current limiting resistor for the LED indicator. Past experience had shown that a 1 kΩ resistor would be okay to use in this application so I went ahead and used the supplied resistor for R15 with no ill effects.

When mounting the high-wattage resistors onto the PC board the instructions called for using masking tape to hold the resistors in place before turning the PC board over and soldering the parts. I feel that this step is unnecessary if you take the time to slightly bend the component leads away from the hole and then solder the connections. It's a minor point, but one that speeds the build.

Testing and Use

Initial testing was a breeze. The instructions outline a valid testing procedure, which I followed. However, I decided to do some additional testing. Having a calibrated QRP wattmeter and dummy load, I connected the SADL kit between my Elecraft K3 and my calibrated wattmeter/dummy load and proceeded to apply 5 W of RF. With all the attenuators bypassed I observed 5 W on the wattmeter. I then switched in the attenuator's dummy load and the output meter dropped to 2.5 W. Essentially, both the dummy load in the attenuator and the dummy load on the wattmeter are in parallel and the output should drop to half the initial output of 5 W, which is exactly what happened.

All components are of high quality. Instructions are very easy to follow and the total build time was just short of two hours.

After switching out the attenuator's dummy load I systematically proceeded to crank in 3, then 6, then 9 and finally 12 dB pads and watched the RF on the calibrated meter. All worked as advertised with the RF output dropping from 5 W to 2.5, to 1.25 W, to 0.625 W and so on — just as it should.

One nice thing is the visual indicator. It's an LED that lights when the internal dummy load is activated and 5 W is applied to the input port of the attenuator. This is a great tuning aid for the workbench.

The choice of attenuator steps is interesting. Many attenuators are configured to include the following switchable pads: 3 dB, 6 dB and several 10 dB and 20 dB pads. This allows a wide range of attenuation. The Xtal Set attenuator kit has a single 3 dB pad, a single 6 dB pad and two 12 dB pads. The 3 dB pad cuts the RF signal in half and is equal to ½ of an S unit. A 6 dB attenuator equals 1 S unit, or a signal decrease by a factor of four. The 12 dB pad equals 2 S units or a factor of 16. In other words, this attenuator makes it easy to assess S meter accuracy. It also makes quick work out of figuring your QRPp (power levels below 1 watt) when reducing your transmitter output for those times you want to play the "How low can you go" game. You can accurately attenuate your 5 W QRP signal all the way down to 2.5 mW in 12 discrete steps for a total of 33 dB of attenuation!

Bottom line: This Xtal Set Society SADL QRP attenuator is an excellent first homebrew/kit building project and provides the frugal QRPer with a very useful and interesting piece of test equipment at an extremely attractive price.

Manufacturer: Xtal Set Society, PO Box 3636, Lawrence, KS 66046; tel 405-517-7347; **www.midnightscience.com**. *$49.95; kit without case, $41.95.*

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

ICOM IC-9100 MF/HF/VHF/UHF Transceiver

ICOM's new dc to daylight transceiver raises the bar.

Reviewed by Rick Lindquist, WW3DE
National Contest Journal *Managing Editor*
ww3de@arrl.org

The only real problem I encountered with the ICOM IC-9100 was getting it away from the delivery guy, a budding ham. He was taken by what was on the outside of the ICOM packing box. Users, however, have been impressed by what's *inside* the box of this solid-performing dc-to-daylight, all-in-one transceiver.

The IC-9100 is essentially the "plus" version of the IC-7410 reviewed in October 2011, and it shares many traits with that radio vis-à-vis its HF and 50 MHz capabilities, which we won't reiterate here in detail.[1] But it's not quite that straightforward. With the IC-9100's substantially higher price tag come the IC-7410's HF and 6 meter performance *plus* all-mode VHF, UHF and satellite features and capabilities. Think of it as a shack in a box. Is the IC-9100 a good value and match for your operating style and preferences — not to mention your budget? We'll report. You decide. Let's take a look.

Genealogy

We're tempted to think of the IC-7410 and IC-9100 solely as descendants of ICOM's venerable IC-746/756 platform (with a bit of IC-706 DNA thrown in for good measure). But, the '9100's nomenclature also recalls ICOM's noteworthy VHF-UHF three-band all-mode transceiver of a decade ago, the IC-910H. It comes as no surprise that the IC-9100 has retained the best features of its older sibling. ICOM and other manufacturers offer several all-mode transceivers that cover from HF through 440 MHz. The IC-9100, however, is only one of two currently available desktop radios that include an option for 1.2 GHz.

Fish or Fowl?

ICOM has done a creditable job of balancing the IC-9100's HF+50 MHz performance with its expanded VHF and UHF coverage and capabilities. The bare-bones IC-9100 is a full-featured 100 W transceiver for HF, 6 meters, 2 meters and provides 75 W on 70 cm, with all the goodies you'd expect for FM simplex and repeater operation plus satellite work. With our IC-9100 we ordered the optional UX-9100 23 cm module (10 W), UT-121 D-DSTAR module, optional narrow 1st IF ("roofing") filters for HF and 50 MHz and the *RS-BA1 IP Remote Control Software* package that permits remote control via the Internet or other IP network (more on this later). Add a power supply and antennas, and you're ready to cover considerable Amateur Radio real estate in relative style — without even having to be in your shack!

Doubling and Tripling Down

Packing these expanded capabilities into a box that's very similar to the IC-7410's and that has a nearly identical front panel requires many dual-purpose (or multi-purpose) buttons and controls. The labels are the same, nicely contrasting white-on-black style as the '7410's and easy to read, once you've deciphered the abbreviations dictated by space restrictions. Legends for some second and third-tier functions can be harder to make out. Good shack lighting helps considerably.

The '9100's broader and more-complex range of functions, especially those reserved for satellite work, means a steeper learning curve. The IC-9100 diverges from the IC-7410 in several significant ways, starting with the front panel, where there's been a bit of musical chairs between models. The '9100 features two independent receivers and can receive on two bands at the same time — although *not* on two HF bands.

There's a single MAIN DIAL for tuning, but the main and sub receivers do have separate (and concentric) AF GAIN and SQUELCH controls. With a stereo headset (or separate speakers) you can listen to both receivers at the same time, one in each ear. To do things such as operating split on HF means setting up VFO A and VFO B to the appropriate frequencies (you can designate a default split — say, 2 kHz — via the menu). The split function is independent from the repeater split function, also set via the menu.

The '9100 includes a DV/DR button (for digital voice/digital repeater operation) among the

Bottom Line

Compact and versatile, the IC-9100 handles almost any type of operating on the 160 meter through 2 meter bands, plus 70 and 23 cm.

[1] R. Lindquist, N1RL, "ICOM IC-7410 HF and 6 Meter Transceiver," Product Review, *QST*, Oct 2011, pp 49-54. This review and reviews of the other ICOM transceivers mentioned here are available to ARRL members online at **www.arrl.org/product-review**.

mode buttons, which are bracketed by the MENU and FILTER buttons. Given the addition of the DV/DR button, the '9100 does not have separate CW and RTTY mode buttons as on the '7410. There is a single CW/RTTY key. There are other accommodations. Take notes! There will be a quiz.

Since the main receiver's AF/RF SQUELCH controls take up the spot where the MIC and RF PWR controls live on the '7410, ICOM has relegated these functions to the row of four stem controls along the lower apron of the front panel. The '9100's stem controls are sturdier than the ones on, say, the IC-756PROIII, but it's difficult to determine their relative settings. The other two stem controls are for CW PITCH and KEY SPEED. A dab of white paint on the tiny arrow of each stem would help. The '9100's NOTCH control has migrated to the lefthand side of the panel to assume the outer ring position of the NR/NOTCH control, which, in turn, is directly above the main receiver's AF/RF SQUELCH controls.

Topping the column of buttons immediately to the right of the display window is the SATELLITE mode button, followed by the MAIN/SUB (band) selection and SUB buttons. The SPLIT, A/B and XFC buttons are on the bottom. A NOR/REV function for inverting satellite up and downlinks is a secondary function of the 7/[3] band/keypad button.

Complementing the PBT CLR (passband tuning clear) button on the right hand side of the panel is the SUB DIAL button. Its function is too difficult to explain in a few words and without the table in the *Instruction Manual*, which didn't do a very good job of explaining it anyway; the manual says that it enables tuning, mode selection, memory selection and programming for the sub band receiver. The SUB DIAL button is not to be confused with the MAIN/SUB and SUB buttons or with the MAIN and SUB secondary-function buttons.

Concentric rotary controls on the right hand side of the panel — where the NOTCH/CW PITCH controls are on the '7410 — enable selection of memory channels for the main and sub band receivers. There are no physical buttons or controls for enabling and adjusting the speech compressor; these are menu functions. The row of buttons to the immediate right of the stem controls include P.AMP/ATT, NB, VOX/BK-IN, MONITOR and CALL/GPS. *GPS?* With an NMEA compatible, third-party GPS receiver connected to the transceiver's DATA jack, you can display, transmit, receive and store GPS/GPS-A data. The *Instruction Manual* devotes 16 pages to this topic.

Okay, got it? And we haven't even discussed the display!

Table 1
ICOM IC-9100, serial number 02001053

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-60, 136-174, 420-480, 1240-1320 MHz; transmit, 1.8-2.0, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54, 144-148, 430-450, 1240-1300 MHz.	Receive, as specified; transmit, as specified, except 5.255-5.405 MHz, non channelized. The optional UX-9100 is required for 23 cm operation.
Power requirement: 13.8 ±15% V dc; receive, 4.5 A (max audio, HF, 50, 144, 430 MHz), 5.5 A (max audio, 1200 MHz); transmit, 24 A (HF, 50, 144, 430 MHz), 9 A (1200 MHz).	13.8 V dc; receive 3.2 A (no signal, max audio), 3 A (no signal, max audio, backlight off); transmit, 19.7 A (HF, 144, 430 MHz), 8.4 A (1296 MHz); 54 mA (transceiver off). Operation confirmed at 11.4 V dc (89 W output, HF).
Modes of operation: SSB, CW, AM, FM, RTTY, DV.	As specified. The optional UT-121 is required for DV operation.
Receiver SSB/CW sensitivity: 2.4 kHz bandwidth, 10 dB S/N: 0.1-29.99 MHz, 0.16 µV; 50-54 MHz, 0.13 µV, 144/430/1200 MHz, 0.11 µV.	***Receiver Dynamic Testing*** Noise floor (MDS), 500 Hz filter, 3 kHz roofing filter: *Preamp / Off / 1 / 2* 0.137 MHz –122 –131 –135 dBm 0.505 MHz –134 –140 –142 dBm 1.0 MHz –133 –140 –142 dBm 3.5 MHz –134 –142 –144 dBm 14 MHz –133 –141 –143 dBm 50 MHz –130 –140 –142 dBm 144 MHz — — –143 dBm 430 MHz — — –144 dBm 1296 MHz — — –145 dBm
Noise figure: Not specified.	Preamp off/1/2: 14 MHz, 13/6/4 dB; 50 MHz, 17/7/5 dB, 144 MHz, 4 dB; 430 MHz, 3 dB; 1296 MHz, 2 dB.
AM sensitivity: 6 kHz bandwidth, 10 dB S/N: 0.5-1.799 MHz, 12.6 µV; 1.8-30 MHz, 2 µV; 50-54 MHz, 1.6 µV; 144/430 MHz, 1.4 µV.	10 dB (S+N)/N, 1 kHz tone, 30% modulation, 6 kHz bandwidth: *Preamp / Off / 1 / 2* 1.0 MHz 1.68 0.72 0.65 µV 3.8 MHz 1.46 0.62 0.56 µV 50.4 MHz 2.51 0.92 0.75 µV 144 MHz — — 0.57 µV 430 MHz — — 0.55 µV
FM sensitivity: 15 kHz bandwidth, 12 dB SINAD: 28-29.7 MHz, 0.5 µV; 50-54 MHz, 0.32 µV; 144/430/1200 MHz, 0.18 µV	For 12 dB SINAD, 3 kHz deviation, 15 kHz bandwidth: *Preamp / Off / 1 / 2* 29 MHz 0.56 0.21 0.17 µV 52 MHz 0.70 0.20 0.20 µV 146 MHz — — 0.17 µV 440 MHz — — 0.17 µV 1290 MHz — — 0.15 µV
Spectral display sensitivity: Not specified.	Preamp off/1/2, –94/–101/–110 dBm.†
Blocking gain compression dynamic range: Not specified.	Blocking gain compression dynamic range, 500 Hz bandwidth, 3 kHz roofing filter: *20 kHz offset / 5/2 kHz offset* *Preamp off/1/2 / Preamp off* 3.5 MHz 141/139/138 dB 121/111 dB 14 MHz 142/140/134 dB 120/111 dB 50 MHz 139/141/136 dB 119/110 dB *Preamp 2 / Preamp 2* 144 MHz 130 dB 111/110 dB 430 MHz 119 dB 109/103 dB 1296 MHz 100 dB 95/89 dB
Reciprocal mixing dynamic range: Not specified.	Reciprocal mixing dynamic range, 500 Hz bandwidth, 3 kHz roofing filter: 14 MHz, 20/5/2 kHz offset: 101/80/77 dB.
ARRL Lab Two-Tone IMD Testing	See Table 2.
Second-order intercept point: Not specified.	Preamp off/1/2, 14 MHz, +65/+65/+65 dBm; 50 MHz, +73/+73/+73 dBm; preamp 2, 144 MHz, +69 dBm; 430 MHz, +90 dBm.
FM adjacent channel rejection: Not specified.	Preamp 2: 29 MHz, 81 dB; 52 MHz, 78 dB; 146 MHz, 77 dB; 440 MHz, 66 dB; 1290 MHz, 68 dB.

Table 1
ICOM IC-9100, serial number 02001053 [continued]

Manufacturer's Specifications	Measured in the ARRL Lab
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, preamp 2: 29 MHz, 81 dB*; 52 MHz, 78 dB*; 146 dB, 77 dB*; 440 MHz, 66 dB*, 1290 MHz, 68 dB*. 10 MHz channel spacing: 29 MHz, 115 dB; 52 MHz, 113 dB; 146 MHz, 97 dB; 440 MHz, 82 dB; 1290 MHz, 70 dB.
DSP noise reduction: Not specified.	Variable, 18 dB maximum.
Notch filter depth: Not specified.	Manual notch: 61 dB, auto notch: 53 dB, attack time: 40 ms.**
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off/1/2, 62.3/26.3/9.9 µV; 50 MHz, 80.3/31.2/12.3 µV; preamp 2, 144 MHz, 3.35 µV; 430 MHz, 3.16 µV; 1296 MHz, 3.05 µV.
Squelch sensitivity: SSB (HF/50 MHz), <5.6 µV, FM (HF/50 MHz), <0.3 µV; SSB (144/430/1200 MHz), <1.0 µV, FM (144/430/1200 MHz), <0.18 µV.	At threshold, preamps on: SSB, HF, 0.8 µV; 50 MHz, 1.0 µV; 144 MHz 0.39 µV; 430 MHz, 0.46 µV; 1296 MHz, 0.39 µV; FM, 29, 50 and 440 MHz, 0.1 µV, 146 MHz, 0.09 µV; 1290 MHz, 0.05 µV.
Receiver audio output: >2 W into 8 Ω at 10% THD.	2.14 W at 10% THD into 8 Ω. THD at 1 V RMS, 0.85%.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth):** CW (500 Hz): 340-820 Hz (480 Hz); Equivalent Rectangular BW: 504 Hz; USB: (2.4 kHz): 360-2614 Hz (2254 Hz); LSB: (2.4 kHz): 360-2618 Hz (2258 Hz); AM: (6 kHz): 175-3152 Hz (5954 Hz); AM: (9 kHz): 175-3875 Hz (7400 Hz).
Spurious and image rejection: HF and 50 MHz, (except IF rejection on 50 MHz): >70 dB; 144/430 MHz, >60 dB; 1200 MHz, >50 dB	First IF rejection, 14 MHz, 103 dB; 50 MHz, 105 dB*; 144 MHz, 143 dB; 430 MHz, 137 dB*; 1296 MHz, 127 dB*. Image rejection, 14 MHz, >121 dB; 50 MHz, > 110 dB;144 MHz, 75 dB; 430 MHz, 89 dB; 1296 MHz, 104 dB.
Transmitter	***Transmitter Dynamic Testing***
Power output: HF & 50 MHz: SSB, CW, RTTY, FM, 2-100 W; AM, 2-30 W; 144 MHz, 2-100 W; 430 MHz, 2-75 W; 1200 MHz, 1-10 W.	HF: CW, SSB, RTTY, FM, typically 1.8-102 W, AM, 0.25-27 W; 50 MHz: CW, SSB, RTTY, FM, 1.7-95 W, AM, 0.25-25 W; 144 MHz, 1.5-98 W; 430 MHz, 1.4-71 W; 1296 MHz, 0.5-9.3 W.
Spurious-signal and harmonic suppression: >50 dB (HF), > 63 dB (50/144 MHz); >61.8 dB (430 MHz); >53 dB (1200 MHz).	HF, 68 dB (20 m), typically >70 dB; 50/144/430/1296 MHz, >70 dB. Meets FCC requirements.
SSB carrier suppression: > 40 dB.	HF/144/430/1296 MHz, >70 dB; 50 MHz, 68 dB.
Undesired sideband suppression: >55 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified. (dB)	3rd/5th/7th/9th order (20 m, worst case): HF, 100W PEP, –29/–36/–50/–64; 50 MHz, 100 W PEP, –29/–34/–43/–54; 144 MHz, 100 W PEP, –26/–37/–43/–54; 430 MHz, 75 W PEP, –24/–37/–45/–53; 1296 MHz, 10 W PEP, –37/–53/–55/–58.
CW keyer speed range: Not specified.	6.1 to 46.7 WPM. Iambic keyer Mode B.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 87 ms at speaker, 18 ms at accessory jack.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 61 ms; FM, 12 ms.
Composite transmitted noise: Not specified.	See Figure 3.
Size (height, width, depth): 4.6 × 12.4 × 13.5 inches; weight, 24.2 pounds.	
Price: IC-9100, $3600; UX-9100 23 cm module, $700; UT-121 DV adapter, $230; RS-BA1 remote control software, $100; FL-430 (6 kHz), FL-431 (3 kHz) roofing filters, $125 each.	

†Simple band scope; receiver is muted during scanning.
*Measurement was noise-limited at the value indicated.
**Single beat note. Reduces two beat notes up to 40 dB with attack time depending on separation of signals, typically 500 ms.
***Default values, sharp setting (smooth setting is available). Bandwidth and cutoff frequency are adjustable via DSP. CW bandwidth varies with PBT and pitch control settings.

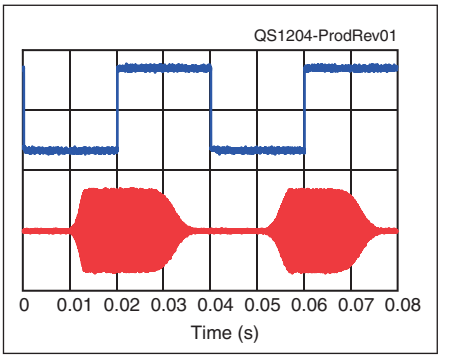


Figure 1 — CW keying waveform for the IC-9100 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

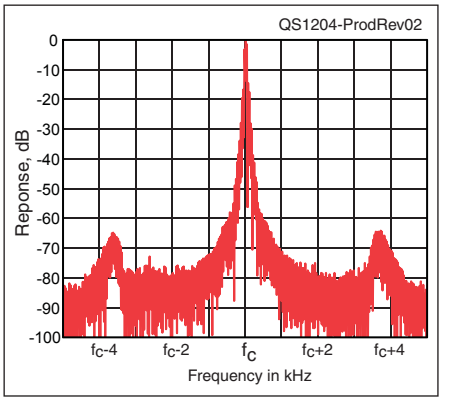


Figure 2 — Spectral display of the IC-9100 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB. Note that the keying sideband level rises slightly at the edges, to the –65 dB range.

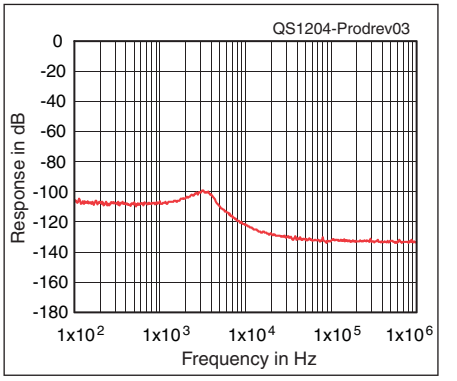
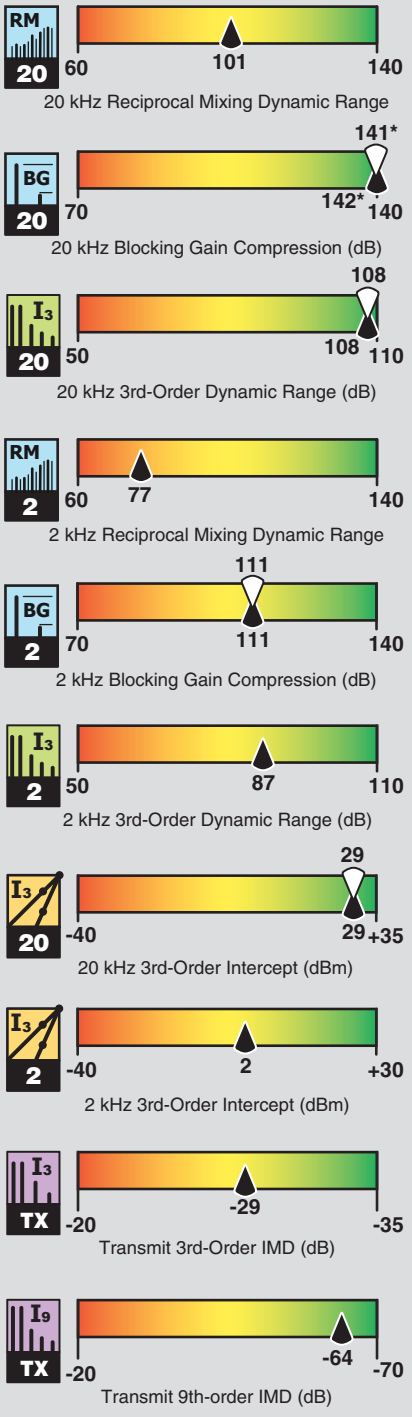


Figure 3 — Spectral display of the IC-9100 transmitter output during composite noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

Key Measurements Summary



pr067

Key: * Off Scale

Dynamic range and intercept values with preamp off.

Intercept values were determined using -97 dBm reference

80 M

20 M

See the digital edition and the QST-in-Depth website (**www.arrl.org/qst-in-depth**) for the VHF/UHF measurements summary.

Table 2
ICOM IC-9100, serial number 02001053

ARRL Lab Two-Tone IMD Testing (500 Hz DSP bandwidth, 3 kHz roofing filter)‡

Band/Preamp	Spacing	Input Level	Measured IMD Level	Measured IMD DR	Calculated IP3
3.5 MHz/Off	20 kHz	–26 dBm –13 dBm	–134 dBm –97 dBm	108 dB	+28 dBm +29 dBm
14 MHz/Off	20 kHz	–25 dBm –13 dBm 0 dBm	–133 dBm –97 dBm –63 dBm	108 dB	+29 dBm +29 dBm +32 dBm
14 MHz/1	20 kHz	–35 dBm –20 dBm	–141 dBm –97 dBm	106 dB	+18 dBm +19 dBm
14 MHz/2	20 kHz	–42 dBm –27 dBm	–143 dBm –97 dBm	101 dB	+9 dBm +8 dBm
14 MHz/Off	5 kHz	–37 dBm –26 dBm 0 dBm	–133 dBm –97 dBm –23 dBm	96 dB	+11 dBm +10 dBm +12 dBm
14 MHz/Off	2 kHz	–46 dBm –31 dBm 0 dBm	–133 dBm –97 dBm –18 dBm	87 dB	–2 dBm +2 dBm +9 dBm
50 MHz/Off	20 kHz	–20 dBm –13 dBm	–130 dBm –97 dBm	110 dB	+35 dBm +29 dBm
144 MHz/2	20 kHz	–47 dBm –34 dBm	–143 dBm –97 dBm	96 dB	+1 dBm –2 dBm
430 MHz/2	20 kHz	–50 dBm –36 dBm	–144 dBm –97 dBm	94 dB	–3 dBm –5 dBm

‡ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. on the first line in each group. The "IP3" column is the calculated third-order intercept point. Intercept points were determined using –97 dBm reference. Receiver IMD not measured at 1296 MHz due to lack of third signal generator capable of operation above 1 GHz.

Window on the World

The main receiver's frequency and settings appear in the top half of the commodious monochrome display, the sub receiver's frequency and settings in the bottom half. Only one-half of the display can handle transmit frequency readout and settings. The receivers' frequency readouts are sizeable and extremely easy to see from across the room. Display contrast and brightness are adjustable via a menu.

I found it difficult to read the rather light "dot matrix" type text presented in the menu area along the bottom of the display. Its limitations were especially noticeable while decoding RTTY signals using the built-in decoder. Selecting the desired first IF filter via this menu can be a bit tricky, too, as this involves pressing and holding a button to step through the choices. These filters sure are nice to have, though; I'd suggest setting these up to defaults by mode.

Since IC-9100 users are more likely to be using the main and sub receivers in tandem, the tiny (but clearer and darker) legends on the display screen may be hard to see. In some cases, these too-subtle readouts provide the only means of knowing a particular feature is enabled. In a few cases I had to toggle the feature on and off, to see where something appeared or vanished.

Let's Do the Numbers!

The IC-9100 delivers the same competent performance we experienced with the '7410 on HF and 50 MHz and more than merely commendable performance on VHF and UHF. It is that latter capability that anyone considering the purchase of an IC-9100 should care about; if not, the IC-7410 might be a better option.

While sensitivity is an important receiver performance metric, all of today's amateur transceivers hear well. This shifts the focus to *dynamic range* as a more significant parameter.

Dynamic range numbers, in general, quantify a receiver's ability to perceive weak signals in the vicinity of strong signals (see sidebar, "Reciprocal Mixing Testing: What Is It?" which explains the subtleties of the various shades of dynamic range). How does the IC-9100 stack up in those higher reaches of the Amateur Radio spectrum? Quite well, as it turns out. A two tone, third order IMD DR number of 100 dB or greater (at 20 kHz spacing) once was considered the hallmark of a quality HF receiver. The IC-9100 tops that benchmark at 50 MHz by 10 dB and it comes pretty close at 144 MHz and at 430 MHz.

In terms of blocking gain compression, the IC-9100 turns in excellent numbers on 144 and 430 MHz, more than 100 dB even at 2 kHz spacing. It's a bit lower on 23 cm. For comparison, on HF (14 MHz), where you'd expect better performance, the '9100 comes in at 142, 120 and 111 dB (preamp off) at 20, 5 and 2 kHz spacings, respectively.

The IC-9100's VHF and UHF performance is superior to that of the IC-910H. To see how far we've come over the past decade, the IC-910H's two tone, third order IMD DR came in at 85 dB (noise limited) at 144 MHz, 80 dB at 432 MHz and 78 dB (noise limited) at 1.2 GHz — all at 20 kHz spacing.

To ALC or Not

In the wake of a report or two we'd overheard on the Internet, we checked for ALC overshoot. This would cause the transmitter's output power to max out for a split second before the ALC circuitry reins it in. Here's what we found: At various barefoot exciter power levels, we observed *no* overshoot whatsoever in the CW mode — the mode we use in testing for power spikes. In SSB mode, we found *no* overshoot at full output. At power levels below 50 W *and with the speech compressor enabled,* however, we observed a power spike on the first syllable of the word *hello*. We carefully observed the ALC readout while transmitting, keeping it at about two thirds of full scale. There was *no* apparent power spike if we switched off the speech compressor.

This particular issue might be a problem when using certain amplifiers. If so, we would recommend turning off the speech compressor; this would also keep the linear amplifier output within the legal power limit.

ICOM was still looking into this issue as this review went to press.

Okay, Now for the Really Cool Stuff

ICOM's optional *RS-BA1* software makes it possible to operate the IC-9100 remotely via the Internet or a local network. The software is actually two programs — a remote connection utility and a virtual front panel to control the radio. I had somewhat mixed but overall gratifying results using it.

Your "server" PC must have a direct Internet connection; for me this meant snaking an extra long Ethernet cable down the stairs and through the house. To load the software, you'll need to enter the product ID and license key from the CD label. Our software CD, labeled "Programming Software Icom Cloning System," came with the original program version and an upgrade. The software does not come with a hard copy manual. A PDF manual was supposed to be on the CD, but it was not, nor was it available on ICOM's website. I found it on a third-party website, **www.ab4oj.com**. ICOM does offer a *RS-BA1 Quick Reference Guide* online at **www.icomamerica.com.**

Understanding the instructions in either resource can require good intuition and even outright speculation, and the English in the software itself was occasionally hard to decipher. What I saw on my screen did not always comport with the instructions. All of this aside, the software *does* work, although setting everything up can be rather demanding and requires some degree of computer and networking savvy.

Help is at hand, however. After running into a brick wall on connecting to the remote

Reciprocal Mixing Testing: What Is It?

You may notice two new color bars in the "Key Measurements Summary" at the top of this review. These are for *reciprocal mixing dynamic range* (RMDR), with measurements at 20 and 2 kHz spacing. We've reported reciprocal mixing since December 2007, but it's easy to overlook these figures in the table. From this review forward, we will include RMDR in the Key Measurements Summary.

We report three dynamic range measurements that determine a transceiver's overall performance. Along with *blocking gain compression dynamic range* and *two tone third order dynamic range,* we must consider RMDR while evaluating how well a receiver hears. Which of these measurements is the most important factor in comparing receivers depends a lot on how you plan to *use* that receiver. For hearing weak signals at or near the receiver's noise floor, receiver noise typically is the limiting factor. For the reception of stronger signals under crowded band conditions, two tone third order DR is the most important number. To assess a receiver's ability to perform well in the presence of a single, strong off-channel signal (common within geographical ham radio "clusters" or with another ham on the same block), blocking gain compression DR is usually the dominant factor.

Reciprocal mixing is noise generated in a superheterodyne receiver when noise from the local oscillator (LO) mixes with strong, adjacent signals. All LOs generate some noise on each sideband, and some LOs produce more noise than others. This sideband noise mixes with the strong, adjacent off-channel signal, and this generates noise at the output of the mixer. This noise can degrade a receiver's sensitivity and is most notable when a strong signal is just outside the IF passband. RMDR at 2 kHz spacing is almost always the worst of the dynamic range measurements at 2 kHz spacing that we report in the "Product Review" data table.

We perform the reciprocal mixing test at 14.025 MHz, using a very low noise Wenzel test oscillator with a measured output of +14 dBm. The test oscillator's sideband noise is considerably below the reciprocal mixing we're measuring. We feed the oscillator's output into a step attenuator, which we adjust until an audio meter on the receiver's output indicates a 3 dB increase in background noise. The RMDR is the output level at which we note this 3 dB increase.

Here's an example: Suppose the receiver's noise floor (minimum discernable signal, MDS) is –133 dBm, and a strong station 2 kHz away causes a 3 dB increase in noise at a level of –53 dBm into the receiver's antenna jack. The reciprocal mixing figure is MDS minus the 3 dB increase level: –133 dBm – (–53 dBm) = –80 dBm. We previously would have reported this as –80 *dBc*. Since we now consider this as a dynamic range number, we report it simply as 80 dB.

In our real-world example, if your receiver's MDS is –133 dBm, a signal 2 kHz away at 20 dB over S-9 will cause the noise in the audio output to increase by 3 dB. This reduces your receiver's MDS by that amount, resulting in an MDS of –130 dBm. A stronger signal will create more noise, but our benchmark for testing is a 3 dB increase in noise.

The upper end of the RMDR bar on the key measurements summary charts has been set just above the highest RMDR seen in the ARRL Lab to date. SDR and analog type receivers have different performance characteristics and design tradeoffs. For instance, some I/Q SDRs have been observed to have rather mediocre third order IMD dynamic range when tested in a laboratory environment with just two signals, but if hooked to an antenna with multiple signals simulating real band conditions, have considerably higher third order IMD dynamic range. RMDR, on the other hand, can be lower under the same conditions than what is observed in the Lab. If choosing a receiver for real world use, it's important to consider all three dynamic range parameters.

Note how reciprocal mixing relates to the two-tone third order DR figures, especially at 5 and 2 kHz spacing. A *single*, strong adjacent signal 5 or 2 kHz from the desired signal with resulting reciprocal mixing has a greater impact on a your ability to hear a desired weak signal than do *two* strong signals 5 and 10 kHz away (5 kHz spacing) or 2 and 4 kHz away (2 kHz spacing) with a resulting intermodulation distortion (IMD) product that covers up the desired signal. In many cases, reciprocal mixing dynamic range is the primary limiting factor of a receiver's performance.

— Bob Allison, WB1GCM, ARRL Laboratory Engineer

Into the Great Beyond: VHF/UHF and Satellite Operation

Prior to lab testing the IC-9100, I installed the UX-9100 23 cm band unit. The electronics are concealed in a die cast metal box, with few connections necessary, but you must follow the single page of instructions closely. Installation took about 40 minutes and went smoothly.

We also added the UT-121 module for digital voice (D-STAR) operation. It's a 1¾ inch double sided circuit board with a tiny, multi-pin connector that plugs in directly behind the radio's front panel. This entails removing both covers and tilting the front panel. Double-sided tape secures the UT-121. The instructions were easy to follow, but have a magnifying glass handy to ensure the plugs are properly seated. Installation took about 20 minutes, and I confirmed proper operation by contacting the W1HQ D-STAR repeater at the ARRL Lab.

ARRL Roanoke Division Vice Director Jim Boehner, N2ZZ, mentioned that after he installed the UT-121 in his new IC-9100, the radio locked on transmit whenever he made a DV transmission. A few other users have reported this issue as well. "I reseated the module several times to no avail," he told us. "What did work, though, was slightly rotating the module clockwise and counterclockwise about a degree or so after insertion. I guess this allowed the contacts to finally seat properly."

Satellite Operation

Since VHF/UHF lab results overall were quite good, I was curious to try the IC-9100 using the satellite mode. So, it was off to W1AW where station manager Joe Carcia, NJ1Q, hooked up the satellite tracking antenna. Rotator control was via *Orbitron* software, which also provided a Doppler-corrected frequency readout of the uplink and downlink frequencies of available satellites. If you're relatively new to satellite operation (as I am), you'll soon realize the need to do some homework before attempting contacts. I picked the AO-27 FM "Easy Sat."

As a first time satellite operator, I naively pushed the SATELLITE button and hoped for the best. Most who have operated through satellites will not be surprised that after aimlessly pressing other buttons I had to go to the well written manual.

With a bit of practice, I determined how to enter satellite mode and dial in a satellite's uplink and downlink frequencies. The '9100 has 20 satellite memory channels. I simply used VFO mode, which is pretty slick. The uplink and downlink frequencies track each other, and you can reverse the direction in one VFO for inverting satellites (as well as invert sidebands as necessary).

As AO-27 passed above the horizon, I simply tuned for best reception while matching the predicted Doppler adjusted frequency that *Orbitron* displayed. To ensure you're not running too much power (doing so can sap the satellite's power resources) you can perform a *loop test*. This is done by noting the satellite beacon's signal strength and then listening to yourself on the downlink. Your downlink signal should *always* be weaker than that of the beacon. I found that just 2 or 3 W did the trick.

During the next pass I made two contacts. Many were waiting to do the same, so I kept each contact brief. I greatly appreciated the ease with which the '9100 makes satellite contacts possible. The sensitivity on each

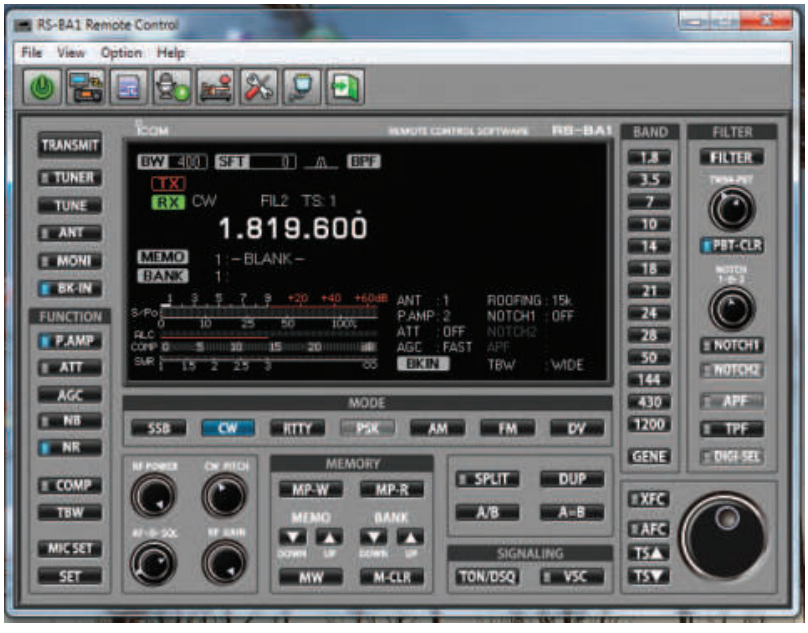


Figure 4 — The RS-BA1 control screen.

server, I got excellent advice and assistance from the *Yahoo! RS-BA1* users' group, especially from Herb Schoenbohm, KV4FZ, who is extremely knowledgeable regarding the ins and outs of networking in general and this software in particular.

I was able to connect to the IC-9100 via my wireless LAN and control it from my den using a laptop. The virtual front panel (Figure 4) is smallish and generic, since the *RS-BA1* software works with other ICOM radios, including the IC-7600, '7700 and '7800, and even some older ICOMs, such as the 'PROIII. It is not possible to access all of the radio's functions remotely — most notably in the case of the '9100, the satellite mode — and only *one* VFO is available, although split operation is still possible. You cannot change filter settings or adjust noise reduction or noise blanker levels. The screen offers full metering capabilities, including an S-meter. Among other limitations, while you can access the radio's four CW memories, there is no way to adjust the CW keyer speed from the remote PC, and there's no VOX for phone operation. A loud and increasingly annoying beep accompanies every mouse action on the control screen. This includes tuning up and down, done via the right and left mouse buttons, respectively.

Operating CW involves inputting text from the keyboard, which either goes into a buffer or can be sent immediately (there's no way to connect a key or paddle). This takes getting used to, but I was able to work stations after a fashion. Operating phone was another matter, and I never really was able to get clear, untroubled audio from the remote PC to the transceiver. When connected via the remote laptop, considerable hiss and hash threatened to overwhelm the spoken word completely. Connecting "locally" at the

band is excellent, which helps pull out the weak-ish signals emanating from low powered satellites.

Terrestrial V/UHF Operation

The ARRL January VHF Sweepstakes offered another opportunity to put the '9100 to the test. My own all band transceiver does all right with the help of external preamps, although at times it's prone to overload and other unwanted effects from several local strong stations, especially on 2 meter SSB.

I normally run a 150 W brick amplifier on 2 meters, but the '9100's 100 W out represented only about a 1.8 dB gain reduction. On the other hand the nearly 75 W output on 432 MHz was an improvement over my usual 20 W, yielding a 5.7 dB boost. A temporary 14 element loop Yagi served as my very first 23 cm antenna for SSB operation, providing a calculated 100 W ERP.

My high hopes of beating my own previous best score were dashed somewhat, as the very cold weather made my rotators sluggish or freeze up altogether. I got a good idea of strong adjacent signal receive performance when big gun and fellow HQ staffer Dave Patton, NN1N, aimed his 6 meter array at me, with a booming 40 dB over S9 signal. I listened carefully about 2 kHz away and found only a small amount of reciprocal mixing noise adding to the noise floor.

I had quite a thrill making my first 23 cm SSB contacts. The IC-9100 with the UX-9100 operated as expected, with clear audio from the speaker. A local contester who knows my voice listened with a critical ear and reported clean, smooth sounding transmitted audio.

In Summary

Overall, I found my operating experience with the '9100 very pleasing and the performance superb, but I did find one thing that would cause minor issue in my shack. Granted, having a separate antenna jack for each VHF/UHF band is great for contesting and satellite operation, but it might hamper FM operation a bit with my multiband 2 meter/70 cm antenna. I'd need a diplexer to monitor both bands at once. A minor footnote: AM mode is not available above 50 MHz. Also, seasoned VHF and UHF contesters often pair HF transceivers with high performance, single band transverters. The IC-9100 does not include provisions to accommodate transverters for 222 MHz, 2304 MHz or other bands of interest to some VHF/UHF operators.

Two things could use improvement. First, I would like to see individual RF output settings for each RF output port. This would make operation "*Ooops!* proof" while using external amplifiers, each needing a specific drive level. Operating full output at 70 cm then switching to 2 meters without reducing the '9100's RF power output control would send 100 W into the brick amp and damage it. Second, the optional narrow first IF filters are not available above 6 meters. For a more serious contester with a lot of aluminum in the air, having a narrow roofing filter could make a huge difference in bands crowded with strong signals.

All told, I would consider the IC-9100 an ideal choice for the single radio shack. — *Bob Allison, WB1GCM, ARRL Test Engineer*

server PC in the shack greatly attenuated, but did not eliminate, this noise. Some users have complained about "hiss" in their audio, and this may be what I heard.

The most fun I had with the *RS-BA1* software was connecting to another radio amateur's IC-7410 in another part of the world. While there was a fair amount of latency (delay) on the connection, I was able to hear my own station's signal on 160 meters, which offered an opportunity to check different antennas and power levels. All told, this ICOM package can and does work, although there are more elegant solutions to remotely controlling your station — some of them free.

Miscellany

The IC-9100 includes provisions for using VHF/UHF mast mounted preamps. The manual points out that ICOM AG-25, AG-35 or AG-1200 preamplifier units are compatible for the 2 meter, 70 cm and 23 cm bands, respectively. If you want to use one of these OEM preamps, however, you'll have to find it on the used market. As a footnote points out, they've been discontinued. The menu includes an EXT-P.AMP selection for each affected band.

A potentially ear saving touch: The IC-9100 has a CW sidetone level limit in the menu, so the sidetone does not get louder beyond a specified level as you advance the AF control. (I sure wish my current transceiver had this!) The sidetone level is a separate adjustment in the SET menu.

As with the IC-7410, you can monitor SWR and *relative* power output at the same time. The '9100 has an LCD bar-graph style meter, which can be set up to hold peaks for 0.5 second. The radio also retains the really slick SWR plotting feature, letting you read and *graph* your antenna system's SWR curve, right on the screen. This is available on all bands except 1.2 GHz. You can plot up to 13 points in various steps. Transmit briefly to plot the SWR on each step, and when you're done, the screen will graphically display the SWR profile of the antenna system under test.

The '9100 has an automatic frequency control feature with settable limits. This feature, especially useful for satellite work, automatically compensates for a drifting received signal.

The transceiver draws 54 mA when it's turned off. This may only be of concern if running the radio from a battery power source; leaving the transceiver hooked up to the battery will consume 1.3 Ah per day. The *Instruction Manual* recommends disconnecting the battery from the transceiver if you don't plan to use it for a while.

The Verdict?

All told, the IC-9100's multimode capability and ample feature set get the job done, and, if equipped for 1.2 GHz operation — on *14* MF, HF, VHF and UHF bands! Throw in the *RS-BA1* remote package, and you're on the air from any place you can connect to the Internet.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 800-872-4266; **www.icomamerica.com**.

ICOM IC-9100 Video

If you own a tablet or smartphone with the appropriate application, scan this QR Code to see a video overview of the ICOM IC-9100 transceiver. You can also watch this video on your computer by going to (case sensitive):

http://youtu.be/tVgSFn2nV04

The Doctor is In

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

Can you use that antenna on another band? Maybe.

Q Tom, K7TBM, asks: In the January 2012 "Doctor is In" column you discuss the fact that the ground reflections that add to support low angle radiation from a horizontal antenna occur at some distance from the antenna: "*Again, this is not the ground directly under the antenna, but the ground from which the reflection takes place, some distance away. The higher the antenna is, the further the distance to the ground that will reinforce the peak of the elevation pattern.*"

Is there an easy way to determine what this reflection distance is? I overlook some water and I am curious if that is the reflection point.

A There are a number of ways to address this. The results are not just dependent on height, but also the contour of the nearby terrain. The program *HFTA (High Frequency Terrain Analysis)* that comes with recent editions of *The ARRL Antenna Book* makes use of the actual USGS terrain mapping data to make the calculations for your exact location.[1]

[1] *The ARRL Antenna Book*, 21st Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

To get a rough idea we can use plane geometry, with the simplifying flat earth assumption, to estimate the distance for level terrain. Figure 1 shows the geometry involved, while Figure 2 shows the geometry using the equivalent "image" antenna beneath the ground. As indicated, while the wavelength is important to figure the intensity of the combined direct and reflected wavefronts, it is not a factor in determining the actual distance to the reflection point.

Table 1
Distance to Reflection Point for Ray Traced Wavefront vs Take-off Angle

Take-off Angle θ (°)	Tan θ	Distance, H=50' (')	Distance, H=100' (')
2°	0.035	1432	2864
5°	0.087	571	1143
10°	0.176	284	567

The distance to the reflection point can be determined from Tan θ = H/D. Thus,

D = H/Tan θ.

Table 1 shows the results from the calculations for some typical heights and angles with the resulting distances to the reflection point.

The path to any distant point is a function of the ionospheric height at any moment and the required take-off angle, which change throughout the day. Of course, the ray model used is a simplification. The ground is not a smooth reflecting surface, and will likely have a smear of reflections from different depths. Still it should give you a good idea of what you are working with.

Q Rob, WB2HYO, asks: Could I use my ¼ wave 20 meter vertical ground plane antenna on 10 meters without having to install any other matching system?

A The 20 meter ¼ wave will be close to the dimensions of a half wave end-fed monopole on 10. It will have a good pattern on 10, especially if you add a few ¼ wave 10 meter radials, but will have an impedance of around 1000 Ω and a 20:1 or greater SWR in 50 Ω coax.

If you were to feed a 20:1 SWR through 100 feet of low loss LMR-400 coax, it would suffer about 2.5 dB loss and have an SWR of 11:1 at the radio end. Neither of

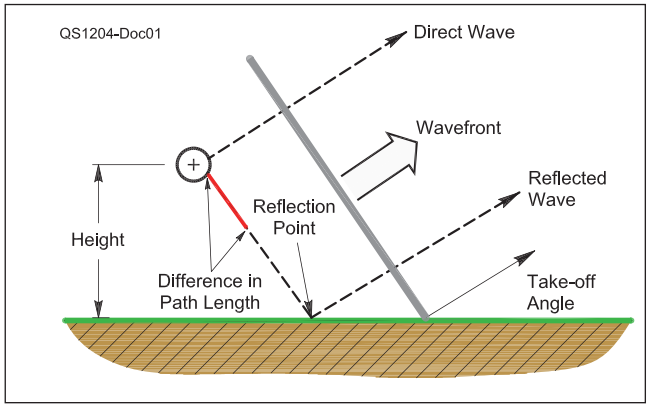


Figure 1 — Illustration of additional path length and thus phase delay of reflected wave.

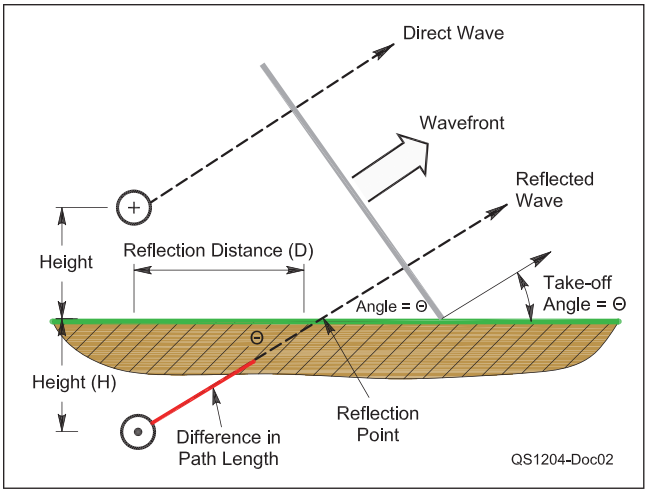


Figure 2 — Image antenna concept for visualizing ground reflection. Note opposite polarity (180° phase shift) of image for horizontal polarization.

these effects would be terrible. In fact it will have about 2 dB gain at low angles compared to a similar ¼ wave ground plane on 10 meters, so it will be close to a break-even situation.

The only problem will be whether your tuner can deal with it. Shorter coax will mean less loss, but a higher SWR at the radio end, while longer or lower quality coax will have more loss but lower SWR. Still many tuners have more tuning range at 10 meters than on the lower bands. If you will have a higher SWR than your tuner's specification, even though it may tune, it might exceed the tuner ratings, especially at high power.

Using a remote antenna tuner at the base will solve the loss problem, but will likely subject the tuner to more stress than desired. A length that is longer, such as ⅝ wave on 10 meters (about 21.5 feet), should avoid the high impedance problem, work better and be easy to match on both bands.

Q Lynn, K9KR, asks: How far apart do the wires in a balanced transmission line need to be before they are no longer considered a feed line and become part of the antenna? If one uses a V type of feed line, with the top about 2 feet apart, and the bottom 3 or 4 inches apart, is it a feed line?

A There is not an exact answer, because it depends on how much radiation will be acceptable. A terminated rhombic antenna is, after all, just a wide spaced transmission line that radiates a lot. But it is still a transmission line because about half the power reaches the termination at the far end. If you were looking at it from the standpoint of a transmission line, you'd say "this line has 3 dB loss" — not bad compared to some coax, for example.

The usual rule of thumb is that if the spacing is less than 1/100 of a wavelength, the radiation is "small." This works out to be about 4 inches on 10 meters, a fairly typical spacing for open wire line. This assumes that you are measuring at some distance from the line such that the spacing is much less than the total distance. If you are worried about coupling to something very close to the conductors, it will be a different story, which is why such line needs to be in a friendly environment.

A short, wider section, such as one that is forming a delta match (see Figure 3), may radiate a little at the high end of HF, but it usually is with the antenna, which will radiate a lot more, so it isn't usually a problem, or even noticed.

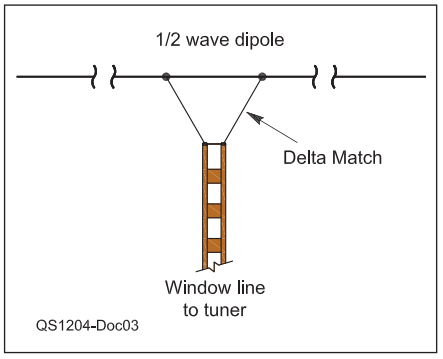


Figure 3 — A delta matched dipole.

Q John, HI3/KL7JR, asks: My top floor condo patio is my only place for antennas. I use a 100 W HF transceiver with built-in auto tuner and I have an external 100 W auto tuner that I rely on to match my loop (main antenna) or various verticals and assorted wire antennas that I can squeeze in for my antenna experimenting. Sometimes on some bands the best match I can get is an SWR of 1.5 or 2:1 using my external tuner. I then hit it with the internal tuner and easily achieve an SWR of 1:1. This technique has worked well for me for over 6 months. Considering my situation, is this good practice?

A Well, it is not unreasonable if you want an exact match, but there are a few issues to consider. There are two likely reasons why your external autotuner may not be able to get a 1:1 match, and the resulting issues are somewhat different.

First, most autotuners use switched discrete components to make their adjustments, not continuously variable inductors and capacitors as in many manual tuners. Sometimes the value needed for a 1:1 match is in between the available choices and the tuner does the best it can.

Usually they can get pretty close, but the difference between the exact match and the best they can do depends on the step size between discrete values, part of the design of your tuner.

The second reason is that the antenna impedance you are trying to match may be beyond the design range of the tuner. Many autotuners are specified to match up to a 10:1 SWR. If you ask such a tuner to match an impedance with a higher SWR, it may not be able to match it to as low an SWR as it would if it were in spec.

In the first case, if the SWR is low enough so that it is within the transceiver's spec and it can put full power to the antenna system, there will not be much benefit to using the additional tuner. Since every tuner has some loss, you may actually end up with less transmitted signal than if you lived with the 2:1 SWR. You can decide either by measuring the antenna current at the antenna in both cases, using a field strength meter or asking other stations if they can tell any difference whether or not your internal tuner is bypassed. It probably won't make much difference.

For the second case, all the above is still true, but there is another consideration. In my experience, antenna tuners can often tune mismatches beyond their rating. If they do, the voltage or current within the tuner components will be above their design value and it is possible to have component damage. The maximum voltage and current in the system will go up by the square root of the SWR. To be safe, measure the SWR of the antenna itself and reduce the transmit power accordingly. For example, with your 100 W transceiver and 100 W antenna tuner rated for a 10:1 SWR, assume the actual antenna SWR is 15:1. That's a factor of 1.5 above the rated SWR. The voltage or current could thus go up by as much as a factor of 1.22. To reduce your power so that the voltage and current are in spec, reduce your power by 1/1.5 to 67 W.

Elwood, WBØEW, provided a useful link to explore the pings from meteor tails that I discussed in the January 2012 column. He notes that the website **topaz.streamguys.tv/~spaceweather/index.html** *lets you literally listen to the "ping" sound of meteors in real time as they fly high over Texas.*

Ted, K6HI, proposes an improved method of splicing coax in response to my comments in the December 2011 column. He avoids the problems that I have had with conductor splice ends poking through tape by cutting a piece of the dielectric and slipping it over the splice and then putting the braid back over it and soldering. He finds it ends up more like a continuous piece of the coax and that there is less chance of a short.

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

Managing Power (and Saving Money) in the AM Carrier

Tom Ray, W2TRR, is the Vice President/ Corporate Director of Engineering for Buckley Broadcasting/WOR Radio in New York City. In this month's column he shares some interesting details about how commercial AM broadcast stations use creative technology to reduce the cost of generating all that RF power.

The RF envelope of a typical AM transmission consists of a carrier signal and two modulation sidebands (upper and lower). A substantial portion of the power in an AM signal is tied up in the carrier, which does relatively little, while the rest is in the sidebands that carry the actual audio information. In most ham applications the cost of the electricity used to generate RF is of little concern, but when you're working with thousands of watts the cost can be significant. So, one way to make AM broadcast transmissions more cost effective is to manage the amount of energy used in creating the carrier signal.

Since the audio information exists in the sidebands, it's reasonable to ask why we bother transmitting a carrier at all. After all, in an SSB transmission the carrier is completely absent; only one of the sidebands is sent. This greatly conserves both power and bandwidth.

In AM broadcast, however, we *must* transmit the carrier so that consumer AM receivers have a steady reference signal. This reference is used to demodulate the audio in the sidebands. Without it listeners will hear nothing but distorted mush.

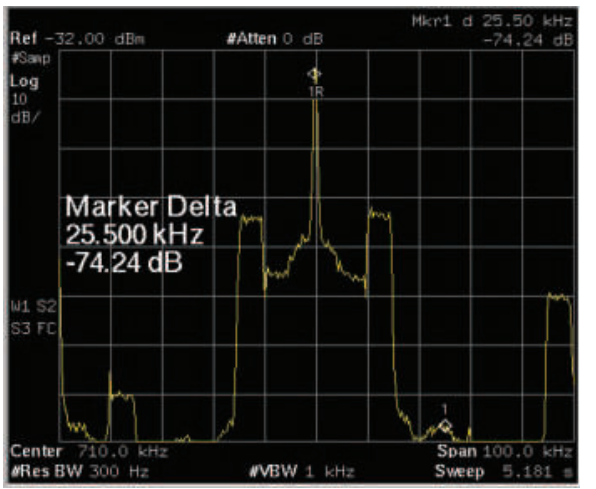
At a 50 kW transmitter facility such as WOR, our power bill runs around $10,000 per month.

One of the "secrets" to achieving greater AM power efficiency in the broadcast world is known as *MDCL* — Modulation Dependent Carrier Level. This is something that has been used in Europe for a number of years and it is now making inroads in the US. There are two flavors of MDCL — *Dynamic Carrier Control* (DCC) and *Amplitude Modulation Companding* (AMC).

With DCC, the carrier power is maintained at about 6 dB below nominal level when modulation is at 0% (when the audio channel is utterly quiet). When audio is present, the carrier power *increases* up to the nominal level. This is happening, of course, in tiny fractions of a second as the loudness of the programming changes.

With AMC, the carrier is at full power when modulation is at 0%. When there is audio on the channel, the carrier level *decreases* by up to 3 dB. Once again, these are split-second changes.

So which is best?



The 710 kHz WOR signal as seen on a spectrum analyzer with MDCL disabled. The carrier is in the center and easy to recognize.
[TOM RAY, W2TRR]

Well, at WOR we tried DCC and didn't like it because the receive audio tended to be plagued with annoying pops. I suspect this was caused by the rapid carrier fluctuations. When the carrier was at a reduced level, the receiver's AGC would raise the gain to a high level. When the audio modulation kicked in, the radio's detector would instantly overload and the AGC circuit would abruptly drop the gain like a rock. The combination of the two would create the pop. This effect also destroyed the HD Radio digital signal that resided in the sidebands. Finally, during quiet programming the gain of the radio would rise in response to the reduced carrier level and stay there. This resulted in a higher noise floor that would often be audible to listeners.

AMC, however, appears to be HD Radio friendly and its effects are not nearly as audible — unless you are in a weak signal area. In that situation the noise tends to rise, but it is far from objectionable.

The benefits to WOR's bottom line are impressive. In our tests with DCC, we showed a potential power savings of 16.5% at the transmitter. With AMC, however, the potential savings were *37%*! We re-ran the tests several times and triple checked the connection of the power consumption monitoring equipment. With each and every AMC test the power savings reached 37% compared to no MDCL intervention at all.

At a 50 kW transmitter facility such as WOR, our power bill runs around $10,000 per month. When we isolated the costs to only what is needed to operate the transmitter, we discovered that MDCL was saving us a whopping $2500 per month! The power savings pay back the cost of the MDCL equipment in a short period of time.

In case you're wondering how the MDCL power manipulation affects our coverage, the answer is "not at all." Remember that MDCL only reduces carrier power; there is no reduction in sideband power. Since the audio is contained in the sidebands, there is no loss of coverage.

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment 111

Coiled-Coax Chokes

After several months laboring on circuit boards it's time to get back to something a little more "radio-y," don't you think? Back in Experiment #91 the topic was an overview of *common-mode chokes* that are used primarily to fight RFI, isolate antennas from feed lines and reduce RF current on the outside surface of coax shields.[1] This month, we'll take a closer look at one of the most popular types of common-mode choke, the *coiled-coax choke*. By building one in three different ways you'll get a better idea of how they work.

Functions of a Balun

The coiled-coax choke is often referred to as a *choke balun*. You probably already know that *balun* is an abbreviation for **bal**anced to **un**balanced. What may not be clear is that balun is a general term referring to *any* device that transfers differential-mode signals between balanced and unbalanced systems while maintaining symmetrical signals in the balanced system. That's a mouthful!

You'll encounter both *voltage* and *current* baluns. Voltage baluns develop equal voltages at the balanced terminals and current baluns develop equal currents. If the balanced terminals both have equal impedances, such as a properly terminated parallel conductor feed line, equal voltage and equal currents will result with either type. If the balanced system is an antenna system, however, the impedances of the two terminals are often quite different. That means equal currents won't flow into the antenna terminals and since current is what results in radiating signals, the antenna won't be radiating symmetrically. Thus, a current balun is preferred for use with an antenna to force the currents to be equal.

Why wouldn't an antenna have roughly equal impedances at its terminals? You might have noticed the word *system* in the previous paragraph. That's a clue that there might be more than just the antenna itself getting involved. Sure enough, there is — the outside of the coax shield that is also connected to one side of the antenna either directly or by coupling to the antenna through proximity. The function of the current balun is to disconnect that "third wire" while forcing equal currents into the actual antenna terminals. (This is described in detail by Roy Lewellan, W7EL, in his article "Baluns: What They Do and How They Do It."[2])

There are three common methods of performing the current balun function. The first is to turn the outside surface of the coax shield into a quarter-wavelength transmission line that has high impedance at the point where the balanced and unbalanced systems meet. This is a *sleeve balun*, often used at VHF and UHF where wavelengths are short. The second method creates high impedances with ferrite beads and the third method by coiling the feed line to form an inductor. (All three techniques are discussed in *The ARRL Handbook* and *The ARRL Antenna Book*.[3,4])

The inductive reactance of the coiled feed line acts as an *RF choke*, reducing current flow and forcing the equal currents inside the feed line to divide equally between the antenna terminals. Similarly, received signal currents on the antenna have no other path and so combine in equal amounts inside the feed line.

Making a Coiled-Coax Choke Balun

While coiling the cable does create an inductor, you must also consider the effects of inter-winding capacitance that creates a parallel-resonant circuit with the coil so that it has a *self-resonant frequency*, f_0: Below f_0, the balun acts like an inductor and above f_0 it acts like a capacitor.

Figure 1 — The coiled-coax choke balun is wound on a plastic form and attached to the analyzer using a binding-post adaptor. The analyzer then reads R_S and X_S. A 1 kΩ swamping resistor across the binding posts limits the variations in R_S and X_S to displayable values.

This is fairly easy to demonstrate by using an antenna analyzer that can display impedance (or a combination of resistance and reactance) such as the MFJ-269 shown in Figure 1. All you'll need is a few feet of spare coax and a 1 kΩ resistor. For the baluns tested in this experiment, I used 9 feet of RG-58 coax. Some plastic forms are also required — I used a 6 inch diameter empty coffee container and a 3 inch diameter almost-empty peanut butter jar. Any plastic or glass form will do — just be sure not to use metal.

Strip about 1½ inches of jacket off each end of the coax and create pigtails by twisting the braid strands together. Wind the coax onto the larger form with about 1 inch spacing between the turns (also known as *pitch*).

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

[2] R. Lewallen, W7EL, "Baluns: What They Do and How They Do It," **www.eznec.com/Amateur/Articles/Baluns.pdf**.

[3] *The ARRL Handbook for Radio Communications,* 2012 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6672 (Hardcover 6634). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

[4] *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**.

Arrange the coax so that the pigtails are close enough to attach to the analyzer and secure the coax to the form with electrical tape.

If you have a binding-post adapter as shown in Figure 1, connect one pigtail to each post. If you don't have an adapter, solder the pigtails to pieces of wire and clamp them to the analyzer's RF connector or stick them in the center socket. Support the coil with something non-conducting — I used a small cardboard box. The entire setup should be assembled on a wooden or plastic table away from large metal surfaces.

Turn on the analyzer and set it to display series resistance (R_S) and reactance (X_S) — this is the default on most analyzers. Sweep the analyzer across the upper HF bands (the MFJ-269 10-27 MHz range is about right) and look for a range of frequencies where R_S peaks and X_S becomes a very small value. The middle frequency in this range is f_0. For my larger coil, f_0 was 17.96 MHz.

If the values exceed the analyzer range (this is likely), add a 1 kΩ resistor in parallel with the coil (not in series). This *swamping resistor* limits the variation of resistance and reactance to displayable values without affecting f_0.

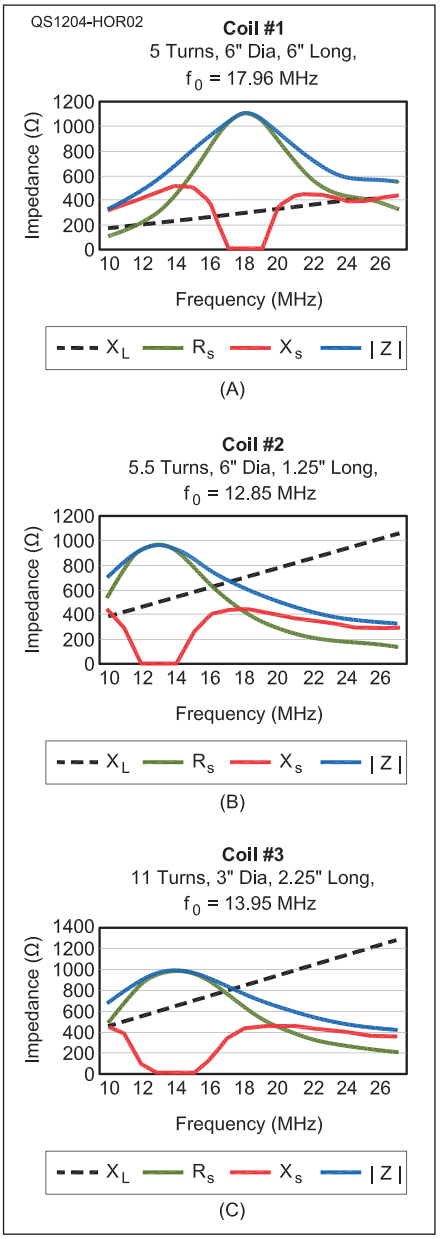


Figure 2 — Three different baluns, all using the same length of coax, are wound on different diameter forms and with different turn spacing (pitch). The resulting shift in self-resonant frequency, f_0, is dramatic.

Measuring the Balun

For reliable impedance measurement there are many things wrong with the setup in Figure 1. Measuring absolute impedance at RF is very tricky and susceptible to many sources of error. We are only going to measure f_0 and observe how impedance changes with coil shape — that's a lot easier.

Tune the analyzer to resonance and watch the displayed values for R_S and X_S as you touch the jacket of the coil, the case of the analyzer, and the power cord for the analyzer. Even bringing your hands *close* to the coil or analyzer should make the values change a little. With the sensitivity of the test in mind, as you take data try not to disturb the setup and don't touch the analyzer case while adjusting the controls or reading the display.

Record R_S and X_S at 1 MHz intervals throughout your chosen range — from well below f_0 to well above f_0. Record the actual value of f_0. Use a spreadsheet to capture all the values and make a graph as shown in Figure 2A through 2C. (An *Excel* spreadsheet for plotting all graphs is available on the Hands-On Radio website for this experiment.) It should look something like the graphs of Figure 2.

The spreadsheet also calculates the approximate inductance of the coil and plots its reactance ($X_L = 2\pi fL$) as the straight dashed line on the graph. (The spreadsheet also calculates and graphs the magnitude of the polar form of the impedance, $|Z|\angle\theta$.) Obviously, our real-world coil behaves a lot differently than an ideal inductor. Remember that by adding the swamping resistor, the analyzer is reading the parallel combination of it and the coil so the values will probably not be close to the ideal inductor's reactance. We are only interested in the shape of the curve, though.

Assuming you see a graph like that in Figure 2A, self-resonance is clearly shown. Impedance of the coil will increase up to f_0 and then drop off. The balun is most effective at reducing shield current from about ½ to ⅔ f_0 to a few MHz above f_0. You'll also see X_S dive toward zero and then rise again. Most analyzers don't display the sign of reactance, but by understanding resonant circuits you'll realize that the sign reverses at f_0, changing from inductive to capacitance reactance.

Figure 3 — A smaller diameter coil may have similar inductance to a larger coil but its lower Q causes its impedance curve to be broader. All coils in this article are made from the same length of coax feed line.

Now loosen the coil on the form and move the turns together so the jackets of adjacent turns are touching. Secure the coil to the form and repeat the measurements. You'll see f_0 shift downward quite a bit in Figure 2B as the inductance of the coil and the inter-turn capacitance increase.

Transfer the coil to the smaller form and repeat the measurements. For the peanut butter jar coil shown in Figure 3, f_0 increased by about 1 MHz and the response curve broadened as shown in Figure 2C, reflecting the lower Q of long, narrow coils. You can continue to alter the shape of the coil to observe how it affects f_0.

You now know how to make a coiled-coax choke balun and can even tune it for the highest impedance right where you need it. Don't be too precise as the sensitivity test showed you that lots of things can affect the coil, including attaching it to an antenna. There are several pretested designs for coiled-coax choke baluns in *The ARRL Handbook* and *The ARRL Antenna Book*, as well.

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

Waxing, Waning and Kazoo Contacts

Wax Finds Waning Transistor

Here is a tip I think anyone who works on transistorized RF amplifiers will appreciate. This is a quick test to help determine the condition of RF output transistors. I'm sure most of us who have serviced amplifiers will relate to this scenario. You have an amplifier and suspect the RF output transistors may have suffered damage because you observed low RF output or a high quiescent current.

Quiescent current is the current measured when the amplifier is powered-up and keyed with no RF input. Basically an unmodulated SSB signal or an AM or FM signal with the drive (exciter) turned all the way down. Just because an amplifier is producing good RF output, doesn't mean the transistors are working properly. They can be partially damaged and still produce output, yet will draw excessive current at idle when keyed up. This is easily detected when you can't bias the amplifier properly or it gets hot faster than usual. Abnormally high quiescent current usually indicates an emitter-collector short on RF transistors. Base-emitter or base-collector shorts are often obvious as they tend to burn-up resistors in the drive circuitry that feeds the RF output transistor's base.

The normally accepted way to check collector current is to lift the collector lead from each output transistor and measure the current with a dc ammeter. This can be a very tedious process. Most RF power transistors use large foil-type component leads. These leads require a lot of heat to melt the solder so the lead can be lifted from the circuit board. Not only does this require the skillful use of a very large soldering iron, you also run the risk of damaging a good transistor and the circuit board it is mounted to.

I used to stick my finger down into the amplifier and physically feel the temperature of each transistor. This very low-tech method sometimes worked but seldom gave me much more than a burned finger and lots of questionable transistors.

Let me set the scene here. I was working on a Metron MA1000B linear amplifier whose output was down a bit and had high quiescent current. The Metron is a 12 V HF amplifier that draws about 85 A on voice peaks. It was manufactured in the late '80s with a rated output of 600 W. Its quiescent idling current should be less than 2 A.

I knew the amplifier had at least one damaged transistor and maybe more. I normally like to replace all the transistors with a matched set when one goes bad. This is the best way to repair any amplifier that uses multiple output transistors or tubes, in my estimation. The problem was the Metron uses eight rather expensive RF output transistors (around $35 each). Not only that, the amplifier still worked producing over 500 W on 75 meters. Not bad, but that quiescent idling current was very high (about 20 A) and would climb even higher as the transistors heated up, approaching a runaway condition.

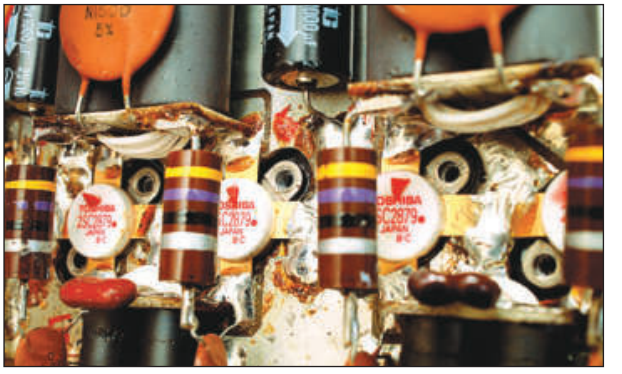


Figure 1 — To begin the test, place small chips of candle wax on each of the transistors to be tested. Here the wax chips are visible at the 12 o'clock position.
[GREGG HOWE, KI6IUJ]

I thought to myself, there has to be a better way to troubleshoot all these transistors rather than going through the pain of lifting each collector lead or feeling the transistors for excessive heat. Sure if you're lucky enough to have access to a data-logger that would work, although still a time consuming setup. Then I thought maybe I'll go buy one of those temp-gun digital thermometers. After thinking about this approach through, I realized it would also be time-consuming and have a potential for error.

To accurately measure all of the individual transistors with a temp-gun would involve moving components aside that blocked direct access to the top of the transistor. Not only that, I could only check one transistor at a time with a temp-gun or risk causing further damage due to the long key-down time required to check all eight RF output transistors. Another temp-gun method would require an exact key-down time for each transistor under test, with a rest period allowing things to cool before the next transistor could be tested. Also very time consuming.

After pondering the situation for a while I had an idea. What if I shaved off some candle wax and placed a shaving on each transistor? This would allow a quick temperature comparison of all eight transistors at the same time under the exact same conditions. I used red candle wax to aid the visual effect (see Figure 1).

Bingo! It worked. The wax melted on the bad transistor pulling excessive quiescent current (see Figure 2). I replaced the bad transistor, the quiescent current dropped to within specification and the amplifier stayed

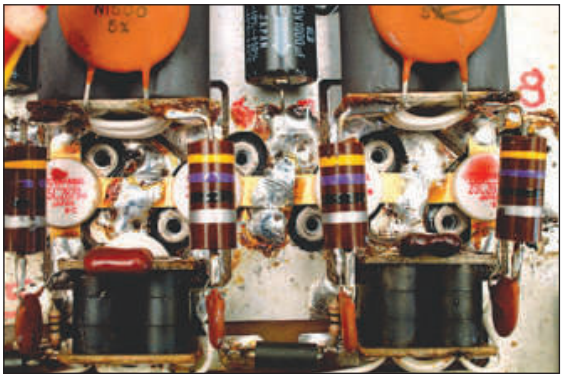


Figure 2 — The transistor on the right is getting hot enough to melt the wax while the one on the left is remaining cool.
[GREGG HOWE, KI6IUJ]

cool. Although the quiescent current was now correct, the power output was still down a bit. On to part two of the wax test.

In this next test, we're now looking for a weak or blown transistor that is not producing an acceptable level of RF output power. This test is done with RF drive into the amplifier. In most amplifiers, transistor or tube, the transistors that get hot or the tubes that glow red are the ones producing power, while the ones that run cool are suspect. So once again, with wax shavings sitting on top of the transistors, I applied RF power, this time with the amplifier keyed up. I expected the wax to melt on the good transistors indicating that, yes they are getting hot producing power. The cold ones (no melting) are weak or blown (assuming they're receiving drive at the base lead). — *73, Gregg Howe, KI6IUJ, 27221 Westridge Ln, Laguna Hills, CA 92653*, **s9radio@aol.com**

Breath-Activated Key

What do an old relay, a balloon and a kazoo have in common? No, this isn't the start of a shaggy dog story. This is better; it's an old ham story. I have been getting older, as most of us seem to do and I get tremors in my hands making it very difficult to use a key of any kind. Fortunately, my mouth still works (my spouse will verify that) so I decided to make a key that uses air to close the contacts.

The parts needed are shown in Figure 3.

Figure 3 — The parts needed to create your own breath-activated key are, clockwise from left, wire, stopper, kazoo, transceiver plug, shell, shell cover, contacts and balloon.
[LEE CHEEVER, W5IG]

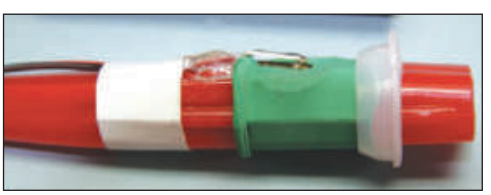


Figure 4 — The contacts are glued to the body of the kazoo so that they extend onto the balloon. The top contact should include the stiffener.
[LEE CHEEVER, W5IG]

First take a plastic kazoo and cut the top off of it. Smooth the hole with some fine sandpaper. Next, take a balloon with about a ¾ inch wide neck and cut the neck off at about 1¼ inches from the lip. Pull the neck of the balloon over the kazoo to cover the hole in the top. Plug the rear of the kazoo with whatever is available. I used the lens from a small panel light that was the right diameter.

Open up the old relay and take the contacts out. If you use a small relay and it is a double pole double throw type, you will get enough contacts to make eight or 10 keys. Pick two good contacts and one stiffener. One contact with a stiffener on the top should be soldered to the end of a wire. Make the wire long enough to reach your key jack, plus a little extra so you can move around. The other contact is soldered to the other wire. Add the proper plug for your transceiver.

The contacts are then laid on the balloon with the stiffener on top and glued in place (Figure 4). Space the contacts so that with a small amount of air the balloon will expand and push the bottom contact up into the top contact; the stiffener is to keep the top contact from moving a lot, making a better connection.

Basically the key is done at this point. I took a small tubular pill bottle, painted it black, cut a ⅝ inch hole in the cap, drilled another same-size hole in the end of the tube and pushed it on the kazoo. This protects the contacts and gives you something to hold on to (see Figure 5).

When the key is finished, plug it into the key jack, put it to your mouth like a trumpet, gently blow in the key and interrupt the airflow with your tongue. It'll take a little practice to make dots and dashes with your tongue, but you'll catch on pretty quickly. You will be surprised at how fast you can send. I have sent good code at over 20 wpm. People on the other end can't tell it's not a straight key. You can see my key in action on my YouTube video at **www.youtube.com/watch?v=UtYswqOEMZE**.

It could be used for mobile hands-free CW. Just imagine the looks on your fellow travelers' faces as you drive down the road, both hands on the wheel, making kazoo contacts.[1] — *73, Lee Cheever, W5IG, 2727 Leta Mae Cir, Dallas, TX 75234-6234*, **w5ig@swbell.net**

Figure 5 — The breath-activated key ready for you to plug into your transceiver and make CW music on the bands.
[LEE CHEEVER, W5IG]

Mini Paint Roller

Occasionally, I have a radio project that needs painting. In cases where the surface area is small and I want a smooth finish, a miniroller is very handy. Most paint departments sell 3 inch wide rollers and matching paint pans. In cases where the 3 inch roller is too large, I have made my own micro-roller as follows:

1. Cut a 3 inch paint roller brush to the desired length (1 inch for my projects).

2. Slide the paint roller onto a nail (mine is about 4 inches long) with a flat head to keep the miniroller from falling off.

3. Cut a piece of #20 AWG solid insulated hookup wire to approximately 6 inches.

4. Twist a loop at the midpoint of the wire next to the bottom of the 1 inch roller.

5. Run the two hookup wire tails parallel to the nail. Make the wire holder snug against the miniroller, but not tight enough to interfere with rolling action. This prevents the miniroller from sliding off the other end of the nail.

6. Run a loop of tape around the wire tails

[1]For another approach to a breath-activated key see G. Gordon, K6KV, "Build a Puff-and-Sip Key," *QST*, Mar 2004, pp 31-32.

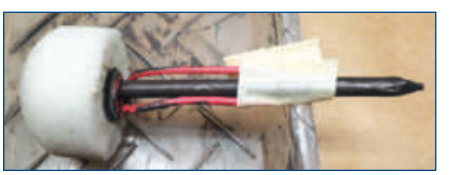


Figure 6 — The completed miniroller ready to get into those tight spaces.
[TOM HART, AD1B]

to hold them in place. When done, remove the tape loop to disassemble and clean the miniroller (see Figure 6).

This setup allows the miniroller to turn easily when adding or rolling paint. The wire retainer slides on and off the nail to allow the miniroller to be cleaned. — *73, Tom Hart, AD1B, 54 Hermaine Ave, Dedham, MA 02026*, **tom.hart@verizon.net**

Boat Anchor Noise

There had been a steady S9+ noise level at my station on all HF bands. The problem was eventually located after much snooping. I had purchased a Viking Valiant transmitter and an NC-300 receiver several months earlier with the hope of getting the old boat anchors on the air and trying 40 meter AM. Both units were off but were plugged into the 120 V line. When the Valiant was unplugged the noise disappeared! Television interference was a big deal in the '50s when these radios were in their heyday, so line cord bypass capacitors were common. The Viking has several bypass capacitors on the 120 V line *before* the power switch. One or more was leaking and creating quite a lot of noise, even with the unit off. So for any of you boat anchor fans with high noise levels, this might be the cause. — *73, Dick Dabney, K6BZZ, 42561 W Jail House Rock Ct, Maricopa, AZ 85138*, **k6bzz@arrl.net**

Switch Shaft Extension

I wanted to add a long extension shaft to my antenna selector switch. I found a perfect 36 inch length of ¼ inch aluminum rod stock for only about a $1.50 at our local home improvement store. Then it occurred to me that I needed a way to join my new shaft to the short switch shaft. Wandering around the plumbing department, a little compression union for ¼ inch copper pipe caught my eye (see Figure 7). It cost about twice as much as the aluminum shaft but I was in a hurry. I slipped the extension shaft in one end of the union and the short switch shaft in the other and tightened the nuts. So, if you are in a hurry, give the coupling a try. By the way, they look cool too! — *73, Martin Huyett, KØBXB, 7735 Big Pine Ln, Burlington, WI 53105*, **huyettmeh@tds.net**

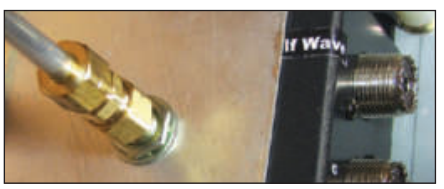


Figure 7 — A ¼ inch pipe compression coupling repurposed as a switch shaft extension.
[MARTIN HUYETT, KØBXB]

Hair Dryers in the Shack

The August 2011 hint on PA module repair reminded me how often I use a hair dryer in my shack.[2] I use it to preheat the heat sink prior to working on a PA module or other device that has a heat sink or large amounts of printed circuit board copper attached. With the copper or heat sink hot, the heat from the iron is concentrated on the work area when soldering.

I also use the hair dryer to heat up PL259s before I solder them, for heat shrink and to assist in finding intermittent issues in radios. A 1200 W hair dryer is fairly hot. It can actually melt plastic or solder if given the chance but with careful use I have not encountered issues.

I have a Revlon Iconic, which has a "nub" designed to sit on the table as well as a detachable curved spout. It allows me to position it on the bench and move the item to be heated around the air flow or point the heated air where needed. — *73, Ron Wagner, WD8SBB, 5065 S Kessler-Frederick Rd, Troy, OH 45373*, **wd8sbb@arrl.net**

Pipe Insulation Feed Through

There is a simple and inexpensive method to feed cables through a window. Just take a couple of pieces of soft water pipe insulation and cut the length to fit the inside of the window track. Place one on the window sill. Then lay down the coax or wire that you want to feed through. Finally, put the other piece of insulation on top to form a "wire sandwich" and close the sash. The insulation will compress and form a good weather seal. For the colder climates, take another piece of insulation and cut it lengthwise so that it is thin enough to fill the gap between the top and bottom sashes. This will prevent cold air from entering the shack. Make sure that you label each wire to eliminate confusion. Finally, don't forget to engage the window's security tabs to prevent someone from slipping in. — *73, Bob Steinberg, WA2KHR, 55 Daisy Farms Dr, New Rochelle, NY 10804*, **waveguide33@gmail.com**

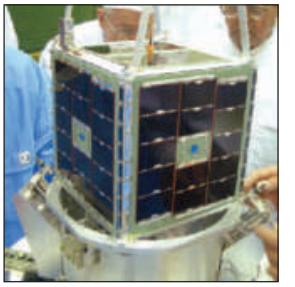
[2]D. Larkin, W8RVT, "PA Module Repair," *QST*, Aug 2011, p 57.

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

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

Feedback

- In "Webcam Microscope for the Radio Amateur" [Mar 2012, pp 38-39] the name of the author of the referenced article is Jim Koehler, VE5FP, not Joe.
- We have learned that the image we have been describing as AMSAT-OSCAR 51 [see, for example, Feb 2012, p 87] is actually a different satellite. — *tnx Drew Glasbrenner, KO4MA*

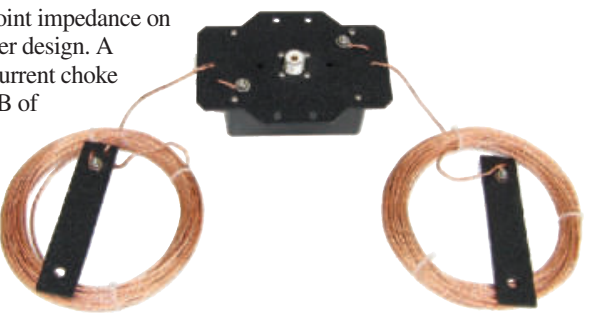


The real AO-51 spacecraft is shown here.
[BOB MCGWIER, N4HY]

New Products

MFJ OCFD Antennas For 160/75 and 60/30 Meters

The MFJ-2016 off-center fed dipole (OCFD) antenna covers the low end of 160 meters and the 75 meter SSB DX window. The antenna is 240 feet long and is rated for 1500 W CW/SSB. The MFJ-2013 for 60/30 meters handles 300 W PEP SSB and is 86 feet long. These antennas were designed by Rick Littlefield, K1BQT. Compared to a traditional OCFD antenna, they are said to deliver wider bandwidth, lower SWR, more gain and full-frequency agility without a tuner. The computer modeled element is said to deliver the same feed point impedance on every band with a new transformer design. A built-in bifilar-wound Guanella current choke balun is rated for more than 30 dB of common mode rejection on all bands. Price: MFJ-2013, $79.95; MFJ-2016, $129.95. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.



South of Sixty South

The 2011 VP8ORK DXpedition to Antarctica's South Orkney Islands

Michael A. Mraz, N6MZ

It's another cool, gray, misty January morning in Ushuaia, Argentina as the stevedores toss our mooring lines to the crew. By late afternoon, we'll be entering the notorious Drake Passage. Several of us examine the latest weather map from the WEFAX that shows two deep lows approaching the Drake and merging — certainly *not* what we want to see! Skipper Matt Jolly laughs and shrugs it off. "If we wait for good weather on the Drake, we'll never leave Ushuaia, mate!"

Two of the team choose not to take medications for motion sickness; others had applied their scopolamine patches hours earlier. I have a motto, "I'll do anything not to barf," so I am taking the oral version of scopolamine. We each have a large "chunder bucket" next to our bunk just in case. Thankfully, mine serves solely as a waste basket.

The next morning, old *Braveheart* is bucking along like a hobby horse. The 15 foot seas don't do much for our boat's speed but there's a half knot of favorable current pushing us along. Let's celebrate with toast and coffee for breakfast!

Almost unbelievably, the Drake calms down for the rest of the southbound trip. We slip south of 60° south latitude, entering the realm of Antarctica. The crew goes on iceberg watch, slowing the ship to a crawl and using a powerful searchlight to spot the bergs, some of which are monstrous. A few hours later there are thousands of smaller elephant-sized "growlers" surrounding us. Thankfully we can see the southwest coastline of Signy Island appearing on the radar screen now, and the sky is starting to brighten although it's foggy and snowing.

Arrival at Signy Island — South Orkneys

My alarm clock is the unmistakable sound of heavy chain running through the hawse pipe as the anchor drops in Borge Bay. The weather's better, about the same as a cold mid-winter morning at home near Seattle. DXpedition leader James, 9V1YC, holds a meeting with a few of the management committee, Ralph, KØIR, George, N4GRN, and antenna expert John, VE3EJ. They decide to make a reconnaissance run to the island as soon as the crew's ready.

The recon party reports that the beach on which we plan to set up camp is too wet and muddy and has too many resident seals. It's also too shallow for the tender and the crew worries about seriously damaging the outboard motor trying to land there. The camp site is at the base of a ravine and the potential of a flood concerns James. "The beach won't work, but there's a plateau up the hill about 10 minutes away," reports 9V1YC via VHF radio. Decision made; it's time to go to work.

Our stick-framed and insulated shelter foundations take longer than planned to construct. The most frustrating problem occurs with the smallest tools of all, the square-drive tips for the construction screws. We have several fantastic Hilti cordless drills, but the screwdriver tips we chuck into them can't take the load. They begin to break and we have only 10 of them, so

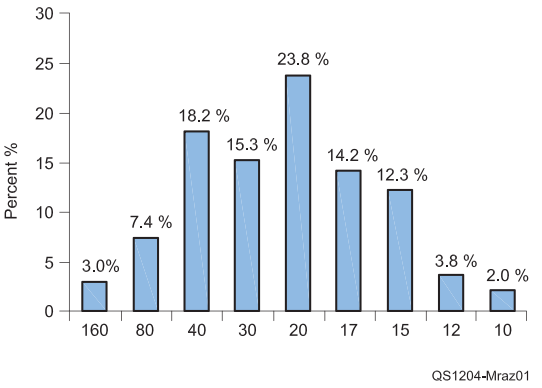


Figure 1 — VP8ORK contacts by band.

The VP8ORK team. From left to right: W3WL, Pete the Penguin, 9V1YC, VE3EJ, N6MZ, N1DG, WB9Z, KØIR, K6AW, N4GRN, K9ZO, W7EW, ND2T and EY8MM.
[NODIR TURSOON-ZADEH, EY8MM]

The central source of our power, what we affectionately called "Signy Power & Light."
[MIKE MRAZ, N6MZ]

extreme care is the word. Who would have imagined? I hide one of the tips in my foul-weather-gear pocket for safe-keeping, just in case.

The antenna team, led by John, VE3EJ, does an incredible job, erecting most of the verticals the first day, including miles and miles of radial wire. We save the big boy, the Battle Creek Special, for the following morning. Exhausted, we head back to the ship around 8 PM local time. Needless to say, supper tastes great and everyone sleeps like logs.

A winter snowscape dead ahead, despite that fact that it was the height of summer in Antarctica.
[NODIR TURSOON-ZADEH, EY8MM]

More Work, Then On the Air

The "brain fog" from being at sea usually clears up by the second day. Everyone seems much more productive on January 26 and the first shelter is up before lunch time along with plenty of 50 Hz 220 V ac courtesy of "Signy Power & Light." The radio team starts to fill Shelter 1 with six stations, which include Elecraft K3 transceivers, Acom amplifiers and logging PCs running *Writelog*.

Meanwhile, John steals a half-dozen of us from the construction team to help erect the Battle Creek Special low-band vertical. We have the "Super Special" version designed for severe locations, which has four sets of guy lines at four levels. After helping raise Battle Creeks on five previous DXpeditions, I've learned to measure the level of teamwork on a trip by how smoothly this operation goes (and by how much or how little yelling accompanies it). John is the maestro and we have that beauty in the air, straight and true, in less than an hour with no yelling.

Thursday the 27th opens with a brief but intense snowstorm, which lays down about a half inch of wet white stuff, just enough to slow progress on the final tasks. George, N4GRN, and I test our Inmarsat Broadband Global Area Network (BGAN) satellite Internet link. The Inmarsat Americas satellite is 9° above the northern horizon, but we can't connect to it from the island, only from *Braveheart* at anchor out in the bay. Unfortunately, there's a mountain on Signy that blocks all low-angle radiation from our location to North and South America. There isn't much we can do about it; our permits constrain us to a fairly small area of Signy.

We went on the air a little behind schedule; HB9AUS was the lucky ham to make the first contact with us on 20 meter SSB. It was time to start shoveling contacts!

The VP8ORK crew shovels contacts as fast and furiously as possible.
[LEWIS SAYRE, W7EW]

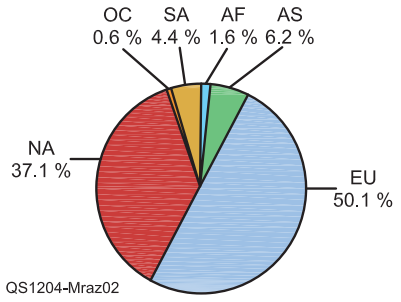


Figure 2 — VP8ORK contacts by continent.

Exhausted

The station builders fix a few minor technical issues and then we start filling the logs. The bands are hot and everyone's excited to be on the air. However, by the second day our 8-hours-on, 8-hours-off schedule is playing serious havoc with our circadian rhythms. We discover first-hand why ships never use this as a watch schedule!

I take some photos after a few days of operating; they're some of my favorites. It's about midnight local time, and our most energetic operator is asleep, head resting on a closed laptop, drooling. The op next to me has no contact rate on 20 meter RTTY, so he pulls his ski cap down over his eyes for a quick rest; soon he's snoring, but still upright in the chair. Another op a few stations away nods off involuntarily every few minutes, chin bouncing off his chest every time. Yet another gives up and heads for the freezing, unheated Shelter 2 to take a quick nap. I have a fantastic pileup on 30 meters, but I'm struggling mightily to stay conscious, falling asleep in the middle of CW exchanges. Amazingly, VE3EJ is on the 160 meter station pounding out the contacts as if he just sat down at his home station after morning coffee!

Frustration and Success

The VP8ORK pileups are the most frustrating I've experienced. Almost the rule instead of the exception, I come back to a loud caller with his call sign and signal report, only to hear dead air in return. Often it requires two more calls to get a QSL response, even when the other station is an S9-plus European. You can imagine what that's doing to our contact rate. The Americas have the additional handicap of Signy's signal-blocking mountain, which negates all low-angle radiation. The Sun decides not to cooperate also, as the average solar flux for January 2011 is only 84 compared to 134 eight months later.

We call CQ on 10 meters when we should have peak propagation and occasionally we generate a thin pileup. The few openings we have on the band are some of our best times on the air. The other bright spot is 160 meters. We have some of the world's finest top-band DXpeditioners on the team including EY8MM, KØIR and VE3EJ. This indomitable trio makes almost 2000 contacts on 160 meters, not a trivial accomplishment from 60° south latitude when nights are only a few hours long.

As you can see from our statistics, we're almost all CW lovers and 30 meters always seems to make us smile, this DXpedition being no exception. The band seems to be open 24 hours a day and we make almost one-sixth of our contacts there, including what we believe may be the first 30 meter RTTY contacts ever made from the Orkneys.

Farewell to Another Spectacular Island

On February 8, Jerry, WB9Z and Ralph, K9ZO, start disassembling antennas at first light (about 4 AM), which saves the full antenna team many hours of labor. The higher-frequency bands above 40 meters are dead; Nodir, EY8MM, works 160 meters dry and then joins the frigid early-morning antenna party. K6VIA makes the final contact with VP8ORK on 40 meter CW and then I join the guys to begin tearing everything down. Steve, K6AW, takes the tedious and thankless job of neatly rerolling thousands of feet of coax and radial wire. Actually, W3WL, N4GRN and I did thank Steve, although he didn't hear us, when we unpacked all that wire and cable from the shipping container several months later in Atlanta.

After most of the camp moved to the beach, several of us stay there to help the crew lift gear into the jet boat for transport back to *Braveheart*. The aluminum tender's expensive outboard motor had died a few days earlier as the other shift motored to the island, a victim of a melted piston crown. We're extraordinarily careful with the jet boat because it's a large inflatable. One stray construction screw means disaster!

A cold mist blows through all four layers of my clothing as we carry the gear into the sea and onto the jet boat. The curious fur seals play around the boat while a male elephant seal and his harem quietly nap a few hundred feet away. After a very long afternoon of work, punctuated by some jaw-dropping demonstrations of strength and agility by the crew on slippery rocks in freezing water, we all finally return to *Braveheart*, leaving the island as pristine as we had found it a few weeks earlier.

The crew cooks us a wonderful kiwi barbecue that night, and even though we're beat we certainly find the energy to do a little

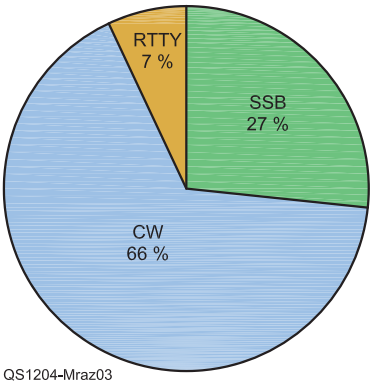


Figure 3 — VP8ORK contacts by mode.

partying! A berg disintegrated a few days earlier and we pour small shots of whiskey over berg ice the crew pulled out of the bay. It's fascinating to hear the continuous little pops as the whiskey absorbs ancient air bubbles liberated from the ice.

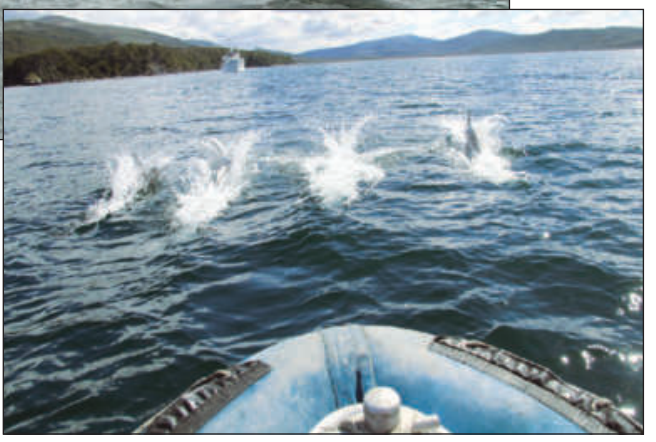
Northbound on the Drake

It's Wednesday, February 9, and *Braveheart* slowly motors across the bay into the ice field at the base of a huge glacier on Coronation Island. Appropriately named Sunshine Glacier, it always seems to be glowing in sunlight even when clouds cover the rest of the islands. The bay is choked with ice calved from the 200 foot sheer cliff of the glacier and I watch the seawater temperature fall to 30°F as a result of all these ice cubes. The ship coasts along at less than a knot as Matt does his best to avoid striking the larger growlers. The ones that can't be avoided obtain a reddish "kiss" where they scrape off a little bottom paint.

Matt estimates a five-day voyage on the return, thanks to the current, wind and waves opposing us. After less than four days, the sound of the ship's main engine reducing RPMs wakes me instantly at around five in the morning. I jump out of my rack and hurry to the wheelhouse to take a look. Something's wrong — I see land a mile away, but my eyes won't focus on the water. A glance at the anemometer tells me why: the wind's blowing at 50 knots and the sea surface is whipped into foam. Matt says that a storm appeared out of nowhere about 8 hours before and that we had sailed through 60 knot winds and rough seas ever since. Unbelievably, I slept through all the excitement. Worse yet, nobody got any photos or video!

We're 36 hours ahead of schedule, which means that our berth space in Ushuaia isn't available. So we anchor in beautiful, primi-

The fur seals probably thought we were crazy.
[JOHN SLUYMER, VE3EJ]



Our dolphin friends playing with the jet boat.
[NODIR TURSOON-ZADEH, EY8MM]

James films as the ship plows through the ice field (with the Sunshine Glacier in the background).
[MIKE MRAZ, N6MZ]

tive Bahia Aguirre, at the extreme eastern tip of Patagonia. After breakfast, the winds dissipate, the sky begins to clear and a school of dolphins comes around asking us to play. We oblige, and for hours we zoom around in the jet boat as the dolphins race along ahead of us just for fun. What a fantastic day at "El Fin Del Mundo"!

The Uncertain Future of High-latitude DXpeditions

Is DXpeditioning from these remote islands rapidly becoming impossible? It's always been difficult to obtain official permission to visit these spectacular places, and it isn't becoming any easier. A heavy-fuel-oil ban in the Antarctic took effect in 2011, which means that larger ships will no longer be able to visit south of sixty south. Another proposal may require an escort ship for every non-governmental vessel in the Antarctic. Imagine the impact!

But the financial aspects are the real killers. We received most of our major donations in US dollars, in particular our large grant from the fantastic Northern California DX Foundation. As the US dollar weakens, our expenses automatically go up because we have to pay almost all of them in foreign currencies. Then there's the huge burden of petroleum prices. Even tiny *Braveheart* burns about 11 liters of diesel fuel per nautical mile and in early 2011 marine diesel fuel was running about $1 per liter.

Our DXpedition was plagued by these economic forces and more, especially as we encountered significant unforeseen logistical expenses in South America. These charges could be classified in the category of "stuff happens," but nonetheless they were a budget buster on top of the third-of-a-million US dollars we had already committed to spend.

Many of us would love to activate other high-latitude DXCC entities. However, the subset of DXpeditioners who can afford to take 5 weeks out of their lives and over $15,000 (and climbing) out of their bank accounts is becoming smaller and smaller. Keep this in mind when you see appeals to donate to DXpeditions.

For more photos and information visit the VP8ORK website at **http://vp8o.com**.

N6MZ discovered the magic of shortwave radio as a youngster in Ohio and was licensed at age 11. He eventually found his way to Ohio State for a BS degree in electrical engineering. His favorite professor was the incomparable Dr John Kraus, W8JK (SK). Mike joined his first major DXpedition team in 1997, VKØIR, and has operated from an additional dozen fascinating islands, most recently Signy and Desecheo. If you miss N6MZ on the air, you may find him visiting family and ham friends in Europe or sailing somewhere on Puget Sound, Washington. You can contact Mike at 15526 SE 50th St, Bellevue, WA 98006-3611; **n6mz@arrl.net**.

Join the Conversation Today

Here's something new to try with your FM transceiver: IRLP "Topic Channels."

Alexia Steffen, KE7UWU

Tired of just exchanging signal and weather reports? Bored with rag chewing? Here's an exciting new twist to having meaningful QSOs. Join a *Topic Channel* on IRLP!

IRLP, Internet Radio Linking Project, now offers channels devoted to topics of interest. Interested in chasing DX? Go to the DX Channel. Interested in what's going on in the world today? Go to the History and Current Events Channel. There's a channel for almost any topic under the sun.

Why Topic Channels?

Most conversations on ham radio today relate to ham radio itself: name, location, a signal report followed by a listing of equipment, and then, of course, the weather. The level of discourse in amateur radio needs some fixing. We want to make it easy to find those who are kindred spirits. Who is "we"? The Oregon Internet Radio Group, OIRG, has taken this on as a project. Our goal is to provide a radio space where people with common interests can meet and talk 24/7 every day of the year.

By using printed and online channel guides, you can find, for example, amateur historians talking about the Civil War on the History Channel. On the Media Channel you can join a discussion on the latest movie, Broadway show or song. The Sports Channel will allow you to find others who enjoy the same sport or team in your area or around the world. On the DX channel you can share hints on improving your country count. There are "fixed channels" where the topics remain mostly the same, and there are "flex channels" where topics change according to current events. For example, when a tropical storm builds in strength and becomes a hurricane a "Storm Channel" can be created immediately.

Besides raising the level of discourse, OIRG feels there will be other benefits. IRLP Topic Channels, the brainchild of Michael Bloom, W7RAT, will encourage digital operation, using existing resources more efficiently. It will also bring new hams to the hobby, and restore interest to those of us whose interest has lagged.

IRLP? What's That?

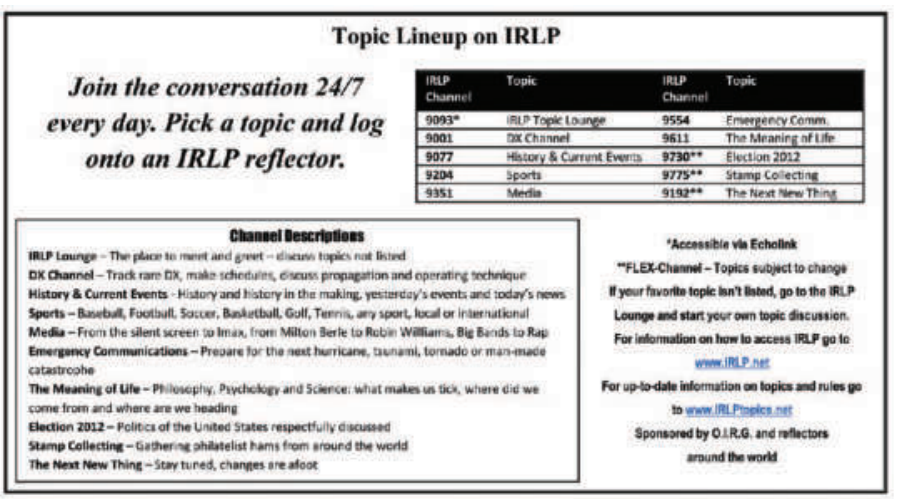
The Internet Radio Linking Project was initiated by Dave Cameron, VE7LTD, back in 1998 as a way of using the Internet to link repeaters and simplex stations. Each station (simplex or repeater) is called a *node*. Each node has a computer that links the node's VHF/UHF transceiver to the Internet via the computer's sound card. Each node also has a unique four-digit identifying number. For example, our Portland, Oregon node is 3039. If you have an IRLP node near you all you need to do is ask the node owner's permission to join one of the IRLP Topic Channels and you can participate in the discussion.

To find out if there is a node near you just go to **http://status.irlp.net/** and you'll find nearly 3000 nodes listed. Each node has a link for reaching its node owner so getting permission is usually pretty easy. To get a far more complete picture of how IRLP works visit **www.irlp.net**.

IRLP Network Infrastructure

It's helpful at this point to explain a bit more about how the elements of IRLP fit together. Every node (remember that's a computer and a radio) is identified with four digits, like 3039. But in the real computer world computer addresses are referred to as "IP addresses" and look something like this: 235.235.23.45. In the IRLP world the IP addresses are converted to those four-digit node numbers so you don't have to worry about them.

When one node wants to talk to another node here's what happens. Consider Mary and Pam, both of whom own IRLP nodes. Mary's node tries to call Pam's node using the four-digit identifier. Pam's node authenticates Mary's node to make sure Mary's node is an authentic IRLP station. This checking is known as "handshaking." Once handshaking has taken place communications can begin.



Topic Lineup on IRLP

Join the conversation 24/7 every day. Pick a topic and log onto an IRLP reflector.

IRLP Channel	Topic	IRLP Channel	Topic
9093*	IRLP Topic Lounge	9554	Emergency Comm.
9001	DX Channel	9611	The Meaning of Life
9077	History & Current Events	9730**	Election 2012
9204	Sports	9775**	Stamp Collecting
9351	Media	9192**	The Next New Thing

Channel Descriptions

IRLP Lounge – The place to meet and greet – discuss topics not listed
DX Channel – Track rare DX, make schedules, discuss propagation and operating technique
History & Current Events – History and history in the making, yesterday's events and today's news
Sports – Baseball, Football, Soccer, Basketball, Golf, Tennis, any sport, local or international
Media – From the silent screen to Imax, from Milton Berle to Robin Williams, Big Bands to Rap
Emergency Communications – Prepare for the next hurricane, tsunami, tornado or man-made catastrophe
The Meaning of Life – Philosophy, Psychology and Science: what makes us tick, where did we come from and where are we heading
Election 2012 – Politics of the United States respectfully discussed
Stamp Collecting – Gathering philatelist hams from around the world
The Next New Thing – Stay tuned, changes are afoot

*Accessible via Echolink
**FLEX-Channel – Topics subject to change
If your favorite topic isn't listed, go to the IRLP Lounge and start your own topic discussion.
For information on how to access IRLP go to www.IRLP.net
For up-to-date information on topics and rules go to www.IRLPtopics.net
Sponsored by O.I.R.G. and reflectors around the world

This is an example of an IRLP Topic Channel chart that you'll find published on the **www.irlptopics.net** website as well as on the IRLP Reflector Status website at **http://irlp.g4eid.co.uk/status/all_reflectors.html**.

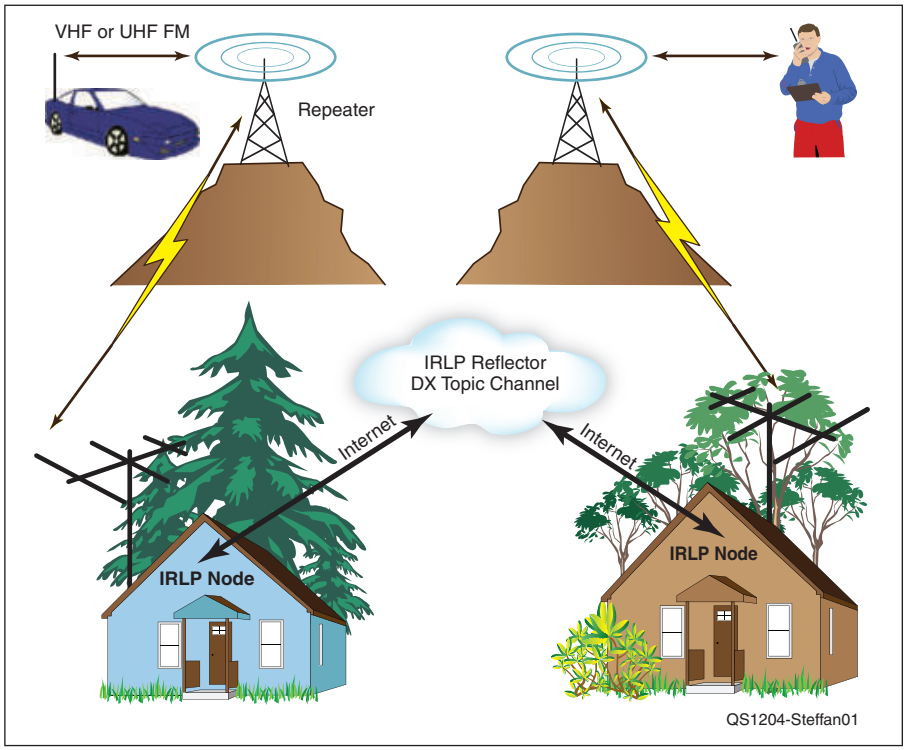


Figure 1 — In this example, the mobile operator links to an IRLP node through his local VHF or UHF FM repeater. With the node connected to the IRLP network via the Internet, the operator accesses the DX Topic Channel. Hundreds or even thousands of miles away, an amateur with a handheld FM transceiver connects to his local repeater and, in turn, to the IRLP network on the Internet through a nearby node. Through the node he joins the conversation with the mobile operator, and possibly many others, on the DX Topic Channel.

Mary has a handheld FM transceiver. She transmits to her node's radio. The node's radio receiver picks up Mary's signal and outputs analog audio to Mary's node computer soundcard, which converts the analog audio into digital packets. These packets are actually Voice over Internet Protocol packets, or *VoIP*, similar to Skype and VoIP telephones. The packets travel over the Internet.

The voice packets arrive at Pam's node computer where the sound card converts the voice packets into analog voice signals. These analog signals are passed to the microphone input of Pam's node radio and a voice signal is transmitted. Pam's base station radio receives her node's transmission. She now hears Mary's voice coming out of the speaker.

One-to-One and One-to-Many

Mary and Pam can now talk to one another. Mary's voice packets go directly to Pam and Pam's voice packets go directly to Mary. This is a one-to-one connection. But how do you have a three-way or four-way conversation? You use a *reflector* (see Figure 1). A reflector is a kind of computer server that takes in voice packets from one IRLP node and sends them out to all other nodes that are connected to the reflector. This allows multiple users to connect to the same reflector and talk to each other. There are about 30 IRLP reflectors around the world, each having 10 available channels. Reflectors also have four-digit ID codes, but they begin with the number nine. So a reflector identifier could be 9250 (the zero channel on the 925X reflector); likewise, 9253 is channel three on the same reflector.

Unused Channels

The vast majority of reflector channels are unused. The Oregon Internet Radio Group contacted the owners of these reflectors and asked them to commit channels to the IRLP Topic Project. At the time of writing there are 20 channels committed on reflectors located in the US, Canada, Australia and Norway with more on the way. These channels represent a huge underutilized resource and a major opportunity to add something special to our hobby.

Note to the Antenna Challenged

If antenna restrictions are taking the fun out of Amateur Radio, consider this: Even if you can't stick a wet noodle outside your residence you can operate worldwide and talk about a variety of interesting topics on IRLP! Next time there's a major breakthrough in science (such as there *are* extraterrestrials!) you can be pretty sure that if you turn on your FM radio you'll find a discussion about it on the IRLP Science Channel or the new IRLP, E.T. Flex-Channel!

How Topics Are Selected

The sponsoring radio club, OIRG has seeded the topic list with 10 entries. The first, channel 0, is the IRLP Topics Lounge. Channels 1 to 6 are fixed topic channels that are expected to last over a period of many months. Channels 7 to 9 are flex channels that will be seeded with topics in the near future. Reflector owners do not choose channels, but have to approve the topic that will run on their reflector channel. Up to date postings will be published on the **www.irlptopics.net** website as well as on the IRLP Reflector Status website **http://irlp.g4eid.co.uk/status/all_reflectors.html** and at ham-fests and other gatherings. The activity on topic channels will be monitored to provide information on the popularity of a topic. Popular topics will carry over month to month, while others will be dropped and replaced.

Acknowledgments

OIRG would like to recognize the contributions of reflector owners around the world who have generously contributed channels to this project: Vancouver Reflector in Vancouver, BC, Dave Cameron, VE7LTD; Alaska Reflector in Anchorage, Dave Cloyd, KL7M; the Western Reflector in Las Vegas, Kent Johnson, W7AOR; Seattle Reflector, Mark Hagler, KK7U; Crossroads Reflector in Indianapolis, Dave Gingrich, K9DC; WALA LAX Reflector in Los Angeles, Herman Pang, N6HHP; Adelaide Virtual Pub Back Bar Reflector in Adelaide, Australia, Tony Langdon, VK3JED; Great Lakes Reflector, in Greenville, MI, Mike Wolthius, KB8ZGL; Norwegian Reflector, Norway, Frank Hagen, LA9KY.

KE7UWU's passion is the Internet Radio Linking Project (IRLP). She is president of the Oregon Internet Radio Group, an organization established to promote the use of voice over Internet combined with traditional radio-based Amateur Radio. Alexia is a personal historian for Voices of Our Generation, producing family heirloom biographies for people from all walks of life. You can contact Alexia at 11705 SW Pacific Hwy, Suite Z, Portland, OR 97223; **asteffen2010@comcast.net.**

All the Time in the World

In ham radio there is more to telling time than "the big hand is on the 1."

Steve Sant Andrea, AG1YK

You've all no doubt heard the recent news about superluminal neutrinos. If these results bear up under scientific scrutiny then time travel will be possible. In some far off November a ham who misses busting the pileup to the last section when 0259Z ticks onto his triCesium, satellite synchronized chronometer can still get that clean sweep. How? Our ham of the future just jumps into his "Little Jiffy Time Teleporter" and zaps himself back to his shack 10 minutes ago. Once there, Future ham can tell Past ham the frequency for that last section. With Past at the microphone and Future at the big knob they make the contact with a whole millisecond to spare. Clean Sweep!

But wait! Future returns to, well, the future and looking at his rig suddenly realizes that Past and him were so busy celebrating that they forgot to hit the ENTER key and log the contact. So even in our grand ham future, logging is important and the most important thing about logging is the time.

"Okay, but I have a clock on the wall and mom taught me about the big hand and the little hand."

In ham radio telling time is for grownups. Remember, that the time you put in your log for that contest or award credit doesn't exist in a vacuum. Your log has to be *coordinated* with another ham's log for that entry to get credit and the time in both logs is the first thing that must match up.

Keeping in Time

Ham radio is a worldwide hobby and the world has 24 different times, divided into hourly zones. The US alone covers six time zones, eight if you include our territories. So just about everyone you contact is going to have their "little hand" on a different number than you.

We all need to know our local time. If not, we might be late for dinner. But many activities in the world (like ham radio) are international in nature and the countries of the world developed the system of Coordinated Universal Time (UTC or Zulu) to keep all their ducks in line and on time.

Starting at the 0° (prime) meridian that runs through Greenwich, England (which is why UTC was originally GMT, Greenwich Mean Time) the earth is divided into 24 hourly zones. The prime meridian is taken as the "standard world time" or UTC. Basically this is the *winter* local time in London, England (London is on Daylight Saving Time in the summer). When we hams set our clocks to UTC we are setting it to this standard world time. So every ham, everywhere using UTC has the same time, all the time. Contacts logged in UTC will be the same even if they're between Tennessee and Fiji (3D2).

Telling Time

Back in the shack there are some things to consider. First, there is the question of which time to keep, local time or UTC. You can do either one, whichever is convenient for you — but it's *imperative* that you are *consistent*. If you prefer local time then *all* entries must be in local time. In my shack I have a 24 hour wall clock set to UTC to keep my log on time and a 12 hour clock set to local to keep me on time for dinner.

Hold on — we're not done yet. You still have to decide if you want to use a 12 or 24 hour system. For logging, the 24 hour system is a lot clearer than the 12 hour system. Remember, a broken 12 hour clock is right twice a day, a 24 hour clock only once.

"Yeah, but what about that 0000 — 2400 stuff? With my 12 hour clock, there's only one midnight. No guessing."

Yes, that's an issue with the 24 hour clock. The time "0000" (zero hundred hours) is midnight and the time "2400" is also midnight. To deal with this the convention developed that 2400 represents the day ending and 0000 represents the day beginning. In ham terms, if you start a contact at 2330 and end it 30 minutes later you would log it as ending at 2400 hours yesterday. If you're then called by another station and begin a new contact you would log it as beginning at 0000 hours today, even though the new contact started at the same time the old one ended. Same Time Different Day. Also remember to update the date at 0000. UTC time must match UTC date.

Staying on Time

For all this coordinating of logs by time to work, we all have to have our clocks set to the right time. Luckily, it is easy to keep your triCesium chronometer in sync with the rest of the world. You can obtain precisely correct time at **time.gov**. If you really want to be all ham about it you can tune into WWV or WWVH at 2.5, 5, 10, 15 or 20 MHz. There is an audio broadcast of the exact time and each broadcast is on an exact frequency so you can not only set your clock but calibrate your rig at the same time.

Finally, to keep your computer clock in sync run *nistime-32bit.exe.* This program synchronizes your computer's clock with the National Institute of Standards and Technology (NIST) time reference. It can be downloaded for free from **www.nist.gov**. Search on "nistime."

The International Date Line generally follows the 180° meridian but does jog east and west to accommodate countries that prefer to be in tomorrow or yesterday.

Steve Sant Andrea is an Assistant Editor at *QST*. He can be reached at **ag1yk@arrl.org**.

ARRL EXPO 2012 – Save the Dates!

ARRL has joined forces with two great hamfests — making these conventions the places to be!

Bob Inderbitzen, NQ1R

Plans are underway to bring ARRL EXPO (**www.arrl.org/expo**), our popular show-within-a-show, to two major conventions this year.

The first event, in May, is Dayton Hamvention® at "the crossroads of America" (I-75 north/south meets I-70 east-west in Dayton). Hamvention has been sponsored by the Dayton Amateur Radio Association since 1952 and attracts some 20,000 attendees annually.

The second event, in October, is the 2012 ARRL National Convention hosted this year by Pacificon in Santa Clara, California. Pacificon is the well-established West Coast convention sponsored by members of the Mount Diablo Amateur Radio Club.

Hamvention and Pacificon will both feature a full slate of forums, presentations, training sessions, equipment manufacturers and sellers, radio club booths, and flea market. ARRL's large exhibition area at both events, ARRL EXPO, will be occupied by many program representatives and officials — an opportunity for members and volunteers to interact with ARRL and with each other. There are also plans for live presentations and demonstrations on the ARRL Stage.

Having the ARRL National Convention in the heart of Silicon Valley will give the event a high-tech flavor. Santa Clara is home to many of the world's largest technology corporations, including Intel, Yahoo, Cisco and McAfee. At Pacificon 2011, attendees were treated to innovative exhibits including live video and telemetry from a nearby parachute mobile team with Amateur Radio-equipped skydivers, and real-time demonstrations of amateur satellite communications. Pacificon also boasts an all-day antenna seminar on Friday (an additional registration fee is collected and includes substantial handouts). Think about extending your trip to Santa Clara (and nearby San Francisco) to enjoy the region's historic sites and attractions.

Whether you plan on attending Hamvention or Pacificon (or both!), each event promises to deliver the very best of our Amateur Radio Service!

Bob Inderbitzen, NQ1R, is the ARRL Marketing Manager. He can be reached at **nq1r@arrl.org**.

Dayton

When: May 18-20, 2012

Where: Hara Complex in Trotwood, Ohio

Program Highlights:

- Hamvention® (**www.hamvention.org**) has been sponsored by the Dayton Amateur Radio Association since 1952. The convention includes a full slate of forums, presentations, training sessions, manufacturer exhibits, radio club booths and the world-renowned huge outdoor flea market.
- ARRL EXPO (**www.arrl.org/expo**)
- ARRL-sponsored forums and presentations
- Special Guest and Speaker John Amodeo, NN6JA, well-known TV producer.
- International exhibits (ARRL EXPO area).

See **www.hamvention.org** for more information including lodging options and travel information. While you're there, explore some of the other Dayton Montgomery County area activities and attractions (**www.daytoncvb.com**).

Santa Clara

When: October 12-14, 2012

Where: Santa Clara Marriott, Santa Clara, California

Program Highlights:

- Pacificon (**www.pacificon.org**) is a premier Amateur Radio event on the West Coast. The convention features 100 world class presenters in over 80 forums. Exhibits will include programs for QRP, DX, youth education and scouting, kit building, and demonstrations of Amateur Television (ATV/DATV), satellite and International Space Station operating. Dozens of commercial vendors and a large flea market help round out this annual hamfest.
- Kick-off Breakfast with Gordon West, WB6NOA
- Saturday Banquet and Keynote Presentation
- ARRL EXPO (**www.arrl.org/expo**)
- ARRL VEC-sponsored license exam sessions
- ARRL-sponsored forums and presentations
- W1AW/6 Special Event Station, sponsored by the Mount Diablo Amateur Radio Club
- ARRL Wouff Hong Ceremony

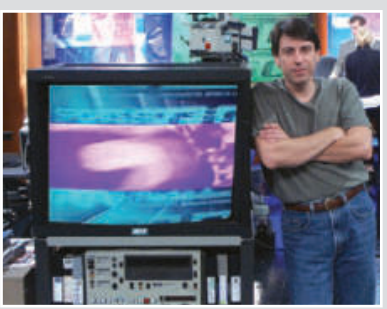
While you're there:

- California's Great America theme park (next door!)
- Intel Museum
- The Tech Museum of Innovation
- Winchester Mystery House
- Triton Museum of Art
- Computer History Museum
- NASA Ames Exploration Center
- Children's Discovery Museum in San Jose
- Shopping and restaurants galore. San Francisco and wineries are just a short drive away.
- Santa Clara Visitors Bureau (**www.santaclara.org/thingstodo**)

See **www.pacificon.org** for more information, including lodging options and travel information

ARRL Special Guest, John Amodeo, NN6JA, to Attend Hamvention

Those following Amateur Radio in the media and popular culture will want to catch special guest John Amodeo, NN6JA, at Hamvention. Amodeo is a working TV producer living in Los Angeles. He has produced such hits as *Arrested Development*, *Sports Night* and the hit ABC comedy *Last Man Standing* staring actor Tim Allen as Mike Baxter, KAØXTT.



At ARRL's invitation, famed TV producer John Amodeo, NN6JA, will give a Hamvention presentation sharing his perspective on the media's portrayal of ham radio and ham radio operators. [COURTESY NN6JA]

New Privileges on 60 Meters

Effective March 5, amateurs gained new privileges on the 60 meter band. With new privileges, however, come new responsibilities.

Dan Henderson, N1ND

If you've never tried operating on the 60 meter band, you now have even more reasons to do so. In November 2011, the Federal Communications Commission issued a Report and Order that expanded Amateur Radio privileges on the band. The new privileges went into effect on March 5, 2012 and they apply to anyone with an Amateur Extra, General or Advanced class license.

The Report and Order creates some exciting possibilities for amateurs on this intriguing band. In addition to upper sideband voice, hams are now allowed to transmit CW and certain digital modes. The FCC also bumped the permitted effective radiated power from 50 W to a full 100 W.

The FCC also changed one of our 60 meter channel frequencies. Channel 3 used to be centered at 5368 kHz, but it is now at 5358.5 kHz.

Five Channels to Check Out

The 60 meter band is unique in that it consists of five specific frequency channels. See Table 1. Each channel has an effective bandwidth of 2.8 kHz.

The trick to using our 60 meter channels is to understand that the frequencies shown in Table 1 are *suppressed carrier frequencies*. These are the frequencies that appear in the tuning displays of most transceivers when they are operating in the USB mode.

It may be helpful to think of the suppressed carrier frequency as being the "bottom edge" of the channel (see Figure 1). When you transmit USB, the RF signal created by your voice extends from that frequency *upward*. According to the rules for 60 meters, the limit is 2.8 kHz above the suppressed carrier frequency. That's why it is important to avoid overdriving your rig and creating splatter that might extend beyond the upper edge of the channel. CW and digital operating is a bit more complicated and we'll address that in a moment.

Table 1
60 Meter Suppressed Carrier Frequencies

Channel 1: 5330.5 kHz
Channel 2: 5346.5 kHz
Channel 3: 5357.0 kHz
Channel 4: 5371.5 kHz
Channel 5: 5403.5 kHz

More Power to You

Our new privileges allow us to transmit with an effective radiated power of 100 W or less, relative to a half-wave dipole. That comes as welcome news for 60 meter ops who have to contend with noisy conditions on a regular basis, but what does that power specification mean in practice?

For the sake of discussion let's assume that an ordinary ½ wavelength dipole antenna has a gain of 0 dB. If there are no losses in your feed line, you can transmit 100 W to such an antenna and be perfectly legal under the new privileges.

But let's consider an antenna that has a bit of gain, such as a directional antenna that you've created for 60 meters. Imagine such an antenna with 3 dB gain. Can you still transmit 100 W to this antenna? Unless there are compensating losses in your feed line, the answer is "no." Instead, you must reduce your output by 3 dB or 50 W.

Remember that the limit is 100 W *relative to a 0 dB half-wavelength dipole*. That doesn't mean you have to use a dipole — you can use any antenna you wish — but if the gain of your antenna is greater than 0 dB, you must reduce your RF output accordingly.

You probably noticed that in this example we assumed that your feed lines were essentially lossless. Of course, this is never the case; there is always some amount of loss in any feed line. The FCC Report and Order only specifies RF applied to the antenna. So, if you want to be picky, we could probably run a bit more power to our hypothetical gain antenna if we subtract the feed line loss. Let's say that you have a 1 dB loss in your feed line on 60 meters and you are using a 3 dB gain antenna. Rather than reducing your transceiver output by 3 dB you could take the 1 dB loss into account and reduce your output by 2 dB instead.

If you are using a gain antenna on 60 meters the FCC Rules require you to keep a copy of the gain specifications in your station records. And if you're hedging your power output by taking feed line loss into account, you need to make note of this as well.

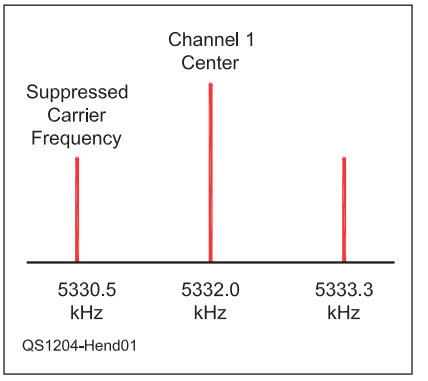


Figure 1 — The suppressed carrier frequency effectively marks the "bottom" of a 60 meter channel. We're using Channel 1 in this example. Each channel is 2.8 kHz wide and the Report and Order specifies that the channel center is 1.5 kHz above the suppressed carrier frequency.

Don't let the issue of RF output intimidate you. Most amateurs are using dipoles, verticals and similar antennas on 60 meters, all of which usually have gain figures in the neighborhood of 0 dB or less. If you are like the majority of 60 meter operators you can set your transceiver output to 100 W and not be concerned.

Running CW on 60

The Report and Order gives you the ability to use CW on 60 meters, but there's a catch. Your CW signal must be in the *center* of your chosen channel. See Table 2 for a list of the channel center frequencies. Note that each channel is 2.8 kHz wide and the Report and Order specifies that the center is 1.5 kHz above the suppressed carrier frequency.

So how do you know if your CW signal is in the center of the channel? Start by reading the manual that came with your radio. Some transceivers transmit CW at the exact frequencies shown on their displays when the rigs are operating in the CW mode. If that's

the case you can simply tune to the channel center frequency and be reasonably sure you're at the right spot. Other transceivers, however, offset the actual CW transmission frequency by a certain amount (for example, 600 Hz) from what is shown in the display. If your manual is not clear on this point, contact the manufacturer.

The only way to be absolutely certain is the use a frequency counter and make sure your signal is exactly where it should be. If there is any doubt, consider borrowing or buying a counter. Once you determine the correct CW frequencies for each channel, you can store them in your transceiver's memory slots — assuming your rig offers this feature — and easily return to them later.

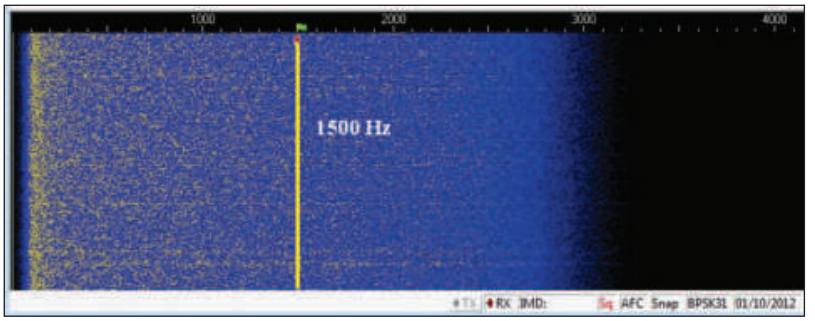


Figure 2 — When operating PSK31, tune your transceiver to the suppressed carrier frequency and then select the point in your waterfall display that corresponds to 1500 Hz above the suppressed carrier frequency.

Digital Operation

Our expanded privileges on 60 meters were the result of collaboration between the FCC and the NTIA — the National Telecommunications and Information Administration, the agency that manages and coordinates telecommunications activities among US government departments, the primary users of the band. Depending on how you choose to interpret the wording of the FCC Report and Order, you might come away thinking that a wide variety of digital modes are permitted on 60 meters under our new privileges. For example, while the Report and Order mentions RTTY, it also specifies that the signal must be less than 60 Hz wide. This is too narrow for amateur teletype signals. Only a much narrower mode such as PSK31 (about 50 Hz wide) meets this requirement.

Before you begin parsing the language of the Report and Order looking for legal justification for your favorite digital mode, consider that the NTIA specifically requested that amateurs limit digital operations to PSK31 and PACTOR III *only*. They are our partners in this venture and if we expect to see more privileges on 60 meters in the future, the ARRL believes it is in our best interests to cooperate and restrict ourselves to PSK31 and PACTOR III.

As with CW, you must operate PSK31 on the channel center frequencies (see Table 2). The easiest way to achieve this is to place your transceiver in the USB mode and tune to one of the suppressed carrier channel frequencies shown in Table 1. With your PSK31 software display configured to indicate audio frequencies, click your mouse cursor at the 1500 Hz mark (see Figure 2). This marker indicates the center of the channel and it is the frequency on which you should be transmitting.

Table 2
Channel Center Frequencies

Channel 1: 5332.0 kHz
Channel 2: 5348.0 kHz
Channel 3: 5358.5 kHz
Channel 4: 5373.0 kHz
Channel 5: 5405.0 kHz

PACTOR III operation on 60 meters is much more straightforward. With your transceiver in the USB mode, you simply tune to one of the suppressed carrier channel frequencies shown in Table 1. Keep in mind, however, that only live keyboard-to-keyboard operation of PACTOR III is allowed. Unattended automatic operation is *not* permitted.

Good Practices Make Good Partners

Because amateurs are only secondary users on 60 meters, we have to yield the channels to other services. In other words, if you suddenly hear a non-amateur transmission on the channel, you must cease operation immediately.

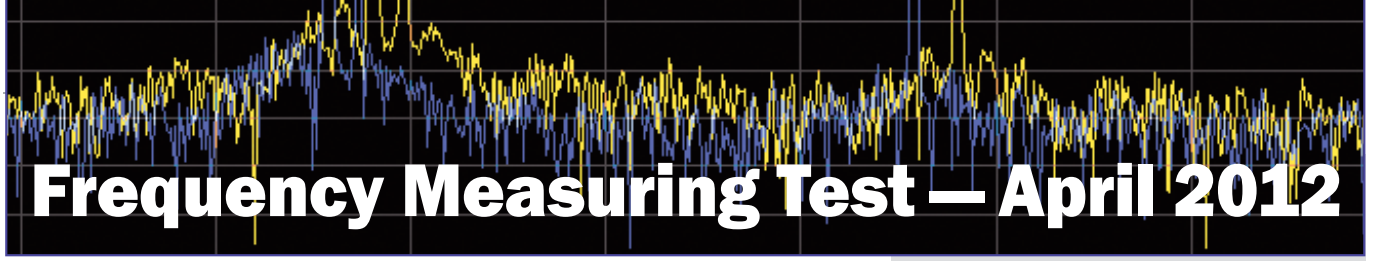
Always listen before transmitting; that's the cardinal rule. If you hear another signal on the channel, whether it is a signal from an Amateur Radio operator or government/private station, *don't transmit.*

As amateurs exercise their new 60 meter privileges, a more detailed and specific channel occupancy plan may become clear. In the meantime, follow these tips to share the channels as efficiently as possible.

- Keep your transmissions as short as possible with frequent breaks to listen for other signals.
- Although split-channel operation (transmitting on one channel and listening on another), is permitted under the rules, this is considered poor operating practice on 60 meters because it effectively ties up two channels at once and increases potential interference. If you must operate split channel, monitor your transmit channel for other signals.
- To locate a clear channel, USB operators should consider beginning at Channel 5 and moving downward (if necessary) to Channels 4, 3, 2 and 1 until a clear channel is found. CW and digital operators should reverse this pattern, beginning at Channel 1 and moving upward until a clear channel is found.
- If you suddenly hear a digital signal on the channel and you're not sure if it is an Amateur Radio signal, move to another channel anyway to be on the safe side. Most primary users on 60 meters operate USB or wide-shift digital signals, so they are relatively easy to recognize. To help you identify the sounds of popular amateur digital modes, see the *Get on the Air With HF Digital* web page at **www.arrl.org/hf-digital**. Scroll to the bottom of this page and you'll also find recordings of government digital operations on 60 meters.
- Take care when using narrow receive filters, such as when operating CW. To be in compliance you need to be able to hear other stations that may begin operating on the channel.
- Over the years, Channel 5 has become a *de facto* international DX channel. With that in mind, avoid domestic QSOs on this channel when possible.

For more information about our new 60 meter privileges, download *60-Meter Operations — New Privileges and Recommended Practices* from the ARRL website at **www.arrl.org/60m-channel-allocation** (scroll to the bottom of the page).

Dan Henderson, N1ND, is the ARRL Regulatory Information Manager. You can reach Dan at **dhenderson@arrl.org**.



Frequency Measuring Test — April 2012

The Frequency Measuring Test (FMT) continues its successful "round-table" format when it takes to the airwaves on the evening of April 19 (April 20 UTC). The test moves to Thursday from the November FMT's usual Wednesday evening, giving everyone an opportunity to participate. Recognizing the higher solar flux, the FMT will lead off with a 20 meter segment — one transmission beaming east and the other west from K5CM in Oklahoma with both transmissions on the same frequency. The sponsors are particularly interested in your comments on frequency differences observed between the directions due to propagation-related effects.

K5CM will lead off on 20 meters with the call-up followed by a key-down period. Following the 20 meter transmission, K5CM will then begin on 40 meters, handing off the frequency to W8KSE who leads with a call-up and then performs a key-down transmission before handing it off to W6OQI and then WA6TZY.

Your job is to measure and report the frequencies of all the stations.[1] The stations will be *close* to the same frequency but not *exactly* on the same frequency! For the 40 and 80 meter transmissions, do *not* assume that all stations will be within the pass band of a CW filter. Be prepared to tune if necessary!

The test will begin on 20 meters near 14055 kHz at 10 PM EDST on April 19. That is on Thursday evening in North America and all times are listed in EDST in Table 1. (For our friends in Europe, that is 0200 UTC on the morning of April 20.) There will be four stations in the 40 meter round-table near 7055 kHz beginning at 10:30 PM: K5CM (OK), W8KSE (OH), W6OQI (CA) and WA6ZTY (CA). The test will then move to 80 meters near 3569 kHz beginning at 11 PM (0300 UTC). The 80 meter stations will be K5CM, W8KSE and W6OQI.

For more information and any updates in procedure, tune in to the ARRL's Frequency Measuring Test web page at **www.arrl.org/frequency-measuring-test**. Results will be reported using the regular web page format provided by WA7BNM. More information on frequency measuring techniques and exercises can be found on K5CM's website at **www.k5cm.com**. — *Ward Silver, NØAX*

[1]*QST* articles more than five years old are available to ARRL members at **www.arrl.org/arrl-periodicals-archive-search**. Use the keyword FMT to find previous articles.

FMT Schedule in Eastern Daylight Saving Time*

20 Meter Time Line (near 14055 kHz)

Beaming East

K5CM	10:00 PM	call up (3 mins)
K5CM	10:03	key down (2 mins)

Beaming West

K5CM	10:05	call up (3 mins)
K5CM	10:08	key down (2 mins)

40 Meter Time Line (near 7055 kHz)

K5CM	10:30 PM	call up (3 mins)
K5CM	10:33	key down (2 mins)
K5CM	10:35	turnover to W8KSE (1 min)
W8KSE	10:36	call up (2 mins)
W8KSE	10:38	key down (2 mins)
W8KSE	10:40	turnover to W6OQI (1 min)
W6OQI	10:41	call up (2 mins)
W6OQI	10:43	key down (2) mins)
W6OQI	10:45	turnover to WA6ZTY (1 min)
WA6ZTY	10:46	call up (2 mins)
WA6ZTY	10:48	key down (2 mins)
WA6ZTY	10:50	end and announce FMT move to 80 meters

80 Meter Time Line (near 3575 kHz)

K5CM	11:00 PM	call up (3 mins)
K5CM	11:03	key down (2 mins)
K5CM	11:05	turnover to W8KSE (1 min)
W8KSE	11:06	call up (2 mins)
W8KSE	11:08	key down (2 mins)
W8KSE	11:10	turnover to W6OQI (1 min)
W6OQI	11:11	call up (2 mins)
W6OQI	11:13	key down (2 mins)
W6OQI	11:15	end FMT announcement

*UTC = EDST + 4 hours

W1AW Schedule

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US Time + 4 hours. For the rest of the year, UTC = Eastern US Time + 5 hours.

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	1400-1600 1700-1945	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	2000	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2100	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2200	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	2300	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0000	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0100	DIGITAL BULLETIN				
6^{45} PM	7^{45} PM	8^{45} PM	9^{45} PM	0145	VOICE BULLITEN				
7 PM	8 PM	9 PM	10 PM	0200	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0300	CODE BULLETIN				

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.
Slow Code = practice sent at 5, 7½, 10, 13 and 15 WPM.
Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 WPM.
Code bulletins are sent at 18 WPM.

♦ W1AW Qualifying Runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted by K6YR and other West Coast stations on 3590 kHz and other frequencies. See "Contest Corral" in this issue. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ Digital transmissions: Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent using 45.45-baud Baudot, PSK31 in BPSK mode and MFSK16 on a daily revolving schedule.

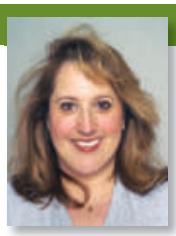
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern Time using Baudot and PSK31.

♦ Voice transmissions: Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour and CW on the half hour.

W1AW code practice and CW/digital bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions.

During 2012, Headquarters and W1AW are closed on New Year's Day (observed January 2), Presidents' Day (February 20), Good Friday (April 6), Memorial Day (May 28), Independence Day (July 4), Labor Day (September 3), Thanksgiving and the following day (November 22 and 23), and Christmas and the day before Christmas (December 24 and 25). For more information, visit us at **www.arrl.org/w1aw**.



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

Amateur Radio Gets Secondary MF Allocation at WRC-12

After years of hard work behind the scenes, Amateur Radio scores a victory in Geneva.

It's official — delegates attending the 2012 World Radiocommunication Conference (WRC-12) have approved a new 7-kilohertz-wide secondary allocation between 472-479 kHz for the Amateur Radio Service. Agenda Item 1.23 had both its first and second readings in Plenary Session on February 14; to become part of the ITU's Radio Regulations, each Agenda Item must be read twice in Plenary Session. While the Final Acts were signed on February 17 at the close of the Conference, the new allocation will not take effect until it is entered into the Radio Regulations on January 1, 2013. In any case, no amateur can use the band until his or her national regulations are revised to implement the allocation.

"This is a fantastic achievement for the Amateur Radio Service," said IARU President Tim Ellam. VE6SH. "A new allocation for spectrum is always something that should be celebrated. The success on this issue is due to the hard work over the last four years from our IARU representatives, as well as the volunteers from the numerous IARU Member-Societies who have worked within the ITU process on behalf of their national administrations. This is excellent work from our team in Geneva, and from those who have assisted from their home countries."

Agenda Item 1.23 called for about a 15-kilohertz-wide spectrum in parts of the band 415-526.5 kHz, taking into account the need to protect existing services. But according to ARRL Chief Executive Officer David Sumner, K1ZZ, there was a conflict with the Maritime Mobile Service. WRC-12 delegates approved Agenda Item 1.10, which called for a worldwide exclusive allocation to the Maritime Mobile Service of 495-505 kHz. Discussion of this allocation to Maritime Mobile "has been in the works throughout the conference preparation (i.e. since 2008)," Sumner explained, "and was the reason why the MF amateur allocation could not be made in this band as some amateurs had hoped. That's why we had to look elsewhere and is what put us in conflict with aeronautical radionavigation."

According to Colin Thomas, G3PSM, CEPT Coordinator for Agenda Item 1.23, WRC-12 delegates moved forward early in the Conference with what he called a "compromise proposal" for the new allocation: "Progress was made with a compromise proposal on Agenda Item 1.23, drafted to take into consideration the views of those for and those against an Amateur Service allocation around 500 kHz. This proposal suggests a 7 kilohertz segment between 472-479 kHz, very close to the CEPT position of 472-480 kHz."

The new allocation calls for a worldwide secondary allocation to the Amateur Service at 472-479 kHz, with a power limit of 1 W EIRP. A provision has been made, however, for administrations to permit up to 5 W EIRP for stations located more than 800 km from certain countries that wish to protect their aeronautical radionavigation service (non-directional beacons) from any possible interference. Footnotes provide administrations with opportunities to "opt out" of the amateur allocation and/or to upgrade their aeronautical radionavigation service to primary, if they wish to do so. In addition to these protections for aeronautical radionavigation, the Amateur Service must avoid harmful interference to the primary maritime mobile service. Quite a few additional administrations — mainly in the former Soviet Union and Arab states — added their country's names to the Footnotes prior to the Agenda Item's consideration in Plenary.

Also at WRC-12, delegates approved allocations to HF oceanographic radars. They do not include the amateur bands, nor are they adjacent to our existing HF bands.

One of the responsibilities of each WRC is to set the agenda for the next WRC. WRC-12 delegates approved an Amateur Radio-related agenda item for the upcoming WRC-15: To consider the possibility of making an allocation of an appropriate amount of spectrum, not necessarily contiguous, to the Amateur Service on a secondary basis within the band 5250-5450 kHz.

More than 3000 participants — representing 165 out of the International Telecommunication Union's 193 Member States — attended the four-week conference. About 100 Observers from among the ITU's 700 private sector members — along with international organizations, including the International Amateur Radio Union — were also in attendance. A number of WRC-12 delegates are radio amateurs.

Each Agenda Item must have two readings in the Plenary before it becomes official.
[GEORGE PETERSEN, PA5G]

FCC News

New 5 MHz Rules in Effect As of March 5

On November 18, the FCC released a *Report and Order*, defining new rules for the 60 meter (5 MHz) band. These rules are in response to a *Petition for Rulemaking* filed by the ARRL more than five years ago and a June 2010 *Notice of Proposed Rulemaking*. In the February 3 edition of the *Federal Register*, the FCC announced that these new rules would take effect at 12:01 AM (EST) on March 5, 2012.

In summarizing the new rules, the FCC explained that they amend the current rules to facilitate more efficient and effective use by the Amateur Radio Service of five channels in the 5330.5-5406.4 kHz band (the 60 meter band): "Specifically, and consistent with our proposals in the *Notice of Proposed Rulemaking* in this proceeding, the Commission replaces one of the channels with a less encumbered one, increases the maximum authorized power amateur stations may transmit in this band and authorizes amateur stations to transmit three additional emission designators. The Commission also adopts an additional operational rule that prohibits the use of automatically controlled digital stations and makes editorial revisions to the relevant portions of the Table of Frequency Allocations and our service rules."

The Amateur Radio Service in the United States has a secondary allocation on 60 meters. Only those amateurs who hold General, Advanced or Amateur Extra class licenses may operate on this band. Amateur stations must not cause harmful interference to — and must accept interference from — stations authorized by any administration in the fixed service, as well as mobile (except aeronautical mobile) stations authorized by the administrations of other countries.

Please see **www.arrl.org/news/fcc-releases-new-rules-for-60-meters** and the article "New Privileges on 60 Meters" elsewhere in this issue for more information on these new rules.

FCC Sets Date for Medical Devices on 70 cm

In November 2011, FCC Commissioners unanimously agreed to allocate spectrum and adopt service and technical rules for the utilization of new implanted medical devices that operate on 413-457 MHz (70 cm). These devices will be used on a secondary basis as part of the Medical Device Radiocommunication (MedRadio) Service in Part 95 of the FCC rules. In the January 27 edition of the *Federal Register*, the FCC announced that the effective date for these new rules was February 27. The new rules expand the existing MedRadio Service rules to permit the use of new wideband medical implant devices that employ neuromuscular microstimulation techniques to restore sensation, mobility and other functions to paralyzed limbs and organs. The rules will allow these new types of MedRadio devices to access 24 megahertz of spectrum in the 413-419 MHz, 426-432 MHz, 438-444 MHz and 451-457 MHz bands on a secondary basis.

FCC Denies Anchorage VEC's Waiver Request

On January 24, the FCC issued an *Order* that denied a *Waiver Request* from the Anchorage VEC, one of 14 Volunteer Examiner Coordinators in the US. In its July 2011 *Waiver Request*, the Anchorage VEC asked the Commission to permit individuals who have previously held an Amateur Radio license grant issued by the Commission — but which has expired and is beyond the two year grace period for renewal — to receive credit for elements previously passed. This would, in effect, grant a new license grant, without additional examination. This *Waiver Request* was in addition to a *Petition for Rulemaking* (RM-11629) filed in April 2011 that asked the FCC to give permanent credit to radio amateurs for examination elements they have successfully passed, effectively creating a license exam credit that would be valid throughout an amateurs' lifetime, never expiring. The FCC noted that the denial of the waiver request was without prejudice to the Anchorage VEC's pending *Petition for Rulemaking*, meaning that this denial will have no impact on the pending *Petition*, and the FCC will still consider it.

In its *Waiver Request*, the Anchorage VEC asserted that grant of the waiver will permit individuals whose Amateur Radio license grants have expired to obtain a new license grant at an early date, thereby allowing them to again participate in normal Amateur Radio activities. It was also stated that several potential beneficiaries of this action are of advanced years and are interested in prompt resolution of this matter.

Section 1.925 of the Commission's Rules provides that the FCC may grant a waiver if it is shown that (a) the underlying purpose of the rule(s) would not be served or would be frustrated by application to the instant case, and grant of the requested waiver would be in the public interest; or (b) in light of unique or unusual circumstances, application of the rule(s) would be inequitable, unduly burdensome or contrary to the public interest, or the applicant has no reasonable alternative. The FCC concluded that the Anchorage VEC did not meet either requirement.

In denying the Anchorage VEC's *Waiver Request*, the FCC noted that "[a]llowing a licensee whose license is active, or can be renewed to receive element credit for examination elements previously passed, is consistent [with] the basis and purpose of the Amateur Service, which includes encouragement and improvement of the service through rules which provide for advancing skills in both the communication and technical phases of the art. Individuals who do not hold a current or renewable Amateur Radio operator license, however, regardless of whether they have held one in the past, must demonstrate their qualifications to be Amateur Radio operators before obtaining a new license. We conclude, therefore, that grant of the requested waiver to allow examination credit to be granted for any previously held Amateur Service operator license would not serve the underlying purpose of the rule. Additionally, we note that Amateur Radio testing opportunities are widely available. [Volunteer Examiners] can administer tests at any location and time convenient to them and the examinee. Consequently, Anchorage VEC has not shown that requiring retesting of examinees whose operator licenses expired more than two years ago, including those of advanced years, is inequitable or unduly burdensome, or that these examinees have no reasonable alternative."

The ARRL opposed the *Waiver Request*, saying that "review of the issue now may be timely, but it should be done in the context of a normal notice-and-comment rulemaking, not by waiver."

W1AW Gets New Antennas

The freak snow storm in late October wreaked havoc on the ARRL HQ antenna farm. According to W1AW Station Manager Joe Carcia, NJ1Q, both of W1AW's 40 meter Yagis were severely damaged, as was the 80 meter cage antenna, and an element on the north tower's 10 meter Yagi was twisted vertically. The antennas atop the ARRL Headquarters building for W1HQ, the station for the Laird Campbell Memorial HQ Operators Club, also received damage: the HF vertical was turned into something that looked like a pretzel, and the rotator was also damaged.

"Until we could get these antennas replaced, we had some temporary fixes so we could

Andrew Toth guides the 40 meter beam into place as W1AW Station Manager Joe Carcia, NJ1Q, and Matt Strelow, KC1XX guide it up the tower from the ground.

[S. KHRYSTYNE KEANE, K1SFA]

still send out the bulletins and provide a station for our visitors," Carcia explained. "For 40 meters, I homebrewed a 'fat dipole,' and for 80 meters, I strung a simple dipole off the north tower."

Matt Strelow, KC1XX, and Andrew Toth of XX Towers came to Newington earlier in February to replace most of the damaged items. Together with Carcia, they removed the damaged 80 meter wire cage antenna and repaired the element on the 10 meter Yagi on the north tower. They also removed the two damaged 40 meter Yagis on the center tower (a 120 foot Rohn 65 tower) and replaced them with two new Cushcraft XM240 40 meter Yagi antennas. For W1HQ, they replaced the damaged rotator with a new Yaesu G-1000DXA rotator. Before Strelow and Toth arrived, Carcia had assembled both of the new 40 meter Yagis and prepared the new W1HQ rotator and its control cable.

"Matt and Andrew normally perform inspections for W1AW and W1HQ twice a year in the spring and autumn," Carcia said. "They were here for two days installing the new antennas, but they did not perform any inspections. They'll come back in the spring for that."

In the early spring, Carcia will replace the Gap Titan that used to be on top of the ARRL HQ building with a vertical antenna that SteppIR has donated to W1HQ.

2012 Field Day Packet Now Available

It's that time of year again — time to start gearing up for ARRL Field Day, June 23-24, 2012. ARRL's flagship operating event — always held the fourth full weekend in June — brings together new and experienced hams for 24 hours of operating fun. Field Day packets are now available for download at **www.arrl.org/fieldday** and include the complete rules, as well as other reference items such as forms, ARRL Section abbreviation list, entry submission instructions, a Frequently Asked Questions section, guidelines for getting bonus points, instructions for GOTA stations and a kit to publicize your event with the local press. A brief one-page flyer with basic "What is Field Day" information has also been included in this year's Field Day packet. Amateur Radio clubs and individuals are encouraged to reproduce this flyer as a handout for information tables.

Logbook of The World to Support CQ Awards

The ARRL and CQ Communications, Inc have signed an agreement to begin providing support for CQ-sponsored operating awards by the ARRL's Logbook of the World (LoTW) electronic confirmation system. The agreement was announced jointly on January 24 by ARRL Chief Operating Officer Harold Kramer, WJ1B, and CQ Communications President Richard Ross, K2MGA.

CQ's awards will be the first non-ARRL awards supported by LoTW and will be phased in beginning with the CQ WPX award, with additional CQ awards to follow. The ARRL's LoTW system — an interactive database recording contacts between radio amateurs — was created in 2003 and has been adopted by 47,500 radio amateurs worldwide. It has records of 400 million contacts and is growing weekly. The target date for beginning LoTW support for WPX is April 2012.

Amateurs will be able to use LoTW logs to generate lists of confirmed contacts to be submitted for WPX credit. Standard LoTW credit fees and CQ award fees will apply.

ARRL Chief Executive Officer David Sumner, K1ZZ, observed that this step gives radio amateurs throughout the world an inexpensive and convenient means of gaining credits toward CQ's popular operating awards: "LoTW has significantly increased interest and participation in the ARRL's DXCC, Worked All States and VUCC awards programs. We anticipate a similarly positive response to the addition of the CQ WPX award. Amateurs will be able to spend more time operating and less time chasing QSL cards."

CQ President Richard Ross, K2MGA,

said he is very pleased to be able to move forward with LoTW support for CQ awards. "We have had excellent results with electronic confirmations for several years," he explained. "I am glad that we are now able to begin expanding that convenience to those participants in our award programs who use Logbook of The World. We look forward to a smooth launch for WPX and to the expansion of LoTW support to include the rest of our award programs, as well."

Yaesu is the Principal Sponsor of the LoTW website.

Silent Keys

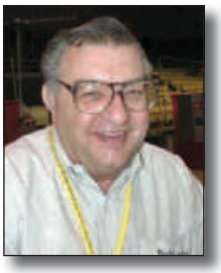
Former ITU-R Director Dick Kirby, W0LCT/HB9BOA (SK): Richard "Dick" Kirby, W0LCT/HB9BOA, passed away on January 26. He was 89. In 1974, Kirby — an ARRL Life Member — was elected Director of the International Telecommunication Union's (ITU) International Radio Consultative Committee; he served as Director until his retirement in 1995. In 1992, under Kirby's tenure as Director, the Committee became the ITU Radiocommunication Sector (ITU-R). One of three sectors at the ITU, ITU-R is responsible for matters concerning radio communication. Its role is to manage the international radio-frequency spectrum and satellite orbit resources, and to develop standards for radiocommunication systems with the objective of ensuring the effective use of the spectrum. For more on Kirby's career and passion for Amateur Radio, please see **www.arrl.org/news/former-itu-r-director-dick-kirby-w0lct-hb9boa-sk**.

Dick Kirby, W0LCT/HB9BOA (SK)

Astronaut Janice Voss, KC5BTK (SK): NASA astronaut Janice Voss, KC5BTK, of Houston, Texas, passed away on February 7 from cancer. She was 55. One of only six women who have flown in space five times, Voss' career was highlighted by her work and dedication to scientific payloads and exploration. In total, Voss spent more than 49 days in space, traveling 18.8 million miles in 779 Earth orbits. Voss participated in making ham radio contacts from space via the Space Shuttle Amateur Radio Experiment (SAREX), the precursor to the Amateur Radio on the International Space Station (ARISS) program. Read more about Voss at **www.arrl.org/news/astronaut-janice-voss-kc5btk-sk**.

Janice Voss, KC5BTK (SK)

***WorldRadio* Founder Armond Noble, N6WR (SK)**: Armond Noble, N6WR — an ARRL Life Member and the founder of *WorldRadio* magazine and its publisher for 37 years — passed away February 1 in Sacramento, California after a short illness. He was 77. *WorldRadio* was published monthly in printed format from July 1971 until the end of 2008, when Noble sold the magazine to Hicksville, New York-based CQ Communications Inc. With its February 2009 edition, the publication was renamed *WorldRadio Online* and became the first online-only major Amateur Radio publication. Read more about Noble at **www.arrl.org/news/em-worldradio-em-founder-armond-noble-n6wr-sk**.



Armond Noble, N6WR (SK)

Section Manager Nomination Notice

To all ARRL members in Connecticut, Idaho, Minnesota, North Dakota, Ohio, Oklahoma, Southern Florida, Western New York, Puerto Rico, South Dakota* and Virgin Islands: 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 June 8, 2012. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before July 2, 2012, to full members of record as June 8, 2012, which is the closing date for nominations. Returns will be counted August 21, 2012. Section Managers elected as a result of the above procedure will take office October 1, 2012.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning October 1, 2012. If *no* petitions are received from a section by the specified closing date, such section will be resolicited in the October 2012 *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 Resolicitation Notice**: Since no nominations were received for the South Dakota Section Manager election by the nomination deadline of December 9, 2011, nominations are hereby resolicited.

Rick Palm, K1CE, k1ce@arrl.org

FCC Staffer Talks on Emcomm at ARRL/TAPR Conference

FCC's Curt Bartholomew, N3GQ, speaks to the ARRL/TAPR Conference on the future of Emcomm.

Curt Bartholomew, N3GQ, senior emergency and continuity manager in the Public Safety and Homeland Security Bureau at the FCC spoke on September 17, 2011, at the ARRL/TAPR Digital Communications Conference on the topic of "Catastrophic Communications — Which Digital Mode Would You Use?" Here's a summary of key remarks that should be of interest to ARES® and indeed every Emcomm operator. Bartholomew has an extensive background in the US Army, 41 years as a radio amateur and as a staffer in five Federal agencies, including FEMA, DHS and for the past 3 years, the FCC. The Public Safety and Homeland Security Bureau's mandate is to ensure the safety of life and property through the use of communications services. Continuity of Federal government operations is Bartholomew's specific job.

Curt Bartholomew, N3GQ, of the Public Safety and Homeland Security Bureau at the FCC presented a speech on "Catastrophic Communications" at the recent ARRL/TAPR Digital Communications Conference. Here he is at his home station ready to take on whatever communications challenge arises. [MATT BARTHOLOMEW, KI4VLR]

Bartholomew reported that Amateur Radio was involved in the government's annual continuity (devolution) exercise for the first time ever, with the scenario of a catastrophic event (nuclear attack) crippling Federal agencies' headquarters and personnel. With electronic communications down, agencies must relocate (devolve) far away from the capitol district and restaff with out-of-state personnel to resume functioning. Past exercise scenarios have included geomagnetic storms, natural disasters, and cyber, chemical and biological attacks.

In the nuclear attack scenario, wireless communications resources would be limited. The only systems that might be usable include limited SATCOMs, limited TV/radio broadcasting, FRS, GMRS, CB, MURS, HF-ALE and Amateur Radio, according to Bartholomew. Under a real devolution scenario, Amateur Radio operators may get called to assist Federal agencies with emergency communications. Bartholomew cited a September 2011 *QST* article "Optimizing Amateur Radio Resources for Major Disasters," as an example of what radio amateurs can bring to the table.[1]

Our Role in Emcomm: The FCC Wants to Know More

The FCC is conducting a survey of Amateur Radio and its role in emergency communications because, according to Bartholomew, the agency doesn't have a sufficient knowledge base and what it does have is largely anecdotal, not empirical. Questions on respondents' training, history of Emcomm work, skill sets, deployment times, digital transmission standards, traffic handling and net control protocols, certifications, guidance and organization, will help the FCC learn more. The FCC is also interested in knowing more about which digital modes are used in Amateur Radio Emcomm and specifically "what are the issues associated with increasing the baud rate on the HF bands (within the bandwidth limits)?" Bartholomew said that packet radio still seems to be the number one digital mode used for Emcomm today. Also, the FCC wants to know what training radio amateurs are taking to qualify them for emergency communication roles.

When you need Amateur Radio, you really need them.

The FCC is also asking what guidance is needed to help the Amateur Radio community meet its goals of compliance with NIMS, establish response standards, mesh with the Incident Command System (ICS), mutual aid initiatives, basis for credentialing, seamless communications interoperability and relationships with served agencies.

On the topic of Emcomm preparedness, Bartholomew spoke on D-STAR, PSK31, HF-NVIS, packet radio, "Go Kits" and traffic handling: Are radio amateurs proficient in these modes and protocols? He asked if the Emcomm operators of tomorrow will be prepared to "provide the connectivity and level of service sufficient to be of value to local governments, VOADs (Voluntary Organizations Active in Disaster) and citizens during significant events."

Bartholomew said that emergency plans must be flexible; to use whatever may be available in a post-catastrophe scenario, traditionally a long-time major asset of radio amateurs. He cited the diverse modes used

[1] V. Cid, W3CID, and A. Mitz, WA3LTJ, "Optimizing Amateur Radio Resources for Major Disasters," *QST*, Sep 2011, pp 30-34.

by radio amateurs in each community or community next door that foster flexibility to get the job done. He noted that not even the CW operator who can copy 20 WPM should be overlooked as a resource.

On ensuring a robust future for Amateur Radio, Bartholomew noted that commercial users pay for their spectrum and thus have an economic interest in using it as efficiently as possible, spreading the costs over as many users as possible. To do this, they have developed more efficient digital modes and protocols. Amateur Radio also has a long history of such development, but we need to ramp up this tradition for us to continue to justify to regulators that we are good stewards of the public resource, even if we do not have the same economic incentives as the commercial users. Additionally, more efficient use of our spectrum translates to better service and safety to the public. Specifically, Bartholomew challenged us to keep experimenting to squeeze more bits of data into the same Hertz of bandwidth.

On the topic of interoperability, a key initiative of the public safety telecommunications arena, Bartholomew challenged us to develop modes and protocols to allow for it, as we do not have national standards toward this goal at this time. "No one has fully worked this issue," he said. Nongovernmental organizations (NGOs) do not have the money and the problem with the Federal government working the issue is that telecommunications regulation is divided among at least five different agencies: the FCC, NTIA, DHS-NCS, FEMA Disaster Emergency Communications and the DHS Office of Emergency Communications. Is it any wonder that it can't be done at the Federal level, Bartholomew asked. The challenge remains.

Bartholomew posed this question to the conferees: "If you were limited to just one or two HF Automatic Repeat reQuest (ARQ) digital modes to send messages with content that absolutely and positively had to be accurately received, what would they be?" He is looking for answers.

Post 9/11

Bartholomew said that the country is much stronger after the events of 9/11 and that there has been a major enhancement of our emergency communication abilities; we just need to continue this trend. "We cannot forget the serious side of Amateur Radio," he said, "as a back-up to the back-ups we have." He cited the widely publicized remarks of FEMA Administrator Craig Fugate at an FCC forum on earthquake preparedness on May 11, 2011, where he praised Amateur Radio as often the first line of communications out of a major disaster area, such as during the Haitian earthquake. And, whenever everything else fails, "Amateur Radio is often our last line of defense."

The telecommunications community has worked to harden their systems and provide interoperability to the point where it doesn't believe they will ever fail. Fugate said "they do, they have, and they will" and "Amateur Radio needs to be worked into our plans accordingly." "When you need Amateur Radio, you really need them."

Bartholomew closed his presentation by thanking radio amateurs for their service and took questions. A conferee asked about the possibility of reregulating amateur spectrum by bandwidth rather than by mode to foster more experimentation toward more spectrum efficiency. Bartholomew responded that staff resources at FCC are limited and, consequently, opportunity to originate rule changes and proposals at the FCC level is limited. He said that ideas, rule changes and proposals must be generated from within the amateur community itself. Another conferee responded that although Amateur Radio has a long tradition of self-regulation, he thought the amateur service tends to "over-regulate" itself, citing the example of the community holding on to the Morse code licensing requirement for so long. Bartholomew emphasized that changes need to be initiated from within the amateur community and a balance struck among the interests of all amateur spectrum users when considering such change.

Emcomm is what saves Amateur Radio from losing spectrum.

Emcomm Activities Give Value to Our Spectrum

Bartholomew stated his opinion that "Emcomm is what saves Amateur Radio from losing spectrum," and "maybe even gaining some," but the public needs to continue to gain benefit. Bartholomew challenged us to do a better job of making the public constantly aware of our service through public relations and the media, for example, by the efforts of public information officers and coordinators.

Another audience member prefaced his question by observing the increasing hurdles and expense of pre-positioning amateur repeaters and antennas on municipal/county property and towers to enable the local amateur community to perform its services during emergencies. He asked what we as radio amateurs can do about gaining more access. Bartholomew responded that it takes "people skills" on the part of radio amateurs, that is, the ability to work well with local officials, to get such access.

He cited his own experience as an emergency coordinator/radio officer (EC/RO) for his home county: by getting to know and working well with county officials, he was able to gain significant placement of amateur assets on county towers and property with no fees and grow his capability accordingly. EC/RO Bartholomew was also able to recruit many new ARES®/RACES members as a result of the enhanced footprint of Amateur Radio in the county. Good relationships with the local fire chief, sheriff and emergency manager are the key, he said.

"It only takes one guy to mess things up" for Amateur Radio at the local level and Bartholomew cited this example: On mission as a Federal Protective Service lead police officer supporting FEMA at a disaster site in North Carolina, Bartholomew was attending a briefing and ended up talking to the sheriff and fire chief about a problematic, belligerent know-it-all who they wanted to arrest for interference and asked officer Bartholomew to check him out. On interrogation, the man angrily said "I'm a ham and these guys don't know what they're doing." The ham left and came back 3 hours later at the invitation of Bartholomew. Calmer, the ham was educated on the need to cooperate with officials to get things done, Bartholomew said. It only takes one ham to ruin the system, opportunity and privilege to serve for the local amateur community, was the message. The FCC's Bartholomew closed the Q&A session with my favorite quote: "I am pro-Amateur Radio."

We cannot forget the serious side of Amateur Radio, as a back-up to the back-ups we have.

Thanks go to *Amateur Radio Video News* (ARVN) for taping, producing and publishing the session (**www.arvideonews.com**) and to ARRL and Tucson Amateur Packet Radio (TAPR) (**www.tapr.org**) for sponsoring the venerable Digital Communications Conference.

Contest Corral – April 2012

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

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

Start - Finish Date-Time				Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
31	0000Z	1	2400Z	- / 144, 10G+	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org
31	0001Z	8	2359Z	1.8-28 / -	Lighthouse Spring Lites QSO Party	Ph CW Dig	ARLHS number or serial, name, S/P/C	arlhs.com
31	1800Z	1	see web	1.8-28 / -	MO QSO Party	Ph CW	RS(T), serial, MO county or S/P/C	www.w0ma.org
3	0200Z	3	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
3	1600Z	3	see web	3.5 / 50,144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
6	0200Z	6	0300Z	1.8-14 / -	SNS and NS Weekly Sprints	CW	Serial, name, and S/P/C	www.ncccsprint.com/rules.html
7	0000Z	8	0000Z	1.8-28 / 50-432	Montana QSO Party	Ph CW Dig	RS(T), S/P/C or MT county	www.fvarc.org
7	0400Z	7	0800Z	7 / -	LZ Open 40 Meter Contest	CW	6-digit serial and serial from previous QSO	www.lzopen.com
7	12 Noon	7	6 PM	14 / -	PODXS 31 Flavors Contest	Dig	S/P/C and name or 070 number	www.podxs070.com
7	1200Z	8	2359Z	1.8-28 / -	QRP ARCI Spring QSO Party	CW	RST, S/P/C, power or QRP ARCI number	www.qrparci.org/contests
7	1500Z	8	1500Z	1.8-28 / -	SP DX Contest	Ph CW	RS(T), serial or SP province	www.spdxcontest.info
7	1600Z	8	1600Z	3.5-28 / -	EA RTTY Contest	Dig	RST, serial or EA province	www.ure.es/contest
9	7 PM	9	11 PM	- / 144	VHF Spring Sprints	Ph CW Dig	Grid Square (6-character preferred)	sites.google.com/site/springvhfupsprints
11	0030Z	11	0230Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
11	1300Z	11	see web	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name, member number or S/P/C	www.cwops.org/onair.html
14	1600Z	14	1959Z	3.5-14 / -	EU Spring Sprints	CW	Both callsigns, serial, name	www.eu-sprint.com
14	1400Z	15	0200Z	1.8-28 / 50	New Mexico QSO Party	Ph CW Dig	Call sign, name, and NM county or S/P/C	www.swcp.com/~n5zgt
14	1600Z	14	1959Z	3.5-14 / -	EU Spring Sprints	Ph	Both callsigns, serial, name	www.eu-sprint.com
14	1800Z	15	1800Z	1.8-28 / 50+	QCWA Spring QSO Party	Ph CW Dig	Call,year lic'd,name,QCWA chap or S/P/C	www.qcwa.org/qso-party.htm
14	1800Z	15	see web	1.8-28 / 50	Georgia QSO Party	Ph CW	RS(T), S/P/C or GA county	gqp.contesting.com
14	2100Z	15	2100Z	1.8-28 / -	Yuri Gagarin DX Contest	CW	RST, ITU Zone	gc.qst.ru/en
15	0200Z	15	0400Z	1.8-28 / -	Run For the Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
15	0700Z	15	see web	7,14 / -	International Vintage Contest	Ph CW	RS(T), grid square	www.contestvintage.beepworld.it
15	0700Z	16	1300Z	1.8-28 / -	Japan International DX Contest	CW	RST, JA prefecture or CQ Zone	jidx.org
15	**1800Z**	**15**	**2359Z**	**3.5-28 / -**	**ARRL Rookie Roundup**	**Ph**	**Both calls, name, check, S/P XE# or "DX"**	**www.arrl.org/contests**
17	7 PM	17	11 PM	- / 222	VHF Spring Sprints	Ph CW Dig	Grid Square (6-character preferred)	sites.google.com/site/springvhfupsprints
20	2100Z	21	2100Z	1.8-28 / -	Holyland DX Contest	Ph CW Dig	RS(T), serial or Israel district	www.iarc.org
21	0000Z	21	2400Z	1.8-28 / 50	TARA Skirmish Dig Pfx Contest	Dig	Name, prefix	www.n2ty.org/seasons/tara_dpx_rules.html
21	0500Z	21	0859Z	3.5, 7 / -	ES Open HF Championship	Ph CW	RS(T), serial, dupes OK once/hour	www.erau.ee
21	1200Z	22	2359Z	3.5-28 / -	CQMM Contest	CW	RST, continent, and category	www.cqmmdx.com
21	1600Z	22	0400Z	3.5-28 / -	Michigan QSO Party	Ph CW	Serial and MI county or S/P/C	www.miqp.org
21	1700Z	22	1300Z	3.5-28 / -	EA QRP Contest	CW	RST, category, M if EA QRP member	www.eaqrp.com
21	1700Z	22	1700Z	1.8-28 / -	South Dakota QSO Party	Ph CW Dig	RS(T) and SD county or S/P/C	www.w0blk.org
21	1800Z	22	see web	1.8-28 / 50,144	Ontario QSO Party	Ph CW	RS(T), S/P/C or Ontario QTH	www.va3cco.com
21	2000Z	21	2200Z	1.8-28 / -	Feld-Hell New Member Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
21	2100Z	22	see web	1.8-28 / -	YU DX Contest	CW	RST and ITU zone	www.yu1srs.org.rs/dl/yudx/yudxmain.html
25	7 PM	25	11 PM	- / 432	VHF Spring Sprints	Ph CW Dig	Grid Square (6-character preferred)	sites.google.com/site/springvhfupsprints
28	0000Z	29	2400Z	- / 2.3G	Worldwide EME Contest	Ph CW	TMO/RS(T) and "R"	www.dubus.org
28	0001Z	29	2359Z	28 / -	Ten-Ten Spring Digital Contest	Dig	Call, name, county & S/P/C, 10-10 number	www.ten-ten.org
28	1100Z	29	1700Z	1.8-28 / 50,144	Nebraska QSO Party	Ph CW Dig	RS(T), NE county or S/P/C	www.hdxa.net
28	1200Z	29	1200Z	3.5-28 / -	SP DX RTTY Contest	Dig	RST, serial, SP province	www.pkrvg.org/zbior.html
28	1300Z	29	1259Z	1.8-28 / -	Helvetia Contest	Ph CW Dig	RS(T), serial or Swiss canton	www.uska.ch
28	1500Z	29	0300Z	7-28 / -	QRP To The Field	CW	RST, S/P/C	www.zianet.com/qrp
28	1600Z	29	see web	7-28 / -	Florida QSO Party	Ph CW	RS(T), FL county or S/P/C	www.floridaqsoparty.org
29	1700Z	29	2100Z	3.5-28 / -	BARTG 75 Sprint	Dig	Serial	www.bartg.org.uk

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 (April 1 for June *QST*) — send information to **contests@arrl.org**. Listings in blue indicate contests sponsored by ARRL or *NCJ*.

Pounding Brass Forevermore — Straight Key Night 2012

With a nod to Edgar Allan Poe...

Dan Henderson, N1ND

Once upon a New Year's dreary, while I pounded brass so weary,

Listening for many a quaint and curious signals as the volume soared —

While I called CQ by rapping, suddenly there came a tapping,

As a signal gently rapping, rapping above my ambient noise floor.

"'Tis some station," I did mutter, "tapping above the old noise floor —

Wanting QSOs, nothing more."

To some, ARRL Straight Key Night is an anomaly in today's digital era. However, remember that it can be argued that CW is the original digital mode — converting sound and letters into characters that are transmitted electronically. Always held during the twenty-four hours of New Year's Day (UTC that is), SKN has become an annual homage to the traditions of our hobby — where many recall days of simpler times.

Presently my fist grew stronger; hesitating then no longer,

Pounding brass the call I answered, pondering the fun in store –

What new friend I was then making, a new contact there for the taking

The signal of my Straight Key rising, rising through the ether to explore —

Now that I was sure I heard you — here I opened wide the door, -

Having fun, and nothing more.

Some are perplexed with the laid-back nature of SKN. Those who venture into this casual, fun time on the air from one of the more hectic or demanding arenas of our hobby (contesting, DXing or EmComm for example) may not understand that there is room in Amateur Radio for all kinds of operations — and operators. Amateurs in 44 states, four Canadian provinces and one DXCC entity accepted the challenge of SKN — making contacts not speedily, but leisurely. The 191 entries received reported 1406 contacts — not contest or DXpedition rate but certainly quality QSOs, each a unique, fun experience.

Hear the magic of the code
Brass pounded code!

What a world of solemn wonder the rhythm in its ode!

In the silence of the night,

How we shiver with affright
At the melancholy menace of the code!

(Oops, wrong poem)

Long-time code operators can instantly tell when they are talking to an old friend long before a call sign is ever transmitted. Participants in SKN are asked to name their choice for "Best Fist" heard during the event. It does not necessarily need to be a station they worked — just one they heard. For 2012, Mike, N1MX, received four votes for "Best Fist." Garry VE5SG; Bill, W9ZN; Bill, WA7OET; Jim KA1LOA, and Dick, K4XU, each received two votes in this category.

Much I marveled through this contact, glad to hear the discourse plainly,

With its answer full of meaning — lots of relevance it bore;

For we cannot help agreeing much great fun we had that evening

And next day different headings beaming, Make more contacts I implore

Different station signals gleaning many louder than before

Pounding brass and nothing more.

You never know what the conversation will bring when you strike up a relaxed SKN contact. That is part of what makes this a fun event — and is why we recognize stations for what participants cite as "Most Interesting QSO." This year, five stations — Jim, WNØI; Jim, WA7OET; Terry, W5TG; John, N2BE, and the operators at the Maritime Radio Historical Society station K6KPH — each received multiple mentions for "MIQ."

One of the best ways to get a feel for SKN is to read the comments of the participants themselves. This is easily done by visiting the ARRL Contest Soapbox online at **www.arrl.org/soapbox**. Select 2012 Straight Key Night from the drop-down menu.

SKN is always from 0000-2359 UTC on New Year's Day. Whether you are a newcomer to the hobby, someone whose rusty fist could use a good workout or an experienced hand with the key, try SKN 2013. You might find the dreary midwinter's night quite fun when you light up the ether! 73…

As the clock approached that hour, the end I hoped would be not dour

Looking back on times remembered from our common hobby's lore;

The legacy of brass a' pounding; the code meticulously sounding;

Making music that the well-trained ear will appreciate and adore

Moments cherished, shared, and stored,

Straight Key Night forever more.

Jon, K1NV, decided to unpack the 75A-4 and Viking II for this year's SKN.
[JON SCHUMACHER, K1NV]

Participants

AA4ZS, AA5N, AA5TB, AA7IR, AA8UU, AAØQZ, AB2AN, AB7MP, AB8FJ, AC7JW, AC8JW, ADØH, AE3A, AE7CG, AH6V, AI6II, HP1IBF, K1NIT, K1NV, K1PDY, K1RM, K2GBH, K2HT, K2NPN, K2RP, K2UY, K3BVQ, K3MD, K4HGX, K4JYS, K4MTI, K4NVJ, K4UK, K5BZH, K5HK, K5IRX, K5SEE, K5VZD, K6CSL, K6FFY, K6KQV, K6LG, K6PBQ, K7ZD, K7ZYV, K8CMD, K8JRE, K8JV, K9AYB, K9PFA, K9UQN, K9YA, KA1BQP, KA3IHS, KA3P, KA3YNV, KA4WJB, KA6ROD, KA7T, KB5IRC, KB8TL, KB8TXZ, KB9W, KD6LM, KD6WKY, KEØG, KF8KS, KG4KGY, KGØJD, KH6GRT, KI5JF, KIØG, KK5FX, KN5L, KO4OP, KO6YG, KO8S, KØDTJ, KØLWV, KØVJ, KR4OE, KT3A, KW3U, KW6G, KX1I, KX5F, KX9X, N1CC, N1JD, N1MX, N2VT, N3JJT, N4DKD, N4NQ, N4TS, N5VU, N6CMF, N6TCZ, N7RVD, N8GM, N8KC, N8XMS, N8XX, N9BOR, N9NM, NA4O, NB4M, NC6Q, NE6O, NF8M, NG2T, NIØR, NJ3K, NMØL, NØBGT, NØJBF, NØLOH, NØYET, NP3CW, NQ4Q, NU7T, VA3RKM, VE5SG, VE7NI, VO1NA, VO1TA, W1PID, W1RO, W1TPB, W1UJ, W1WEF, W2LG, W2NZH, W4IT, W4RK, W4TG, W4UR, W4YOK, W5ESE, W5NZ, W5PDW, W5QLF, W5ROS, W6JHQ, W6VNR, W7DK, W7GVE, W7IZE, W7JZE, W7KTY, W7OS, W7YKN, W8FDV, W8IHG, W8IX, W9CBT, W9RSX, WØAAA, WØESE, WØFBI, WØIKE, WØKIZ, WØRQO, WA1ABI, WA1CFX, WA1VQY, WA2SON, WA2VQV, WA5AU, WA5MUF, WA5OLT, WA6BXV, WA7GSN, WA7OET, WA7YAZ, WA8TOX, WA9ZBW, WA9ZJI, WAØJLY, WAØVQY, WB5LRP, WB6SCA, WB8LZG, WB8YYY, WB9HFK, WB9MII, WBØB, WD8RIF, WD8SDH, WF5W, WN4BFZ (K4YA,op), WS2N

Sean Kutzko, KX9X, kx9x@arrl.org
ARRL Contest Branch Manager

ARRL Rookie Roundup: New Rules for the New Ops Contest

The ARRL Rookie Roundup is beginning its third year as an opportunity for the newly licensed get their feet wet in Amateur Radio contesting. Anyone who received his/her first license during the current calendar year or the previous two calendar years may participate as a Rookie.

We've received many comments and critiques of the event from participants during the past two years. Beginning with the 2012 April (SSB) Rookie Roundup on April 15, we're implementing a couple of changes that were among those most requested by participants.

1) Multioperator category: Many clubs asked about putting on a multiop effort from their club station. We thought this was a good idea. One Multioperator station may host several Rookies, using one call, and exchanging one name and year of license. Only one transmitted signal may be on the air at a time.

All members of a Multioperator effort must qualify as a Rookie in order to enter as a Rookie. Experienced operators are welcome to "Elmer" the Rookies during the contest, of course.

2) Team Competition: Up to five Single-operator Rookies operating from their own stations can band together as a team and submit a team score. There is no geographical limitation to teams; team members can all be in the same town or across the country from each other. A Rookie may be a part of only one team. A Multioperator group is not eligible to participate as part of a Team. Teams must register in advance of the event; see the Rookie Roundup web page at **www.arrl.org/rookie-roundup** for details on how to register.

3) Six Meters: One of the bands eligible for use in the Rookie Roundup was 6 meters. In two years of the RR, however, fewer than 1% of all QSOs made have been on 6 meters. After reviewing the log submissions, we've decided to make the Rookie Roundup an HF-only event and eliminate 6 meters as a band choice.

The RR is an excellent event to get your club together for an "information exchange." Open the clubhouse door, let the Old Timers show the Rookies the ropes then turn the newly licensed hams loose on the air. Order some pizza and make an Open House out of it or get several Rookies active from their own locations as part of a Team and have a post-contest pizza party to compare notes and tell tall tales.

Logging your QSOs has never been easier. For computer logging, N1MM's contest logger and the online web logging service at **www.inthelog.com** will keep your electronic log neat and tidy. If you prefer paper, you can find log sheets for free download and printing on the Rookie Roundup page.

Reporting your score is easy. Thanks to Bruce Horn, WA7BNM, you can fill out the new and improved RR Score Summary form on the RR web page. No complete logs are needed — just a summary of your score and contact totals. Don't forget, you only have three days to turn in your summary! Results will be published on the Rookie Roundup page within a week of the event and certificates will be e-mailed to all Rookies.

The 2012 April Rookie Roundup – SSB

Sunday, April 15 from 1800 UTC through 2359 UTC

The 2012 ARRL April (SSB) Rookie Roundup will be on Sunday, April 15 from 1800 UTC through 2359 UTC. Complete rules and information on Team signup are available at **www.arrl.org/rookie-roundup**. All entries must be submitted by 2359 UTC Wednesday, April 18. No late entries will be accepted. For more information, e-mail ARRL Contest Branch Manager Sean Kutzko, KX9X, at **kx9x@arrl.org**, or call 860-594-0232.

Hope to see you on the air!

Jordan Johns, KF7LUA of Montpelier, Idaho, an ARRL member, won the 7th Call Area in the 2011 ARRL April Rookie Roundup. Look for Jordan to defend his title in 2012!

[COURTESY JORDAN JOHNS, KF7LUA]

Bernie McClenny, W3UR, w3ur@arrl.org

Financing VP8ORK

Behind the scenes of that rare DXpedition contact are many significant costs.

Don Greenbaum, N1DG

Many articles (see the Microlite Penguins DXpedition Team, VP8ORK, story, "South of Sixty South," elsewhere in this issue) cover the many facets involved in going on or working a DXpedition. Yet few go into financing one. The most popular questions I get when making DXpedition presentations concern the financial aspects of running a major expedition like VP8ORK.

Financial Transparency

Expeditions have a responsibility to release their financial records. Some do, some don't. Perhaps if more groups did more disclosure, the DX audience would know the difficulty in financing a major operation and why trips to remote places need more support than those that visit places with hotels and regularly scheduled airline service.

Planning and the Budget

In early 2010, we learned that an experienced Antarctic vessel, *Braveheart* (see Figure 1), would be in the South Atlantic in January 2011. James Brooks, 9V1YC, took the reins and immediately notified members of past Antarctic and environmentally sensitive location DXpeditions. A team was quickly found and we started formulating a budget. By May, 2010 our quotes for most items were in and the budget was approximately $300,000. Four factors drove the costs:

- Travel to the Antarctic is dangerous and the vessel and crew must be experienced.
- The local environment is hostile (weather) so shelters must be wind and water resistant.
- The team required reliable power, reliable radios and sturdy antennas (see Figure 2).
- Chile and Argentina are a monopoly as gateways to the South Atlantic.

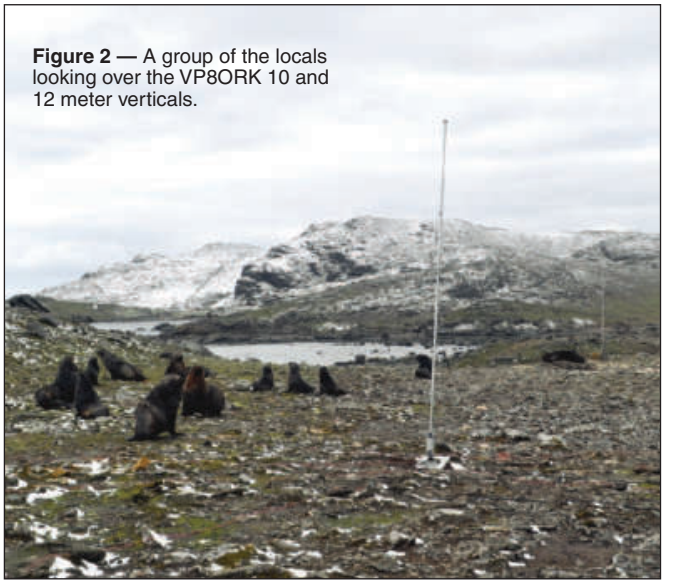


Figure 2 — A group of the locals looking over the VP8ORK 10 and 12 meter verticals.

The most experienced DX vessel in the world is the *Braveheart* out of New Zealand having served 10 award-winning DXpeditions including ZL9CI, VP6DX, VP8THU, VP8GEO and ZL8X. This is a crew who knows the difference between a balun and a balloon. A price was agreed (in New Zealand dollars), which at the time translated to US $227,000 and was contingent on the price of oil remaining below $70 per barrel. The dollar fell for all of the ensuing year after we signed the boat charter and oil steadily rose to well over the $70 per barrel target. The final cost for *Braveheart* came to $244,800.

The hostile environment meant securing proper tents and a way to supply heat to them. We decided on two Weatherport brand shelters and lumber to construct wooden floors and bases. The tents (see Figure 3), lumber, heaters and insulation were budgeted at $12,500. The budget for heating the tents was $700.

Our equipment budget was small. We owned our computers and borrowed all our radios, amplifiers, interfaces and our low band antennas. DX Engineering donated HF verticals and Primus donated coax.

Generators were purchased in New Zealand and the budget, including gasoline for them, came to $8300. Shipping to Argentina and back was budgeted at $12,000. The port fee estimates from Argentina were $18,000.

In advance of our trip, we hired a local shipping agent (referred by our US shipper) to handle the Argentine port affairs. To our surprise, after arriv-

Figure 1 — The MV *Braveheart* amid the rugged seascape off Signy Island.

ing in Ushuaia and loading our ship we were astonished to find bills from the port considerably in excess of our prepayments. For starters, instead of a pilot requirement from just outside the port, now they forced us to use a pilot all the way from the bottom of the Beagle Channel, Puerto Montt, Chile. The bill each way was $4400 and each trip required a pilot twice (up and down the Channel). They also nickel and dimed us on all sorts of charges. The final Ushuaia port fees exceeded $35,000!

Lastly, an item we had in the budget might surprise you. PayPal is an easy but expensive way to collect money. VP8ORK paid over $3500 in PayPal fees.

In total, almost $350,000 was spent to bring the South Orkney Islands on the air. We made close to 64,000 contacts. The cost of providing each contact with VP8ORK was $5.50.

Fundraising

Most large scale DXpeditions rely on raising the bulk of their money from the teams. Each of the 13 VP8ORK team members ultimately contributed $13,000 to the effort to bring a new one to the DX community. This constituted almost 60% of the budget. This excludes the airfare and hotels to and in Argentina and cold weather gear each member purchased. To fund the rest of the trip we approached foundations, clubs and individuals. Shortly after we announced our plans to activate VP8ORK, our fundraising began in earnest. By the time we left for Argentina we had raised approximately $80,000 from foundations and clubs, and another $20,000 from individuals. Significant QSL income was needed to fill the gap.

QSL Income

The final courtesy of a contact is the QSL. It is primarily through the request of QSLs that we had hoped the final gap in our budget would be covered. We set up two QSL routes, an Online QSL Request System (OQRS) for direct and bureau requests, and a direct route via Garry Hammond, VE3XN, the longtime Microlite Penguins QSL manager. Alfio Bonanno, IT9EJW, printed our cards for free but the card shipping, envelopes, labels and postage came to over $5000.

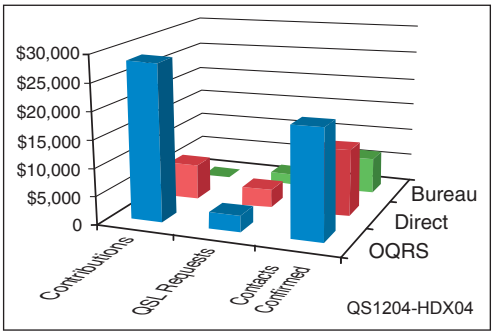


Figure 4 — This diagram shows the amount of contributions, number of QSL requests and confirmed contacts for the various QSLing methods used.

Gross income for those requests via OQRS amounted to $28,500 ($9.25 average per call sign request, not contact) and via VE3XN $6500 ($2 average per request). Clearly, OQRS is a winner for teams in financing DXpeditions. The North Americans have embraced this method while more participation is needed from the rest of the world. As of September 30, 2011 we have answered direct requests from 3095 OQRS and 3290 direct stations representing 32,034 contacts or an average of 5 contacts per request.

Lastly, to fulfill a bureau QSL request there is a cost of approximately 8 cents per card in shipping and postage to and from the bureau. LoTW should be used if you don't want a direct QSL. It costs the team nothing additional to confirm your contact that way. There are 2000 bureau requests pending in the OQRS system (80% non NA) so far.

Support by Continent

Where did our support come from (see Figure 4)? Of the $86,000 in foundation and club support, 86% came from North America, 13% from Europe and 1% from Asia. Of the $54,000 from individual donations before and after the DXpedition (includes all QSL monies), 61% came from North America, 32% from Europe and 6% from Asia. So, in total, North America contributed 76%, Europe 20% and Asia 3%.

The totals in terms of stations worked: North America 36%, Europe 50% and Asia 5%. Oceania, Africa and South America accounted for 9% of the stations worked and 1% of the donations (see Figure 5).

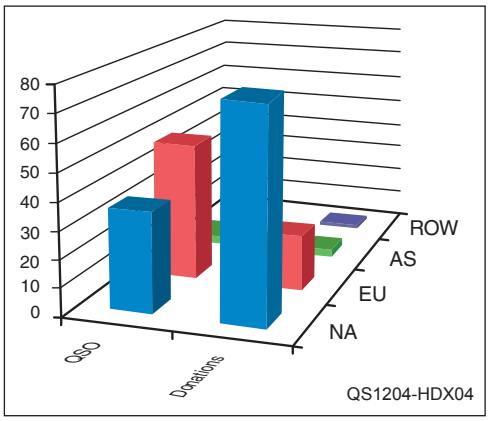


Figure 5 — This diagram shows the number of contacts and donations as a percentage of the total by continent.

Where Do We Go Next?

Financing a major DXpedition to a remote location takes a major effort and requires the support of the DX Community. There will always be some hams who can take a month away from home, endure a 2 week voyage in the most dangerous oceans of the world and operate the pileup for an additional 10 days. But with the price of this climbing to $13,000 per person plus airfare and foul weather gear there is a limit to the funding a team can contribute. We are going to have to be more creative on these trips. Can we bring in corporate sponsors? Can we do more partnering with scientific expeditions to remote locations?

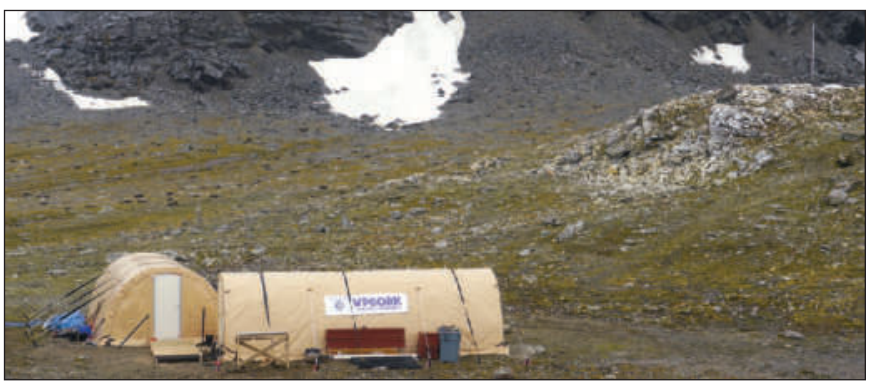


Figure 3 —The two VP8ORK tents at the uninviting South Orkney Island camp.

Photos by Don Greenbaum, N1DG.

Don Greenbaum, N1DG, an ARRL member, first became licensed as WN2DND at age 11 in 1962. In 1996 he changed his call from WB2DND to N1DG. An active DXer and contester, his Challenge total is just a few short of 3000. Don has been on several major DXpeditions including VP8ORK, K4M and A52A. In 2005 Don was inducted into the CQ DX Hall of Fame. He is treasurer and a director of the Northern California DX Foundation. Don can be reached at 27 Pill Hill Ln, Duxbury, MA 02332-5007, **don@aurumtel.com**.

Jon Jones, NØJK, n0jk@arrl.org

F2 Forward Scatter

Is this the secret propagation mode to Malpelo?

On the afternoon of January 25, stations in the Midwest, Rocky Mountains, desert southwest Nevada, Texas and California reported contacts with *HKØNA* on 50 MHz. Many of those who worked rare Malpelo ran high power and large Yagi(s) arrays. At Mapelo, the 6M8GJ Yagi was in service at the top of the hill (see Figure 1). Signal strengths were mostly weak — 529-559 was typical. KØGU noted HKØNA "very, very weak" at 2124 UTC in (DN70). Bob, K6QXY, notes he began hearing HKØNA at 2120 UTC. "He would come in like a scatter signal. We went back and forth for 15 minutes."

Figure 1 — This is the 6M8GJ Yagi at HKØNA "Site A," which was located on a hill at about 1000 feet. Conditions there were so harsh that the group of Site A operators were known as the "Iron Men."

[BOB ALLPHIN, K4UEE]

Occasionally HKØNA was louder, N7KA (DM65) reported a "5 minute burst S9" at 2215 UTC and KØYW (DM67) noted HKØNA was "589" at 2234 UTC. Signals were best direct bearing, suggesting back or sidescatter was not the mode. Some E_s were present from the eastern seaboard to the Caribbean, but no obvious E_s were noted over the western US at this time. The weak signals were not typical of F2. Prior to the opening K6QXY and others worked CX7CO via F2/TEP. What was the propagation mode from stateside to Malpelo? One possibility is F2 forward scatter.

When I think of F2 propagation on 50 MHz, it is usually either the "band is wide open" with strong signals when the MUF is over 50 MHz or it is "dead" when the MUF is below — an all or nothing deal. But that is not always the case.

Over the MUF

F2 forward scatter is known as an "over the MUF" mode of propagation. Some signal does refract back to earth at 50 MHz if the pure refraction MUF for one hop F2 is at 44 MHz, for example. The additional loss at 50 MHz for the MUF of 44 MHz can be calculated from an equation (see sidebar).[1] This equation estimates the additional loss at 50 MHz for 44 MHz pure refraction MUF to be around 14 dB. This is about 3 S-units. It would take an S-9 pure refraction signal down to about S-6.

With 500 W and the 8 element 6M8GJ at Malpelo and big Yagi arrays in the states, pure refraction one hop F2 would be well over S-9 if the MUF is over 50 MHz. Thus the weak signals reported could be F2 forward scatter, with the pure refraction MUF lower than 50 MHz. The F2 MUF was above 28 MHz, as there were numerous spots for HKØNA across the US at this time on 10 meters. That may be as far as we can go in estimating the pure refraction F-layer MUF on this path on January 25. It was higher than 28 MHz but lower than 50 MHz.

[1]C. Leutzelschwab, K9LA, "A New Year's Gift: W6 to ZL on 6M Part 2," *World Radio Online*, Jul 2010, p 4

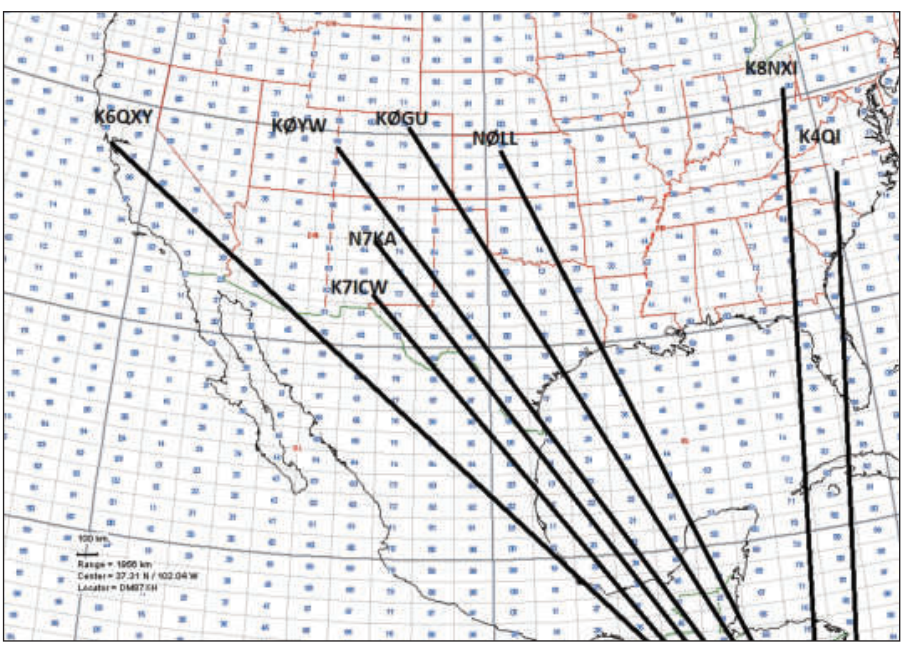


Figure 2 — This map shows NØLL working HKØNA at 2142 UTC on January 25.

[JON JONES, NØJK]

This Month

April 7-8	Good EME conditions*
April 28-29	Good EME conditions*

*Moon data from EA6VQ

I have been on 6 meters for four years, and that was my first TEP opening, wow!

Another possibility is a first hop E_s followed by a second hop forward scatter to Malpelo. Is one hop E_s forward scatter to a second "regular" E_s hop possible with the signal loss?

Big Gun Territory

F2 and E_s forward scatter are a high power, big antenna game. It takes high ERP to overcome the greater path loss above the MUF. So if you want to work this mode routinely, run the legal limit and build a large high antenna array. CW and JT-65A can help. This may motivate you to build an extreme 50 MHz station!

But both E_s and meteor scatter can assist F2 forward scatter and let the little pistols play once in a while. A strong over-dense meteor burst or weak E_s cloud can partially refract the signal toward the F2 layer. This launches the signal closer to the DX station and lowers the "angle of attack" to the F2 layer. This may account for the reports from N7KA, K7ICW and KØYW of stronger signals at times.

Larry, NØLL, commented that his brief contact with HKØNA on the 25th (see Figure 2) reminded him of a 6 meter contact with *VR6JJ* Pitcarin Island back in 1993. He said VR6JJ "suddenly appeared, we worked, then never heard him again. It may have been a burst."

ON THE BANDS

What a month January was! New Year's Day openings to the South Pacific; an awesome January VHF Sweepstakes with about every ionospheric propagation mode and tropo (I will have a discussion of the January VHF Sweepstakes propagation in next month's column.); E_s-TEP to Argentina, Brazil, Paraguay and Uruguay, and 6 meter openings to Malpelo!

50 MHz. Ed, VP9GE, started the New Year with contacts to several W8s and W9s at 1410 UTC on January 1. Ken, AC4TO, in the Florida panhandle had a nice surprise New Year's Day with an opening to New Zealand.

"I had the beam parked at ZL/VK after what the W5s did on New Year's Eve. I was just finishing dinner when I heard CW on 50.110. I went in the shack and found that I had 45.250 ZL video but not too strong and thought what the heck, I will CQ anyway and imagine my surprise when ZL3NW (RE66) came back immediately with a nice strong signal! I also worked ZL3JT and heard ZL3ADT. Terry, K4RX (EM70) got in the opening too as did K4KV in EM81 in southern GA. He worked ZL3NW for a new one."

From Colorado, Jay, KØGU, worked New Zealand on the 2nd and Australia — VK7DD, VK7JG and VK7XX on the 3rd around 0320 UTC.

The E_s dropped off after the 3rd. A limited opening occurred on the 7th between KS, NE and IA to W3 and W8. W8IF and KB3RHR were strong in Lawrence, Kansas around 0130 UTC.

HKØNA Malpelo Island on 6 Meters

The HKØNA Malpelo Island DXpedition made over 192,000 contacts on 160-6 meters. A 6 meter station was set up by the group at "Site A" on top of the rock at Malpelo. A sub-group of the DXpedition known as the "Iron Men" stayed at this site "surviving brutal conditions of heat, lack of food and water and as well as a dangerous climb just to get to the camp." The Iron Men were HK1R, DJ9ZB, *PP5XX*, LU9ESD, HK1T and HK1X. Of note to 6 meter operators, Peter, PP5XX, is a world class 6 meter DXer with enthusiasm and dedication to the band like K5AND, N3DB, W6JKV, W7XU and other well known 50 MHz DXers. This proved to be crucial when 6 opened.

One of the first 50 MHz contacts made from HKØNA (and perhaps the first on the band from Malpelo) was with Jack, OA4TT, on January 15. This was prior to the main team arriving.

"A little before 2300 UTC I heard very weak SSB on 50.110 but could not pull it out. It then disappeared. I went out and did some work on my 160M antenna and came back in and heard them calling CQ. It was the same voice I heard before but a little stronger and was able to work them. They are 1,200 miles away, of which much is over the Andes, and some water on their end."

About 30 minutes later PT7CQ (HI60) spotted HKØNA on TEP. Numerous spots from Brazil followed.

January 25 was the first, longest and most widespread opening to North America from Malpelo. These were the first USA to Malpelo 6 meter contacts! The opening appeared to be in two distinct periods, mid-morning and afternoon. The geomagnetic field was active due to a CME impact a few days earlier. The morning opening favored W4, Quebec and Ontario from 1630-1800 UTC.

It started around 1535 UTC when ZF1EJ worked HKØNA. Fifteen minutes later V31AE logged them via single hop E_s. About an hour later K4SN (EL96) heard them weakly. Signals were better to W4IMD (EM84) in Georgia and N4AVV in South Carolina, which were possibly double hop E_s. Single hop E_s was also present from W1OW (FN42) to W4IMD at this time. VE2XK spotted the C6AFP/b at 1551 UTC; VE3EN had Florida beacons in strong at 1610 UTC. VE2XK (FN07) and VA3LX (FN14) went in the HKØNA log around 1705 UTC. The small footprints and the presence of single hop E_s from Malpelo to XE3, V31 and ZF, and from W1, VE2 and VE3 to the Bahamas and Florida suggest E_s was the primary morning propagation mode from Malpelo to the eastern seaboard and Canada.

Propagation at Frequencies Above the Basic MUF

ITU publication report ITU-R P.2011.1 section 6.5:

Over the MUF Path Loss Equation ITU-R P.533 Model

The reduction in signal intensity at frequencies above the monthly median path basic MUF, as compared with the intensity for a refracted path at a frequency just below the basic MUF is referred to as the ABM loss. It can be calculated as follows:

ABM Loss or $L_m = 0$ dB when $f <= f_b$ where f_b is the basic MUF

$L_m = 36\ [\ f/f_b - 1]^{1/2}$ dB

The January 25 afternoon opening from HKØNA was to NC, OH, KS, CO, TX, CA, NV and NM from 2120-2235 UTC. Many stations heard Malpelo only for a couple of minutes with a "spotlight effect." This opening was different than in the morning and may have been due in part to another propagation mode. The M^2 6M8GJ antenna was now up at "Site A" and when YS1AG worked HKØNA at 2047 UTC, Peter, PP5XX, told him "you are our first QSO with the 8 el Yagi at site A." For the stations trying to work HKØNA, having the big Yagi up on top of the 1000 foot hill with a clear over the ocean shot at the states opened up some amazing propagation possibilities.

Jay, KØGU (DN70) was the first in the Ø call area to work HKØNA at 2125 UTC.

> HKØNA was weak. I could see his sequences on Spectran for a few minutes before I could copy him. It took five or six transmissions for us to make a good QSO on both CW and SSB. *He*

stuck with me until we got it done, excellent operating on his part. He was Q5 on CW finally about the time he switched to SSB. We had a bit of speculation about my prop mode. I had no apparent E_s link, although it might have been out in the Gulf. With their low take off angle, a few of us speculated it might have been some kind of *F layer scattering*. But I will never really know. It is 2912 miles for me. He also worked NØLL and KØYW.

Just before Jay's contact, Bob, K6QXY, worked HKØNA at 2120 UTC on CW for his country #168 on 6 meters. It was his birthday — a nice present!

Here is Larry's, NØLL, tale of working HKØNA from Smith Center, Kansas:

> I caught the post last Wed. the 25th of KØGU at 2124Z for HKØNA and came home which is 8 blocks from work. Had the 6m rig on 50.110 and was doing a DX Sherlock look up when HKØNA CW CQ came in 559. I couldn't believe it and the amp was even on and warmed up as the delay light had just went off. So the amp keyed and all was just right this time and a rare entity is in the log. Probably wouldn't of needed the amp as it only is 200 watts but I didn't know that maybe a big opening was starting to take place.
>
> It was interesting to see KØGU's post at 2124Z, my contact at 2142Z and N7KA's at 2224Z and KØYW 2234Z. HKØNA was a real S-5 here. When PP5XX went to SSB I could just barely tell he was in there. That was around 1 minute after our contact.

Arne, N7KA, in New Mexico noted his contact with HKØNA was similar to Larry's:

> I worked HKØNA on 25 Jan 2012 at 2215Z during an opening that lasted about 3 minutes. I was doing work on computer and was monitoring 50.110 when a loud CQ de HKØNA came out of nowhere. I sent my call twice and was in the log. They were an honest S9 on the K3. 100W and 5el Yagi at about 35 ft is all it took. When it's good it's good.

Al, K7ICW, noted that:

> At 2145 UTC, I worked HKØNA on 50.110 6M SSB signals S-9 both ends, briefly. Propagation mode is undetermined. The operator there asked me to 'post him on the reflector.' I tried to do that on the DX Sherlock, but my password had been cancelled and restoring it didn't work. I saw that NØLL had worked him close to my contact.

HKØNA was spotted by two eastern stations

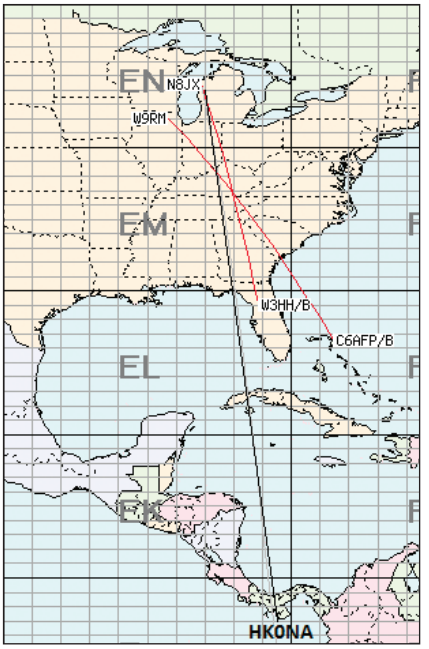


Figure 3 — This is a map of Terry's, N8JX, reception of HKØNA on 50 MHz January 30 at 1709 UTC. Note the intersection of Terry's path to Malpelo and the single hop E_s from W9RM to the Bahamas (C6).

[DXSHERLOCK]

— K4QI at 2133 UTC and K8NXI at 2237 UTC. K4QI also noted 9Y4D at 2148 and HI3TEJ at 2150 UTC. This was probably E_s. KF6A (EN73) had the K4TQR/b (EM63) at 2148 UTC and the C6AFP/b at 2254 UTC on E_s. NWØW in Missouri was on during this period but did not hear HKØNA. Tim spotted FM8DY strong at 2236 UTC. The western contacts, particularly those of KØGU and K6QXY, appeared to have F-layer characteristics. There were confirmed E_s in the eastern states. So does this indicate multihop E_s for the eastern stations and F-layer for stations west of the Mississippi River? We may never know what truly happened to enable these contacts. HKØNA made a total of 483 contacts on 6 meters, with 95 in North America.

That evening there was an extensive E_s-TEP opening from the eastern states, Gulf Coast up through the midsection to South America. Dave, N9HF, in Florida logged ZP6CW, CX7TT and ZP5SNA. Other states working Paraguay included MD, TN, AR, WV and NC (thanks *Daily DX,* **www.dailydx.com**).

The E_s-TEP occurred again on January 27-28 UTC. Ed, W4YO, in Georgia reports great conditions that evening:

> I had just checked the dx cluster before retiring, and found many of my friends in Georgia, South Carolina, and Florida, logging TEP from deep South America. I decided to try my luck, even though I only have *100 watts to an indoor dipole at 35 feet.*
>
> To make a long story short, I worked three PYs, two LUs, a ZP and a CX, before the signals faded. The opening lasted over two hours. I have been on 6 meters for four years, and that was my first TEP opening, wow!

The next opening from HKØNA to the states was January 28. K4RX and KD5M reported contacts with Malpelo on a brief opening. Finally on January 30, Terry, N8JX, in Michigan heard HKØNA briefly around 1709 UTC (see Figure 3). He had E_s to Florida at the same time.

144 MHz. The Quadrantids meteor shower had a short intense peak in the early morning of January 4. Scott, KA9FOX (EN43) had great success in this shower on 2 meters running 100 W and a 2M5WL Yagi. He worked K3JYD (FM09), WD4ELG (FM06), WB2FKO (DM65), W7OUU (DN22, 1176 miles), AD4TJ (FM08) and KA1ZE (FN01). Scott notes "WD4ELG was running 30 watts to an attic antenna of some sort. He has an amp, but had forgotten to turn it on!"

Tropo. Tropo was reported during the January VHF Sweepstakes Sunday morning from Arkansas, Missouri and Oklahoma to Louisiana, Texas and northern Mexico. K5SW worked XE2OR (DL98) and Rafa was heard by W5KI (EM36). This was in association with a warm front that drew up warm, moist Gulf air into the Midwest.

E_s. It is the summer E_s season "down under" and Adrian, VK4OX, reports a huge 2 meter E_s opening Jan 2 from 2300 UTC to 0400 UTC Jan 3. Numerous 2500-3000 km contacts were made by VK5BC/p. These may have been chordal E_s hops.

Strays

Teen Queen from ham family: Jenna Howard, KE7QJV, is the reigning Miss Teen Idaho. Other members of her ham family include grandfather John Walker, AC7GK; her brothers Scott, KE7EPN, and Gavin, KE7JDB, and her mother, Donna, KE7JDC.

[DONNA HOWARD, KE7JDC]

Special Events

Maty Weinberg, KB1EIB, events@arrl.org

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Mar 16-Mar 18, 1200Z-2359Z, KØKKV, Lincoln, NE. Lincoln Amateur Radio Club. Nebraska ARRL State Convention. 28.450 28.035 21.350 21.035. QSL. Gregory Brown, Lincoln Amateur Radio Club, PO Box 5006, Lincoln, NE 68505. *Operations will be intermittent. Principal operations on Saturday will be demonstrations at the hamfest for new HF operators. Your patience while we serve our visitors is greatly appreciated!* **k0kkv.org**

Mar 16-Mar 19, 1400Z-0000Z, N5F, Pineville, LA. Central Louisiana Amateur Radio Club. Amateur Radio at the 27th Annual Louisiana Nursery Festival. 14.275 7.252 7.180 147.330. QSL.* Central Louisiana Amateur Radio Club, PO Box 8852, Alexandria, LA 71306. **www.louisiananurseryfestival.com/schedule-of-events/** *or* **www.arccla.us**.

Mar 31, 1500Z-2100Z, W2EF, Essex Fells, NJ. West Essex Amateur Radio Club. Essex Fells Borough 110th Anniversary. 146.55 21.377 14.277 7.177. Certificate. West Essex ARC, 34 Eastern Pkwy, Caldwell, NJ 07006. **www.wearc.org**.

Apr 1-Apr 16, 1000Z-0000Z, N3C, Washington, DC. District of Columbia Amateur Radio Society. 100th Anniversary of the National Cherry Blossom Festival. HF CW SSB and Digital Modes. Certificate & QSL. N3C — District of Columbia Amateur Radio Society, 3511 Patterson St NW, Washington, DC 20015. *Washington, DC's greatest springtime celebration, commemorating the 1912 gift of trees and the enduring friendship between the people of the United States and Japan.* **www.qrz.com/db/nw3dc**

Apr 2-Apr 7, 0000Z-2359Z, KØR, Boone, IA. Tall Corn Amateur Radio Club. Frost Buster Race. 10 through 40 m SSB CW digital. Certificate. Online only, see URL, Boone, IA. From the Boone Speedway. **www.qrz/db/kd0med**

Apr 6-Apr 7, 2200Z-2200Z, W5CCH, Oklahoma City, OK. Oklahoma City-County Health Department Amateur Radio Club. Celebrating National Public Health Week. 28.365 21.365 14.265 7.265 PSK 14.070 7.080. Certificate. Dave Cox, Oklahoma City-County Health Department, 921 NE 23 St, Oklahoma City, OK 73105. *SSTV contacts on 14.230 will be scheduled upon request.* **www.occhd.org/w5cch**

Apr 7, 1200Z-2000Z, W4DW, Raleigh, NC. Raleigh Amateur Radio Society. 40th Annual RARSfest, ARRL NC State Convention. 14.260 7.260. QSL. RARSfest Special Event Station W4DW, PO Box 17124, Raleigh, NC 27619-7124. **rars.org/hamfest**

Apr 7, 1400Z-1800Z, W4ABZ, Ringgold, GA. Ringgold Amateur Radio Club. 150th Anniversary of the Great Locomotive Chase — The *General*. 14.265 7.265. Certificate. Jim Skeen, 224 Smith Liner Rd, Chickamauga, GA 30707.

Apr 9-Apr 15, 0800Z-1700Z, KØN, Branson, MO. 4State QRP Group. OzarkCon. 21.060 7.040 3.560. QSL. Bart Lawson, 711 E 31st St, Pittsburg, KS 66762. **www.4sqrp.com**

Apr 9-Apr 15, 1330Z-0527Z, W1MGY, Indian Orchard, MA. Titanic Historical Society. 100th Anniversary of the *Titanic* Voyage. 14.260 14.033 7.260 7.033. QSL. Titanic Historical Society QSL, PO Box 51053, 208 Main St, Indian Orchard, MA 01151-0053. **webpages.charter.net/kb1mu/Titanic/titanic.htm**

Apr 12-Apr 15, 1200Z-2000Z, KM1CC, Chathamport, MA. National Park Service and the Chatham Marconi Maritime Center. 100th Anniversary of the Sinking of RMS *Titanic*. SSB 21.260 14.260 7.160/7.060 CW 28.03 21.03 14.030 7.030 PSK 21.070 14.070. QSL. Rob Leiden, K1UI, 21 Paulding Dr, South Chatham, MA 02659. **www.chathammarconi.org**

Apr 13-Apr 15, 0900Z-1700Z, W4T, Newport News, VA. The Mariners' Museum. 100th Anniversary *Titanic* Commemoration. 2 m, all HF. Certificate. C. Verser, The Mariner's Museum, 100 Museum Dr, Newport News, VA 23606. *Friday April 13, 0900Z-1500Z, contacts with school age children sought. Saturday and Sunday April 14-15 0900Z-1700Z daily.* **w4titanic@gmail.com**

Apr 13-Apr 15, 1600Z-2200Z, K1T, Wellfleet, MA. KM1CC. *Titanic* 100 Years — Marconi Wireless. 28.040 21.040 14.040 7.040. QSL. Barbara Dougan, N1NS, 20 Madison Dr, East Sandwich, MA 02537. *Event sponsors, Marconi Cape Cod Radio Club and the National Park Service and Falmouth Amateur Radio Association.* **www.nps.gov/caco** *or* **www.qrz.com/db/km1cc**

Apr 13-Apr 15, 1800Z-1800Z, K4S, Venice, FL. Tamiami Amateur Radio Club. Venice Sharks Tooth Festival. 28.483 21.313 18.153 14.236. QSL. Jack Sproat, W4JS, 1419 E Manasota Beach Rd, Englewood, FL 34223. **tamiamiarc.org**

Apr 13-Apr 15, 2224Z-0022Z, GB100GGM, Cardiff, Wales. Blackwood and DARS (GW6GW). *Titanic* Commemoration. 28.470 21.270 14.270. QSL. Dave Lewis, 23 Gelligroes Rd, Blackwood, Newport NP12 2JU, Wales. **www.qrz.com/db/GW6GW**

Apr 13-Apr 16, 1400Z-2000Z, W4AVM, Tampa, FL. SS *American Victory* Amateur Radio Club. *Titanic* Sinking Commemoration. 14.225 14.040. Certificate & QSL. Morris Bernstein, W4REX, 6507 La Mesa Cir, Tampa, FL 33634. *Special transmissions by ship station KKUI on 500 kc and commemorative bulletin on 468 kc during hours of 0200Z and 0500Z.* **americanvictory.org**

Apr 14, 1200Z-1800Z, K2QS, Poughkeepsie, NY. QSY Society. A Celebration of Morse Code. 14.034 7.034. Certificate & QSL. Dave Ruth, 48 Hoof Print Rd, Millbrook, NY 12545. *From the Samuel F. B. Morse Estate (aka Locust Grove Estate).* **www.qsysociety.org**

Apr 14, 1300Z-1700Z, NC4AR, Trinity, NC. Tri-County Amateur Radio Club. General Hardee's Retreat Civil War Reenactment. 7.208 145.29 Linked. Certificate. NC4AR, PO Box 747, Trinity, NC 27370. **www.nc4ar.net**

Apr 14, 1600Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. USS *Midway* (CV-41) Decommissioned 1992, Chief Petty Officer Grade Established 1893. SSB 14.320 7.250 PSK31 14.070 D-STAR 012C and 2 m/70 cm SOCAL rptrs. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Apr 14-Apr 15, 0000Z-2300Z, W3R, Bowie, MD. National Capital Radio & TV Museum. Remembering the Sinking of the *Titanic*, 100 Years Ago. 21.425 14.255 7.255 3.955. Certificate & QSL. Tony Young, National Capital Radio & Television Museum, 2608 Mitchellville Rd, Bowie, MD 20716. **radiohistory.org**

Apr 14-Apr 15, 1300Z-2200Z, W4S, Pigeon Forge. 470 Amateur Radio Group. 100th Anniversary of the *Titanic*. 28.350 24.940 21.350 14.265 7.220 3.950. QSL. Rick Sawaya Sr, N4JTQ, 2005 Spence Mountain Lp, Sevierville, TN 37876. *Certificate for working both W4S Pigeon Forge, TN and WØS Branson, MO events.* **www.470arg.com/cms/node/724**

Apr 15, 1500Z-2000Z, W9WRL, Moline, IL. W9WRL. *Titanic* Memorial Event. 4.320 7.240. Certificate. James Mayfield, 1821 7th St, Moline, IL 61265. **w9wrl.com/titanic**

Apr 19, 1800Z-2100Z, K7DPS, Phoenix, AZ. Arizona Department of Public Safety Amateur Radio Group. Law Enforcement Torch Run for Special Olympics. 28.400 21.275 14.280 146.52. QSL. Paul Swietek, 5427 E Broadway Ave, Apache Junction, AZ 85119. **www.qrz.com/db/k7dps**

Apr 20-Apr 22, 1800Z-1800Z, W5E, Earth, TX. Ransom Canyon Amateur Radio Club. Earth Day Celebration. 28.450 28.010 21.285 21.030 14.260 14.030 7.260 7.030. QSL. Robert Boyd, 98 S Lakeshore Dr, Ransom Canyon, TX 79366. *Call in and talk to an Earthling. SSB, CW Digital modes. 2-3 stations depending on spring West TX wx.* **wa5vsk@gmail.com**

Apr 21, 1400Z-2000Z, WA5PC, Carthage, TX. Panola County Amateur Radio Club Inc. From the Only International Boundary Marker Within the US. 14.260 7.260. Certificate. Panola County ARC, PO Box 373, Carthage, TX 75633-0373.

Apr 21, 1500Z-2200Z, W5BMC, Morgan City, LA. Bayouland Emergency Amateur Radio Service. Black Bear Festival St Mary Parish Louisiana. 14.245 7.245 . QSL. Jackie Price, 708 Front St, Morgan City, LA 70380. *Recognizing the sanctuary established for the Louisiana Black bear in St Mary Parish.*

Apr 21-Apr 22, 1100Z-1500Z, K4C , Camden, SC. Kershaw County Amateur Radio Club. Armies Though Time 2012. 40 20 10 2 m. QSL. Kirk Morrison, KA4PXK, 30 Wayside Ln, Lugoff, SC 29078. **www.kershawcountyarc.org**

Apr 28, 1400Z-1800Z, W4C, Newport News, VA. Robert Flanary. Coal Miners Memorial. 14.260 7.260. Certificate. Robert Flanary, 253 Batson Dr, Newport News, VA 23602.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Special Events listed in this issue include current events received through February 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

Sean's Picks

Sean Kutzko, KX9X, ARRL Contest Manager

All dates/times are in UTC.

- **State QSO Parties this month:** Florida, Georgia, Michigan, Missouri, Montana, Nebraska, New Mexico, Ohio, Ontario, South Dakota
- **QRP contests this month:** ARS Spartan Sprint (April 3), QRP-ARCI Spring QSO Party (April 7-8), NAQCC Monthly Sprint (April 11), Flying Pigs' Run for the Bacon (April 16), EA QRP Contest (April 21-22), QRP to The Field (April 28-29).
- **VHF+ Operators:** April is the beginning month for the Spring VHF Sprints! Here's the schedule:
  144 MHz: Monday, April 9 (7 PM-11 PM local)
  222 MHz: Tuesday, April 17 (7 PM-11 PM local)
  432 MHz: Wednesday, April 25 (7 PM-11 PM local)
  903 MHz & up: Saturday, May 5 (6 AM-1 PM local)
  50 MHz: Saturday, May 12 (2300 UTC)-Sunday, May 13 (0300 UTC)

  Visit **http://sites.google.com/site/springvhfupsprints/** for rules and log submission info.
- **Japan International DX Contest, CW (April 7-8):** Point those beams northwest and see how many JA prefectures (roughly equivalent to states) you can log. Non-JAs send their CQ zone.
- **International Vintage Contest, HF (April 15):** A worldwide event to show off your vintage gear! A pair of 3-hour operating periods help facilitate DX QSOs. Everybody works everybody.
- **ARRL Rookie Roundup, SSB (April 15):** The "RR" kicks off its third year with a new Multioperator category and new team competition! See the article elsewhere in this issue for complete details.
- **QRP to the Field (April 28-29):** Ah, Spring…flowers bloom, baseball begins, and time to take some QRP gear and set up in a portable location! This fun event gets you out of your house and into some fresh, clean air. Haven't tried QRP? Grab your gear, throw some wire in a tree and enjoy the great outdoors after a long winter. Work as many different prefixes as you possibly can!

Strays

On the Origin of Units of Measure

There were many false starts during the early days of scientific experimentation in the fields of electricity and magnetism. Phenomena were observed and theories formed and tested. Then other theories were proposed, followed by more theories, and then yet another theory before finally...a theory was proposed. And then another theory.

This compelling journey of human discovery has faded from history, but is remembered here as we list some of the initial attempts at defining these miraculous new sources of energy and force with units of measurement now fallen into long disuse.

The moe (YU) was originally the unit of conductance — the complement of resistance — but was replaced by the shemp (Sh).

The Gullible (gB) was used to measure the ratio of acceptance to suspiciance. Ten gB were equal to a Jeepers (jP) and the point at which the ratio became positive was known as the Heebie-Geebie (heBgB).

Electromagnetism was originally thought to be a WC Field with polarity measured in Signfields. Its spatial characteristics, always only single lines, were drawn as Rickles-Youngman flubs with units of heckles.

One tenth of a henry was a hank.

One half of a hertz was an avis.

A vacuum-tube amplifier's efficiency, known as bbQ, was initially measured in webers.

Marconi created an end-fed multiple-half-wave antenna whose gain was measured in zeppos. — *Horace Beldar, PhD, ScD, OBE, WAN, KENOBE, L1AR*

No Code Barrier for This Young Ham

At age 13, ARRL member Jennifer Kruh, KB1TSU, of Reading, Massachusetts became the youngest member of the Straight Key Century Club to earn the ARRL Worked All States award. At the time she earned this award, Jennifer had been a ham for less than a year, having earned both her Technician and General tickets while only 12. Jennifer became interested in Amateur Radio watching the fun her dad, David, WB2HTO, was having working HF. David encouraged Jennifer to learn the code and participate in the SKCC as a way to improve her proficiency. Jen also enjoys working digital modes, and has been active with both the Feld Hell Club and the PODXS 070 PSK club. — *David Kruh, WB2HTO*

Thirteen-year-old Jennifer Kruh, KB1TSU, has earned the ARRL Worked All States award and enjoys both CW and the digital modes.
[DAVID KRUH, WB2HTO]

Have a *QST* Delivery Issue?

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

QST congratulates...

- ARRL member Charles Starke, MD, FACP, NX2T, of Briarcliff, New York on the publication of his new limited-edition book of African wildlife photos, *Footprints of Africa*.
- Bill Finch, W4EHF, of Greenville, North Carolina, still handles traffic for the North Carolina Morning Net. Bill turned 100 on January 15. — *tnx Bill Morine, N2COP*
- ARRL Life Member John Ramsey, W1JNR, of West Hartford, Connecticut, whose new book, *Images of America: Hartford Radio*, has been released by Arcadia Publishing. The book includes over 200 high quality images of Hartford radio broadcasting history.
- ARRL member Bob Sholl, W5DSA, of Denison, Texas, recently recognized by KXII-TV's "12 Who Care" program for his long-time volunteer service to the community through the Grayson County ARC.

April 2012 W1AW Qualifying Runs

W1AW Qualifying Runs are 9 AM EDT (1300Z) Thursday, April 12 and 4 PM EDT (2000Z) Thursday, April 26 (35-10 WPM). The West Coast Qualifying Run will be transmitted by station K6YR on 3590 kHz at 9 PM PDT Wednesday, April 18 (0400Z April 19)(10-40 WPM). Unless indicated otherwise, speeds are from 10-35 WPM.

John Dilks, K2TQN, k2tqn@arrl.org

An Operator to Remember

Harold Cottam, wireless hero of the *Carpathia*

One hundred years ago this month the unsinkable *Titanic* sunk. There will be a proliferation of stories in magazines, newspapers, on the TV news and the history shows. The story is well-known to most of us already and now everyone else will hear all about it. I won't repeat the story here, but instead I want to tell you about someone who made a big difference in the outcome and, I believe, made a difference in the technological tools and toys we enjoy today.

In 1912 ships were not required to carry radios and those that did usually had a single operator. Only the larger liners, such as the *Titanic*, would employ two operators. This meant that when the single operator's (usual 16 hour) shift was done, that operator turned off his radio and went to bed. This was true with the SS *Californian*, which was less than 20 miles from the *Titanic* when it sunk. The *Californian's* radio operator, Cyril Evans, after a tough watch, shut down and went to bed. The *Californian* was close enough that if the SOS-CQD had been heard, it could have reached the site in time to save countless lives.

The rescue ship *Carpathia* on the way to New York City loaded with survivors and the *Titanic's* lifeboats.
[LIBRARY OF CONGRESS]

Harold Cottam on the *Carpathia*

Steaming toward Europe was the SS *Carpathia*. Her only wireless operator was Harold Cottam and he was officially off duty.

"Come quick - we have struck an iceberg - its CQD SOS old man..."

Tired from working extra hours on the preceding days and 7 hours of volunteer overtime that day, he returned to his set to take one last listen before turning in. He heard Jack Phillips of the *Titanic* sending about 15 wpm and he asked if *Titanic* needed assistance.

"Come quick - we have struck an iceberg - its CQD SOS old man - position 41.46 N 50.14 W - MGY," was *Titanic* operator Phillips' reply.

Cottam rushed to the bridge to inform the officers there of the grave situation but they would not listen to him. Breaking protocol, Cottam went to the Masters cabin and woke Captain Arthur Rostron. He told Rostron what had happened to the *Titanic* and with the Captain's answer raced back to the wireless room to inform the *Titanic* they were 58 miles away and coming at top speed to give assistance.

Captain Rostron quickly

Cottam's log, as released by Marconi, spells out the details:

CARPATHIA'S WIRELESS LOG - Compiled by Harold Cottam

Sunday, April 14. 1912. (N.Y.T.)

5:10 p.m. TR's with S.S. Titanic bound west, one S message received.

5:30 p.m. Signals exchanged with Titanic at frequent intervals until 9:45 p.m.

11:20 p.m. Heard Titanic calling 'SOS' and 'CQD'. Answer him immediately. Titanic says: "Struck iceberg, come to our assistance at once. Position: Lat. 41.46 N; Long. 50.14 W." Informed bridge at once.

11:30 p.m. Course altered, proceeding to the scene of the disaster.

11:45 p.m. Olympic working Titanic. Titanic says weather is clear and calm. Engine-room getting flooded.

Monday, April 15, 1912.

12:10 a.m. Titanic calling CQD. His power appears to be greatly reduced.

12:20 a.m. Titanic apparently adjusting spark gap. He is sending Vs. Signals very broken.

12:25 a.m. Calling Titanic. No response.

12:28 a.m. Titanic calls CQD; his signals blurred and end abruptly.

12:30 a.m. Calling Titanic at frequent intervals, keeping close watch for him, but nothing further heard.

1:25 a.m. Called Titanic and told him we are firing rockets. No sign of any response.

1:30 a.m. Continue to call Titanic at frequent intervals but without success.

At daybreak, the Carpathia arrives on the scene of the disaster.

▪▪▪ – – – ▪▪▪

Harold Cottam, the *Carpathia*'s wireless operator. His heroic efforts at the key led to the rescue operation that saved hundreds of *Titanic* surivors.
[BROWN BROTHERS, STERLING, PENNSYLVANIA]

rallied his crew to prepare for the rescue of survivors. Extra men were assigned to fire the boilers. Normally a slow ship that averaged 13-14 knots, they forced a top speed of 17 knots. Lifeboats were swung out and manned — ready to be launched immediately. Other preparations were readied for the survivors.

Approximately 712 survivors were rescued (sources count from 703-714; you would think the exact figure would be known by now) and Cottam would continue at the key sending only "official" and passenger messages. Although offered large sums of money from the press thirsty for his story, Cottam refused and finally collapsed at the key after 3 days of continuous operating. On Wednesday afternoon *Titanic*'s junior operator Harold Bride who had been rescued, was carried from sickbay to the wireless room to assist Cottam. Bride's two feet were so severely frozen by the icy water that he could not walk, but he could sit and work a key. Bride continued to assist until they were docked in New York City.

Conclusion

Upon arrival in New York Captain Rostron and the officers were treated as heroes, which they were. The true hero, Harold Cottam, would not be recognized with the rest. After docking and reporting to Marconi and giving one story to the *New York Times*, he quietly left the ship and went to a hotel and went to sleep.

Both he and Bride would later leave the sea, marry and settle down. They became and remained good friends. Although living many miles apart, their families would visit each other.

Harold Cottam would live to age 93. He passed away in a nursing home and was buried on June 5, 1984. He had worked as an engineer in the Civil Service. He was survived by one son living in the United States and two daughters, one living in Canada and another in Australia.

Carpathia's Captain Rostron and officers were honored in 1913, but Cottam missed the ceremony.
[BAIN COLLECTION, LIBRARY OF CONGRESS]

Harold Bride being assisted off the *Carpathia* at New York City.
[LIBRARY OF CONGRESS]

Titanic survivors on the *Carpathia's* deck.
[BAIN COLLECTION, LIBRARY OF CONGRESS]

With the sinking of *Titanic* and the loss of so many "important people," the authorities were quick to adopt new rules for ships and wireless. Almost all ships were required to be equipped with wireless and manned by at least two radio officers. Almost overnight new companies started making and improving wireless sets. Young men were attracted to Amateur Radio and wireless and became commercial operators on land and at sea. It was a fast-paced time for the growth of wireless. The *Titanic* disaster certainly "jump started" an infant industry into a spurt of early growth.

All the modern electronics we enjoy today had its roots from that time. And since that time radio has made our lives better. Now, 100 years later, we still call our tablets and cell phones "wireless." Funny how that goes.

I will have additional stories about Harold Cottam and links to several websites on my web page (**www.k2tqn.com**) if you want to continue reading about the *Titanic*, *Carpathia* and Harold Cottam.

Costa Concordia

It is my opinion that all too often we don't learn enough from the past. For instance, as I write this column the big news is the Italian cruise ship disaster. All the modern bells and whistles can't replace a lookout with a pair of sharp eyes or just someone paying attention, which it seems, might have avoided the *Costa Concordia* disaster. There is too much reliance on automation and technology where good old common sense would serve better.

The news group of retired seagoing wireless operators I belong to have made a lot of comments about the continuing elimination of essential people and jobs due to automation on ships — all to save money.

What was the *Costa Concordia* worth? And the lives lost? A lesson to remember.

One Last Note

The 1958 British movie *A Night to Remember* is said to have the most accurate Marconi wireless re-creation. It is available from **Amazon.com** and others.

A related article, focusing on the *Titanic*, appears elsewhere in this issue.

The following sources were used in preparing this article:

- H. Dickow and E. A. D'Onofrio, *Sparks Journals*, Society of Wireless Pioneers, 1978-1984.
- Captain L. S. Howeth, USN retired, *History of Communications-Electronics in the United States Navy*, 1963.
- K. Baarslag, *SOS to the Rescue*, 1935 (J. Dilks, K2TQN, "Old Radio," *QST*, Jun 2007, pp 88-89.)

Paul Wade, W1GHZ, w1ghz@arrl.org

Microwave Beacons

Not just for band openings, beacons are a tool to peak your station's performance.

At lower frequencies, beacons are mainly used as propagation indicators. At microwave frequencies, they're much more valuable. Since portable operation is limited during the winter, a beacon might be the only signal heard for months. In some countries, such as Great Britain, beacons are regulated and organized by the national radio society, but in the US, beacons are ad hoc, so any ham or club can put one on the air. As a result, some areas have several, while other areas have none.

A beacon signal is extremely useful for microwave operation. It can provide you with at least three important things:

1. Assurance that your receiver is working

2. A frequency reference

3. A heading for aligning your antenna and a propagation indication — particularly for rain, snow and airplane scatter.

Even if the beacon frequency is not accurately known, any two stations that hear the beacon can use it to meet on a common frequency, for example, 50 kHz below the beacon.

Figure 1 — These are three waveguide slot array antennas for 10 GHz made from WR-90 waveguide.

Beacons are particularly valuable for portable microwave operation, since dish antennas are very sharp and don't always point exactly where they appear to. For that reason, peaking on a signal gives better azimuth calibration. When I arrive at a new site within range of a beacon, I use a compass to point toward the beacon, tune in the signal and peak up the dish. Then I calibrate my azimuth indicator to the beacon's true heading.

Microwave home stations are less common because some home stations are thought to be inadequate for microwave operation. Listening for a beacon may show that a home station isn't hopeless, although it might take rain or snow scatter to overcome local obstructions and work other stations. Finally, the constant signal from any beacon can be an aid in improving a station.

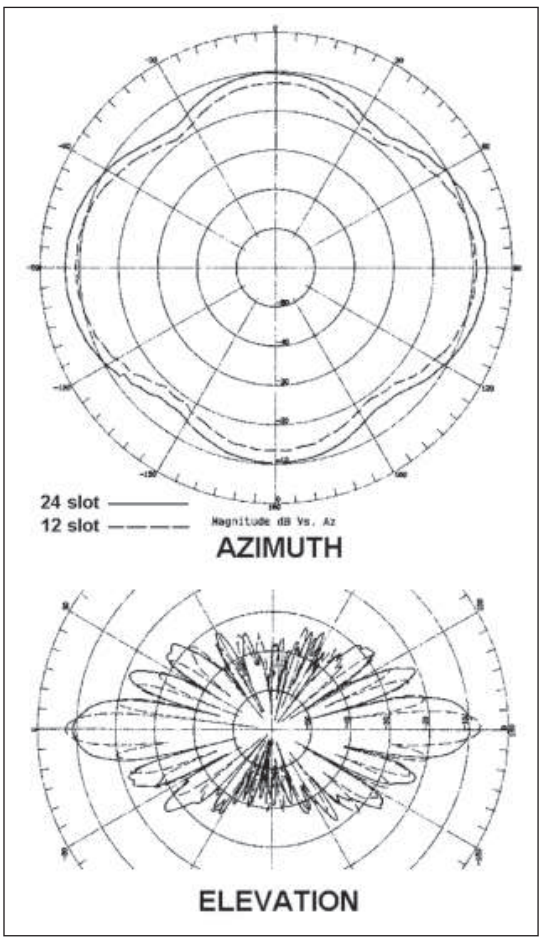


Figure 2 — Here are the radiation patterns for the 12 and 24 slot antennas in Figure 1.

Antennas

To provide a good coverage area, microwave beacons are generally sited at high locations and use antennas that are omnidirectional in the azimuth plane. Since weak-signal work generally uses horizontal polarization, an omnidirectional antenna with horizontal polarization is required. A waveguide slot array is a good choice. Three are shown in Figure 1; the smaller one has 12 slots, 6 on each side, for a gain of more than 10 dBi. The larger ones have 24 slots and about 3 dB more gain.

The one on the right was made by Bobby, WA1ZJG, on a milling machine, while the two on the left were made by Dan Welch, W6DFW. Dan uses a CNC milling machine to produce these so accurately that no tuning is required. He sells antennas and kits and can be contacted at **w6dfw@apex-scientific.com**. Fancy machinery is not necessary to make these types of antennas. Donn, WA2VOI, has successfully made 10 GHz slot antennas by hand, scribing the slot outlines, drilling rows of holes by hand and filing them into slots. A spreadsheet for waveguide slot antenna design may be found at **www.w1ghz.org**.

The slot antennas in Figure 1 have the radiation patterns shown in Figure 2, which were measured by Dave McGee, W2KV. The patterns are reasonably omnidirectional in azimuth but have a narrow horizontal beam in elevation. As more slots are added, the vertical pattern becomes sharper and the gain increases — but twice as many slots are required for a 3 dB increase in gain.

At lower microwave frequencies, waveguide

Figure 3 — Slot antennas require weatherproofing. Here is one possible radome for the 12 slot antenna.

is not only large, but hard to find. The largest slot antennas that I know of were made for 2304 MHz in rectangular aluminum tubing — cheaper and more readily available than precision waveguide.

An alternative for UHF and lower microwave bands is the Alford slot antenna — a resonant slot in cylindrical tubing. I found several examples for 1296 MHz, all based on the work of Mike Walters, G3JVL, on various websites:

- **www.eta.chalmers.se/~pgp/alford_slot/alford_eng.html**
- **www.g8ajn.tv/23cms.htm**
- **www.k5rmg.org/Alford-slot.html**

I haven't made one, but the tuning sounds pretty critical. Both types of slot antennas radiate horizontal polarization. A vertical slot in waveguide is a magnetic dipole, equivalent to a horizontal electric dipole and will have a radiation pattern identical to a horizontal dipole with the same dimensions as the slot.

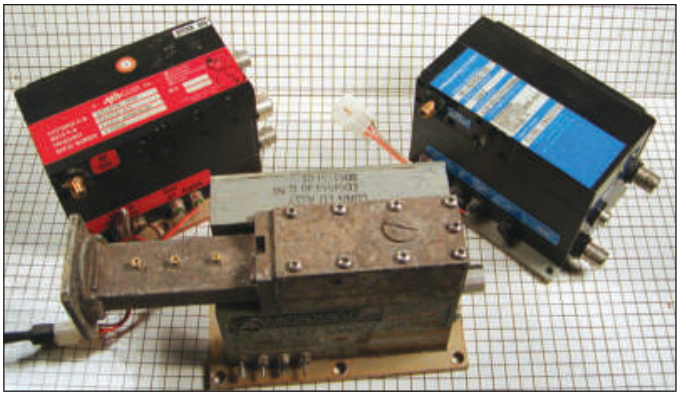


Figure 4 — Microwave phase-locked "brick" oscillators are becoming harder to find and more expensive.

The open slots admit water as easily as they radiate RF, so waterproofing is essential. The problem is to do it without absorbing the RF or detuning the slots. Kapton tape over the slots has proven effective, but needs periodic replacement. A thin plastic tube may work, but should be tried in a microwave oven first — if it melts, it absorbs too much RF to be usable.

Also of concern, most plastics degrade in ultraviolet light. One that I'm going to test is shown in Figure 3. It is intended to store paintballs, but is just the right size for the smaller waveguide slot array.

Transmitter

The power output of most microwave beacons is only a few watts, since it can be difficult and expensive to produce much more. This modest power is adequate — weak signals are preferred for antenna alignment. Modulation is CW, either normal or FSK. FSK with a narrow shift has the advantage of providing a constant S-meter reading if both tones are within the passband, while the information may be copied by zero-beating one tone. With traditional CW, care should be taken to avoid key clicks, which can disturb weak-signal operation wherever the beacon is strong.

More important than power is frequency stability. Many microwave beacons are frequency-locked to an accurate frequency reference, derived from GPS signals.[1] Several types of GPS receivers with an accurate 10 MHz output are frequently available in surplus and an amateur version is available from James Miller, G3RUH (**www.jrmiller.demon.co.uk**).

Many beacons are based on surplus "brick" oscillators like the ones in Figure 4, but these are becoming scarce. These oscillators are phase-locked to a frequency in the 100 MHz range, either an external source or an internal crystal. Many units have the crystal in an oven, but there is still some temperature sensitivity. I know of one 10 GHz beacon that is more effective as a thermometer than as a frequency reference.

Since there are not yet any microwave beacons in Vermont, I wanted a simple one that I could use as a low-power personal beacon for 10 GHz. I started with an A-32 synthesizer, designed by Stephen Hicks, N5AC (**www.downeastmicrowave.com**) to generate a signal at 1152 MHz locked to a 10 MHz GPS reference. This is followed by a multiplier chain using MMICs and pipe-cap filters to get to 10,368 MHz with about 10 mW output. The multiplier board is shown in Figure 5 with details available at **www.w1ghz.org**.

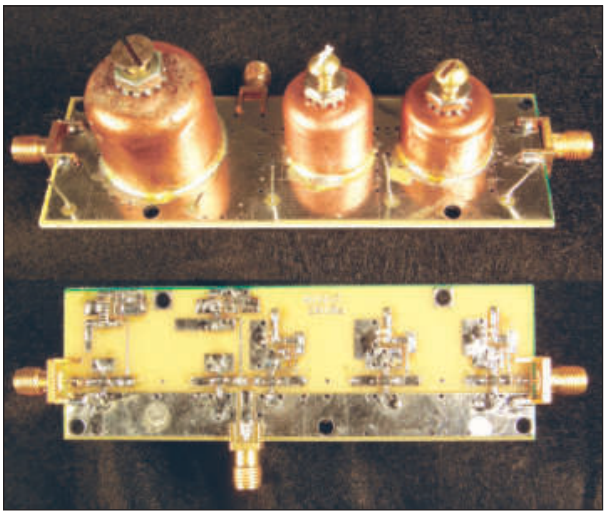


Figure 5 — This is a simple 10 GHz multiplier board for my personal beacon. It uses pipe-cap filters mounted on its back side.

Temperature

While working on the personal beacon board, I set up my MDS source in the barn to provide a weak-signal source for testing.[2] This worked fine until the weather got cold, which caused the brick oscillator to lose its phase lock and the signal to become unstable. This was a reminder that commercial-grade electronics are only guaranteed to work from 0-70°C — and it gets a lot colder than that in Vermont. In hot climates, a closed box may exceed the upper limit. Since military-grade electronics are becoming unavailable even if we could afford them, we must find other solutions. Ideally, we can put the equipment indoors and tolerate some feed-line loss.

While I don't have easy solutions for either waterproofing or temperature control, I'm sure that ham ingenuity will prevail.

Summary

Microwave beacons are a boon to microwave operation and an aid for experimenting. If there isn't a beacon in your area, it might be a good club project. Once a beacon is operational, local hams may find that they can hear it and may even be brave enough to transmit.

[1] P. Wade, W1GHZ, "Microwavelengths," *QST*, Aug 2006, pp 76-77.

[2] P. Wade, W1GHZ, "Microwavelengths," *QST*, Aug 2010, pp 96-97.

Photos by Paul Wade, W1GHZ.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Mobile) — Apr 14 D F H R S V
8 AM-2 PM. *Spr:* Mobile ARC. Abba Shrine Center, 7701 Hitt Rd. *Tl:* 146.82 (203.5 Hz). *Adm:* $5. Tables: $15. Larry Early, WB4YOR, 8495 Desert Oak Ct, Mobile, AL 36695; 251-635-2327; fax 251-639-4769; **mobilehamfest@hotmail.com**; **www.w4iax.net**.

Arizona (Phoenix) — Apr 14 F H R T
6 AM-noon. *Sprs:* Arizona ARC and AR Council of Arizona. DeVry University, 2149 W Dunlap Ave. *Tl:* 147.06. *Adm:* $2. Tables: $10. Gary Hamman, K7GH, 5326 E Voltaire Ave, Scottsdale, AZ 85254; 602-996-8148; **k7gh@arrl.net**; **www.w7io.org**.

Arizona (Sierra Vista) — May 5 D H R T V
7 AM-1 PM. *Spr:* Cochise ARA. Green Acres, 2756 S Moson Rd. *Tl:* 146.76 (162.2 Hz). *Adm:* Free for members, $1 for non-members. Tables: $11. Pat Thies, KD7HAB, 102 E Via Corta, Huachuca City, AZ 85616; 520-227-0142; **kd7habpt@yahoo.com**; **www.k7rdg.org**.

Arizona (Tucson) — Mar 24 D F H R V
6 AM-noon. *Spr:* Radio Society of Tucson. Golden Corral, 4380 E 22nd St. *Tl:* 146.52. *Adm:* $5. Tables: $5. Stephan Shemenski, AK8E, 2151 W Calle Fortunado, Tucson, AZ 85705; 520-245-6182; **AK8E.01@gmail.com**; **K7RST.org**.

California (Sonoma) — Apr 28
D F H R S T V
8 AM-noon. *Spr:* Valley of the Moon ARC. Sonoma Veterans Memorial Building, 126 First St W. Operating QRP station; transmitter hunt; emergency communications vehicles display; pancake, egg and sausage breakfast. *Tl:* 145.35 (88.5 Hz). *Adm:* Free. Tables: $10. Darrel Jones, WD6BOR, 358 Patten St, Sonoma, CA 95476; 707-996-4494; **wd6bor@vom.com**; **vomarc.org**.

INTERNATIONAL DX CONVENTION

April 20-22, Visalia, CA
D H Q R S

The International DX Convention (63rd Annual International DX Convention), sponsored by the Southern California DX Club, will be held at the Visalia Holiday Inn, 9000 W Airport Dr. Doors are open Friday 1-5 PM, Saturday 8 AM-5 PM, and Sunday 7:30-11 AM. Features include DX-oriented forums and presentations; technical sessions; vendors; major equipment manufacturers; exhibitors; K6V Special Event Station; DX University (Friday 9 AM-5 PM); top DX operators from around the world; newcomer eyeball QSO cards (don't forget to pick them up); DXCC card checking; special guest from ARRL HQ Norm Fusaro, W3IZ, MVP Assistant Manager; Saturday barbeque lunch; Saturday eve banquet; Sunday Breakfast Buffet; Saturday Tour; RV parking ($40 for the weekend, must reserve; Brian Lancaster, 559-651-5000 ext 2608; **blancaster@altamonthotels.com**); handicapped accessible. Full registration is $95 (includes all meals); if you're coming just for the day, admission is free to the site. Contact Carl Gardenias, WU6D, 20902 Gardenias St, Perris, CA 92570; 951-443-4958; **gardenias@verizon.net**; **www.dxconvention.org**.

Connecticut (Gales Ferry) — Apr 28 F H R
Sellers 8 AM for equipment setup; 9 AM for bidders' inspection; public 10 AM-3 PM (or until last item is sold). *Spr:* Radio Amateur Society of Norwich. Gales Ferry Firehouse, 1772 Rte 12. RASON Auction. *Tl:* 146.73, 449.725 (156.7 Hz). *Adm:* $2. Gary Divan, WT1SND, 102 Plain Hill Rd, Baltic, CT 06330; 860-884-4218; **WitsEnd@portone.com**; **www.RASON.org**.

Connecticut (Southington) — Mar 18
D F H Q R V
8 AM-noon. *Spr:* Southington ARA. Southington High School, 720 Pleasant St. 29th Annual Hamfest, CT ARES meeting. *Tl:* 147.345. *Adm:* $5. Tables: advance $15, door $20. Norm Fusaro, W3IZ, 586 King St, Bristol, CT 06010; 860-584-1403; **w3iz@sbcglobal.net**; **www.chetbacon.com/flea2012.pdf**.

DELAWARE STATE CONVENTION

April 21, Georgetown
D F H Q R S T V

The Delaware State Convention (Delmarva AR and Electronics Expo), co-sponsored by the Sussex ARA and the Sussex Technical High School, will be held at the Sussex Technical High School, 17099 County Seat Hwy (Rte 9). Gates open at 6 AM and Expo begins at 7:30 AM. Features include flea market, dealers, exhibitors, tailgating ($10), guest speakers, QSL card checking, VE sessions, Chinese Auction, Police K9 Demonstration, handicapped accessible, refreshments. Talk-in on 147.075 (156.7 Hz). Admission is $5. Tables are $15 for the first table; $10 for each additional table. Contact Herb Quick, KF3BT, Box 1431, Seaford, DE 19973; 302-629-4949; **kf3bt@arrl.net**; or Bill Duveneck, KB3KYH, 302-537-4755; **www.radioelectronicsexpo.com**.

Florida (Coral Gables) — Apr 21 F T
7 AM-noon. *Sprs:* Flamingo Net and University of Miami ARC. University of Miami, Physics Parking Lot, 5101 San Amaro. *Tl:* 146.865 (103.5 Hz). *Adm:* Free. Bill Moore, WA4TEJ, 4470 SW 74th Ave, Miami, FL 33155; 305-264-4465; **wa4tej@juno.com**; **www.FlamingoNet.8m.net**.

Florida (Gainesville) — Apr 28 D F H R S T
7 AM-7 PM. *Spr:* Gainesville ARS. Den & Ken's Flea Market, 2708 NE Waldo Rd. Poorman's Hamfest. Foxhunt, cook-out. *Tl:* 146.82. *Adm:* Free (donations welcomed). Tables: Free (donations welcomed). Earl Sloan, KI4OXD, c/o GARS, Box 140383, Gainesville, FL 32614; 352-505-1242; **KI4OXD@arrl.net**; **www.gars.net/**.

Florida (New Port Richey) — Mar 17
F H R T V
8 AM. *Spr:* Gulf Coast ARC. Ridgewood High School (rear Parking Lot), 7650 Orchid Lake Rd. *Tl:* 146.67. *Adm:* $6. Tables: Included in admission. Steve Coe, KI4LVH, 6909 Tierra Verde St, Port Richey, FL 34656; 727-943-9901; **ki4lvh@aol.com**; **www.gulfcoastarc.org**.

Florida (Oakland Park) — Apr 7
F H Q R T V
7 AM-noon. *Spr:* Broward ARC. Collins Center, 3900 NE 3rd Ave. Cy Harris Free Flea. *Tl:* 146.91 (110.9 Hz). *Adm:* Free. Robin Terrill, N4HHP, 4240 SW 20th St, Ft Lauderdale, FL 33317; 954-249-5343; **N4HHP@comcast.net**; **www.eagle3.net/browardarc/documents/events/Cy_Harris_Free_Flea/freeflea.htm**.

Florida (Tampa) — Apr 14 D F H R V
8 AM-1 PM. *Spr:* Tampa ARC. TARC Clubhouse, 7801 N 22nd St. TARCFest XXVII. *Tl:* 147.105 (146.2 Hz). *Adm:* $3. Tables: $15. William Bode, N4WEB, 14302 Capitol Dr, Tampa, FL 33613; 813-382-9262; **n4web@hamclub.org**; **www.hamclub.org**.

Georgia (Sugar Valley) — Apr 28
D F H R T V
8 AM-2 PM. *Spr:* Cherokee Capital ARS. Sugar Valley Community Center, 3295 Sugar Valley Rd NW. *Tl:* 443.675, 146.805 (both 100 Hz). *Adm:* $5. Tables: $10. Felton Floyd, AF4DN, 1054 Mountain Loop Rd NW, Sugar Valley, GA 30746; 770-324-9859; **af4dn@iwispr.net**; **www.k4woc.com**.

IDAHO STATE CONVENTION

April 20-22, Boise
D F H Q R S T V

The Idaho State Convention, sponsored by the Voice of Idaho ARC, will be held at the Boise Hotel and Conference Center, 3300 S Vista Ave. Doors are open Friday noon-9 PM, Saturday 8 AM-9 PM, Sunday 9 AM-noon. Features include indoor and outdoor swapmeet; vendors

Coming ARRL Conventions

March 17
Southern Florida Section, Stuart*
Nebraska State, Lincoln*
West Texas Section, Midland*

March 23-24
Maine State, Lewiston*

March 31
MicroHAMS Digital, Redmond, WA*

Apr 7
North Carolina State, Raleigh*

Apr 14
Delta Division, Bartlett, TN

April 14-15
Communications Academy, Seattle, WA

April 20-21
Southeastern VHF, Charlotte, NC

April 20-22
International DX, Visalia, CA
Idaho State, Boise

April 21
Delaware State, Georgetown
Louisiana Section, Monroe

May 4-6
EMCOMMWEST, Reno, NV

May 18-20
Dayton Hamvention®, Trotwood, OH

June 1-3
Northwestern Division, Seaside, OR

June 2
Georgia Section, Marietta

June 8-9
West Gulf Division, Plano, TX

June 9
Arkansas State, Rogers
Tennessee State, Knoxville

*See March *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

and exhibitors; consignment sales; tailgating ($10 per space); numerous training sessions, seminars and forums; special guest from ARRL HQ Dan Henderson, N1ND, Regulatory Information Manager; VE sessions (two test sessions on Saturday, 10 AM-noon and 2-4 PM; no pre-registration required, $15 cash only; Nina Kurpjuweit, KE7SPP, **ngkurp@yahoo.com**); Friday eve seminar and dinner ($20); Saturday breakfast ($8); Saturday Lunch ($8); Saturday eve banquet ($40). Talk-in on 147.24 (100 Hz). Admission is $10 in advance, $12 at the door (good all three days). Tables are $60 (display booth with single table). Contact Don Lynn, ND7L, 41 N Hastings Dr, Nampa, ID 83687; 208-899-5801; **don_lynn@pacbell.net**; **www.idahostateconvention.com**.

Illinois (Arthur) — Apr 22 D F H R T V
8 AM-noon. *Spr:* Moultrie ARK. Moultrie/Douglas County Fairgrounds, IL Rte 133 (behind High School). 51st Annual Hamfest. *Tl:* 146.655 (162.2 Hz). *Adm:* $7. Tables: $12. Ralph Zancha, WC9V, Box 55, Lovington, IL 61937; 217-254-7574; fax 217-345-5715; **rzancha@one-eleven.net**; **www.qsl.net/mark**.

Illinois (Galva) — Apr 15 D F H R T
8 AM-noon. *Spr:* Area AR Operators. Galva High School, 1020 N Center Ave. *Tl:* 145.49 (225.7 Hz). *Adm:* advance $5 (3 stubs), door $5 (1 stub). Tables: $10. Bill Anderson, WA9BA, 30 Wallace St, Galva, IL 61434; 309-525-0061; **wa9ba@arrl.net**; **aa9ro.com**.

Illinois (Godfrey) — Apr 21 D F H R V
7 AM-noon. *Spr:* Lewis and Clark RC. Lewis and Clark Community College, US Rte 67. *Tl:* 145.23 (79.7 Hz). *Adm:* advance $2 (or 3 for $5), door $3 (or 2 for $5). Tables: $10. Larry Roberts, W9MXC, 5319 Dover Dr, Godfrey, IL 62035; 618-466-0041; **lhrob@charter.net**; **k9ham.org**.

Illinois (Sandwich) — May 6 D F H R T
8 AM-1 PM. *Spr:* Kishwaukee ARC. Sandwich Fairgrounds, US Rte 34. DeKalb Hamfest. *Tl:* 146.73 (100 Hz), 146.52. *Adm:* advance $5, door $7. Tables: 8-ft $10. Bob Yurs, W9ICU, c/o KARC, Box 371, Dekalb, IL 60115; 815-895-7584; **w9icu@arrl.net**; **www.kish-club.org**.

Indiana (Mexico) — Apr 21 D H R V
7 AM-1 PM. *Sprs:* Cass County, Grant County, Miami County, and Kokomo ARCs. Miami County 4-H Fairgrounds, 1029 W 200 N. *Tl:* 147.345. *Adm:* $5 (under 17 free). Tables: $5. Steve Shepler, WA9RVM, Box 824, Marion, IN 46952; 765-661-5260; **shepler1@gmail.com**; **nci-hamfest.net**.

Iowa (Des Moines) — Apr 21 D F H R V
8 AM-1 PM. *Spr:* Des Moines RA Assn. Iowa State Fairgrounds, Elwell Family Center, E 30th St and E University Ave. *Tl:* 146.94 (114.8 Hz). *Adm:* $6 (under 12 free). Tables: $20. Kevin Sanders, KØKDS, Box 88, Des Moines, IA 50301; 515-999-0426; **info@dmraa.com**; **www.dmraa.com/**.

Iowa (Oskaloosa) — Mar 17 D F R
8-11:30 AM. *Spr:* Mahasska ARC. American Legion Hall, 302 High Ave. 24th Annual Swapmeet. *Tl:* 145.49 (146.2 Hz). *Adm:* By donation. Tables: $5. Vern Stanley, NØSJF, 20684 232nd St, Sigourney, IA 52591; 641-622-2154; **vstanley@iowatelecom.net**.

Louisiana (Benton) — May 5 F H R T
10 AM-3 PM. *Spr:* ARC of Shreveport. Cypress Black Bayou Recreation Park, 135 Cypress Park Dr. 11th Annual ARCOS Swapmeet and Cookout, D-STAR demonstration. *Tl:* 146.67 (186.2 Hz). *Adm:* $1 (entry fee to park). Tables: Free (first-come, first-served basis). John Beck, KB5LE, 3457 Harbor Ln, Shreveport, LA 71107; 318-636-5845; fax 318-221-3922; **kb5le@arrl.net**; **www.qsl.net/nwlarn/arcos.htm**.

Louisiana (Kenner) — Mar 24
D F H Q R S V
8 AM-3 PM. *Sprs:* Jefferson ARC, Delta DX Assn, and New Orleans ARC. Muss Bertolino Gymnasium, 600 W Esplanade Ave. *Tl:* 146.86 (114.8 Hz). *Adm:* $5. Tables: $15. Keith Barnes, 14145 Jones Rd, Franklinton, LA 70065; 504-289-1504; **w5gad@w5gad.org**; **noarc.info/hamfest.aspx**.

LOUISIANA SECTION CONVENTION

April 21, Monroe
D F H Q R S T V
The Louisiana Section Convention (Northeast Louisiana Regional Ham RadioFest), sponsored by the Twin City Ham Club, will be held at the Barak Shrine Temple, 6620 Frontage Rd. Doors are open 8 AM-2:30 PM. Features include great flea market, dealers and vendors, forums, QSL card checking, VE sessions, handicapped accessible, refreshments. Talk-in on 146.85. Admission is $5. Tables are $10. Contact Robert Oehmichen, N5ARM, 2402 Pinehurst Dr, Monroe, LA 71201; 318-324-8198; **n5arm@arrl.net**; **tchams.org**.

Maine (South Portland) — Apr 21
D F H R T V
8 AM-noon. *Spr:* Portland Amateur Wireless Assn. Stewart Morrill American Legion Post #35, 413 Broadway St. *Tl:* 147.36. *Adm:* $5. Tables: $10. John Bogner, W1JLB, 90 Wayside Rd, Portland, ME 04102; 207-776-2288; **jbogner1@maine.rr.com**; **www.pawa-maine.org**.

Maryland (Boonsboro) — May 5
D F H Q R S T V
7 AM-1 PM. *Spr:* Antietam Radio Assn. Washington County Ag Expo Center, 7313 Sharpsburg Pike (Rte 65). *Tl:* 147.09. *Adm:* $5. Tables: advance $10, door $15. Page Pyne, WA3EOP, 204 N Locust St, Hagerstown, MD 21740; 301-393-8772 (phone and fax); **wa3eop@arrl.net**; **www.w3cwc.org**.

Michigan (Cadillac) — May 5 D F H Q R V
Set up Friday 6-8:30 PM, Saturday 6 AM; public 8 AM-1 PM. *Spr:* Wexaukee ARC. Cadillac Jr High School, 500 Chestnut St. 50th Annual AR and Compter Swap, UP Net and QCWA meetings. *Tl:* 146.98. *Adm:* $5. Tables: 8-ft $10. Alton McConnell, NU8L, c/o Wexaukee ARC, Box 163, Cadillac, MI 49601; 231-862-3774; **nu8l@yahoo.com**; **www.wexaukeearc.org/other-area-clubs.html**.

Michigan (Highland) — Apr 14 D H R
8 AM-1 PM. *Spr:* Milford ARC. Milford High School, 2380 Milford Rd. *Tl:* 145.49 (67 Hz), 146.52. *Adm:* advance $5, door $6. Tables: $1.50 per foot. Robert Mueller, K8RGM, 3655 W Buno Rd, Milford, MI 48380; 248-685-8903; **k8rgm@comcast.net**; **www.qsl.net/w8ydk**.

Minnesota (Brainerd) — Apr 14 D H R V
9 AM-2 PM. *Spr:* Brainerd Area ARC. Brainerd National Guard Armory, 1115 Wright St. *Tl:* 147.225. *Adm:* $6. Tables: $12. Al Doree, WØRC, 33247 E Shamineau Dr, Motley, MN 56466; 218-575-2404; **w0rc@arrl.net**; **brainerdham.org**.

Missouri (Aurora) — Apr 14 D F H R S T V
Set up Friday 6-8 PM, Saturday 6-8 AM; public Saturday 8 AM-4:30 PM. *Spr:* Ozarks ARS. Pate Middle School, 400 Terrace Dr. *Tl:* 146.97. *Adm:* advance $4, door $5. Tables: advance $8, door $10. Bob Myer, KAØRM, 704 Windsor Ave, Aurora, MO 65605; 417-880-3137; **ctx37607@centurytel.net**; **www.w0oar.com**.

Missouri (Bismarck) — Apr 15 D F H R T V
8 AM-noon. *Spr:* Eastern Ozarks ARC. Bismarck R-5 School, 1 Campus Dr. *Tl:* 147.03 (100 Hz). *Adm:* $2. Tables: $5. Arthur Jones, KE5JLB, 1228 E Lakeshore Dr, Bismarck, MO 63624; 573-915-4116; **ke5jlb@gmail.com**; **www.k0eor.org**.

Missouri (Kansas City) — Apr 21
D F H R S V
8 AM. *Spr:* Ararat Shrine ARC. Ararat Shrine Center, 5100 Ararat Dr. *Tl:* 145.13. *Adm:* advance 3 for $7, door $4 each. Tables: $17. Dave Michael, WAØNXD, 3361 Blue Ridge Blvd, Independence, MO 64052; 816-254-9011; **wa0nxd@arrl.net**; **www.hambash.com**.

EMCOMMWEST CONVENTION

May 4-6, Reno, NV
D F H Q R S T V
The EMCOMMWEST Convention, sponsored by EMCOMMWEST, Inc, will be held at the Grand Sierra Resort and Casino, 2500 E 2nd St. Doors are open Friday 8 AM-5 PM, Saturday 8 AM-10 PM, Sunday 8 AM-1 PM. Features include swapmeet (Saturday 6 AM-noon); ARRL forum; vendors; speakers and presentations; ICS Training; Emergency Communications forums; annual VoIP Topical Conference (Friday, 9 AM-4 PM, $25); VE sessions; Commercial Radio Exams (Saturday; pre-register **comexam@emcommwest.org**); Sunday breakfast buffet (7-9 AM, $20); Saturday banquet featuring special guest speaker Chip Margelli, K7JA (7-9 PM, $40); special guest from ARRL HQ Harold Kramer, WJ1B, Chief Operating Officer; RV accommodations; handicapped accessible. Talk-in on 146.52, 446.0, 147.3 (123 Hz). Admission is $15 in advance, $20 at the door. Contact Rob Gillmore, KI6TRK, 408-888-5565; **info@emcommwest.org**; **www.emcommwest.org**.

New Jersey (Annandale) — Mar 17 D H R V
Set up 6 AM; public 8 AM-3 PM. *Spr:* Cherryville Repeater Assn II. North Hunterdon High School, 1445 Rte 31. *Tl:* 147.375 (151.4 Hz). *Adm:* $7. Tables: First table $25, additional tables $20 by pre-registration, all tables day of event $30. Tony Ploski, W2HWW, Box 308, Quakertown, NJ 08868, 908-256-9568; **aploski@comcast.net**; **www.qsl.net/w2cra**.

New Jersey (Bergenfield) — Apr 14
D F H R S V
8 AM-4 PM. *Spr:* Boy Scout Troop 139/Venture Crew 7373. Conlon Hall, 19 N William St. *Tl:* 146.955 (141.3 Hz), 146.52. *Adm:* $3 (suggested donation per person over age 13). Tables: $20 (1 table), $35 (2 tables); $10 each additional table. J. Gordon Beattie, W2TTT, c/o Troop 139, 29 N Washington Ave, Bergenfield, NJ 07621; 201-314-6964; fax 201-387-8896; **w2ttt@arrl.net**; **sites.google.com/site/boyscouttroop139bergenfield**.

New Jersey (Gloucester City) — Mar 24
D F H R V
6 AM-3 PM. *Spr:* Gloucester City ARC. Pine Grove Fire Assn Hall, 827-829 Jersey Ave. *Tl:* 447.775 (146.2 Hz). *Adm:* $5. Tables: Free. Jay Goheen, KB2ADL, c/o Gloucester City Fire Headquarters, 1 N King St, Gloucester City, NJ 08030; 856-397-3793; **kb2adl@comcast.net**; **nj2gc.org**.

New Jersey (Toms River) — Apr 29
D F H R T V
8 AM-1 PM. *Spr:* Jersey Shore ARS. Riverwood Park, Riverwood Rd. *Tl:* 146.91 (127.3 Hz). *Adm:* $5. Tables: $15 (table or tailgate). Don McGlaughlin, K2HCW, Box 811, Ocean Gate, NJ 08740; 732-237-9448; **k2hcw@comcast.net**; **jsars.org**.

New Jersey (Wall) — Apr 21 H R T V
7 AM-2 PM. *Spr:* Ocean-Monmouth ARC. InfoAge Learning Center, Project Diana Site, 2300 Marconi Rd. *Tl:* 145.11 (127.3 Hz). *Adm:* $5 (tailgating $10 per space). Jeff Harshman, N2LXM, 5 The Arborway, Ocean, NJ 07712; 732-996-0637; **n2lxm@juno.com**; **www.omarc.org**.

New York (Binghamton) — Apr 15 D F H R
8 AM-1 PM. *Spr:* Binghamton ARA. Knights of Columbus Hall #206, 136 Park Ave. *Tl:* 146.865 (146.2 Hz). *Adm:* $6. Tables: $10. Ford Drake, AB2HS, 2237 Farm to Market Rd, Johnson City, NY 13790; 607-754-1214; **ab2hs@stny.rr.com**; **www.wtsn.binghamton.edu/bara/**.

New York (LaGrangeville) — Apr 29
D F H R T V
8 AM-2 PM. *Spr:* Mt. Beacon ARC. Tymor Park, 249 Duncan Rd. *Tl:* 146.97 (100 Hz). *Adm:* $7. Tables: advance $12, door $15. Dave Ruth, KC2AFK, 48 Hoof Print Rd, Millbrook, NY 12545; 845-677-5079; **kc2afk@optimum.net**; **www.wr2abb.org**.

New York (Newark) — Apr 14 D F H R T V
Set up 7 AM; public 8 AM. *Spr:* Drumlins ARC. Marbletown Fire Department, 6416 Silver Hill Rd. *Tl:* 146.685. *Adm:* $5. Tables: $5. David Taylor, KB2KBY, 228 W Jackson St, Palmyra, NY 14522; 315-597-4293; **kb2kby@rochester.rr.com**; **www.drumlinsarc.org**.

SOUTHEASTERN VHF SOCIETY CONFERENCE

April 20-21, Charlotte, NC
D F H Q S

The Southeastern VHF Society Conference (16th Annual Conference), co-sponsored by the Southeastern VHF Society and the Carolina DX Assn, will be held at the Doubletree Inn Airport, 2600 Yorkmont Rd. Doors are open at 9 AM both days. Features include flea market; vendor displays; technical programs; noise figure and antenna gain testing; equipment auction; QSL card checking; Friday luncheon with special guest speaker ARRL President Kay Craigie, N3KN ($20); Saturday banquet with special guest speaker Dr Joe Taylor, K1JT ($35); handicapped accessible. Registration in advance (by Mar 22) is $35, $40 at the door. Contact Bill Fisher, W4GRW, 1317 Corton Dr, Apt L, Charlotte, NC 28203; 704-307-2206; **wvfisher@gmail.com**; **www.svhfs.org**.

North Carolina (Morganton) — Apr 21
D F H R S T V
8 AM-1 PM. *Spr:* McDowell ARA. Burke County Fairgrounds, 145 Bost Rd. *Tl:* 147.15. *Adm:* advance $4, door $5. Tables: $10. Michael Fox, KF4MWX, 4895 Karen Ct, Morganton, NC 28655; 828-437-2787; **kf4mwx@gmail.com**; **cvhamfest.com**.

Ohio (Athens) — Apr 29 D F H R T V
8 AM-1 PM. *Spr:* Athens County ARA. Athens Community Center, 701 E State St. 33rd Annual Hamfest. *Tl:* 145.15. *Adm:* $5. Tables $10. William McFadden, WD8RIF, 12600 Adeline Cir, Athens, OH 45701; 740-593-7176; **wd8rif@arrl.net**; **ac-ara.org**.

Ohio (Cuyahoga Falls) — Apr 14 D H R
8 AM-1:30 PM. *Spr:* Cuyahoga Falls ARC. Emidio & Sons Party Center, 48 E Bath Rd. 58th Annual Hamfest. *Tl:* 147.27. *Adm:* $6. Tables: $15. Ted Sarah, W8TTS, 239 Bermont Ave, Munroe Falls, OH 44262; 330-688-2013; **w8tts@w8tts.com**; **www.cfarc.org/hamfest2012.html**.

Ohio (Jackson) — Apr 21 F H R T V
9 AM-1 PM. *Spr:* Jackson County ARC. Jackson County YMCA, 594 E Main St. *Tl:* 146.79 (167.9 Hz). *Adm:* $5. Tables: $10. Darrell Tilley, KD8GSP, Box 161, Coalton, OH 45621; 740-229-9653; **lonewolfdt@hotmail.com**; **jacksoncountyarc.org/index.html**.

Pennsylvania (Boston/McKeesport) — Apr 29
D F H R V
8 AM-3 PM. *Spr:* Two Rivers ARC. The Boston Spectrum, 6100 Smithfield St. *Tl:* 146.73. *Adm:* $5. Tables: $10. Roger Johnson, WI3R, 1301 Clearview Ave, White Oak, PA 15131; 412-203-2015; **wi3r@comcast.net**; **www.trarc.net**.

Pennsylvania (Newtown/Wrightstown Twp) — May 6 D F H Q R T V
Set up 6 AM, public 7 AM. *Spr:* Warminster ARC. Middletown Grange Fairgrounds, 576 Penns Park Rd. *Tl:* 147.09, 443.95 (both 131.8 Hz). *Adm:* $5. Tables: indoor $15; tailgating $10 plus admission. Stew Leabman, KB3JRB, Box 113, Warminster, PA 18974; 215-794-1360; **hamfest@k3dn.org**; **www.k3dn.org/hamfest.htm**.

Pennsylvania (Spring Grove) — Apr 14
D F H Q R S T V
8 AM-1 PM. *Spr:* York Hamfest Foundation. Porters Community Fire Company, 1199 Porters Rd. 57th Annual York Hamfest. *Tl:* 147.33 (123 Hz). *Adm:* $5. Tables: $15. Duane Sterner, KB3QLQ, 7197 Hershey Rd, Spring Grove, PA 17362; 717-332-1385; **duane.sterner@yahoo.com**; **www.yorkhamfest.org**.

South Carolina (Spartanburg) — May 5
D F H R S V
8 AM-3 PM. *Spr:* Blue Ridge ARS. Spartanburg Fairgrounds, 575 Fairgrounds Rd. *Tl:* 146.61. *Adm:* $7. Tables: $8. Martin Ballenger, N4BDR, 11 Citadel St, Piedmont, SC 29673; 864-901-3025; **n4bdr@yahoo.com**; **upstatehamfest.org**.

DELTA DIVISION CONVENTION

April 14, Bartlett, TN
D F H Q R S T V

The Delta Division Convention (Memphis FreeFest®), sponsored by the Mid-South ARA, will be held at the Bartlett Station Municipal Center, 5868 Stage Rd. Doors are open for setup Friday 4-6 PM, Saturday 7-9 AM; public 9 AM-3 PM. Features include flea market; vendors; tailgating; seminars (noon-3 PM); special guest from ARRL HQ Ed Hare, W1RFI, Laboratory Manager; QSL card checking; VE sessions (morning); MARS Meeting; handicapped accessible; refreshments. Talk-in on 147.03 (107.2 Hz). Admission is free. Tables are free ($10 per table refundable deposit). Contact Tony Brignole, WA4KHN, 2444 LaCosta Dr, Bartlett, TN 38134; 901-372-2738; **abrigno@comcast.net** or **freefest@maraonline.org**; **www.maraonline.org**.

Tennessee (Clarksville) — May 5 F H R T
8 AM-3 PM. *Spr:* Clarksville Amateur Transmitting Society. Hilldale Baptist Church Family Life Center Picnic Pavilion, 250 Old Farmers Rd. *Tl:* 147.39. *Adm:* Free. Tables: Free. John Freed, KX6F, 216 Maplewood Dr, Clarksville, TN 37042; 931-216-2503; **jdfreed@bellsouth.net; kf4l.org**.

Texas (Belton) — Apr 14 D F H T V
7 AM-2 PM. *Spr:* Temple ARC. Bell County Expo Center, 301 W Loop 121. "HamEXPO." *Tl:* 146.82 (123 Hz). *Adm:* $5. Tables $10-$25. Mike LeFan, WA5EQQ, 1802 S 13th St, Temple, TX 76504; 254-773-3590; fax 254-231-4128; **expo@tarc.org**; **www.beltonhamexpo.org**.

Texas (Smithville) — May 5 D F H R T V
7:30 AM-1 PM. *Spr:* Bastrop County ARC. Dr. George M. Jones VFW Post 1309, Loop 230 (Hwy 95). Enchilada Dinner (Friday, May 4, 6-8 PM, $7, RSVP). *Tl:* 145.35, 443.75 (114.8 Hz). *Adm:* $1. Tables: $10. Mike Temple, AD5SU, Box 307, Smithville, TX 78957; 512-965-5653; **ad5su@arrl.net**; **www.bcarc-hams.org/**.

www.arrl.org/hamfests-and-conventions-calendar

Virginia (Chesapeake) — Apr 29
D F H R T V
9 AM. *Spr:* Chesapeake AR Service. Moose Lodge, 1400 N George Washington Hwy. *Tl:* 146.82 (162.2 Hz). *Adm:* advance $6, door $7. Tables: 1 free with admission if reserved in advance, additional tables $7 each. Paul Buckwalter, K4PRB, Box 6867, Chesapeake, VA 23703; 757-484-6047; **w4car@arrl.net**; **www.W4CAR.org**.

COMMUNICATIONS ACADEMY

April 14-15, Seattle, WA
D H R S

The Communications Academy (14th Annual Event – theme is "Practical Solutions for Real EmComm Challenges"), co-sponsored by the WWA Medical Services Team, ARES of King County, and Seattle ACS, will be held at the South Seattle Community College, 6000 16th Ave SW. Doors are open both days from 8:30 AM-5 PM. Features include two days of continuing education training in emergency management; classes and workshops; keynote presentations; basic radio communications; technical and hands-on communications; communications van display; exhibitors and vendors; Portable Radio Kit Contest; Special Event Station W7A; keynote speaker Andrew Seybold, Wireless Communications Consultant; special guest from ARRL HQ Mike Corey, KI1U, Emergency Preparedness Manager. Talk-in on 147.08 (103.5 Hz). Registration in advance for one day is $30, $55 for the weekend (by Apr 1); $35 for one day, $65 for the weekend (Apr 1-11); registration at the door is $45 for one day, $75 for the weekend (Apr 12-15). All registration fees include buffet luncheon. Contact Marina Zuetell, N7LSL, Box 15624, Seattle, WA 98115; 206-954-4099; **n7lsl@arrl.net**; **www.commacademy.org**.

Washington (Selah) — Apr 14 D F H R S V
9 AM-4 PM. *Spr:* Yakima ARC. Selah Civic Center, 216 S 1st St. Indoor bunny hunt. *Tl:* 146.66 (123 Hz). *Adm:* $6. Tables: $15. Lindsay Kooser, N7RHW, Box 4054, Yakima, WA 98904; 509-965-6612; **n7rhw@arrl.net**; **www.w7aq.org**.

West Virginia (Ripley) — May 6 D F H R V
8 AM-2 PM. *Spr:* Jackson County ARC. Ripley Middle School, School St and Klondike Rd. *Tl:* 147.105, 146.67. *Adm:* $5. Tables: $5. Roy Moore, KB8ZSG, 25 Daniels Run Rd, Spencer, WV 25276; 304-927-4412; **morning_glory114@hotmail.com**.

Wisconsin (Cedarburg) — May 5 D F H R
Set up 6 AM; public 8 AM. *Spr:* Ozaukee RC. Circle-B Recreation Center, 6261 State Hwy 60. 34th Annual Swapfest. *Tl:* 146.97 (127.3 Hz). *Adm:* advance $4, door $5. Tables: $10 (buy 4, get 1 free). Tom Nawrot, AA9XK, 10335 N Grasslyn Rd, Mequon, WI 53092; 262-242-1029; **tnawrot@wi.rr.com**; **www.ozaukeeradioclub.org**.

Wisconsin (Stoughton) — Apr 14
D F H R V
8 AM-1 PM. *Spr:* Madison Area Repeater Assn. Mandt Community Center, 400 Mandt Parkway. *Tl:* 147.15 (123 Hz). *Adm:* $5. Tables: $16 (until Apr 1), $20 (Apr 1-13), $25 day of event. Paul Toussaint, N9VWH, 3835 County Rd A, Stoughton, WI 53589; 608-205-1994; fax 608-205-1996; **w9hsy@execpc.com**; **www.qsl.net/mara/swapfest.html**.

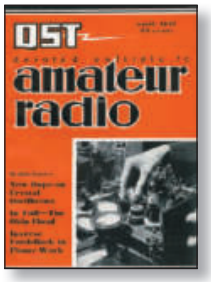
Wisconsin (Superior) — May 5 D H R V
9 AM-2 PM. *Spr:* Arrowhead RAC. Head of the Lakes Fairgrounds, 4700 S Tower Ave (Hwy 35). *Tl:* 146.94 (103.5 Hz). *Adm:* $7. Tables: $10. Robert Schulz, KCØNFB, 115 Eden Ln, Duluth, MN 55805; 218-724-6957; **arac_hamfest@charter.net**; **www.thearac.org**.

75, 50 and 25 Years Ago

Al Brogdon, W1AB

Jim Lamb, Clinton DeSoto and George Grammer tell it like it was

April 1937

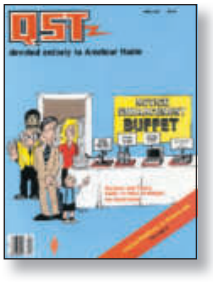


- The cover photo shows James Lamb working on a modern crystal oscillator.
- The editorial reports that the F.C.C. has sent two investigators into the area of recent severe flooding, to study how emergency communication can be improved.
- "In the Public Interest, Convenience and Necessity," by Clinton B. DeSoto, W1CBD, provides an account of amateur, emergency work in the flooded Ohio River Valley.
- Morton Moore. W6AUX, and F. L. Johnson, W6CNX, report on their work using rhombic antennas, in "Directed Vertical Radiation with Diamond Antennas."
- "A New I.F. Coupling System for Superhet Receivers," by James Lamb, describes a new high-selectivity electro-mechanical filter transformer.
- In the next article, Lamb presents "A Practical Survey of Pentode and Beam Tube Crystal Oscillators for Fundamental and Second Harmonic Output."
- George Grammer, W1DF, tells about "A Push-Pull Amplifier for the Band-Switching Exciter," a 500-watt unit using a pair of 100TH tubes.
- In "Inverse Feedback Applied to the Speech Amplifier for the Amateur 'Phone Transmitter," J. B. Carter reports on the use of transmitting-type beam power tubes in audio applications.
- The lead item in "How's DX?" reports that "the most sensational expedition of all times" is now being organized. All DX amateurs are invited to participate in its financial support. The plan is that the expedition will contact *only* its financial supporters. A ham who donates $10 to the cause will be entitled to 10 contacts ($1 per contact) in the radio-rarest countries. Hams who have donated will sign "/PU" after their call signs, to indicate "paid-up" status. The item ends by noting, "… look what month it is."

April 1962

- The cover photo shows one of the new ARRL Booster pins marching along at the head of column of ARRL pins.
- The editorial discusses the proposed new FCC licensing fees, under the heading "License fee — or Tax?"
- J. D. Gooch, W9YRV, O. E. Gardner, W9RWZ, and G. L. Roberts explain the workings of "The Hairpin Match" in matching feed lines to Yagi antennas.
- In "Five Transistors — Two Tubes — 35 Watts," John Meissner, K5CXN, describes his compact three-band HF mobile 'phone rig.
- Lew McCoy, W1ICP, explains "How to Avoid Radiation of Spurious Signals," for the benefit of Novices and other hams.
- Theodore Jones, W3CHU, describes the techniques of "Field Day Power Distribution" used by the Chester County, Pennsylvania, ARC.
- Raphael Soifer, K2QBW, discusses "Amateur Participation in Echo A-12." The launch of the A-12 balloon satellite is expected mid-year, and hams are invited to use it to reflect 2-meter signals over long distances.
- R. H. McCollister, W6BNK, tells about his small adapter that will provide "Clean A.M. for the S-Line Units."
- W. M. Quitter, W8YLU, tells us how to deal with band overcrowding, using his simple principle to provide "Clear Channel Operation."
- Edward Hayward, W1PH, asks "Have You Tried 160 Lately?" and then tells about his simple 'phone and C.W. rig for 1.8 Mc.

April 1987



- The cartoon cover announces that "Novices and Techs Feast on New Privileges."
- The editorial, "220: A Call to Arms," reports that 220 MHz is, once again, under attack, and tells us how to join the fight against its reallocation to land mobile use.
- The pair of lead articles, "FCC's NPRM Concerning the 220-MHz Band" and "Amateurs Respond" tell us more about the 220-MHz threat.
- Curt Holsopple, K9CH, tells us, "Novice Enhancement: New Test Procedures Start *Now*!"
- Following Curt's article is a discussion of "New Written Exams for Technician and General Class Licenses."
- Doug DeMaw, W1FB, helps us save money on antenna projects by describing "Antenna Hardware You Can Build."
- The much-anticipated photo feature, "Results: 1987 Messy Shack Photo Contest," is presented by Andrew Tripp, KA1JGG.

Field Organization Reports

January 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**.

544 W5KAV
410 KT2D
387 W4LHQ
385 KI4KWR
365 KØIBS
344 N4HUB
335 KA2ZNZ
300 KB2ETO
290 WB9YBI
274 W2MTA
272 KB8VXE
271 W7FQQ
270 WD9FLJ
260 K2DYB
246 K8OLY
240 KK5NU
235 KY5SR
230 KD8QPF
215 WB8RCR
210 K2HAT
208 AE5VY
207 KA8KUF
205 K8RDN
200 WB9JSR
196 K4BEH
191 WB9FHP
190 KB2KOJ
187 W9YQ
186 KJ4KZ
177 WA2BSS
175 N7EIE
170 W5DY N8IO
168 K2ABX
167 WD8USA
165 KC2SFU
164 KC5ZGG
163 KC8QWH
160 KGØGG VE7DXD N8OSL
159 AB4WL
156 WW4CC
155 KE5HYW W7IZ
152 W4AVD
150 K9LGU WK4P
149 KA8ZGY
148 W9WXN K7OAH
145 WA9LFO KB2RTZ KB2BAA W2DWR
140 K7BFL N9VC KK3F N8JWH
135 N7CM W4DNA W3YVQ
130 KØVTT WS6P K6JT WB2FTX WØLAW KW1U K4IWW KA4IZN K2TV NX8A
128 W2LIE
125 NN7H AG6EF K7EAJ KB8RCR
120 K6HTN KA4FZI AG9G N2GJ WA3EZN K4GK W1GMF N2JBA NM1K WB6OTS WI2G KB5SDU WB8WKQ
119 W3CB
115 KD1LE KB1NMO
114 WM2C
111 AD4BL
110 W7QM KE4CB W7GB NX9K KC5OZT K7BDU W7QM WB8SIQ K3RC N9WLW WA5LOU N1IQI N1LKJ N7XG N7YSS N9MN WE2G KB1RGQ W7JSW W2EAG N5NVP
109 WA4UJC
107 WB8YYS
105 KF5IOU KF7GC
102 W4GLE N2RDB
101 KB9KEG N3RB
100 WØCLS
NØMEA WAØVKC W4OTN K4SCL W8CPG N1JX N3SW W3TWV WB8HHZ WG8Z WD8Q W9LW WA2NDA KA1G NU8K KT4YA K7FLI N2WKT WB4FDT KB3LNM KØPTK K8VFZ
99 N2VC
98 N2GS K2GW W4TTO
97 NA9L
95 KB5KKT N8CJS WB6UZX KJ4PZI
94 N2DW
93 NA7G
92 AA3SB AK4AS
90 NC3F KE5YTA W8DJG KB8HJJ K4BG WB4BIK W9BGJ W9MBT AA2SV K2UHF K1YCQ N4ELI W3GQJ KJ4HGH KZ8Q KBØDTI N3ZOC K3IN KC8BW N5ASU KD8CYK KD8LZB
89 WD8BCS
88 K6FRG
87 W5GKH
84 W2CC K4JUU
83 K4MSG NC8V N1TF
82 W5ESE
80 KØDEU NIØI NØMHJ KFØXO KCØZDA K5AXW WB8KPE W8MAL WDØGUF K8KV KD4KFR KJ4JPE KJ4RUD WB8TQZ WB8R
78 KC2EMW W8IM K2UL N2RTF
76 WØRJA KC2UMX W1PLK
75 AL7N WB3FTQ KC4PZA
74 KK7DEB
73 W5XX N2YHQ
72 N2VQA W4BKG KA4SZQ W2KFV
71 KJ4KZT KJ4NO KC2SYM KD8AAD
70 KDØAYN KØDLK NØDUW NØDUX WØFUI N3NTV KØPTK KØRXC KD7ZUP N2YJZ

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AR, AZ, CO, CT, EB, ENY, EPA, EMA, GA, LAX, IA, IL, IN, KS, ME, MI, MN, MS, NC, NE, NFL, NLI, NNJ, NNY, NTX, OH, OK, OR, SD, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WNY, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, ENY, GA, IA, IN, KS, MDC, MI, MN, MO, MT, NLI, NM, NNJ, NTX, OK, SFL, STX, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W5KAV 2905, N8JWH 2219, N1IQI 1682, KK3F 1677, WB9FHP 1574, W1GMF 1055, WB2FTX 1027, WB5NKD 1024, NX9K 858, N9VC 845, K6HTN 739, WB9JSR 727, K7BDU 712, WD8Q 625, KZ8Q 552, KW1U 530, W9WXN 501.

Operators who qualified for BPL by Originations plus Deliveries: K6FRG 126, NM1K 113.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

N1CDD **Manning**, Malcolm M. Sr, Morrisville, VT
WB1DBQ **Nichols,** Walter E. Sr, East Hampton, CT
KL1EM **Jaynes**, Milo R., Seward, AK
WB1FDJ **Thresher**, Clifford E. Jr, Wakefield, RI
WA1FJT **Goodell**, Lee F., Willington, CT
KA1GDX **Lombardo**, Paul V., Wethersfield, CT
WV1K **Cassarino**, Matthew J., Brewster, MA
N1NDT **Nyhan**, Richard J., Brookline, MA
KB1NWS **Anderson**, Roger F., Manchester Center, VT
W1OJ **Perkins**, D. Roger, Bolton, MA
K1OQM **Archer**, James C. Sr, Marion, MA
♦W1RAA **Allard**, Raymond A., Brooksville, FL
WA1RAU **Blanchard**, Jean C., West Warwick, RI
ex-NV1T **Driscoll,** Gerard A., Needham, MA
KQ1U **Sousa**, Ronald J., Pelham, NH
K1UCA **Wanta**, Raymond C., Cambridge, MA
K1VGU **Midgley**, Philip B., Forestdale, MA
W1VYH **Wood**, Elizabeth, Peabody, MA
K1YZW **Schreuer**, Walter, Ipswich, MA
KI1Z **Walker**, Mary A., Everett, MA
W2AK **Floring**, Charles W., Venice, FL
N2AXV **Sposato**, Vincent A. II, Passaic, NJ
N2BEO **Cohen**, Sam, Rochester, NY
W2CVN **Shar**, Malvin L., Freehold, NJ
K2DOT **Jacoy**, John B., Garland, TX
K2FCL **Macey**, Stephen R., Buffalo, NY
KB2G **Parker**, Wilson B., East Syracuse, NY
W2GIS **Housman**, Lawrence W., Berkeley Township, NJ
W2HMW **Milasus**, Aloysius G., Linden, NJ
WA2IPX **Kloskowski**, Stanley E., Hamilton, NJ
♦WB2JAB **Nellis**, Walter, Winthrop, NY
W2JIO **Casey**, Francis R., Albany, NY
KB2JKC **Smith**, Florence A., Chappaqua, NY
WA2KLU **Avery**, Charles W., Auburn, NY
N2LR **Rosen**, Leonard, Bandon, OR
N2LZH **Stevens**, George W., Bridgeport, NY
W2MAY **Mele**, Vincent P., Egg Harbor Township, NJ
WA2NQM **Neeley**, Frank J., Albany, NY
W2PPB **Mullin**, Leroy A. Jr, Plainville, NY
W2RPN **Abbate**, John, Vineland, NJ
KC2STS **Young**, Joseph X. Jr, Hopewell Township, NJ
WA2ULV **Gearing**, Franklin A., Canaan, NY
KC2VDG **Yancy**, Kyle, Hopewell Junction, NY
WA2VPH **Hughes**, Leland E., Moravia, NY
WB2ZHD **Grills**, Lee J., Honeoye Falls, NY
WT3B **Thompson**, William R., Linthicum, MD
W3DBQ **Van Arman**, Clarence G., Fort Washington, PA
WB3EZT **Gotwalt**, Robert L., York, PA
KE3G **Raab**, Raymond R., Berkeley Springs, WV
WA3GHU **Refford**, Lester W. Sr, West Chester, PA
W3GMY **Ryan**, Gary J., Glen Burnie, MD
N3JWN **Belton**, Richard G., Baltimore, MD
NM3L **Wiltshire**, Cecil A., Erie, PA
K3MAP **Puderbaugh**, Michael A., Muncy, PA
W3NN **Heck**, Norman A., Leesburg, VA
W3OGI **Rosenberg**, Harold R., Erie, PA
K3QDC **Tavan**, Norman J., Saratoga, CA
KA3QDM **Kelly**, Donald L., Erie, PA
NT3U **Lawson**, Arnold E., Mount Lebanon, PA
WA3VKJ **Richards**, Joseph M., Bridgeport, PA
K3YWY **Pearce**, Charles W., Emmaus, PA
KA3YXO **Kranch**, Daniel D., Pottstown, PA
W3ZEH **Bashaw**, Walter R., Donegal, PA
W4BEJ **Grieb**, William L., Elizabethtown, KY
W4DMV **Elliott**, William E., Dothan, AL
KF4EEG **Hope**, Wilma M., Three Rivers, MI
WD4EQT **Sloat**, Bettie C., Tice, FL
KE4ERZ **Morris,** Thomas S., Tuscaloosa, AL
W4FKR **Graham**, Lamar T., Bradenton, FL
W4FR **Sherrill**, Bobby E., Maiden, NC
ex-KB4FRV **Brookshire,** Ronald J., Starr, SC
AA4JG **Sutterfield**, Gerald R., Atlanta, GA
♦K4JHM **Myers**, Harold C., Waxahachie, TX
WB4JPZ **Heaton**, Robert L., Lake Placid, FL
WD4LMK **Voss**, William R., Salisbury, NC
KI4NZJ **Simble**, Richard L., Rock Spring, GA
K4OBP **Porter**, Oscar B. Jr, Rocky Mount, NC
N4RXC **Kelly**, Gregory M., Savannah, GA
K4SMP **Hall**, Robert L., Easley, SC
WA4WSD **Gossett**, John H., Greenville, SC
AD4XW **Willemse**, Hans, Rockledge, FL
AA5AD **Jenkins**, James A., Mount Ida, AR
K5ANN **Webb**, John B., Crowley, LA
N5BVS **Rawles**, Leonard M., Alamogordo, NM
KA5CEY **Elliott**, John W. Sr, Alvin, TX
KA5CMX **McCandless**, Richard E., Baton Rouge, LA
♦WB5COO **Kennedy**, Stiles "Mike" C., Baton Rouge, LA
AA5DX **Marra**, Ronald P., North Port, FL
NF5E **Frazier**, Carl S., Houston, TX
WA5EAF **Jackson**, Elbert J. W., Abilene, TX
K5EET **Gray**, Roy T., West Monroe, LA
AA5EM **Oyler**, Jack L., Fox, AR
KD5ETU **Kreiger**, James L., Emerson, AR
WD5ITH **Smith**, James A., Hobbs, NM
W5JIF **McKee**, Travis, Houma, LA
W5JWM **Montgomery**, G. F., Houston, TX
♦W5KNA **Inks**, Floyd B. Jr, Austin, TX
W5KZU **Hollenbach**, Roy E., Albuquerque, NM
KD5NDB **Brown**, Don, Flint, TX
N5NKK **Peterson**, Glenn C., Stephensville, LA
WB5PJH **Blaylock**, Raymond L. Jr, Pearland, TX
N5QHP **Gaines**, Kyle M., Emerson, AR
WA5TLP **Jiles**, Virgil L. Jr, Williston, ND
♦N5TT **Petrosky**, Bob N., Georgetown, TX
W5UAK **Spiva**, Norman M., Rock Hill, SC
KK5VM **Tiller**, Lynn D., West Monroe, LA
N6CHA **Winscott**, William C., Fort Smith, AR
W6FJD **Lafferty**, Travis, Oakland, CA
WA6FSB **Swan**, Edward H., San Leandro, CA
K6GUK **Conway**, Mark H., Riverside, CA
NH6HX **Savidge**, John J., Sanford, NC
WA6ITE **Wynn**, Wally, Chino Hills, CA
KG6JBY **Gallagher**, Cedric L., Pleasanton, CA
WH6JL **Ah Sam**, Judith, Kapaau, HI
KA6KBI **Croda**, Thomas G., San Leandro, CA
K6MDW **Skelton**, Parke, Colorado Springs, CO
♦WB6OFO **Goldberg**, Robert, Medford, OR
N5QHP **Gaines**, Kyle M., Emerson, AR
K6SMV **Filice**, Peter C. Jr, Auburn, CA
AK6SS **Smith**, Steven R., Indio, CA
NW6T **Chandler**, Hubert A., Los Angeles, CA
KG6TVH **Perry**, Lyne, Alpine, CA
W6VAW **Lodge**, James E., Vista, CA
AA6VN **Reilly**, John J., Walnut Creek, CA
KE6YCZ **Stoehr**, William C., Fresno, CA
KA7BQW **Wagy**, Robert R., Albany, OR
KD7DCG **Tice**, Thomas E., Mesa, AZ
KL7DTR **Kometz**, George L., Tacoma, WA
K7KHB **Stiel**, Vernon J., Sandy, UT
AA7MX **Elfbrandt**, Ken W., Tumwater, WA
W7OU **Hiller**, Horst W., Mesa, AZ
W7PF **Hiller**, Ethel L., Mesa, AZ
KD7SJK **Brown**, Kaye, Sandy, UT
WB7WNM **Klempel**, Vanda L., Bothell, WA
NL7XZ **Simpson**, Robert R., Juneau, AK
AK7Y **Farkas**, Gregory J., Alpine, AZ
♦N8AC **Schmidt**, Donald E., Brunswick, OH
N8AJN **Close**, John C., Nathrop, CO
KC8ALQ **Dickson**, John B., Worthington, OH
KC8DRE **Schafer**, William C., Deming, NM
WR8F **Cramer**, John J., Ann Arbor, MI
W8IJB **Lungerhausen**, John C., Hermansville, MI
W8IMX **Degenkolb**, Robert J., Weirton, WV
♦W8JG **Gallucci**, John C., Fort Myers, FL
W8JNH **Hemp**, Jack D., Greenville, OH
W8JZZ **Wilde**, Albert S., Englewood, FL
K8KTJ **Krauer**, John H., Mayville, MI
K8MKF **Carlton**, Merrill W., Whittemore, MI
K8MMC **Crawley**, Marion M., Athens, OH
♦WB8PHO **Vanden Bos**, John W., Houston, TX
WA8RJN **Flahie**, William E., Manchester, MI
KC8RNY **Nagy**, Gregory R., Plymouth, MI
WB8ROC **Eckerd**, Gerald D., Bay City, MI
W8TJS **Clarke**, Vernon E., Wadsworth, OH
W8TQ **Watson**, Carli I., Holland Patent, NY
NZ8X **Martek**, Steven, Bay City, MI
W8ZNH **Eckels**, William H., Big Rapids, MI
WB9AUV **Robinson**, Lorin "Robbie" A., Plainfield, IL
W9BB **Simons**, William A., Minneapolis, MN
N9ES **Hayes**, Charles "Lester," Decatur, IL
W9HOC **Whitmore**, Wayne W., Dixon, IL
♦WB9OHN **Bonnell**, Frank H., Wauconda, IL
W9QB **Braswell**, William P., Gary, IN
KC9RGM **Statzer**, Michael S., Pendleton, IN
K9RRG **Valenti**, Donald B., Portage, IN
N9RUS **Legg**, David H., Waynetown, IN
W9VN **Yacono**, Anthony S., Chicago Heights, IL
♦W9YCE **Switzer**, Harold M., Springfield, IL
K9YJW **Stewart**, Don W., Indianapolis, IN
N9YMA **McGlasson**, Ronald R., Somonauk, IL
WB9YRT **Shudick**, Daniel M. Jr, Munster, IN
AAØCU **Thompson**, Leann B., Pendleton, OR
WØFBH **Schaffer**, Virgil F., Cedar Rapids, IA
WAØFIJ **Cain**, Orlan K., Griswold, IA
WAØFKL **Shirck**, James F., Round Rock, TX
KIØKS **Dunn**, Robert J. Jr, Kearney, NE
WØMLM **Martin**, Michael L., Newton, IA
♦KØODY **Potter**, Rupert W., Sturgis, SD
KBØOPY **Horrell**, Thomas R., Raytown, MO
WØOZJ **Ross**, Harold E., Lead, SD
KOØQ **Strong**, Gary J., Minneapolis, MN
WØRRQ **Balden**, Harold A., Safety Harbor, FL
♦WFØS **Orendorff**, Lynn, Maquoketa, IA
KØTXN **Berger**, Fritz J., Schleswig, IA
WBØWWU **Morris**, Edward P. Jr, Manning, IA
WBØWZG **Wheeling**, C. S. Jr, Ottumwa, IA
KBØYZJ **Mentzer**, Neil K., Loveland, CO
VE6UM **Rohde**, Rolf, Calgary, AB, Canada

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111.

APRIL IS YAESU MONTH AT HRO

HAM RADIO OUTLET®

Refreshments and live in-store demos at all 12 Stores!
Watch for schedule at www.hamradio.com

WORLDWIDE DISTRIBUTION

Check out the latest Cool Winter Specials from YAESU
Yaesu coupons expire 3/26/12

YAESU

#1 Yaesu Dealer Worldwide

Competitive pricing!

FTM-350AR 2m/440 Dualband

- 50W 2m/440† - 1 watt 220Mhz
- TNC built-in, Bluetooth capable
- Band scope built-in
- 500 Memories

$20. mfr coupon

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)

$20. mfr coupon

FREE YSK-857

Call for Low Price!

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!

FTDX5000MP 200w HF + 6M Transceiver

- Station Monitor SM-5000 Included
- 0.05ppm OCXO included
- 300 Hz Roofing filter included
- 600 Hz Roofing filter included
- 3 kHz Roofing filter included

$70. mfr coupon

FT-7900R 2M/440 Mobile

- 50w 2m, 45w on 440mHz
- Weather Alert
- 1000+ Mems
- WIRES Capability
- Wideband Receiver (Cell Blocked)

FREE YSK-7800

Call Now For Your Low Price!

FT-950 HF + 6M TCVR

- 100W HF/6M
- Auto Tuner built-in
- 3 roofing filters built-in
- DMU-2000 Compatible

NEW!

$30. mfr coupon

Call Now For Low Pricing!

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 ft.
- Built-in CTCSS/DCS
- Internet WIRES compatible

Now available in Black!

FT-2000/FT2000D HF + 6M tcvr

- 100 W w/ auto tuner • built-in Power supply
- DSP filters / Voice memory recorder
- 200W (FT-2000D)
- 3 Band Parametric Mic EQ • 3 IF roofing filters

$40. mfr coupon

Call For Low Pricing!

FREE YSK-8900

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!

NEW!

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 Special Pricing

NEW EXPANDED STORE!

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!

$30. mfr coupon

$20. mfr coupon

VX-8GR only

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 ft 30 mins
- GPS/APRS operation optional
- Li-ion Hi-capacity battery
- wide band Rx

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 Blvd, 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
newcastle@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
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
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

D-STAR EXPERTS!

World's LARGEST HAM RADIO INVENTORY in stock for quick delivery

DISCOVER THE POWER OF DSP WITH ICOM!

IC-9100 The All-Round Transceiver

• HF/50MHz 144/430 (440) MHz and 1200MHz*3 coverage • 100W on HF/50/144MHz, 75W on 430 (440) MHz, 10W on 1200MHz*3 • 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

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

D-STAR READY

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

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

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

D-STAR READY

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

IC-PW1 HF + 6M Amplifier

• 1.8-24MHz + 6M Amp • 1KW amplifier • 100% duty cycle • Compact body • Detachable controller • Automatic antenna tuner

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

IC-V80 2M Handheld Transceiver

• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation

D-STAR READY

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

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

ICOM®

*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. *†AA Alkaline batteries not included, radio comes with a AA alkaline battery tray. *‡For shock and vibration. *3Optional UX-9100 required. Contact HRO for promotion details. QST APRIL 2012. The Icom logo is a registered trademark of Icom Inc. 70007

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

Look for the HRO Home Page on the World Wide Web
http://www.hamradio.com

#1 in Customer Service

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
NEW Expanded Store
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

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 Blvd, 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
newcastle@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
NEW EXPANDED STORE!

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
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
sales@hamradio.com
Exit 1, I-93;
28 mi. No. of Boston
salem@hamradio.com

HAM RADIO OUTLET®

WORLDWIDE DISTRIBUTION

World's LARGEST HAM RADIO INVENTORY in stock for quick delivery

Cool Winter Specials From Kenwood

Kenwood instant coupons expire 4/30/12

KENWOOD

$40. Kenwood Coupon

TM-D710A 2M/440 Dualband

- 50w 2M & UHF
- Optional Voice synthesizer
- 1000 memories • Dual receive
- Advanced APRS Features
- Echolink ® Ready w/ 10 memories
- Built-in TNC • Sky Command II+
- GPS I/O Port
- Choice of Green/Amber LCD backlight

Call Now For Special Introductory Price!

$25 Kenwood Coupon

TM-281A 2 Mtr Mobile

NEW!

- 65 Watt, 200 Mems, CTCSS/DCS
- Mil-Std specs, Hi-Quality Audio

Call Now For Special Low Price!

TH-D72A

NEW!

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!

TS-2000 HF/VHF/UHF TCVR

TS-2000 $200 Kenwood Coupon
TS-2000X $225 Kenwood Coupon

- 100W HF, 6M, 2M • 50W 70CM
- 10W 1.2 GHz w/opt UT-20 module
- Built-in TNC, DX packet cluster
- IF Stage DSP • Backlit Front Key Panel

Call Now For Special Price!

TS-480SAT/HX HF+6M Transceiver

- 480SAT 100w HF & 6M w/AT
- 480HX 200w HF & 100w 6M (no Tuner)
- DSP built in
- Remotable w/front panel/speaker

Call Now For Your Low Price!

TS-480SAT $250 Kenwood Coupon
TS-480HX $250 Kenwood Coupon

TH-F6A

$25 Kenwood Coupon

2M/220/440

- Dual Chanel 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!

$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 Amber/Green for LCD panel
- 104 code digital code squelch
- "Five in One" programmable memory
- 1,000 multifunction memory

Call Now For Your Low Price!

TS-590S HF+6M Transceiver

NEW!

- 100W HF + 6M
- 500Hz & 2.7Khz roofing filter
- built-in Auto Tuner
- best Dynamic Range in class
- 32 bit DSP

Call Now For Your Low Price!

TH-K20A

2M Handheld

2m 5.5w • VOX • CTCSS/DCS/1750 Burst Built In • Weather Alert •

Call For Special Low Price!

AZ, CA, CO, GA, VA residents add sales tax. Prices, specifications, descriptions, subject to change without notice.

Look for the HRO Home Page on the World Wide Web
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!

World's LARGEST amateur radio dealer!

12 STORE BUYING POWER

HAM RADIO OUTLET

ALL sales staff are ACTIVE HAMS

WORLDWIDE DISTRIBUTION

TOKYO HY-POWER

FLASH!

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 w/ most ICOM/Kenwood/Yaesu tcvrs

CALL FOR ADDITIONAL THP PRODUCTS!

KANTRONICS

KAM XL

- DSP modem offers great performance on Packet 300/1200,G-tor,Pactor, Amtor,PSK-31
- RTTY, Navtex, ASCII, Wefax, CW, GPS NMEA-0183 and more!

Call Now For Special Pricing!

KPC-3 Plus/KPC-9612 Plus

High-performance, low power TNC.
Great for packet, and APRS compatible.

Call For Special Low Price!

REMOTE RIG

RRC-1258 MkII-S-Set

NEW!

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"

US TOWER

Shown with Optional Rotor Base

MA-40

40' Tubular Tower

Call For Latest Pricing!

MA-550

55' Tubular Tower

Handles 10 sq.ft. at 50mph
Pleases neighbors with tubular streamlined look

Call For Latest Pricing!

TX-455

55' Freestanding Crank-Up
Handles 18 sq. ft. @ 50 mph
No guying required
Extra-strength const.
Can add raising and motor drive acces.

Towers Rated to EIA Specifications
Other Models at Great Prices!

Call For Latest Pricing!

Buy From HRO, World's Largest U.S. Tower Dealer

All US Towers shipped by truck; freight charges additional

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

HRO Owned and operated by ACTIVE HAMS

Look for the HRO Home Page on the World Wide Web
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 Blvd, 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
newcastle@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
NEW EXPANDED STORE!
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
woodbridge@hamradio.com

SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
sales@hamradio.com
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.
Now including practice exam software on CD-ROM.
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 July 1, 2011 to June 30, 2015. **Now including 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—9th Edition. Achieve the highest level of Amateur Radio licensing!
Now including practice exam software.
Order No. 8874 ..... $29.95
ARRL's Extra Q & A—2nd Edition. Order No. 1379 ..... $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 2.0
Order No. 6467 ..... $39.95
ARRL Exam Review for Ham Radio Download. Order No. 6467D $39.95

Operating and Reference

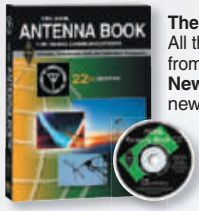
The ARRL Operating Manual. 9th Edition.
Order No. 1093 ..... $29.95
NEW! ARRL Repeater Directory®. 2012/2013 Edition.
Pocket-sized. Order No. 5347 ..... ARRL Member Price $10.95 ..... ~~$12.95~~
Desktop Edition. Order No. 5485 .... ARRL Member Price $15.95 ..... ~~$17.95~~
NEW! TravelPlus for Repeaters™. 2012-2013 Edition. CD-ROM, Ver 16.0.
Order No. 4678 ..... $39.95
NEW! TravelPlus Mobile GPS™ Download. 2012/2013 Edition.
Order No. 1371 ..... $24.95
The ARRL DXCC List. July 2011 Edition. Order No. 7440 ..... $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 ..... $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 ..... $19.95
Hints & Kinks. 17th Edition. Order No. 9361 ..... $17.95
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 3.0
Order No. 1424 ..... $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
ARRL's Vintage Radio. Order No. 9183 ..... $19.95
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 inches. Includes grids!
Order No. 8977 ..... $15
ARRL Map of the World (Azimuthal). 27 x 39 inches.
Order No. 7717 ..... $15
ARRL Map of the World (Robinson). 26 x 34.5 inches.
Order No. 8804 ..... $15
ARRL Worked All States (WAS) Map. 11 x 17 inches.
ARRL Frequency Chart on reverse side. 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
NEW! 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. 9th Edition. Order No. 0180 ..... $19.95
RSGB Morse Code for Radio Amateurs. Order No. 0221 ..... $15.95
RSGB Computers in Amateur Radio. Order No. 0139 ..... $24.95
2012 Super Frequency List on CD-ROM. Order No. 1233 ..... $44.95
2012 Shortwave Frequency Guide. Order No. 2615 ..... $59.95

Antennas and Transmission Lines



The ARRL Antenna Book—22nd Edition.
All the information you need for complete antenna syatems—from planning, to design and construction CD-ROM included! **New and Improved!** Includes a complete reorganization, new content, and exciting new antenna projects.
Hardcover Antenna Book. Book with CD-ROM.
Order No. 6801 ..... OUT-OF-STOCK! $59.95
Softcover Antenna Book. Book with CD-ROM.
Order No. 6948 ..... $49.95
Basic Antennas—Understanding Practical Antennas and Design.
Order No. 9994 ..... $29.95
The ARRL Antenna Designer's Notebook. Order No. 1479 ..... $34.95
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
RSGB Practical Wire Antennas. Order No. R878 ..... $17
RSGB Practical Wire Antennas 2. Order No. 9563 ..... $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
NEW! 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
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

QST on CD-ROM!

CD-ROM Collections

NEW! 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 2012 Edition. Order No. 3683 ..... $49.95
HamCall™ CD-ROM. Order No. 8991 ..... $49.95

Continued on page 108

DX ENGINEERING

More Power to Your Antenna Means You Stand Out in the Pileups—Work More DX!

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

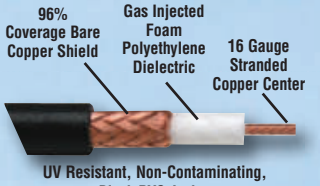
Available in full spools or cut to your specified lengths.

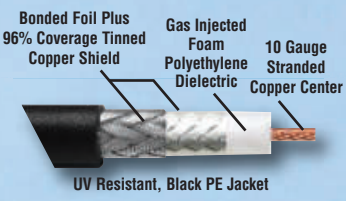
Made in USA

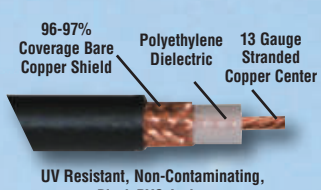
Hand-Crafted, Fully-Tested Cable Assemblies

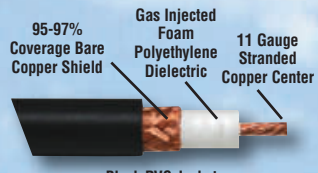
- Highest quality DX Engineering workmanship
- Silver-plated, Teflon®-insulated connectors
- Hi-Pot high-voltage tested
- Weatherproof, adhesive shrink tube seals connections

Complete information is available at DXEngineering.com. Contact DX Engineering Customer Support for your application.









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%
4.8 dB @ 150 MHz	0.4 kW	33%

Cable Only		
DXE-8X	By the foot	$.31/ft.
DXE-8X-1000	1000 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

DXE-400MAX 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

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	6.5 kW	93%
0.5 dB @ 10 MHz	4.4 kW	90%
0.7 dB @ 30 MHZ	2.5 kW	83%
0.9 dB @ 50 MHz	1.7 kW	79%
1.6 dB @ 150 MHz	1.0 kW	65%
3.1 dB @ 450 MHz	0.5 kW	47%

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

FREE SHIPPING on Coax Orders!

**Your coax cable order is shipped free, via UPS ground, anywhere in the contiguous 48 United States.*

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: **1204QS**
Prices effective through 5/15/12

Order by 4 PM ET (US) for Same-Day Shipping

We Will Beat Any Competitor's Prices—Call Us for Details!

ARRL Publications – Continued from page 106

Practical Circuits and Design

The ARRL Handbook—2012 Edition.
A single resource covering electronic fundamentals, radio design, and loads of practical treatments and projects. You'll read it, study it, and turn to it… again and again. **Updated and Revised!** This eighty-ninth edition includes something for every radio amateur and experimenter, brand-new projects and the most up-to-date information. CD-ROM included! (version 16.0)

Hardcover Handbook. Book with CD-ROM.
Order No. 6634 ..... **$59.95**
Softcover Handbook. Book with CD-ROM.
Order No. 6672 ..... **$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 ..... **$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**
MFJ 20-meter CW Cub Transceiver Kit. Order No. 0018 ..... **$89.95**
L/C/F and Single-Layer Coil Winding Calculator. Order No. 9123 ..... **$12.95**
ARRL's RF Amplifier Classics. Order No. 9310 ..... **$19.95**
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**
NEW! 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**
AC Power Interference Handbook. Order No. 1103 ..... **$34.95**
Power Supply Cookbook. Order No. 8599 ..... **$63.95**
Instruments of Amplification. Order No. 9163 ..... **$19.95**
NEW! 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**
NEW! Test Equipment for the Radio Amateur. Order No. 1027 ..... **$24.95**
RSGB Weekend Projects for the Radio Amateur. Order No. 0123 ..... **$24.95**

Digital and Image Communications

VHF Digital Handbook— 1st Edition.
Everything you need to get started in digital radio applications. Includes Packet Radio, APRS, D-Star, digital applications in public service and emergency communications, and more! Order No. 1220 ..... **$19.95**
ARRL's HF Digital Handbook. 4th Edition. Order No. 1034 ..... **$19.95**
NEW! Get on the Air with HF Digital.
Order No. 6016 ..... **ARRL Member Price $22.95** ..... ~~$25.95~~
NEW! 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**
The ARRL Image Communications Handbook.
Order No. 8616 ..... **$19.95** ..... ~~$25.95~~
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**
Digital Communication Systems *Using SystemVue*. Order No. 1084 ..... **$49.99**

Public Service and Emergency Communications

The ARRL Digital Technology for Emergency Communications Course.
CD-ROM, version 1.0 Order No. 1247 ..... **$49.95**
The ARRL Emergency Communications Handbook. Order No. 9388 ..... **$19.95**
The ARRL Emergency Communication Library. CD-ROM, version 1.0
Order No. 9868 ..... **$19.95**
The ARRL Introduction to Emergency Communication Course.
4th Edition. Order No. 7303 ..... **$24.95**
ARES Field Resource Manual. Order No. 5439 ..... **$12.95**
NEW! Emergency Power for Radio Communications. 2nd Edition.
Order No. 6153 ..... **ARRL Member Price $24.95** ..... ~~$27.95~~
NEW! Eton Microlink FR160 Radio. Order No. 1150 ..... **$35**
NEW! Solar Crank Flashlight. Order No.0173 ..... **$40**
NEW! 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**
NEW! 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**
The ARRL UHF/Microwave Projects CD. Order No. 8853 ..... **$24.95**
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.
The Story of MI6 Communications—1939-1945 (World War II). A story that includes hams among those patriots that helped the allied war effort.
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 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**
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**

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 an international delivery service. Express delivery options and other specialty forwarding services 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 2-4 weeks delivery
Up to $20.00	$7.50	$15.00
$20.01 to $50.00	$10.50	$25.00
$50.01 to $250.00	$12.50	$35.00
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 888/277-5289 (US)

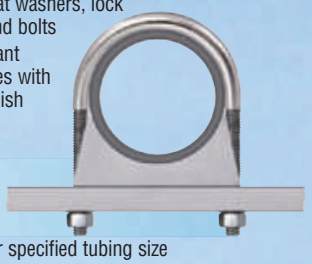
DX ENGINEERING

Strong, High Quality, Corrosion-Resistant, Unique, Purpose-Designed Clamps

Our Clamps are Specified by Scientific, Military & Government Designers! Used by Antenna Builders: Commercial & Amateur!

Saddle Clamps with Cast Saddles

- Stainless steel flat washers, lock washers, nuts and bolts
- Corrosion-resistant aluminum saddles with as cast rough finish for secure grip



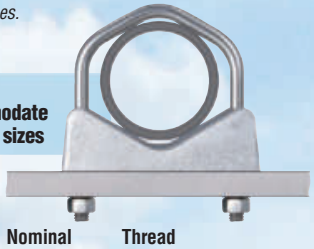
U-Bolt Style, designed and sized to fit tubing

- Full 360° grip for specified tubing size

Part Number	Nominal Size	Thread Bolt Size	Price
DXE-SAD-050A	0.50	1/4-20	$4.95
DXE-SAD-075A	0.75	1/4-20	$5.35
DXE-SAD-100A	1.00	1/4-20	$5.70
DXE-SAD-125A	1.25	1/4-20	$6.55
DXE-SAD-150A	1.50	1/4-20	$7.40
DXE-SAD-175A	1.75	1/4-20	$8.55
DXE-SAD-200A	2.00	5/16-18	$9.75
DXE-SAD-200B	2.00	3/8-16	$10.95
DXE-SAD-250A	2.50	5/16-18	$11.75
DXE-SAD-250B	2.50	3/8-16	$13.25
DXE-SAD-300A	3.00	5/16-18	$13.30
DXE-SAD-300B	3.00	3/8-16	$14.90
DXE-SAD-400A	4.00	3/8-18	$34.40
DXE-SAD-450A	4.50	3/8-16	$39.90

Dimensions in Inches.

V-Bolt Style, sized to accommodate ranges of tubing sizes



Part Number	Nominal Size	Thread Bolt Size	Price
DXE-CAVS-1P	0.50 to 1.75	1/4-20	$9.95
DXE-CAVS-11P	0.50 to 1.75	5/16-18	$10.45
DXE-CAVS-2P	1.00 to 2.00	5/16-18	$11.95
DXE-CAVS-3P	2.00 to 3.00	3/8-16	$14.95

Dimensions in Inches.

Clamps with black powder coated saddles are also available in U-Bolt and V-Bolt styles, designed and sized to fit ½" to 2" tubing.

Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads.

- A356-T6 cast aluminum saddle, with rough, as-cast finish for high torque grip on masts, etc
- Cast stainless reinforcement plate included
- Armor coated bolt sets sold separately

Part Number	Tube O.D.	Price
DXE-SDS-200P	2.00	$32.00
DXE-SDS-250P	2.50	$39.00
DXE-SDS-300P	3.00	$49.00

Dimensions in Inches.

Resin Support Blocks

Securely mount tubing to any flat surface. An insulated mount between tubing and plates, ideal for antenna construction and electrical applications.

- Optional stainless steel reinforcement plates available

Part Number	Tube O.D.	Price
DXE-RSB-I02500	0.250	$2.65
DXE-RSB-I03125	0.3125	$2.65
DXE-RSB-I03750	0.375	$2.65
DXE-RSB-I05000	0.500	$2.90
DXE-RSB-I06250	0.625	$2.90
DXE-RSB-I03400	0.750	$3.05
DXE-RSB-I10000	1.000	$3.05
DXE-RSB-I11250	1.125	$4.70
DXE-RSB-I12500	1.250	$4.70
DXE-RSB-I11500	1.500	$4.70
DXE-RSB-I13400	1.750	$7.15
DXE-RSB-I20000	2.000	$7.15
DXE-RSB-I22500	2.250	$7.95

Dimensions in Inches.

Cushioned P-Clamps

- Provides strain relief of coaxial cable connections
- Grips the cable jacket without nicking or cutting

DXE-CPC-250 For RG-8X, RG-6, RG-59 cable.....pack of 10 **$14.95**

DXE-CPC-375 For RG-213, RG-8, RG-11 cable.....pack of 10 **$14.95**

V-Bolt Style Saddle Clamps with Stainless Steel Saddles

- Stainless Steel Saddles, serrated to secure hard pipe surfaces
- Stainless steel V-bolts and hardware

Part number	Nominal Size	Price
DXE-SSVC-1P	.50 to .75	$6.95
DXE-SSVC-150P	1.00 to 1.50	$9.95
DXE-SSVC-2P	1.00 to 2.00	$11.95
DXE-SSVC-3P	2.00 to 3.00	$14.95

Dimensions in Inches.
Also available with a tab and 1/4" hardware for grounding as shown.

Coaxial Cable Grounding Brackets

- Stainless steel bracket supplied with stainless steel V-Bolt and hardware

DXE-CGB-150 Fits .50" to 1.50" O.D. tube **$15.95**

DXE-CGB-200 Fits 1.00" to 2.00" O.D. tube **$15.95**

Stainless Steel, Studded Band Clamps

- Welded 10-24 stud
- Easy connection to aluminum elements
- Useful for mounting items to round or irregularly shaped structures.

Part Number	Nominal Size	Price/Pack of 2
DXE-ECLS-050	0.500	$9.99
DXE-ECLS-062	0.625	$9.99
DXE-ECLS-075	0.750	$9.99
DXE-ECLS-087	0.875	$10.99
DXE-ECLS-100	1.000	$10.99
DXE-ECLS-125	1.250	$11.49
DXE-ECLS-150	1.500	$11.49
DXE-ECLS-175	1.750	$11.49
DXE-ECLS-200	2.000	$11.49
DXE-ECLS-225	2.250	$11.49
DXE-ECLS-250	2.500	$11.99
DXE-ECLS-275	2.750	$11.99
DXE-ECLS-300	3.000	$11.99
DXE-ECLS-325	3.250	$11.99

Dimensions in Inches.

Tell us how you used DX Engineering clamps. The best design will win 200 DX Bucks! One winner every month. Details at DXEngineering.com!

World Class Products Shipped Worldwide, Every Day!

Thousands More Ham Products at

DXEngineering.com

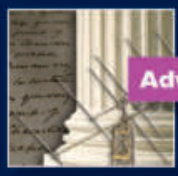
1.800.777.0703

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: **1204QS**
Prices effective through 5/15/12

Order by 4 PM ET (US) for Same-Day Shipping

April Winner: 20 meter dipole antenna made by James, K8JHR. James says DX Engineering saddle clamps made it easy to build "A high precision, easy to tune and adjust, aluminum dipole." See it on DX Engineering's Customer Showcase at DXEngineering.com.



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
Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
Intl CD	$39	$76	$111	Annual CD-ROM (*QST*, *NCJ* and *QEX*) for international members
Blind	$8	$16	$24	No *QST* delivery, all other member benefits apply
Family	$8	$16	$24	Reside at the same address as the primary member, no additional *QST*. Membership dates must correspond with primary member.

Membership includes $15 per year for subscription to *QST*. Memberships and *QST* cannot be separated. Dues subject to change without notice and are nonrefundable.

If you are 21 or younger a special rate may apply. Contact ARRL for more details.

Additional membership options available online at www.arrl.org/join.

Name _____ Call Sign _____

Street _____ City _____ State _____ ZIP _____

E-mail _____ Birth Date _____

Family Member Name _____ Call Sign (if any) _____

☑ Payment Options

☐ Visa ☐ MasterCard ☐ Amex ☐ Discover ☐ Check Enclosed

☐ Total enclosed payable to ARRL $ _____

☐ If you do not want your name and address made available for non-ARRL related mailings, please check here.

Card Number _____ Expiration Date _____

*Cardholder's Signature _____

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

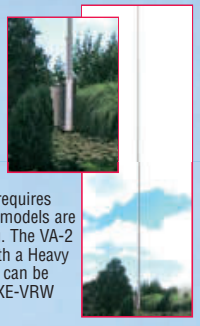
Source Code: QST 3/2012

DX ENGINEERING

ICOM · Cushcraft Amateur Radio Antennas · hy-gain · COMTEK · 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 · ARRL · LDG ELECTRONICS · CQ · HEIL SOUND · DIAMOND ANTENNA · BENCHER, INC. · STI · RADIO

We Will Beat Any Competitor's Price!

DX Engineering Full Size 75/80 Meter Quarter-Wave Vertical Antennas



The 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.

- 2:1bandwidth up to 500 kHz
- DX Engineering structural design + high strength tubing manufactured to 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 OD base section	**$379.50**
DXE-7580FS-VA-2	Vertical Antenna, Heavy Duty, 3 inch OD base section	**$675.50**
DXE-7580FS-VA-3	Vertical Antenna, Super Duty, 4 inch OD base section	**$1,675.50**

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**

65 Ft. Telescoping Antenna Kit

- Eleven telescoping sections from 2" to 7/8" O.D.
- Stainless steel element clamps

DXE-ATK65	Telescoping Antenna Kit	**$194.50**
DXE-VE-BASE	Fixed Vertical Insulated Base Kit	**$99.50**
DXE-VA-BASE	HD Vertical Insulated Tilt Base Kit	**$159.50**

6063-T832 Aluminum Tubing

- Smoothly telescoping sections
- Drawn, not extruded, tubing
- Best quality at the lowest price, guaranteed
- Custom made to DX Engineering's rigid specifications
- For best results, use DXE Stainless Steel Element Clamps to assemble slit lengths

DX Engineering Has Stainless Steel Element Clamps that Fit Exact Tubing Sizes! See DXEngineering.com for details.

Telescoping, High Strength, FiberGlass Tubing

Great for wire antenna spreaders or insulated stacking frames.

- Tubing custom made to DX Engineering's rigid specifications in smoothly telescoping sections
- Neutral, light gray color
- 1/8" nominal wall x 8 feet long
- Available in unslit tubing or one end slit tubing

Unslit End, Telescoping Fiberglass Tubing
available in sizes from 0.500" O.D. to 2.000" O.D.
(in .25" increments) ..... **$6.45 to $25.95**

Slit One End, Telescoping Fiberglass Tubing
available in sizes from 0.750" O.D. to 2.000" O.D.
(in .25" increments) ..... **$18.95 to $30.95**

50 Ft. Telescoping Fiberglass Tubing Mast Kit

- Includes DX Engineering Stainless Steel Element Clamps
- Tapers from 2.00" to .50" O.D. in seven 8 ft. sections

DXE-FTK50 50 ft. Telescoping Tubing Kit..... **$138.00**

Rohn Commercial Towers

Rohn Commercial Tower products and accessories are now available at DX Engineering. We have the Rohn products – Towers, Masts, and Tower and Installation Accessories – to meet your tower structural needs. ***Contact DX Engineering Customer Support for your application.***

SignaLink™ USB Unit from Tigertronics

- Easiest installation and setup—for Mac or PC
- Software included on CD ROM
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Supports all sound card digital and voice modes, including MT63, EchoLink®, PSK-31, SSTV, CW and RTTY

TIG-SL-USB **$89.95**

- **Requires a radio interface cable**

Any Radio Interface Cable (except the special Elecraft K3 cable), is only **$12.95** when purchased with a SignaLink™ unit

TOTALLY FREE SHIPPING ON COMTEK BALUNS*

COMTEK W2FMI Series Baluns

Better Performance, Lower Prices!

From just $49.95

Design inspired by Jerry Sevick, W2FMI, and perfected by DX Engineering's Balun R&D department.

- Featuring a DX Engineering innovation: High voltage compensating capacitors for unequalled low SWR
- Large fender washers distribute fastener loading
- Special toroid core handles high power with minimum thermal stress
- High, consistent common mode impedance across HF spectrum provides isolation where it's needed most
- Special wire sizing and Teflon-insulated wire sleeves for exact impedance matching and better isolation than Thermaleze wire
- Typical insertion loss: less than 0.2 dB
- Power handling: up to 5 kW+ intermittent depending on model, see website
- Silver-plated gasketed SO-239 connectors, stainless hardware and a weatherproof NEMA box

1:1 Dual Wire/Single Core, 1.8 to 54 MHz		
COM-BAL-11130E	3 kW, side eyebolts	**$49.95**
COM-BAL-11130ET	3 kW, side and top eyebolts	**$49.95**
COM-BAL-11130S	3 kW, side studs/wingnuts	**$49.95**
COM-BAL-11130T	3 kW, top studs/wingnuts	**$49.95**
1:1 Coax/Single Core		
COM-BAL-11150E	5 kW, side eyebolts	**$49.95**
COM-BAL-11150ET	5 kW, side and top eyebolts	**$49.95**
COM-BAL-11150S	5 kW, side studs/wingnuts	**$49.95**
COM-BAL-11150T	5 kW, top studs/wingnuts	**$49.95**
1:1 Dual Wire/Dual Core		
COM-BAL-11140T	5 kW, top studs/wingnuts	**$69.95**
COM-BAL-11140S	5 kW, side studs/wingnuts	**$69.95**
1:1 Coax/Dual Core		
COM-BAL-11150DS	5 kW, side studs/wingnuts	**$69.95**
COM-BAL-11150DT	5 kW, top studs/wingnuts	**$69.95**
4:1 Dual Wire/Single Core		
COM-BAL-41130E	3 kW, side eyebolts	**$59.95**
COM-BAL-41130ET	3 kW, side and top eyebolts	**$59.95**
COM-BAL-41130T	3 kW, top studs/wingnuts	**$59.95**
COM-BAL-41130S	3 kW, side studs/wingnuts	**$59.95**
4:1 Dual Wire/Dual Core		
COM-BAL-41150T	5 kW, top studs/wingnuts	**$89.95**
COM-BAL-41150S	5 kW, side studs/wingnuts	**$89.95**
COM-BAL-41150E	5 kW, side eyebolts	**$89.95**

Contact DX Engineering Customer Support for recommendations for your application. **Your Comtek balun order is shipped free, via UPS ground, anywhere in the contiguous 48 United States.*

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: **1204QS**
Prices effective through 5/15/12

Order by 4 PM ET (US) for Same-Day Shipping

We Will Beat Any Competitor's Prices—Call Us for Details!

LDG ELECTRONICS

#1 Line of Autotuners!

- *5 to 1,000 Watts PEP*
- *RF Sensing*
- *Auto and Semi Tuning Modes*
- *Two-Position Antenna Switch*
- *2,000 Memories per Antenna*
- *1.8 to 54 MHz range*
- *6 to 800 ohm range (15 to 150 on 6M)*

M-1000 Meter sold separately

NEW! AT-1000Proll

Building on the success of the AT-1000Pro, LDG Electronics has refined and expanded its flagship 1KW tuner with optional external 4.5" analog meter. The new AT-1000Proll keeps many of the same features of the previous model, but simplifies the operation. With the two-position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six-foot DC power cable.

Suggested Price $539.99; Optional M-1000 external analog meter $129.99

Z-11Proll

Meet the Z-11Pro II, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" × 7.7" × 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 through 6 meters. The Z-11Proll uses LDG's state-of-the-art, processor-controlled, Switched-L tuning network. It will match dipoles, verticals, inverted-Vs, or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes six-foot DC power cable.

Suggested Price $179.99

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple: one button push on the tuner is all that is needed, the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2,000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the Tune button on the tuner. Powered by four AA internal alkaline batteries (not included), so there are no additional cables required.

Suggested Price $129.99

We have a tuner that will work for you!

We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the ***Tuner Comparison Chart*** *on our web site for more selection help!*

radio not included

AT-897Plus for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment, takes power directly from the CAT port of the FT-897, and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price $199.99***

AT-600Pro

The AT-600Pro handles up to 600 watts SSB and CW, 300 on RTTY (1.8–30 MHz), and 250 watts on 54 MHz. Matches virtually any kind of coax-fed antenna and will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use it with longwires, random wires, and antennas fed with ladder line just by adding a balun. Two antenna ports with a front-panel indicator, and separate memory banks for each antenna. LED bar-graph meters shows RF power, SWR and tuner status, tactile feedback control buttons and an LED bypass indicator. Operates from 11–16 volts DC at 750 mA. Includes six-foot DC power cable.

Suggested Price $359.99

Z-100Plus

Small and simple to use, the Z-100Plus sports 2,000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes six-foot DC power cable.

Suggested Price $159.99

LDG Electronics, Inc. 1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

NEW! Z-817H

The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal alkaline batteries (not included). 2,000 memories cover 160 through 6 meters.

Suggested Price $159.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-100Proll

This desktop tuner covers all frequencies from 1.8–54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch with LEDs, allowing you to switch instantly between two antennas. The AT-100Proll requires just 1 watt for operation, but will handle up to 125 watts. Includes six-foot DC power cable.

Suggested Price $229.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-200Proll

The AT-200Proll now includes LEDs to show antenna position and if the tuner is in bypass. A two-position antenna switch stores 2,000 memories per switch. Handles up to 250 watts SSB or CW on 1.8 to 30 MHz and 100 watts on 54 MHz. Rugged and easy to read LED bar graphs simultaneously show RF power and SWR. Includes a six-foot DC power cable.

Suggested Price $259.99

IT-100

Matched in size to the IC-7000 and IC-706, for either manual or automatic tunes, and status LEDs. Control the IT-100 and its 2,000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. For your Icom radio that is AH3 or AH-4 compatible. ***Suggested Price $179.99***

YT-100

For Yaesu FT-857, FT-897 and FT-100 (and all D models) an integrated tuner, powered by the interface. Press the Tune button on the tuner, and everything else happens automatically. ***Suggested Price $199.99***

KT-100

For AT-300 compatible Kenwood transceivers (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies. ***Suggested Price $199.99***

YT-450

Designed for Yaesu's newest 100 watt radios. Interfaces directly with the Yaesu FT-450 and FT-950 radios. Press the Tune button on the tuner and the rest happens automatically. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1. 2,000 memories recall settings in an instant! Seamless connection to a PC.

Suggested Price $249.99

YT-847

YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the Tune button on the tuner and everything else happens automatically!

Suggested Price $249.99

FREE!

RBA-1:1 Balun or RU-4:1 Unun

When You Buy A S9V 43', 31' or 18' Multiband Antenna

Purchase an S9V 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!

Antennas!

S9V 43' $199.99

80-6 meters *Fixed Operation*

The S9V 43' is a high-performance, lightweight, telescoping fiberglass vertical. The best value in high-performance "tall" verticals!

S9V 31' $99.99

40-6 meters *Fixed or Portable Operation*

S9V 18' $49.99

20-6 meters *Fixed or Portable Operation*

The S9V 31' and 18' are tapered, ultra-lightweight, fiberglass, vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

S9RP $39.99

Aluminum Radial Plate

Includes 20 sets of stainless steel nuts & bolts.

Your Favorite Dealer has these tuners in stock NOW! Don't Miss Out - Call or visit them TODAY!

Visit our website for a complete dealer list www.ldgelectronics.com

LDG ELECTRONICS

hy-gain® ROTATORS

. . . the first choice of hams around the world!

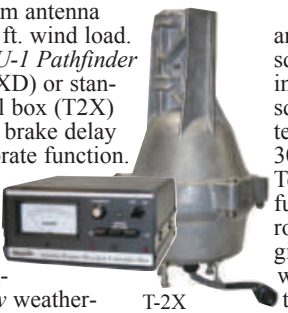
HAM-IV

HAM-IV **$649.95**

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II



For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II **$449.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V **$1099.95** with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

ROTATOR OPTIONS

MSHD, $109.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $49.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

AR-40

AR-40 **$349.95**

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A **$1499.95**

King-sized antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

Digital Automatic Controller

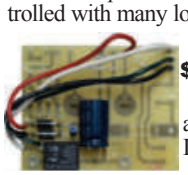
DCU-1 **$749.95**

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35 **$89.95**

For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.



RBD-5 **$29.95**

NEW! Automatic Rotator Brake Delay

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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

IC-80AD 2M/440 D-Star & FM HT

- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/2.5/0.5/0.1W • Improved User Interface
- Optional HM-189GPS Speaker Mic adds GPS capabilities

IC-92AD 2M/440 D-Star & FM HT

- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/2.5/0.5/0.1W • Duel RX
- Optional HM-175GPS Speaker Mic adds GPS capabilities

GPS Speaker Microphones

- Shows your position data on the display and offers a position reporting function in DV mode
- HM-189GPS for IC-80AD and HM-175GPS for IC-92AD

IC-2200H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207
- D-Star upgradable with optional UT-118

ID-880H 2M/440 FM Analog & D-Star Digital Dual Bander Mobile

- TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W
- Memories: 1052

IC-2820H 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 118-549.95, 810-999.990 MHz (cell blkd) • Power: 50/15/5W
- Packet ready (9600 BPS) • Upgradable D-Star DV (digital voice) & GPS capabilities w/optional UT-123

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
- Much faster DSP unit compared to the IC-746PRO
- Automatic antenna tuner • USB connector for PC control

IC-7600 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 101 • 5.8 inch color screen
- High-resolution real 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
- Optional 3 kHz & 6 kHz Roofing Filters (first IF)
- 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

FOLLOW US ON TWITTER!
twitter.com/K9AES

TRADE UP TO ICOM
CALL AES NOW FOR A QUOTE!

Radios by ICOM

FT-250R 2M FM HT

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 5/2/0.5W • Memories: 209

FT-60R 2M/440 FM HT

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 5/2/0.5W • Memories: 1000

VX-8DR Quad-band FM HT

• TX: 50-54, 144-148, 222-225, 430-450 MHz
• RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
• Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
• Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand mic provides you with APRS® data

FT-2900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 75/30/10/5W • Memories: 221

FT-7900R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blocked)
• Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
• Memories: 1055 • YSK-7800 included!

FT-8800R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
• Crossband repeat • YSK-8900 included!

FT-8900R Quad-Band FM Mobile

• Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 included!

FT-450D HF/6M Compact Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 500 • Auto Tuner • Same as the FT-450AT with new features: Key illumination, Foot stand, Selectable 300 Hz/500 Hz/2.4 kHz CW IF Filters and more!

FT-897D 100W HF/VHF/UHF Portable

• Similar to the FT-857D but can also operate 20W using optional FNB-78 13.2V @ 4.5 Ah NiMH battery packs

FT-950 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 100 • Auto Antenna Tuner
• 32-bit Floating Point DSP • Built-in high stability TCXO

FT-2000 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
• Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive • Internal Power Supply
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000D RF output is 200W, PS is external

FTDX-5000MP

FTDX-5000 Series – Covers HF and 6M; Three different configurations all running 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" also comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000 - Basic Model & ±0.5ppm TCXO
FTDX-5000D - With Station Monitor & ±0.5ppm TCXO
FTDX-5000MP - With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

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

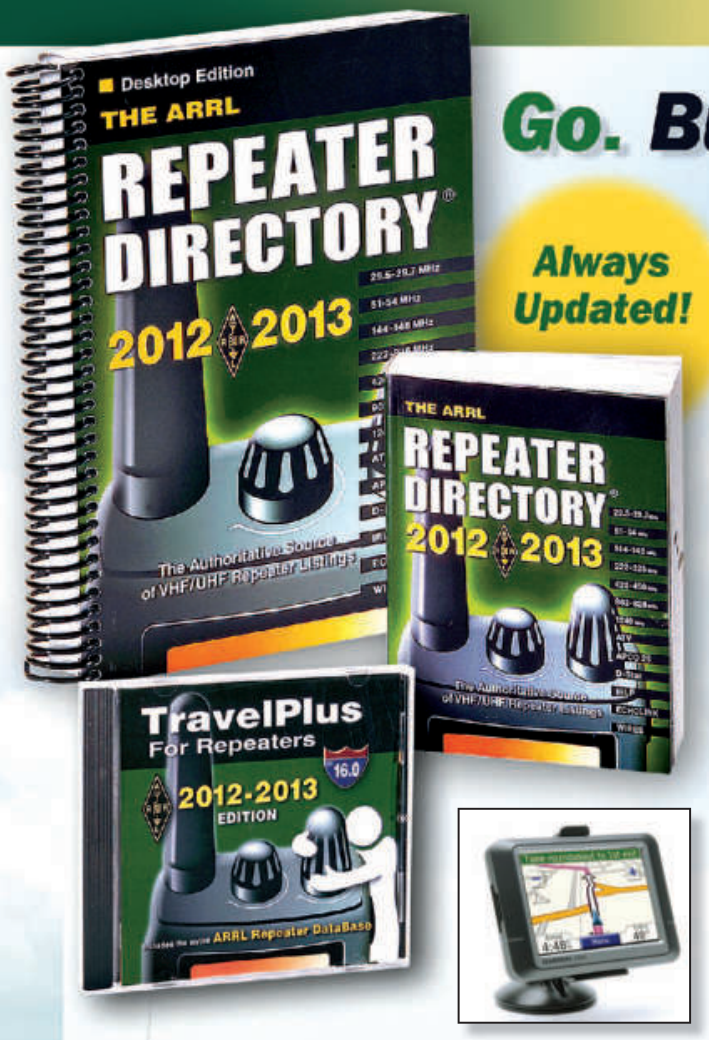
Included items are available for limited time.

FOLLOW US ON TWITTER!
twitter.com/K9AES

TRADE UP TO YAESU
CALL AES NOW FOR A QUOTE!

Radios by YAESU

Go. But keep in touch...



Always Updated!

The ARRL Repeater Directory®

NEW! 2012/2013 Edition

The best directory of frequencies for the 21,800+ repeaters around the country! Includes D-Star and APCO-25, references for operating practices, tips for handling interference, emergency message handling and more. Now includes guidelines for severe weather reporting to SKYWARN/National Weather Service.

- Spiral Bound **Desktop Edition** *lays flat!*
- Handy indexing tabs on the cover.
- Easy-to-read listings.
- Repeater notes located right up front.
- Updated with the latest listings each year!

The ARRL Repeater Directory®

Desktop Edition Spiral Bound (6 x 9 inches).
ARRL Order No. 5485 ..... ~~$17.95~~*
ARRL Member Price **$15.95***

Pocket-sized Edition (3.75 x 5.25 inches).
ARRL Order No. 5347 ..... ~~$12.95~~*
ARRL Member Price **$10.95***

TravelPlus for Repeaters™

NEW! CD-ROM—version 16.0

Make ***TravelPlus*** your traveling companion and you'll never be alone on the road. Locate ham radio repeaters along US and Canadian travel routes using this map-based software. It's like having the power of ***The ARRL Repeater Directory®*** on your **COMPUTER!**

- Map your travel route and tune in. Supports GPS.
- View and print maps and repeater lists.
- Includes **The ARRL Repeater Database**, global Internet linked nodes, AM/FM radio, broadcast television, NOAA weather stations, USA and Canadian licenses, and ham radio points of interest.
- Export data for radio programming, handheld devices, and more.

TravelPlus for Repeaters™ CD-ROM
ARRL Order No. 4678 ..... **$39.95***

BONUS OFFER!

Get a **FREE** pocket-sized ***Repeater Directory*** when you pre-order ***TravelPlus***. You get both for only $39.95.** Pre-orders will ship early May.

Upgrade at Dayton Hamvention®. Visit TravelPlus in the ARRL EXPO area. Bring your previous version proof-of-purchase for a special upgrade price!

**Bonus "ARRL Repeater Directory" premium cannot be redeemed for cash. No returns. Exchanges must be accompanied by premium. Valid on pre-orders direct from ARRL, only. This offer may be cancelled or modified at any time due to system error, fraud or other unforeseen problem. Void where prohibited.

TravelPlus Mobile GPS™

NEW! 2012-2013 Edition

Connecting Amateur Radio with your Garmin Nüvi GPS!

Only $24.95 Download Today!

Access all open repeaters from ***The ARRL Repeater Directory*** or ***TravelPlus for Repeaters*** database. Easy to use and all just a touch away! For more information and to place an order visit **www.arrl.org/shop**. At checkout, you will receive an email confirmation with instructions for downloading and installing to your GPS.

Minimum System Requirements: Garmin nüvi, dēzl or zūmo GPS with at least 3.0 MB free memory space available for POI file.

TravelPlus Mobile GPS™ Download
ARRL Order No. 1371 ..... **$24.95**

Order Online **www.arrl.org/shop**
Call Toll-Free **1-888-277-5289** (US)

*Shipping and Handling charges apply. Sales Tax is required for orders shipped to CT, VA, and Canada. Prices and product availability are subject to change without notice.

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)

QS4/2012

TH-K20A 2M FM HT

- TX: 144-148 • RX: 136-174
- Power: 5.5/2/1W • Memories: 200

TH-F6A Triband FM HT

- TX: 144-148, 222-225, 430-450 MHz
- RX: 0.1-1300 MHz (cell blkd) • Dual band RX
- FM Wide/Narrow, AM, SSB and CW receive modes
- Power: 5/0.5/0.05W • Memories: 435

TH-D72A 2M/440 FM HT Built-in GPS

- TX: 144-148, 430-450 • RX: 118-174, 320-524 MHz
- Power: 5/0.5/0.05W • Memories: 1000 • USB Port
- 1200/9600 bps packet TNC • SkyCommand and APRS
- Stand-alone Digipeater • Built-in High Performance GPS
- GPS logging - stores up to 5,000 points of track data
- Echolink® ready • KISS mode protocol

TM-281A 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 65W • Memories: 200

TM-D710A
Dualband FM Mobile w/TNC

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G6 & EchoLink® ready

Green Light Labs GPS-710

- Plug-and-play adds GPS for TM-D710A & RC-D710
- Acquires GPS lock from cold start in under 60 seconds
- Quick and easy install typically in less then 5 minutes
- Longer cable sold separately to mount on vehicle's glass

TM-V71A Dualband FM Mobile

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready
- The optional RC-D710 can replace the TM-V71A control panel to enable all the features of the TM-D710A.

TS-480HX 200W HF/6M Mobile

- TX: HF/6M • RX: 0.5-60 MHz • Power: 10-200W (with two optional 22A PS's) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band 100W with auto antenna tuner.

TS-480SAT 100W version with built-in automatic antenna tuner.

TS-2000 100W HF/VHF/UHF Transceiver

- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

TS-590S 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz
- Power: 5-100W (5-25W on AM)
- Memories: 110 + 10 Quick Channels
- HF/6M Auto Antenna Tuner
- Full/semi break-in CW • 10 Hz Dual VFO Display
- USB connectivity for PC and remote control

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 KENWOOD
CALL NOW FOR A QUOTE!

Radios by KENWOOD

ARRL Field Day is June 23-24, 2012

Get Active, Get Outdoors and Get on the Air!

Show off your support for ARRL Field Day!

Official Field Day pocket t-shirts, hats, participation pins, and more are a great way to recognize your involvement in this annual operating event. All items are available for order now, and will begin shipping April 1. **Clubs, order early!** Collect orders from members, and place a single order—pay only $12.50 shipping for orders over $50, while supplies last.

•Field Day Pocket T-Shirt
Sand pocket t-shirt featuring the 2012 Field Day logo above the pocket. ARRL diamond and "Ham Radio" silkscreened on top back.
ARRL Order No. 1098 ..... **Only $14.95**

•Field Day Hat
Texas orange cap embroidered with "Field Day". One size fits most.
ARRL Order No. 2301 ..... **Only $9.95**

•Field Day Pin
Official 2012 Field Day Pin. Size 1-1/8" x 7/8".
ARRL Order No. 3357 ..... **Only $5.00**

•GOTA Pin
Don't forget GOTA pins for your Field Day newcomers. Size 1" x 1".
ARRL Order No. 8911 ..... **Only $5.00**

•Field Day Poster (pack of 25)
Encourage participation in ARRL Field Day. A great recruitment tool!
ARRL Order No. 4840 ..... **Only $5.95**

•Field Day Logbook
Log sheets, dupe sheets, VHO Operating Tips, WAS map and more.
ARRL Order No. 4500 ..... **Only $7.95**

•The ARRL Field Day Handbook
A collection of tools and resources for Field Day FUN!
ARRL Order No. 0885 ..... **Only $19.95**

www.arrl.org/FieldDay
Order Online www.arrl.org/shop
or Call Toll-Free 1-888-277-5289

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

New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore™ Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive™* peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D **$389.95**

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T™*

MFJ-986 **$349.95**

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$219.95**

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$179.95**

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune™*, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E **$139.95**

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M *mobile* Tuner

MFJ-945E **$129.95**

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$119.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$99.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

MFJ-902 **$99.95**

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $149.95.** Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

MFJ-16010 **$69.95**

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$99.95**

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 **$89.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 *artificial* RF Ground

MFJ-931 **$109.95**

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

Dealer/Catalog/Manuals

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 *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-998 1500 Watt *Legal Limit IntelliTuner*™

Only the MFJ-998 gives you fully automatic antenna tuning for your legal limit full 1500 Watts SSB/CW linear amplifier!

MFJ-998 **$699.95**

Ultra-fast Automatic Tuning

Instantly match impedances from 12-1600 ohms using MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms with over 20,000 *VirtualAntenna*™ Memories.

Safe auto tuning protects amp

MFJ's exclusive *Amplifier Bypass Control*™ makes tuning safe and "stupid-proof"!

Digital/Analog Meters

A *backlit* LCD meter displays SWR, forward/reflected power, frequency, antenna selected, an auto-ranging bargraph power indication, and much more.

Has quick-glance auto-ranging Cross-Needle SWR/Wattmeter.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 switchable antenna coax connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total. Has binding post for end-fed long wire antennas.

Download & Upgrade Remotely

Download from internet and upgrade your MFJ-998 firmware as new features are introduced.

Plus Much More!

Built-in radio interface controls most transceivers.

Automatically bypasses with excessive tuning power.

Use balanced line antennas with external **MFJ-912, $59.95**, 1.5 kW 4:1 balun.

Small 13Wx4Hx15D inches easily fits into your ham station. 8 pounds. Requires 12-15VDC at 1.4 amps maximum or 110 VAC with **MFJ-1316, $21.95**.

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

300 Watt...Best Seller

Digital Meter, Ant Switch, Balun

The *world's best selling* automatic antenna tuner is *highly acclaimed the world over* for its ultra high-speed, wide matching range, reliability, ease-of-use! Matches virtually *any* antenna.

MFJ-993B **$259.95**

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

G5RV Antenna

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

MFJ-1778 **$44.95**

200W...Weather-sealed

for Remote/Outdoor/Marine

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926B **$279.95**

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 **$259.95**

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

Dayton HAMVENTION® 2012
Internationally Connected

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

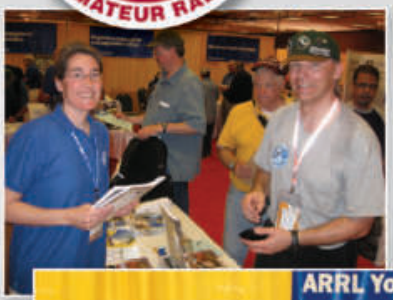
The Biggest Show on Earth

Ticket Prices: $20 in advance, $25 at the door.
General Inquiry: Dayton Hamvention®
937.276.6930 P.O. Box 964 Dayton, OH 45401

May 18-20, 2012 Hara Arena, Dayton, Ohio

ARRL EXPO 2012

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

MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $59.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ 1500 Watt *Fully Balanced* Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get superb 10 Meter performance due to MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

Ladder line, Twin lead, Insulators, Copper wire . . .

Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

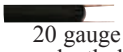
MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at midpoint with SO-239, quadruple weave-through ladder line stress relief.

MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead



20 gauge stranded copper wire. Black polyethylene. MFJ-18T050, **50 Ft.**, $24.95. MFJ-18T100, **100 Ft.**, $44.95. MFJ-18T250, **250 Ft.**, $99.95.

Copper Antenna Wire

Flexible, 7-strand, 14 gauge, hard solid-copper wire. Strong/long-lasting. MFJ-18G100, **100 Ft.**, $24.95. MFJ-18G250, **250 Ft.**, $59.95.

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 *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them with one hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

MFJ-4125 **$84.95**

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

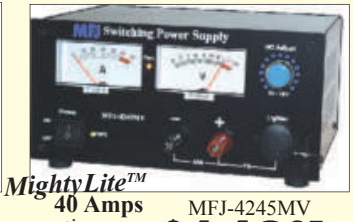
MFJ-4125P, $94.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4225MV **$99.95**

40 Amp Continuous



MightyLite™

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4245MV **$149.95**

70 Amp Continuous

75 Amps maximum and 70 Amps continuously. Adjustable voltage 4.0-16 VDC. Short circuit, overload and over-temperature protection, 10.5 lbs. 9¾Wx5½Hx9½D". Great for Ameritron's ALS-500M mobile amplifier!

MFJ-4275MV **$249.95**

High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a* single *DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

MFJ-1118 **$84.95**

MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1116 **$59.95**

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1112 **$44.95**

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

MFJ-1117 **$64.95**

All PowerPoles™

MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx1¼Hx2¾D".

MFJ-1128 **$104.95**

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®*, *extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

MFJ-1126 **$84.95**

PowerPoles™ AND 5-Way Binding Posts

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, 12½Wx1¼Hx2¾D inches.

MFJ-1129 **$114.95**

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost*.

MFJ-1124 **$64.95**

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. 1½ lbs. Tiny 3¾Wx2¼Hx3¾D inches fits easily in an overnight bag.

MFJ-4115 **$59.95**

30 Amps Continuous

Linear with 19.2 lb.Transformer

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. 9½Wx6Hx9¾D in.

MFJ-4035MV **$149.95**

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 *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 *giant* 6.5 inch SWR/Wattmeter

World's *largest HF SWR/Wattmeter has giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868 **$149.95**

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5$^{1}/_{2}$Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 7$^{1}/_{4}$Wx4$^{1}/_{2}$Hx4$^{1}/_{2}$D in.

MFJ-891 **$109.95**

MFJ *high-accuracy* Digital SWR/Wattmeter

MFJ-826B has a large high-contrast, high-accuracy *backlit* LCD display. Auto-ranging selects optimum full-scale range from 25W, 250W and 1500W ranges with full 10-bit resolution on each range. Covers entire amateur power spectrum. Built-in frequency counter selects frequency compensated data set to insure highest accuracy for each band. Displays frequency, provides digital read-out for older rigs and QRP rigs. *True* peak/average and forward/reflected power, SWR and frequency are *simultaneously* displayed. Select bargraphs to display forward/reflected power *or* forward /SWR *or* SWR only. MFJ's *PeakHold*™ freezes highest forward power displayed 1, 2 or 3 seconds. When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds. Use 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6$^{1}/_{2}$Wx2$^{5}/_{8}$Hx6D inches.

MFJ-826B **$179.95**

www.mfjenterprises.com . . . World's largest selection of HF/VHF/UHF SWR Wattmeters!

MFJ-822 **$59.95**

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862 **$69.95**

Lighted Cross-Needle Meter**,** SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864 **$99.95**

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C **$89.95**

Lighted 3" C/N Meter**,** SWR/Watts, 1.8 -30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B **$39.95**

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

tery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7$^{3}/_{4}$Wx4Hx2$^{1}/_{8}$D inches.

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 bat-

100 Watts SSB from cigarette lighter socket!

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ-4403 **$119.95**

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

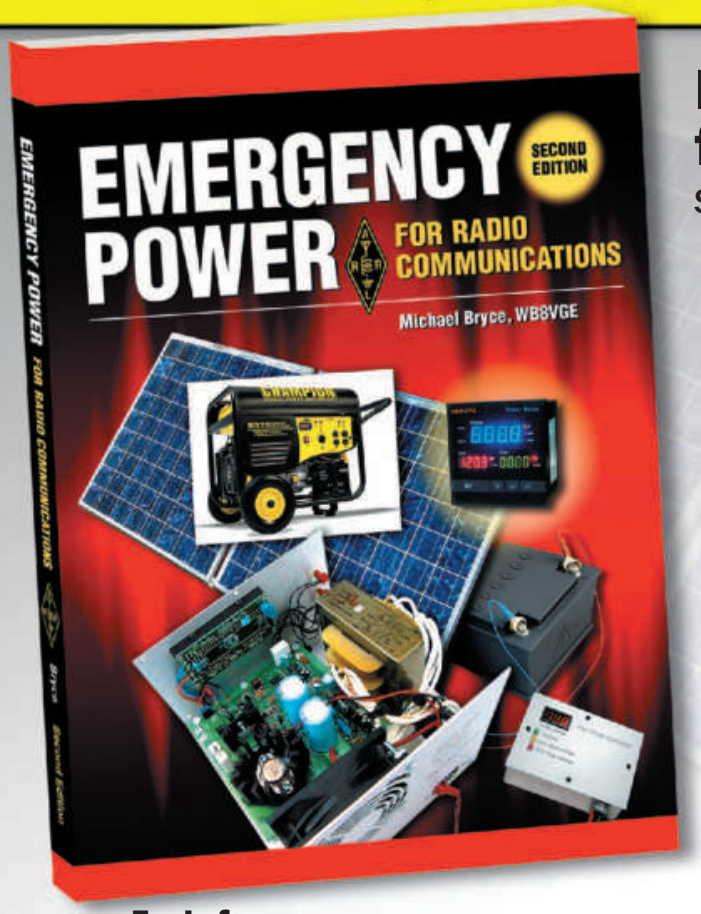
• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

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!

Be Prepared for the Next Blackout!

When the power goes out due to the next storm or natural disaster, will you be prepared? **ARRL can help...**



Emergency Power for Radio Communications

Second Edition

By Michael Bryce, WB8VGE

NEW!

Explore the various means of electric power generation for every application—from charging batteries, to keeping the lights on. This book covers the foundation of any communications installation—**the power source**. Find ways to stay on the air during a short-term or long-term power outage and reach beyond the commercial power grid. Identify methods for alternative power generation that will work best in your particular situation.

Contents:

- Keeping the Signals on the Air
- Emergency Lighting
- Solar Power
- Charge Controllers for Photovoltaic Systems
- Generators: Gas, Wind and Water
- Load Sizing
- Battery Systems and Storage
- Systems for Emergency Power
- Inverters
- Station Instrumentation
- Safety
- Emergency Practices

Plus, Emergency Power Projects from the pages of *QST*

Tools for...

- **Emergency or Backup Power**
- **Energy Independence**
- **Portable Energy**

ARRL Order No. 6153
Special ARRL Member Price!
Only $24.95 (retail $27.95)

Emergency Preparedness Items Now Available from ARRL!

NEW! Eton Microlink FR160 Radio
Self-powered AM/FM/NOAA weather radio with built in LED flashlight, solar power and USB cell phone charger. Get one radio for your disaster supplies kit and another for your ham radio "go kit."

ARRL Order No. 1150
Only $35

NEW! Solar Crank Flashlight
Be prepared for any emergency with this powerful LED flashlight. Charge it using the built-in solar polar, hand crank, or AC/DC input. Convenient hook allows for hands-free use.

ARRL Order No. 0173
Only $40

NEW! 2 in 1 Flashlight/Lantern
Never be without light! Unique design allows you to enable flashlight mode and extend for lantern mode. Provides 60 lumens (1 watt) of light and 10 hour run time.

ARRL Order No. 0264
Only $20

Order Online www.arrl.org/shop
or Call Toll-Free 1-888-277-5289 (US)

*Plus shipping and handling. Sales Tax is required for all orders shipped to CT, VA, and Canada. Price and product availability are subject to change without notice.

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)

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

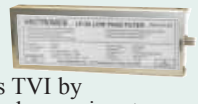
PM-30, $89.95, for 1.8 to 60 MHz.
Displays forward/reflected power, SWR simultaneously on Cross-Needle meter. True shielded directional coupler assures accuracy. Backlit meter displays peak or average power in 300/3000 Watt ranges. First-rate construction, scratch-proof case, durable paint, Lexan front 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

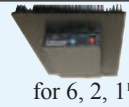
6 Meter Amplifier

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*.

Amateur TV Amps

Industry standard ATV amps: **D-1010-ATVN, $439**, 82 W PEP out/10W in. **D-100-ATVN, $449**, 82W PEP out/2W in. (without sync compression).

1¼ Meter Amps (223-225 MHz)

10 models -- 20-220 Watts out for 2-50W in, $169-$739.

Low Noise GaAsFET preamps

High gain ultra low noise *GaAsFET* preamps for receiving weak signals. Selectable 15-22 dB gain prevents intermod. < 0.8 dB noise figure, auto RF switching to 160W.

In-shack or Mast-Mount models.

Frequency, MHz	*In Shack, $149.95*	*MastMount,$199.95*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

Commercial Amps, $159 to $429

Commercial Amps for 150-174, 450-470 MHz, VHF marine bands, 70-130 Watts out.

Accurate SWR/Wattmeters

Read SWR directly and Forward/Reflected, Peak/Average power. Remote coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

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.

Monitoring Times

Explore - the - Spectrum

Tune your transceiver, scanner, or HT outside the ham bands to hear:

- Shortwave broadcasting
- Government and military communications
- In-flight aircraft
- Ships at sea
- Public safety
- Tactical and scientific satellites

...and more

Every month Monitoring Times brings you informative articles written by experienced hams and other radio experts to help you sharpen your listening skills – The latest frequency information, loggings of activity, in-depth reviews of radio equipment and accessories, background stories and schedules of international radio broadcasters, internet radio, amateur radio, and even antique radio.

CALL TODAY!

800-438-8155

www.monitoringtimes.com

Mention that you learned about us in QST and get 3 FREE MONTHS of MTXpress!

MONITORING TIMES EXPRESS

MT Express brings you the entire Monitoring Times magazine in downloadable PDF format, including free software and FTP delivery. Unavailable in the more expensive print copy, MTX is full color and easily navigated by clicking on the table of contents. Interested in foreign language programming? Only MT Express has this exclusive coverage in every issue. Search each copy with your key words for topics or station schedules. Print it out as much as you'd like to retain for your library, or keep it as an electronic file for quick reference.

Download your free sample now at www.monitoringtimes.com and click on Free Sample, or give us a call for a free print copy: 1-800-438-8155.

Monitoring Times print subscription: Only $32.95 for a full year!

Monitoring Times Express: only $19.95 for a full year!

Call today....If it's on the air, Monitoring Times has it covered!

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!

- 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

Now Shipping

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.

Signal Processing, Antenna Analysis, Data & Remote Control

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.

DSP-599zx Audio Signal Processor*

Noise Reduction, precision highpass, lowpass, bandpass & notch filtering for audio, CW & data.

ANC-4 Antenna Noise Canceller

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

Logic Level plus PTT

PK-232 RS-232-to-USB Adapter*

Use the PK-232 with new computers!

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!**

www.timewave.com
sales@timewave.com

Timewave Technology Inc.
27 Empire Drive, Suite 110
St. Paul, MN 55103 USA

651-489-5080
Fax 651-489-5066

It's No Leap of Faith...

The TH-K20A is fully equipped for clear communications – wherever and whenever needed.

TH-K20A

144 MHz FM TRANSCEIVER

Boasting 5.5 watts of RF output, Kenwood's new TH-K20A radio is powerful. Despite being small enough to fit comfortably in your hand it offers full-size performance with numerous features to ensure superb operating ease.

Both display and keypad are backlit for nighttime use, and for added convenience everyday functions are pre-programmed. This is perhaps the easiest to use and the loudest portable that you will ever own. Comes standard with a drop-in charger.

KENWOOD

KENWOOD U.S.A. CORPORATION
Communications Sector Headquarters
3970 Johns Creek Court, Suite 100, Suwanee, GA 30024
Customer Support/Distribution
P.O. Box 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745
Customer Support: (310) 639-4200 Fax: (310) 537-8235

www.kenwoodusa.com

ADS#65011

VHF/UHF DUAL BAND FM TRANSCEIVER

IC-T70A

Classic RUGGED

Modernized Classic
Rich in analog features, Icom's easy-to-use IC-T70A offers practical 2m/70cm operation and ruggedness, updated for today's ham radio enthusiasts.

Military Specifications
Tested to and passed the MIL-STD requirements and IP54 water resistance and dust protection standards.

Impressive Loud Audio
The BTL amplification increases the audio output by doubling the voltage delivered to the speaker. Greater volume in the palm of your hand!

P
I E

Long Lasting Battery
Get 5W of power on VHF and UHF in a small, lightweight package. An optional AA alkaline battery case is ideal for long storage or quick back-up.

5W
2m
70cm

Rugged MIL-STD 810

IP54

Information & Downloads

BROCHURE | MANUAL | AMATEUR TOOL KIT | COMIC BOOKS | VIDEOS | WWW.ICOMAMERICA.COM

ICOM®

HF

IC-7410 HF + 6m

USB Control Audio

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 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

IC-7000 HF/6m/2m/70cm

100W (40W AM), 50W on 2M (20W AM),
35W on 70CM (14W AM)
RX: 30–199.999, 400–470MHz*
Digital IF Filters
Digital Voice Recorder
Front Panel Separation with
Optional 3.5m or 5m Cable (As Shown)

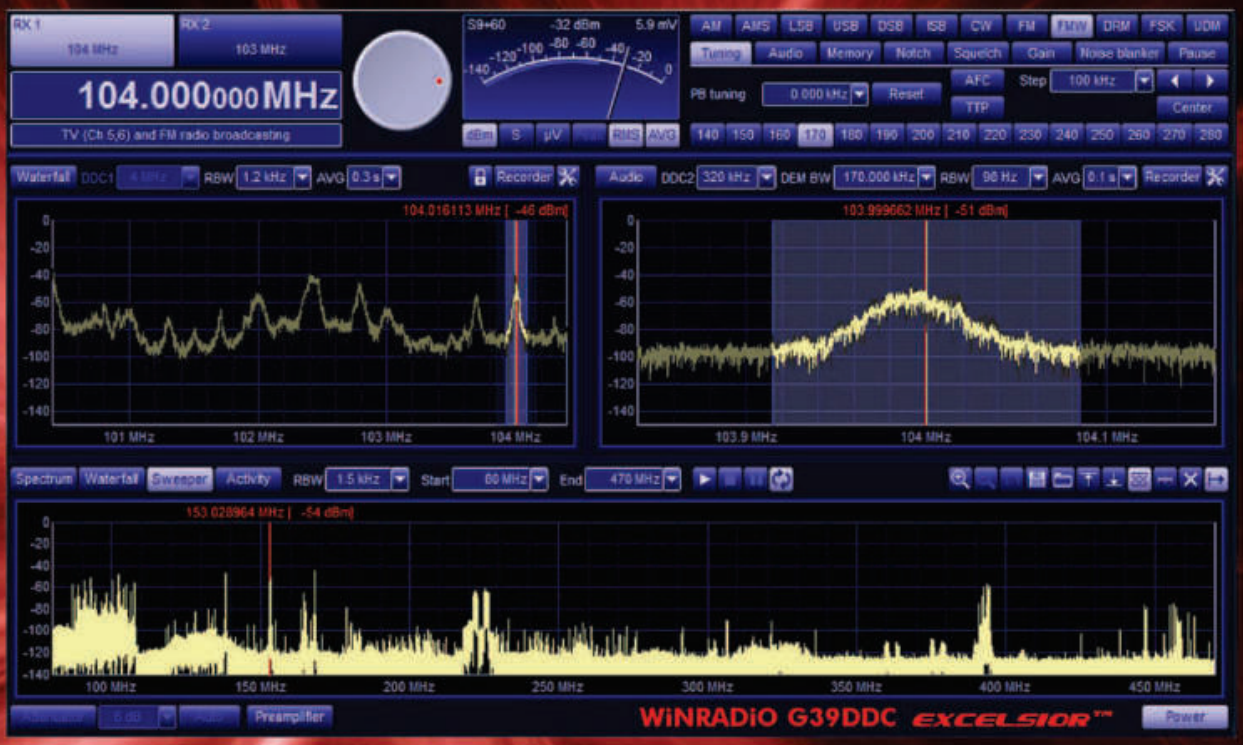
Information & Downloads

AMATEUR TOOL KIT | COMIC BOOKS | VIDEOS | WWW.ICOMAMERICA.COM

*Frequency coverage may vary. Refer to owner's manual for exact specifications.

ICOM®

The All-New *EXCELSIOR*™.



- 9 kHz to 3.5 GHz
- 16 MHz real-time spectrum
- 1 GHz/s search speed
- 2 simultaneous channels
- USB and PCIe models

Introducing the WiNRADiO G39DDC *EXCELSIOR*.
Is it a great receiver with an added spectrum analyzer?
Or a great spectrum analyzer with an added receiver?

You decide:

www.winradio.com/g39

WiNRADiO® by RADIXON®: Great receivers ahead of their time.℠

Quicksilver Radio

See us at Hamfests From Maine to Florida
Visit our Huge Display at Dayton 2012

New Item!
PWRblok4
4-Way Powerpole Splitter

Andy-Crimp *Pro*™

No other tool does all of this:

15-30-45-50-75 Amp Powerpoles
And **Molex-type Connectors**
And **Insulated Terminals**
And **Uninsulated Terminals**
And **has available dies for coax connectors**

And **is on sale for just**

$49.73

More Powerpole Stuff Than Anybody!

We sell only genuine Anderson Powerpoles. No Chinese copies here!

40W variable temperature soldering station. Blowout Sale price *$29.73*

The Ultimate Powerpole *and* Coax Prep, Strip & Crimp Kit

Includes full-cycle ratchet crimper with our Andy-Crimp Pro™ die set plus two coax die sets, two coax strippers, wire strippers and coax cutter; all in a sturdy ABS carrying case. Crimps 15-30-45-50-75A Powerpoles, Molex connectors, 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 Now for Just

Antenna Supplies

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

Quicksilver Radio Products

Sign up on our Web Site for your free newsletter.
Ham Radio news, articles, & special discounts

www.qsradio.com

Quicksilver Radio

Why does Spectrum Defense Matter to You?

Whether you operate phone, CW or digital modes, from HF to the microwave bands, spectrum is the conduit that allows connections and QSOs.

We know that radio spectrum is a resource to be treasured and protected. ARRL staff and volunteers battle against mobile broadband providers and other technology-related industries seeking to acquire access to frequencies reserved for Amateur Radio. Big business is persistent in their pursuit—and we are just as persistent in our defense to block them from acquiring bands designated for our use.

We need your support to continue the fight for our Amateur Radio frequencies. Please give generously to the Spectrum Defense Fund and help to ensure that our spectrum will always be available to the Amateur Radio community.

Go to **www.arrl.org/arrl-donation-form** to make a contribution today!

For more information, contact:

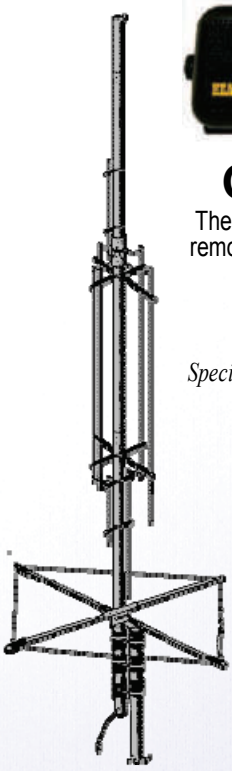
Lauren Clarke
Individual Giving Manager
ARRL
225 Main Street
Newington CT 06111-1494
Telephone: 860-594-0348
Email: lclarke@arrl.org

NEW ARRL 2012 Spectrum Defense Mug and Pin!

Support Spectrum Defense with a gift of $50 and you will be eligible to receive our newly designed 2012 Spectrum Defense pin. Make a gift of $100 or more and you can request both the mug and pin.

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



Gap Hear It Speaker

The HEAR IT SPEAKER's fully adaptive, active, DSP, removes unwanted background noise from your radio's audio output.

$159.95

Special price good through 4/20/12 or until stock is depleted, Limit 2

TITAN DX

8 Band Multiband DX Antenna Bands: 10m 12m 15m 17m 20m 30m 40m and 100 KHz on 80m, Bandwidth -- Under 2:1, Entire band on 40m 30m 20m 17m 15m 12m 10m, 100KHz on 80m, Height -- 25 ft, Weight -- 25 lbs, Mount : All hardware supplied except the 1 1/4" steel pipe. Counterpoise : 4 rigid counterpoises 80" long, Ground Area Required : None

$369.95

Special price good through 4/20/12 or until stock is depleted, Limit 2

Low Noise LFA Yagis!

Britain's InnovAntennas combine state-of-the-art design with robust construction guided by a passion for performance to create a lineup of exceptional antennas ***now available in the United States via R&L Electronics!***

50 MHz

450S	*4 Element 50MHz LFA Yagi*	**234.95**
550AWB	*5 Element 50MHz LFA-VR Yagi (4.35m)*	**309.95**
6850LFA2	*6 Element 50MHz LFA2 Yagi (6.8m)*	**464.95**
750LFA2B	*7 Element 50MHz LFA2 WOS Yagi (9.5m)*	**599.95**

This is just a few of Innovantennas products. For a complete list go to www.randl.com or www.innovantennas.com

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	**91.95**
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**

VX8GR/DR

Bluetooth Hands-Free Operation with GPS/APRS and Real RF-Dual Wideband Receive… The next generation Amateur Handheld transceiver from Yaesu, who has been introducing Leading -Edge Transceiver Technology for years.

BH1A	Bluetooth Headset Stereo	**94.95**
BH2A	Bluetooth Headset Mono	**84.95**
BU1	Bluetooth Unit	**83.95**
CD40	Charger Cradle BH1 & BH2	**25.95**
CD41	Rapid Charger Cradle	**39.95**
CSC93	Soft Case	**17.95**
FBA39	Alkaline Battery Tray	**34.95**
FGPS2	GPS Unit for VX8DR	**79.95**
FNB101LI	7.4V 1100mAh LI-Ion	**59.95**
FNB102LI	7.4V 1800mAh LI-Ion	**74.95**
MH74A7A	Speaker Mic	**64.95**
NC85B	Wall Charger for CD40	**17.95**

We have a very large stock of Yaesu. If you don't see it listed here, give us a call!

YAESU
Choice of the World's top DX'ers℠

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 cross-band 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	**35.95**
YSK8900	Separation Kit	**41.95**

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	**35.95**
YSK7800	Separation Kit	**39.95**

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 February16th through March15th will appear in May *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. See **http://www.arrl.org/news/features/2005/07/15/1/?nc=1** for further details. REMEMBER: TRANSACT CAREFULLY AND PROTECT YOURSELF.

QST Ham Ads on the Web
Updated Monthly!

www.arrl.org/ads/ham-ads.html

Club/Hamfests/Nets

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

MARCO The Medical Amateur Radio Council Ltd is a charitable non-profit group of health care professionals who meet weekly at 10:00am 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 423-479-6160. Web site www.marco-ltd.org

RAINBOW AMATEUR RADIO ASSOCIATION Serving the gay/lesbian/GLBT community since 1995. ARRL affiliated. Privacy respected. Active weekly HF/VoIP nets, newsletters, chat room, message forum, cruises, Dxpeditions. Web Site: WWW.RARA.ORG. Information: 954-502-6969 or PO Box 18541, Rochester NY 14618-0541.

Property/Vacation/Rentals

AM radio station in small-town southern market for sale. Includes 11 acres perfect for ham antenna farm. Good opportunities to build revenue, studio has living quarters. Perfect for retirement! K5GFC, 817-235-7383.

Antigua beach dx qrz.com V26WT

BELIZE VACATION QTH www.wishwilly.net

Great home in what Money Magazine called "the best town in America. 20 minutes to Philadelphia, 1 hour 40 minutes to NYC. 70ft grandfathered tower. Call Cell: 310-903-3052 for details.

COLORADO CHALET with ham gear for weekly rental, www.lostcreekcabin.com. WØLSD, Buena Vista, CO.

HAWAII DX VACATION RENTAL STEPP-IR Antennas KH6RC. 808-929-7101 www.leilanibedandbreakfast.com

Home 39.1 Acres East Central Arizona off Grid Well Solar Wind Power 10K Generator Three 71' Towers Antennas NR7G 928-245-2108

Paradise Antenna Farm. 40 acres. **Southern Arizona**, $360K, Large tall towers, many antennas, living area and ham shack. Call for details 520-398-2722 w7uo@hotmail.com

Spacious, breezy HAM house with 3 antennas for rent Barbados southeast cliff on waterfront. 2 bdrms plus enclosed porch can sleep 8. We get your license. www.bajan.info/rental; amybeam@yahoo.com

VY2TT www.peidxlodge.com

www.w0tm.com SALE RENT

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

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

COLLINS ... Owners of Collins 30S-1 amplifiers. Very rare K201, K202 and K203 relays now available. More info on **WWW.COLLINSRADIOACTIVE.COM**

Drake C-Line collector edition. Had my time enjoying them moving on. Selling for new TS-480hx fully loaded rig towards remote base station set up. R4C Sherwood Eng enhancements ser# 29090. Upgraded AC-4. T4XC installed cooling fan new finals. ser#29099. All professionally serviced by WB4HFN. You pay shipping. ve6fs@yahoo.ca

HALLICRAFTERS MANUALS $10.00 ARDCO ELECTRONICS, P O Box 24, Palos Park, IL 60464. www.ardcoelectronics.com. wa9gob@aol.com

Visit THE SOUTHERN APPALACHIAN RADIO MUSEUM! - www.saradiomuseum.org 828-299-1276. Asheville, NC.

W4QCF MANUALS - 828-298-1847 http://www.w4qcfmanuals.com

Wanted Pre1980 Historical MicroComputers for Museum Collection, Alto, Star, Notetaker, Dorado, Apple 1 and others. kk4ww microcomputercollector.com

Wanted back issues of West Coast Ham Ads, Western Radio Amateur and Electronics Journal. bob@krassa.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

CALL SIGN NAME BADGES. Club logos our specialty. Certified ARRL engraver. Capital Engraving, 3109 Marigold St, Longview, Washington 98632-3415. Al, WA7UQE. capengrave@kalama.com. http://www.kalama.com/~capengrave/

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

FREE SAMPLES. The QSLMAN®, Box 73, Monetta, SC 29105. Phone/FAX (803) 685-7117 anytime. Email: w4mpy@qslman.com. Always 100% satisfaction guarantee on anything we do. Check the web site at: http://www.qslman.com

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

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.HamStuff.com by W7NN

www.airmailpostage.com

General

220 Megacycle Wacom Duplexers 100 watt amplifiers for sale, W8JVV dungey@charter.net

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

Colins Radio 32V3 Transmitter $750. R390A Receiver $750. 5KW Generator For Sale $250.High voltage filter capacitors 120 mfd 3,000 volts dc , 100 mfd 4,000 volts dc $50.00 each. RF signal generator Measurements Corp. 25 mhz to 960 mhz, Model T1034C $100.00. Audio Signal Generator 20 hz to 200,000 hz adjustable output 0-10 volts ac $100.00. 200 feet Andrew 7/8th inch coax cable $200.00. Insulator for series fed tower $150.00. Manuals available for the Collins 32 v transmitter and the 5KW generator. Equipment all in good to excellent condition. 520-398-2722 wes0331@gmail.com

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**

CW Ring Tones for Your Cell Phone: Customized text, be creative! Visit www.SuperBertha.com then click Amateur Radio, then click CW Ring Tones.

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

FT 690 with FL 6010 Amp for Multimode 70 cm XCVR (619) 749-9609

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 Electronics 609-846-5190 Email k3ten@verizon.net Web http://www.k3ten.com All Hybrids plus the TS-930,TS-940, TS-950, TS-2000, TS-430, TS-440, TS-850s, TS-450s, TS-690s. **"TL-922 HF Power Amplifier Upgrades and Repairs, Please call for other Amplifier Brand Repairs"**

Kenwood, Hybrid repairs and restoration 520, 520S, 520SE For more info please call **856-447-3391**

Kitano Key $175.00 & $5. S&h. www.kitanokey.com or k9kray@addressisp.com

LEARN CODE by Hypnosis, www.success-is-easy.com 561-302-7731

MicroLog-By-WA0H .. Easy to use logging program .. Free download .. www.wa0h.com

OWA Yagis by WA3FET/K3LR: Bust pileups using proven DX and Contest winning "Ultimate OWA Yagis"! Visit www.SuperBertha.com for info and free PDF catalog.

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 J38 half scale CW key full function polished brass w/mahogany or black base $85.00 post paid U.S. KA6IRL@Gmail.com

RFI Filters www.RFchoke.com

Rohn BX Tower 2-7 with Hardware 860-338-3162

Sell large American, Russian, European tube collection: http://www.proradioantic.ro/index.php?x=colectii PICK UP ONLY: Queens, NYC. wb2aqc@nyc.rr.com

St Petersburg FL has a store, Ralph's Hobbies and Amateur Radio Supply - 5208 66th St. N, Call 727-547-8607 - for directions.

SuperBertha...BudgetBertha...EcoBertha Rotating Monopole Towers: No guy wires, Entire pole rotates, Ground level rotor. Stack and rotate all your antennas at optimum heights on one monopole. Visit www.SuperBertha.com for info and free PDF catalog.

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

WE BUY/SELL RADIOS. **#1 IN ESTATES** – www.recycledradio.com (603) 942-7173

Wilson antenna parts, manuals, rotors and accessories: www.antennapartsoutlet.com

WOOD BADGES & LICENSE FRAMES - www.Gifts4Hams.com

WORLD FINEST AMATEUR RADIO EMBROIDERY HATS SHIRTS JACKETS www.hamthreads.com 817-471-4488

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! Your membership in AMSAT will support projects 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 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.

QST Index of

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
May 2012	Wednesday, March 14, 2012	Friday, March 16, 2012
June 2012	Friday, April 13, 2012	Monday, April 16, 2012

For links to the Web sites of all ARRL advertisers, visit www.arrl.org/ads/adlinks.html

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.

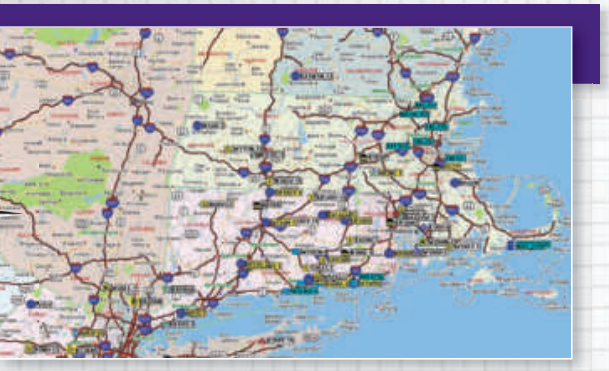
www.arrl.org/QuickStats

Online QuickStats Poll Results for January 6 through February 6.

Get on the web and vote today at **www.arrl.org/quickstats**!

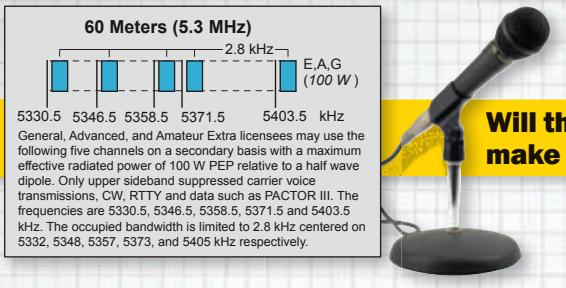
Are you active on APRS (Automatic Position Reporting System)?

Yes: **21%**
No: **75%**
I don't know what APRS is: **4%**



Will the new privileges on the 60 meter band make you more inclined to operate there?

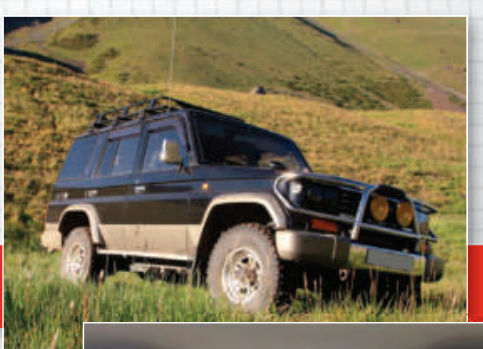
Yes: **36%** No: **64%**



General, Advanced, and Amateur Extra licensees may use the following five channels on a secondary basis with a maximum effective radiated power of 100 W PEP relative to a half wave dipole. Only upper sideband suppressed carrier voice transmissions, CW, RTTY and data such as PACTOR III. The frequencies are 5330.5, 5346.5, 5358.5, 5371.5 and 5403.5 kHz. The occupied bandwidth is limited to 2.8 kHz centered on 5332, 5348, 5357, 5373, and 5405 kHz respectively.

Do you still have some vacuum tubes in your parts box?

Yes: **61%**
No: **35%**
I don't have a parts box: **5%**



Do you have a call sign license plate on your vehicle?

Yes: **59%**
No: **39%**
I don't own a licensed vehicle: **2%**

powerwerx.com

Bringing you the best in DC power products!

WOUXUN

KG-UV3D

$119.99

Affordable, full featured, compact, 2M/440MHz dual-band handheld

- Full 5 Watt Power Output on VHF, 4 Watts UHF
- High capacity (1700 mAh) Li-ion battery pack included
- Dual-band monitor (VHF/UHF, VHF/VHF, UHF/UHF)
- Dual Alpha-Numeric Backlit Display w/ 128 Channels
- Desktop 3 1/2 hour rapid charger included

See our complete new 2012 handheld and accessory line, visit powerwerx.com/wouxun

FCC Certified

2M/220 Dual-Band model also available at the same low price!

USB Computer Programming Cable — **Only $15.99**

Extended life 1700 mAh Li-Ion Battery — **Only $27.99**

Economy Speaker Microphone — **Only $15.99**

AA Battery Pack (holds 5 AA batteries) — **Only $10.99**

30 Amp Desktop Supply with Powerpoles

$119.99

- 13.85 VDC output, 25 Amps continuous and 30 Amps surge
- Switchable input 115/230 VAC
- Small 6 x 5 x 2.5" footprint
- Quiet internal cooling fan
- 3 Year limited warranty

SS-30DV

NEW!

Rack Mounted 30A Power Supplies in Single or Dual configurations

Anderson Powerpoles

Adapter & Extension Cables

OEM Connectors & Filters

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

- 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!

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!

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	$289
Yaesu G-550	$389
Yaesu, G-800SA	$389
Yaesu, G-800DXA	$489
Yaesu, G-1000DXA	$599
Yaesu, G-2800DXA	$1289
Yaesu G-5500	$699

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

1108 Summit Avenue, #4 • Plano, TX 75074
Hours: M-F 9 AM–5 PM Central Time
Email: sales@texastowers.com

TOLL FREE **(800) 272-3467**

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
Choice of the World's top DX'ers℠

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 some areas. Frequency coverage may differ in some countries. Check with your local Yaesu dealer for specific details.

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

The Legend Continues

TS-520 - 1973

TS-570D - 1997

TS-590S

Ask any experienced Ham which HF radios have the best audio tone, the answer has always been Kenwood! The TS-590S is perhaps the best receiver you can buy for the dollar, but it not only starts there. DSP flows throughout the radio and the Noise Reduction is arguably the best in the business. Don't be fooled by big boxes, high price tags, and complex operation.

Kenwood continues to build outstanding products with unparalleled performance and value. It's not too late to own a Legend, because we are still building them today.

KENWOOD

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

www.kenwoodusa.com

ISO9001 Registered
Communications Equipment Division
Professional Systems Business Group
JVC KENWOOD Corporation

ADS#69011

Scan with your phone to download TS-590S brochure.