SPECIAL DIY ISSUE

# QST

DEVOTED ENTIRELY TO AMATEUR RADIO

January 2013 WWW.ARRL.ORG

# Celebrate the Homebrew Spirit!

**QST reviews:**



**Inside:**



Official Journal of ARRL
The national association for AMATEUR RADIO

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YAESU

The radio

# Choice of the

## Covering HF and 6 meters the FT-DX9000 Series answers the call for the ultimate DX base station.

### FT DX 9000MP

No other Amateur transceiver offers you 400 Watts of transmitter power for the biggest, cleanest voice on the bands. And switching to Class-A operation at 100 Watts of output, you enjoy the benefits of ultra low distortion others can't match at 100 Watts! Two pairs of Meters, plus LCD Window; Data Management Unit and Flash Memory Slot Built In. Main/Sub Receiver VRF, plus Full Dual Receive Capability, External 50V/24 A Switching Regulator Power Supply and Speaker with Audio Filters.

### FT DX 9000D

The "Fully loaded" model represents the total FT DX 9000 experience. Included is the large TFT display, along with 1.8-14 MHz high-Q "μ" front-end RF tuning circuit, utilizing a large-diameter 1.1" (28mm) ferrite core and precision motor drive. Its Q of over 300 provides razor-sharp RF tuning-ideal for today's crowded bands! Large TFT, Data Management Unit and Flash Memory Slot Built In, Main/Sub Receiver VRF, plus Full Dual Receive Capability, Three μ-Tuning Modules for 160 – 20 M, 50 V/12 A Internal Switching Regulator Power Supply


### FT DX 9000 Contest

The FT DX 9000 gives you the opportunity to build up your radio to match your operating style and competitive requirements. World-class ergonomics combine with leading-edge performance to put more QSOs in your log faster. This is what Amateur Radio is about: building the best, so you can be your best! Two Pairs of Meters, plus LCD Window, VRF Input Preselector Filter, Three Key Jacks, and Dual Headphone Jacks, 50 V/12 A Internal Switching Regulator Power Supply

## FT-2000, FT-2000D, FT-950 and the FT-450D

### FT-2000 and FT-2000D

This rugged DX hunter has power and performance to spare. The FT-2000 provides a full 100 Watts RF output on 160 through 6 meters with an internal power supply, but the FT-2000D version doubles down with 200 Watts and an external supply. The impressive feature list for both versions includes dual receive capability for effortless split frequency operation; a receiver front-end VRF (Variable RF Tuning) preselector; 1st IF roofing filters (3/6/15 kHz) for superb dynamic range; variable IF bandwith and IF Shift; receiver DSP with Auto-Notch, Manual Notch, Digital Noise Reduction; and a continuously-variable passband contour control.

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

# Top DXing Rig Picks

# *World's top DX'ers*

***For communications to the farthest corners of the world***

## FT DX 5000 Series

The FT DX 5000 Series HF/50 MHz 200 Watt Transceivers are a premium Class of Yaesu radios with 2 Independent Receivers plus many options and accessories designed for the serious DXer.

With 112 dB dynamic range and an IP3 [3rd Order Intercept Point] of +40 dBm (CW, 500 Hz BW), you'll find extra sharp roofing filters for VFOA/Main receiver are selectable between 300 Hz (optional on some versions), 600 Hz, 3 kHz, 6 kHz and 15 kHz.

Three electro-luminescent sub-displays indicate sub frequency, graphical wave and menu functions. Additional features: Parametric Microphone Equalizer; Dual Receive In Band Function Contest-ready Antenna Selection; Manual and Automatic Digital Notch; High Speed Automatic Antenna Tuner; DSP Noise Reduction.

### FT DX 5000MP

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

### FT DX 5000D

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

### FT DX 5000

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


### FT-950

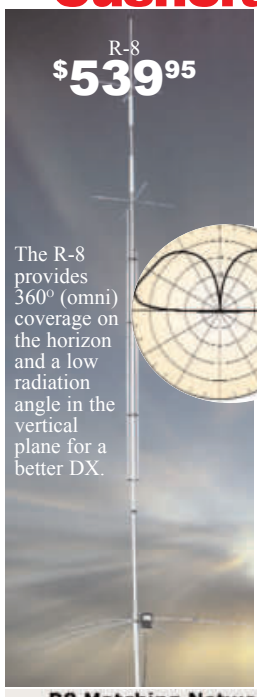
Whether you're a serious or casual DXer, the Yaesu FT-950 should be at the top of your list. The FT-950 packs a 100 watt punch on 160 through 6 meters and includes a built-in antenna tuner; triple-conversion superheterodyne receiver; three factory-installed 1st IF roofing filters; variable IF bandwidth and IF shift, manual IF notch filter, an Automatic Digital Notch Filter (DNF) and many other expanded features available with optional DMU-2000 Data Management Unit.

### FT-450D

This easy-to-pack radio is a DXpeditioner's dream come true – a lightweight, high performance transceiver spanning 160 through 6 meters with 100 Watts RF output. When it's time to wade into the pileups, you'll appreciate the FT-450D's 10 kHz bandwidth roofing filter in the 68 MHz first IF, right after the first mixer. This filter provides outstanding selectivity when the going gets rough – a feature rarely found in rigs in this price range!

# Cushcraft R8 *8-Band Vertical*

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




The R-8 provides 360° (omni) coverage on the horizon and a low radiation angle in the vertical plane for a better DX.

**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!

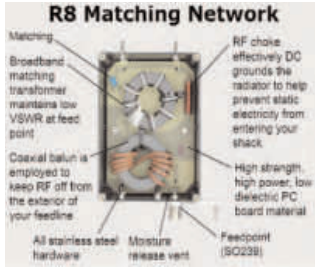
**Rugged Construction:** Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

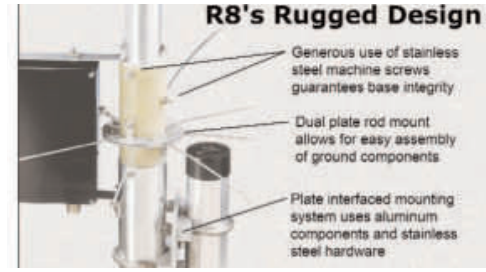
**Compact Footprint:** Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

**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.



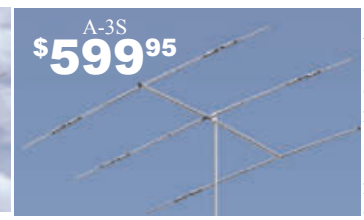

# MA-5B *5-Band* Beam

***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.

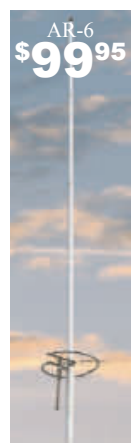
**The** 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

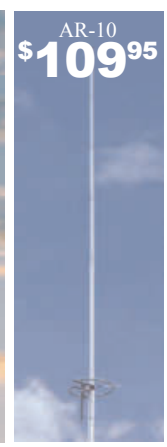
## Cushcraft Dual Band Yagis

***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 *Ringos* 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
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• **Sales/Tech:** 662-323-5803 • **FAX:** 662-323-6551
***http://www.cushcraftamateur.com***



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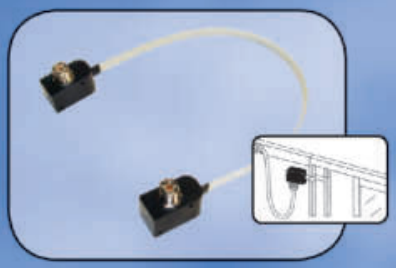
# Life is a JOURNEY, Enjoy the ride!



## NEW! COMET CTC-50M
### Window Gap Adapter!

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

## MALDOL HVU-8
### Ultra-Compact 8 Band Antenna!

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

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

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

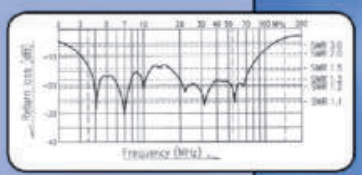
## COMET CHA-250B
### Broadband HF Vertical!

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

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

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

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




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

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

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

COMET and Maldol

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

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

# In This Issue

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## Technical




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## News and Features

**Our Cover**
Our January *QST* cover celebrates the joy of Do-It-Yourself hamming. Among the items shown (clockwise from left center): A Small Wonder Labs (**www.smallwonderlabs.com**) RockMite transceiver for 20 meters built into a "ham" can by Dar Piatt, W9HZC; a 40 meter CW transmitter built in 1974 by ARRL RFI Engineer Mike Gruber, W1MG; a 6 meter direct-conversion receiver built by ARRL Senior Engineer Zack Lau, W1VT, and a digital station clock (**www.arrl.org/shop**) assembled by ARRL Product Review Engineer Bob Allison, WB1GCM.


# Radiosport




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# Columns



# Departments



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# The King of Mobile

- Massive Heatsink guarantees 75 Watts of Solid RF Power with No Cooling Fan Needed
- Loud 3 Watts of Audio Output for noisy environments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users




HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

## FT-2900R

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

NEW

2 m MONO BAND




## Best Selling, Reliable Mobile

- 55 Watts of Solid RF Power within a compact footprint
- Loud 3 Watts of Audio Output Power for noisy enviroments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

## FT-1900R

2 m MONO BAND

Size: 5.5" (W) x 1.6" (H) x 5.8" (D) / Weight: 2.2 lb

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

# A TECHNOLOGY BREAKTHROUGH

## New Advanced VX-8 Series GPS/APRS® Handheld Transceivers
## Choose the Yaesu that meets your APRS® operating preferences in the field

50/144/(222)*/430 MHz
FM 5 W/AM 1W (50 MHz) Triple Band Handheld
**VX-8DR** * 222 MHz/1.5 W (USA version)
(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)


Actual Size

144/430 MHz
FM 5 W Dual Band Handheld
**VX-8GR**
(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)


Actual Size

# VX-8DR NEW

**All-in-one Prestigious Tri-band Transceiver**
**Bluetooth® for hands-free Operation with optional accessories**
**Waterproof/Submersible IPX 7 rated - 3 ft for 30 minutes**

Optional GPS and antenna unit for GPS/APRS® operation

Attached to the radio (microphone input) using the optional GPS Antenna Adaptor CT-136

The optional GPS Antenna Unit FGPS-2 attached to the optional speaker Microphone MH-74A7A

Bluetooth®

# VX-8GR NEW

**144/430 MHz Dual Band Transceiver with GPS unit included**
**Built-in GPS Antenna - Waterproof**
**Wide Band Receive for 108-999 MHz** (Cellular blocked – US Version)

## Supports APRS® communication by the Built-in Worldwide Standard AX.25 Data TNC

**The VX-8 series radios are compatible with the world wide standard APRS® (Automatic Packet reporting System) using the GPS system to locate and exchange position information.**

- SmartBeaconing™ Function
- Memories to list 50 stations
- Memories to store 30 APRS® messages
- DIGI-PATH routing indication function
- 8 DIGI-PATH routing settings
- GPS Compass Display - "Heading Up" or "North Up"
- APRS® Symbol Icon pre-set function
- Clearly displayed APRS® Beacon Messages
- Selective Message Received indicated by Flashing LED



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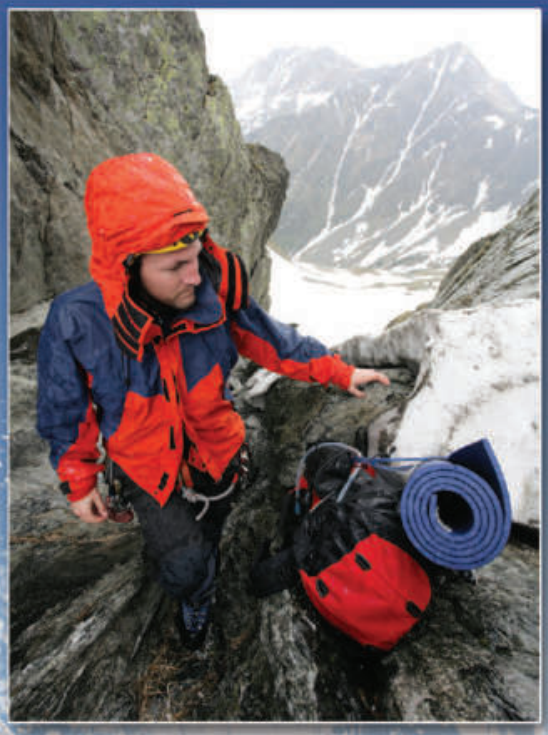

# Field Gear That Goes The Distance!

## FT-897D

HF/VHF/UHF Portable Operation Powerful Transceiver

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

## FT-817ND

The Ultimate Backpack, Multi-Mode Portable Transceiver

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

## FT-857D

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

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

## FT-450D

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

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

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

# Exceptions

*"We live in an era blessed with telecommunications services that could not have been imagined just a few years ago. Mobile broadband allows us to access information and communicate with almost anyone from almost anywhere, at almost any time. But there are exceptions."*

Like other Red Sox fans I remember the 1986 World Series. For most, the dominant memory is the shock of seeing the error that caused defeat to be snatched from the jaws of long-awaited victory. Mine is of being in Buenos Aires at the IARU Region 2 Conference, unable even to hear the games.

A generation later, while attending the IARU Region 3 Conference in Ho Chi Minh City I was able to follow the November 6 election results on my laptop as quickly and in as much detail as if I had been home. While on an excursion to the Mekong Delta a few days later I watched another conferee as he kept up with his e-mail and tracked the progress of our bus on a map on his iPad.

Although we have only enjoyed these capabilities for a relatively short time, they have become such an integral part of daily life that it can be very disorienting to be without them. Yet, we know that no technology is 100% reliable and no infrastructure can reach every point on the planet. Access to good communications is the rule but we must be prepared for the exceptions. As radio amateurs we are, or should be, better prepared than most of our fellow citizens.

When it comes to radio communication and to Amateur Radio in particular, exceptions can be both good and bad. Of all the users of the radio spectrum, amateurs are by far the most knowledgeable about the vagaries of ionospheric and tropospheric propagation. We want to communicate as reliably as anyone, but we also want to experience the thrill of reaching out past our normal limits. There are many among us who live to exploit unusual band openings; you may not hear them on the air from day to day, but if propagation conditions look promising they will come out of the woodwork.

What's good for us may be bad for others, particularly if they haven't taken exceptional propagation into account. A recent case in point involved the Township of Woodbridge, New Jersey. In December 2008 the FCC granted the Township's request to use 15 frequency pairs in television channel 20 (506-512 MHz) for a trunked land mobile system serving its police, fire, emergency and other government services. TV channels 14-20 (470-512 MHz) are shared between broadcasting and the fixed and land mobile services, but land mobile operation is limited to certain metropolitan areas and the idea is to maintain enough geographic separation from TV transmitters that interference is avoided. Installation of the new system was completed in late summer 2009 at a cost of approximately $10 million.

Woodbridge is about 95 miles from a channel 20 TV transmitter in Waterbury, Connecticut. That might be far enough apart to avoid interference most of the time. However, any amateur in the Northeast with UHF operating experience could have predicted what happened: Woodbridge's shiny new system often was rendered useless by tropospheric ducting, which occurs frequently and for long periods of time along the coast. The digital TV signal drowned out the handheld portables used by Woodbridge's public safety personnel.

In September 2012, three years after its $10 million system went into operation, the Township received permission from the FCC to substitute frequencies in TV channel 19 for the remaining ones it had been using in channel 20. (Some of its operations had been shifted to frequencies in channel 16 two years earlier.) By staying in the so-called "T-Band" the Township was able to preserve most of its investment, but in the meantime the safety of its citizens and personnel was compromised.

Woodbridge's experience notwithstanding, ducting is a rather benign weather-related phenomenon. A hurricane is not, as Sandy demonstrated on October 29. By the time most hurricanes make it to the northern latitudes they don't pack as much of a punch as they do in Florida and the Gulf. Sandy was an exception. Considering the magnitude of the storm the communications infrastructure held up pretty well. Even so, four days later the FCC reported that in the most severely impacted area 15% of the cell sites were still out of service. The wired telecom network fared no better, with widespread outages caused by power failures and downed lines. Despite being victims of the storm themselves, hundreds of amateurs answered the call to report to shelters, Emergency Operations Centers and hospitals and to provide SKYWARN observations. It was an exceptional response to an exceptional situation.

Most of the time, we can rely on electricity to reach our homes and businesses. We can pick up a telephone, confident that we will hear a dial tone. We can open a web browser and expect to see a home page. We can look at a cell phone and see the little bars that say we have service. We can count on our favorite repeater being there if we want to talk to someone.

Most of the time, we can. Sometimes we can't. One measure of our skills as radio amateurs, of our ability to be of service to our communities, is how well we handle the exceptions.

# 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 . . .***

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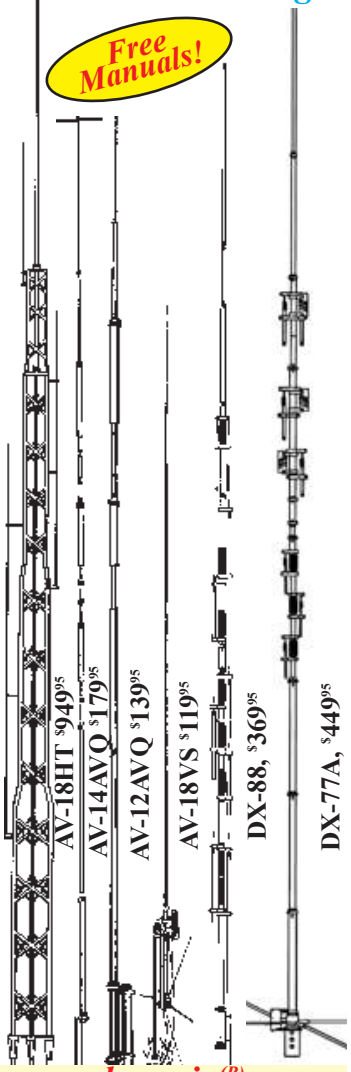


## hy-gain® Classics

***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.

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**Coming Soon!**

Dual TFT Display and Dual Receiver covers the HF amateur bands plus 6 meters

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IF DSP Filtering, Internal TNC

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**TS-480HX/TS-480SAT**
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Separate control panel is perfect for base or mobile use.

## ICOM

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**IC-718**
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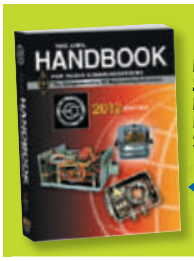


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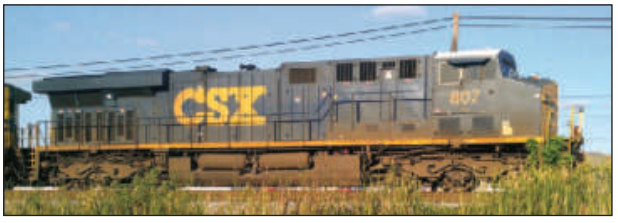
Remember when 807 transmitting tubes were as common as laptop computers are today? John Morton, WA4UMR, found this "807" hard at work.

John writes, "I have to admit we're comparing apples and crowbars here. This 807 weighs 432,000 pounds and can exert nearly 200,000 pounds of force on the drawbar. Power output is 3300 kW, or 4400 horsepower."

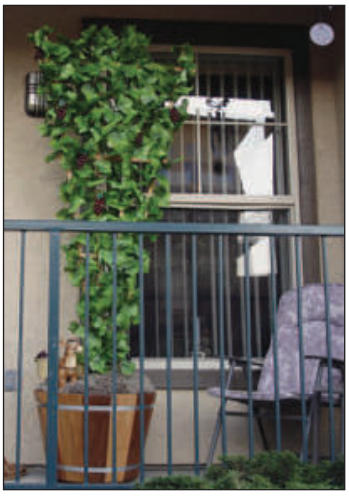



This 807 is a GE model ES44AH ready to pull a train south out of Osborn Yard (CSX Transportation) on the south side of Louisville, Kentucky. [John Morton, WA4UMR, photo]

In keeping with the railroad theme, Bob Morrow, N7PTM, spied this hopper car in Helena, Montana.

How much "coax" can a railroad car hold? We're guessing quite a bit! [Bob Morrow, N7PTM, photo]

KDØPHG's J-pole began life in a bucket. [Bud Chick, KDØPHG, photo]



The J-pole transformation is complete! [Bud Chick, KDØPHG, photo]

Bill Burek, ACØVC, passed along these photos of Bud Chick's, KDØPHG, approach to a stealth antenna. Bud has homeowner association issues where he lives. To make matters worse, Bud is also located on the ground floor, so there is always pedestrian traffic walking past his small patio. Bud's solution to enjoying 2 meter FM began with a J-pole antenna mounted in a bucket of cement. His creative wife took over from there and an extremely stealthy antenna came into being. Antenna? What antenna?

## Inside HQ

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

# The Joy of Kit Building

### This issue of *QST* celebrates the DIY spirit of Amateur Radio

This is our fourth annual DIY (Do It Yourself) issue and it is one of our most popular special editions of the year.

Hams have a long tradition of building their own hardware. When it comes to kits, we usually think in terms of assembling electrical and electronic devices. However, "kit" building often extends beyond this definition. For example, almost every HF antenna and many VHF/UHF antennas that we buy or build are kits that require user assembly. Our stations themselves are not kits, per se, but they are comprised of an integrated assemblage of components such as microphones, headsets, CW paddles, tuners, amps, etc.

This issue of *QST* kicks off a larger organizational focus on DIY and kit building activities for 2013. Based on our experiences with the kit building activities we've organized at hamfests and League conventions, we are working on a more structured approach to kits that will provide positive outcomes for newcomers as well as experienced hams. We intend to offer a variety of devices with a more systematic progression of kits later this year. We'll also be adding more kit reviews to *QST*'s "Product Review."

## iOS App

This month we're proud to announce the debut of the *QST* iOS app for iPhones, iPads, iPod touches and other Apple devices. Many members have requested this app and it's now available in the iTunes store under "*QST*." For those of us who are never more than five feet from our "iDevices," the dedicated app will allow us to download an issue of *QST* and read it even if we are off line.

Sorry, there is no dedicated app for Android devices yet. Android users can still read issues of Digital *QST* on their devices using web browsers, but they cannot yet download and save them. Our digital publishing partner, Nxtbook, tells us they will be adding additional app-like features to the Android browser environment in 2013.

## International Members

The digital edition of *QST* has been quite popular with our international members. Rather than waiting for the print edition to arrive, members in other countries can now enjoy the digital edition of the magazine on the same day it is available to American amateurs.

Delivering paper *QST*s to countries in certain parts of the world has always been problematic and expensive. As those of us who send QSL cards to other countries know, some postal services are much less efficient than others. In fact, *QST* delivery often takes many months to reach international members in remote parts of the world.

ARRL international membership has been growing rapidly, so postal delivery problems have become an increasing concern. There are presently about 9800 ARRL members in 131 countries. In case you were wondering, after the USA, Canada has the highest number of ARRL members, followed by Japan, Great Britain, Germany, Australia and Italy.

If you are interested in the international aspects of Amateur Radio, check out the new International Amateur Radio Union (IARU) website at **www.iaru.org**. It has recently been redesigned and is full of information about our sister Amateur Radio societies and other international Amateur Radio activities.

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- **ARRL Member Directory**
  Connect with other ARRL members via a searchable online Member Directory. Share profiles, photos and more with members who have similar interests.

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

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

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

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

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### Quick Links and Resources

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

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

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

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

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**Steve Ford, WB8IMY, upfront@arrl.org**

## Grand Canyon Repeaters

The Grand Canyon in Arizona is 277 miles long and the most popular access point is on the South Rim at Grand Canyon Village. About 5 million visitors pass through the Village every year. Thanks to past and present hams, there is Amateur Radio infrastructure at the Village that extends deep into the Grand Canyon. Any licensed ham with a handheld transceiver can access it.

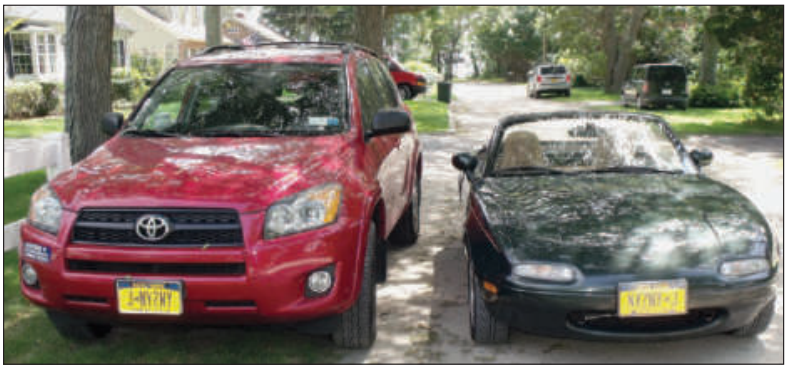
From anywhere in the Village you can reach the Hopi Point repeaters (147.320 MHz + / 442.075 MHz +; no CTCSS) with a handheld transceiver on low power. Paul Glazer, WB6JAA, has his IRLP/EchoLink radio on the Hopi Point VHF repeater, which can be linked worldwide. Sean Fielding, KL1SF, has an I-Gate in the Village that provides great APRS coverage there.

The National Weather Service has Amateur Radio based weather stations WX7FGZ-1 and WX7FGZ-2 at Indian Gardens and Phantom Ranch deep within the Canyon. Every 5 minutes they transmit weather reports over APRS, which are captured by KL1SF's I-Gate up on the Rim. The weather stations also operate as APRS digipeaters relaying messages out of the Canyon to the worldwide APRS infrastructure. KL1SF's I-Gate supports the APRS e-mail protocol so you can send short e-mails to your friends over the Internet.

What about using voice communications in the Canyon? The Hopi Point repeaters have limited coverage on the Bright Angel trail (the most popular Canyon trail) and no coverage at Phantom Ranch. I found that I could communicate from Phantom Ranch or anywhere on the Bright Angel or South Kaibab Trails to someone who was standing at any of the South Rim overlooks. Unfortunately, communications are lost when the person at the overlook retreats a short distance from the Rim.

There are places you can park a vehicle near the Rim and get good coverage down inside the Canyon. For years I have been using my Jeep's Kenwood D700 transceiver as a crossband repeater to link my signals from inside the Canyon to the IRLP/EchoLink node up on the Rim. Using a gain antenna on the vehicle, I can get full quieting from most places in the Canyon with only ½ W of transmit power. — *George Helser, W7SAZ, IRLP node 4243*

When parked close to the South Rim W7SAZ's Kenwood D700-equipped Jeep can crossband signals from down in the Canyon to a repeater and IRLP node up on top. [George Helser, W7SAZ, photo]



## Ingenuity Trumps Bureaucracy

In 2010, I applied to New York state for a ham radio license plate with my new call, NY2NY. I was informed by the state that "NY2NY" had already been issued in error to a non-ham as a "vanity" plate. After several unsuccessful appeals, I decided to apply for two vanity plates of my own for my two cars: "J-NY2NY" and "NY2NY-J," which were promptly issued by the state. There is more than one way around the bureaucracy! — *Jay Buscemi, NY2NY*

Dueling plates: J-NY2NY and NY2NY-J.

## Does The FCC Speak with Greater Authority in Ravenna?

I saw this sign displayed on the rear of a building in Ravenna, Ohio, and did a double-take. How could this small town warrant a Field Office for the Federal Communications Commission? Although the FCC exercises a lot of power, the "God is still speaking" tag line seemed to be a bit of an overstatement.

Upon driving around the corner and seeing the front of the building I realized that it was the local First Congregational Church. I guess the radio scofflaws in the area can breathe a sigh of relief. — *Jim Aylward, KC8PD*

# Let's Make This a Year to Remember...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# Letters from Our Members

## Renewing a License is the Ham's Responsibility

I have been reading about the latest restructuring proposal granting element credit to expired licensees ["Happenings: FCC Seeks to Change Amateur Radio Licensing Rules, Allow Additional Emission Types," Dec 2012, pages 64-66]. I am not in favor of this at all. Let's assume someone has an expired General Class license from 30 years ago and wishes to be reinstated. The body of knowledge of the exams circa 30 years ago is completely different today. To hand that person a ham license without re-examination is unconscionable. At VE sessions, there are often previously licensed candidates present for re-examination who understand that re-examination is necessary for their own edification to be a knowledgeable ham. If someone wants to return to Amateur Radio, the license should be *earned* and not just *given* away.

Amateur Radio places a lot of emphasis on education and being informed about the latest technologies and theories; to allow *carte blanche* element credit is a contradiction to this tenet. Having one's license lapse is nobody's fault — other than the amateur's. The current two-year grace period for renewing a license is more than sufficient.

**Gordon Bello, K1GB, ARRL Life Member**
Waltham, Massachusetts

## Safe Driving

I found the article by John Swartz, WA9AQN, to be quite interesting ["Distracted Driving and Amateur Radio — A Civil (Law) Perspective," Nov 2012, pages 81-82]. As a practicing ophthalmologist, I am aware of the neurophysiology of vision and the requirements for safe driving. Safe driving of a motor vehicle requires acute central vision, good peripheral vision, alertness, attentiveness, awareness and, at times, quick responses to dangers. The visual images and auditory sounds are processed digitally by the brain. Processing of sounds may at times be distracting, whether the sounds come from a child in the back seat who needs discipline, a spouse in the front passenger seat engaging the driver in intense conversation or sound coming from the speaker of a mobile radio. There was a fatal accident in my area when a teenage driver was apparently distracted by friends in the back seat who were loudly celebrating.

The content and intensity of the conversation is more relevant to the level of distraction than the location of the sounds. That is why there is no statistical difference in accident rates between hands-free and hands-on cellular use in the car. Mobile ham radio conversations tend to be less intense than cellular conversations. The key to safe driving is to keep your eyes on the road. Adjusting the HVAC mode control or changing a CD can be visually distracting. Modern mobile VHF/UHF transceivers allow the vehicle operator to change bands and change memory channels without looking at the display. If traffic conditions worsen, I put down the microphone. I have never had an accident in more than 30 years of mobile operating.

**Richard R. Jamison, MD, WA2QDP**
Pittsford, New York

■ I read with interest the article by John Swartz, WA9AQN, that suggested hams concede that mobile operation constitutes distracted driving and that we should voluntarily cease mobile operation, be it regulated or not. I find both John's suggestion — and the comments by the legislator in Illinois he relies upon — both ridiculous and insulting.

The accident that John cited in Gray Summit, Missouri was used out of context to support his position; the accident involved texting while driving, not radio operation while driving. Truckers and hams have operated mobile for at least 50 years without this becoming an issue. Texting while driving should be treated differently. It is exponentially more likely to contribute to an accident than Amateur Radio operation, adjusting or listening to a car radio, having a conversation with a passenger or even looking out the window. No driver pays total attention to the road at every instant, and accidents do happen. Does this mean we should all stay home today? No. Instead, each person should consider her own situation prior to choosing to drive, much less before any mobile operation.

I am a lawyer in North Carolina. I have practiced law for 26 years and have been on both the plaintiff's and the defendant's side in accident cases. These comments are not offered as legal advice, but as simple common sense — something that is far too often lacking in the legal system these days.

**Glenn Lassiter, KC4GL**
Pittsboro, North Carolina

## Tried and True

While driving in Baltimore a few days after Hurricane Sandy, I was quite surprised — and delighted — to hear a commercial on FM radio for ham radio. The commercial described some recent natural disasters, such as the tsunami in Japan and the recent hurricane, and stated that the only communication that was able to get through was ham radio. The commercial was short and straight to the point and advised the listener to contact the ARRL for further information. I thought this was a well-timed promotion of Amateur Radio, especially when a natural disaster hits and knocks out our traditional way of communicating by cell phone and computers. With all of the recent technological achievements in smart phones and tablets, sometimes the simplest methods — such as a radio and a piece of wire — are tried and true in a disaster.

**Len Walinski, WB3EFP**
Delta, Pennsylvania

## Simpler Equipment Brings Back Memories

I greatly enjoyed the article by Martin Huyett, KØBXB ["Have Fun Building the Simplest Transmitter," Nov 2012, pages 46-48]. This is exactly the type of equipment that I started out with. Martin's article surely brought back the simplicity of starting out in Amateur Radio. Back in those days, radio amateurs were very hands-on, and they took great satisfaction in homebrewing their own gear whenever possible and practical. I am in favor of embracing the newest technology, but please: Let's not lose sight of where — and how — it all began.

**Don Stubberfield, VE7ESE**
Fort St John, British Columbia, Canada

■ The great article by Martin Huyett, KØBXB, was an adrenalin rush for me. I went to my library and there, ragged cover and all, was my 1954 copy of *How to Become a Radio Amateur*. I quickly turned to page 19 to find the same transmitter article: "A Simple Transmitter." I had pored over this transmitter project article countless times, pricing, searching parts catalogs, and building it in my mind — even though I didn't have a ham license. Getting a license was a boyhood dream that didn't materialize until 1956. Now, 58 years later, I still haven't built this long-forgotten transmitter, although I've built many other projects. Martin's article has relit old and cold embers. Now this project is on my "to do" list once again. Thanks Martin!

**Allen T. Poland Jr, K8AXW**
Keyser, West Virginia

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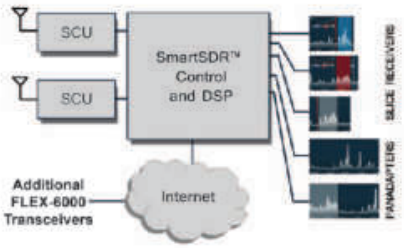



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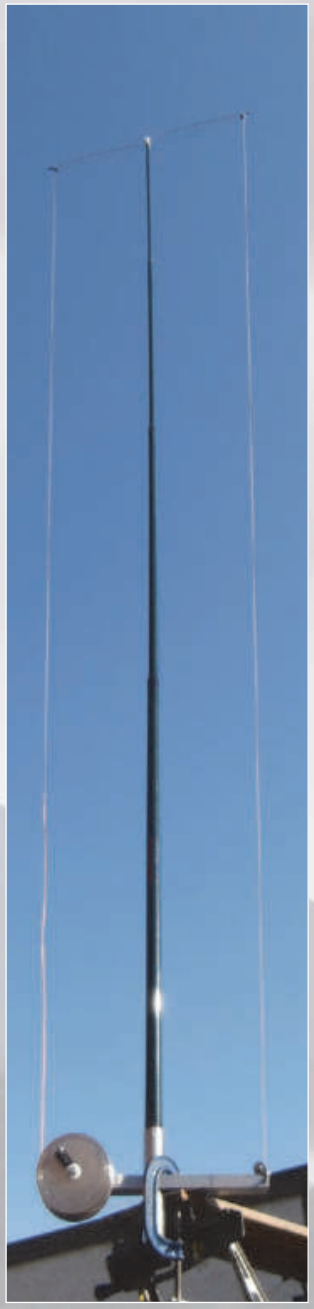

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# Cheap and Easy SDR

## Get your feet wet with the latest technology for the price of a night at the movies.

**Robert Nickels, W9RAN**

There's little doubt that software defined radio (SDR) will be a big part of ham radio for a long time. While many experimenters and homebrewers enjoy working at the "bleeding edge" of this new blend of RF and software, SDR is still a mystery to many hams. This article describes how you can put together an all-mode software defined receiver that covers nearly from dc to daylight for less than $50, and a VHF/UHF version for about half that.

### Digital Broadcasting — A Game Changer

The television broadcast world has undergone a momentous change from analog to digital broadcasting. DVB-T (digital video broadcast — terrestrial) has emerged as the standard for digital broadcast transmission used by nearly 100 countries throughout the world (mostly in Europe, Asia, Australia, and parts of Africa). North American TV stations now broadcast using ATSC (Advanced Television Systems Committee, North American Standard). But what does this have to do with cheap and easy SDR?

The answer is what's become known as the "DVB-T Dongle" — a small, inexpensive USB "stick" (flash drive) that was developed to allow DVB-T viewing on a standard PC or laptop (see Figure 1).


**Figure 1** — DVB-T dongles are all you need for a V/UHF SDR. They come in various shapes and sizes.

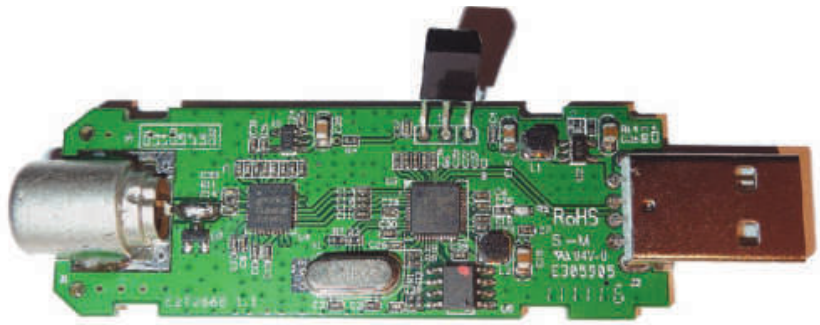



**Figure 2** — Inside view of a typical DVB-T dongle. The RF connection is on the left, a USB connector on the right, and in between is an SDR.

A *Linux* developer in Finland named Antti Palosaari, who was working on digital television drivers for *Linux*, noticed something very interesting buried in the instruction set of the Realtek RTL2832 quadrature decoder chip that's inside every DVB-T dongle.

A special *Radio* mode, which was intended to allow the dongle to be used for FM broadcast reception, actually caused the device to output a stream of 8 bit I/Q samples at a rate of up to 2,000,000 samples per second. He quickly saw the potential for a cheap and easy SDR, and with the enthusiastic help of other developers from the Osmocom (Open Source Mobile Communications) group, a set of basic drivers and utilities to communicate with the complex ICs in the dongle was developed for both *Linux* and *Windows*.

To understand why this is a big deal, we'll need to delve slightly into how a SDR works. Many hams have played with a simple direct conversion receiver, in which a local oscillator very near the desired frequency is mixed with the RF signal to produce an audio signal without any intermediate conversion or IF stages. Since one type of SDR also uses this *zero frequency IF* approach, the Osmocom developers soon had the DVB-T dongle spitting out a stream of I/Q data in the same format used by existing SDR applications. While other inexpensive front ends such as the SoftRock rely on a PC sound card to convert this stream of data from analog to digital form, the RTL2832 quadrature sampling decoder performs this task at speeds up to 20 times faster, and without using a sound card at all.

This means that rather than being able to see, for example, a 96 kHz wide segment of an amateur band using the sound card approach, the DVB-T chip can digitize a slice of the RF spectrum more than 2 MHz wide. While each sample has only 8 bits of resolution, it turns out that this is not a limitation for most uses.

### This SDR starts at VHF

Recalling that the DVB-T dongle was created for watching digital TV, it's not surprising to learn that it doesn't cover the HF bands. But it does include a synthesized tuner chip (initially the Elonics E4000, see Figure 2) that provides continuous coverage from 64 through 1700 MHz (with a gap between 1100 and 1250 MHz). The *RTL_TEST* utility can be used to measure the actual coverage range of each dongle, as exact coverage can vary a bit.

A few pieces of open source software turn the DVB-T dongle into an all mode SDR that covers all VHF and UHF bands, and an easy to build HF converter can extend the coverage range from the AM broadcast band up through 6 meters.

### Build Your Own Cheap and Easy SDR

First, you'll need to get a DVB-T dongle. Since they aren't compatible with the North American TV standard, they aren't easily found in North America. Most of us have obtained ours through online sources such as eBay. Search terms like "RTL2832," "DVB-T" or "SDR" should produce a number of suppliers, just be sure to get one that uses the RTL2832 and E4000 combination for greatest coverage range, although drivers for the Raphael Micro R820T tuner have recently been added. The price range runs from $20 up. A partial list of dongles known to work can be found online (see the references).

### Gathering the Rest of the Pieces

While you're shopping, pick up at least one coaxial adapter to fit your dongle that will accept a regular TV type F connector. Most will require what is described as "PAL Male to F Female," although technically it's the "Belling-Lee" connector that's been used for decades in areas where the PAL video standard was supported (see, for example, Radio Shack Model: 278-261, shown in Figure 3).

The DVB-T has good sensitivity, but there's no substitute for a good antenna. Outdoor antennas such as the discone, collinear vertical and log periodic (or even old TV antennas) will do a good job on the VHF and UHF bands, especially if connected via RG-6/U or similar low-loss coax. The system connectivity is shown in Figure 4.

### An SDR needs a PC

It would hardly be "cheap and easy" if you had to go out and buy a new lightning-fast PC to play with SDR. The system described runs well on older hardware. In my experience, it typically runs at about 10% CPU utilization on my 3.4 GHz Pentium D machine, and 12% on a 5 year old Core Duo laptop. You should be okay with a modest PC running *Windows XP* or newer OS and with one available USB port.

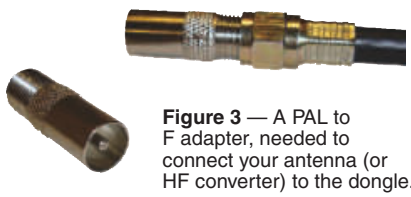


**Figure 3** — A PAL to F adapter, needed to connect your antenna (or HF converter) to the dongle.

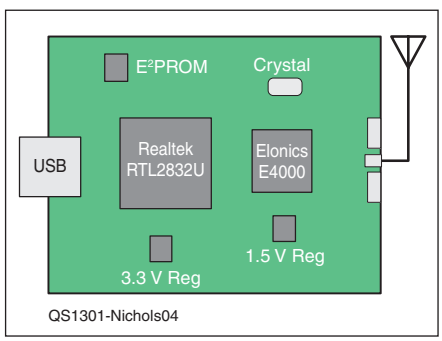



**Figure 4** — Block diagram of the DVB-T dongle based SDR.

### And the PC Needs Software

The first step is to get the dongle running on VHF/UHF. I suggest you read through the complete procedure, then use the *Install* script shortcut that will automate much of the procedure (you will still have to run the driven utility manually at least one time to install the proper *WinUSB* driver, but the script will automate the download of *Zadig* for you).

### Driver Installation

You will need two pieces of software to install the proper driver. First, download *Zadig* from Sourceforge at **sourceforge.net/projects/libwdi/files/zadig/**. If necessary, download the *7Zip* archiver needed to install *Zadig* from **www.7-zip.org/**. Use *7Zip* to open the archive and install *Zadig*.

Plug in the DVB-T dongle, then run *Zadig*, the utility to install the custom driver. Abort the NEW HARDWARE FOUND dialog if it comes up. Now install the correct driver with *Zadig*. In *Zadig*, click on OPTIONS and LIST ALL DEVICES.

You should now see a screen that looks like Figure 5. Click on the item that says BULK-IN, INTERFACE (INTERFACE 0). This is your RTL device.

Make sure WINUSB is shown in the box to the right of the green arrow — not LIBUSB or LIBUSBK.

Click on REPLACE DRIVER. A few seconds later you should receive a success message. This completes the driver installation, although you may need to repeat the above sequence if you use a different USB port, or for other reasons the driver linkage is lost. It should be a one-time event, however.

To double-check, open *Windows Device Manager* and you should see an entry that includes the words LIBUSB WINUSB BULK INTERFACE DEVICE (0). If so — great, you're done. If not, *Windows Plug-and-Play* may have automatically installed TV drivers under "Sound Video and Game Controllers." If so, these must be removed before the dongle will work as an SDR. Remove the driver using *Device Manager*, then re-run *Zadig* as described above. (There may be slight variations in syntax due to different versions of *Windows*).

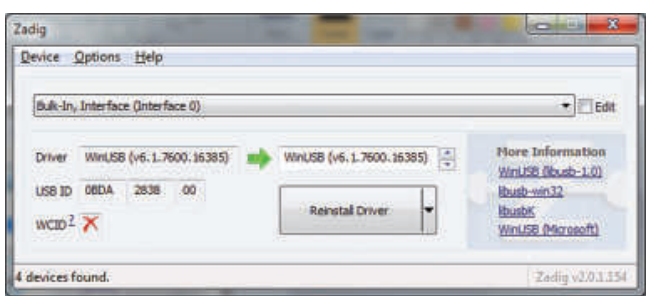



**Figure 5** — *Zadig* main screen.

This completes DVB-T driver installation but we need one more thing: A *Radio* application or app!

### A "Sharp" Approach to SDR Software — Radio Apps

A number of talented programmers have developed very comprehensive and powerful SDR applications (apps), and several of them have been modified to work with the DVB-T dongle as the RF front-end. While you may wish to try others, I will describe how to get started using *SDR#* (pronounced and sometimes spelled *SDRSharp*) — an SDR app that I've found to be simple, powerful and easy to use. It's also free!

*SDR#* is an open source software defined radio application for *Windows* created by Youssef Touil in Paris, with collaborative assistance from other volunteer software engineers around the world. *SDR#* is written in *C#*, a modern, general-purpose, object-oriented programming language developed by Microsoft. *SDR#* is intended as a DSP application for use with a wide range of RF hardware, including SoftRock, FiFiSDR, FUNcube Dongle, SDR-4, LazyDog's LD-1, SDR-IQ, SDR-14, RTL2832U / RTLSDR, any sound card based SDR front end and any external input/output based SDR front end. A script provides for one-click installation — see the link below. The following procedure is provided for reference.

### Integrating the Software

The following steps must be followed to integrate *SDR#* and the necessary RTL drivers from Osmocom. Refer to the instructions at **rtlsdr.org/softwarewindows** for screenshots and a more detailed step-by-step procedure (all this is done automatically by the *Install* script).

- Download a copy of the "Continuous Integration" or "Dev" version of *SDR#* from the *SDR#* website: **www.sdrsharp.com** and unzip it into its own directory.

- Download the pre-built *Windows* zipfile RTLSDR binaries and libraries from Osmocom at **sdr.osmocom.org/trac/raw-attachment/wiki/rtl-sdr/RelWithDebInfo.zip**.

- From the zipfile directory **RelWithDebInfo.zip\ rtl -sdr-release\x32** copy **rtl_sdr.dll** and **libusb-1.0.dll** to the directory. *SDR#* is unzipped to open the file *SDRSharp.exe. Config* in a text editor. Scroll down to the line that looks like <!-- <add key="RTL-SDR / USB" value="SDRSharp.RTLSDR. RtlSdrIO,SDRSharp.RTLSDR" /> --> and remove the leading <!-- and trailing --> so that it looks like:

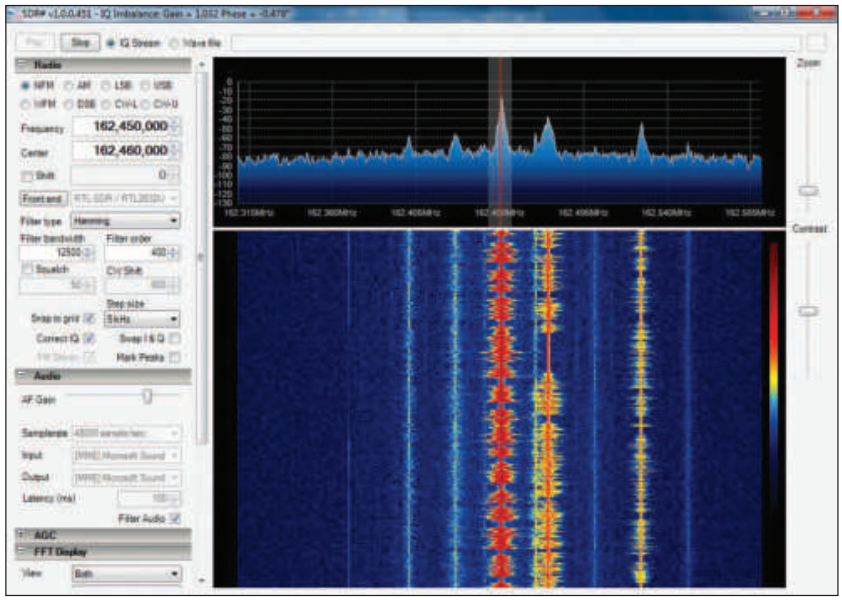



**Figure 6** — *SDR#* Installed screen showing broadcast FM spectrum.

<add key="RTL-SDR / USB"value="SDRSharp.RTLSDR.RtlSdrIO,SDRSharp.RTLSDR" /> and save the file.

■ Download the *SDR# RTL Plugin* and copy the contents of the zip file to the SDR# directory.

This may seem like a lot of work, but it goes much faster than hours of metalworking, soldering and testing required to build a receiver from hardware. There is a shortcut that automates the above process, making it even easier. Download the install script from: **sdrsharp.com/downloads/sdr-install.zip** and run it, that should be all there is to it. Refer to the manual steps and websites above if you need further assistance.

The *SDR#* executable will be found in a new directory. Since the registry is not modified, *SDR#* files can be deleted, moved and reinstalled as desired.

## Making it Play

Double click on SDRSHARP.EXE to launch the application — you should see a screen like that in Figure 6. Once you have completed driver installation, and have attached a VHF-UHF antenna to your dongle, go ahead and launch the *SDR#* program. Set RADIO MODE to WFM (wideband FM). From the topmost box, change OTHER — SOUND CARD to RTLSDR / USB. You'll notice the frequency and center boxes are filled in with a default frequency in the FM broadcast band. Click on PLAY. You should be greeted with a brightly colored spectrum display on top and a waterfall display below. As you change the frequency (or click and drag the spectrum display chart) you should be able to hear FM broadcast audio. Congratulations! You've just "built" your first software defined radio!

## *Using* SDR#

The *SDR#* human interface is intuitive and flexible to use (see Figure 7). The PLAY/STOP button is found at the top of the screen, along with the ability to select live data from a connected IQ stream such as the DVB-T dongle, or you can play back stored files.

The balance of the *SDR#* screen consists of three functional areas. There are expandable control panels along the left-hand side, tuning controls and spectrum display at the top and a waterfall display at the bottom. In addition, there are controls for spectrum ZOOM and waterfall CONTRAST along the rightmost edge.

Mode selection is at the top of the RADIO control panel (see Figure 9), with TUNING and FILTER controls below. Default settings for everything else should be okay — go ahead and play — you can't hurt anything and this is the only way to learn what various features do.

## *Tuning with* SDR#

SDR tuning is a little different, but for those who came up through the radio ranks with a *general-coverage* or *two-dial* receiver, it will seem familiar. The center box is analogous to the MAIN TUNING in that it determines which 2 MHz-wide slice of the RF spectrum is selected and visible in the spectrum display. The FREQUENCY entry shows the exact frequency the SDR is tuned to within this window, much like a BANDSPREAD control on a two-dial receiver.

Tuning can also be performed by using the mouse to click or drag within the SPECTRUM DISPLAY area of the main screen. Dragging the black background area will change the

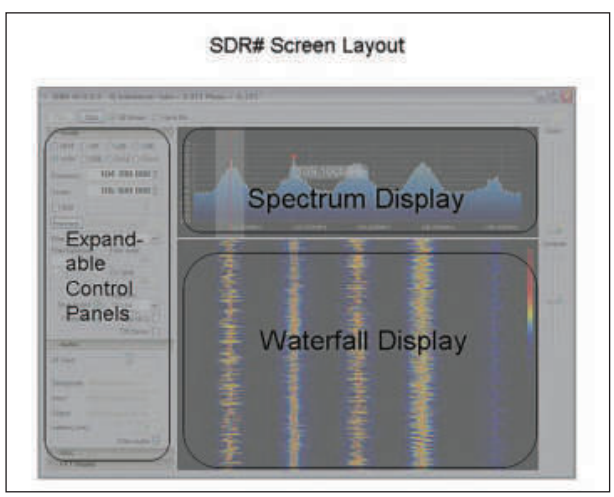



**Figure 7** — *SDR#* main screen layout.

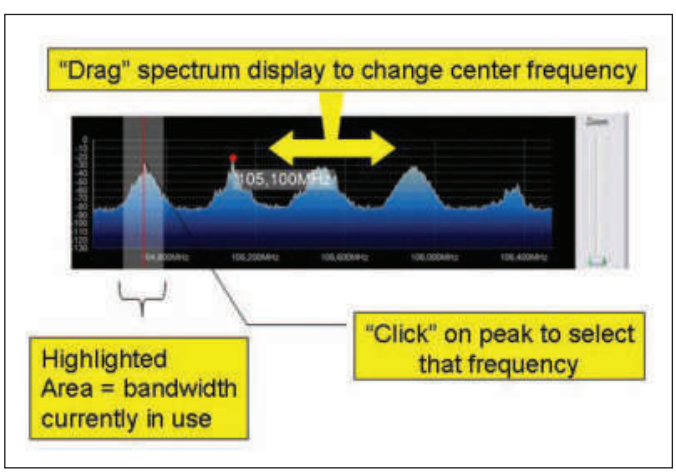



**Figure 8** — Tuning with *SDR#*.

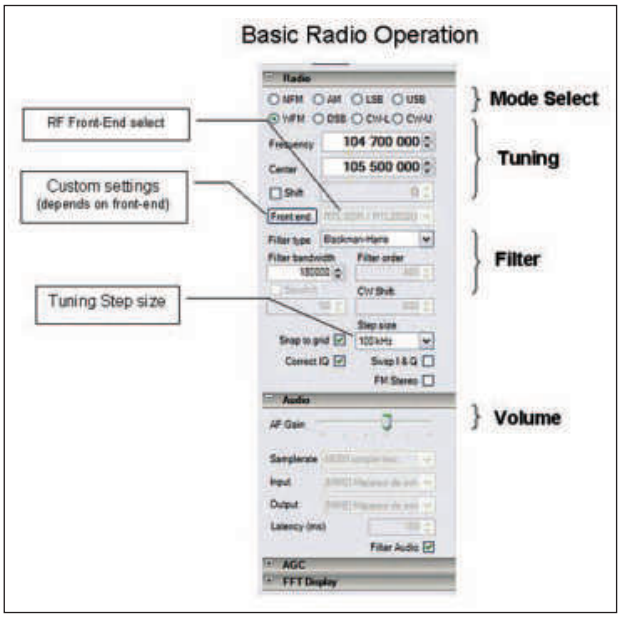



**Figure 9** — *SDR#* radio control panel.

## Cheap and Easy

Every new technology in Amateur Radio represents a step forward, and each time there are pioneers who help pave the way by making it possible for average hams to get involved in the latest technology. My personal interest in the early days of single sideband provides a perfect example — the March 1956 *QST* article "Cheap and Easy SSB" by Anthony Vitale, W2EWL, in which he described his easy to make SSB transmitter.

W2EWL based his design on the same phasing-type circuit that had been published before, and was in commercial production. He made use of a ubiquitous World War II *command set* transmitter, which was widely available as surplus for a few dollars at that time, and he simplified the circuit and found ways to use off-the-shelf components. The effect of this approach was to make it more attractive for an average ham who was interested in SSB to give it a try.

My hope is that by combining similar low cost hardware and proven designs, along with open source software and the ubiquitous *Windows*-based PC, this 21st century *Cheap and Easy* will encourage more amateurs (and potential future amateurs) to get their feet wet with the SDR, which I believe will have as much impact on the future of Amateur Radio as SSB did 60 years ago.

center frequency (see Figure 8), moving the 2 MHz window up and down in frequency. Clicking any signal peak within the SPECTRUM DISPLAY will instantly tune to that signal. The ZOOM slider on the right allows you to spread out signals and see more detail. Resolution is determined by the FFT (fast Fourier transform) setting selected in the FFT DISPLAY control panel.[1] The frequency manager provides unlimited memory capacity, and the ability to store and edit groups of favorite frequencies. Other options are available in experimental versions of *SDR#* and, if you're a *C#* programmer, there's a long wish list of future enhancements.

### The Waterfall "Time Machine"

The most striking feature of any SDR screen is the colorful *waterfall* display. Previously used in applications such as sonar, speech processing and seismology, the waterfall (also known as a *spectrogram*) display gives us a brief look back in time as signals appear at the top and then scroll down and off the bottom of the display. The frequency of each signal is the same as in the spectrum display above, so the waterfall will show *wiggles* as we click and drag the spectrum display to change frequency. Since the waterfall is a two-dimensional view (frequency vs time), the amplitude of each signal is depicted through the horizontal width and color of the line painted under each signal in the waterfall. After a few minutes of adding the visual sense to your radio listening, you'll wonder how you ever got along without it.

Black indicates no signal, and shades of blue, yellow and red correspond to increasingly higher received signal levels. A very strong signal will be almost solid red, while a weak signal will consist of mostly yellow and blue. Modulation type can be determined from the waterfall display as well, in fact the dits and dahs of a CW signal can usually be read vertically as the display scrolls.

The rest of the radio controls are pretty self-explanatory. It's great to be able to tailor the filter as you wish and gain familiarity with the magic of using software to do what most of us still think of as the domain of capacitors and resistors. And if you find that the performance isn't quite up to the level of a commercial rig, just remember that the RF part of this receiver can be easily lost amongst your pocket change.

### Adding HF Coverage

The first thing any ham does when confronted with a new radio is to spin the tuning dial. Unfortunately, the lower end of the DVB-T dongle is around 64 MHz, well short of six meters and the popular HF ham bands. But that is easily fixed, using technology that has been an essential part of radio for over 100 years!

#### The HF Converter

A radio frequency *mixer* is a device that accepts two different frequencies as inputs, and creates the sum and difference of them as outputs. It is shown schematically in Figure 10.

Think of it as mixing two colors of paint. If we combine yellow and blue, for example, the result will be green. A good RF mixer will combine two radio frequencies so completely that we see only the *green* output, with no yellow or blue left. For our HF converter, the INPUT signal will come from an HF antenna, such as a longwire or dipole. For the local oscillator signal I've chosen 125 MHz because a preassembled CMOS oscillator provides a "cheap and easy" solution, with the 0-30 MHz HF bands moving up to 125-155 MHz. This frequency eliminates the possibility of interference from FM radio stations.

We can use the heterodyne mixer to build a frequency converter for the HF range (and beyond). Table 1 shows the relationship between the LO, Input and Output for frequencies in the 80 and 10 meter ham bands:

The SDR software will automatically take care of the arithmetic when the converter is in use so we can have a direct frequency display.

#### HF Converter Design

There are many ways to create a heterodyne mixer, but the NE-602 and the improved NE-612 integrated circuits were created for exactly this purpose. They have been proven in countless designs. It provides high sensitivity, a low noise figure and low-cost in a single device that uses a *Gilbert cell* circuit that cancels unwanted signals and produces clean output. I found that using a standard CMOS oscillator module was the best way to provide the 125 MHz local oscillator signal.

[1]Greater resolution requires more CPU horsepower, so the basic rule is to set the resolution as high as needed, but no more. For most uses, 4096 is sufficient.

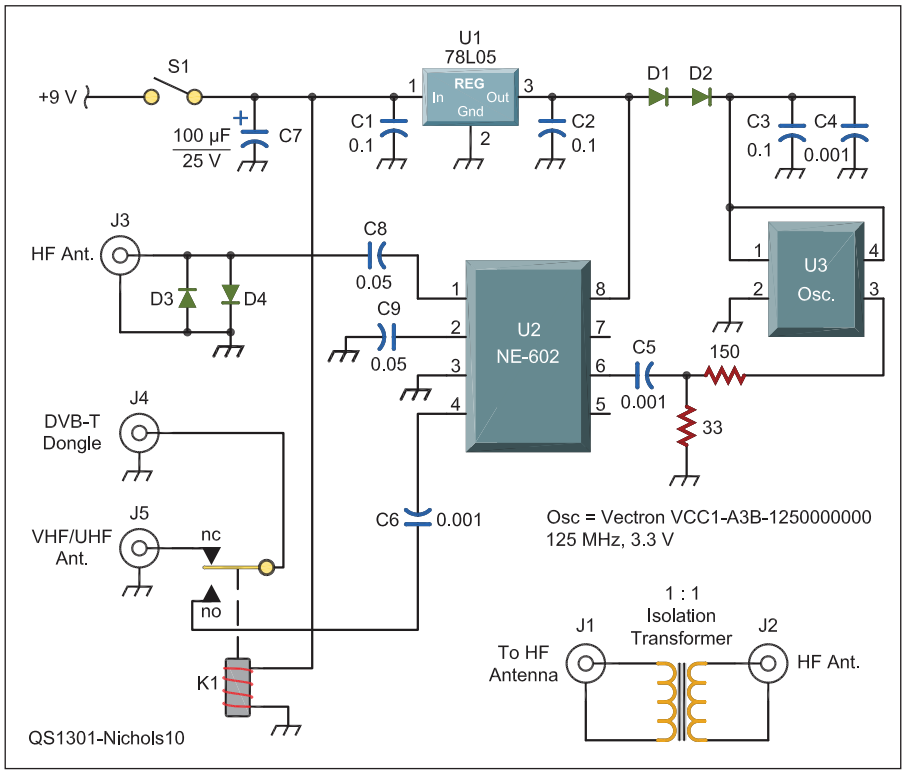



**Figure 10** — Schematic diagram and parts list for the HF upconverter for SDR operation down to below the AM broadcast band.

C1-C3 — 0.1 µF, capacitor.
C4-C6 — 0.1 µF, capacitor.
C7 — 100 µF, 25 V electrolytic capacitor.
C8, C9 — 0.05 µF, capacitor.
D1-D4 — 1N4007 silicon diode.
J1-J3 — RCA type panel jack.
J4, J5 — F-type coax panel jack.
K1 — SPDT relay, 5 V coil. Omron G5LA-14-DC5 or equivalent.
R1 — 150 Ω, ¼ W resistor.
R2 — 33 Ω, ¼ W resistor.
S1 — SPST miniature toggle switch.
T1 — RF isolation transformer, 2 turns each side on BN-43-2402 binocular ferrite core.
U1 — LM7805 voltage regulator IC.
U2 — NE-602 mixer IC.

The converter needed for SDR has one big difference when compared with a typical converter hams are familiar with. Normally we would add tunable filters on the input to pass only the signals of interest and reject everything else. Since we want to view the entire HF band, I found that a simple wideband untuned input and output circuit worked well, at least in my location. These design decisions greatly simplify the converter, but those who are located near strong RF sources (such as broadcast transmitters) may need to add some external filtering.

Although the AGC in the tuner works well, it can be overloaded by strong signals. Click CONFIGURE to turn off the tuner AGC and manually adjust the RF GAIN slider as needed for optimal reception.

Figure 10 shows the schematic and the parts list of the HF converter using an NE-602 mixer IC. Separate antenna connections are provided for HF and VHF-UHF antennas. A relay is used to automatically connect the converter if HF operation is desired. If converter power is off, the normally-closed contact routes VHF/UHF signals directly to the DVB-T dongle for normal operation. This makes it possible to locate the converter any desired distance from the DVB-T dongle and select between HF and normal operation by simply switching the power to the converter on or off. The converter can be built on a small PC board, or using perforated project board.

**Table 1**
**Relationship Between the Local Oscillator (LO), Input and Output Frequencies for the 80 and 10 Meter Amateur Bands**

| Input Frequency (MHz) | LO Frequency (MHz) | Output Frequency (MHz) |
|---|---|---|
| 3.58 | 125 | 128.58 |
| 28.5 | 125 | 153.50 |

Figures 11 and 12 show the completed upconverter board and the board in its cabinet. Additional details are on the QST In Depth website (**www.arrl.org/qst-in-depth**).

Inexpensive RG-6U coax and F type connectors are used, as they provide low loss through the UHF range. Input signals from the antenna are coupled to pin 1 of the NE-602 through a broadband coupler and back-to-back diodes that provide isolation and protect the input from static discharges.

Through hole components are used for everything but the 125 MHz CMOS oscillator module, which is only available in a surface mount package, but this component is easily attached with a small-tipped soldering iron. Simply apply a small amount of solder to the pad area, then hold the part in place while reflowing the solder to one pad to hold it in place, then add a bit of solder and reflow the remaining pads. The 125 MHz output from the module is reduced by means of a voltage divider to the proper level required by the NE-602. PC boards are available from FAR Circuits at **www.farcircuits.net**.

Any source of dc power from 9-12 V can be used, but I strongly urge the use of a linear rather than switching type power supply to minimize the potential for switching noise that can cause interference in the converter's output. The 5.0 V output from a 7805 regulator powers the NE-602 and is reduced by approximately 1.4 V by two series diodes to provide the 3.3 V needed by the oscillator. The oscillator draws approximately 50 mA, so a well regulated supply is needed.

Interconnecting wires between the converter PC board and the connectors must be kept short to prevent undesired pick-up of undesired signals. Use fully shielded coax such as RG-6U for antenna interconnections. A USB extender cable may be used to move the DVB-T dongle away from the RFI-noisy PC. As with any receiver, a suitable antenna should be chosen for the type of reception desired on the VHF/UHF bands. For HF, a simple longwire or dipole located away from noise sources will produce good results.

## Operating the SDR

Once you experience the fun of having spectral and waterfall displays, it will be hard to go back to using a conventional radio. With just a few hours of use it becomes easy to identify various types of signals, even to the point of recognizing which sideband is being transmitted. It will become easy to click the SDR exactly on frequency.

Using the SDR on HF is no different than on the higher direct frequency range, except everything is shifted up by 125 MHz. While it's

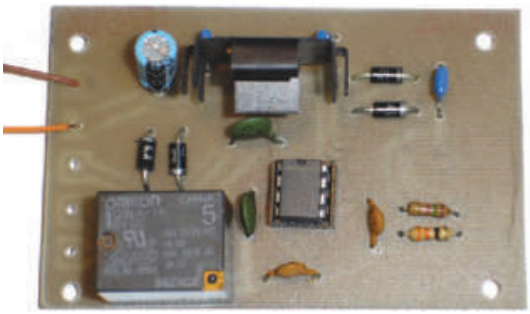


**Figure 11** — Assembled upconverter board — ready for final assembly.

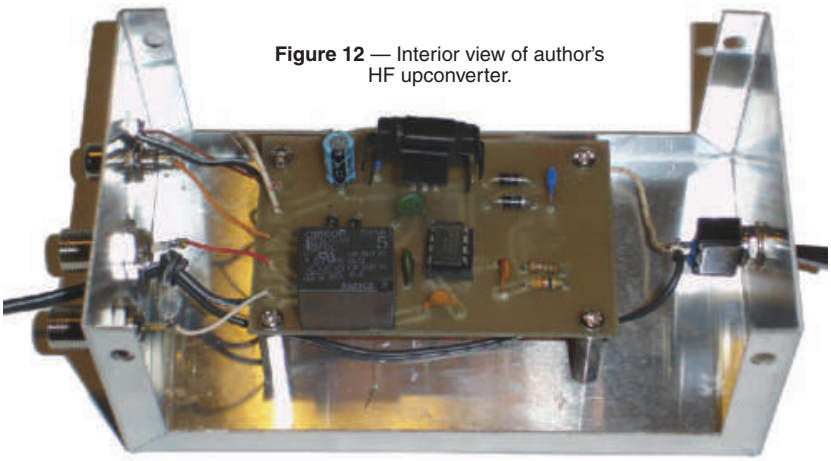


**Figure 12** — Interior view of author's HF upconverter.

pretty easy to "do the math," *SDR#* also includes a provision for a frequency shift that will automatically be added or subtracted from the frequency that is displayed and stored in *Frequency Manager*. So, if we enter "–125000000" as the shift, the frequency will be displayed correctly (we use a negative offset because this is the amount to be subtracted from the displayed reading).

As with normal SDR listening with the DVB-T dongle, a slice of radio spectrum up to 2 MHz wide is presented at one time, equally centered about the selected center frequency. So to begin with, Enter "135000000" in the CENTER FREQUENCY box (note the offset is not applicable to center frequency). In normal operation, we would be tuned to 135 MHz in the aircraft band, but with the HF converter switched on, the center frequency is now 10 MHz. With the ZOOM slider all the way down, most North American listeners should see a fairly tall spike near the center of the display. Make sure the AM mode is selected and click on the spike — if you're lucky you will be hearing the sounds of the US NIST time and frequency standard station, WWV from Fort Collins, Colorado.

I've written a guide that explains more about the features of *SDR#* (see references).

## The SDR Difference

Few have ever actually seen the entire HF spectrum all at once, but a panoramic view of the whole HF spectrum is possible. It is fascinating to visually see the HF spectrum unfold, and to identify signal types by sight. While I'm not ready to give up my tuning knob, I'd be lost without this added dimension while cruising the bands. You will quickly become adept at visually identifying signals and modulation types, and using the spectrum display to spot unknown signals or open frequencies.

The core of every SDR is the digital signal processing (DSP) software that is used to demodulate and filter the incoming I/Q stream. *SDR#* gives you a choice of several filter algorithms and infinite control of bandwidth to suit your taste or band conditions. Likewise, the waterfall and spectrum displays can be customized as desired.

I suspect that hidden features of the RTL2832 mark the beginning of what promises to be a long journey into the world of SDR. We all remember the idiosyncrasies of our first Novice rig, but also the thrill of learning, and how much fun it was to eke the most performance out of inexpensive and simple gear. That experience was invaluable when it came time to upgrade, as we had a good idea of what features and capabilities to look for in our next rig. Through the power of software, new features and capabilities are only a download away.

## For More Information

The following is a partial listing of compatible DVB-T device and Osmocom references.

Osmocom: **sdr.osmocom.org/trac/wiki/RTL-sdr**.

The official *SDR#* website: **sdrsharp.com.**

Shortcut to official download page: **sdrsharp.com/index.php/downloads**. (Note: "Continuous Integration" or "nightly" versions contain the latest enhancements and new features that are not described in this article.)

RTL2832 DVB-T dongle installation information: **RTLsdr.org/softwarewindows**. (Note: The above procedure must be followed before RTL devices can be used with *SDR#*.)

Bob Rich's standing download site for the latest version of his experimental code (including *Auto Tuner* and *Trunking*): **public-xrp.s3.amazonaws.com/Release-latest.zip**.

##RTLsdr and #sdrsharp on Freenode IRC

Yahoo *SDR#* group: **uk.groups.yahoo.com/group/SDRSharp/**.

My own collection of SDR-related info on Google Docs: **tinyurl.com/blsg2or**.

My *SDRSharp* user guide and other information can be found at **goo.gl/suS2w**.

ARRL member and Amateur Extra class licensee Robert Nickels, W9RAN, was first licensed at age 14 in 1965 as WNØOHO in Nebraska. He has a BS from Fort Hays State University in Kansas, and credits ham radio as a major influence during his 35 year career in the electronics manufacturing industry. A holder of three US patents, Bob recently retired from Honeywell, where he held positions as a principal engineer, engineering manager, and strategic marketing director. He currently heads up RAN Technology Inc, a business and technology consulting firm. An avid cyclist and cross-country skier, he enjoys ham radio history and homebrewing, in addition to his main interest — collecting, restoring and operating a growing collection of vintage electronics and boat anchor radios from the last five decades.

You can reach Robert at 2645 East Dr, Freeport, IL 61032 or at **w9ran@arrl.net**.

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

# Down Periscope!

## Keep that vertical out of sight and safe from lightning when you're not using it.

**Burt Yellin, K2STV**

I recently came to the conclusion that I required a different antenna in order to take advantage of the upward-bound side of the current sunspot cycle. In order for me to be successful, there were several issues that had to be resolved. First, I wanted an antenna with a low radiation angle. To me, that meant a vertical. Second, I had to abide by my homeowner restrictions and covenants that would not permit buried radials. Third, I live in the Tampa Bay area — the lightning capital of the US. I am very concerned about lightning effects after surviving two lightning strikes at two different locations in this area. The thought of a rod poking more than 20 feet into the sky scares me. My final concern is that I have very little space for an antenna footprint without conflicting with the priorities of my long-suffering wife. My solution — a vertical antenna that is only up in the air when I need it.

### My Vertical Radiator

My band of choice is 17 meters. The antenna I ended up with is a full quarter wave vertical on 17 meters composed of telescoping aircraft aluminum tubes. The total radiator length, after adjusting for best SWR, was about 12 feet, 10 inches. I used three telescoping tubes — 0.875, 0.75 and 0.625 inches in diameter.

### The Counterpoise

The counterpoise is the unique part of this antenna. My counterpoise is composed of two shortened citizens band (CB) antennas. A company named FireStik manufactures a tunable CB antenna that is rated at 650 W [That's a surprising safety margin for a service limited to 3 W RF output. — *Ed.*] and is only 3 feet long.[1] Since I normally run between 500 and 600 W, this product was a natural choice for me. These CB antennas are tuned via a plated ¼-20 screw at the end. While their frequency can be altered by a few megahertz, it was not quite enough to tune to 17 meters. I tried using a piece of ¼-20 rod as an extension, but could not get a sharp enough dip in the 17 meter SWR while electrically lengthening it.

I then tried a "top hat" capacitance end-loading arrangement and got the bandwidth necessary for SSB operation with an SWR of less than 1.5:1. The top hats are 4.75 inch aluminum discs that are held in place by the supplied ¼-20 screws and by ¼-20 stainless steel nuts, washers and lock washers on either side for better electrical connectivity (see Figure 1).

The completed vertical in its extended position.

### Construction Details

The vertical section is doubly insulated from the mounting plate by shrink tubing over the aluminum. The tubing acts as a space shim to make a better fit in the 1 inch PVC support tube. I then reamed out the stops from the insides of two PVC couplers, slid them on the main piece of PVC, and glued them into place to act as another layer of insulation. They also serve as the U-bolt mounting surface.

The largest tube extends several inches below the PVC pipe. I drilled a 3/16 inch hole ½ inch from the bottom of the antenna tube and secured the coax center conductor with a #10-32 stainless steel bolt and lock washers. I used conductive/anti-oxidation paste on the connection. I then wrapped the connection with tape and put a piece of heat shrink tubing over it to make it weatherproof. The coax braid was secured to the ¼ inch aluminum plate with a #10-32 bolt, lock washers and conductive/anti-oxidation paste. Figure 2 shows the construction details of the vertical.

[1]Notes appear on page 38.

**Figure 1** — The capacitance hat end loading arrangement on the repurposed CB whips used as radials.

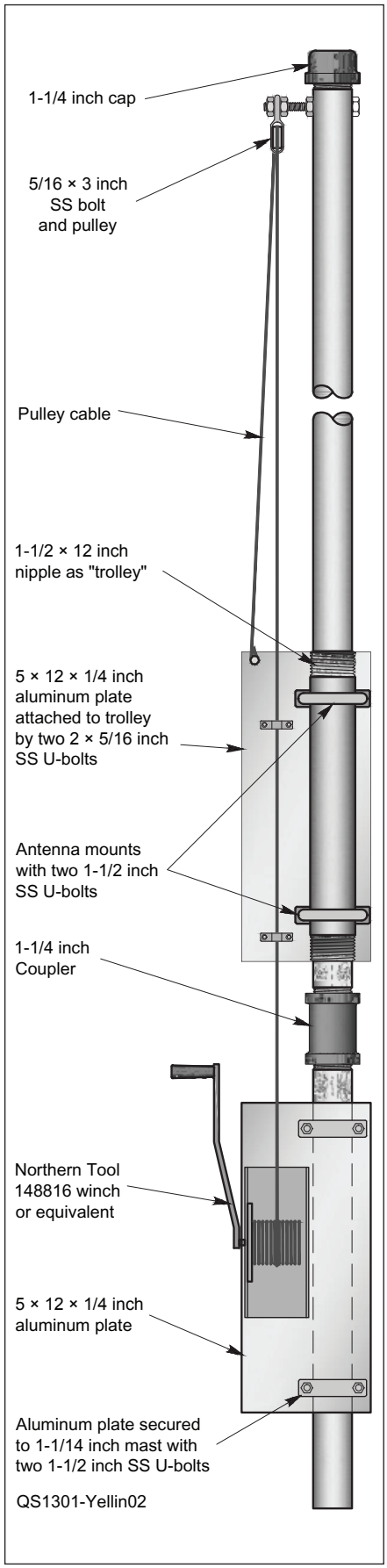



**Figure 2** — Construction details of the antenna and mounting system.

**Figure 3** — View of the trolley on the 10 foot length of the 1¼ inch galvanized steel pipe. This trolley is the means by which the antenna slides up and down the 10 foot pole.

**Figure 4** — The winch used to raise and lower the antenna. It can work in either position, but performs better if raised.

## Mounting Arrangement

I now had a vertical antenna, but how could I mount it so that it couldn't poke permanently into the sky? I came up with the idea of a crank up pole. I purchased 10 foot and 5 foot lengths of 1½ inch galvanized steel pipe. I then pounded the 5 foot length 3 feet into the ground and dug out a base around this pipe about 1 foot deep. I mixed Sakrete and filled in the space. At the top of the 10 foot length I drilled a 5/16-inch hole just below the threads and bolted a 5/16 × 3 inch stainless steel bolt to the pipe.

**Figure 5** — The end of the winch cable is attached to the trolley as shown.

I then mounted the pulley on the bolt and secured it with two stainless steel nuts. After that, I capped the pipe top with a 1¼ inch PVC cap. This entire assembly was then screwed onto the 5 foot length via a 1¼ inch galvanized steel coupler. This was done after I slid a 1½ inch × 12 inch galvanized steel nipple to serve as my *trolley* on to the 10 foot length of the 1¼ inch galvanized steel pipe (see Figure 3). This trolley is the means by which the antenna slides up and down the 10 foot pole. I happened to have large diameter shrink tubing and I shrunk it over the cap and the coupler.

## Making it Go Up and Down

The final step was to devise a means for raising and lowering the antenna. This was accomplished through the use of a simple winch. I found a light duty trailer winch with 600 pound pulling capability at an overstock store, but something similar should be available from other sources. Pulling capability was far in excess of the weight of the antenna, the antenna trolley, the aluminum mounting plate and all the mounting hardware necessary to move this antenna up and down, thus providing a margin of safety (see Figures 4 and 5).

When raised, the antenna is approximately 23 feet in total height. When nested it is

**Figure 6** — The fully nested antenna is approximately 13 feet in height.

approximately 13 feet in height (see Figure 6) — hopefully that's low enough to escape a stray lightning bolt. As a side note, galvanized steel pipe comes in 20 foot lengths, thus giving you the additional height if you want it. However, my winch only came with 21 feet of cable and that was my limiting factor in designing and constructing this antenna.

## On the Air

Although this vertical antenna can be used in the nested position, I choose to use it only when it is raised. The ARRL was kind enough to generate and run an *EZNEC* model of the antenna for me and they discovered that it has 1 dB more gain when raised.[2] Of even more importance, upon raising the antenna, the peak elevation angle dropped from 24° to 17°, providing improved low angle coverage.

I am not concerned with direct lightning strikes while the antenna is lowered. The lowered height of 13 feet is well below the roof ridge vent of my house. I also have on my property two well grounded 17 foot pipes that are mounted about 35 feet apart to support a 20 meter dipole. One of those pipes is just visible in the lead photo for this article.

To protect against coupled lightning effects, the coax connects through an ac coupled surge protector as it enters the station. This protector is directly grounded to two 8 foot ground rods near to where the lines enter my shack. The antenna seems to work quite well as I have had many overseas and stateside contacts since it went up.

**Notes**

[1]**www.firestik.com**, FireStik FS3.

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

ARRL member and Amateur Extra class licensee Burt Yellin, K2STV, has been a licensed ham since May 1956. It was ham radio that brought him to a career as an electronic engineer. He graduated from Brooklyn (NY) Technical High School in 1956, went to RCA Institutes and, while working as an electronics technician, succeeded in earning a degree at Long Island University by attending at night for 9 years.

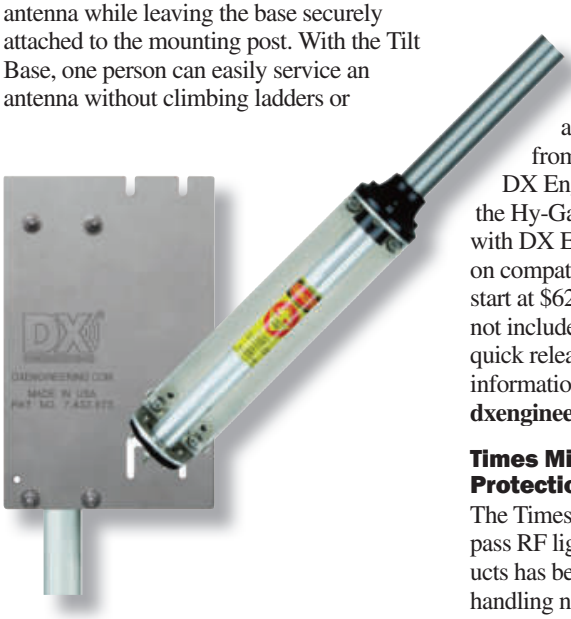
You can reach Burt at 1813 Columbine Pl, Sun City Center, FL 33573-5053 or at **k2stv@tampabay.rr.com**.

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


# New Products

### DX Engineering Tilt Base

The DX Engineering Tilt Base mounting plate enables you to raise or lower a vertical antenna while leaving the base securely attached to the mounting post. With the Tilt Base, one person can easily service an antenna without climbing ladders or removing brackets from a support post. The stainless steel mounting plate attaches to the same pipe that you use for the antenna and radial plate. Models include: DXE-TB-3P for Hustler BTV vertical; DXE-TB-4P for ground mounted ¼ wave vertical antennas including most models from Butternut, GAP, Hy-Gain and DX Engineering; and DXE-TB-6P for the Hy-Gain 14AVQ and 18AVQII. Check with DX Engineering for more information on compatibility with specific models. Prices start at $62.50 (V-clamps for pipe mounting not included). Optional wing nut knobs for quick release, $7.95 per pair. For more information, or to order, visit **www.dxengineering.com**.

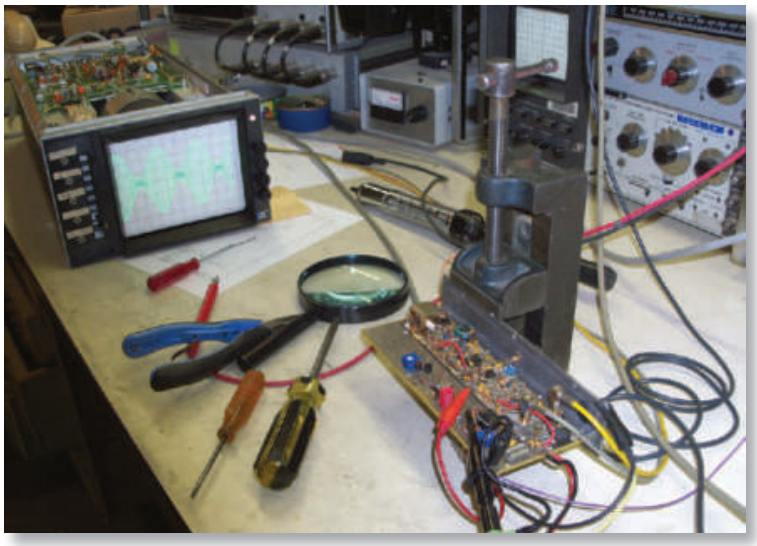


### Times Microwave Systems Lightning Protection Products

The Times-Protect LP-GTR series of dc pass RF lightning and surge protection products has been expanded for higher power handling needs. With the addition of the LP-GTR-N-35 series, the entire product range with either the type N or 716DIN connector will handle 50, 210 or 550 W. Designed to pass dc as well as RF, the LP-GTR series is intended to protect distributed antenna systems and tower mounted electronics. The N connector designs cover dc to 3000 MHz while the 716 DIN types can be used from dc to 2500 MHz. Various connector options are available. Prices start at $69. For more information, visit **www.timesmicrowave.com**.

# A Sampling Down Converter for Low Frequency Oscilloscopes

**This down converter lets you use that old low frequency 'scope as a modulation monitor for bands up into the VHF range.**



**Bob Dildine, W6SFH**

Low frequency oscilloscopes can often be found for a few dollars at swap meets and flea markets. Only their limited frequency response keeps them from being useful as a monitor to watch for the clipping that can occur on SSB if overdriving a linear amplifier, or to check modulation levels on that vintage AM transmitter.

This article describes an inexpensive down converter that extends the usefulness of a low frequency 'scope to the ham bands up into the VHF range without the need for band switching. The down converter is based on the same principles used in high performance sampling oscilloscopes, network analyzers and other microwave instrumentation.

## Sampler Theory

The heart of the down converter is a sampler. This is a circuit that takes a very quick "snapshot" of an incoming signal at a periodic rate that is considerably slower that the signal being sampled. Referring to Figure 1, a sample is taken of the incoming RF signal every other cycle at a slightly different point in the cycle. These samples create an "IF" signal of considerably lower frequency than either the RF signal or the sampling rate. Although Figure 1 shows samples being taken every other cycle of the RF input signal, samples can be taken at any rate that is a submultiple of the signal frequency of the RF signal. By adjusting the sampling rate (think local oscillator, LO) signal frequency to be slightly different than a sub harmonic of the RF signal, a low frequency IF signal is generated. The frequency of the IF signal is $F_{IF} = \pm F_{RF} \pm N \times F_{LO}$ where N is an integer. In the frequency domain the sampler can be thought of as a mixer with a comb generator as the local oscillator. In this case the IF is equal to the difference between the RF signal and a harmonic of the LO signal.

This sampling down converter uses an LO frequency of 1.75 MHz, which yields IF frequencies between 100 kHz and 1 MHz for the phone portions of all the bands up through 6 meters. For example, the eighth harmonic of 1.75 MHz is 14.0 MHz so the phone portion of the 20 meter band (14.150 MHz to 14.350 MHz) down converts to 150 to 350 kHz. Other crystal frequencies can be used, keeping in mind the frequency relationship discussed. In fact, I used a 1.771 MHz crystal from the junk box with good results.

## The Circuit

The sampling down converter is shown in Figure 2. The crystal oscillator is based on one shown in the 2005 *ARRL Handbook*.[1] The series combination of C3 and C4 is chosen to resonate with L1 at the crystal frequency and their ratio is chosen to give

[1]Notes appear on page 43.

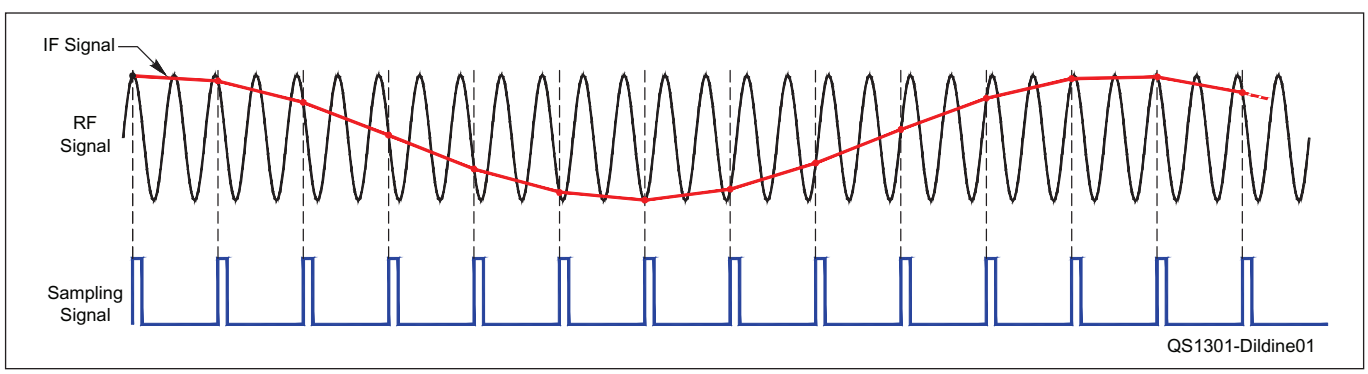



**Figure 1** — Each time the sampling pulse occurs, a sample of the incoming RF signal is transferred to the IF. When these samples are cascaded together in time, they recreate the IF waveform but at a lower frequency. Note that if the sampling pulse occurs at exactly the same point on every second, third, or $N^{th}$ cycle of the RF signal, the IF would simply be a constant dc level.

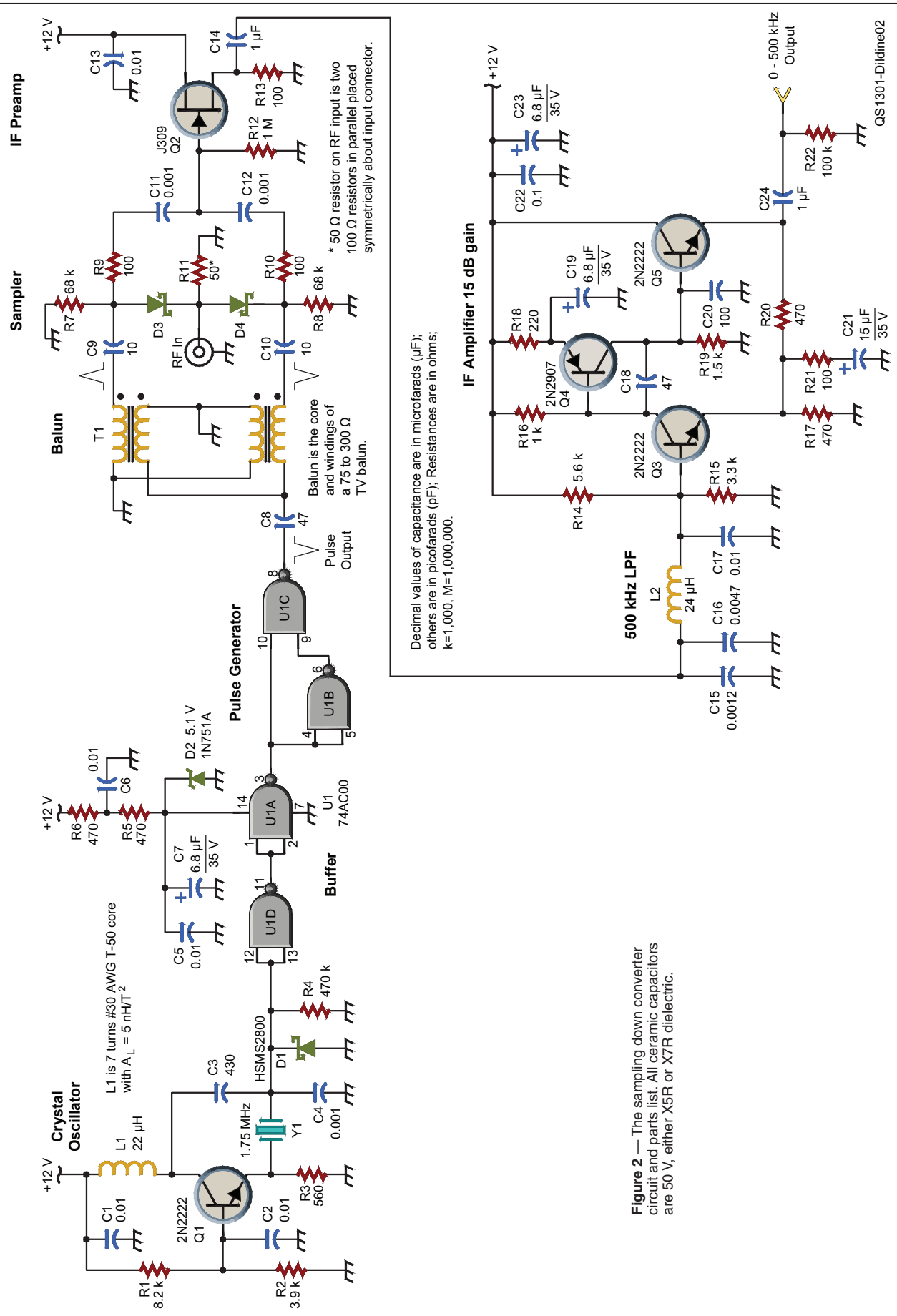



**Figure 2** — The sampling down converter circuit and parts list. All ceramic capacitors are 50 V, either X5R or X7R dielectric.

C1, C2, C5, C13, C17 — 0.01 µF ceramic capacitor.
C3 — 430 pF ceramic capacitor.
C4, C11, C12 — 0.001 µF ceramic capacitor.
C6, C22 — 0.1 µF ceramic capacitor.
C7, C19, C23 — 6.8 µF, 35 V tantalum capacitor.
C8, C18 — 47 pF ceramic capacitor.
C9, C10 — 10 pF ceramic capacitor.
C14, C24 — 1.0 µF ceramic capacitor.
C15 — 0.0012 µF ceramic capacitor.
C16 — 0.0047 µF ceramic capacitor.
C20 — 100 pF ceramic capacitor.
C21 — 15 µF tantalum capacitor.
D1, D3, D4 — Avago HSMS-2800 Schottky diodes or equivalent. Any small-signal Schottky diodes should be suitable
D2 — 5.1 V, 0.5 W Zener diode (1N751 or equivalent).
L1 — 22 µH inductor (77 turns #30 AWG on T-50 core with AI = 5 nH/T$^2$).
L2 — 24 µH choke.
Q1, Q3, Q5 — 2N2222A transistor.
Q2 — J309 FET (see text).
Q4 — 2N2907A transistor.
R1 — 8.2 kΩ, ¼ W, 5% metal film resistor.
R2 — 3.9 kΩ, ¼ W, 5% metal film resistor.
R3 — 560 Ω, ¼ W, 5% metal film resistor.
R4 — 470 kΩ, ¼ W, 5% metal film resistor.
R5, R6, R17, R20 — 470 Ω, ¼ W, 5% metal film resistor.
R7, R8 — 68 kΩ, ¼ W, 5% metal film resistor.
R9, R10, R13, R21 — 100 Ω, ¼ W, 5% metal film resistor.
R11 — 50 Ω (see text).
R12 — 1 MΩ, ¼ W, 5% metal film resistor.
R14 — 5.6 kΩ, ¼ W, 5% metal film resistor.
R15 — 3.3 kΩ, ¼ W, 5% metal film resistor.
R16 — 1 kΩ, ¼ W, 5% metal film resistor.
R18 — 220 Ω, ¼ W, 5% metal film resistor.
R19 — 1.5 kΩ, ¼ W, 5% metal film resistor.
R22 — 100 kΩ, ¼ W, 5% metal film resistor.
T1 —Transformer core and winding removed from a 75 to 300 Ω TV balun.
U1 — 74AC00 quad NAND gate integrated circuit.
Y1 — 1.75 MHz crystal (see text).

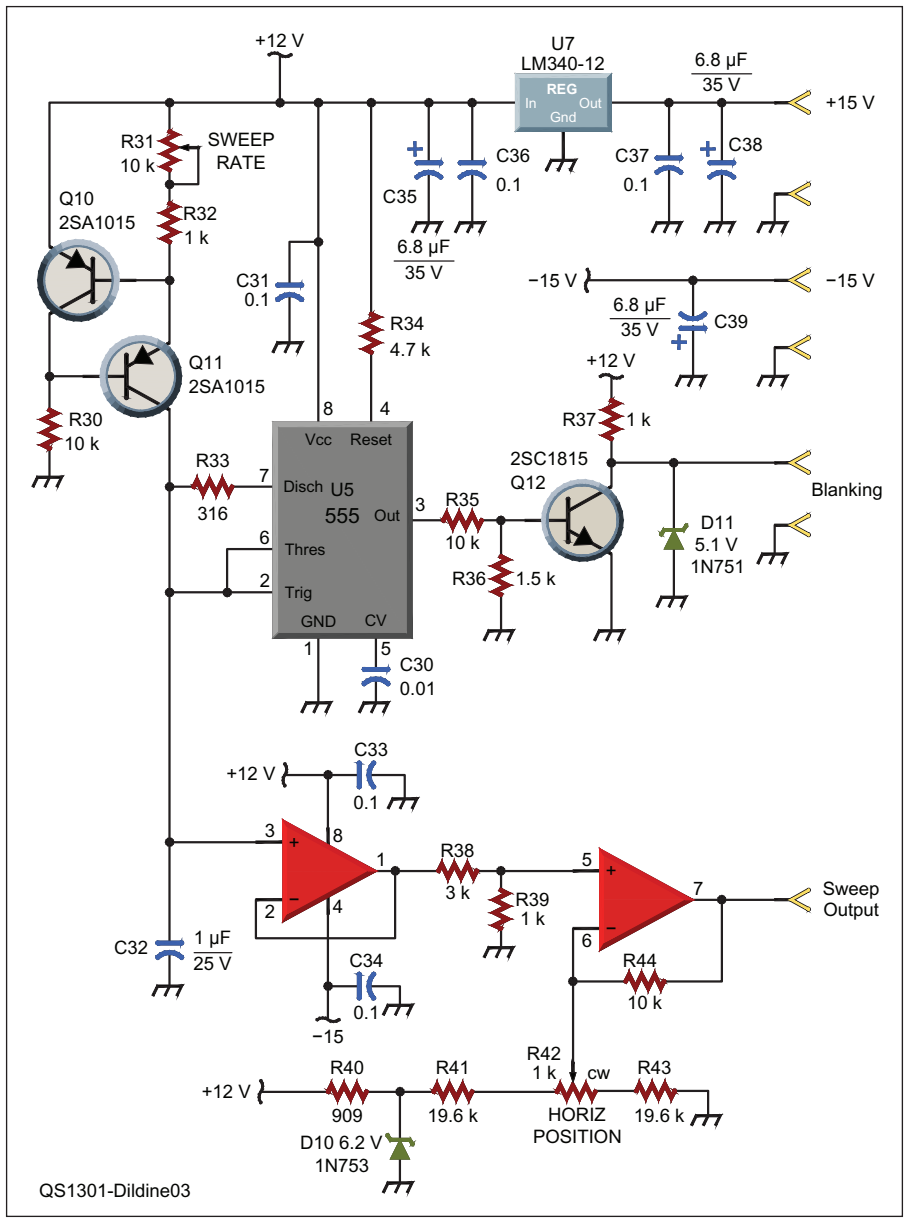



**Figure 3** — A simple sweep generator. All ceramic capacitors are 50 V, either X5R or X7R dielectric.

C30 — 0.01 µF ceramic capacitor.
C31, C33, C34, C36, C37 — 0.1 µF ceramic capacitor.
C32 — 1 µF Mylar capacitor (see text).
C35, C38, C39 — 6.8 µF tantalum capacitor.
D10 — 6.2 V, ½ W Zener diode (1N753 or equivalent).
D11 — 5.1 V, ½ W Zener diode (1N751 or equivalent).
Q10, Q11 — 2SA1015 or 2N3906 transistor.
Q12 — 2SC1815 or 2N2222 transistor.
R30, R35, R44 — 10 kΩ, ¼ W, 5% metal film resistor.
R31 — 10 kΩ trimming potentiometer.
R32, R37, R39 — 1 kΩ, ¼ W, 5% metal film resistor.
R33 — 316 Ω, ¼ W, 1% metal film resistor.
R34 — 4.7 kΩ, ¼ W, 5% metal film resistor.
R36 — 1.5 kΩ, ¼ W, 5% metal film resistor.
R38 — 3 kΩ, ¼ W, 5% metal film resistor.
R40 — 909 Ω, ¼ W, 1% metal film resistor.
R41, R43 — 19.6 kΩ, ¼ W, 1% metal film resistor.
R42 — 1 kΩ trimming potentiometer.
U5 — 555 timer integrated circuit.
U6 — OP284 dual op-amp integrated circuit (see text).
U7 — LM340-12 12 V, 3-terminal voltage regulator integrated circuit.

sufficient coupling to make the circuit oscillate.

The crystal I used was an old one from the junk box and the coupling had to be increased to make it oscillate reliably. L1 is 22 µH and consists of about 77 turns of #30 AWG enameled wire on a T-50 toroid. The inductance of such a coil is approximately 5 nH/T$^2$ where *T* is the number of turns. Output is taken from the tap between C3 and C4 and is clamped to ground by D1, a small Schottky diode, to give a signal from 0 to 5 V — perfect for the CMOS circuit that follows.

Narrow pulses are required for the sampler circuit. The sampler's theoretical frequency response will have a null at the frequency corresponding to the reciprocal of the sampler drive pulse width. So the narrower the pulse, the better. The crystal oscillator's output drives two cascaded sections of a 74AC00 quad 2 input NAND gate, U1D and U1A. The 74AC00 was chosen for its fast

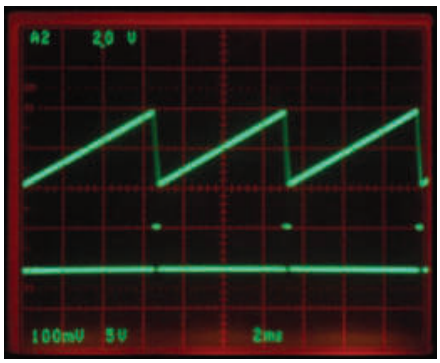



**Figure 4** — The top trace is the –1 V to +1 V sweep generator output. The lower trace is the 0 to 5 V blanking pulse that occurs during retrace. [Greg Farrell, K6SRO, photo]

edges and short propagation delay. The other two sections, U1B and U1C are arranged to form a pulse generator.

When the output of U1A is low, the output of U1B is high and the output of U1C is also high. When U1A's output goes high, both inputs of U1C are initially high causing its output to go low until the change in state propagates through U1B. After U1B's propagation delay, one input to U1C is high and one is low causing U1C's output to go high again. The pulse width at the output of U1C is approximately equal to U1B's propagation delay of about 2 to 3 ns.

The pulse generator's output is ac coupled to balun T1 to generate balanced positive and negative pulses that drive the sampling diodes. T1 is taken from a 75 to 300 Ω TV balun.

The pulses from the balun are ac coupled to turn on the sampler diodes D3 and D4. When turned on, they conduct a sample of the incoming RF signal to the IF preamplifier through 100 Ω resistors and 0.001 μF capacitors. The diodes generate self bias through 68 kΩ resistors connected to ground. The sampler diodes are Avago HSMS-2800 Schottkys, although any small-signal RF Schottky should do. The 50 Ω resistor terminating the incoming RF signal is actually two 100 Ω resistors in parallel placed symmetrically about the input connector.

A field effect transistor (FET) preamplifier, Q2, provides a high impedance load for the sampler. A J309 FET was used, but any similar type of RF FET should work equally well. Look for one with low gate-source and low gate-drain capacitance. This is followed by a 500 kHz low pass filter to eliminate mixing products from adjacent harmonics of the LO.

A feedback amplifier with about 15 dB gain, consisting of Q3, Q4 and Q5, boosts the IF signal to about 1 V. C18 and C20 roll off the open loop gain for compensation and the closed loop gain is set by the ratio of R20 the parallel combination of R17 and R21. This circuit is a handy one, as it has pretty good bandwidth and the dc feedback stabilizes the operating points of the transistors well. Bypass and coupling capacitors were chosen for a low frequency cutoff of about 100 Hz.

## What About the X-Axis?

The sampling down converter is a good match to an oscilloscope with a built-in sweep generator for the horizontal axis, and if that's what you're using you can skip this section. I happened to acquire an HP 1332A X-Y display that I wanted to use for a modulation monitor, but it has no horizontal sweep.

Figure 3 shows a simple sweep generator based on a 555 timer and an op-amp. The 555 works by charging a capacitor through a resistor. When the capacitor voltage reaches ⅔ of the timer's supply voltage, an internal comparator trips and the timer starts to discharge the capacitor. When the capacitor's voltage is reduced to ⅓ of the timer's supply voltage, the discharge stops and the cycle repeats.[2]

If the capacitor is charged from a constant current source, its voltage will be a linear ramp verses time. A current source consisting of two PNP transistors, Q10 and Q11, charges a 1 μF timing capacitor, C32. 2SA1015s were used in this circuit but any small signal PNP transistors such as the 2N3906 or 2N2907 will do. C32 should be a good quality capacitor with a dielectric of one of the plastics such as Mylar or polypropylene. Ceramic capacitors usually have too wide a tolerance and poor temperature characteristics, and electrolytics can have high enough leakage to cause nonlinearity in the sweep ramp. But if that's all you have, then by all means try it.

The current source is adjustable from about 60 to about 650 μA by R31, which gives sweep rates from about 75 to 150 Hz. Smaller values of timing capacitor C32 will give faster sweep rates. The 555 timer, U5, discharges the timing capacitor when it charges to ⅔ of the timer's supply voltage or about 8 V. The discharge rate is limited by R33 and when timing capacitor is discharged to ⅓ of the 555's supply voltage or about 4 V, the cycle repeats.

Any resistive load across the timing capacitor will distort the linear voltage ramp, so the capacitor's voltage is buffered by a voltage follower, U6A. An op-amp level shifter, U6B, transforms the 4 to 8 V ramp to ±1 V. R42 controls the amount of level shift and hence the horizontal position. An OP-284 dual op-amp was used because it was available, but any dual op-amp should work. The 555's output goes from +12 to 0 V during the time the timing capacitor is discharging, and this gives a handy output for blanking.

A simple one transistor inverter, Q12, turns this negative going pulse into a positive going blanking pulse for the HP 1332A. A 5 V Zener diode, D11, clamps the blanking output. A 12 V, three-terminal voltage regulator supplies positive voltage for the sweep generator and the sampling down converter circuits. Negative voltage for the op-amp is taken from a separate power source. Figure 4 shows the ramp and blank-

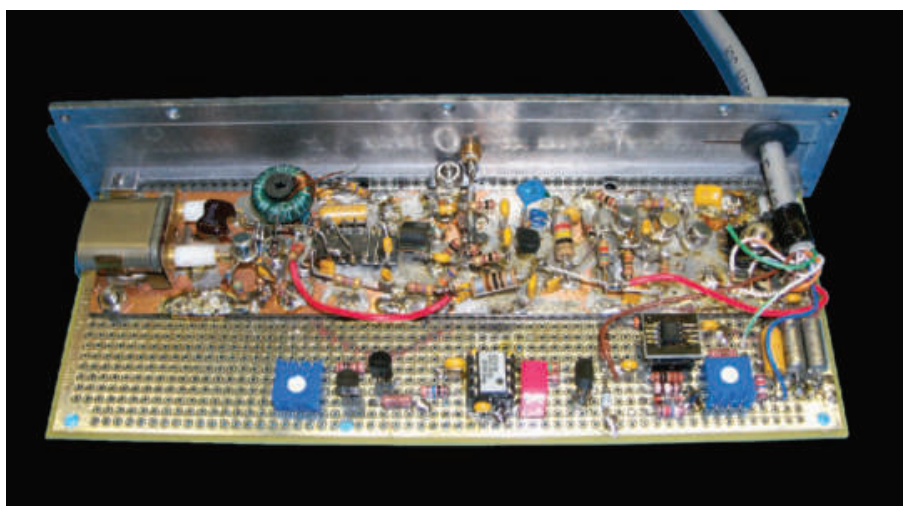


**Figure 5** — The sampling down converter is built dead bug style on a narrow strip of bare copper-clad PC board and mounted on a piece of perf board for convenience. The sweep generator is built on the lower half of the perf board and the whole assembly mounted in a die cast aluminum box.

ing outputs from the sweep generator.

## Construction

The sampling down converter was built "dead bug" style on a narrow strip of raw copper clad board and then mounted to a piece of perforated project (perf) board on which the sweep generator was also built, as shown in Figure 5. The perf board was mounted in a small aluminum die cast box. Power is obtained from the HP 1332A X-Y display with which it is used.

Layout is not critical, but as with any RF circuit, lead lengths should be kept short.

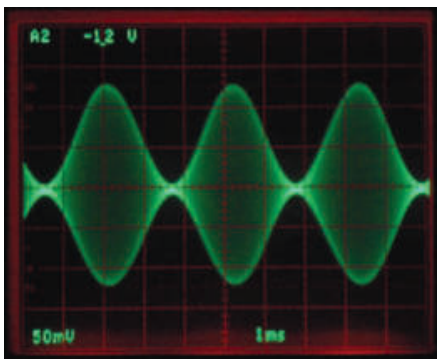



**Figure 6** — An amplitude modulated signal at 3870 kHz. The carrier frequency of the displayed waveform is about 328 kHz. [Greg Farrell, K6SRO, photo]

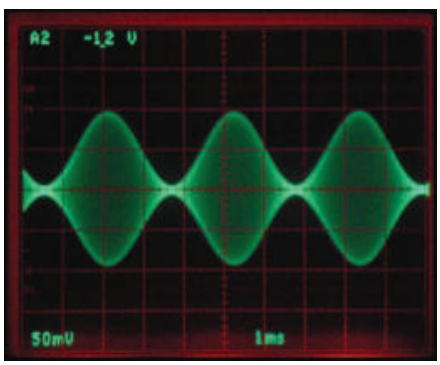



**Figure 7** — An amplitude modulated 223 MHz signal. The carrier frequency of the displayed waveform is about 150 kHz. [Greg Farrell, K6SRO, photo]

Dead bug style construction makes this easy and keeps stray capacitance to a minimum. The parts making up the sampler section should be arranged symmetrically similar to the way the schematic is drawn; leads should be kept as short as possible. While the sweep generator layout is not critical at all, careful placement of the parts will make the wiring easier.

All resistors can be 5% metal film types, although I used 1% parts in some places simply because they happened to be on hand. One percent metal film resistors are cheap enough nowadays that there's no real reason not to use them routinely. Ceramic capacitors should be C0G, X5R or X7R dielectric. Y5V and Z5U dielectrics have poor tolerance and even poorer temperature coefficients and therefore should be avoided. All the parts used are readily available from the usual distributers such as Digi-Key or Mouser, or from a well stocked junk box.

## Performance

With +3 dBm RF input the sampling down converter gives 1 $V_P$ output over all the HF bands. The conversion efficiency is 3 dB down (0.7 V peak output) at 226 MHz. At 450 MHz the output is still a useful 180 mV. The conversion efficiency goes through a null at about 550 MHz, indicating that the sampling pulse width is about 2 nanoseconds. Above 550 MHz the conversion efficiency comes up again and with an 800 MHz input, the output is 100 mV. The maximum input signal for good linearity is about +5 dBm.

Figure 6 shows a 100% modulated AM signal at 3870 kHz and Figure 7 shows the same modulation at 223 MHz.

## Further Work

There is always room for improvement on any design, and this one's no exception. The crystal oscillator could be replaced by a tunable LC oscillator for more flexibility, if desired. One of the stable VFO circuits shown in any recent *ARRL Handbook* would be a good place to start.[3]

The sampler conversion efficiency might be improved by varying the self bias on the sampler diodes, or by introducing some fixed bias. Also, some improvement in the frequency response might be had by a different method of generating the pulse drive to the diodes, perhaps by using an emitter-coupled logic (ECL) circuit or a pulse generator based on a step-recovery diode. Experimenting with different balun types might also help. Microwave samplers operating beyond 50 GHz are designed in this manner.

The sweep generator could be simplified by just ac coupling the ramp generated by the 555 timer with only a little loss of linearity if it feeds a high impedance input.

**Notes**

[1] *The ARRL Handbook*, 2005 edition, p 10.25.
[2] B. Marshall, "Operational Characteristics of the 555 Timer," *Ham Radio*, Mar 1979, p 32.
[3] *The ARRL Handbook,* 90th Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 4050. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

Photos by the author except as noted.

ARRL member and Amateur Extra class licensee Bob Dildine, W6SFH, was first licensed as a Novice in 1957 with the call WN6SFH. He is primarily interested in the technical aspects of Amateur Radio from audio to microwaves. He received a BSEE from San Diego State College in 1967 and an MSEE from the University of California at Berkeley in 1973. He then joined Hewlett-Packard as an R&D engineer where he has done precision analog design on microwave synthesizers and network analyzers. He retired from Agilent Technologies in 2003 and continues to enjoy designing and building Amateur Radio projects as well as restoring vintage electronic equipment.

You can reach Bob at 2321 Sycamore Ave, Santa Rosa, CA 95404 or at **w6sfh@sonic.net**.

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# New Products

### Compact Low Power Antenna Accessories from MFJ

MFJ's "QRPocket" compact antenna accessories are designed for QRP and portable operation. The MFJ-9213 SWR/wattmeter ($39.95) reads forward and reflected power in 5, 30 and 100 W ranges, plus SWR. Frequency range is 1.8 to 50 MHz. The MFJ-9214 wattmeter and dummy load ($29.95) has a built-in 50 Ω dry load and reads 5 W full scale from 1.8 to 150 MHz. The MFJ-9231 artificial ground ($59.95) is used to achieve a good RF counterpoise from 1.8 to 30 MHz even if an earth ground isn't available nearby. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.


# Feedback

In "Product Review — Elecraft KX3 HF and 6 Meter QRP Transceiver" [Dec 2012, pp 39-44] the last word of the first paragraph under *What's In The Box* on page 39 should be "translator," not "transistor."

# A Uniquely Tuned 2 Meter Transmitter Hunting Loop

## This compact, inexpensive, easy-to-build loop is ideal for close-in direction finding and transmitter-hunting.

**John Portune, W6NBC**

One of the hidden joys of transmitter hunting is that it provides an excuse for homebrewing. As a new participant in this radiosport, I found myself constructing antennas I never would have considered for other activities. This little loop is a perfect example (see Figure 1).

**Figure 1** — Left to right, loop, coupling loop, balun, attenuator and handheld transceiver mount (behind attenuator).

### The Basic Dynamics of Transmitter Hunting

At the starting point of a transmitter hunt, one needs high gain — a Yagi or quad, and a sensitive receiver. As you approach the hidden transmitter, however, the game changes dramatically. Now you need a portable antenna and an attenuator. This is the realm of the loop or a hand-held Yagi. I prefer the loop. It's handier and, in most cases, just as effective.

### Loop Sensitivity

Compared to a Yagi or a quad, a small loop has downsides, even though it does have equally good directivity. One is its size, which does not let it capture as much signal, particularly if not tuned to the frequency of the transmitter. Commercially manufactured direction finding (DF) loops are often not tuned. They are designed this way to permit them to be used on more than one band.

I preferred to increase my loop's ability to receive by tuning it to 2 meters with a variable capacitor at the loop's ends. The loop's untuned resonance is roughly 450 MHz, making it inefficient on 2 meters. For locating radio-tagged wild animals, finding memory impaired patients or locating a VHF aviation beacon, it is easy to retune the capacitor for another VHF band.

I chose a somewhat unconventional variable capacitor simply because common rotary and compression mica variables are awkward to add to a loop. Furthermore, they are becoming hard to find. At first I did not know what kind of variable capacitor to use. Then lightning struck.

Why not dispense with using a discrete capacitor at all? Let the loop itself be one of the plates of a variable capacitor by constructing it of tubing instead of solid rod or wire. The other plate of the capacitor is 11½ inches of the center conductor and dielectric of a piece of RG-8X coax, with the black outer jacket and shield removed. It's inserted inside the tubing of the loop as shown in Figure 2.

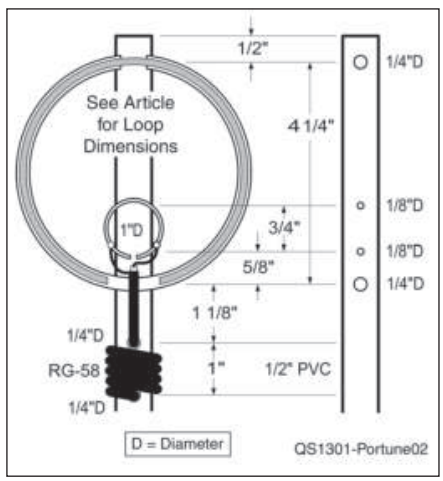


**Figure 2** — The transmitter hunting loop. Note that a tuning capacitor is formed by the tubing of the loop itself and an inserted length of the inner conductor and dielectric from RG-8X coax.

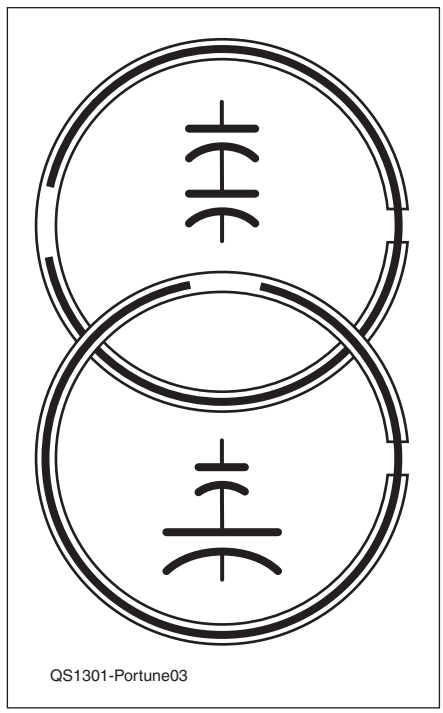


**Figure 3** — Cross sections of the loop with coax inner conductor and dielectric from RG-8X coax in two different positions. Maximum capacitance is with the inner conductor as in the top loop.

Notice that this design creates two capacitors in series. One is above the gap, the other is below it. As illustrated in Figure 3, when the sides are equal total capacitance is maximum. Move the sliding piece to either side and the capacitance decreases, increasing the resonant frequency. Note the equivalent circuit of the two capacitors.

Therefore, to adjust the frequency of the loop you merely slide the coax inner conductor and dielectric with your fingernail at the gap in the top end of the boom. See Figure 4.

The tuning is very stable. I've never needed to retune my loop, though I did have to experiment, using an antenna analyzer, with tubing size and inner conductor length to find the right combination. Just duplicate the dimensions and you will have no trouble tuning the loop.

**Figure 4** — Loop from the top end. Tune the loop by sliding the coax inner conductor and dielectric with your fingernail.

**Figure 5** — Carol Adams, KG6VLG, demonstrating the use of *body fade*. Note the placement and orientation of the loop. She is facing the hidden transmitter.

## The Small Coupling Loop

There are several possible ways to match the loop to 50 Ω coax. I use compact and flexible RG-58 for this application. From practical experience with small loops, I have found that an inductive coupling loop is the easiest matching method. This one is 1 inch in diameter, made from #14 AWG solid copper wire. Note that there is a gap in it inside the boom. Solder the feed coax, as shown, to the coupling loop just outside of the boom. There is no electrical connection to the main loop. The two constitute an RF transformer with energy passing via magnetic induction.

## Tuning the Antenna

The easiest way to tune up the antenna is with an antenna analyzer such as an MFJ-259 or equivalent. Begin by centering the coax inner conductor. Next find the resonant frequency by sweeping across the VHF band with the antenna analyzer connected to the feed coax and looking for the SWR dip. It will be below the 2 meter band at first. Again, don't concern yourself with SWR. If you later want to use the loop for transmitting, you can then fine tune the coupling loop for a better match. For receiving, the dimensions shown are entirely adequate.

Slide the coax inner conductor with your fingernail in small increments. Each time, again find the dip. Gap length increments work fine. Repeat the process until you reach the desired frequency. I easily tuned up a dozen new loops this way one afternoon at a radio club build-it session.

## Building the Loop

The vertical boom is a length of common ½ inch PVC water pipe, visible in Figure 2. The pipe shown is actually the handle of a dust pan. It is a little lighter and has a nice feel.

Construction is very straightforward. Cut and bend the loops with your fingers. A form is not necessary. Then drill the holes in the boom for the loops and balun. Next, rotate the loops into place through the holes and add the coax, forming the balun as you go. Finally, solder the ends of the coax to the coupling loop and attach a connector.

## An Attenuator

To use the loop as part of the sport of radio transmitter hunting you will need an attenuator. It cuts down the strong signals as you get close to the hidden transmitter. Without it, your receiver will saturate and you will lose the ability to determine directions through peaks and nulls.

Two types of attenuator are common. One operates with the receiver "on channel" and attenuates with switchable resistive pads or a potentiometer. The other, called an *off-set* attenuator, mixes the incoming signal with a local crystal oscillator, typically at 2 or 4 MHz. Hence, you listen high or low. With a resistive on-channel attenuator your receiver needs to be shielded to prevent direct pickup through the case. An off-set attenuator is much simpler to use.

I also made the boom long enough to accept glued-on rectangles of PVC, cut from a blank 120 V ac duplex PVC outlet box cover plate. You attach the attenuator and 2 meter handheld transceiver to these using squares of stick-on hook and loop fastener.

## The Balun

Also essential to all transmitter hunt antennas is a balun. If it is omitted, the antenna pattern will be skewed, which could lead you in the wrong direction.

As above, drill four additional holes in the boom to secure it. This type of balun is an RF choke formed of five turns of the feed coax. VHF ferrite beads may also be used.

## Using the Loop

When using this antenna, keep in mind that there are two nulls and two peaks. The peaks occur when the loop is in line with the hidden transmitter, the nulls when it is broadside. To resolve this all you need is a very elementary transmitter hunting technique called *body fade*.

With the loop held close to your chest, and also in line with the transmitter, turn in a full circle. You will still get two peaks (and two nulls). But with your body present the correct and stronger peak will occur when you are facing the hidden transmitter (see Figure 5). Once you know the right direction, hold the loop high above your head. The peaks and nulls will be more evident.

Many good construction and operating tips for transmitter hunting may be found on our radio club's website, **satellitearc.com**. Of particular value is an audible S meter that we dub "the screamer," developed by veteran transmitter hunter David E. Dowler, KA6BFB. A variable tone eliminates the need to look at the S meter on your handheld. Also, the screamer has a much wider signal strength range.

Try this inexpensive little loop at your next transmitter hunt. You will be pleased. Also consider it as a radio club build-it project. It was a big hit at mine.

ARRL member and Amateur Extra class licensee John Portune, W6NBC, received a BSc in physics from Oregon State University in 1960 and a BA in liberal arts and communications from Ambassador College in Pasadena, California in 1963. He earned an FCC Commercial General Radiotelephone license and an FCC Radiotelegraph license. John retired as a broadcast television engineer and technical instructor at KNBC in Burbank and then from Sony Electronics in San Jose, California.

You can reach John at 519 W Taylor St, SPC 111, Santa Maria, CA 93458, or at **jportune@aol.com**.

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# Build a Legal Limit Bias T that Covers 1.8 to 230 MHz

## This simple device lets you send up to 3 A dc down your coax, along with the RF.

**Phil Salas, AD5X**

A bias T permits the insertion and removal of a dc voltage onto the center conductor of a RF transmission line. It is used to provide dc power to remotely located RF switches, preamps and antenna tuners to avoid the need for a separate dc power cable. Figure 1 (at the bottom of this page) shows a typical application in which a pair of bias Ts power a remote antenna tuner. As you can see, the bias T orientation permits it to either insert or recover the dc operating voltage.

### Design Considerations

A dc RF isolating inductor must provide high reactance across the bands of interest while carrying the required dc current. Also the Q must be high to minimize inductor power dissipation and thus loss of the RF signal.

I measured a large number of inductors on my Array Solutions AIM*uhf* vector network analyzer and found most had either multiple resonances across the HF spectrum, or the Q was too low for the desired efficiency. I finally settled on a J. W. Miller 40 µH inductor. This inductor is rated at 3 A with a typical specified self resonant frequency of 145 MHz. Figure 2 shows the measured inductor data. $R_P$, the orange curve, is the finite parallel resistance of the inductor due to inductor Q. RF power will be dissipated

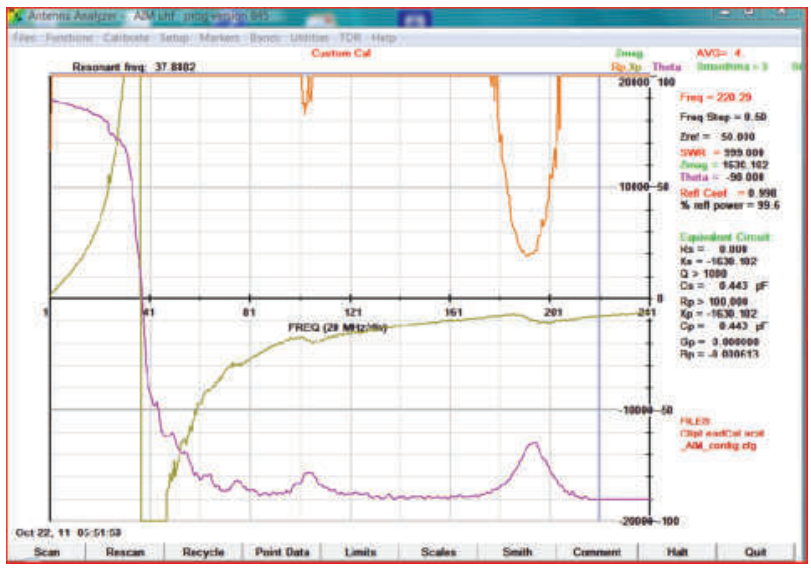


**Figure 2** — AIM*uhf* data sweep of 40 µH inductor.

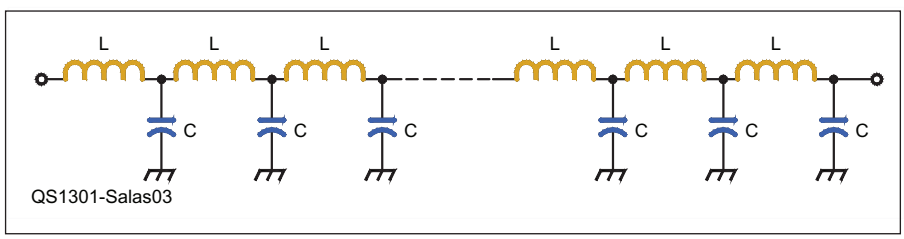


**Figure 3** — Lumped element equivalent circuit of a transmission line.

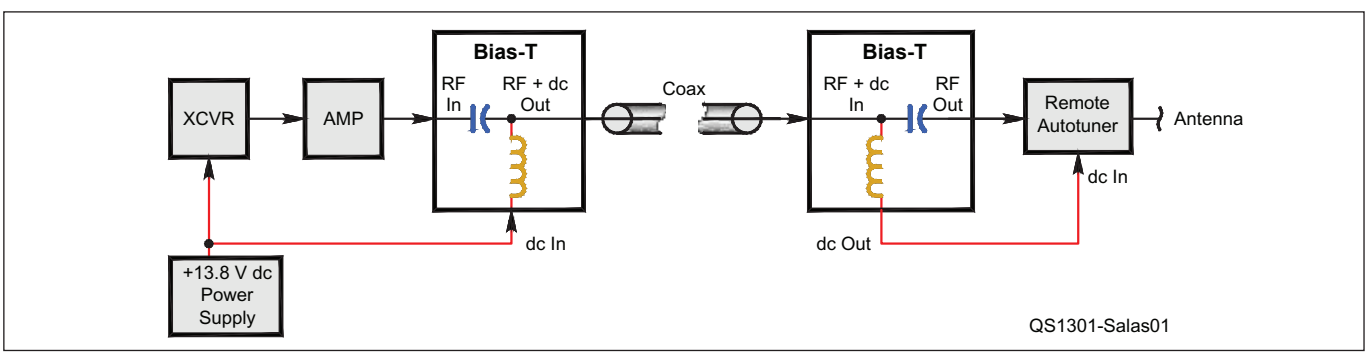


**Figure 1** — Typical system connection diagram of a bias T.

**Table 1**
**40 µH $R_P$ and Calculated Inductor Power Dissipation ($P_D$) at 1500 W**

| Band (meters) | 160 | 80 | 40 | 20 | 17 | 15 | 12 | 10 | 6 | 2 | 1¼ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $R_P$ (kΩ) | 23 | 34 | 40 | 41 | 42 | 48 | 37 | 43 | 29 | 100 | 100 |
| $P_D$ (W) | 3.3 | 2.2 | 1.9 | 1.8 | 1.8 | 1.6 | 2 | 1.7 | 2.6 | 0.75 | 0.75 |

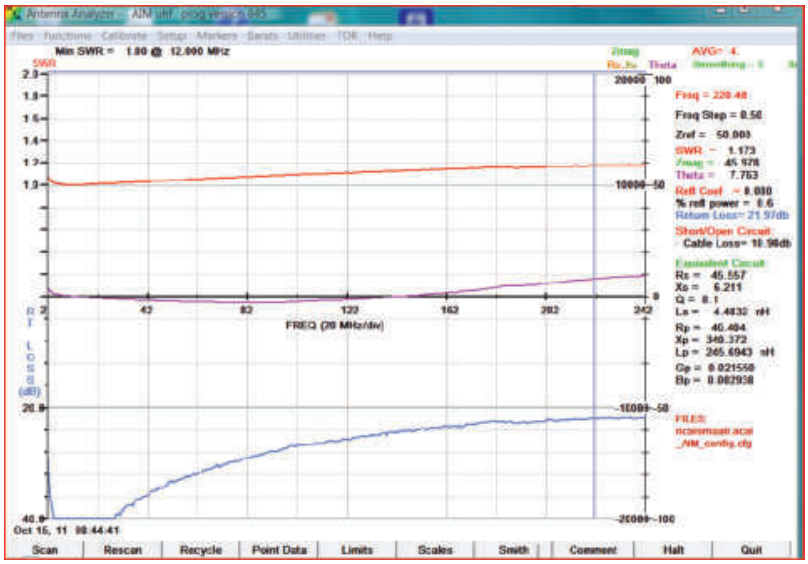

**Figure 4** — AIM*uhf* data sweep of the bias T SWR with compensation.

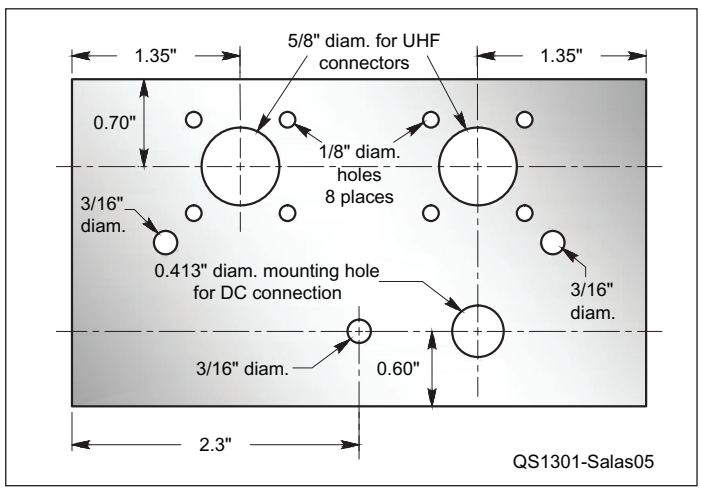


**Figure 5** — Cover plate hole locations with dimensions.

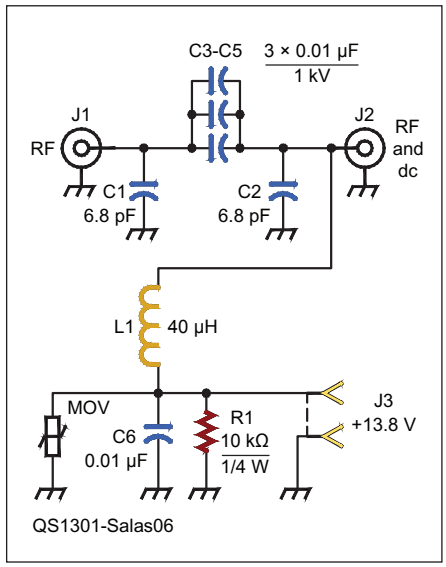


**Figure 6** —Schematic diagram and parts list for the bias T. Mouser parts are available from **www.mouser.com**.

C1, C2 — 6.8 pF, 1 kV capacitor (Mouser 75-561R10TCCV68).
C3-C6 — 0.01 µF, 1 kV capacitor (Mouser 81-DEBF33A103ZA2B).
J1, J2 — SO-239 UHF coax sockets (Mouser 523-83-1R).
J3 — Chassis connector, dc power (Mouser 163-1060-EX).
L1 — 40 µH, 3 A inductor, J.W. Miller 5240-RC (Mouser 542-5240-RC).
MOV — Metal-oxide varistor, 18 V dc (Mouser 667-ERZ-V10D220).
R1 — 10 kΩ, ¼ W resistor (Mouser 660-MFS1/4LCT52R103J).
Electrical box, Reddot S100E (Lowes 71209).
Metal box cover, Reddot S340E-R (Lowes 303624).

in this resistance. As you can see, $R_P$ stays high in the ham bands of interest.

I tabulated $R_P$ for the different ham bands in Table 1. And I calculated the inductor power dissipation at 1500 W ($P_D = V^2/R_P$ where $V^2 = 75{,}000$ at 1500 W and 50 Ω). For typical low duty cycle SSB or CW operation, the power dissipation will be about 25 to 30% of that shown.

Next I built the bias T. My first bias T circuit had acceptable SWR through 6 meters (the 6 meter SWR was 1.2:1). The SWR degraded, however, to about 1.7:1 on 2 meters, so I decided to see if I could improve the performance at higher frequencies.

A lossless transmission line can be modeled as an infinite number of incrementally small series inductors and shunt capacitors (see Figure 3) with the characteristic impedance given by $Z_0 = (L/C)^{1/2}$.

A hand wired assembly such as this bias T tends to be inductive unless you use good transmission line construction practices. Sure enough, my AIM*uhf* measurement data showed that the assembly was inductive. Since $Z_0 = (L/C)^{1/2}$, increased series inductance can be compensated for by increasing the shunt capacitance. With a little experimentation I found that 6.8 pF capacitors across the input and output significantly improved performance. As you can see in Figure 4 the SWR is less than 1.05:1 up to 50 MHz, less than 1.1:1 on 2 meters, and less than 1.2:1 at 220 MHz.

## Construction

I built the bias T into an inexpensive outdoor electrical cast aluminum box from a home supply store. Figure 5 shows the hole locations on the cover that ensure that the connectors and components don't interfere with the internal cover mounting brackets. I used a step drill for the dc and UHF connector holes.

After drilling the ⅝ inch diameter holes for the UHF connectors, I inserted the UHF connectors in the holes and marked the locations for the #4 (⅛ inch) mounting holes

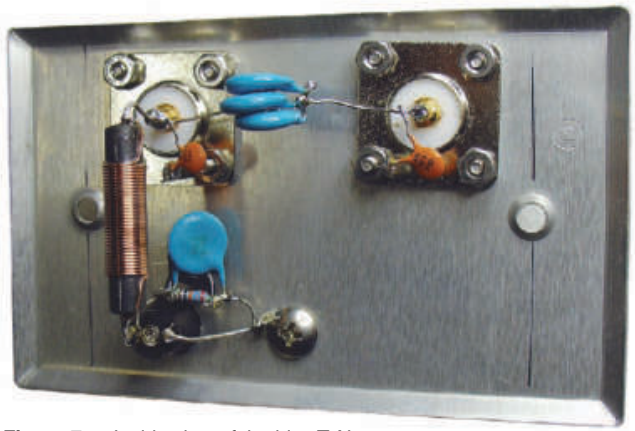

**Figure 7** — Inside view of the bias T. Note the input/output compensating capacitors.

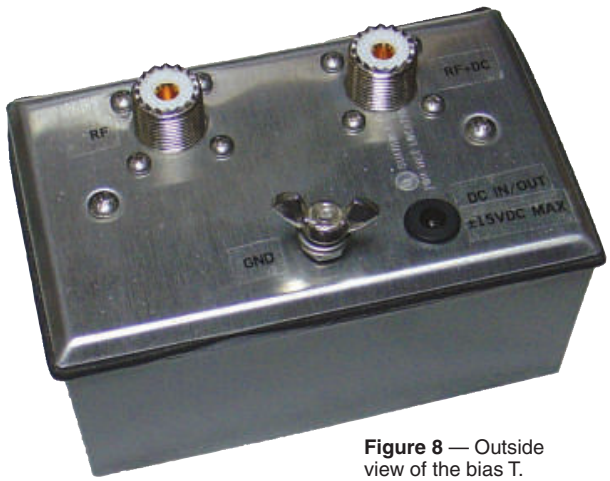


**Figure 8** — Outside view of the bias T.

with an ultra fine pitch permanent marker. I then center punched and drilled these mounting holes.

The complete parts list and the schematic are shown in Figure 6. All components mount on the outlet box cover. The mounting hardware is stainless steel for outdoor use (the cover includes a weatherproof gasket). The three 0.01 µF, 1 kV paralleled capacitors were not chosen for their voltage rating, as there should be virtually no RF voltage drop across them. I did want, however, physically large capacitors that were capable of handling the power dissipation due to the approximately 5.5 $A_{RMS}$ RF current through them under legal limit operation. On the dc in/out side, the metal oxide varistor (MOV) provides transient protection for voltages over about 18 V dc and the 0.01 µF capacitor provides RF bypassing. I included a 10 kΩ resistor to provide a constant dc path to ground.

Figure 8 is an outside view of the bias T. I used a #8-32 wing nut on the ground lug, but a standard #8-32 stainless steel nut can be substituted. Casio "Black on Clear" labeling tape sprayed with Krylon clear coat adds the text. A black permanent marking pen is a good alternative weatherproof marking method.

## Conclusion

A bias T can be the ideal solution for providing dc operating voltages through your coax cable to remotely located devices. The weatherproof unit described here can provide up to 3 A of dc while simultaneously handling RF power up to 1500 W from 1.8 to 220 MHz.

ARRL Life Member and Amateur Extra licensee Phil Salas, AD5X, has been licensed continuously since 1964. Because of his interest in ham radio he obtained BSEE and MSEE degrees from Virginia Tech and SMU respectively. This led to a 33 year career in Microwave and Lightwave R&D. Now fully retired, Phil spends his time tinkering with ham related projects and relaxing with his wife and best friend Debbie, N5UPT.

You can reach Phil at 1517 Creekside Dr, Richardson, TX 75081 or at **dpsalas@tx.rr.com**.

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# New Products

### Cushcraft 6 Meter and HF Squalo Antennas

Cushcraft's Squalo antenna is a half-wave, horizontally polarized omnidirectional antenna offering a 360 degree pattern with no deep nulls. The square shape allows full electrical length with compact dimensions. Squalo antennas are intended for horizontally polarized mobile or fixed operation on SSB, CW or AM. Elements may be stacked for added gain. The 6 and 2 meter models are packaged with rubber suction cups and magnets for vehicle top mounting and a horizontal center support for mast or tower mounting. The 10, 15 and 20 meter models are designed for mast or tower mounting. Power rating is 100 W PEP for CW or SSB. Prices: ASQ-2, 2 meters, 10 × 10 inches, $119.95; ASQ-6, 6 meters, 30 × 30 inches, $139.95; ASQ-10, 10 meters, 50 × 50 inches, $159.95; ASQ-15, 15 meters, 65 × 65 inches, $189.95; ASQ-20, 20 meters, 100 × 100 inches, $229.95. For more information, to order, or for your nearest dealer, call 800-973-6572 or see **www.cushcraftamateur.com.**

### Compact Antenna Tuner from MFJ

The MFJ-902B antenna tuner uses air variable capacitors (600 V, 322 pF) and three stacked powdered iron toroids. Rated to handle 150 W on 80 to 6 meters, the tuner is intended to be used with compact transceivers such as the ICOM IC-706MKIIG, Yaesu FT-100D, Kenwood TS-50 or any other 100 W class transceiver with a built-in SWR meter. The MFJ-902B measures 2.25 × 4.5 × 2.75 inches (HWD) and weighs less than 2 pounds. Price: $109.95. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com.**

# For Best Results, Consider a Balun in Your Antenna System

## If you need a balun, almost nothing else will do. If you don't need one, it won't hurt to have it.

**Joel R. Hallas, W1ZR**

Many, perhaps most, antennas that we use, including the lowly center fed dipole, are inherently balanced. That is, each side, while driven by the opposite polarity at any instant, should be at the same magnitude. If we connect the dipole to the radio system via coax cable, as in Figure 1, the current from the inner conductor drives one side of the antenna. The current from the inside of the shield splits between the other side of the dipole and the outside of the shield.[1]

### So What's Wrong With Current on the Outside of the Coax?

RF current on the outside of the coax acts like RF current on any conductor — it radiates. If it happens to be propagating to the same place you wanted it to go, perhaps there is nothing wrong — it may even help. On the other hand, if we wanted radiation from the cable between the antenna and the radio, we would have made it part of the antenna, rather than a transmission line that isn't supposed to radiate.

There are a few kinds of problems that can result from this unintended radiation:

- If we are using a directional antenna, such as a beam, the radiation from the coax will reduce the front to back ratio, as well as generally distort the pattern and reduce the signal in the desired direction.

- While an outdoor transmission line doesn't often get us into too much trouble, usually the coax eventually enters a building — perhaps where the radio gear is located. Now it has an opportunity to couple into house wiring and interfere with systems, such as the telephone, alarm systems and other radio based devices. Equally important, unintended radio signals from all these devices and others will couple into the antenna system and become interference on receive.

- If the current ends up as RF voltage on equipment cabinets, it can result in RF tingles or burns. In some cases the signals will couple to mic and speaker wiring causing transmitter lockup or other operating problems.

[1]Notes appear on page 50.

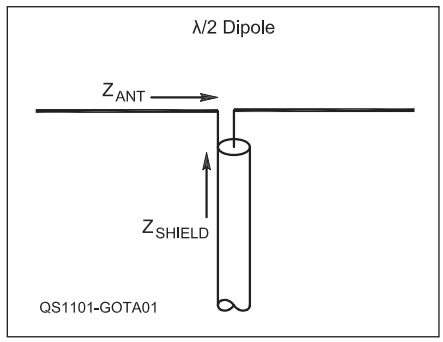


**Figure 1** — Diagram of a center fed dipole with a transition to coax. Note that the current on the shield side will split between the half of the dipole connected to the coax shield and the outside of the shield.

### How Big is the Problem?

This is an interesting question. Talk to 10 amateurs about whether they need a balun on their coax fed antenna and you may get a dozen answers! The reason is that the effect will depend on the conditions at their station. Some may not have problems, others may have them and not be aware of them. They make calls and they get answers — what could be wrong?

The current split between the antenna conductor and the shield in Figure 1 depends on the impedance of each conductor. The impedance of one side of a resonant half wave dipole is about half of the center impedance of 50 to 100 Ω, depending on height. The impedance of the outside of the coax, on the other hand, is not quite so obvious. It will depend mainly on the bottom termination and the coax length.

**With a common mode choke your power will go to the antenna.**

If the coax happens to be ½ wavelength long (or a multiple), and grounded well at the bottom, the low impedance of the bottom will be reflected to the top and the current on the outside of the shield can be comparable to that on the antenna. On the other hand, if the coax happens to be ¼ wavelength long (or an odd multiple), and grounded well at the bottom, the low impedance at the bottom will be transformed to a very high impedance at the top, and little current will flow on the shield. In-between lengths will have in-between impedances, but mostly will be higher than the half antenna, resulting in relatively small shield current.

### Enter the *Balun* or Balanced to Unbalanced Transformer

In order to eliminate current on the outside of the coax, two steps are required:

- Insert a device between the coax and the antenna that causes the coax current to flow only to the antenna. This is called either a *balun* or a *common mode choke*.

- Ensure that the coax is perpendicular to the antenna for at least ¼ to ½ wavelength. Efforts to avoid shield current with a choke or balun at the antenna can be circumvented if the coax is closer to one side than the other. The antenna can then couple to the coax, picking up a signal on the outside from the antenna's field.

#### *The Balun*

The classic balun is an actual transformer design, generally constructed of wire wound in parallel windings on a ferrite rod or toroid and connected to cancel currents on the outside of the coax. The typical ferrite core balun offers operation over a wide range of frequencies, often the whole HF spectrum or beyond, making it a good choice for multiband antennas. There are a number of other balun types, often useful on a single narrow range of frequencies and constructed of coax in various configurations. These are described in detail in *The ARRL Antenna Book*.[2]

#### *Common Mode Chokes*

A common mode choke is an inherently simpler device — and much easier to make. The idea is that it offers a high impedance to currents on the outside of the shield, the *common* mode, while having minimal effect on the desired currents inside the coax, the *differential* mode. One of the joys of working with coax is that what happens on the outside is effectively shielded from what happens on the inside. Thus, unlike window or open-wire line, a coil of coax has the same attenuation to the differential mode as if it were straight.

**Figure 2** — Common mode choke made by winding the antenna feed coax through a ferrite toroid. The coax can be neatly secured with nylon tie wraps. The choking inductance is proportional to the square of the number of turns.

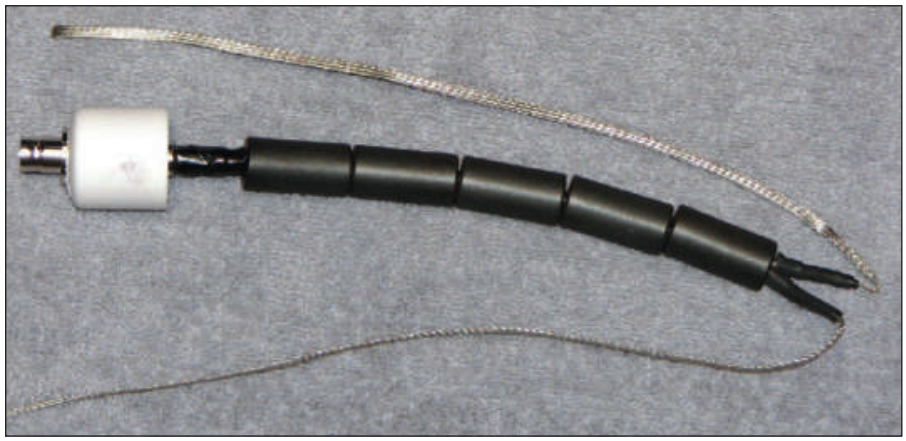

**Figure 3** — A common mode choke can made from multiple ferrite beads. This is a better solution for foam dielectric coax, such as RG-8X. The choking inductance is proportional to the number of beads. [Photo courtesy Lou Burke, W7JI]

That same coil has inductance that just affects the common mode, and that is the basis of our common mode choke. In fact many amateurs just use a small coil of coax at the antenna feed point to serve that function. It actually makes sense to be somewhat more scientific about the coil design. *The ARRL Antenna Book* has a section describing the optimum coil wound on PVC tubing for different bands.[3] A simpler, if slightly more expensive approach is to wind coax through a ferrite toroid. These donut shaped cores increase the inductance without increasing the capacitance very much, are lighter weight and use less coax — a consideration described below. They can be as effective as the much larger air wound type, and cover a wider frequency range.

My favorite common mode choke arrangement is to use a 2.4 inch diameter K mix ferrite core (**www.amidoncorp.com/items/23** or **www.fair-rite.com**, for example). Wrap as many turns of thin size coax as you can (but not foam coax, such as RG-8X — it can't handle the tight turns), just before it connects to the antenna as shown in Fig-ure 2. Some nylon tie wraps can be used to secure the coax neatly. One advantage of this configuration is that there are no extra connections exposed to the weather and any extra loss is just that associated with a few feet of the same coax you would use anyway.

If you prefer to use the popular lower loss foam coax, such as RG-8X, the choke can be constructed using multiple ferrite beads as shown in Figure 3.[4] This avoids the tight bending radius required with a ferrite toroidal core. Note that while with the toroid, the choking inductance goes up with the square of the number of turns, with the beads the inductance for N beads is just N times the number of beads. This is because they act as individual inductors in series, rather than as coupled turns with mutual inductance.

**Notes**

[1]Because of skin effect, current at radio frequencies can flow on the inside and outside of a coax cable independently — it's as if they were separate conductors.

[2]*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**.

[3]See Note 2, pp 24-42, 423.

[4]Available from Palomar Engineers (**www.palomar-engineers.com**), part FB56-43.

Joel R. Hallas, W1ZR, is *QST* Technical Editor and can be reached at **w1zr@arrl.org**.

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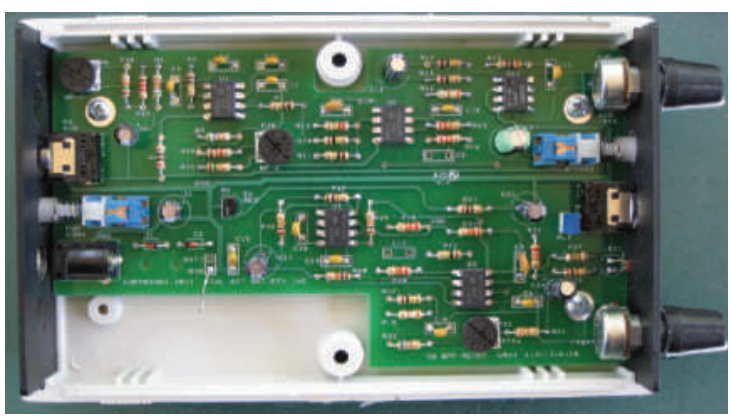
## New Products

### CW Regenerative Filter Kit from the Xtal Set Society

This kit is intended to help reduce the effects of galactic noise encountered when listening to HF CW. There isn't much that can improve copy of CW notes that are simply too weak, but it is possible to scrub away a portion of the static with an audio regenerative filter. For example, when tuned to a quiet spot on 30 meters with the regen filter engaged, the regen's output shows a reduction in noise compared to the signal at the receiver's headphone jack. In bypass mode one simply listens to what the rig has to offer. In scrubber mode, the multiple feedback filters and regen work together to remove a portion of the remaining white noise. The processed signal is said to sound clean with a slight echo-chamber quality. For most operators this may improve copy. The filter requires a well regulated and grounded 13.8 V dc supply or one or two 9 V batteries. Price: PC board and manual only, $29.95; full kit without case, $49.95; full kit with case, $69.95. For more information, or to order, visit **www.midnightscience.com**.



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

# ICOM IC-2300H 2 Meter FM Transceiver

**A worthy successor to the IC-2200H, a popular high power 2 meter mobile rig.**

*Reviewed by Rick Palm, K1CE*
*QST Contributing Editor*
**k1ce@arrl.org**

*Workhorse* was the first word that came to mind as I tested ICOM's successor to its popular IC-2200H 2 meter FM radio, which in turn was the successor to its IC-2100 model. I've owned and operated the IC-2200H for several years now. It has been my main radio for FM voice, repeater and D-STAR applications. I have had nothing but excellent performance from it after figuring out some nuances for digital operation and D-STAR. The '2300H is smaller (shorter, but the same width as the '2200H — the same mounting bracket can be used), but retains the easy, simple user interface with few frills that made the IC-2200H so popular for FM voice operation.

To make the unit smaller, something had to give, and my guess is that it was the UT-118 digital board that plugged into the IC-2200H for D-STAR digital voice and data applications, an option not available for the IC-2300H. That was a bit of a surprise to me, as the popularity of D-STAR continues to grow, at least here in northern Florida and the southeastern US in general. There are other ICOM radios available for D-STAR operation, but the IC-2200H was a relatively inexpensive way of getting into it.

## Overview

A first for me as I reviewed this radio was my use of a PC cable and software from RT Systems to program the memories. I had always thought that this was a bit of a gimmick, frankly, but I dutifully installed the software and plugged in the cable (USB connector on one end, and the speaker jack connector on the other — yes, the cable plugs into the speaker jack on the back of the radio) as I tried to keep an open mind.

The instruction manual is blissfully short and sweet, and I was programming memories and scan edges in no time at all. I was pleasantly surprised at how well the memory programming process worked.

The steps are simple: load the software, type in the disk's serial number, get data from the radio, type in your memory, scan and menu preferences, and then save and send the file to the radio. Disconnect the cable and you are good to go. To be honest, I had a lot of fun programming the radio using the software and it wasn't a chore. The screen looks a little like an *Excel* spreadsheet.

While we are on the topic of memory channels, one of the many things I like about this series of radios is the memory bank option. The user can program a set of memories in one of the memory banks for one location and another set of memory frequencies for another location. For me, that meant a set of local repeater frequencies for my home locale in Daytona Beach, Florida in one bank, and another set of repeater frequencies in another bank for my cabin retreat out by the Suwannee River, with repeater activity centered on Lake City. This is quite handy.

Otherwise, the radio is set up similarly to its predecessor. A series of seven solid-feeling (not flimsy) buttons along the bottom of the front panel, with labels on the illuminated display, select the basic functions of the radio. The primary functions are SET (Set mode), MONI (monitor repeater input frequency), LOW (output power selection), TONE selection, M/CALL (select memory, call and weather channels) and V/MHz to select VFO mode. Secondary functions include LOCK, ANM (select channel names or numbers), DUP (select duplex offset or simplex), T-SCAN (scan for CTCSS tone in use by the repeater), PRIO (priority watch) and SCAN. These are functions that I use often. Lesser used functions and selections are found within the extensive menus, a standard of the industry nowadays.

Most of the primary control functions can be found on the HM-133V remote control microphone, which is provided as a standard accessory. I just can't recommend using the mic to program your radio while driving for the same reasons you shouldn't text and drive. While the owner will develop a preference for controlling the radio from the front panel or the microphone keypad, I liked the front panel method the best.

### Bottom Line

The IC-2300H is a small, high power mobile or fixed station workhorse of a 2 meter FM radio, perfect for first line home fixed, mobile and field operations.

## Putting the Radio to Work

I used the IC-2300H to solicit audio reports on local repeaters and also had a friend transmit with the radio so that I could actually hear the audio myself on my handheld

transceiver. All audio reports received (both repeater duplex and simplex — after all, the repeater itself processes and affects the audio) were fine. There is plenty of received volume to overcome just about any ambient noise, rendering the radio useful in high noise situations on busy city streets. Public service communication is my primary interest, and a high level of good, clean audio is especially helpful at disaster scene incident command posts where noisy generators, helicopters and emergency vehicles are coming and going constantly.

Speaking of suitability of the radio for deployment and use at demanding public service and even disaster sites, I found the IC-2300 to be extremely rugged. ICOM states that the radio is tested to the MIL-STD 810 G specifications, and "has passed the latest specifications including shock, vibration and temperature tests." Whatever, but it seems to me to be built like a tank.

Output power levels are 65, 25, 10 and 5 W for the High, Mid, Mid-Low and Low levels, respectively. You will need a robust power supply to support the higher power outputs. The dc power cable is fine, but I would like to see all manufacturers employ the Anderson Powerpole connectors that are now the standard for applications in ARES field operations for portability and compatibility among users. Just a thought.

## Tones and Scanning

Subaudible tones are programmed via the menus, and a repeater output can be scanned for the tone in use from the front panel of the radio. DTMF tones for autopatch and repeater control functions are available and can be programmed into 10 DTMF memory channels. The radio has 207 memory channels, which includes six scan edge memory channels (three pairs) and one CALL channel (the frequency most used by the operator). There are multiple ways in which memory channels can be programmed, including by personal computer with the special software and cable as described earlier.

Memory channels and the CALL channel can be programmed with an alphanumeric name, but I like to just have the repeater frequency displayed. To me, a repeater's frequency is its name.

Scan types include a full scan of the entire frequency range of the radio (136 to 174 MHz), programmed frequency ranges (up to three), and a memory scan function in which just the memories are scanned, except for the memory channels that the user has programmed to be skipped. There are 11 scan pause options and seven timer options selectable! Wow, that seems a bit over the top!

The PRIORITY WATCH function checks a static memory channel selected by the user every 5 seconds, even when a contact is in process, so that activity on that channel is brought to the almost immediate attention of the user. The function also can be programmed to scan each memory channel, including the call channel, in turn.

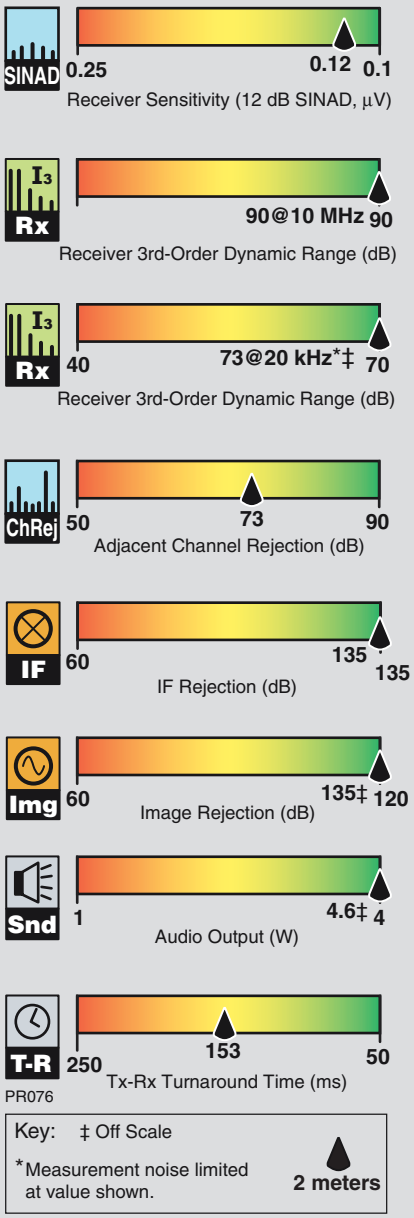
DTMF codes can be programmed for autopatch or for controlling other radios or repeaters. A "pocket beep" function uses subaudible tones as a common pager to inform the user that someone has called. When a signal with the matching tone is received, beep tones sound. A tone/DTCS squelch system is handy if the user wants to talk with, or receive a specific station or stations, and the involved radios are programmed with a tone or digital code that opens the squelch of the user's radio. Conversely, the user can program the radio to close the squelch when a specific tone or code from another station is acquired — for example, if he/she is not interested in listening to the banal conversation of a particular operator.

A tone scan function (front panel selectable)

**Table 1**
**ICOM IC-2300H, serial number 05001694**

| Manufacturer's Specifications | Measured in ARRL Lab |
|---|---|
| Frequency coverage: Receive: 136-174 MHz; transmit: 144-148 MHz. | As specified. |
| Mode: FM. | As specified. |
| Power requirements: Receive: 0.4 A (standby), 1.5 A (max audio); transmit: 11 A (65 W out) at 13.8 V dc ±15%. | Receive: 460 mA (max volume, lights on, no signal), 261 mA (standby, lights on). Transmit: 9.45 A (high), 5.9 A (mid), 3.92 A (mid-low), 2.81 A (low) at 13.8 V dc. Operation confirmed at 11.7 V dc (52 W output). |
| **Receiver** | **Receiver Dynamic Testing** |
| FM sensitivity: 12 dB SINAD, < 0.18 µV. | For 12 dB SINAD, 0.12 µV; at 146 MHz and 162 MHz. |
| FM two-tone, third-order IMD dynamic range: Not specified. | 20 kHz offset: 73 dB*; 10 MHz offset: 90 dB. |
| FM two-tone, second-order IMD dynamic range: Not specified. | 83 dB. |
| Adjacent channel rejection: Not specified. | 20 kHz offset: 73 dB. |
| Spurious response: Not specified. | IF rejection: >135 dB; image rejection: >135 dB. |
| Squelch sensitivity: <0.13 µV (threshold). | At threshold: 0.1 µV (min), 0.2 µV (max). |
| S meter sensitivity: Not specified. | 2.98 µV for S9 indication. |
| Audio output: >3.5 W at 10% THD into 4 Ω. | 4.6 W at 10% THD into 4 Ω. THD at 1 V RMS, 0.95%. |
| **Transmitter** | **Transmitter Dynamic Testing** |
| Power output: 65 W (high), 25 W (mid), 10 W (mid-low), 5 W (low) at 13.8 V dc ±15%. | 65 W (high), 24 W (mid), 9.8 W (mid-low) 4.6 W (low) at 13.8 V dc. |
| Spurious signal and harmonic suppression: >60 dB. | >70 dB, meets FCC requirements. |
| Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified. | Squelch on, S9 signal, 153 ms. |
| Receive-transmit turnaround time ("tx delay"): Not specified. | 65 ms. |
| Size (height, width, depth): 1.6 × 5.5 × 6.4 inches (w/o knobs). Weight: 2.4 lbs. | |
| Price: $260. | |
| *Measurement was noise limited at the value indicated. | |

## Key Measurements Summary




can determine the tone frequency in use by the various repeater and other station operations employing tones. An excellent article on the evolution of tone use for repeater and other operations appeared in September 2012 *QST*.[1] Don't miss it.

### Other Features

There are numerous and sundry other functions and settings associated with this radio. A transmit inhibit function prevents children in the home from accidentally transmitting when they inevitably play with Dad's or Mom's cool radio. A weather alert is included and is obviously a useful function. NOAA weather channels can be monitored, too, of course. Another nice little function (the first one the operator sees) occurs as the radio is first turned on. The output voltage of the power supply is displayed briefly — a quick check on power supply health.

Frequency range on receive is 136-174 MHz. The SO-239 UHF ANTENNA socket is hard-mounted on the back panel, reversing a trend of a few years back that had manufacturers put the connector on the end of a short cable coming out of the back panel. That cable was prone to failure due to cutting and abrasion in vehicles or in the field.

### In Summary

I was happy to review this unit, as I've owned and operated my IC-2200H with pleasure for years and was eager to learn about its successor. ICOM did another fine job, although the D-STAR and digital mode option was not included this time around. The IC-2300H is rugged, powerful and offers a handsome and simple front panel user interface for the most important functions. I was able to easily navigate the menu system for the lesser used functions and settings as well. This radio is highly recommended by this reviewer.

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

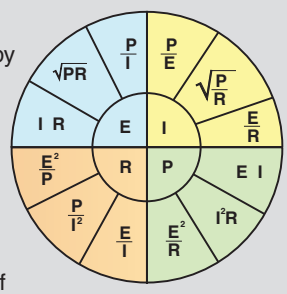
[1]S. Ford, WB8IMY, "Tone Magic," *QST*, Sep 2012, pp 33-35.

**See the Digital Edition of *QST* for a video overview of the ICOM IC-2300H transceiver.**

## *QST* Tip

### Ohm's Law and Power Circle

During the first semester of my *Electrical Power Technology* program, one of the first challenges issued by our dedicated instructor — Roger Crerie — to his new freshman students was to identify and develop 12 equations or formulas that could be used to determine voltage, current, resistance and power. Ohm's Law is expressed as R = E / I and it provided three of these equation forms while the basic equation relating power to current and voltage (P = I × E) accounted for another three. With six known equations, it was just a matter of applying mathematical substitution for his students to develop the remaining six. Together, these 12 equations compose the *circle* or *wheel* of voltage (E), current (I), resistance (R) and power (P) shown in the accompanying figure. Just as Roger's previous students had learned at the Worcester Industrial Technical Institute (Worcester, Massachusetts), our Class of '82 now held the basic electrical formulas needed to proceed in our studies or professions. As can be seen in the figure, we can determine any one of these four electrical quantities by knowing the value of any two others. — *Dana G. Reed, W1LC*



Electrical formulas.

# LNR Precision FX-2 40/30 Meter QRP CW Transceiver

*Reviewed by Chuck Skolaut, KØBOG*
*ARRL Field and Regulatory Correspondent*
**k0bog@arrl.org**


It was a pleasant surprise to learn about another low power (QRP) radio being made available to radio amateurs — the FX-2 offered by LNR Precision in Asheboro, North Carolina. LNR specializes in Par EndFedz antennas and formerly offered classic custom made telegraph keys. Larry Draughn, AE4LD, the owner of LNR, coordinated with a firm in China to design and fabricate this radio to his specifications.

As a result the FX-2 was announced in April 2012 and was ready for introduction and showing at Dayton. Since that time, LNR has implemented a firmware upgrade that adds and improves some features and fixes a few bugs. This review describes the radio with firmware version 2.1 (version 2.2 now shipping). Steve Weber, KD1JV, was instrumental in the design and upgrade of the firmware. Owners of the introductory model purchased prior to June 10, 2012 may contact LNR regarding the firmware upgrade.

## Overview

The LNR website describes the FX-2 as an introductory level radio ideal for those who need portability or the convenience of a small lightweight CW transceiver. Weighing a little over 10 ounces and measuring 1.9 × 5.2 × 2.3 inches, it certainly fits the description of a trail friendly transceiver that is ideal for backpacking or slipping into a carry-on bag for portable operation almost anywhere.

The transceiver includes full frequency coverage of 7 to 7.3 MHz and 10 to 10.150 MHz, CW only. The power supply requirement is 9 to 13.8 V dc. Power output is approximately 5 W on 40 meters and 2.4 W on 30 meters with a nominal 13.8 V supply. In the Lab we found that the FX-2 will operate at reduced power with as little as 6 V dc — useful for portable operation with limited battery capacity.

In addition to the two band coverage, the radio features receiver incremental tuning (RIT, ±9.9 kHz); a switchable bandwidth IF (five settings, about 350 to 1200 Hz); TUNE mode with SWR indicator; an iambic keyer with two programmable CW message memories of up to 120 characters each; and 20 user programmable frequency memories, 10 per band.

The physical layout of this radio is a bit different from other recently introduced QRP radios in that the ON/OFF/VOLUME control and TUNING knob are on the right hand side of the unit, and the dc POWER INPUT and BNC ANTENNA connector are on the left hand side. Since it has a small footprint, this configuration allows more room on the top of the unit for the display and four pushbuttons. The KEY and HEADPHONE jacks are on the front, along with a SIDETONE LEVEL control that is a screwdriver adjustment (turning it clockwise lowers the volume). The steel case feels hefty and should prove to be durable.

## An Informative Display

The bright blue display provides easy to read contrast for the frequency and other features. The frequency display is in the format 00.000.000, and a cursor below the digits lets you easily select the tuning rate by means of arrow buttons.

At initial power up, the 40 meter band is selected, the tuning rate is 100 Hz, keyer speed is set for 20 WPM and IF bandwidth is set to BW 1 (the narrowest setting). The S meter bar graph is active on the display. On transmit, the S meter changes to indicate T, with the bar graph scale beginning at 1 W output and increasing in approximately 0.5 W increments to a full scale of 4.5 W or greater.

As a battery saving feature, the LCD backlight turns off after 2.5 minutes of inactivity. The display can still be viewed under strong light with the backlight off and any activity — pushing a button, tuning the frequency or tapping a key or paddle — will turn the light back on.

### Bottom Line

The LNR Precision is a tiny 40 and 30 meter QRP CW transceiver with features such as full band coverage, a digital display and a built-in memory keyer that make this radio a worthy travel companion.

## Hooking it Up

The quick setup description in the manual instructs the user to connect an antenna before proceeding. It suggests that RG-174 miniature coax has proven satisfactory for runs up to 25 feet as part of a compact, portable wire antenna system. The FX-2 features protection for an SWR of up to 3:1. The manual cautions to use an antenna analyzer and antenna tuner to bring the antenna within range if you anticipate a higher mismatch.

Plug in your favorite key or keyer paddle using a ⅛ inch stereo plug. A menu choice selects either straight key or paddle. The unit provides sufficient audio output to drive earphones. A power supply cord with the matching plug is supplied, and the positive side of the cord is marked by a stripe or line. Although LNR says that the external power jack has reverse polarity protection, the manual carries the following caution: "Make sure this is wired to your power supply correctly or damage will occur to FX-2!"

## Tuning Around

Tuning is accomplished with the rotary detent knob labeled TUNED, and the frequency changes with every other click. The tuning rate can be changed by the left and right arrow buttons and the rate is indicated by the cursor under the corresponding digit (10 Hz, 100 Hz, 1 kHz or 10 kHz). The CALL/IF button is used to toggle between the 40 and 30 meter bands. Push and hold the CALL/IF button for about two seconds, release the switch when you hear a beep tone and the band in meters is shown in the menu window. The operating frequency displays

**Table 2**
**LNR Precision FX-2, Rev 2.1, serial number N/A**

| Manufacturer's Specifications | Measured in the ARRL Lab |
|---|---|
| Frequency coverage: Receive & transmit: 7-7.3, 9.999-10.150 MHz. | Receive & transmit: 7-7.3001, 9.999-10.1501 MHz. |
| Power requirements: 9-13.8 V dc. | 13.8 V dc external power, receive, max audio, no signal, backlight on, 89 mA, backlight off, 74 mA; transmit, 850 mA (7 MHz), 530 mA (10 MHz). Minimum operating voltage, 6 V dc at 900 mW RF output. Receive sensitivity reduced below specified voltage range. |
| Mode: CW. | As specified. |
| **Receiver** | **Receiver Dynamic Testing** |
| Sensitivity: 0.7 µV (–110 dBm). | Noise floor (MDS), 500 Hz filter (BW setting = 3): 7 MHz, –116 dBm*; 10 MHz, –115 dBm. |
| Noise figure: Not specified. | 31 dB (7 MHz), 32 dB (10 MHz). |

ARRL Lab Two-Tone IMD Testing (500 Hz filter, BW setting = 3)**

| *Band* | *Spacing* | *Input Level* | *Measured IMD Level* | *Measured IMD DR* | *Calculated IP3* |
|---|---|---|---|---|---|
| 7 MHz | 20 kHz | –43 dBm | –116 dBm | 73 dB | –6 dBm |
| | | –36 dBm | –97 dBm | | –5 dBm |
| | | 0 dBm | –20 dBm | | –10 dBm |
| 7 MHz | 5 kHz | –44 dBm | –116 dBm | 72 dB | –8 dBm |
| | | –37 dBm | –97 dBm | | –7 dBm |
| | | 0 dBm | –18 dBm | | –9 dBm |
| 7 MHz | 2 kHz | –44 dBm | –116 dBm | 72 dB | –8 dBm |
| | | –37 dBm | –97 dBm | | –7 dBm |
| | | 0 dBm | –16 dBm | | –8 dBm |

| | |
|---|---|
| Second-order intercept point: Not specified. | 7 MHz, +5 dBm. |
| S meter sensitivity: Not specified. | S9 signal at 7 MHz: 69.2 µV (four dots on display). |
| IF/audio response: Not specified. | Range at –6 dB points, (bandwidth): CW, 500 Hz filter (BW setting = 3), 640-1137 Hz (497 Hz). Equivalent Rectangular BW: 512 Hz. |
| Spurious and image rejection: Not specified. | First IF rejection: 76 dB; image rejection: >125 dB. |
| **Transmitter** | **Transmitter Dynamic Testing** |
| Power output: 4 W (7 MHz), 2.5 W (10 MHz) with 13.8 V dc external power input. | 13.8 V dc external supply, 7 MHz, 5.4 W, 10 MHz, 2.4 W. |
| Spurious signal and harmonic suppression: Not specified. | 43 dB (7 MHz), 54 dB (10 MHz). Meets FCC requirements. |
| CW keyer speed range: 5-40 WPM. | 5-41 WPM; iambic Mode B. |
| CW keying characteristics: Not specified. | See Figures 1 and 2. |
| Receive-transmit turn-around time (tx delay): Not specified. | 325 ms. |
| Size (height, width, depth): 1.9 × 5.2 × 2.3 inches, including protrusions. Weight: 10.3 oz. | |
| Price: $185. | |

*Measured level, but usable audio level is –110 dBm or greater.
**ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.

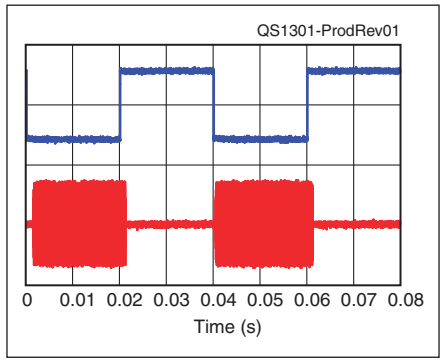



**Figure 1** — CW keying waveform for the FX-2 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 5 W output on the 7 MHz band.

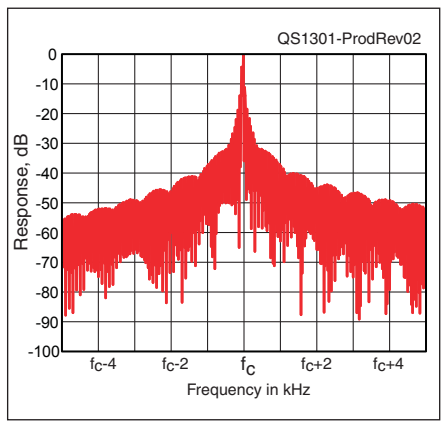



**Figure 2** — Spectral display of the FX-2 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 5 W PEP output on the 7 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

when the button is released. If a frequency has been programmed into the MEM 0 memory location, this becomes the default frequency at power up. Otherwise 7.030 or 10.118 MHz are loaded. After the initial frequency has been loaded, the FX-2 remembers the last frequency selected when toggling between bands.

There are 10 frequency memories for each band. To enter the frequency memory mode, push and hold the CALL/IF button for about 1 second until the display shows the memory mode. The display changes to MEMx ??.???.??? where x is a memory number 0 to 9 and the ? symbols are replaced by a frequency unless the location is empty. Select a memory location with the left and right arrow buttons. To store the current displayed operating frequency, tap the M/V button. Once stored, the display returns to normal operation. To recall a frequency, press and hold the CALL/IF button for about 1 second.

To enter into the RIT mode, simply tap the CALL/IF button. When in the RIT mode, the offset between the transmit frequency and the receive frequency (up to ±9.900 kHz) is displayed under the operating frequency. In RIT mode, the transmit frequency is locked and the receive frequency is adjusted using the TUNED knob. Tap the CALL/IF button again to exit RIT mode.

## Menus and Settings

The M/V button allows you to select the various menu functions by holding the button until the desired function is displayed. A beep sounds as you scroll through menus for TUNE mode, bandwidth adjustment, and keyer speed, memory and paddle selections. Code speed is changed by tapping the M/V button briefly and using the dot and dash paddles to increase or decrease the speed. When the TUNE mode is selected, the rig can be placed in transmit by using the dot paddle. In this mode, relative forward and reflected power levels are displayed. The reflected power scale is most responsive when the SWR is below 2 to 1 to help with adjustment of an antenna tuner. A full scale of 6 dots indicates a SWR above 3 to 1. Exit the TUNE mode by tapping the M/V button.

To select the various IF bandwidths, push the M/V button and hold it until you see BW 1 through BW 5 on the display. BW 1 is the narrowest. Select the desired bandwidth with the left or right arrow buttons and exit this mode by pushing M/V again.

The last menu selection deals with the keyer memory. Press and hold the M/V button until you see KMEM in the display; when it's released the keyer memory function becomes active. The top line displaying KMEM clears and the bottom line shows ESC, BS, IS and RM, each label above a button to remind you of its function. To exit without storing a message, simply push the M/V button.

Two messages of up to 120 characters each can be stored by using your paddle to key in the message. As you key it in, the letters, numbers and common punctuation characters are decoded and shown on the display. When the memory is full, the sidetone sends MF and you can decide to store the message as is or delete some characters with the backspace button. When the message is okay, store it in one of the two memories. Memories can be edited later. To send the stored memory, tap the M/V button, then within 1 second, tap either the dot paddle for message 1 or the dash paddle for message 2.

## Lab Tests

Although the FX-2's performance is generally good for a CW QRP radio in this price class, the Lab found a few issues to be aware of. Receiver sensitivity measured –116 dBm, but that signal level is barely audible in a normal pair of headphones. The receiver needs a signal of about –110 dBm (the specified sensitivity) or greater for it to be usable. This would be considered low sensitivity for a desktop 100 W transceiver (typically –120 dBm or better without preamp).

The transmitter passes FCC requirements, although it just barely passes on 40 meters. The keying waveform (Figure 1) is hard and the keying sidebands are relatively wide (Figure 2), but at the 5 W power level, key clicks are not evident on the air. Used by itself, it's okay, but the Lab wouldn't recommend using an external RF amplifier with this radio.

The Lab was unable to perform a composite noise test, which requires the transmitter to remain stable, key down, for several minutes. We found that when the transmit key is held down, current consumption increases over time; the power goes up a couple of hundred mW and the current draw increases. With the key down for 30 seconds or so, the final PA heats up and the current rapidly increases to 1.4 to 1.5 A, while the power then drops. Take care to avoid prolonged key down operation.

## Final Thoughts

I found this radio fun to use and made many enjoyable contacts during the review, mostly on 40 meters, using my low dipole antenna to work stations up and down the East Coast. I received good signal reports with no reports of key clicks or chirps. As with other recent QRP radios we've tested, the display is a pleasure to behold. Its digital frequency readout eliminates the need for calibrating a tuning dial.

The radio comes with a two position flip stand so you can tip up the front for easier viewing of the display — something I particularly liked. The tuning detent control has a nice solid feel, and ample audio output was available for earbud headphones.

This small radio should prove to be popular with QRP enthusiasts or anyone looking for a transceiver to stow away for a trip in a minimal amount of space. The FX-2 offers some modern features at a low price and is ready to go right out of the box. Just add power supply, earphones, antenna and paddle and you'll be on the air in no time.

*US distributor:* LNR Precision, Randleman, NC 27317, tel 336-495-7714; **www.lnrprecision.com**.

**See the Digital Edition for a video overview of the LNR Precision FX-2 transceiver.**

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

# Another Delta Loop Idea

## A Homebrew, Light Duty Metal Brake Revisited (August 2012)

When using a metal brake like the one described in the August 2012 issue of *QST*, or the previous article from the October 1996 issue, there are several references that can be helpful. George Averill, K4EOR, described the need for a bend allowance when calculating the overall length of sheet metal required for a project. He describes making bends in a piece of the sheet metal you plan to use, and measuring the difference in flat length versus the length and height of the bent piece.

A good approximation for the Bend Allowance (BA) is given in *Blueprint Reading for the Machine Trades*, by Russ Schultz.[1] Schultz gives an equation for BA that assumes the neutral axis to be 44% of the metal thickness.

$$BA = (0.017453R + 0.0078T)N \qquad [Eq\ 1]$$

where:

R = Inside radius of the bend
T = Metal thickness
N = Number of degrees of the bend.

In *Marks' Handbook for Mechanical Engineers*, they give the neutral axis as between 35% and 45% of the metal thickness.[2] — *73, William Abbott, KB1KOY, 48 School St, Hudson, NH 03051;* **wabbitt@comcast.net**

## Changing to a Delta (Sep 2012) Slant Delta Loop

After reading the article on delta loops in the September 2012 issue of *QST* (Sajid Rahim, VA3QY/A22EW/H5ANX, "Changing to a Delta," Technical Correspondence), I was inspired to do a little experimenting of my own. I needed an antenna for 15 meters and had hopes of scheduling some contacts with friends in New England from my location in Texas. A delta loop looked like it might serve. It turned out to be one of the easiest antennas I have ever built.

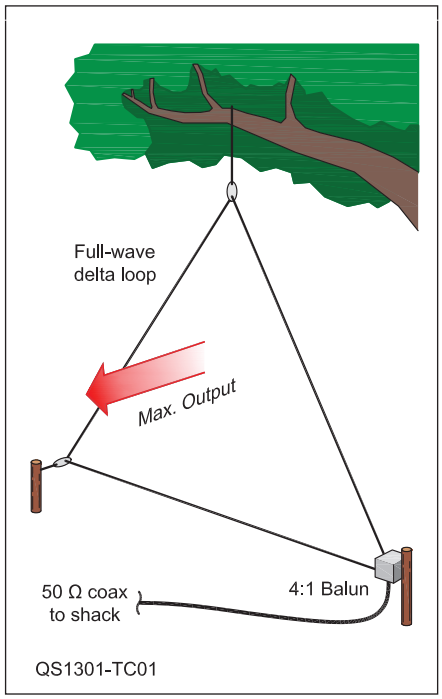



**Figure 1** — This drawing shows the final configuration. The antenna is tilted out of the vertical plane by about 30°. Maximum signal strength is in the direction opposite to the tilt.

**Figure 2** — If the antenna wire were black or gray, it would be even harder to see. Good for an inconspicuous installation. I needed to add the white ribbon so I wouldn't blunder into it while walking around. Note the "high tech" rocks holding the antenna down.

I decided to focus on the corner-fed full wave delta loop as described in Sajid's article. I liked the idea of a ground-independent system, as he mentioned. A little *EZNEC* modeling predicted that this configuration would, indeed, work very well close to the ground — even, in fact, with the bottom (horizontal) leg *on* the ground! Also, by tilting the plane of the delta off vertical it seemed that I could realize some forward gain over a strictly vertical orientation, while the elevation pattern still showed a maximum at a fairly low angle. This seemed too good not to try. Figure 1 shows the configuration. The best part of this antenna is that it's very easy to put up.

Step 1: Measure one full wavelength of wire at the target frequency, plus some extra to allow for final trimming. I used #18 AWG insulated doorbell wire. Because of the insulation on the wire and the closeness to the ground, the total wire is shorter (by about 5%) than the length predicted by the formula given in Sajid's article. (For a 21 MHz loop, I needed 46 feet of wire.) Mark a spot one third of the distance from one end.

Step 2: Find a tree limb or a pole about ¼ λ above ground. At 21 MHz, this was about 11 feet. This distance is not critical; it's just low enough to tilt the delta loop out of the vertical plane. Pass the wire over the support so that the spot you marked is at the peak.

Step 3: Form the rest of the wire into an equilateral triangle as shown in Figure 1. Since the bottom corners are on the ground, you can use a couple of rocks to hold them in place, as shown in Figure 2.

Step 4: Connect a 4:1 balun to the two loose ends and run 50 Ω coax to the transmitter. Trim the antenna wire for minimum SWR, using an antenna analyzer or low power from the transmitter.

Step 5: Get on the air!

Maximum radiation is perpendicular to the plane of the loop. According to *EZNEC*, slanting the antenna at about 30° from vertical gives an increase in gain of about 2 db

[1]Russ Schultz, *Blueprint Reading for the Machine Trades*, 3rd Ed, 1996, p 288, ISBN: 0-13-287541-1. The current update is the 7th Ed, Oct 2011, ISBN: 978-0132172202.

[2]Eugene Avallone, Theodore Baumeister and Ali Sadegh, Editors, *Marks' Standard Handbook for Mechanical Engineers*, 11th Ed, Nov 2006, ISBN: 0071428674 / 9780071428675.

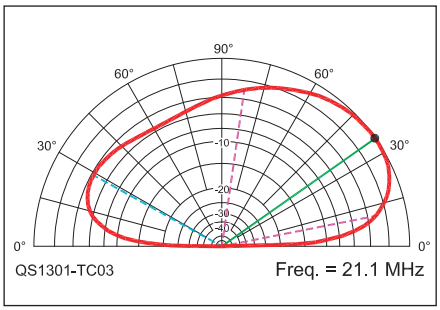



**Figure 3** — The elevation pattern shows a maximum gain of 2.34 dBi at 34° elevation. This is only 0.25 dB less than if the antenna were in free space (at an infinite height above ground). It's nearly 2 dB more than if the antenna were strictly vertical (not slanted).

over a straight vertical orientation. Figure 3 is the *EZNEC* elevation plot, using the *EZNEC* "real ground model" (conductivity = 0.008 S/m, dielectric constant = 13).

It's worthwhile to keep in mind that, as mentioned in Sajid's article, this loop will also tune up nicely at twice the fundamental frequency, although with some changes in the radiation pattern. With the right length of wire, 20 meter/10 meter dual-band operation seems an attractive possibility.

I suggest this would make a nice antenna for low power operation, perhaps for Field Day or a backpacking expedition. It's quick and inexpensive, and if you have a need to rotate it, just pick up the rocks and walk it around! It is a pretty effective antenna. With the setup I've shown here, running 75 W from my location in Texas, I have worked hams in Japan, Germany and South America, besides attaining my original goal of making contacts to New England. — *73, Larry Coyle, K1QW, 167 Black Hawk Ct, Dripping Springs, TX 78620*; **k1qw@arrl.net**

## Heating Ventilation Air Conditioning (HVAC) EMI Generation

In the summer of 2010 we moved to a new home with a bit more space. As I was becoming accustomed to the new place and its obstacles, one of these I was not ready for. I had chosen to establish the radio room adjacent to the utility room because it provided all the necessary items, such as space, access to the outside for the antenna coaxial runs and electrical wiring just to name a few. I was looking forward to another season of Top Band DX contesting, but that was short lived. To my surprise when I powered on my Kenwood TS-940 for the first time there was a loud hiss/whine coming from the speaker and it didn't matter where I tuned, whether it was on 1.8 MHz or right through to 30 MHz.

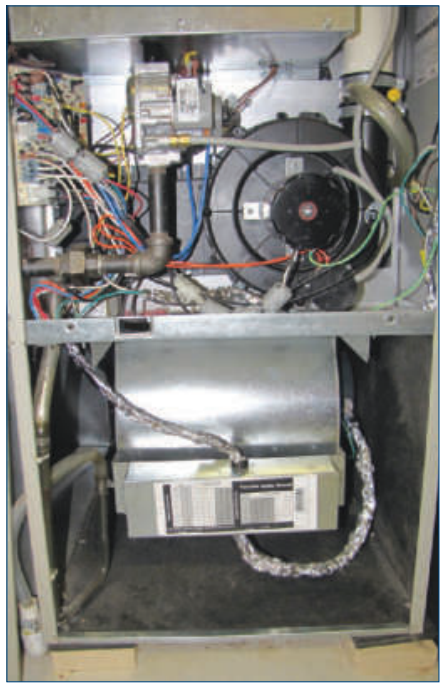


**Figure 4** — This view inside of my HVAC unit shows how I wrapped some of the wiring harnesses with aluminum foil to shield the EMI that the dc control signals generate. You can also see where I placed snap-on ferrite beads over some of the wires.

The whine was found every 30 kHz while spinning the main dial.

What was the cause of all this EMI that suddenly appeared one hot afternoon just after setting up my radios in the shack for the first time? It became very apparent when I heard the HVAC system shut off, and the EMI came to an abrupt stop.

This interference was not coming from an outside source such as the house next door, but from my own home. Realizing that the EMI was coming from the HVAC unit only 3 meters away in the next room really bothered me. On further investigation, when the HVAC unit energized again the noise heard on the radio seemed to be synchronized to the sound of the variable speed blower motor as it ramped up in speed.

My new home was equipped with a more up-to-date high efficiency HVAC unit than my previous location, which had a much older mid-efficiency unit and was equipped with only a two speed blower motor that caused no EMI.

Needless to say I was not impressed with this situation. Researching solutions on the Internet only produced minimal results regarding the EMI hash that was being generated. I called the manufacturer of the unit (TAPPAN), and heard that they had never entertained this complaint before. I knew then it was up to me to resolve this problem as they would be of no help.

The variable blower speed control was created by converting the applied 120 V ac to a steppable dc voltage module mounted inside the motor itself, which when energized controlled the blower's speed from 500 to 1870 rpm.

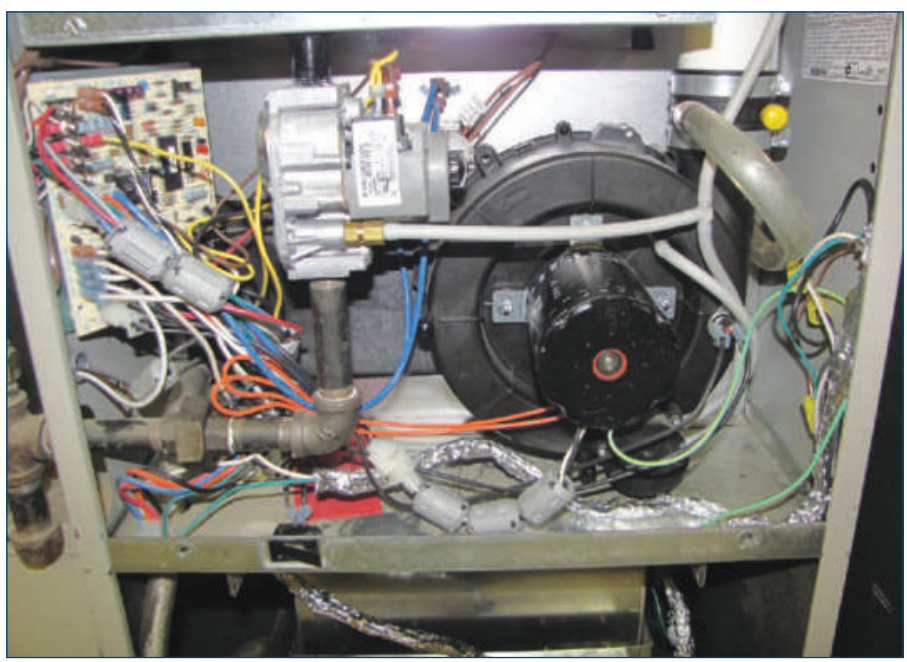


**Figure 5** — This view shows more detail of the wiring in the top portion of the unit.

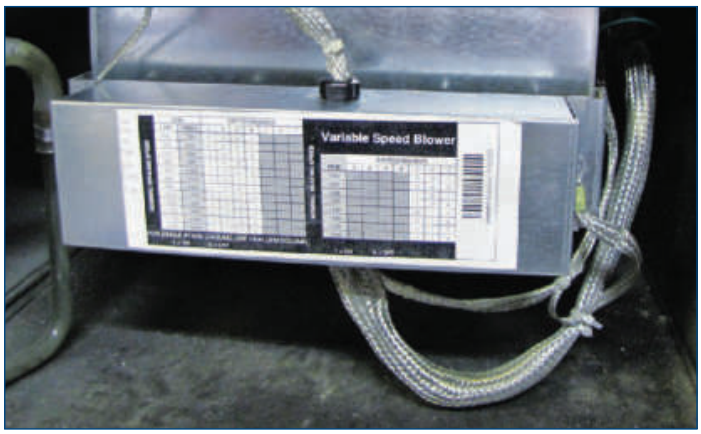



**Figure 6** — After I knew that shielding the wiring harnesses would suppress the EMI, I applied braid tubing over the wires to produce a more professional looking result. Note the shield grounding strap on the right side of the unit.

After a bit more research on how to possibly suppress this EMI, I did not find any solutions on the Internet. Then I remembered that I had purchased over a dozen clamp-on ferrite RF beads, which could possibly be used as RF suppressors. After turning off the 120 V ac supply, I placed several of these RF beads on the multiple open wire harness of this variable speed motor. Alas, this did not suppress the EMI. It then occurred to me that an RF shield of some sort would be a possible solution to my problem.

I believed placing the open wire harness inside of a metal sleeve of some sort might be the answer. I was unable to locate any of my large braided shield that was big enough to use for a sleeve. It was still packed away in one of the many boxes piled up in the garage. Then another possible quick solution came to mind. I went to the kitchen to fetch some aluminum foil and took this down to the utility room to be used as a temporary shield on the HVAC unit.

As a first step, I used plastic wire ties to harness the separate motor wires together into a bundle. Then I cut off long strips of aluminum foil and carefully wrapped the foil around these now bundled wires in a temporary shielded harness. I carefully made sure that the foil did not come into contact with any of the circuit connections that would be behind the inspection panels of the HVAC unit when closed up. I added several ferrite beads in select locations that I thought might help in suppressing some of the EMI as well. See Figures 4 and 5.

Once I was satisfied that I had shielded most of the exposed wires of the blower motor as best I could, I re-applied the 120 V ac to the HVAC unit.

Now, checking my HF rig with the HVAC running there was no EMI hash being generated from the unit. Success!

I have since modified the wire harnesses by placing the bundled wires inside a more suitably appropriate braided strap that fits this application. See Figure 6.

I hope this solution will help some of you who are having EMI issues that have until now gone unresolved, possibly because of this newer methodology in controlling some ac power applications. — *73, Larry Parker, VE3EDY, 1741 Lake Shore Rd, Sarnia, ON N7X 1G1 Canada*; **ve3edy@cogeco.ca**

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

Materials for this column may be sent to ARRL, 225 Main St, Newington, CT 06111; or via e-mail to **tc@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence. Whether you are praising or criticizing a work, please send the author(s) a copy of your comments. The publishers of *QST* assume no responsibility for statements made herein by correspondents.

## At the Foundation

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

# Calling All Students!

Have you submitted your application for an ARRL Foundation Scholarship?

The annual application period for ARRL Scholarships for FCC-licensed radio amateurs closes promptly on February 1, 2013. More than 70 scholarships valued at over $82,000 are scheduled to be awarded in the spring of 2013. There are many opportunities for qualified students to benefit from the generosity of donors who have established (and who now maintain) these scholarships over the years.

All the information about the scholarships, including selection criteria, application forms and instructions can be found on the web at **www.arrl.org/scholarship-program**. And don't forget — a current transcript is required for all applications. In addition, high school seniors who apply for the William R. Goldfarb Memorial Scholarship must submit a Free Application for Federal Student Aid (FAFSA) based on the family's most recent tax return. These documents should be submitted electronically to **foundation@arrl.org**.

If you are affiliated with an Amateur Radio club, please share this information in your newsletter and on your website.

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

# Feed Lines Do Work Both Ways, But...

**Q Riley, K4ZDH, asks: I'm considering a complete feed line replacement in the near future. I also have several routing options, some of which are short but more difficult to implement. I've generated a table showing the loss for a variety of transmission lines. In order to help me make the best feed line and routing decision, I've included maximum and minimum length and SWR for the bands I operate.**

**While it's been a revealing and helpful exercise, I can't help but wonder, is the impact of feed-line loss on transmit the same as it is on receive?**

A There are a number of parts to this question. First, if the line is feeding terminations matched to its characteristic impedance ($Z_0$) at each end, the loss will be exactly the same in each direction. Note though that the *effect* of the loss may not be the same. On transmit any loss will result in a reduction of signal-to-noise ratio (S/N) at the far end. If you have 3 dB loss, for example, that means that your signal will be ½ an S unit weaker in the other station's receiver. The impact on your received S/N is not quite as simple. If you are operating on a band on which you are atmospheric noise limited (typically 20 meters and lower frequencies), even though your S meter will read ½ an S unit lower, your S/N will be almost unchanged. This is because the loss will reduce the atmospheric noise by the same amount as the signal, keeping the S/N the same.

This is why small receiving antennas can be so effective on the lower frequency bands. On bands in which the receiver noise is the limiting factor, such as on VHF, UHF and sometimes the higher frequency HF bands, both the S meter and S/N will be reduced by transmission line loss. If you want to check which noise is most important at a particular time, switch the input between a dummy load and your matched antenna system. If the noise is much higher with the antenna, you are in atmospheric noise limited territory.

The mismatched case is somewhat more complicated. Most transmitters, either directly or through an antenna tuner, can drive mismatched antenna systems. The additional transmission line loss due to the mismatch will be higher with lossier transmission line as shown in Figure 1. The total loss will reduce your transmitted signal, and thus your signal received at the far end.

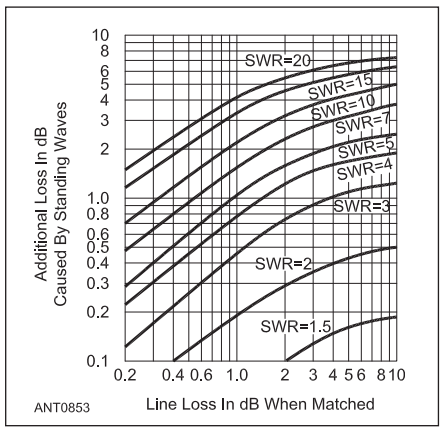



**Figure 1** — Additional loss for mismatched transmission line. Note that the effect of mismatch is small if the matched loss is low, but lossy coax with high SWR makes for serious additional loss.

While most transceivers are specified to have a nominal output impedance of 50 Ω, their receiver input impedance may not be exactly the same. That means that the SWR as seen on receive may be different. There will be two effects here. First, the impedance seen by the antenna on receive will not be matched, but will be the input impedance as transformed by the line. Unlike the transmitter end, the antenna will not deliver all of its received signal power to the line. In addition, the received signal will suffer the attenuation on the line due to its mismatch.

This effect may not be significant in most cases, but is something to consider. Again, in the atmospheric noise limited environment, reasonable loss will not impact received S/N. On the other hand, at VHF the receive input impedance may be an important parameter.

**Q Dennis, KB9SDS, asks: Someone asked me if hams call CQ on FM simplex frequencies as they do on HF. I realized that I have never heard anyone do that because I always tune in on a contact already in progress.**

A In the world of amateur FM communications, "simplex" means transmitting and receiving on the same frequency, rather than transmitting on one frequency and listening on another, as with a repeater. Note that in traditional telecom, simplex actually means "one-way transmission," such as from a broadcast station, or even a doorbell.

To get back to your question, while there is no rule against calling CQ on FM simplex channels, generally people looking for a contact on a simplex frequency just announce their presence. For example "This is W1XYZ listening on 146.49 simplex." The indication of the listening frequency and mode identifies that someone isn't hearing a signal on a repeater input or output channel, in which case they should respond with a frequency offset to access the repeater.

The usual HF "CQ" is sent repetitively in order to let someone who is tuning up and down the band hear you. On a band segment that uses discrete channels (including 60 meters on HF) someone is either listening or they aren't, so a short call is all that is required.

**Q Bernie, W4EDX, asks: I have a question regarding the "third order intercept point," that most every transceiver advertisement lists as a receiver specification. I see numbers such as +40 dBm or +30 dBm. I would appreciate your description so some of us older operators can understand and evaluate the importance of this parameter. As an example: when all else fails, can a product with a +40 dBm design do a better job in reducing interference located, say, 3 kHz away from my receive frequency than a +30 dBm product or have I mixed apples and oranges? Normally there are quite a few dollars difference in the two products. In your opinion is the additional cost worth it?**

A The third order "intercept" is a figure of merit intended to predict the linearity of a receiver. If a receiver were perfectly linear, there would be no intermodulation distortion. Unfortunately, no receiver is perfect and if more than one signal is present

at the input there will be undesired products. The third order product is the result of mixing one undesired signal with the second harmonic of another undesired signal. This second harmonic is generated in the receiver.

Let's say you are listening to a weak signal at 14,000 kHz and there are strong signals at 14,050 and 14,100 kHz. In a linear receiver with a typical IF filter, the signals at 14,050 and 14,100 would be eliminated and you would just hear your desired signal. They would all pass through the usual receiver front end and rattle around in the RF amplifier and mixer, until they hit the first filter that was narrow enough to eliminate them.

In a real receiver, however, they and their harmonics will all mix anywhere in the signal path that isn't linear — especially in the mixer, which is designed to do that sort of thing. Thus, within the mixer in addition to your weak desired signal and its harmonics, you will have signals at 14,050, 28,100, 14,100 and 28,200, along with higher order harmonics. Note that a mixing (difference) product between 28,100 and 14,100 will result in a signal at 14,000, right on top of your desired signal. This is a "third" (second plus first) order product — and a major limitation of communications receivers.

Figure 2 shows the usual graphical construction of a third order intercept. Note the desired signal that increases linearly with a 1:1 slope, while the third order response must be stronger to appear at the noise floor, but increases with a 3:1 slope (this is why attenuators are effective in such an environment — they reduce third order signals three times as much as desired signals). The point at which the curves cross is the "intercept point." But note that it is actually above the receiver's capability to respond — your +40 dBm example is 10 W, enough to smoke most receivers. Thus, the intercept point occurs at an input level that the receiver can't respond to, making its significance somewhat questionable.

While it seems unlikely that there will be signals on exactly those frequencies, note that there is an infinite set that will cause the problem — for example: 14,002 and 14,004 kHz, which will get through many roofing filters, will be even more trouble.

In addition, most third order intercept specifications are at spacings of perhaps 50 kHz (outside of all roofing filters). Since modern amateur receivers operating in contesting conditions have lots of close-in signals, the response to signals 2 kHz apart, as in the second example above, are usually more meaningful. *QST* Product Reviews measure the effects of third order intermod at 2 kHz spacing. In place of the extrapolated "intercept point," we measure the actual close-in (2 kHz) third order intermodulation dynamic range (3OIDR), based on actual receiver action in the presence of such signals all carefully combined in the Lab.

So that's a capsule of the 3OIMD response, but there are other dynamic range issues. We also report "blocking dynamic range." The most recently measured, and frequently the most important figure of merit we are measuring and reporting in *QST* Product Reviews, is reciprocal mixing dynamic range. This is an effect resulting from low level noise surrounding an oscillator's desired frequency. If the noise extends out 2 kHz, for example, a strong signal 2 kHz away from a weak desired signal will generate noise on the desired frequency. This makes the receiver act like it is less sensitive (its noise floor is increased).

So, I think the dynamic data in product reviews is a better indicator of real world performance than "third order intercept." In some receivers one measurement is more significant than another, but all receivers have some limits. These are all definitely real effects.

Whether you will find the improvement between a good receiver and a great receiver worthwhile, however, may depend on what kind of operating you do. If you operate on 40 meters in Europe, for example, you will need the best receiver you can get to eliminate products from 39 meter shortwave broadcast stations. In the US, the contesters with big antennas that generate large signals into their receivers will have the most need for top performance. But a busy band, or even a few strong signals in the wrong place, can cause headaches for a casual operator.

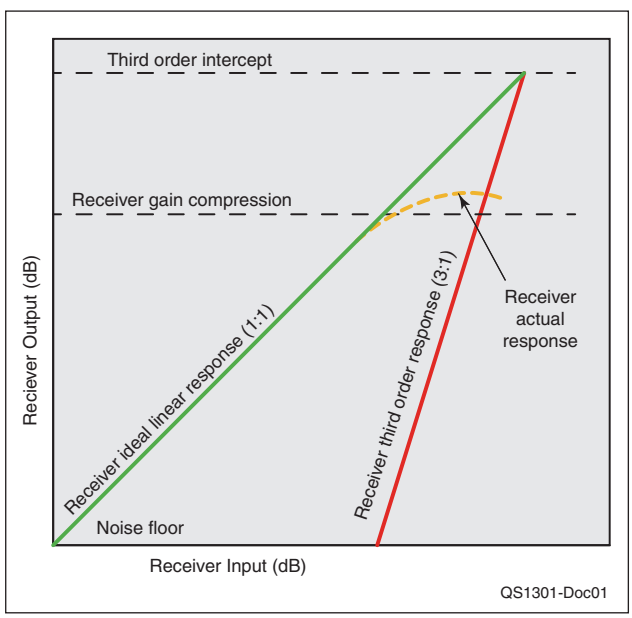



**Figure 2** — The usual graphical construction of a third order intercept.

**Q Jim, N4QZU, asks: I have been copying HF PSK31 keyboard-to-keyboard communication using *Digipan* software on my PC. I have never been able to copy both sides of the conversation, I can only see one side of the contact. Could my antenna be the problem?**

A You don't say what band you are using, but a guess would be 20 meters — probably the most popular PSK31 band. The usual propagation on 20 meters can easily result in what you are seeing, but I wouldn't expect you to never hear the other side.

For example in our (eastern) afternoon, we will often hear stations on the west coast, while they may have good conditions to Japan, but we won't hear JA stations on our side of the world. We also might not hear stations in the Midwest, if they are in our skip zone. To see if that is what's happening, look up the locations of the stations that you aren't hearing, based on the call sign the station you do copy sends, and see if you note a pattern.

It is also possible that the two stations are not on the quite the same frequency. If you watch the *Digipan* display as the stations switch over, you will see the "tracks" of the sending station abruptly stop. If you see another set of tracks start up just a few moments later with a slight frequency offset, it may be that the other station is on a slightly different frequency. If you click between the new set of tracks, you may find it is the other side of the conversation.

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

# Alpha Delta DX-EE Four Band Dipole Antenna

I'm personally fond of non-resonant HF antennas that I load with my trusty antenna tuners, but sometimes you want an antenna that simply *works* without the additional hassle and expense of adding a tuner in the line. In other words, you want an antenna that allows you to just attach a length of coax and go.

The Alpha Delta DX-EE is such an antenna. It is resonant on four bands and much shorter than you might expect — an attractive feature for hams with limited space.

The DX-EE consists of three wire dipoles in parallel. The top wire, which serves as the 40/20-meter radiator, is the longest at 40 feet. That's about 26 feet short of a half wavelength for 40 meters, but the DX-EE reduces the length by using inductive loading on both legs. This compromise works, although it also narrows the 40 meter SWR bandwidth considerably.

The remaining dipoles are full-size half wavelengths on 15 meters and 10 meters. They are separated from each other by plastic insulators.

The center section of the DX-EE at a height of 25 feet.

The DX-EE uses inductive loading on the 40/20 meter wires to reduce the overall length to just 40 feet.

## Assembling the DX-EE

The DX-EE arrives in a clear plastic bag with the tops of the dipole insulators attached to the 40/20 meter wire. All three wires are secured to a rugged center insulator. Alpha Delta also thoughtfully includes two 12-foot lengths of Dacron rope.

Your task is to thread the 15 and 10 meter wires through the correct holes in the insulators, keeping the wires reasonably taut as you do so. At first I attempted to accomplish this by simply standing in my yard and juggling the wires, but it quickly became obvious this approach was way too clumsy. My solution was to string the 40/15 meter dipole between two supports at a height of about five feet. With the wire pulled tight, I was able to just walk along the antenna and slide the 15 and 10 meter wires through the insulators, making adjustments as necessary to keep them straight.

The finished antenna does not have to look like a typical parallel dipole drawing with impossibly straight lines. Instead, the idea is to arrange the wires so that they are separated and supported. When I was satisfied with my handiwork, I twisted short lengths of wire at the tops and bottoms of each insulator to prevent them from shifting in the breeze. Alpha Delta provides wire for this purpose.

## Time to Test

After hauling the antenna to a height of 25 feet and sweeping it with an antenna analyzer, I was pleased to discover that the dipoles were all resonant in the lower portions of the bands. As a CW and digital operator, that suited me just fine. Of course, you can easily tweak the wire lengths to move the resonant points higher.

On 40 meters the 2:1 SWR bandwidth extended from 7.000 to 7.080 MHz with the lowest SWR being 1.7:1. On 20 meters the bandwidth was more generous, ranging from 14.000 to 14.228 MHz with the lowest SWR at 1.6:1. The results on 15 meters were similar to 40 meters with a range of 21.000 to 21.100 MHz. Ten meters was the broadest of all with a 2:1 SWR bandwidth extending from 28.000 all the way to 28.400 MHz with the lowest dip at 1.2:1.

I was reviewing the DX-EE on the weekend of the CQ World Wide RTTY contest, so I decided to put it to the test while running just 5 W. The antenna performed quite well despite the relatively low height. In fact, it often "out played" my 43-foot vertical, especially on the higher bands. Unlike the vertical, however, I didn't have to cycle a remote antenna tuner every time I changed bands.

The DX-EE is strongly built and I have a feeling that it would hold up well against the elements in a permanent installation. That said, with an assembly time of less than 30 minutes the DX-EE is also an attractive option for portable use.

*Manufacturer: Alpha Delta Communications;* **www.alphadeltacom.com**; *tel 888-302-8777 (orders only); $140.*

H. Ward Silver, NØAX, n0ax@arrl.org

## Experiment #120

# Power Polarity Protection

Part of being a successful radio gadgeteer is knowing how to make sure your gadgets survive the various insults and screwups that are part of life in the electronics world. This month's and next month's columns will show you how to deal with some common gremlins that seem to live just outside your gadget's power connection.

### Polarity Protection

We've all done it — accidentally connected power with plus where minus should be and vice versa, "just for a second," letting the magic smoke out of our precious components. That's why I was encouraged to see Terry Fletcher, WAØITP, publish a collection of circuits in *QRP Quarterly* that protect equipment against reversed power polarity.[1] Terry collected some circuits from various sources and published them all in one place with a comparison of each circuit's strong points and weaknesses. (I thought these were so useful, I added them to the 2013 *ARRL Handbook*, too![2]) Most of these circuits can be retrofitted into existing equipment — as long as you take note of and remember the following characteristics of each circuit.

### Diode Protection

Figure 1A shows the simplest protective circuit of all — a rectifier in series with the positive lead between the power source (In) and electronic device (Out). A Schottky barrier diode is also shown next to the conventional silicon junction diode. The typical 1N4000 series junction diode rectifier has a nominal forward voltage drop of 0.7 V but at 1 A of current, the forward voltage drop can be a bit greater than 0.9 V with nearly 1 W of power dissipated as heat. Schottky barrier rectifiers have a lower forward voltage drop: 0.75 V at 1 A for the 1N5418. Be sure your equipment will work properly with its input voltage a little bit lower than without the diode. Don't exceed the diode's average forward current rating or it will overheat and fail. The protective rectifier should have a reverse voltage rating of at least twice the supply voltage so a 1N4002 (50 V, 1 A) or 1N5418 (30 V, 1A) are suitable in 12 V systems.

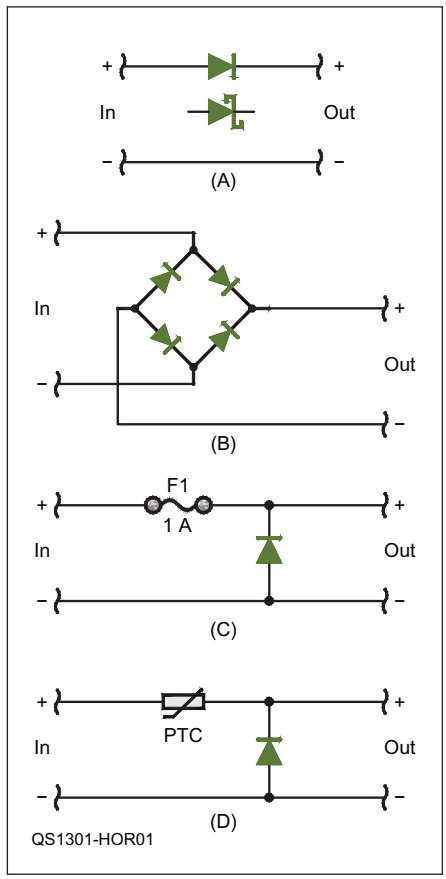



**Figure 1** — Diodes connected in series and shunt can either block reverse polarity voltage or cause a protective fuse to open if voltage is reversed.

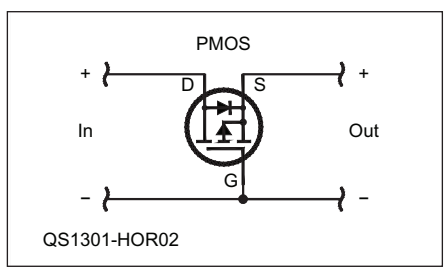



**Figure 2** — A PMOS enhancement mode MOSFET conducts with a very low ON resistance with normal voltage polarity but blocks reverse polarity voltage.

The diode bridge circuit in Figure 1B not only protects the circuit but allows it to operate normally with voltage of either polarity applied. The trade off is *two* voltage drops in series with the power source so your operating voltage takes a hit of 1.5 to 2.0 V, depending on what type of diodes you use. Diode bridges can be purchased all in one package, so this is a convenient option.

Figures 1C and 1D rely on a fuse to protect the circuit. A shunt connected diode across the power source will conduct high current if voltage polarity is reversed. This will blow a metal fuse very quickly and the diode will limit any applied voltage to one negative forward drop. The fuse has no significant voltage drop under normal conditions. The fuse needs to be large enough to handle normal device current but not so large that the surge current through the reverse connected diode causes the diode to fail first. If you use this method, make sure the fuse is accessible and replaceable.

The PTC (positive temperature coefficient) fuse in Figure 1D is a *resettable* fuse that acts like a solid state circuit breaker. When its rated current is exceeded, the fuse material heats up and changes to a high resistance state. When the material cools, it changes back to the low resistance state. PTC fuses are characterized by their trip current at which the material changes resistance and their *holding current* that keeps them in the high resistance state. A typical PTC device for low current 12 V protection is the

[1] T. Fletcher, WAØITP, "Reverse Voltage Protection Overview," *QRP Quarterly*, Spring 2012, pp 12-13. Also online at **www.wa0itp.com/revpro.html**.

[2] *The ARRL Handbook for Radio Communications,* 2013 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 4050 (Hardcover 4197). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

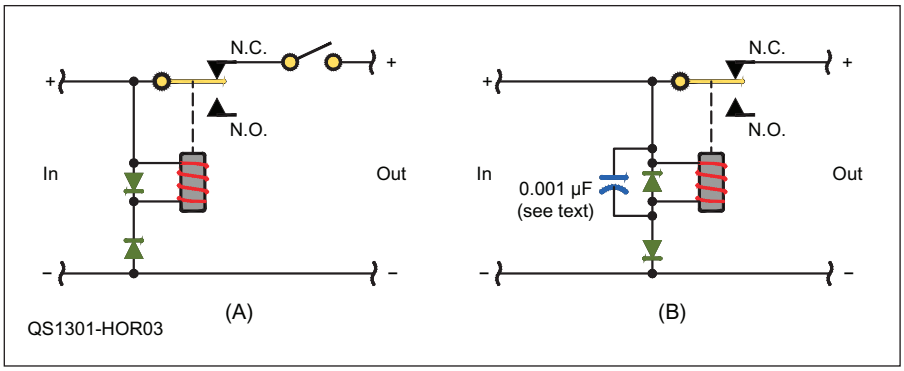



**Figure 3** — Relays can be used to open (A) or not close (B) when reverse polarity voltage is applied.

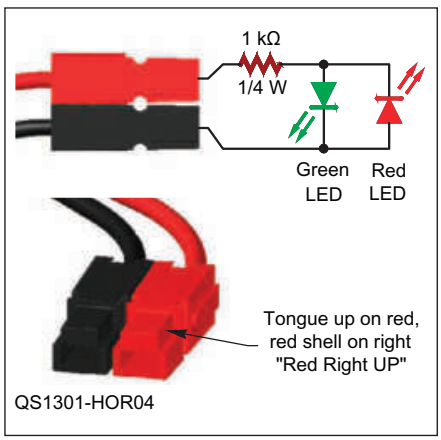



**Figure 4** — A handy voltage polarity checker can be made inexpensively and added to your go-kit.

Littlefuse 60R050XPR, which has a trip current of 1 A and a holding current of 500 mA. PTC fuses do heat up a bit when in the high resistance state and they insert a small resistance in series with the power source (around 1 Ω) that can cause a voltage drop. Again make sure that the diode can handle a big surge current when needed!

Sometimes the shunt diodes in Figures 1C and 1D fail due to the high surge current. If the diode fails shorted or in a low resistance state, it will continue to blow the fuse until replaced. If the diode fails open or with a high resistance, it will no longer protect the circuit. If shunt diode protection is used and the fuse opens, check the diode to be sure it has not failed as well.

## Active Device Protection

Many voltage regulators that use PNP or PMOS transistors (P channel MOSFETs), such as the LM2940, offer reverse polarity protection. A PMOS transistor will also work as shown in Figure 2. (The diode symbol represents the *intrinsic body diode* that is created due to the way the transistor is made.) The PMOS enhancement mode transistor conducts unless the drain-to-gate bias becomes negative as when the applied voltage is reversed.

PMOS devices have low ON resistance ($R_{DS(ON)}$) and high maximum current ratings. For example, the SPP08P06P (at a cost of less than a dollar) has an ON resistance of 0.3 Ω at 8.8 A of continuous drain current. Lower resistances and higher current ratings are available, as well. For more information about using PMOS and NMOS devices for polarity protection see Maxim Electronics Application Note 636, "Reverse Current Circuitry Protection."[3]

## Relay Protection

Figure 3 shows a pair of circuits that can be used for polarity protection. Relay based circuits have the advantage of little to no voltage drop, even at high currents, as long as the contact ratings are sufficient. The circuits are more complex than the diode based circuits described in the preceding section but can generally handle more current and are not damaged by reverse polarity voltages. The circuits reset themselves automatically.

The circuit in Figure 3A uses the normally closed (NC) contacts of a single pole, double throw (SPDT) relay. There is no current drain through the relay coil until reverse polarity voltage is applied. There will be a few milliseconds, however, during which reverse polarity voltage gets through to your circuit if no power switch is used or the power switch is closed. This is enough time for damage to occur so this circuit is only recommended if a power switch is used to turn the equipment on and off after voltage is applied.

[3]**www.maxim-ic.com/app-notes/index.mvp/id/636**

The normally open (NO) contacts are used in Figure 3B. The relay contacts close and supply power to the equipment only when applied voltage has the proper polarity. The relay coil draws current continuously during normal operation. Small relays draw anywhere from 10 to 50 mA and this level of current drain may be unacceptable for low power and battery powered equipment.

## Other Gotchas

WAØITP also notes that it is very, very easy to accidentally connect the wrong terminals of a 9 V battery to its snap on clip. Make sure you protect circuits that use those batteries!

Assuming voltage polarity is okay if the power source has a red and black connection can be an expensive assumption. It's always a good idea when connecting your gadget (or radio) to an unknown power source to first check for proper voltage polarity. Figure 4 shows a simple circuit you can make and use with any connector style, although PowerPoles are shown here. Hot glue or epoxy could be used to secure the small components right on the connector making an enclosure unnecessary.

Another problem doesn't pertain to circuit protection but can occur if diodes are connected to wires near antennas — RF harmonic generation and mixing. All of these diodes are likely going to be connected to long power leads and to be in close proximity to antennas radiating a pretty strong signal. The signal is picked up by the power leads and can cause diodes that are not conducting (or heavily reverse biased) to turn ON and OFF at the frequency of the RF. This creates harmonics and if more than one signal is present, you've created a dandy mixer, as well.

The leads that pick up the signal and conduct it to the diodes are happy to take the harmonics and mixing products from the diode and radiate them. These spurious signals are right in your shack so they are very easy to receive. The easiest fix is to simply connect a small ceramic capacitor across each diode — Figure 3B shows an example. Any value from .001 to .1 µF will do. (This is a good idea for rotator controllers and other switching gadgetry in your shack, too.)

## Next Month

In the following column we'll take a close look at transient protection, particularly in mobile applications. You may be shocked by what you learn!

Note that some of the solutions provided in next month's column will also protect reverse polarity at no additional cost.

Steve Ford, WB8IMY, wb8imy@arrl.org

# New PSK-31 Apps for the iPad and iPhone

Luca Facchinetti, IW2NDH, has unveiled a new PSK-31 app for the iPhone and iPad known as *PSK31PAN*. The unique feature of *PSK31PAN* is its ability to decode up to 10 PSK31 conversations at once (see Figure 1). If you tap on one of the text lines, the app instantly morphs into a spectral display with the tuning bar centered on the chosen signal. There is a separate screen for pre-programmed macros, which are always handy when you're dealing with a tiny on-screen keyboard. You can purchase *PSK31PAN* for 99 cents from the iTunes Store.

*PSKer* by Mark Oskin, KE7SCH, is available in separate versions for the iPhone and iPad. Both can be downloaded from iTunes for $2.99 each. One of the most interesting features of *PSKer* is its sensitive, high-resolution waterfall display. I don't own a device with a high-definition display, but even on my iPhone 4S it was impressive (see Figure 2). *PSKer* also offers a transmit buffer immediately above the waterfall so you can type your text and transmit with ease.

Both of these apps work best when you connect the device directly to your transceiver using a VOX-style transmit/receive interface such as the one designed by Skip Teller, KH6TY, as seen in the March 2011 issue of *QST* ("Digital VOX Sound Card Interface," page 34). Be that as it may, I was also able to enjoy the apps with good old "acoustic coupling." In other words, I held my iPhone close to my transceiver speaker to receive and then moved it to the microphone to transmit. It's an awkward approach, but it works.

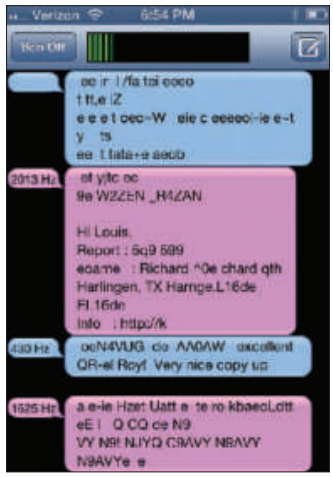


**Figure 1** — *PSK31PAN* decoding multiple signals simultaneously.

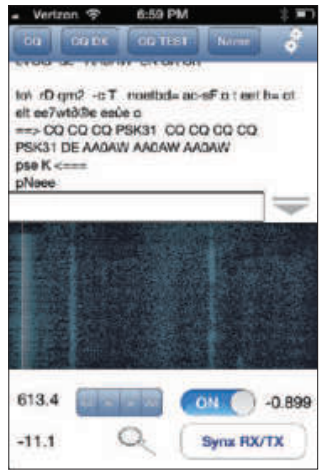



**Figure 2** — *PSKer* by Mark Oskin, KE7SCH.

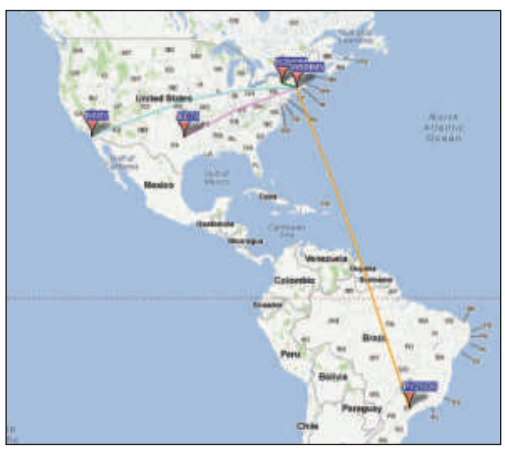
## WSPR: Fascinating at Any Speed

If you're at all curious about the mysteries of propagation, WSPR (Weak Signal Propagation Reporter) is one of the most fascinating investigative tools at your disposal. Both the WSPR digital protocol and the free software that receives and transmits the WSPR signal were developed by Dr Joe Taylor, K1JT — the same person who revolutionized digital moonbounce and meteor scatter communication.

To experience the wonders of WSPR, all you need is an SSB transceiver and a sound card interface to connect the transceiver to your computer. You can download WSPR now at **http://physics.princeton.edu/pulsar/K1JT/wspr.html**.

To get the most out of WSPR, the other key component you'll need is an Internet connection. Each WSPR signal your station decodes is automatically uploaded to the WSPRnet website at **http://wsprnet.org/**. Every few minutes, your transceiver will send its own stream of WSPR-modulated RF for other monitoring stations to receive and report to WSPRnet.

By logging into the site (registration is free) you'll see reports of your signal that have been gathered from WSPR monitoring stations throughout the world. Recently, while puttering around the station and working on a kit project, I let WSPR do its thing on 10 meters with just 1 W output to a vertical antenna. The band was utterly dead — or so I thought — until I took a break from my project to log onto WPSRnet and look at the 10 meter map. In the space of a half hour two stations in the western US and one in Brazil had reported my flea-powered WSPR beacon.



I thought 10 meters was stone cold dead — until I tried a "WSPR watt" and checked the results.

WSPR is particularly useful for propagation studies at low frequencies where the noise levels are high. Thanks to the robust nature of WSPR, American hams have been doing some intriguing work on 160 meters. Amateurs overseas who are blessed with allocations at 136 kHz are using variations known as "Slow WSPR" (specifically, WSPR-8 and WSPR-32), which was created by Markus Vester, DF6NM, to probe the conditions on these frequencies.

Markus has made slow WSPR available for free downloading at **http://df6nm.bplaced.net/wspr/slowWSPR.zip**, but at the time this column went to press the software was still very much under development.

Paul Wade, W1GHZ, w1ghz@arrl.org

# Antenna Measurement: Methods and Equipment

**The accurate evaluation of your antenna is an essential element of effective communications.**

The last "Microwavelengths" described the design of an antenna measurement range.[1] To actually make antenna gain measurements, we transmit from a source antenna and detect a received signal with a test antenna. The path loss equation described in my last column allows us to estimate the received signal level, so we can determine the transmit power required to obtain an adequate signal level at the detector, the detector type also being a factor.

## Comparison Measurements

Direct measurement of antenna gain is very difficult, but what we can do is to compare the gain of two antennas. If we have an antenna whose gain is known, then we can compare the gain of other antennas to the antenna of known gain, thus arriving at an estimated gain for each unknown antenna.

Though commercial standard gain antennas are available, hams can build copies with specified dimensions that will provide reasonably repeatable gain. For UHF and low microwave frequencies, the EIA standard gain antenna shown in Figure 1 (a pair of ½ λ dipoles over a ground plane) will provide a gain of 7.7 dB. I have built these for frequencies from 432-2304 MHz using a standard coax halfwave balun rather than the sleeve balun shown. For higher frequencies, horn antennas provide very predictable gain at microwave frequencies — the *HDL_ANT* program will calculate the gain from horn dimensions within a few tenths of a dB.[2]

Note that dipoles are not suitable as standard gain antennas, though we often express gain as dB over a dipole. Stray reflections can make the measured gain of a dipole vary by 6 dB or more; the uncertainty of a dipole measurement is too large to be useful.

## Measurement Technique

With the source transmitting, we stand at the receiving position and receive the signal with various antennas. The first step in measurement is to make sure the received field is uniform, by moving around a small antenna looking for variations in received signal level. It should not vary more than 1 dB over the aperture area of any antenna to be tested. Also, the peak in the vertical direction should be at the expected height calculated in the previous column; if not, adjust the source antenna height until the peak is at the receiving measurement height. We used a patch antenna to probe the field, but the standard gain antenna could be used as well.

Next, we adjust the standard gain antenna for maximum received signal and note the signal level. Then the standard gain antenna i s replaced with an unknown antenna; after peaking the signal, the difference in signal level compared to the standard gain antenna is measured, either with an instrument that accurately measures dB or a calibrated attenuator that is used to match signal levels. Finally, the standard gain antenna is reconnected to see if the signal level has changed.

## Ratiometry

Using this process, often the signal levels vary, as instruments and signal sources drift and moisture levels in the ground change, adding uncertainty to a series of tests. One way to reduce the uncertainty is to compare all measurements to a third, fixed, antenna. This can be done with a switch or relay, or by an instrument that does the comparison automatically. The test sequence remains the same but the uncertainty and variation is reduced. Figure 2 is a diagram of an antenna ratiometry range.

## Instrumentation

The signal source can be a dedicated one or just a transmitter or transverter with modest power output, as long as the output power is stable. Some detection instruments require AM modulation at a frequency of 1 kHz. An SSB transmitter can easily meet this requirement.

The receiving detector is usually more specialized, since it must be capable of resolving signal differences much smaller than a dB. Ideally, it will also indicate signal

[1] P. Wade, W1GHZ, "Microwavelengths," *QST*, Oct 2012, pp 63-64.

[2] www.w1ghz.org/software/hdl_364.zip

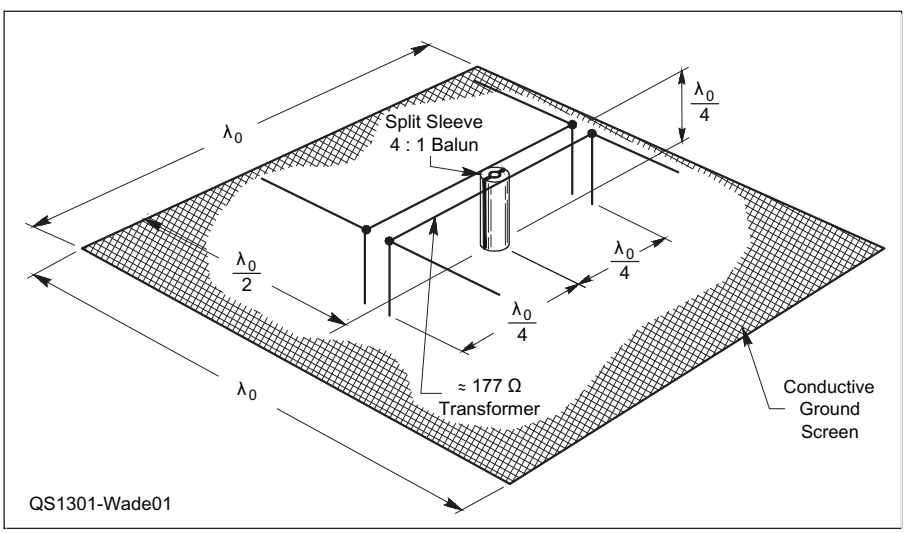



**Figure 1** — This diagram shows an EIA standard linear-polarized feed suitable for 432 MHz. The dipole lengths and transformer spacing are adjusted for a 50 Ω impedance at the balun input (at rear of ground screen).

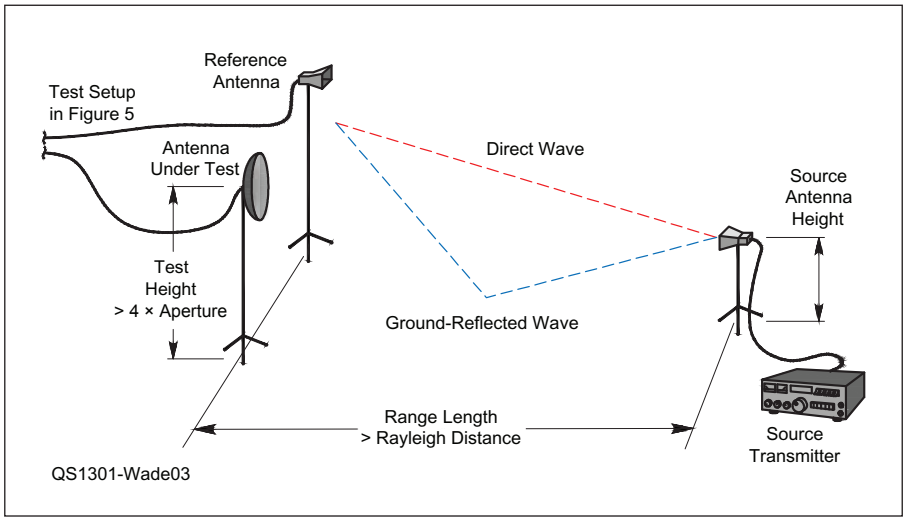



**Figure 2** — This is the diagram of an antenna range setup used with the antenna ratiometry test setup shown in Figure 4 for ratiometry testing.

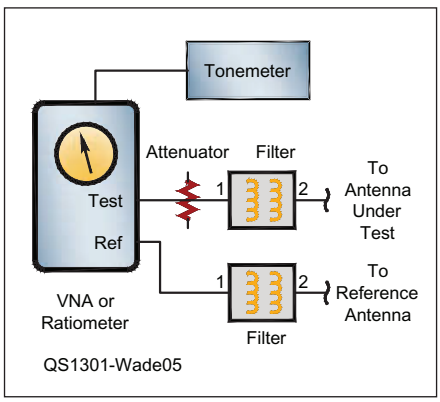



**Figure 3** — This is a diagram of an antenna ratiometry test setup that would be used in conjunction with the antenna range setup of Figure 2.

changes accurately in dB. Ordinary S meters do not meet these requirements — resolution is poor and S units in most receivers are highly variable. One exception might be some of the SDR receivers, which can be calibrated to reasonable accuracy.

A spectrum analyzer can also be used, since it is basically a wideband receiver with graphical output on a cathode ray tube or video display. The screen display may not have the desired resolution and smaller screens may be difficult to read at a distance.

For direct detection of signals, microwave power meters like the HP 43x series are quite accurate, but have limited sensitivity so significant transmitter power may be required. Better sensitivity is possible using a microwave crystal detector with a "SWR meter" like the HP 415, which requires 1 kHz modulation of the transmitter; other brands have equivalent instruments.

Antenna ratiometry measurements are easily made using a vector network analyzer (VNA), but even surplus prices can be prohibitive; sometimes, one can be borrowed for a test session. I built a simple homebrew ratiometer and network analyzer (**www.w1ghz.org/small_proj/hna.zip**), which operates up to about 2.5 GHz. Other amateur network analyzers are also available. A two channel converter can extend the frequency range of any of these instruments.

Figure 3 is a diagram of a test setup for antenna ratiometry with a VNA or ratiometer. These detecting instruments, as well as most of the others mentioned, are broadband and will respond to stray signals, so filters to eliminate out-of-band signals are essential. Figure 4 is a photo of a test setup with my homebrew ratiometer — it also uses 432 MHz homebrew filters made from Australian beer cans. Modern cans are aluminum and hard to solder, but I'm sure ham ingenuity can find something.

The blue box to the left of the filters in Figure 4 generates an audio tone with frequency proportional to the strength of the received signal. The tone is played through a speaker as an aid to peaking the signal without having to watch a meter or display. Details can be found at **www.w1ghz.org/small_proj/tonemeter.zip**

Finally, calibrated attenuators can be useful in setting signal levels and for accurate signal level comparisons. Comparison measurements tend to be more accurate when the difference in signal levels is small — one way to do this is to make the signal levels equal with a calibrated variable attenuator and read the difference from the attenuator.

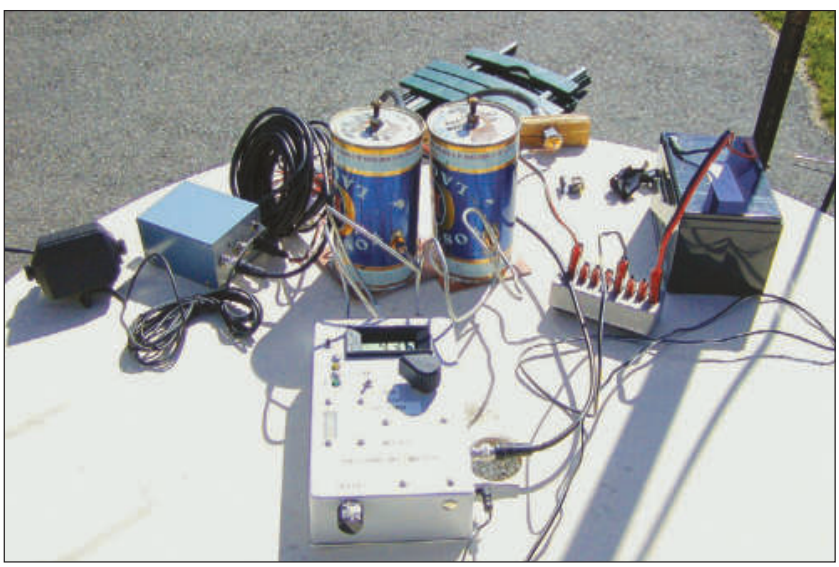


**Figure 4** — Here is an actual antenna ratiometry test setup using homebrew ratiometer, filters and tonemeter.

## Summary

Getting good antenna gain measurements takes experimentation, patience and attention to detail. The results of the effort are rewarding — knowing that your antenna is working and knowing that improvements are effective.

If all this is daunting, take advantage of antenna measurement ranges set up at VHF conferences.

Perhaps we will see your antenna at Microwave Update 2013 (**www.microwaveupdate.org**) in Moorehead, Kentucky this October.

*All photos courtesy Paul Wade, W1GHZ.*

Steve Sant Andrea, AG1YK, hk@arrl.org

# Eagle T/R delay, Removing Coil Cores and a Boom in Your Room

## T/R Delay for the Eagle

I love my Ten-Tec Eagle (**www.tentec.com**) transceiver, but soon found that in CW the amplifier relay output follows the keying even if a CW T/R delay is set. Therefore, the Eagle is not compatible with non-QSK (break-in) amplifiers.

This was a problem for my Ameritron AL-811 amplifier (**www.ameritron.com**), which cannot follow keying. Some correspondence with Ten-Tec confirmed that this is the way it operates and the issue cannot be addressed through a firmware update. My solution was to build an outboard delay relay circuit to provide semi-break-in operation of the amplifier.

I searched the *QST* archives for a solution and found a "Hints and Kinks" article by Charles Darrow, K8GZQ, which addressed the same issue with the Ten-Tec Century 21 transceiver.[1]

Upon reviewing his circuit, it became apparent to me that Darrow's arrangement would not work off the Eagle's relay output. His approach was to pick up the receive line voltage from the transceiver and use that to trigger an NE555 one-shot multivibrator to provide an amplifier relay output with an adjustable delay. The NE555 starts when the voltage on the trigger input (pin 2) goes low, so Darrow's use of the 12 V receive line voltage filled the bill (it goes low on transmit). The Eagle's relay output is a transistor switch to ground, however, so Darrow's circuit needed some tinkering, which resulted in the circuit shown in Figure 1.

It is like Darrow's circuit, except I trigger the NE555 by using the Eagle's amplifier switch to ground the trigger input, which is held at a positive voltage by the 47 kΩ resistor connected between it and the +12 V dc supply. The 47 kΩ resistor between the trigger input and the reset terminal (pin 4) of the NE555 is important, as it keeps the NE555 constantly resetting by applying voltage to the reset terminal during every key-up period. Otherwise, the delay relay would open after the multivibrator reaches its time delay set point, then the circuit would reset and the relay would reclose on the next character sent.

Using the component values shown, the circuit will provide a delay from almost nothing to many seconds. Any small 12 V relay should work. I used a RadioShack (**www.radioshack.com**) double-pole, double-throw (DPDT) miniature PC relay, catalog number 275-0249, so I could provide two outputs (one for my amplifier and one for a VHF transverter). [Caution, the recommended output current for the NE555 is ≤ 200 mA. Total device dissipation must be < 600 mW. — *Ed.*] The diode (a 1N4005) across the relay terminals prevents the coil's reverse transient voltage from affecting the NE555. I constructed the circuit on a RadioShack general purpose IC board (catalog number 276-159) and housed the unit in a plastic project box (see Figure 2). I fastened the relay to the cover plate of the box with double-sided foam tape. Shielded conductors were used for the relay input and output lines; non-shielded, two conductor speaker wire was used to pick up operating voltage from my station is 12 V dc buss.

Now when using the Eagle with an amplifier, I can set the delay to minimum when operating SSB and dial in a suitable delay when operating CW. Be aware that if set for a very small delay (little or no resistance on the potentiometer) the circuit will break into oscillation when keyed rapidly. I keep the setting high enough to avoid this, but you could install a suitable fixed resistor in series with the potentiometer to prevent oscillation.

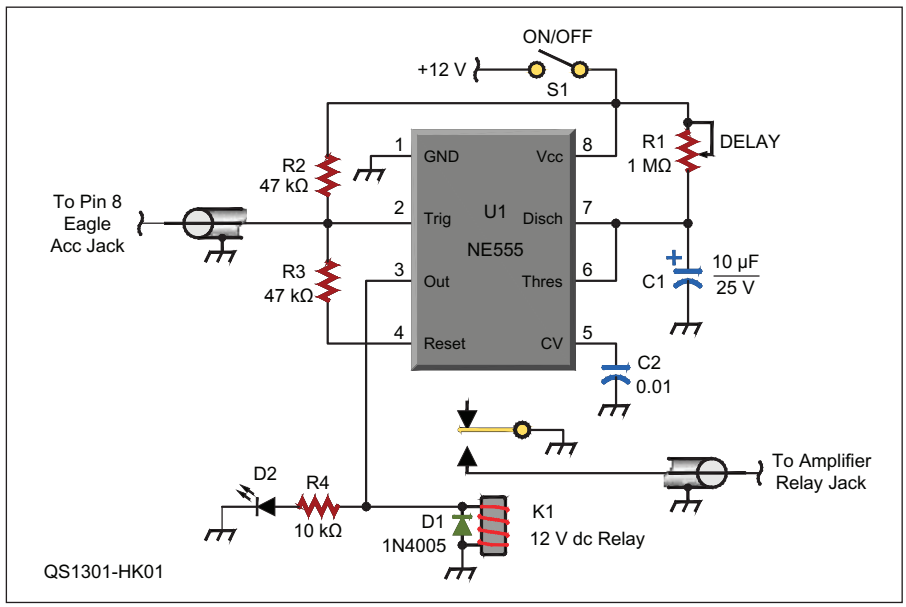



**Figure 1** — This is the circuit for the adjustable T/R delay for the Ten-Tec Eagle.

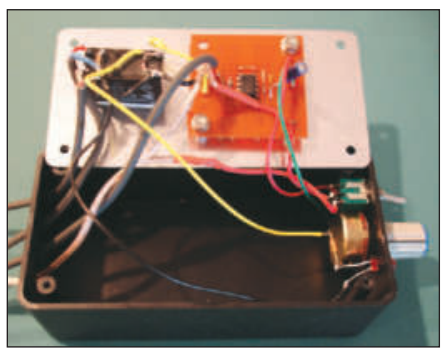


**Figure 2** — The Eagle T/R delay circuit requires only a few simple components that all fit neatly in a small project box. [Thomas Valenti, K3AJ, photo]

[1]C. Darrow, K8GZQ, "Semi-Break-In for the Century 21," *QST*, Dec 1979, p 57.

The Eagle has a 17 ms delay between the amplifier relay output and the generation of RF, which is plenty of time for the delay relay to pull in and switch the amplifier. I chose to incorporate an LED to indicate when the relay output is closed and a power switch to disable the delay relay when running the Eagle barefoot. — *73, Thomas Valenti, K3AJ, 17210 Foreston Rd, Upperco, MD, 21155-9410*, **tomv307@hotmail.com**

## Coil Core Removal

Slug-tuned coils often suffer from a major deficiency that becomes apparent over time. After years of being set in place, the core becomes frozen in the phenolic-paper tube. When applying pressure, the alignment tool snaps the core. When this happens the core is cracked and any attempt to turn it will fail. When sharp tools are put into play, the form is usually damaged, and replacements are no longer available. To remove single cores without damaging them, find a long screw that will pass through the core and check that its head will pass through the coil form. A screw with a fillister head works best, but others may be used if filed or ground to clear. Be sure the screwdriver slot is retained.

Next, find a couple pieces of metal tubing that will clear both the screw threads and the coil form. Place one piece of tubing over the screw, insert the screw through the core, place the second tube on the screw and tighten a nut to grip the core by its ends (see Figure 3). With a screwdriver, turn the screw-slug assembly to remove it from the coil. Be sure to replace the slug with the same type of material. A word of wisdom — be careful that you don't lock two slugs together in the center of an IF transformer — those are hard to remove. If there are two cores, remove the free one before applying the fixture.

Using end pressure to hold a slug together makes it seem feasible to apply the same principle with small, slotted cores by mounting a piece of drill rod in the chuck of a lathe and one in the tool holder. Then clamp the core between the two rods and remove it by turning the core.

When you wind cores on phenolic tubes, too much pressure can reduce the tube diameter, making the core bind. Heavy wire should be wound like a spring, placed on the form and secured with adhesive. If a core is too loose in a coil form, a bit of lacing cord may be placed lengthwise in the form before screwing in the core. Rubber bands are sometimes used, but they deteriorate rather quickly. — *73, Doyle Strandlund, W9NJD, 2849 N 035 W, Huntington, IN 46750*

## Stripping Coax

An old-fashioned seam ripper is a cheap and very effective tool for slicing open the jacket of CAT5 or coaxial cable without damaging the twisted wires/braid underneath. Simply insert the leading edge of the tool underneath the jacket and run it along the length of the cable as far as necessary. — *73, William M. Bickley, W2ET, 6900 Pentridge Ln, Chestertown, MD 21620*, **w2et@arrl.net**

## Inexpensive Microphone Boom

Why spend over $100 on a microphone boom? For $15-20 you can buy a boom style desk lamp at office supply stores. Simply remove the lamp assembly and cord from the boom and install the microphone using your existing floor or desk stand holder (see Figure 4). I used two washers to make up for the difference in thickness between the lamp head and the microphone holder (see Figure 5). Strap your microphone cable to the boom arms, leaving some slack at each elbow. Depending on the weight of your microphone, you may have to change the boom's counterbalance springs. — *73, Joe Vlk, W8DCQ, 3967 Shoshone Ct, Oxford, MI 48370-2933*, **w8dcq@arrl.net**

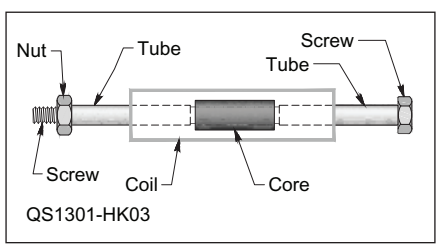



**Figure 3** — A long screw and a couple of pieces of tubing can help get that stuck core free from its coil.

**Figure 4** — For a few bucks and a little time an inexpensive flexible-arm desk lamp can become a boom for your microphone. [Joe Vlk, W8DCQ, photo]

**Figure 5** — A couple of washers will compensate for the difference in size between the lamp assembly and the microphone holder. [Joe Vlk, W8DCQ, photo]

## Setting True North

When using a compass to align antennas, declination must be considered. In my area, it is almost 9° off. Google Maps (**maps.google.com**) provides a simple way to align your antenna to true north. The map satellite pictures are aligned to Earth's Maidenhead Grid system, which is itself aligned to true north and not magnetic north.

Find your antenna or tower on Google Maps. The shortest line from your antenna to the top of the map is true north. Print the map and draw a line straight from your antenna to the top of the map. Anything along this line is true north of the antenna. Point the antenna to an object on the line and tighten the hardware. Remember that the farther the object is from the antenna the more accurate the alignment. — *73, Rick Brown, NN4RB, 3 Poplar Forest Dr, Forest, VA 24551*, **nn4rb@arrl.net**

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

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

# Radio in Retirement — One Ham's Tale

## A dusty Drake transceiver becomes the seed for a retirement community's ham station.

**Grant Bagley, W3GB**

I surveyed the view from my perch on top of my 120 foot tower. The air of this clear autumn day allowed me to see beyond Baltimore and the Chesapeake Bay almost to Washington DC. This would be my last look and also the last time a radio signal would be sent aloft from this spot. I keyed the 2 meter handheld and informed the ground crew that they could begin lowering the triband Yagi that had occupied this position for 15 years. The 160 meter sloper and the dipoles were already gone.

I could still remember the excitement over finding the perfect house, close to work and on the very top of a hill. The perfect place for a ham to live and I discovered that it had been the home of a ham since it was built in 1937. As the Yagi began its descent, the thoughts of past contests, rare DX contacts and weekly nets with friends all tumbled through my memory. An era was coming to an end.

After nearly 2 years of looking for somewhere to retire, my spouse, Margaret, and I finally selected Collington, a continuing care retirement community in Maryland. We found it an almost perfect fit for our needs.

The *almost*, of course, meant no ham radio. Ham radio was not a prominent feature of most communities that we had visited. I convinced myself that I didn't need my own home station. I could always find a nearby club with a station or operate 2 meters mobile. There were always club activities and public service events.

Margaret and I began the sorting and packing of our many possessions. A lifetime of ham gear, a well-stocked junk box and many unfinished projects all found new owners. Several local ham clubs, including the nearby university club whose members had helped take my tower down, got needed equipment and supplies. Several radio and electronics museums were more than pleased with my generous contributions. I convinced myself that the parts and plans for the many things I was going to build and design in retirement were really unnecessary.

**As the Yagi began its descent, the thoughts of past contests... tumbled through my memory.**

Although the distance to our new life was only about 30 miles it seemed more like moving to another world. I told myself repeatedly that I would not miss my ham station. We joked that I didn't need to be "radio-active."

### A Vintage Nugget

While settling into our new home I began searching for new activities. I responded to a plea for help in the auditorium where the sound system never seemed to work properly. Any Extra Class ham could fix that problem, I thought. Wandering backstage, I located the audio equipment and found that readjusting some components improved things.

Then something caught my eye. In the corner were two pieces of equipment, just sitting on the floor. I asked if anyone knew how they came to be there. No one did. I was told that they had been there for 7 years or more and no one knew who the owner might be. Of course I knew immediately what they were. They brought back memories of *QST* advertisements showing the stylish panel of the Drake TR-4C transceiver. I coveted one then and even now could hardly believe such a prized radio would be abandoned. What was the story behind this backstage radio?

I could easily imagine another ham moving here having reluctantly decided to give up Amateur Radio. Apparently, the decision had not been quite final. In the hope of someday returning to the air again, this ham had kept a treasured piece of equipment. I knew this because I had done the very same thing.

Our new garage contained boxes that held a basic ham station. I too harbored the hope of returning to the airwaves. The optimism and the sadness of that kindred ham spirit from the past convinced me try to add a source of enjoyment to this retirement community for future hams and myself.

*Don't be in a hurry*, I thought as I began to casually inquire, "Has there ever been any interest in ham radio here?" and "What do you know about ham radio?" I asked questions carefully and of those who would have some knowledge of what ham radio can offer such as military retirees, former foreign


These are the original four members of the Collington Community Radio Club: (L to R) Dick Wilder, K3DI; Martha Wilder, N3FZB; Grant Bagley W3GB, (ex W7CAV), and Karl Edler, KB3US [Robert Elkin, photo]

service officers and others who had lived abroad for extended periods. Yes, they knew what Amateur Radio was and many had positive memories. Unfortunately, I also got other reactions: "That would never work here," "A tower and an antenna would destroy our beautiful views" and of course "It would interfere with my _____."

I talked to the head of buildings and grounds. He told me that he had tried on two occasions to convince the residents that having a cell tower on the campus would be a good idea. It would improve cell coverage and provide some income from ground rent. He described the vocal and strident opposition to the presence of a tower. His comment to me was an unencouraging "good luck." I considered how to overcome this not unexpected problem.

**Ham radio was not a prominent feature of most communities that we had visited.**

## A First Step

I needed some help. ARRL® offers a wealth of information and strategies for dealing with the public and I made good use of their web resources. I formulated a plan to convince my new neighbors they would benefit from the disaster communication ability ham radio could provide. I obtained a copy of the community's disaster plan. Yes, there were plenty of communications problems and ham radio could solve most of them.

I began the daunting task of rewriting the disaster communications plan. I knew this would be a hard sell but was convinced it had potential. As I pondered this strategy, I discovered that the retirement community's public affairs consultant had forwarded a message to the management from the local Amateur Radio Emergency Service (ARES®) group. They were inquiring about establishing an emergency Amateur Radio communications system in our healthcare center. This system would connect with all of the county's hospitals as well as the countywide communications system. They were offering to set up a volunteer-operated disaster communication capability. It seemed like an answer to my prayers, giving me the help I so desperately needed.

It didn't take long for me to track down and meet with the ARES leadership. Prince George's County Emergency Coordinator Jim Montgomery, WB3KAS, and Assistant Emergency Coordinator for the Prince George's County ARES Hospital Program Wanda Montgomery, KA3AHI, helped put together an action plan. I found a satisfactory location for a ham station in a storage room near the woodworking shop where it would not be disruptive in any way.

We talked to management. Yes, there was interest and we received cautious and conditional permission to participate in an upcoming statewide communications exercise. Now we had our chance, but only a week to prepare.

## Sink or Swim

I recognized this was not just a trial run but also a chance to get established and demonstrate our capabilities. I cleaned the storage room in the woodshop building. I had explained the need for a small amount of space and the woodshop group had agreed. Now I wanted more than just a demonstration for the exercise. I wanted us to participate with a real station. This meant setting up a functional station that looked permanent. Since the event was only a few days away that meant building a ham shack in one weekend.

I scrounged and came up with various pieces of discarded office furniture. Armed with these cast-off items and using the nearby woodworking shop I hastily built an operating position then dressed it up with my equipment stash and erected a 2 meter/70 centimeter vertical whip. Now a real station was on the air! I could announce that there was an operating ham station in our community.

The day of the exercise came and our station let us play our minor role without any problems. Now I was off and running. I released an informative news report for residents reporting on the successful participation by "our community ham radio station" in the exercise. I found another inactive ham, Karl, KB3US, and now with doubled numbers we doubled our efforts.

The hard work paid off. Before Karl and I knew it, we had two more hams, Dick, K3DI, and his wife Martha, N3FZB. Was ham radio helping to attract residents? With four active hams, a fifth popped up. The "new" ham had let his license lapse — in 1939! We told him this was a perfect time to regain his license. Several more residents and staff were interested in a class. Now it was time for a club. The Collington Community Radio Club, K3CCR, became a reality.

**I formulated a plan to convince my new neighbors they would benefit from the disaster communication ability ham radio could provide.**

Summer arrived and brought the opportunity to assist another community activity, a sailboat racing regatta, featuring 4 foot long, R/C controlled Chesapeake Bay skipjacks. The regatta is one of the major social events of the summer. While doing an interview with a writer who was covering the regatta, I mentioned our ham radio activity. His article was on aspects of retirement living. He thought the ham radio story was fascinating and he put together and posted a video: **www.youtube.com/watch?v=Ezxa4R8XndM**.

## The Creature Feature

We were making real progress toward community acceptance and still had no complaints. Our goal of having a real all-band multioperator station was looking better all the time. In mid August, our club waited for a slightly cooler day and then got an early morning start to put my triband Yagi in the air once more. We placed it on a short tower on the top of the woodshop building, a respectable height of 35 feet, and patiently waited to see if there would be any flak.

No one objected but I was determined to cement our position and remove all doubt about the antenna creating a problem. How could I call attention to the beam and at the same time minimize its impact? After examining many creative ideas, we settled on the one that seemed to offer the best chance of success. We sponsored a new and novel activity to add some variety to the Labor Day weekend: an outdoor movie. We advertised that it would be like the drive in movies of the '50s. *The Monster that Challenged the World,* a black and white movie from 1957, was chosen. We advertised and nervously prepared for the big night.

The outdoor movie needed to be a first class event, which would require a large screen. We looked at the options and found that large screens were very expensive. Then, while searching the Internet, we discovered blackout cloth. We purchased a 9 × 16 foot piece and some black felt edging and grommets to make a screen for under $100. We stretched it out on a 1 inch PVC pipe frame and hung it on the side of the woodshop building. We filled the small parking lot with chairs, added an LCD projector, a DVD player and a pair of powered speakers to complete the setup.

The smell of popcorn wafted over the scene as the audience gathered. While they waited for darkness and the beginning of the movie, music played from the speakers and the crowd had a chance to socialize and enjoy the summer evening. Of course, the newly erected Yagi rose from the top of the building but didn't look quite so large in contrast

From its humble beginnings K3CCR has evolved into a two operator station often used by members for contest operations. Here Karl Edler, KB3US (left), and Dick Wilder, K3DI, operate the station. [Jamie Windon, photo]

to the nearby movie screen. The weather was perfect, the movie was a big hit and everyone urged us to plan for another outdoor movie. We heard nothing but praise for the event. The antenna was not a problem and there was not a single negative comment about the beam that now shared our sky.

### A Helping Hand

It was time to make things really functional and attractive. We needed to remodel the hastily erected operating bench and hook up the equipment, including the growing inventory from our new arrivals. As we settled into operating schedules we inevitably started to talk of contests, DX and how fortunate we were to have found the support we needed. As of this writing, we have not yet powered up the Drake TR-4C or identified the owner, but it will finally transmit after its long hiatus when we have an appropriate occasion. Meanwhile it sits in a place of honor.

On a recent Sunday afternoon, I finished chatting with old friends on a net I have checked into for 25 years. Band conditions had been good, S9 signals and the fellowship was as strong as ever. I looked around at the ham station we had built, feeling a sense of pride but also a sense of purpose. How can we share our success? We know there are silent hams in many retirement communities, just like the mysterious owner of our TR-4C. At the very time of their life when Amateur Radio can offer them so much they think, as I did, that they must give it up.

I was casually looking over my e-mail and wondering how to use my newly acquired experience to help others stay on the air. Amid the ads and junk mail of my inbox, I noticed a call sign, AB9MT, and felt that e-mail definitely deserved a look.

> Grant,
>
> I saw your video on the Kendal site, it was sent to me by my sister who resides in Kendal at Crosslands in PA. She has shown an interest in setting up or starting a ham radio group at her location but has never worked in the hobby.
>
> She sent me your link so that I might get the chance for a QSO with your station. I am wondering if you have set times that you operate and on what bands you might be found.
>
> Thanks for the information in advance and keep up the great work.
>
> 73,
>
> Barry

I wonder how far it is to Crosslands, Pennsylvania? It can't be that far and I'll bet the TR-4C is ready for the journey.

Grant Bagley, W3GB, an ARRL Life Member, became a licensed Amateur Radio operator over 50 years ago starting out as WN7CAV. He is both a physician and an attorney. His career as a physician evolved into health policy and law after a mid-career graduation from law school and working for federal agencies including the FDA and CMS (Medicare). He recently retired and now lives at Collington, a continuing care retirement community located in the suburban Washington, DC area. His ham radio interest include DXing, contests, disaster preparedness and participation in club activities. Grant can be reached at 10450 Lottsford Rd #5112, Mitchellville, MD 20721, **w3gb@me.com**



## New Products

### Profiles in Amateur Radio e-Book for the Kindle

*Profiles in Amateur Radio*, edited by Ken Reitz, KS4ZR, is a collection of 19 articles taken from the First Person Radio series that appeared in *Monitoring Times*, a national monthly magazine about radio. These stories are told in the words of radio hobbyists who have experienced a lifelong impact from shortwave listening or Amateur Radio. Price: $2.99 from **www.amazon.com**.

### RF, Microwave and Fiber Optic Products from Pasternack

Pasternack Enterprises has launched a website for its RF, microwave and fiber optic product line. Product Wizards, Parameter Search and Filtered Navigation have been developed to help locate any of the 30,000+ available parts. Additional features include improved product names, high definition product photos, a streamlined shopping cart and much more. For more information, visit **www.pasternack.com**.

## Strays

### Still On the Air at 103+ Years!

One of the oldest active amateurs in the United States may be Harry Wolf, W6NKT, of Morro Bay, California. Harry will turn 104 on January 28, 2013. Since the 1930s Harry has been on the air almost every day. "I work the world," says Harry, who uses both CW and SSB. His station is in his home overlooking California's famed Morro Rock, Morro Bay and the Embarcadero.

Harry is a graduate of the California Polytechnic University (Cal Poly) in San Luis Obispo, where he taught for 18 years. While there, he established the electronic engineering department, which was later incorporated into the electrical engineering department. He retired from teaching in 1972. — *Bill Fageol, KA9A*

[Michael Raphael, KJ6LGX, photo]

# Spreading the Joy of CW

## Old timers and newbies team up to bring more Morse code to the bands.

**Rob Brownstein, K6RB, and Jay Temple, W5JQ**

Mark Twain wrote "The report of my death was an exaggeration." The same might be said of CW. Many of the world's telecommunications authorities have eliminated CW skills from ham radio license qualifications. That, in turn, spawned ominous predictions that CW would quickly become a scarcely used mode. But the naysayers have turned out to be wrong and CW continues to enjoy popularity as a mode of communication. Why? The many reasons include simpler, lower-cost gear; the ability to get through in poor conditions; easy portability; less interference, and better operator behavior, just to name a few.

Unlike phone or digital modes, when left to each ham's own learning methods, CW technique can suffer. To help new operators develop proper operating habits, today's experienced CW operators must help them to become tomorrow's experienced operators. This is the primary, worldwide goal of The CW Operators' Club (**www.cwops.org**) and its CW Academy (**www.cwops.org/cwacademy.html**).

### A Look Back

At one time in the US, there was an informal infrastructure called the Novice bands, which helped hams become competent at CW. On 80, 40 and 15 meters, a portion of each CW band was allocated to Novice licensees.

Those of us who had our licenses in the 1950s will remember the Novice bands fondly. In some ways we were the "blind leading the blind." With few role models to help us learn good operating technique, we experimented with long CQs and repetitions of information. As time passed, our speeds improved, our techniques refined — and when we passed our General code exams, we moved on confidently to the General CW subbands.

Today, that Novice class license and its code requirements are all history. In the US, one can go from the lowest to highest class license without knowing a "dit" from a "dah." Nevertheless, a significant number of hams worldwide prefer to operate CW and they do it well. In the US, many of them are operators who came up through the Novice ranks, improved their skills on the Novice bands and have continued to operate using CW. Outside the US, many operators find CW equipment less costly and more effective than phone for DXing.

### Today's Challenge

Currently, CW is enjoying widespread use and likely will continue to do so — at least in the short term. But without the CW licensing requirement will it endure in the long term? Not wanting to leave that to chance, The CW Operators' Club (CWops) was formed.

**But the naysayers have turned out to be wrong and CW continues to enjoy popularity as a mode of communication.**

The club's mission is to increase the population of competent CW operators worldwide. Certainly, with today's computer software, there are many effective ways of learning to "copy" Morse code. Yet these tools will take the student only so far. In other words, a student may learn proper tennis strokes, but until he gets out on the court and begins playing, they're academic. The same is true of CW. You can learn to recognize the characters, but using them in an on-air conversation is a whole other matter. The Novice bands provided that piece of the puzzle.

Today's Amateur Radio beginners have no external pressure to learn and use CW, so most of them don't. Yet interestingly, a number of beginners in all International Telecommunication Union (ITU) regions would like to become CW operators. However, with neither a Novice band nor a large population of other beginners also trying to learn CW, and with most CW contacts proceeding at well above 15 WPM, beginners who want to learn CW may feel understandably discouraged. Without the opportunity to work other CW operators at more moderate code speeds, today's CW aspirants are at a disadvantage. To help solve this problem, the CWops Club created the CW Academy (CWA).

### The CW Academy

In the Novice days, experienced CW operators would spend time on the Novice bands, sending at reduced speeds and serving as an example of how to operate properly. These few Elmers helped many beginners. Unfortunately, those days are gone.

So, the first task of the CWA's program was to find volunteer advisors worldwide who were willing to slow down and engage in casual CW contacts with operators seeking to learn the basics or improve their skills.

The CWA has earmarked quiet segments of various bands and encourages advisors and students to congregate in those segments. This has resulted in many opportunities for students to work other students as well as experienced CW operators who can actively help them improve their skills.

The CWA is not just a US campaign. Like CWops, a global club with a global membership, the CWA's focus is worldwide. Currently CWops boasts a membership of CW operators from over 75 countries and all

Instructor Rob Brownstein, K6RB, conducts twice-weekly CW classes using a virtual classroom where students can see and hear each other, and the sent code, though the students are widely dispersed (Arizona, Hawaii, Ohio and New Mexico).

members are strongly encouraged to help others in their regions to acquire CW skills.

### Simplex CW

The CWA pairs students with advisors who can help them improve their CW skills. The CWA gathered information about each student's availability and band access — ie, all the information necessary to ensure that a student/advisor pair would have times and bands in common. Based on that information, the CWA assigns a student to an advisor, and the advisor then e-mails the student to set up on-air schedules. Advisors are encouraged to meet the students on CWA frequencies, which are about 50 kHz above the bottom of the 80, 40, 20, 15 and 10 meter bands.

**Unlike phone or digital modes, when left to each ham's own learning methods, CW technique can suffer.**

Needless to say, a student's ability to communicate on-air with advisors requires that they know Morse code and can operate at a reasonable, if slow, speed. The CWA embraces those eager to learn Morse code but who don't know any or all of the characters. For students who don't yet know Morse code, the CWA provides online training resources and offers suggestions for how to avoid early missteps. Once a student can send and receive all 26 letters and 10 numerals, the process switches to on-air work.

In the span of its first few months of operation, the CWA paired about 25 advisors and students for one-on-one instruction. The success of the program is reflected in these comments:

- "My advisor, Art, KØRO, has been very helpful and my code speed is improving weekly. — Phil, N1DN
- "My code speed is improving, especially from Jack's, WØUCE, method; he's very patient and helpful." — Donna, AG6V
- "Pablo, XE3WMA, and I have a schedule on Tuesdays and Wednesdays and it's going well. I am sending Farnsworth style and his speed is improving. Pablo translates from English to Spanish and we have a budding friendship." — Mike, KE5AKL

### A Solid Future

As the number of students and advisors continues to grow, they are encouraged to work others near the CWA frequencies in addition to their partners. The CWA also wants others who hear increased activity on those frequencies to be able to identify CWA student/advisor pairs. To accomplish this, the CWA encourages advisors and students alike to call "CQ CWA" to signify that they are operators working together to improve their CW competency.

The CWA will have achieved its goal when these frequencies become populated with an increasing number of capable CW operators. To that end, the CWA will continue reaching out for more advisors and students in all ITU regions. If the CWA can re-create the nurturing environment of the old Novice bands, and do it on a global scale, they will have met their objectives and helped to perpetuate the joy of operating CW.

Rob Brownstein, K6RB, an ARRL member, was first licensed in 1958 as KN2UMU. His favorite mode is CW and his operating preferences are for casual CW contacts and CW contests. He lives in California and works for LitePoint Corporation, a maker of equipment used for testing wireless devices during manufacture. He can be reached at 3881 Winkle Ave, Santa Cruz, CA 95065-1100, **k6rb@arrl.net**.

Jay Temple, W5JQ, an ARRL member, was first licensed in 1966 as WN5QVI. Jay's favorite mode is CW and he enjoys casual CW contacts. He lives in Colorado and works as a consulting geologist. He can be reached at 1068 Parkview Rd, Woodland Park, CO 80863-1244, **jtemple@pcisys.net**.



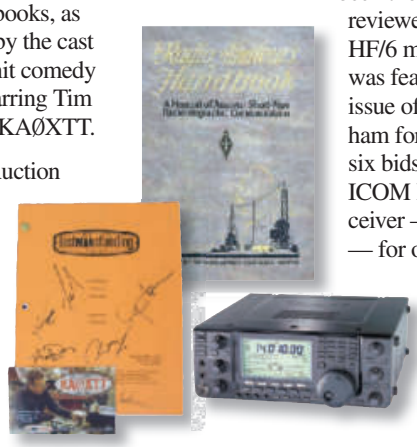
# The Seventh Annual ARRL On-Line Auction: Going, Going, GONE!

## With almost 200 items up for bid, there was something for just about everyone.

**S. Khrystyne Keane, K1SFA**

After a week of frenzied bidding, the Seventh Annual ARRL On-Line Auction ended with a bang of the virtual gavel on October 31. The 2012 running of the auction featured almost 200 items, ranging from high-end Product Review equipment to a great assortment of antique books, as well as items donated by the cast and crew of the ABC hit comedy *Last Man Standing*, starring Tim Allen as Mike Baxter, KAØXTT.

According to ARRL Auction Coordinator Lisa Tardette, KB1MOI, a first edition copy of *The Radio Amateur's Handbook* received the most bids. This 1926 book — the very first version of what we know today as *The ARRL Handbook* — had a cover price of $1. After 27 bids, a lucky ham in England won it with a winning bid of $750.



Many items that have appeared in the pages of *QST* as Product Review items are placed in the ARRL On-Line Auction after they have been thoroughly tested and reviewed. The Elecraft KPA500 HF/6 meter power amplifier, which was featured in the February 2012 issue of *QST*, went to a California ham for $2249 after 14 bids. After six bids, a Washington ham won an ICOM IC-7410 HF/6 meter transceiver — featured in October 2011 — for only $1610. A ham in Brazil placed the winning bid for a Byronics Micro-Trak AIO APRS transmitter that was featured in June 2012. After 21 bids, it went for $430.

The cast and crew of *Last Man Standing* donated quite a few items to this year's auction, including tool sets autographed by Tim Allen, t-shirts and QSL cards. But the item that received the most attention from bidders was a script signed by the entire cast. The script was from the final episode of the show's first season and originally aired on May 8, 2012. With a starting bid of $50, an Illinois ham walked away with this one-of-a-kind item for $361.

Once the results were tallied, the Seventh Annual ARRL On-Line Auction offered 191 items, attracting a total of 1228 bids and 88 winning bidders, many of whom had winning bids on multiple items. "We have certainly grown since we held the First Annual ARRL On-Line Auction in 2006," Tardette said. "Back then, we only had 109 items for bid. Even though the auction is closed for 2012, it's not too soon to start thinking about the 2013 auction. "

# A Trip to Homebrew Heaven

## Father and son hams travel to Colorado to visit the shack of one of the founding fathers of the personal computer.

**John Hill, K2YY**

A great metal horse, copper sulfate blue, rearing back and ready to kick, glared at me with flaming red eyes, seemingly saying "Welcome to Denver, mortal." *Well okay,* I thought. *Now I'm someplace new.*

Why was I at Denver International Airport? A little background: I've been a ham since 1953, when I was 11 years old. I've been around to see many changes. When I started out my transmitter was a Philmore crystal controlled 6L6 kit. My first receiver was a Hallicrafters S-38B.

I've seen tubes replaced by transistors, then by ICs. I was always waiting for what was coming next. In the early 1970s I was taken with RTTY. I got a Model 15 teletype, then a 28RO teletype. I got a reperforator and made a homebrew speed converter. I was thrilled when someone sent me a picture of Bugs Bunny made out of keyboard characters.

**"It's your brain, use it or lose it."**

### The PC Arrives

I was primed for the arrival of personal computers in the mid 1970s, especially the ones that promised an enhanced ham radio experience. I looked eagerly at ads for companies like IMSAI and MITS. I was impressed by an ad for a new computer from a company called The Digital Group. It promised almost unlimited memory (8 kb in addition to the 2 kb on the motherboard), its plug in motherboards allowed it to be upgraded and best of all, it had ham radio applications that could send CW and RTTY. In addition, it was a kit, which meant I'd be spending many happy hours in the shack with some music and a soldering iron for company.

I ordered my new Digital Group computer with the whole 10 kb package and the computer controlled, two cassette playback system. I spent many peaceful hours assembling it and was thrilled when I discovered that it worked. I imagined firing up CP/M and using word processing, database and billing software for a recording studio I was building at the time.

But in 1979 The Digital Group stopped making computers, and I began to lose interest in keeping an orphaned system going. As much as I loved my computer, I resolved never again to buy anything unique. From that point on I was going to stick with whichever company had the biggest market share. This decision led me to become a die-hard PC user.

### Digital Time Capsule

I reluctantly (but carefully) wrapped my Digital Group computer in plastic and put it, along with a couple of unbuilt peripherals and a shoebox of programs on cassette tapes, in my attic.

Time passed, I bought more modern computers, and I forgot what was in the attic. In the meantime, my son Mike, KB2EUC, who was born while I was building the Digital Group computer, grew up to be a Stanford electrical engineer.

For the last few years, Michael has exhibited what some folks might consider unusual behavior. He bought a couple of old Apple 2Cs. While haunting Silicon Valley estate sales, he found a TRS-80, a Timex/Sinclair, an old Atari and an Amiga 500. When he bought an Osborne, I knew he had officially become a vintage computer collector.

During the Christmas season in 2010, Mike asked if I might have anything interesting hanging around. I immediately remembered the prize possession in the attic. We opened

**Figure 1** — The14 foot dish on a 10 foot Rohn 45 tower with a triband patch feed for 435, 1269 and 2401 MHz.

**Figure 2** — The base of the 90 foot, tilt-over, linear loaded vertical with matching L/C tuner. This antenna has a ground screen made of 500 feet of barbed wire buried six inches below the ground for lightning protection, plus quarter-wave radials four inches above ground.

Mike, KB2EUC, and Bob, WØLMD, after our tour of the mountaintop antenna farm.

the door to the crawl space timidly yet optimistically. Sure enough, there it was, still wrapped as if it had been prepared for a time capsule. We carefully pulled out the computer, the Phi-Deck (Digital Group's name for its two cassette system), an 8 inch floppy drive and a shoebox of cassette tapes, most of them with labels intact.

We fired it up. The ON light lit. A fan started. The monitor displayed INITIALIZING Z80 OPERATING SYSTEM. We discovered the keyboard didn't work, but Michael created a fix that translated the signals from a PS2 keyboard into Digital Group format. In spite of the voluminous documentation (pounds of it, literally), we still had some questions.

**I glanced to my right and saw a full sized pipe organ, right there in his living room.**

## Mountain Ham

We both remembered having seen references to a "Dr Suding" who was the creator of this computer. Some research revealed that he was a ham, WØLMD, so we looked him up on **QRZ.com**.

His listing was impressive. He had monobanders for 15 and 20, two elements each for 40 and 17, *two* dishes covering 435, 1269 and 2401 MHz, and a 90 foot tiltable vertical complete with barbed wire as part of its ground plane. And at the bottom of the page, this: "My life has one rule now: 'It's your Brain, Use it or Lose it.'"

His address was in Conifer, Colorado, so we had a way to contact him. I called Dr Suding to see if he'd be interested in receiving a couple of acolytes (by then, the doctor had acquired an almost mythological presence in our imaginations). He said he would. I asked him about his involvement with The Digital Group, but it was clear that Dr Suding's focus was on the present. He told me about the projects he was working on. I listened, but didn't really understand the scope of the projects until I saw them for myself.

## Destination Denver

Which brings me back to that blue horse. That same month Mike and I flew into Denver and headed for Conifer. When we arrived at Dr Suding's house, we rang the bell and heard the sound of footsteps from inside. A tall, thin, silver haired man opened the door and we introduced ourselves. He didn't move from the doorway, and began to talk about some of his antennas. For a moment, I wondered whether we were going to be invited into the house after coming all that way.

Suddenly, I saw movement to my left where, about 20 feet away, three deer were languidly munching on plants. Dr Suding said "Oh, that's Dora. They come here every day. We put out food for them." Perhaps it was due to Dora's presence, but luckily for us Dr Suding stepped into the yard and closed the door behind him.

He began by giving us a tour of his antenna farm, starting with the towers that held the 15 and 20 meter monobanders. Then we saw the 10 foot dish, which was set up with two feed horns so it could be used on either 2401 or 1269 MHz. It had an az-el mount with computer controlled rotators to track satellites or the moon. Next we saw the 14 foot dish for 435, 1269 and 2401 MHz and the cross polarized 2 meter beam, also used for satellite contacts (see Figure 1). This part of our tour ended with the 90 foot vertical for 160, 80 and 40, which featured a tilt-over mount for maintenance and barbed wire for a ground plane (see Figure 2).

The reason for the barbed wire was that lightning likes points. Dr Suding explained that Conifer was at such a high elevation (his station is at 9000 feet!) the question was not *if* his antennas would be struck by lightning, but *when*. He's put barbed wire everywhere a ground screen would be helpful — meaning all over.

## Homebrew Heaven

As our tour continued, we saw a few of Dr Suding's other projects, including two prototype HD TV antennas made of foil on a piece of foam, a Nissan awaiting conversion to electric propulsion, and a garage full of many mysterious parts for upcoming inventions.

Once we had been ushered into the house, Dr Suding asked "Want to see my pride and joy?" Of course we did. We went into the living room. Above a doorway was a sign: "DR. SUDING OFFICE HOURS 9 AM TO 3 AM".

Against one wall stood what appeared to be a full sized organ keyboard. It seems that in addition to being a ham and an inventor, Dr Suding is a musician. I wasn't surprised; being a renaissance man has to include some artistic skill.

I looked for the speakers and amplifier. I glanced to my right and saw a full sized pipe organ, right there in his living room (see Figure 4). He was amused by our incredulity. I guess that was the point.

Like nearly everything else Dr Suding owned, he had built the organ from scratch; he had calculated the length of each of the pipes to create the right pitch. Dr Suding has had Parkinson's disease for 10 years so he has some difficulty using the keyboard. When playing his instrument he controls it using a computer (running *Cakewalk*) and MIDI (musical instrument digital interface).

"Listen to this," he said, before choosing a file.

We waited as it loaded. Then, a mighty multi octave sound erupted. Here's a

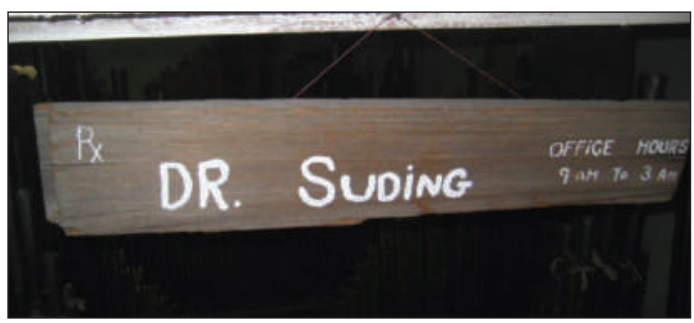



**Figure 3** — The sign (in the living room) rescued from Dr Suding's office. Please note the office hours!

**Figure 4** — This is the homebrew pipe organ that Dr Suding made from scratch. It's in an alcove adjacent to the living room, which attests to a *very* understanding spouse.

transcription of what it was:
[–.–. ––.– –.–. – – .–
–.. .––– ––––– .–.. –– –..].
It went on, sending name, location and RST. It was the most interesting use of a pipe organ I'd ever heard. He went on to "play" us several more pieces — both silly and serious — including the famous Bach "Toccata in D Minor." Of all the things we had seen that morning, none seemed to bring him more pleasure than that demonstration.

## The Shack

Dr Suding's shack occupied most of his basement, and had several plaques on the wall from the Pikes Peak R/C Club and the Sky Corral R/C Club for achievements in radio controlled model aircraft. All of the plaques proclaimed "First Place." If there was a mere "Honorable Mention" in there I missed it. I thought to myself, *When does this guy sleep?*

There was a huge workbench with lots of new test gear. The WØLMD station itself took up most of a big L shaped table. His equipment is an ICOM 7700 transceiver with an external monitor, Henry 2K and Alpha 77 linears, and three or four additional monitors. Unlike many shacks, his has windows. I'm guessing Dora and her deer friends make an occasional appearance just outside.

**What we have in common with our fellow hams from a century ago is the spirit of invention...**

Soon after our visit, he wrote to me, saying "I am about to erect two 45 foot tree towers, an 85 foot Rohn 45 tower, (with) stereo infrared TV cameras for spotting wildfires, experiments and antennas...Will continue later. Just came up with 18 more projects."

## An Inventor's Spirit

When this hobby started, hams built spark gap transmitters that were so noisy they could be heard down the block. Those early hams were on the cutting edge of antenna design. They were experimenting with a brand new technology and making up the rules as they went along. Sometimes things worked; more often they didn't. Making a two way contact on 5 meters was a miracle. Now we have 5 GHz cordless phones, cell phones that can access the Internet from anywhere in the world and 2.4 GHz Wi-Fi networks in our homes that let us use laptop computers by the pool.

What we have in common with hams from a century ago is the spirit of invention, the willingness to try what hasn't yet been tried. The first hams trying to cross the pond with their spark CW had the same impulse as today's hams trying to work South Africa using JT65 and a faint reflection from the moon.

The ham spirit is the idea that at the end of the day, we are all experimenters. I saw this spirit in Dr Suding. He is many things: computer designer, inventor, entrepreneur,

All photos by John Hill, K2YY.

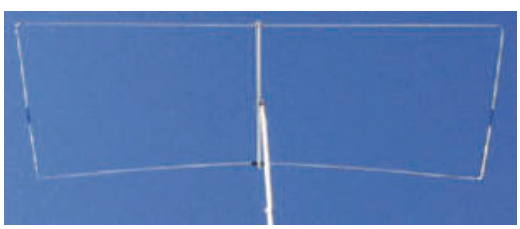
John Hill, K2YY, an ARRL® member, was first licensed as WN1YCJ in 1953. Currently he holds the Extra call sign K2YY. He also holds the license VP2MP and has operated as VP2MOC, KH6/K2YY and others. He has held temporary calls in France, Switzerland, Great Britain and other countries. He has operated contests "from DC to daylight." He is a member of both the Stanford Amateur Radio Club, the Palo Alto Amateur Radio Club and the Northern California Contest Club. He divides his time between Southern New Jersey and Palo Alto, California. When not in the shack, John is a film and TV composer, an arranger and a music producer.



# New Products

### MFJ 6 and 10 Meter Moxon Antennas

The Moxon antenna is similar to a 2 element Yagi with the elements folded to make the antenna more compact. The MFJ-1896 for 6 meters weighs 5 pounds with an element span of 7 feet on a 34-inch boom. The MFJ-1890 for 10 meters weighs 8 pounds with an element span of 12 feet on a 50 inch boom. Each



antenna has an SO-239 pigtail for feed line connection and can be mounted and rotated with TV antenna hardware. Price: MFJ-1890 (10 meters), $84.95; MFJ-1896 (6 meters), $69.95. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com.**

# Five Band Worked All States for the Small Station

## With persistence and some creative thinking, 100 W and a wire can put 5BWAS on the wall.

**Ron Pollack, K2RP**

As we get older, most of us realize that we won't be sports stars, captains of industry or President of the United States. That doesn't mean we lose the ambition to achieve milestones. In our Amateur Radio lives, most of us with average equipment, limited antenna possibilities and insufficient available time won't find ourselves on the DXCC Honor Roll or with a top ten score in a major contest.

As I was wondering what kind of meaningful goal I might achieve, I went to a meeting of my radio club and one of the members Harry Hughes, W6YOO, had brought in his album of 250 QSLs representing the requirements for the 5 Band Worked All States Award (5BWAS). The number of his award was in the high 2000s, which aroused my curiosity. After a little research I discovered that the award began on January 1, 1970. This was a "start from scratch" award, in that all contacts had to be made on or after that date. I was surprised that so few, relatively, had been issued in all that time.

As I considered 5BWAS, I realized I was working with some "handicaps:"

- Only 100 W from a venerable FT-767GX transceiver.
- Small suburban lot, with a 50 foot pole for a wire antenna.
- Still working full time.
- Station in a "corner" of the country.
- A cross country move eliminated 30 years of contacts.

Still, I took up the challenge and 5 Band WAS plaque #3014 is ready to hang on the shack wall. Here are some tips on how *you* too can do it.

There are two parts to completing this project: Make the contacts and collect the confirmations. First, get familiar with the rules (**www.arrl.org/was**). The specific bands required are 80, 40, 20, 15 and 10 meters. All modes are eligible and there is no endorsement by mode.

**State and regional QSO parties are quick and easy ways to grow your total.**

The next step is to download and print a copy of the worksheet (**www.arrl.org/was-forms**) or create a spreadsheet to keep track of your progress. Next, go through your existing confirmations, both LoTW and paper QSLs, and mark off the ones you have. If you use software logging, much of this is automatic. Now, to help you work the rest here are a few suggestions:

### Work the Contests

There are domestic contests most weekends of the year. Among those events, state and regional QSO parties are quick and easy ways to grow your total. Most of the active stations work various bands throughout the event and will be happy to share their operating schedule. The QSO parties have websites, most of which outline the schedules of active hams in that state or region. Working the same station on several bands will make confirmation easier. These are usually "low pressure" contests, with no huge pileups or complex exchanges, so even if you're not a contester, you'll be welcome and not overwhelmed.

Put the national contests on your calendar as well. Sweepstakes and the North American QSO Party, for example, bring out all states on all bands. If you're not a serious contester, just concentrate on working the band/states you need. Note that in Sweepstakes, only one contact with a station is allowed no matter what band you work them on. Most other contests allow contacts with the same station on multiple bands and modes. Don't forget "specialty" contests, like the ones run by the FISTS (**www.fists.org**) and 10-10 clubs (**www.ten-ten.org**), as well as the ARRL® 10 Meter Contest (**www.arrl.org/10-meter**).

### Join Some Nets

There are several "WAS nets" that exist to help qualify participants for various WAS awards from their organizations and from ARRL, as well as some general nets that can serve the same purpose. A few of them are 3905 Century Club, OMISS, YLISSB, 10-10 International and Geratol (see Table 1). Most meet on a daily basis, with check-ins from throughout the country.


Ron, K2RP, shows off the 5BWAS he earned using 100 W and a wire antenna. [Paul Williamson, KB5MU, photo]

**Table 1**
**Nets with National Memberships**

| Net | Website | QSL Bureau |
|---|---|---|
| 3905 Century Club | **3905ccn.com** | Yes |
| County Hunters | **countyhunter.com** | Yes |
| 10-10 International | **ten-ten.org** | Yes |
| OMISS Net | **omiss.net** | Yes |
| Geratol Net | **geratol.net** | Yes |
| FISTS CW Club | **fists.org** | Yes |
| YLISSB | **ylsystem.org** | No |

Usually the net control takes a list of participating stations and each one takes a turn giving a call to the stations needed for whatever award he is chasing. This can be time consuming, but all states show up frequently and the other station will be listening hard for you. The County Hunter nets are also a good source of contacts and a spotting website is available. Listen for a few minutes to learn the protocol of each net before checking in. In general, these nets are very friendly and helpful places.

### Learn and Use CW and Digital

While this isn't absolutely necessary, it's generally easier to complete difficult contacts using low power and marginal antennas using these modes. There is plenty of CW and digital activity during the contests.

### Listen Listen Listen

Listen to casual ragchews and if you don't get the locations from the conversation, look up the calls on **QRZ.com** or other online database. If you need the band/state, politely break in and ask for the contact. The vast majority of hams are happy to accommodate.

### The Tough Ones

When I was down to the last few, I e-mailed hams known to be active on the bands I needed. How did I find them? Easy. Just look at the results of Sweepstakes and other contests. They are available on the ARRL website and can be sorted by section and band. If you need Nevada on 80, for example, look up the last Sweepstakes result, find a Nevada station with lots of contacts on 80, look up his e-mail address on **QRZ.com** and schedule a contact.

**There are several "WAS nets" that exist to help qualify participants for various WAS awards...**

These "big guns" often have sophisticated antennas and high power, and are easy to work. When I needed an East Coast station on 80, the big gun station was so strong I thought he was in my driveway. Everyone I wrote to was extremely gracious, set an immediate schedule and confirmed quickly. If this system doesn't yield results, e-mail the Section Manager (**www.arrl.org/sections**) of the section involved and ask for a referral to an active ham. Be creative!

### The Close Ones

The hardest ones for me were the nearby states on 15 and 10 meters. Again, contests and prearranged schedules provided the contacts I needed. Keep listening for short skip conditions.

### Low Cost Confirmations

The rules require confirmations of all 250 contacts. Don't be discouraged about the cost and time required to send 250 SASEs since there are no-cost and low-cost alternatives.

The best tool available is ARRL's Logbook of The World, (LoTW). If you're not familiar with this program, the ARRL website offers a step by step tutorial (**www.arrl.org/logbook-of-the-world**). If I ever find my name on a top ten list, it will be titled "Least Computer-Literate Hams." Despite that, I was able to navigate the instructions, enroll and use LoTW. There's no charge and thousands of hams upload their logs regularly, especially contest operators. A LoTW confirmation is as good as a paper QSL for WAS purposes plus it's free and fast.

Many of the nets and organizations in Table 1 offer QSL bureau services for the cost of an SASE. These work much the same as the ARRL DX QSL Bureau does. Just send a few SASEs to the bureau of the net you're active with and they will forward the cards. I used the 3905 Century Club. Their bureau is extremely efficient and members of the net are strongly encouraged to QSL. The County Hunters group has a bureau that charges a nominal amount per card, but multiple contacts with the same station are on the same card. Many of the County Hunter contacts are with mobiles, so you can work the same station on different bands, in different states and confirm with one card.

Sometimes, however, the SASE route is the only way to go. When you're down to the last few, you'll be headed for the post office to mail your QSL and SASE before the rig cools down, but this will be the case in very few instances.

### Do It Now

I started this project in 2002 and by 2005 I had 249 of the required 250 confirmations. Then the sunspots disappeared and I began a daunting quest for North Dakota on 10 meters. I had many scheduled contacts set up when conditions looked promising, but my wire antenna was not up to the task without the help of sunspots. In the fall of 2011, the 10 meter band came to life and on October 10 (the annual 10-10 club "10-10" day) I contacted Nancy, K9DIG, in Thompson, North Dakota and my 5BWAS was complete. The QSL arrived immediately and I submitted my application promptly. My 249th contact was in June of 2005 and I had to wait over 6 years for #250. But it was worth it; the plaque looks great on my shack's wall!

We're at the beginning of Solar Cycle 24 and both 10 and 15 meters are open on a daily basis. Get on those bands and start accumulating states. You'll find that this is a meaningful challenge, but one that is achievable with some skill, effort and above all patience.

Ron Pollack, K2RP, an ARRL member, was first licensed in 1959 as WV2GLP. Ron soon upgraded to General becoming WA2GLP. In 1971 while living on Long Island he took the last step to Amateur Extra class eventually getting the call K2RP. In 1989, he moved to southern California.

Ron has sampled much of what our hobby offers. When not acting as vice president of the Palomar ARC he enjoys homebrewing, RTTY award collecting, county hunting, mobiling, DXing and especially "boat anchor" restoration and collecting. He can be reached at 659 Shanas Ln, Encinitas, CA 92024, **k2rp@arrl.net**


## Strays

### A Meeting Place on the Air for Work-At-Home Hams

Scott Davis, N3FJP, is a work-at-home ham who suspects he has a lot of company. Like most of us, when he has been at work on a project for hours he needs to take a break and clear his head. At an office this often takes place at the nearest water cooler, but what happens when you are at home? "I love working from home," Scott says, "but I sure miss that office diversion. It turns out others do too, so we are randomly meeting at the metaphorical water cooler on 21.446 MHz daily for brief chats about sports, the weather and anything ham related." For more information go to **www.n3fjp.com/watercooler/**.

# Try RTTY Contesting on for Size

## With a RTTY contest on the air almost every weekend, you're sure to find one that's a perfect fit for you.

**S. Khrystyne Keane, K1SFA**

ARRL News Editor Khrystyne Keane, K1SFA, operates about 12 RTTY contests each year from the K1TTT Superstation in Peru, Massachusetts. [Michael Keane, K1MK, photo]

If you ask a dozen hams which Amateur Radio activity they enjoy the most, you will more than likely get a dozen answers. My primary interest is contesting, particularly RTTY contesting. While I'm not on the air each weekend, I do make it a point to get on for about 12 contests each year, including the three "big ones": ARRL RTTY Roundup in January (**www.arrl.org/rtty-roundup**), CQ WPX RTTY in February (**www.cqwpxrtty.com**) and CQ WW RTTY in September (**www.cqwwrtty.com**). For those new to RTTY — or to contesting in general — these three contests can seem a bit overwhelming. Fortunately, there are many smaller RTTY contests scattered throughout the year, enabling even the faintest of heart to get on the air and make some RTTY "diddles."

While this is not a comprehensive list of RTTY contests, these are the contests that I operate in each year. Some are small, while some are a bit larger. Try a couple of them on for size to find one that's the right fit for you.

■ **BARTG Sprint** (*held the last full weekend in January*): In this contest, not only will you need to work all the DX you can, you also need to work all six continents, as both are multipliers. This is a great contest in which to start your RTTY contesting experience in that you are not competing directly against the hams who have done well in prior years. The BARTG Sprint rules state that if you have placed in the top 10 percent in any of the three years prior to that year's contest, you will compete in the Experts category. This is a 24-hour contest. See **bartg.org.uk** for more information.

■ **NAQP RTTY Contest** (*held the last Saturday in February and the third full weekend in July*): The North American QSO Party, sponsored by the *National Contest Journal*, runs two contests a year for SSB, CW and RTTY. This is a 12-hour contest; single ops work only 10 of the 12 hours. Power is limited to 100 W. The exchange is your name and your state or province; DX stations send just their name. See **www.ncjweb.com/naqprules.php** for more information.

■ **SP DX RTTY Contest** (*held the fourth full weekend in April*): The goal in this contest is to work stations in all 16 Polish provinces. These provinces, along with each DX entity and the six continents, count as multipliers on each band. This is a 24-hour contest. The exchange is a signal report and a consecutive serial number (beginning with 001). See **www.pkrvg.org/zbior.html** for more information.

■ **SARTG RTTY Contest** (*held the third full weekend in August*): I love this contest! Its structure makes it easy for single operators to have a lot of fun. This contest is a 24-hour contest held over 36 hours, with the operating time broken up into eight-hour sections: you work the first eight hours, off for the next eight, work the next eight, off for the next eight and then back on again for another eight hours. The exchange is a signal report and a consecutive serial number (beginning with 001). Hams who compete in the "All Band" category can also choose to enter their best band, too — it's like two contests in one! See **www.sartg.com/contest/wwrules** for more information.

■ **SCC RTTY Contest** (*held the last full weekend in August*): This 24-hour contest is sponsored by the Slovenia Contest Club. The exchange in this contest is a little different: Along with giving a signal report, you also give the year you were first licensed. It is not uncommon to work hams giving out exchanges from the 1940s or 1950s! See **lea.hamradio.si/scc/rtty/rtty.htm** for more information.

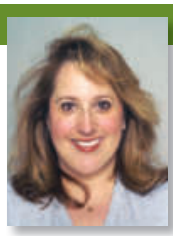
■ **Russian WW RTTY Contest** (*held the first Saturday in September*): This 24-hour contest is usually held on Labor Day weekend. Russian stations will give out a signal report and their oblast abbreviation, while other stations give out a signal report and their CQ zone. See **www.qrz.ru/contest/detail/93** for more information.

■ **Makrothen RTTY Contest** (*held the second full weekend in October*): Like the SARTG RTTY Contest, the Makrothen RTTY Contest is also done in three eight-hour sections over 36 hours. But what makes this one fun is the distance-based scoring method: You get more points the further away you are from the other station! The exchange is only your grid square; no signal report is required. See **home.arcor.de/waldemar.kebsch/The_Makrothen_Contest** (case sensitive) for more information.

■ **OK RTTY DX Contest** (*held the third full weekend in December*): This 24-hour contest counts both stations in the Czech Republic and DXCC entities as multipliers, with extra points on 40 and 80 meters. The exchange is a signal report and your CQ zone. See **www.crk.cz/ENG/DXCONTE** (case sensitive) for more information.

Even if you don't plan on trying to win an award in a contest, please send in your log to the contest organizers. They appreciate this and they use your log as a check log against the other logs. If you are interested in setting up your station to operate RTTY, *Getting on the Air with HF Digital* by *QST* Editor-in-Chief Steve Ford, WB8IMY, is an excellent source for all digital modes, including RTTY. For information regarding RTTY contesting, check out **www.rttycontesting.com**, run by RTTY contester extraordinaire Don Hill, AA5AU.

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



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

# ARRL Members in Hudson Division Elect New Director; Northwestern Division Re-elects Director

**For the first time ever, ARRL members elect leadership via electronic ballots.**

On November 16, ballots were counted in the races for Director in the Hudson Division and for Director and Vice Director in the Northwestern Division. This year, there were only three contested races for Director or Vice Director in the five Divisions holding elections. In the Hudson Division, Mike Lisenco, N2YBB, defeated incumbent Joyce Birmingham, KA2ANF, for the top slot in that Division. In the Northwestern Division, Jim Fenstermaker, K9JF, defeated William Balzarini, KL7BB, for Director, while James Pace, K7CEX, was elected as Vice Director in a three-way race. Terms for Directors and Vice Directors begin at noon on January 1, 2013 and run for three years.

The following incumbents ran unopposed and were declared the winners of their elections by the League's Ethics and Elections Committee this past August: Central Division Director Dick Isely, W9GIG, and Vice Director Vice Director Kermit Carlson, W9XA; Hudson Division Vice Director William Hudzik, W2UDT; New England Division Director Tom Frenaye, K1KI, and Vice Director Mike Raisbeck, K1TWF; Roanoke Division Director Dennis Bodson, W4PWF, and Vice Director James Boehner, N2ZZ. The rules state that if a candidate is running unopposed, he or she shall be declared the winner without balloting.

For the first time, ARRL members who live in Divisions where there was balloting were able to vote via electronic ballot. The election was conducted by Survey & Ballot Systems of Eden Prairie, Minnesota, which has more than 20 years of experience with association elections. Whether cast electronically or on paper, all votes were by secret ballot. ARRL Dakota Division Director Greg Widin, KØGW, was on hand to oversee the balloting and observe the tabulation of the results; Widin is Chairman of the ARRL's Ethics and Elections Committee.

## Hudson Division

Incumbent Hudson Division Director Joyce Birmingham, KA2ANF, of Ridgewood, New Jersey, faced ARRL New York/Long Island Section Manager Mike Lisenco, N2YBB, of Brooklyn, New York. Lisenco was declared the winner, with 836 votes. Birmingham received 533 votes. Lisenco has served as ARRL New York/Long Island Section Manager since 2009. Prior to being elected Section Manager, he was Section Emergency Coordinator from 2007-2009.

Hudson Division Director Mike Lisenco, N2YBB

## Northwestern Division

Incumbent Northwestern Division Director Jim Fenstermaker, K9JF, of Vancouver, Washington, faced challenger William Balzarini, KL7BB, of Auburn, Washington. Fenstermaker was declared the winner with 1485 votes to Balzarini's 497. Fenstermaker has served as Director since 2005. Prior to being elected as Director, Fenstermaker was appointed Northwestern Division Vice Director in 1999, replacing Greg Milnes, W7AGQ, when Milnes moved up to Director upon the death of then-Director Mary Lou Brown, NM7N.

Northwestern Division Director Jim Fenstermaker, K9JF

Incumbent ARRL Northwestern Division Vice Director Grant Hopper, KB7WSD, of Everett, Washington, chose not to seek election for a full term as Vice Director of the ARRL's Northwestern Division. Hopper was appointed Vice Director in February 2010 when the position became vacant due to no one submitting the materials necessary for running for Vice Director during the regular election cycle. Three hams vied to be the next Northwestern Division Vice Director: James Pace, K7CEX, of Centralia, Washington; William Sawders, K7ZM, of La Pine, Oregon, and Daniel Stevens, KL7WM, of Kent, Washington. After all votes were tallied, Pace was elected as the new Vice Director in the Northwestern Division with 701 votes. Sawders came in second with 672 votes, while Stevens came in third with 583 votes.

Northwestern Division Vice Director James Pace, K7CEX

"This year was the ARRL's first-ever experience with electronic voting for Division Directors and Vice Directors," Widin explained. "Our choice of external partners was validated by an extremely smooth process on all electronic voting. We will be reviewing our experience after voting is complete to determine the best direction for future elections. In electing Directors and Vice Directors, ARRL members have a chance to chart the League's direction for the future. It is gratifying to see that our members care about their League and support it through voting. Thanks to all the candidates, and to all members who voted, for their participation."

## As Hurricane Sandy Wreaks Havoc on East Coast, Hams Heed Call to Help

Even though Hurricane Sandy was declared a post-tropical cyclone by the time it made its final landfall — just 5 miles southwest of Atlantic City, New Jersey at about 8 PM EDT on October 29 — the storm still had winds in excess of 80 miles per hour. Hams across the region, from the Carolinas to Maine, responded to requests for assistance and activated local nets, supported the Hurricane Watch Net's and the VoIP Hurricane Net's operations, assisted their local and state Emergency Operations Centers and provided assistance at shelters and wherever needed.

This image from NASA shows Hurricane Sandy as it moved toward the East Coast on October 29.

President Barack Obama and FEMA Administrator Craig Fugate participate in a briefing with federal agency partners on preparations for Hurricane Sandy. In May 2011, Fugate called Amateur Radio "the last line of defense." [Photo courtesy of FEMA]

### Northern New Jersey

Two hospitals in Northern New Jersey requested assistance from radio amateurs. According to ARRL Northern New Jersey Section Emergency Coordinator George Sabbi, KC2GLG, the hospitals were experiencing issues with their communications systems they use for direct communications between these their facilities in Middlesex and Union Counties.

Sabbi said that a shelter in Bergen County utilized radio amateurs when it opened on Monday, October 29 until late in the morning the next day. "Operators went off duty for rest and came back on Tuesday," he said. "The Red Cross is working on getting more Amateur Radio resources into additional shelters, noting that travel is a restriction for many volunteers due to the numerous road closures all over the state. I've received several reports of repeaters being on backup power or off-the-air, and in all cases, we've moved to alternate frequencies."

### Southern New Jersey

Through its Ham Aid program, the ARRL sent six VHF radios to Ocean County, New Jersey. ARRL Ocean County Emergency Coordinator Bob Murdock, WX2NJ, programmed them for deployment to the six shelters in Ocean County shelters today. One of the ARRL's National VOAD partners, NECHAMA — Jewish Response to Disaster, provided transportation to Ocean County.

ARRL Southern New Jersey Section Emergency Coordinator John Zaruba, K2ZA, ran a Section Resource net on the SNJ ARES repeater at 7 AM, 1 PM and 7 AM each day to provide support to the County Emergency Coordinators. He sent requests, asking for six relief operators from within the Section to deploy to Atlantic County and another six relief operators to go to Ocean County. Both shoreline counties used Amateur Radio in the shelters run by the American Red Cross.

ARRL Southern New Jersey Section Manager Gary Wilson, K2GW, told the ARRL that one of the reasons that New Jersey is somewhat better prepared than other states is that New Jersey Office of Emergency Management won't approve a County Emergency Management Plan unless it includes a RACES annex. "As a result, *every* county EOC has permanent Amateur Radio capability on 2 meters simplex, a 220 MHz radio aimed at the NJ2EM 220 MHz repeater that covers the entire state, 2 meter APRS for text messaging and HF capability on 75 meters LSB," he explained. "These are tested once each month on statewide nets. Similarly each American Red Cross chapter tests its 2 meter capability monthly with the central Red Cross station at N2ARC in Princeton, which then links to the State Emergency Operations Center in West Trenton. And of course, each county has a 2 meter repeater designated for its own work at the county level."

### Eastern New York

The Eastern New York Section Coordination Net on the N2ACF system operated throughout Hurricane Sandy. According to ARRL Eastern New York Section Emergency Coordinator David Galletly, KM2O, Section leadership assessed the incoming reports and determined the duration of continued operations following the passage of Sandy through the Section. Even though the formal nets were over, the system was available for informal use by those stations that still need emergency communication coordination.

Following a request from Westchester County Emergency Coordinator Tom Raffaelli, WB2NHC, operators from the Northern and Central Districts in the ARRL's Eastern New York Section deployed to relieve Westchester operators. Galletly and Central District Emergency Coordinator

Leonard Signoretti, N2LEN, arrived in Westchester on November 1, to provide relief shelter duty, and operators from Albany arrived later in the week.

### Connecticut

Hams associated with SKYWARN were very active in Connecticut. "Assistant District Emergency Coordinator for SKYWARN Jim McBride, KD1LD, kept all of us updated about current conditions and did a great job working with our very dedicated SKYWARN Emergency Coordinators who coordinated activity in their counties," explained ARRL Connecticut Section Manager Betsey Doane, K1EIC. "We had hams in Hartford, Fairfield, New London and Windham Counties who participated in the SKYWARN nets. We needed a fill-in for New Haven County, so Craig Lang, W1MHZ, spontaneously volunteered, even under his own emergency conditions. He ran a few nets while camped out at his neighbor's home; as I understand it, he had to be evacuated. His work was commendable."

Many shelters throughout the Section were supported by radio amateurs, some of whom are also CERT trained. Stamford Emergency Coordinator Jon Perelstein, WB2RYV, reported that eight volunteers and two American Red Cross disaster leaders supported the three Stamford shelters, provided backup communications for Red Cross between the shelters, the Emergency Operations Center and the Red Cross chapter house in Darien. Those staffing the shelters did everything from intake to cooking to support for the elderly and infirm. Other hams staffed Stamford's Citizen Service Line, taking reports of downed trees and power lines for dispatch of Connecticut Light & Power and city work crews.

In the western part of the state, Danbury Emergency Coordinator Mark Hertzbert, WA2IZQ, and his ARES group staffed the Danbury Emergency Operations Center, the shelter at the War Memorial and Danbury Hospital. "They served as backup communicators and were generally useful to the served agencies in tasks that were not necessarily communication-related," Doane explained. "Everyone participated in continually assessing the situation in their areas of responsibility."

### Massachusetts

In Eastern Massachusetts, the Section ARES group activated its Amateur Radio command centers in Acushnet and in Brookline. According to ARRL Eastern Massachusetts Section Emergency Coordinator Rob Macedo, KD1CY, both of these centers have HF capability, and can be used if the there were widespread outages on 2 meters. "The Emergency Operations Center in Boston requested Amateur Radio support, as did the American Red Cross for several regional shelters within the Eastern Massachusetts Section," Macedo said. "Cape Cod ARES supported several regional shelters and there were amateur operators at several area hospitals. Other hams ran net control for their district net out of the Red Cross Chapter in Hyannis. The Massachusetts Emergency Management Agency (MEMA) Region Two Office in Bridgewater also had Amateur Radio support."

At the National Weather Service office in Taunton, Amateur Radio SKYWARN station WX1BOX was active for a 22 hour period on Monday and Tuesday of the storm. "During Hurricane Sandy, WX1BOX handled several hundred reports of wind damage (including roof structural damage reports in some areas, as well as many trees and wires down), wind measurements, rainfall measurements, storm surge and urban flooding reports from heavy rainfall," Macedo said. "This was done over a dozen local area VHF/UHF repeaters with liaisons, as well as the utilization of the New England EchoLink/IRLP Reflector system, which was combined and linked into the VoIP Hurricane Net system. In this way, we created one large hurricane net that covered the Delmarva region into New Jersey, New York and New England, and also included WX4NHC, the Amateur Radio station at the National Hurricane Center. The damage and meteorological information was shared with other agencies such as the American Red Cross, local and state emergency management, and the media to provide situational awareness and disaster intelligence during Sandy's impact on the region.

### North Carolina

In North Carolina, ARES groups in the state participated in response to Hurricane Sandy activities. "Local teams operated during the response-and-recovery phases at several County Emergency Operations Centers and at the State EOC at Raleigh," said ARRL North Carolina Section Emergency Coordinator/North Carolina RACES Officer Tom Brown, N4TAB. "All operators participated under the NIMS/ICS model. The AUXCOMM team at the State EOC operated under the ALL HAZARDS model and we had several Communication Leaders (COMLs) and a Communication Technician (COMT) from our own resource group on duty at all times."

## Robin Walbridge, KD4OHZ, Missing at Sea after Sinking of Tall Ship *Bounty*; Ship's Electrician Doug Faunt, N6TQS, Rescued

Every DXer knows the story of the HMS *Bounty* and Pitcairn Island, VP6: In 1789, the HMS Bounty — a small three-masted sailing vessel sent by Britain's Royal Navy to the Pacific on a supply expedition — was roiled by tension between its crew and its captain, William Bligh. After landing in Tahiti and taking on a cargo of breadfruit, the *Bounty* set sail for the West Indies; it never reached that destination. Instead, Master's Mate Fletcher Christian led the men in a mutiny, eventually allowing Bligh and his loyalists to sail off in a longboat. After an arduous journey, they reached safety at the Dutch-owned port of Kupang. Christian and his followers ended up on Pitcairn Island where they burned the *Bounty* and settled on the island. Passing ships did not discover the enclave until after the turn of the 20th century.

Doug Faunt, N6TQS, on the deck of the tall ship *Bounty*. [Photo courtesy of Doug Faunt, N6TQS]

On October 29, a replica of the *Bounty* — built in 1960 for a remake of the 1962 film *Mutiny on the Bounty* — sank off the coast of North Carolina as Hurricane Sandy made its way toward New Jersey. Of its 16 crew members, 14 were rescued by the US Coast Guard. *Bounty* Captain Robin Walbridge, KD4OHZ, never made it

to one of the two deployed life rafts and is presumed dead. Claudene Christian, who claimed to be a direct descendent of Fletcher Christian, was found unresponsive and passed away at a North Carolina hospital that evening.

Doug Faunt, N6TQS, of Oakland, California, was one of the 14 who was rescued by the Coast Guard; Faunt served as a deckhand and was also the ship's electrician. According to Spud Roscoe, VE1BC, Faunt had satellite communications equipment and *Winlink* capabilities on board the Bounty, but he was not the ship's radio officer. "Sailing on replica ships was a hobby of Doug's," Roscoe told the ARRL. "He had previously sailed across the Great Australian Bight on a replica of the HMB *Endeavour*, Captain Cook's ship. He was an able seaman of the watch." Roscoe was the radio officer on the replica *Bounty* for its original voyage to France in 1962.

Faunt told the ARRL that the *Bounty* crew tried various methods, including a satellite phone, to call for help, "but we got nothing when tried calling out on HF. We tried calling the Maritime Mobile Net, but nothing was out there. We had *Winlink* on the ship that we used for e-mail and accessing the Internet to post to blogs and to Facebook, and we finally found an e-mail address for the Coast Guard. As a last-ditch effort, we used *Winlink* to e-mail the Coast Guard for help. Within an hour, we heard a C-130 plane, and later, a helicopter overhead." According to Faunt, it was Walbridge, as master of the ship, who sent out the distress messages.

"I don't know how I made it off the ship," Faunt recalled. "I had finished serving a long watch, and then we started going down. I was exhausted. I had to swim to get to the life raft. The water was full of rigging, and here I am, in my Gumby suit, trying to swim. It was so difficult. While swimming to the raft, I came up for air and a spar was coming at me. I finally found a raft and tried to climb into it, but I almost didn't make it, tired as I was. Through the help of my shipmates who were already aboard the raft, I got on." The two life rafts were out about 100 miles from shore when they were rescued.

The vessel left Connecticut on Thursday, October 25 with a crew of 11 men and five women, ranging in age from 20-66. After being treated at a hospital in Elizabeth City, North Carolina, Faunt arrived back home in California on October 31. "I'm looking for a new boat to sail and a DXpedition to go on," Faunt told the ARRL. "Ham radio got me into my position on the *Bounty*, and ham radio got me out alive!"

## USPS Seeks to Phase Out IRCs

If the US Postal Service (USPS) gets its way, it will no longer sell International Reply Coupons (IRCs) after January 27. According to the October 23 edition of the Federal Register, there is not sufficient demand for the USPS to continue offering IRCs to customers; however, per the Universal Postal Union (UPU) regulations, the USPS must continue to exchange (redeem) IRCs that have been purchased in foreign countries and presented at USPS facilities. The current Nairobi model is valid through December 31, 2013. IRCs provide foreign addressees with a prepaid means of responding to inquiries, solicitations or other types of communications — such as QSL cards — that are initiated by US senders. IRCs are exchangeable for postage stamps by postal administrations in member countries of the UPU. Each IRC is equivalent in value to the destination country's minimum postage price for an unregistered airmail letter. The purchase price in the US is currently $2.20 per IRC.


## Section Manager Election Notice

To all ARRL members in Maryland/DC, Nebraska,* Nevada, New Hampshire, New York-Long Island, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas. You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

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

We suggest the following format:

(Place and Date)

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

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

(Signature___ Call Sign___ City___ ZIP____)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 8, 2013. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2013, to full members of record as March 8, 2013, which is the closing date for nominations. Returns will be counted May 21, 2013. Section Managers elected as a result of the above procedure will take office July 1, 2013.

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

***SM Nomination Petition Resolicitation**: Since no nomination petitions were received for the Nebraska and New York City-Long Island Section Manager Elections by the nomination date of September 7, 2012, nominations are hereby resolicited. See the above for details.

Rick Palm, K1CE, k1ce@arrl.org

# The Future of ARES is CERTain

**ARES® and CERT team up to help the unprepared meet a disaster's challenges.**

The core of disaster preparedness in the US is not the local or county emergency management office, nor is it FEMA. The true core of disaster preparedness is individuals and households. However, a Citizen Corps national survey conducted in 2009 found that "29 percent of Americans have not prepared because they think that emergency responders will help them and that over 60 percent expect to rely on emergency responders in the first 72 hours following a disaster. The reality is that in a disaster, first responders and emergency workers may not be able to reach everyone right away. In addition, providers may not be able to restore critical services, such as power, immediately."

**29 percent of Americans have not prepared...and over 60 percent expect to rely on emergency responders in the first 72 hours...**

In today's society, our expectations of immediate service, comfort and gratification have combined to generate an increasing level of impatience. When we combine this with the above-cited lack of household preparedness, declining public resources and our instinctual fight or flight response, a volatile situation ensues. It creates a perfect storm that can result in a huge emergency management problem at best and an unnecessarily elevated threat to life and property at worst.

A major disaster devastates wide swaths of homes, businesses and infrastructure that the citizenry takes for granted and can leave hundreds or thousands homeless, mentally and physically shocked and on their own. Some people mistakenly believe a disaster could never happen to them, or that they are prepared because they bought a fire extinguisher, first aid kit and a case of bottled water. Others believe that when a hurricane destroys their homes, neatly uniformed public servants in official emergency vehicles will roll right up to transport them to a cozy Red Cross shelter. Once there, they will be served milk and cookies while the insurance adjustor pays the contractor to rebuild their house. They expect to move back into their home in a day or two.

Most people go into shock when that doesn't happen. Their inability to cope and protect their family can cause feelings of guilt and elevating levels of stress and panic. People in this condition can become dangerous to their family, neighbors and even themselves. You get the (grim) picture.

## Enter CERT

The challenges of gaining public awareness for the need for preparedness and victim management have not gone unaddressed. After 9/11 and Katrina, the entire face of emergency management changed, with vast sums of federal money being made available, at least until the recession began. One of the best solutions to come out of this new

## CERT Actions Around the Country

- In 2009, Sacramento City (California) CERT activated Sacramento City Fire CERT and Sacramento County ARES for a large natural gas leak in South Sacramento. According to ARRL Sacramento Valley Section District Emergency Coordinator and CERT Communications Manager Frank Reshke, N6SNO, a two block area was evacuated due to the leak. "Around 30 people came to a shelter that had been set up at a local church," he said. "This is where the CERT and ARES amateurs established a communications network with the Unified Command of Sacramento City Fire, Police and the Red Cross."
- At the end of the SAR mode after the infamous EF5 tornado that struck Joplin, Missouri in 2011, ARRL Missouri Section Emergency Coordinator Ken Baremore, WØKRB, said that even though ARES had been stood down, he received a request for radio amateurs to help with communications for the CERT teams still operating throughout the city. Earlier in the year, Emergency Management/CERT liaison Rich Vogt, KB9YZE, assisted emergency management after a tornado caused EF-1 damage in southwestern Missouri.
- Bill Williams, AG4QX, Greater Tampa (Florida) CERT Liaison for the City of Tampa was asked by the city's Office of Emergency Management to provide emergency backup communications during the Republican National Convention, August 24-September 2, 2012. This was treated as a CERT event for the city.
- The Jupiter Farms (Florida) CERT Group sponsored classes that resulted in more than 118 new Amateur Radio licensees from the local fire fighter, police officer and CERT communities.
- Amateur Radio operators and CERT members learned to save lives by learning how to search for missing children and at-risk adults during a one day training event held in Stockton, California. The *Urban Search for CERT and ARES* workshop kicked off creation of a new rapid-response program using Amateur Radio operators and CERT members as searchers. Leaders of the Alameda County Sheriff's Search and Rescue Team taught it.
- The Alachua County (Florida) Fire Rescue's Reserve Division K-9 Search and Rescue unit has teamed up with local radio amateurs, members of the CERT and reserve EMTs to form a combined resources team for improved wilderness and urban search and rescue (USAR). The USAR K-9 team initiated training in basic SAR skills for the new team members. Held near the Gainesville Airport, team members conducted practice searches and practiced skills required for the National Association for Search and Rescue (NASAR) SARTECH II certification.

era has been the development of the Community Emergency Response Team (CERT) program, which has been highly successful in areas where it has been rolled out.

Part of the Department of Homeland Security's (DHS) Citizen Corps program, a CERT is a group of neighbors (the more, the better) who are educated and trained by their local emergency management office to save themselves and their neighbors from post-disaster threats while they are cut off from immediate outside assistance. They are trained to perform basic fire mitigation, light search and rescue, medical assistance, communications and other critical functions on a level that a layman can easily learn and, most importantly, perform. The neighbors become the solution themselves, reducing the risk of physical conflict.

**There is an ever-increasing role for ARES and this role is in the context of the CERT program...**

### The CERT Program and ARRL®

In June 2003, ARRL became an official affiliate program of Citizen Corps. The Statement of Affiliation made ARRL an affiliate under the four charter Citizen Corps programs — Neighborhood Watch, Volunteers in Police Service, Community Emergency Response Teams and Medical Reserve Corps. ARRL has worked very closely with FEMA since 1984 when a Memorandum of Understanding was signed that helped ARRL volunteers coordinate their services with emergency management at all levels of government. FEMA's job then was as a "last responder," as opposed to first-line defense entities — the local, county and state emergency management agencies. Today, Citizen Corps groups assist their neighbors and first responders on the ground.

DHS and ARRL continue to work together to raise public awareness of Amateur Radio as a safety resource in the context of emergency and disaster response communications. Together they also promote the formation of CERTs and assist them with education, training and service opportunities that support their neighbors, first responders, disaster relief organizations and community safety efforts.

### Critical Link: Radio Communications

A critical aspect of any CERT operation is communications among team members on Search and Rescue (SAR) missions and between the team and the local Emergency Operations Center (EOC). Radio amateurs, especially ARES-registered operators, are the perfect choice to fill this function, since hams reside in nearly every neighborhood.

While CERTs use Family Radio Service (FRS), Multi-Use Radio Service (MURS) or General Mobile Radio Service (GMRS) for intrateam short-range radio communications to good effect (see the *QST* article "Beyond Our Bands" for a description of these radio services and uses by CERTs),[1] they cannot compare to the value added by the greater flexibility and utility of Amateur Radio and its operators. Amateur Radio offers communications in all ranges — short, medium and long — involving intrateam, interteam, local/county emergency management agency and State EOC capabilities, if necessary.

The neighborhood ham is an ideal CERT member and leader. As an example, Cypress Knoll, a neighborhood in the city of Palm Coast, Florida, has a small but effective CERT team, which includes five radio amateurs. According to its leader, Charlie De Poalo, WB2CIC:

> "About seven years ago, the City organized a CERT team, of which Cypress Knoll was a part. However, with the advent of the Flagler County CERT Advisory Council, we made a transition to serve under the county agency that provides us with training and equipment.
>
> Recognized by all CERT teams in Flagler County was the need to communicate within each team and with the county EOC. Currently, FRS radios are populated within all CERT teams. At the next level, GMRS radios are the choice for communicating with the EOC. On a weekly basis, Cypress Knoll conducts FRS radio checks and GMRS radio checks. As a backup, we use Amateur Radio and two-meter radios."

Steve Szabo, WB4OMM, of the Daytona Beach (Florida) CERT Amateur Radio Club points out that "Emergencies and emergency management are about people; special events are about people; public service is about people; ham radio is about people. CERT brings all of these together and does the greatest good for the greatest number of people. Our CERT Amateur Radio club adds to these people skills. With CERT, we help people help themselves. Amateur Radio becomes an extension and enhancement of our CERT in our community. It works for us."

Steve Szabo, WB4OMM, President of the Daytona Beach CERT Amateur Radio Club. [Photo courtesy Steve Szabo, WB4OMM]

[1]S. Sant Andrea, AG1YK, "Beyond Our Bands," *QST*, Aug 2012, p 70.

### ARES in a New Context

Some see ARES and Amateur Radio as having a shrinking role in emergency management and response communications service with new public safety broadband functionality to be rolled out soon.[2] In fact, just the reverse is true. There is an ever-increasing role for ARES and this role is in the context of the CERT program, which is picking up steam across the country.

The strong suit of ARES has always been to provide communications services for local and county public safety agencies, the Red Cross and SKYWARN. The CERT program takes ARES a step closer to the individual homeowner and their neighborhood. With CERT, Amateur Radio has unlimited opportunities for service. More and more CERTs form every day. Become involved in your own neighborhood CERT or form one if none exists. Then, attend the local CERT training and become a trainer yourself. There is a well-done, comprehensive CERT website at **www.citizencorps.gov/cert**, which includes a wide array of training, drills and tabletop exercises.

## Feedback

The November 2012 Public Service column lead item on Public Safety broadband trends by Andrew Seybold, W6AMS, generated good feedback. Readers can contact Mr Seybold directly at **aseybold@andrewseybold.com**; 315 Meigs Road, Suite A-267, Santa Barbara, CA 93109; 805-898-2460 office; 805-898-2466 fax; **www.andrewseybold.com**

[2]R. Palm, K1CE, "Public Safety Moves Toward 22nd Century Communications," *QST*, Nov 2012, pp 89-90.

## Strays

### Minute Men of the Air

Yekta Gursel, KJ6DRO, writes, "I have just listened to a recording of the radio program 'Cavalcade of America: Minute Men of the Air' sponsored by DuPont Chemicals and broadcast on February 3, 1937 on the Columbia Broadcasting System. The program highlights Amateur Radio activities at the time. Members might be interested to know that the recording is available from the Old Time Radio Catalog on the Web at **www.otrcat.com** as a part of their 'Cavalcade Of America' collection."

# Contest Corral – January 2013

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

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

| Start - Finish Date-Time | | Date-Time | | Bands HF / VHF+ | Contest Title | Mode | Exchange | Sponsor's Website |
|---|---|---|---|---|---|---|---|---|
| Dec 29 | 1500Z | Dec 30 | 1500Z | 3.5-14 / - | Original QRP Contest | CW | RST, serial and category | www.qrpcc.de |
| **1** | **0000Z** | **1** | **2400Z** | **3.5-28 / 50+** | **ARRL Straight Key Night** | **CW** | **General QSO information** | **www.arrl.org/straight-key-night** |
| 1 | 0000Z | 1 | 0100Z | 3.5 / - | New Years Snowball Contest | Ph CW | RST, serial, AGB number | ev5agb.com/index.htm |
| 1 | 0800Z | 1 | 1100Z | 3.5-7 / - | SARTG New Year RTTY Contest | Dig | RST, serial, "Happy New Year" in your language | www.sartg.com |
| 1 | 0900Z | 1 | 1200Z | 3.5-14 / - | AGCW Happy New Year Contest | CW | RST, serial, AGCW number | www.agcw.de |
| 4 | 0200Z | 4 | 0300Z | 1.8-14 / - | SNS and NS Weekly Sprints | CW Dig | Serial, name and S/P/C | www.ncccsprint.com |
| 5 | 0000Z | 5 | 2400Z | 3.5-28 / - | 070 PSKFest | Dig | Call sign, RST, S/P/C | www.podxs070.com |
| 5 | 1500Z | 5 | 1800Z | 3.5-28 / - | QRP Pet Rock Sprint | CW | RST, S/P/C, QRP ARCI number or power | www.qrparci.org/contests |
| **5** | **1800Z** | **6** | **2400Z** | **3.5-28 / -** | **ARRL RTTY Roundup** | **Dig** | **RST, state/province/serial** | **www.arrl.org/contests** |
| **6** | **1800Z** | **6** | **2400Z** | **3.5-28 / -** | **Kids Day** | **Ph** | **Name, age, location, favorite color** | **www.arrl.org/kids-day** |
| 7 | 1600Z | 7 | See web | 3.5 / 50, 144 | OK1WC Memorial Contest | Ph CW | RS(T) and serial | www.hamradio.cz/ok1wc |
| 8 | 0200Z | 8 | 0400Z | 3.5-28 / - | ARS Spartan Sprint | CW | RST, S/P/C and power | www.arsqrp.blogspot.com |
| 9 | 1300Z | 9 | See web | 1.8-28 / - | CWops Monthly Mini-CWT Test | CW | Name and member number or S/P/C | www.cwops.org/onair.html |
| 12 | 1200Z | 13 | 2359Z | 1.8-28 / 50 | MI QRP Club Jan QRP Contest | CW | RST, S/P/C, MI QRP number or power | www.miqrp.org |
| 12 | 1200Z | 13 | 1200Z | 3.5-28 / - | WW Peace Messenger Cities | Ph CW | RS(T) and PMC ref number or CQ zone | www.s59dcd.si |
| 12 | 1200Z | 13 | 1200Z | 3.5-28 / - | UK DX RTTY Contest | Dig | RST and serial | www.ukdx.srars.org |
| **12** | **1800Z** | **13** | **0600Z** | **1.8-28 / -** | **North American QSO Party** | **CW** | **Name and S/P/C** | **www.ncjweb.com/naqprules.php** |
| 12 | 2000Z | 12 | See web | 1.8 / - | EUCW 160 Meter Contest | CW | RST, serial, club name, member nr or "NR" | www.uft.net |
| 13 | 0900Z | 13 | 1059Z | 28 / - | DARC 10 Meter Contest | Ph CW | RS(T), serial, DOK code | www.darc.de/referate/dx/contest |
| 16 | 2300Z | 17 | See web | 1.8-7 / - | Linc Cundall Memorial CW Contest | CW | See website | www.antiquewireless.org |
| 17 | 0130Z | 17 | 0330Z | 3.5-14 / - | NAQCC Monthly QRP Sprint | CW | RST, S/P/C and NAQCC mbr nr or power | naqcc.info |
| 17 | 0200Z | 17 | 0256Z | 3.5-7 / - | Locust QSO Party | CW | Name, state or province or "DX" | www.k6vva.com/lqp |
| 19 | 0000Z | 19 | 0400Z | 3.5, 7 / - | LZ Open Contest | CW | 6-digit serial and serial from previous QSO | www.lzopen.com |
| 19 | 0000Z | 20 | 2359Z | 1.8-28 / - | YLISSB QSO Party | Ph | Call sign, RS(T), ISSB number | www.ylsystem.org |
| 19 | 0600Z | 19 | 1400Z | 3.5-28 / - | International United Teenager Contest | Ph CW | RS(T) and age or "RT" | ur4nww.narod.ru/documents/pdf/CQUTContest_2013A.pdf |
| 19 | 1200Z | 20 | 1200Z | 1.8-28 / - | HA DX Contest | Ph CW | RS(T) and serial | www.ha-dx.com |
| 19 | 1600Z | 19 | 1800Z | 1.8-28 / - | Feld Hell Gridloc Sprint | Dig | RST, S/P/C, Feld Hell member nr | www.feldhellclub.org |
| **19** | **1800Z** | **20** | **0600Z** | **1.8-28 / -** | **North American QSO Party** | **Ph** | **Name and S/P/C** | **www.ncjweb.com/naqprules.php** |
| **19** | **1900Z** | **21** | **0400Z** | **- / 50+** | **ARRL January VHF Contest** | **Ph CW** | **Grid square** | **www.arrl.org/contests** |
| 21 | 0200Z | 21 | 0400Z | 1.8-28 / - | Run For the Bacon | CW | RST, S/P/C Flying Pig nr or power | www.fpqrp.org |
| 25 | 0130Z | 25 | 0330Z | 1.8 / - | NAQCC Special 160M Sprint | CW | RST, S/P/C and NAQCC mbr nr or power | naqcc.info |
| 25 | 2200Z | 27 | 2200Z | 1.8 / - | CQ WW 160 Meter Contest | CW | RST and S/P/C | www.cq160.com |
| 26 | 0600Z | 27 | 1800Z | 3.5-28 / - | REF French Contest | CW | RST and serial or department ID | concours.ref-union.org/contest |
| 26 | 1200Z | 27 | 1200Z | 3.5-28 / - | BARTG RTTY Sprint | Dig | Serial | www.bartg.org.uk |
| 26 | 1300Z | 27 | 1300Z | 3.5-28 / - | UBA Contest | Ph | RS, serial and ON province | www.uba.be/hf/contest-rules |
| 26 | 1700Z | 27 | 1700Z | 1.8-28 / 50+ | Winter Field Day | Ph CW Dig | Call sign, RS(T), category, local temp | www.spar-hams.org |
| 27 | 2000Z | 27 | 2359Z | 3.5-28 / - | QRP Winter Fireside SSB Sprint | Ph | RS, S/P/C, QRP ARCI number or power | www.qrparci.org/contests |
| 27 | 1900Z | 28 | 2300Z | 1.8 / - | WAB Top Band Phone Contest | Ph | See website | www.worked-all-britain.co.uk/contest |
| 27 | 1400Z | 28 | 0800Z | 1.8-28 / 50, 144 | Classic Exchange | CW | RST, QTH, model of rcvr and xmtr | www.classicexchange.org |

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

# 2012 ARRL UHF Contest Results

## The Quest to rise above 250 log submissions continues!

John (JK) Kalenowsky, K9JK, hamk9jk@ameritech.net

The chart showing "QSOs by Band" from 2007 through 2012 tells the story — while still not over the 200-log threshold of 2009 and 2010, the 171 logs received for 2012 did rise from last year's disappointing count of 142. Most of the increase was in Single Operator, Low Power logs with 94 (compared to 71 in 2011). With the rise in logs submitted, the total number of QSOs reported in this year's logs grew as well, with just over 8800 QSOs reported.

### Where the Action Was

Among stations submitting logs, a total of 113 grid locators were represented and contacts were reported with 168 different grid squares in 2012. The three most reported grid locators were FM19 (549), FN20 (500) and FN42 (432).

Fixed stations were active from 81 of the 113 grids with 56 uniquely represented by fixed stations. FN42 was the most popular locator for fixed stations with 10 logs received listing 475 QSOs. FN20 and EM86 were next with eight logs each but FN20 stations reported 367 QSOs compared to 166 QSOs from EM86.

The 115 grids activated by Rovers included 32 that were visited only by Rovers — an average of five grids were activated by each Rover. Four Rovers that visited DM13 reported the highest QSO total for a given locator with 173. FN00 was a close second for Rover QSOs with 172 reported by three Rovers that activated the grid. DM04 and CM97 were both visited by five Rovers, with 153 and 112 QSOs reported, respectively.

### When Did Contacts Happen?

As usually happens, the busiest hour was the first, in which just shy of 1400 QSOs were logged, a little over 15% of the total QSOs reported in the contest. The chart of "QSOs by Hour" shows that strong activity continued in the following three hours, netting over one third of the total QSOs in the first four hours of the contest. Sunday morning started off slowly with under 200 QSOs between 1000 and 1159 UTC but activity grew and remained steady at over 400 QSOs per hour from 1200 UTC until the end of the contest time.

### Top Scorers by Category

In Single Op, High Power, **Phil, K3TUF** claimed the top spot for 2012 from his Eastern Pennsylvania station. Second place in the "B" category went to Maryland-DC's **Dave, K1RZ**. Another Maryland-DC station, **Owen, K3CB**, claimed the third spot in SOHP.

What can be said about a score of 111,111? It seems unlikely that **Paul, W3PAW** was trying to achieve that specific score but that placed his effort from Western Pennsylvania atop the Single Op, Low Power category. Following Paul in SOLP were **Roger, W3SZ** from Eastern Pennsylvania and

### Top Ten By Category

**Single Operator, Low Power**

| Call | Score |
|---|---|
| W3PAW | 111,111 |
| W3SZ | 55,890 |
| K1KG | 43,260 |
| AF1T | 40,887 |
| N6MU | 36,036 |
| K2DRH | 34,068 |
| K2KIB | 32,670 |
| WB2SIH | 26,847 |
| W2BZY | 24,111 |
| WB2JAY | 22,200 |

**Single Operator, High Power**

| | |
|---|---|
| K3TUF | 167,076 |
| K1RZ | 120,840 |
| K3CB | 56,619 |
| KØVX | 55,296 |
| WB2RVX | 47,610 |
| N2GHR | 45,576 |
| WØZQ | 26,469 |
| VE3ZV | 20,496 |
| K8TQK | 16,929 |
| N7EPD | 13,932 |

**Multioperator**

| | |
|---|---|
| WØUC | 31,293 |
| K2LIM | 19,581 |
| KBØHH | 9,801 |
| N2BJ | 6,048 |
| NE1B | 3,654 |
| KO9A | 2,709 |
| AG4V | 2,016 |
| NC6EO | 198 |
| W4HXP | 36 |
| WA4ZKO | 12 |

**Rover**

| Call | Score |
|---|---|
| N6NB/R | 329,508 |
| W6XD/R | 319,200 |
| W6TAI/R | 301,620 |
| N6EY/R | 253,914 |
| N2CEI/R | 56,916 |
| W3HMS | 28,755 |
| KCØP/R | 22,155 |
| NN3Q/R | 16,770 |
| WA2IID/R | 13,386 |
| W1AUV/R | 12,426 |

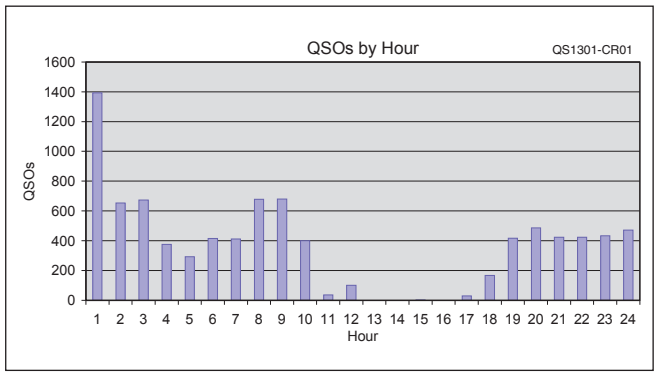
**Limited Rover**

| | |
|---|---|
| K9JK/R | 5,451 |
| WW7D/R | 5,136 |
| WAØVPJ/R | 3,366 |
| AB2YI/R | 510 |
| N6ZE/R | 12 |

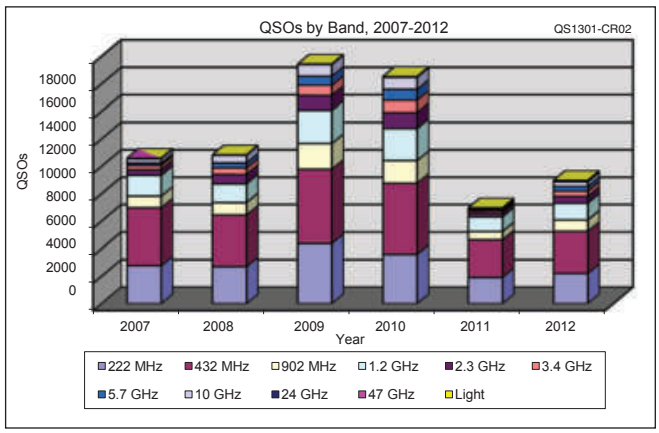
**Unlimited Rover**

| | |
|---|---|
| N3IQ/R | 252,879 |
| WA3PTV/R | 72,912 |

These towers full of antennas kept Gary Gerber, KBØHH and his ops on the bands and loud, too! Gary and his "Bunkhouse crew" earned third place in the Multioperator category from his EMØ6 QTH. [Photo courtesy Gary Gerber, KBØHH]




QSOs by hour (2012)




QSOs by band 2007-2012

**Warner, K1KG** from Eastern Massachusetts.

In the Multioperator category, **Paul, WØUC** teamed up with K9MU and battled the bands from Paul's Wisconsin station to claim the top spot. The **K2LIM** "LIM Amateur Radio Group" was at their favorite Western New York location and claimed the second spot (as they had in 2011). **Gary, KBØHH** (along with KAØKCI and KD5EKX) operated from Gary's Oklahoma bunkhouse station and finished in third place.

The Rovers from Southern California returned to activity in 2012 with **Wayne, N6NB** claiming the national top score in the category (and top score overall for this year). Wayne was closely followed by **Art, W6XD**, **Carrie, W6TAI** and **Jason, N6EY** (+W6TE). Outside of Southern California, the top scoring Rover was **Steve, N2CEI** from Florida, with over 200 QSOs from traveling through eight grids with eight bands. **Brian, N3IQ** in the Unlimited Rover category had the highest QSO total of all entrants (375) from the nine-band station he piloted. One other entrant joined Brian in Unlimited Rover, **Joe, WA3PTV** who travelled through four grids with his eight-band station.

In Limited Rover, your author, **John, K9JK** reclaimed the top spot for 2012, visiting four grids in Illinois with three bands. Second and third places in Limited Rover were the same as in 2011 except that they traded spots; **Darryl, WW7D** and **John, WAØVPJ (+AIØZ)** earned second and third respectively.

## Regional Highlights

The Northeast continues as the log count leader among the regions with 53 logs total; 22 from the Atlantic Division, 20 from the New England Division and 11 from the Hudson Division. The Northeast was also the place to be for top scores among Single Op fixed stations.

After the lowest count of logs (20) among the regions in 2011, "the South rose again" with 33 logs from the Southeast region; with 14 from the Southeastern Division, 10 from the Delta Division and nine from the Roanoke Division. Like "the South(east)," the Central Region also rose again with 29 logs (eight more than 2011); 14 from Central Division, 12 from Great Lakes Division and three from Ontario.

The West Coast Region was the source of 29 logs this year (down from 33 in 2011). The Northwestern and Pacific Divisions each contributed 11 logs plus there were six logs from the Southwestern Division and one from British Columbia. Midwest Region participants submitted 27 logs in 2012, comprised of 11 from the Dakota Division, seven from the Midwest Division, six from the West Gulf Division and three from the Rocky Mountain Division.

## What About the Clubs?

Of this year's 171 logs, 101 of them listed an Affiliated Club name in their Cabrillo log file. With six logs submitted, the Southern California Contest Club won the Medium Club gavel. Seven members of the Bristol (Tennessee) Amateur Radio Club submitted their logs to claim the Local Club gavel. See the table for complete Club Competition results.

## Rising!

The ARRL UHF Contest will definitely rise again in 2013, starting at 1800 UTC on August 3, 2013. Rising above 250 log submissions won't be easy but I still believe we CAN do it. Closing once again with Bill Seabreeze's famous (infamous?) directive to *"listen for the weak ones!"* and taking a bit of liberty with the statement I attribute to Lloyd NE8I, let's MAKE the activity *rise*!

## Division Leaders by Category

| | | |
|---|---|---|
| **Single Operator, Low Power** | | |
| Atlantic | W3PAW | 111,111 |
| Central | K2DRH | 34,068 |
| Dakota | WØJT | 1,596 |
| Delta | N4QWZ | 18,468 |
| Great Lakes | KF8QL | 1,890 |
| Hudson | K2KIB | 32,670 |
| Midwest | NØTTW | 561 |
| New England | K1KG | 43,260 |
| Northwestern | KD7UO | 3,564 |
| Pacific | AF6RR | 2,808 |
| Roanoke | K4FJW | 1,452 |
| Rocky Mountain | W6OAL | 4,620 |
| Southeastern | W2BZY | 24,111 |
| Southwestern | N6MU | 36,036 |
| West Gulf | WB5ZDP | 900 |
| Canada | VE7FYC | 3,249 |
| **Single Operator, High Power** | | |
| Atlantic | K3TUF | 167,076 |
| Central | W9GA | 7,776 |
| Dakota | WØZQ | 26,469 |
| Delta | AA4DD | 4,158 |
| Great Lakes | K8TQK | 16,929 |
| Hudson | N2GHR | 45,576 |
| New England | W1FKF | 10,290 |
| Northwestern | N7EPD | 13,932 |
| Pacific | KC6ZWT | 3,150 |
| Roanoke | K4QI | 10,260 |
| Rocky Mountain | WA7KYM | 1,020 |
| Southeastern | KØVXM | 55,296 |
| West Gulf | K5LLL | 1,728 |
| Canada | VE3ZV | 20,496 |
| **Multioperator** | | |
| Atlantic | K2LIM | 19,581 |
| Central | WØUC | 31,293 |
| Delta | AG4V | 2,016 |
| Great Lakes | WA4ZKO | 12 |
| New England | NE1B | 3,654 |
| Pacific | NC6EO | 198 |
| Southeastern | W4HXP | 36 |
| West Gulf | KBØHH | 9,801 |
| **Rover** | | |
| Atlantic | W3HMS | 28,755 |
| Dakota | KCØP/R | 22,155 |
| Great Lakes | NE8I/R | 4,104 |
| New England | WA2IID/R | 13,386 |
| Pacific | N6NB/R | 329,508 |
| Southeastern | N2CEI | 56,916 |
| Canada | VE3CRU/R | 5,301 |
| **Limited Rover** | | |
| Atlantic | AB2YI/R | 510 |
| Central | K9JK/R | 5,451 |
| Dakota | WAØVPJ/R | 3,366 |
| Northwestern | WW7D/R | 5,136 |
| Southwestern | N6ZE/R | 12 |
| **Unlimited Rover** | | |
| Atlantic | N3IQ/R | 252,879 |

## Affiliated Club Competition

| Medium Club | Score | # of Logs |
|---|---|---|
| Southern California Contest Club | 1,240,806 | 6 |
| Mt Airy VHF Radio Club | 338,262 | 9 |
| Potomac Valley Radio Club | 289,893 | 5 |
| North East Weak Signal Group | 114,504 | 11 |
| Northern Lights Radio Society | 100,761 | 11 |
| Florida Weak Signal Society | 55,296 | 9 |
| Society of Midwest Contesters | 48,249 | 5 |
| Pacific Northwest VHF Society | 35,925 | 8 |
| Contest Club Ontario | 30,981 | 3 |
| Badger Contesters | 27,060 | 8 |
| Yankee Clipper Contest Club | 10,146 | 4 |
| **Local Club** | | |
| Bristol (TN) Amateur Radio Club | 10,137 | 7 |

# The February 2013 School Club Roundup

**1200 UTC Monday, February 11 - 2359 UTC Friday, February 15**


After a year off the air, The Burr and Burton Academy ARC of Manchester Center, VT returned to the SCR in February 2012 in force; 62 students made 584 QSOs from this very desk and took first place in the High School category. [Photo courtesy Chris Kochenour, WD1W]

- Students of all ages from grade school to college will take to the airwaves the second week in February for the Spring Term running of the School Club Roundup!
- This week-long event for school clubs combines the experience of Amateur Radio in the classroom with a fun, competitive atmosphere all students can enjoy. SSB and CW operation is strongly encouraged! Does your local school have a club station? If so, get involved! If not, offer to bring Amateur Radio into the school. If you feel that there needs to be more youth activity in Amateur Radio, help make it happen!
- Separate categories for Elementary, Middle, High School and College clubs.
- Send logs to: **scr@limarc.org**. All logs must be received by March 18, 2013.

**Complete rules, logging sheets and other info can be found at**
**www.arrl.org/school-club-roundup**

**Scan this QR code with your smartphone to go directly to the School Club Roundup rules page.**

## 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 | 1400 | | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 7 AM-1 PM | 8 AM-2 PM | 9 AM-3 PM | 10 AM-4 PM | 1500-1700 1800-2045 | VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH) | | | | |
| 1 PM | 2 PM | 3 PM | 4 PM | 2100 | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 2 PM | 3 PM | 4 PM | 5 PM | 2200 | CODE BULLETIN | | | | |
| 3 PM | 4 PM | 5 PM | 6 PM | 2300 | DIGITAL BULLETIN | | | | |
| 4 PM | 5 PM | 6 PM | 7 PM | 0000 | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE |
| 5 PM | 6 PM | 7 PM | 8 PM | 0100 | CODE BULLETIN | | | | |
| 6 PM | 7 PM | 8 PM | 9 PM | 0200 | DIGITAL BULLETIN | | | | |
| $6^{45}$ PM | $7^{45}$ PM | $8^{45}$ PM | $9^{45}$ PM | 0245 | VOICE BULLETIN | | | | |
| 7 PM | 8 PM | 9 PM | 10 PM | 0300 | FAST CODE | SLOW CODE | FAST CODE | SLOW CODE | FAST CODE |
| 8 PM | 9 PM | 10 PM | 11 PM | 0400 | 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 2013, Headquarters and W1AW are closed on New Year's Day, Presidents' Day (February 18), Good Friday (March 29), Memorial Day (May 27), Independence Day (July 4), Labor Day (September 2), Thanksgiving and the following day (November 28 and 29), and Christmas (December 25). For more information, visit us at **www.arrl.org/w1aw**.

## How's DX?

**Bernie McClenny, W3UR, w3ur@arrl.org**

# International Reply Coupons

**There's more to getting that rare DX QSL card than just an envelope and a mailbox.**

If you, as an Amateur Radio operator, want to send a direct QSL card to a DX station and expect to get a reply, you need to put something other than your QSL card into the envelope. When making a direct request for a QSL from a DX station you should send a self-addressed envelope (SAE), your QSL card and some form of return postage so the receiving station can send a card back, unless the DX station has indicated otherwise.

Your three choices are to send postage (not from your own country but rather from the DX station's country or the QSL manager's country), the proper number of US dollars (aka "green stamps") or something called an International Reply Coupon (IRC). If you don't send anything you probably won't get a reply, or if you are lucky you might get your QSL via the bureau. Our main focus this month is on IRCs but first I will give some details about the other two methods.

### Using Foreign Postage

For the purpose of this article let's say an Amateur Radio operator is from the US and wants to receive a direct reply QSL card from a station in Europe. One method is to buy foreign stamps from a dealer making sure you know the amount of postage needed to mail from the DX country back to you in the US. There are at least two reliable online services here in the US: **www.airmailpostage.com**, which is run by James Mackey, K3FN, and **plumdx@msn.com**, which is run by shortwave listener Bill Plum.

After obtaining the postage, you include it with your SAE. I personally would *not* recommend affixing the postage to the envelope for two reasons. The DX operator's card might be larger than your envelope so he might have to put your postage on a larger envelope. The second reason would be that the DX operator might want to use his own, different rate stamps.

Using postage from other countries can be helpful to the DX station. It saves the opera-


The Nairobi model 2009 IRC. This is the current IRC and the only one that is valid for postage.

**The current Nairobi model is the only one that is currently valid, and will be until December 31, 2013.**


The Rome model 1907 IRC.

### List 1

DXCC Entities that are members of the UPU and should be able to redeem IRCs:

3A, 3B8, 3C, 3D2, 3DAØ, 3V, 3W, 3X, 4J, 4L, 4O, 4S, 4W, 4X, 5A, 5B, 5H, 5N, 5R, 5T, 5U, 5V, 5W, 5X, 5Z, 6W, 6Y, 7O, 7P, 7Q, 7X, 8P, 8Q, 8R, 9A, 9G, 9H, 9J, 9K, 9L, 9M, 9N, 9Q, 9U, 9V, 9X, 9Y, A2, A3, A4, A5, A6, A7, A9, AP, BY, C2, C5, C6, C9, CE (all), CM, CN, CP, CT, CT3, CU, CX, D2, D4, D6, DL, DU, E3, E5, E6, E7, EA (all), EI, EK, EL, EP, ER, ES, ET, EU, EX, EY, EZ, F, FG, FH, FJ, FK, FM, FO, FP, FR (all), FS, FT5 (all), FW, FY, G, GD, GI, GJ, GM, GU, GW, H4, HA, HB, HBØ, HC, HC8, HH, HI, HK, HKØ/S, HL, HP, HR, HS, HV, HZ, I (all), J2, J3, J5, J6, J7, J8, JA, JD/M, JD/O, JT, JY, K, KHØ, KH2, KH6, KH8, KL7, KP2, KP4, LA, LU, LX, LY, LZ, OA, OD, OE, OH, OHØ, OK, OL, ON, OX, OY, OZ, P2, P4, P5, PA, PJ2, PJ4, PJ5/6, PJ7, PY (all), PZ, S2, S5, S7, S9, SM, SP, ST, SU, SV (all), T2, T3Ø, T31, T32, T33, T5, T6, T7, TA, TF, TG, TI, TJ, TL, TN, TR, TT, TU, TY, TZ, UA (all), UK, UN, UR, V2, V3, V4, V5, V8, VE, VK (all), VP2E, VP2M, VP2V, VP5, VP6, VP8/F, VP8/G, VP8/Shet, VP9, VQ9, VR2, VU, XE, XT, XU, XW, XX9, XZ, YA, YB, YI, YJ, YK, YL, YN, YO, YS, YU, YV, Z2, Z3, Z8, ZA, ZB, ZD7, ZD8, ZD9, ZF, ZK3, ZL, ZP, ZS


The London model 1930 IRC.


The Vienna model 1960 IRC.

The Lausanne model 1975 IRC.

tor a trip to purchase the stamps. However, it is a little more time consuming on your end because you have to purchase the stamps and wait to receive them before mailing your QSL to the DX station.

### Using Green Stamps

A second option is to use green stamps (aka US dollars). Sending a few US dollars to most countries is legal, although in a few countries it is reportedly illegal for hams to receive US dollars. If a station's **QRZ.com** listing or personal website says "IRCs only" or "Don't send green stamps" that is usually a clue. Using green stamps is my preferred method when sending direct. The following websites can be helpful in determining how many green stamps (or IRCs) you should send for a return QSL.

W9OL —
**www.qsl.net/w9ol/IRC_Chart.htm**

N6DHZ —
**www.n6dhz.com/irc-chart.html**

K4HB —
**www.k4hb.com/postage.html**

DL6ZFG —
**www.dl6zfg.de/porto.htm** (in German)

### IRCs

The last method I'll discuss, the International Reply Coupon or IRC, is the main subject of this month's column. Over my tenure writing this column I have discussed IRCs several times. The first IRCs became available in October 1907.[1] In all there have been seven different "models" of the IRC, each being named after the city in which they were approved. First was the Rome model (1907-1929), followed by London (1930-1959), Vienna (1960-1974), Lausanne (1975-2001), then a new color model for Beijing I and II (2002-2009) and finally the current Nairobi model (July 1, 2009-2013). The next model will be called the "Doha" after the 25th Universal Postal Union (UPU) Congress that was recently held in Doha, Qatar. This new IRC will be available in July 2013.

**The United States Postal Service (USPS)...had proposed to discontinue the sale of IRCs, effective January 27, 2013...**

### List 2

DXCC Entities that are members of the UPU and sell IRCs:

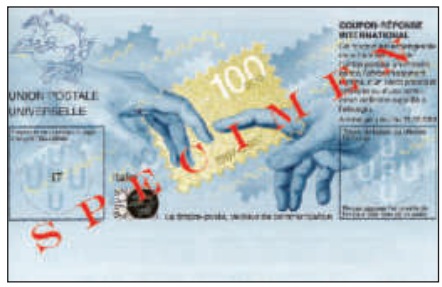
3B8, 3V, 3X, 4J, 4S, 4X, 5B, 5H, 5R, 5T, 5U, 5V, 5X, 6W, 6Y, 7Q, 8P, 8Q, 9A, 9G, 9H, 9Q, 9U, 9V, 9X, A6, A7, AP, BY, CE, CN, CP, CT, CX, D4, D6, DL, DU, E7, EA, EK, EP, ER, ES, ET, EU, F, FK, FO, FW, HA, HB, HC, HH, HK, HL, HS, HV, I (all), J2, JA, JT, JY, *K, LA, LU, LX, LY, LZ, OA, OE, OH, OHØ, OK, OL, ON, OX, OY, OZ, PY, S2, S5, S7, SP, ST, SU, SV (all), T7, TA, TF, TJ, TN, TR, TT, TU, TY, TZ, UN, UR, V8, VE, VK, VP9, VR2, XE, XT, XX9, YK, YL, YO, YU, Z2, Z3, ZA, ZB, ZL, ZS

*K could be removed from this list on January 27, 2013.

The Beijing I model 2002 IRC.

### Purchasing and Redeeming IRCs

Not all countries accept IRCs (see List 1 for those countries that should). All members of the UPU are mandated to accept them and provide postage when an IRC is redeemed, but there are some who do not abide by this requirement! Some of the countries that do not redeem IRCs are listed on the above-mentioned websites. Not all UPU countries sell IRCs (see List 2 for those that do). As of October 2012, the United Kingdom no longer sells IRCs; however, it does redeem them. At press time the United States Postal Service (USPS) had proposed to discontinue the sale of IRCs, effective January 27, 2013; however, regardless of the final decision on this matter, it will continue to redeem them for the foreseeable future.



The Beijing II model 2002 IRC.

As with anything in life there are pluses and minuses. The advantage of using IRCs is that they have been a kind of "international money." Unfortunately they are very expensive when you consider that in the US it costs $2.20 to get $1.05 in postage. Some QSL managers sell IRCs at costs ranging from $1.05 to $2.20, typically somewhere in the middle.

There are good IRCs and there are bad IRCs and sometimes the good IRCs can also be bad as I explained in my 2006 column.[2] The Nairobi model is the only one that is currently valid, and will be until December 31, 2013. The older models are worthless except perhaps to collectors.

### Direct QSLing Wrap Up

When QSLing direct my preference is to send the proper amount of green stamps where they are accepted. In my opinion, IRCs are a last resort since most postal workers do not know what they are and have difficulty processing them correctly. A DXer who sends QSLs direct and wants a return QSL direct should make sure there is proper return postage, which can be in the form of appropriate stamps, green stamps or IRCs. Don't put the cost burden on the DX operator, unless he or she indicates otherwise!

### Wrap Up

That's all for this month. Don't forget to send your DX news, photos, club newsletters and whatnot to **w3ur@arrl.org**. Until next month, see you in the pileups!
— *Bernie, W3UR*

[1]B. McClenny, W3UR, "International Reply Coupons," *QST*, June 1999, p 83-84.

[2]B. McClenny, W3UR, "Revisiting the International Reply Coupon (IRC)," *QST*, Jun 2006, p 85.

Jon Jones, NØJK, n0jk@arrl.org

# The K5N DXpedition Takes On DL88

## Blistering heat, tire eating rocks and tent toppling winds make DL88 one of America's toughest grids.

*Grid DXpeditions can be as difficult and potentially hazardous as a DXpedition to a remote island. Rare grids are sought after for awards like the VHF/UHF Century Club Program (VUCC) and the Fred Fish Memorial Award (FFMA). Such was the case with the June 2012 K5N DXpedition to one of the rarest grids in the US, DL88. Only a tiny sliver of the grid is located in the US, at the southern end of Big Bend National Park in Texas (see Figure 1). DL88 is along the US/Mexican border where drug cartel violence is a real risk, which makes it difficult to travel to and operate in. The following K5N (DL88) story is by Marshall Williams, K5QE. — Jon, NØJK*

The FFMA has become the premier award available to the dedicated 6 meter operator. FFMA requires working and confirming all 488 grids in the continental US. So far, only five operators have earned this prestigious award.

Many of the 488 required grids are easy to work. Others have no 6 meter operators. To work those grids, someone has to go there and hand out the grid to the deserving. Of these, DL88 is one of the most difficult to get to. The K5N Grid Activation Group made an assault on DL88 in 2010, but failed to reach it due to a washed out road. So, we planned another attempt for 2012.

### Bound for Big Bend

The operators for this trip were Bill Simpson, N5YA; Russ Dwarshuis, KB8U; Jason Goldsberry, N5NU; Tim Groman, KD5IKG, and I. We loaded two 1 ton dually pickups and Tim's Tahoe with water, food, supplies, batteries, rigs and antennas using a DXpedition-sized shoehorn. Remember, there are no stores where we were going.

Bill, N5YA, acted as the "trail boss." He decided that we should begin our trip on Monday the 18th and drive about halfway staying in a motel in Johnson City, Texas.

The next day, Tuesday, we drove to Marathon, Texas and stayed at a motel. The drive was not without problems. Bill's truck developed a faulty thermostat and kept overheating. We stopped in Ft Stockton for repairs. Then the Tahoe lost a serpentine belt about halfway to Marathon. Bill and Tim raced back to Ft Stockton to buy a replacement. We installed the new belt and were moving again.

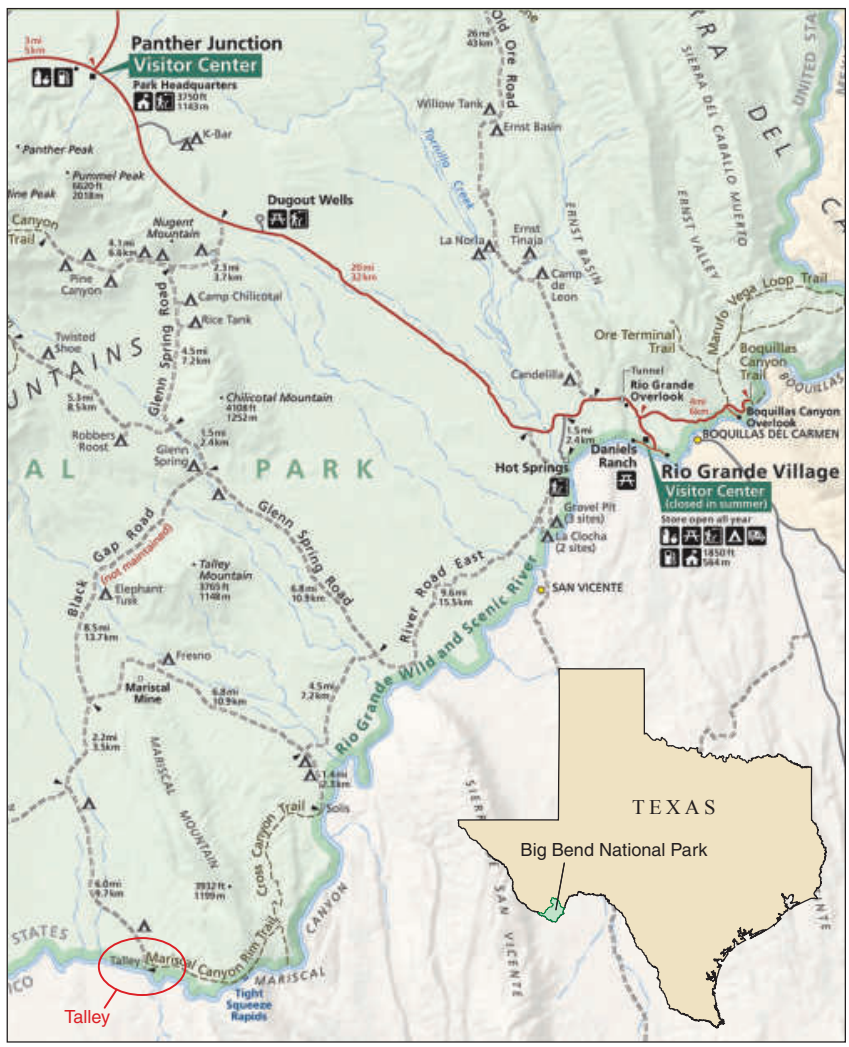



**Figure 1** — DL88 just skims through the southern tip of Big Bend Park in Texas.

Wednesday morning we drove to the Big Bend National Park entrance and paid $20 for a weeklong vehicle pass. I presented myself to the Ranger at Panther Junction, the main Park HQ. I showed the Ranger our Special Use Permit, which I had secured several months before, paid our camping fees and received the mandatory lecture about taking plenty of water and watching out for the bears. The paperwork was signed and the real adventure began.

### Into Big Bend

There are two roads to Talley 2 Campground in DL88 — Glen Springs Road and River Road. Now, the word "road" is used very

**Figure 2** —The angry sky and unforgiving land of DL88 surround the K5N DXpedition as they operate from one of America's most inaccessible grids. [Photo courtesy Marshall Williams, K5QE]

loosely in the Park! Some parts of these "roads" were more like double wide pig trails. Apparently the Park staff had bladed the roads because some of the impassable washouts that we encountered two years ago were all patched up and quite passable.

Bill decided we should drive in via Glen Springs Road because there were no arroyos on that route. This tough road passes near the Chilicotal Mountains and in some areas, the roadway is just solid rock outcroppings making it hard to drive. We made it past that treacherous area and moved out onto the desert floor. Suddenly, a sharp rock punctured the Tahoe's right rear tire. We had to unload part of the Tahoe to get the jack and spare. It took the jack from Bill's pickup along with the Tahoe jack to get the tire off and replaced.

We continued on Glen Springs Road to River Road and then to Talley Road — the road to Talley 2 Campground and DL88. About 1.2 miles north of the campground, we encountered the arroyo that had ensnared Bill Musa, K5YG, and Danny Cristina, N5OMG, in 2010, ending that DL88 DXpedition. Bill, N5YA just powered right across the arroyo with his 4WD pickup. Jason followed in the 2WD pickup and got stuck. Bill got a big chain from the toolbox, hooked his truck to Jason's and was able to pull it free. The 4WD Tahoe came right through. Moral of the story: go to Talley 2 in 4WD trucks *only*.

It was just a short drive down Talley Road to Talley 2 Campground. We arrived about 5 PM on Wednesday, June 20th. It only took 6 hours to drive about 40 miles! We had made it! The real work was now ahead of us.

## Talley 2 On the Air

Tim was in charge of the tents and, with help from Jason and Russ, quickly pitched a tent for the operating position. There was a rain-squall far off in the desert, which provided a nice break from the heat. Unfortunately, it also gave us winds of 25-40 MPH. We had to tie down the tent to as many large rocks as we could find. The constant wind forced us to build and erect the antennas and set up the camp and operating position in the midst of a gale (see Figure 2).

Bill had built a nifty tilt-over mount for two sections of Rohn 25 tower that mounted on the back of his truck. We assembled the two 6M5X antennas and mounted them to the elevation rotator. Then we pulled the tower to the upright position and locked it in place. Voila — 2 × 6M5X on 6 meters with full azimuth and elevation rotation. Jason and Russ set about hooking up all the cables to make the station functional.

Finally, at about 10 PM (0300 UTC June 21), we were on the air. There are absolutely *no* services available at Talley 2 Campground. No water, no electricity, no cell phone service, no nothing. I announced our status to the FFMA faithful via the Inmarsat Broadband Global Area Network (BGAN) terminal that we had brought along. This was the only method for getting Internet access at Talley 2.

## Late Night Meteor Scatter

Since there was no sporadic E ($E_s$) at 10 PM, I began with WSJT meteor scatter. Our first contact was KS7S (DM41) at 0439 UTC and then Danny, N5OMG, in the New Orleans area. Activity was light that first night. Our final contact that night was XE1AO, whom we later worked on SSB too.

On Thursday June 21, we began again with WSJT meteor scatter around 6 AM local time. After the morning hours, the group began calling CQ on SSB and CW. KA9FOX (EN43) was logged at 1730 UTC along with other 9s. The propagation was very poor and we were only able to pick up some random contacts. The evening brought more WSJT meteor scatter. If you aren't using the digital meteor scatter modes of WSJT (FSK441 and ISCAT) you are putting your station at a significant disadvantage. When $E_s$ is not open, meteor scatter is just about the only game in town.

During Thursday afternoon, Lance, W7GJ, was on one of the Internet chat pages asking for an EME contact. We had not found the B+ cable for the amplifier and were not ready for EME yet, but he was insistent and we agreed to make the attempt with only 200 W. Quite amazingly, we worked Lance via EME at 2120 UTC with our antennas pointed almost straight up! No ground gain there. Unfortunately, our other EME attempts were not successful, even with the amplifier.

We noticed that about 7 PM local time, the wind started to blow again although there was no storm in the area. The wind was about 25 MPH this time but it threatened to blow away the operating tent. The high winds snapped the fiberglass support poles, destroying the food and sleeping tents. This pattern repeated itself every day with the high winds returning about 7 PM and continuing until about 1 AM.

After the wind finally died down, you could look up at the stars from your bunk. There were no manmade lights anywhere and the stars were very bright with very little twinkling. We could see what looked like clouds, but then we realized that we were seeing the Milky Way and thousands of other stars. It was an exceptionally beautiful sight.

## Hunting for Skip

On Friday June 22, we began the morning with more FSK441 meteor scatter followed by more hunting for contacts via $E_s$. Things were very slow going as the propagation was still very poor. Finally, Jason caught a 2 hour opening to the Northeast and Midwest. Not a great opening, but certainly welcome after the previous 2 days. We worked VY2RU (FN86) at 2306 UTC and VE1YX (FN74) at 2332 UTC.

At 0032 UTC on June 23 we worked

VE1SKY (FN74), which is a really long haul contact at about 2339 miles! VE1SKY is in Nova Scotia and was our longest contact. (I made the error of going out to dinner during the $E_s$ opening. I saw the K5N spots on my smartphone and raced home just in time to log K5N at 0003 UTC June 23.) K5N finished Friday with more meteor scatter after the $E_s$ opening faded out.

Saturday morning was more FSK441 and weak $E_s$, including NØLL (EM09) at 1458 UTC. The afternoon was spent searching for short $E_s$ contacts. There still was not much activity on 6.

Field Day arrived on Saturday and Sunday, so we put up a 40 meter dipole and a 20 meter vertical with a few radials to operate it. We set up an ICOM IC-756PROII for the FD rig and ran 100 W. Saturday evening, Jason caught another $E_s$ opening on 6 meters. This one opened to the west and northwest. We worked several W6s and a few W7s. The last spot for K5N was by K7XC at 0322 UTC June 24.

After that opening faded, we decided it was time to go. We'd all had enough and we kept seeing rain in the Park to the north and west of us. If it had rained where we were, it would have taken several days for the roads to dry out enough for us to leave. Since we did not have enough water and supplies for another week, we needed to depart.

### Exit Strategy

Starting Sunday morning, we disassembled the antennas, packed up the trucks and began the long drive out. All of us were very tired, so it was a good decision. We got past Stuck Arroyo very easily this time, since the return trip was downhill. The group encouraged Bill to take River Road believing it to be an easier trip, which proved to be the case. The trip on River Road is only 40 miles back to Panther Junction, but the drive took us 3½ hours. We had another tire issue along the way, but were able to pump up the tire with a portable air compressor that we had brought along.

Looking back on our adventure, once we got to Talley 2 Campground, the DXpedition went perfectly. The equipment functioned flawlessly and the operators did well in spite of the oppressive heat (the maximum was 111 °F in the shade, but typically "only" 107 °F during the day). It was bad luck that the propagation gods were on strike during the time we were in DL88. In late June, there should have been lots of $E_s$ reaching all over the US, but that just didn't happen. The group did take advantage of everything that was given to us, and worked just about everything possible under the circumstances.

Thanks to everyone who participated for all their efforts in what proved to be a hard activation. We all survived just fine, but I don't think any of us want to do it again.

## On the Bands

### Major Aurora October 1 and 8, and $E_s$ on the 15th and 23rd

A major aurora opening took place on the 1st caused by a direct CME impact September 30, which sparked a strong geomagnetic storm. The K index rose to 7. Aurora $E_s$ allowed K1TOL to work MMØAMW at 0055 UTC. Lefty also heard JX7SIX/b at 0104 UTC and VE7FG/b (CO70) at 0128 UTC. He copied northern Canadian beacons including VYØSNO/b, VE8WD/b and the VYØYHK/b (EP28) at 0300 UTC.

KH7Y worked 9Y4VU and 9Z4BM on October 2 at 2359 UTC. He says signals peaked "direct path" but were weak. 9Y is Fred's DXCC # 91 on 6 from the Big Island.

Another aurora occurred October 8, from a CME impact at 0500 UTC (see Figure 3). The K index rose to 6 this time. W9RM (EN52) made aurora contacts on 2 meters as far as VE2. On the 9th, Fred, KH7Y, put Christmas Island, VK9XM, in his 6 meter log at 0641 UTC. Pekka, OH1TV, operated from Christmas Island with 100 W from a K3 transceiver into a three element Yagi.

The only significant 6 meter $E_s$ opening of the month took place on the 14th and 15th. Bob, N6RW (DM13) worked ZL1RS and FK8CP around 2345 UTC October 14th. W4IMD (EM84) made many contacts to Arkansas, Illinois, Kansas, Missouri, Oklahoma and Texas from 0100-0400 UTC on the 15th (see Figure 4). I heard W4CHA/b (EL88) and W3HH/b (EL89).

$E_s$ – TEP occurred on 6 meters on the 23rd. Dennis, K7BV/4 (FM04) heard the CE6B/b (FF30) at 2100 UTC and worked LW3EX at 2107 UTC. Single hop $E_s$ was present from

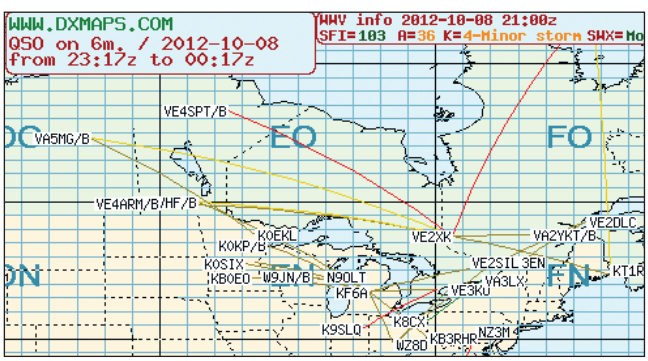



**Figure 3** — October 8 brought another aurora from a CME impact at 0500 UTC, which resulted in some short range contacts across the northern tier. [**www.dxmaps.com**]

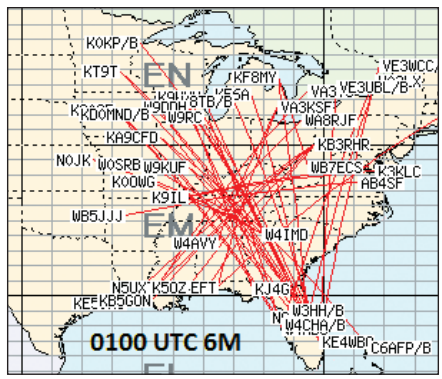



**Figure 4** — A major $E_s$ opening allowed W4IMD (EM84) to make numerous contacts throughout the southern tier. [**www.dxmaps.com**]

Georgia (W4ETN, W4IMD (EM84)), and N4UK (EM92) to VP5KE (FL41). K7BV also worked CO8DM via $E_s$. This may have been the "$E_s$ link" for Dennis. Earlier N3LL and AC4TO (EM70) worked rare VP8NO. Lance, W7GJ, worked T3ØSIX via EME on 50 MHz October 16th for his DXCC #183. Lefty, K1TOL, heard the 6V7SIX/b via F2 on the 29th.

## Here and There

Jay Rupar, KØETC, Joplin, Missouri died October 29. Jay was one of the few 6 meter DXers from the Ø call area to achieve DXCC on 50 MHz. His QRP KØETC/b (EM27) was spotted by JR2HCB (PM85) on December 28, 2001 alerting others to a huge $E_s$ – F2 JA opening. Thanks WØJRP.

Jeff, K1ZM, noted that Jack, W4OWJ, recently became an SK. Jack was an outstanding 160 meter operator and also chased DX on the Magic Band. I lost my coworker and dear friend Ashley Alcala on October 18. She was 34.

Solar Cycle 24 DXpedition suggestions from the November column were to include both San Andres (HKØ) and Fernando de Nornoha (PYØF). Clipperton was last activated on 6 meters by FOØAAA in 2000. The Cordell Group as TX5K plans a DXpedition to Clipperton Island in early March, 2013. This would be a prime time for F2 and TEP on 50 MHz, along with the potential for $E_s$. Lance, W7GJ, may be able to travel with the Cordell Group to operate both EME and terrestrial on 50 MHz.

## Special Events

**Maty Weinberg, KB1EIB, events@arrl.org, www.arrl.org/special-event-stations**

***Contact these stations and help commemorate history. Many provide a special QSL card or certificate!***

**Through Dec 31, 0000Z-2300Z, GB175PO**, Herne Bay, England. P&O Ferries. 175 years of P & O. 80 - 10 m where QRM permitted. Certificate & QSL. Armando Martins, MØPAM, 6 Thornhurst, Churchill Ave, Herne Bay CT6 6SQ, England.

**Dec 16-Dec 21, 1500Z-1111Z, KC2UFO**, Merritt Island, FL. Skywatchers and Communicators. 12.21.2012 — Game Over. 14.260 7.050. Certificate. Skywatchers and Communicators, do not mail; see URL for instructions. *Look for KC2UFO to be on the air from various locations and frequencies leading up to the end.* **kc2ufo.org**

**Jan 1, 0300Z-0900Z, K1R, Brooklyn, NY**. 72 Rag Chew Organization. 72 Rag Chew New Years Day Special Event. 7.272. Certificate. Robert W. Lobenstein, WA2AXZ, 1958 E 36th St, Brooklyn, NY 11234. **wa2axz@arrl.net**

**Jan 1-Jan 31, 0000Z-2359Z, K3Y**, All US Call Areas. Straight Key Century Club. SKCC 7th Anniversary. 14.050 10.120 7.055 3.550. QSL. David Burke, K9AAA, 8394 Corey Dr, Delton, MI 49046. *Celebrating 7 years of steady growth to over 9,800 members on CW.* **www.skccgroup.com**

**Jan 5, 1600Z-2000Z, WØCS**, Clinton, IA. Clinton Amateur Radio Club. Eagle Watch On The Mississippi. 14.250 14.050 7.250 7.050. QSL. Clinton Amateur Radio Club, PO Box 1501, Clinton, IA 52733. *QSL and pamphlet explaining the Corps of Engineer Eagle Watch Day on the Mississippi River at Lock and Dam #13.*

**Jan 6, 1800Z-2359Z, W9MQB**, Jefferson, WI. Whitewater Emergency Management with Tri-County Amateur Radio Club, JefCares and Lakes Area Amateur Radio Club. ARRL Kids Day. 14.265 7.265 3.965 145.490. Certificate. Kathryn Hinds, N7702 Kettle Moraine Dr, Whitewater, WI 53190.

**Jan 12, 1700Z-2359Z, NI6IW, San Diego, CA**. USS *Midway* (CV-41) Museum. USS *Nautilus* first ship underway on nuclear power 1954; US Seal Teams established 1962. 14.320 7.250 PSK-31 14.070 D-STAR. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

**Jan 26, 1700Z-2359Z, W8VP**, Cambridge, OH. Cambridge Amateur Radio Association. Commemoration of Ohio Blizzard of '78. 14.260 7.135. Certificate & QSL. Cambridge Amateur Radio Association, W8VP, PO Box 1804, Cambridge, OH 43725. *Commemoration of Ohio's worst blizzard. 1st Special Event of CARA's year-long 100th Birthday Celebration. QSL card. Certificate available for anyone who works all 12 of the 2013 monthly Special Events.* **www.w8vp.org**

**Jan 26-Jan 27, 1400Z-2000Z, AL7LS**, Edwards, CA. BioRem RAC North Base. *Hot Rods to Hell* 46th Filming Anniversary. 7.243 3.952 PKT 14.105 7.105. Certificate & QSL. Katrin Rossi, 2127 Sierra Stone Ln, Las Vegas, NV 89119. *Commemorating 46th anniversary release date for* Hot Rods to Hell *(1967): Country, USA; Date January 27,1967. Filming Locations Antelope Valley, CA (gas station), Calabasas, CA (the arena).* **santhomasaquino.tripod.com**

**Jan 31-Feb 6, 1500Z-2100Z, W3C**, Washington, PA. Washington Amateur Communications, Inc. Washington County Sportsman Show. 21.250 18.130 14.260 7.120. QSL. Bill Steffey, NY9H, 401 Bells Lake Rd, Radio Hill, Prosperity, PA 15329. **wacomarc.org**

**Certificates and QSL cards:** To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 ×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

**Special Events Announcements:** For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Offline completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Mar** *QST* would have to be received by **Jan 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through November 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

## Sean's Picks

***Sean Kutzko, KX9X, kx9x@arrl.org***

- **State QSO Parties this month:** None
- **QRP Contests this month:** QRP ARCI Pet Rock Sprint (Jan 5), ARS Spartan Sprint (Jan 8), NAQCC Monthly QRP Sprint (Jan 9), MI QRP January CW Contest (Jan 12-13), Flying Pigs Run for the Bacon (Jan 21), QRP ARCI Winter Fireside SSB Sprint (Jan 29)
- **Straight Key Night (Jan 1):** Yes, we know SKN isn't a contest, but it's one of the best operating events in all of Amateur Radio. Get "Old School" with your radio and send Morse by hand for a day; you'll be glad you did!
- **RTTY Roundup (Jan 5-6):** Go digital! RTTY contesting is fun and very addictive! It remains easier than ever to get on the digital modes with your PC. A great event for RTTY beginners.
- **North American QSO Party, CW (Jan 12-13):** CW takes center stage for this 12-hour event focused on North America. Exchange is just your name and state, province or "DX." With a 100 W power limit and single ops limited to 10 of the 12 hours, this contest offers lots of fun with plenty of weekend time to spare.
- **ARRL January VHF Contest (Jan 19-21):** If you've never tried operating the VHF bands, this is a good event for getting started. Two new categories emerge this year: Single Operator, 3 Band and Single Operator, FM Only. Visit **http://www.arrl.org/january-vhf** for complete info on the new categories.
- **North American QSO Party,** Phone (Jan 19-20): Like the sound of the NAQP CW contest mentioned above, but you're not a CW operator? Try NAQP SSB; it's the same rules and format, only using a microphone instead of a key.
- **CQ Worldwide160 Meter CW Contest (Jan 25-27):** Getting on 160 meters isn't as tough as it sounds...put up as long a wire as you can, run it through a tuner, and start making QSOs. This is one of the favorite events on many an operator's calendar.
- **Winter Field Day (Jan 26-27):** Sponsored by the Society for the Preservation of Amateur Radio, this 24-hour event includes the outside temperature as part of the exchange. Operate from home, portable indoors, or outdoors. Brrrrrrring on the QSOs!

### February 2012 W1AW Qualifying Runs

W1AW Qualifying Runs will be held at 10 PM EST Friday, January 4 (0300Z January 5) and at 9 AM EST (1400Z) Thursday, January 17. The West Coast Qualifying Runs will be transmitted by station K6YR at 3950 kHz at 9 PM PST on Wednesday, January 9 (0500Z January 10). Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

John Dilks, K2TQN, k2tqn@arrl.org

# The ARRL Emblem

**The ARRL® Diamond started as the symbol of the ARRL and became the worldwide symbol of Amateur Radio.**

Thinking that members needed a recognizable emblem, officials at ARRL put the following in the January 1920 *QST*.

> What do you think — we of the A.R.R.L. are to have an emblem, an identifying insignia of some sort whereby one A.R.R.L. man will recognize another on the spot! Our organization has fast grown to the point where this is needed, and now we call on you for suggestions. What do we want, a pin or a lapel button? What shall the design be? How expensive shall it be? How about different colors — one for the membership at large and another for relay officials?
>
> We want all of you to send in your ideas, for we need your help in deciding just what form our emblem shall take. As a starter we suggest that it be a button with the device around the edge and provided with a small blank space in the center, where, in quantities, we could provide it engraved with the initials or insignia of affiliated clubs, or where the individual A.R.R.L. man could engrave his call letters. This is up to you, however, and as to the design — you artists please sharpen up your pencils and get busy. Tell us what you want and we'll fix it up and make the emblems available just as soon as possible, and then we'll all know each other when we meet. [1]

The design was announced in the July 1920 *QST*.

> Several months ago we solicited an expression of opinion on the subject of an A.R.R.L. Emblem. The response was instantaneous, and solidly in favor of it. Many were the designs and suggestions received, and from them we arrived at the device shown, which was officially adopted by our Board of Direction at its last meeting.
>
> We all know that our emblem must be chaste in design and color, distinctive, and symbolic of our work. These qualities, we feel, are well represented in this insignia, which is a diamond with slightly rounded corners, bearing in its corners the letters 'A R R L,' and containing in its center an elementary 'hook-up' which is symbolic alike of transmission and reception, telegraph or radiophone, spark or C.W. — in other words, representative of us all.
>
> This design will appear on everything A.R.R.L., but our immediate concern was a pin or a button whereby one A.R.R.L. man might recognize another, and these our Board has arranged to supply, as stated in an advertisement elsewhere in this issue. In these, the design and border are in gold, and the background in black enamel — a neat and extremely good looking insignia. Now we will know each other. As quickly as we can get these distributed they will become the sign of a Hail-Fellow-Well-Met in amateur radio — a Brother A.R.R.L. man.[2]

[1]"The A.R.R.L. Emblem," *QST*, Jan 1920, p 16.

[2]"The A.R.R.L. Emblem," *QST*, Jul 1920, p 23.

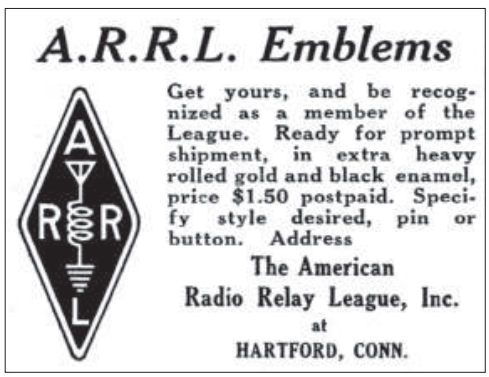



**Figure 1** — The 1920s *QST* advertisement for the lapel pin and button.

**Figure 2** — The original 8 inch flannel ARRL sweater emblem, shown with the modern 4 inch embroidered jacket emblem the ARRL sells today. [J. Dilks, K2TQN, photo]

In the 1920s many clubs and organizations adopted pins and buttons. ARRL would do the same. I found an ad in the October 1920 *QST* where members could purchase a nice lapel pin or button for $1.50 (see Figure 1).[3]

## Other ARRL Emblems Become Available

A "Stray" from the July 1924 *QST* announces "A large paper mache A.R.R.L. emblem, 18 inches high, in black and gold, has been added to the list of 'A.R.R.L. Apparatus.' This emblem is just the thing for hanging on the wall of your station. It can also be used by affiliated radio clubs, radio conventions and is fine for use in decorating your club booth at the radio show. You will find these large emblems advertised in June *QST*."[4]

ARRL found there was a demand for recognition by members. They designed other emblem items for various uses. Among them was an 8 inch flannel sweater emblem suitable for sewing onto sweaters, jackets and flags (see Figure 2).

An April 1926 "Stray" told how "One fellow hung a 'jumbo' A. R. R. L. emblem on the top of his mast.[5] The neighboring B. C. L.'s [broadcast listeners] think it is a license to broadcast."

An August 1927 "Stray" explained, "6ANV wanted to get an A.R.R.L. emblem for his shack. He bought one of the sweater emblems advertised in *QST* and also a black picture frame measuring nine by six inches. The glass was removed and a piece of black felt laid over the back. The emblem was placed upon this and the glass put on again. The result is good looking in spite of the small cost."[6]

**Figure 3** — This is the 5 inch emblem designed for automobile use. [J. Dilks, K2TQN, photo]

[3]Lapel Pin Ad, *QST*, Oct 1920, p 60.
[4]Stray, *QST*, Jul 1924, p 62.
[5]Stray, *QST*, Apr 1926, p 32.

A. R. R. L. MEMBERS!

Get Your Automobile Emblem NOW!

As your lapel emblem gives you distinction and gets you recognition from brother amateurs when you're on foot, so the A. R. R. L. Automobile Emblem on your radiator proclaims you to the whole motoring world as one of the aristocracy of radio.

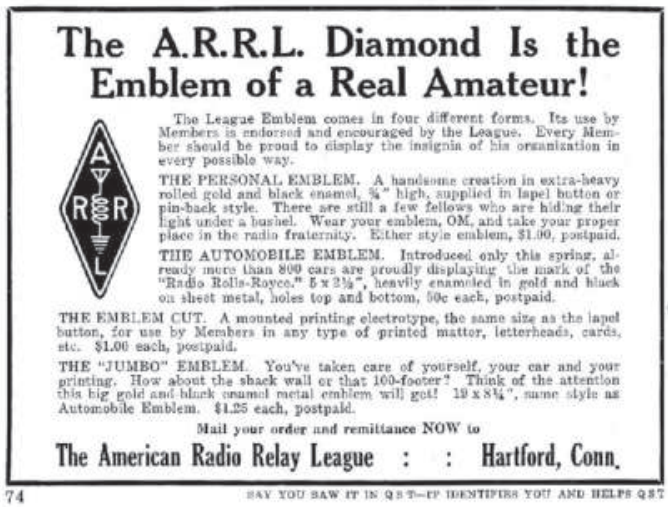
Gold and black, heavily enameled on sheet steel, 5 x 2¼", holes top and bottom for handy attachment, only 50c postpaid to members.

Mail Your Order NOW!

The American Radio Relay League, Hartford, Conn.

SAY YOU SAW IT IN QST—IT IDENTIFIES YOU AND HELPS QST

**Figure 4** — The *QST* advertisement for the automobile emblem.



The A.R.R.L. Diamond Is the Emblem of a Real Amateur!

The League Emblem comes in four different forms. Its use by Members is endorsed and encouraged by the League. Every Member should be proud to display the insignia of his organization in every possible way.

THE PERSONAL EMBLEM. A handsome creation in extra-heavy rolled gold and black enamel, ¾" high, supplied in lapel button or pin-back style. There are still a few fellows who are hiding their light under a bushel. Wear your emblem, OM, and take your proper place in the radio fraternity. Either style emblem, $1.00, postpaid.

THE AUTOMOBILE EMBLEM. Introduced only this spring, already more than 800 cars are proudly displaying the mark of the "Radio Rolls-Royce." 5 x 2¼", heavily enameled in gold and black on sheet metal, holes top and bottom, 50c each, postpaid.

THE EMBLEM CUT. A mounted printing electrotype, the same size as the lapel button, for use by Members in any type of printed matter, letterheads, cards, etc. $1.00 each, postpaid.

THE "JUMBO" EMBLEM. You've taken care of yourself, your car and your printing. How about the shack wall or that 100-footer? Think of the attention this big gold and black enamel metal emblem will get! 19 x 8¼", same style as Automobile Emblem. $1.25 each, postpaid.

Mail your order and remittance NOW to

The American Radio Relay League : : Hartford, Conn.

74 SAY YOU SAW IT IN QST—IT IDENTIFIES YOU AND HELPS QST

**Figure 5** — A 1925 *QST* ad listing all four of the ARRL emblem products.

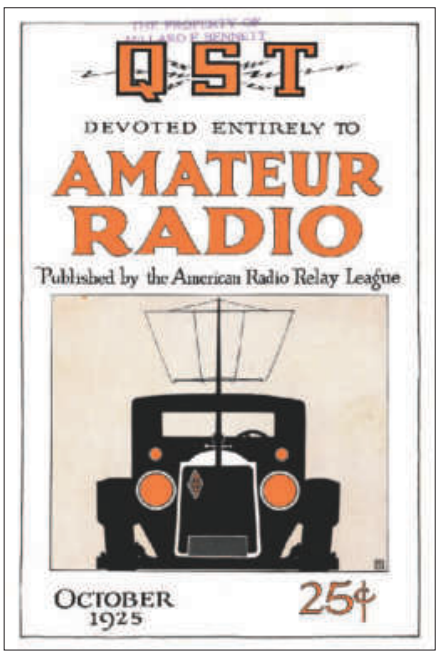



**Figure 6** — The October 1925 *QST* cover showing the 5 inch automobile emblem displayed on a front grille.

**Figure 7** — Any ham of the 1920s would have been proud to have this 19 inch ARRL emblem on their shack. [J. Dilks, K2TQN, photo]

A large and small metal porcelain emblem became available. A 19 inch "Jumbo" and a 5 inch automobile emblem were offered (see Figures 3, 4 and 5).

In the February 1929 *QST* this "Stray" appeared: "There is another reason why you should 'pin' an ARRL emblem [see Figure 6] to your car. W5AMK had one on his car and five hours after it had been stolen, it was recovered by the police. He believes the yellow and black diamond had a great deal to do with it."[7]

## At the Sign of the Diamond

ARRL's symbolic design of a diamond with the slightly rounded corners, bearing in its corners the letters "A R R L," and containing in its center an elementary "hook-up" became immediately recognizable worldwide among radio amateurs. The concept of the design was adopted by many other radio organizations for their logos.

In the August 1926 *QST*, this "Stray" appeared: "About seven years ago the A. R. R. L. adopted an emblem, the now-familiar diamond. It is interesting to note how the idea has spread around the world until now many radio societies have emblems based on the original concept of a diamond containing radio symbols and the initials of the association. This similarity is pleasing, for it makes the diamond the sign of the radio amateur. We show a few of the devices with which we are familiar [French (IARU), Italian, German, French, Spain, Great Britain]. Doubtless there are others and we would appreciate having our readers bring any additions to our notice. It is probable that when the device of the International Amateur Radio Union is determined upon, it too will be in the diamond family. — *K.B.W.*"[8]

Over the years I collected some of the early emblems. The large 19 inch and 5 inch metal porcelain emblems are my favorites. In looking through early ham magazines I have seen them displayed in photos on the outside walls of backyard shacks and on walls inside shacks. I commandeered my wife's backyard garden shed to display the 19 inch emblem to show you how it would have looked on an early ham shack (see Figure 7).
— *K2TQN*

[6]Stray, *QST*, Aug 1927, p 14.
[7]Stray, *QST*, Feb 1929, p 19.
[8]K. B. Warner, 1BHW, "At the Sign of the Diamond," *QST*, Aug 1926, p 17.

# Convention and Hamfest Calendar

**Gail Iannone, giannone@arrl.org**

**Abbreviations**
*Spr* = Sponsor
*Tl* = Talk-in frequency
*Adm* = Admission

### Arizona (Glendale) — Jan 12
D F H Q R T V

*Spr:* Thunderbird ARC. Northwest Christian Church, 16401 N 43rd Ave. 6 AM-noon. *Tl:* 146.7 (162.2 Hz), 446.15 (100 Hz). *Adm:* $2. Tables: $10 per parking spot. Alfred Johnson, AE7GM, 4101 W Union Hills Dr, Apt 1128, Glendale, AZ 85308; 623-202-3654; **ae7gm@cox.net**; **w7tbc.org**.

## QUARTZFEST CONVENTION
**January 15-25, Quartzsite, AZ**
F H R S T V

*Spr:* Quartzfest Organizers. Road Runner BLM Campground, US 95 at La Paz Valley Rd. Doors open at 9 AM. Special Event Station W7Q, RV camping and more. *Tl:* 146.55. *Adm:* free. Steve Weed, KO4QT, 11279 S Glenwood Ave, Yuma, AZ 85367; 619-733-2320; **organizer@quartzfest.org**; **www.quartzfest.org**.

### California (Palm Springs) — Jan 26 D F R S
*Spr:* Desert Radio Amateur Transmitting Society of Palm Springs. The Boskovich Estate, 4193 Matthew Dr. 9:30 AM-4:30 PM. *Tl:* 146.94 (107.2 Hz). *Adm:* $2. Tables: Free. Gary, KD6QLT, and Susie, KD6TVO, Boskovich, 4193 Matthew Dr, Palm Springs, CA 92264; 760-328-9662; **sboskovich@dc.rr.com**; **desertrats.am**.

### Colorado (Brighton) — Feb 10 D F H R V
*Spr:* Aurora Repeater Assn. Adams County Fairgrounds Exposition Hall, 9755 Henderson Rd. 9 AM-1 PM. *Tl:* 147.15 (88.5 Hz). *Adm:* $5. Tables: $10. Wayne Heinen, NØPOH, Box 471802, Aurora, CO 80047; 303-699-6335; **n0poh@arrl.net**; **www.n0ara.org**.

### Florida (Arcadia) — Jan 26 D F H R T V
*Spr:* DeSoto ARC. DeSoto Turner Center, 2260 NE Roan St. 7 AM-1 PM. *Tl:* 147.075 (100 Hz). *Adm:* $5. Tables: $10. Doug Christ, KN4YT, 2200 NE Roan St, Arcadia, FL 34266; 863-990-2507; fax 863-993-4840; **kn4yt@yahoo.com**; **desotoarc.org/**.

## SOUTHERN FLORIDA SECTION CONVENTION
**January 19, Fort Myers**
D F H R S T

*Spr:* Fort Myers ARC. Southwest Florida Public Service Academy, 4312 Michigan Ave. 8 AM-2 PM. Tailgating ($10 per space, includes one admission; additional spaces $5 each. *Tl:* 147.345 (136.5 Hz). *Adm:* $5 (under 13 free with paid adult; students 13-18 $3 with valid ID). Tables: $15 (plus admission). Drexel Turner, W4DHT, 7670 Eaglet Ct, Fort Myers, FL 33912; 239-225-0826 or 239-464-1350; fax 239-254-9054; **w4dht@arrl.net**; **fmarc.net**.

### Florida (Miami) — Feb 1-2 D F H R S T V
*Spr:* Dade Radio Club of Miami. Miami-Dade Fair Expo Center, 10901 SW 24th St. Friday noon-8 PM; Saturday 8 AM-6 PM. *Tl:* 147.0, 146.925 (94.8 Hz). *Adm:* $10 advance (by Jan 1), $12 door. Tables: $50 (first table), $45 (additional table); $40 (for each electrical hookup); tailgate spots $35 each. Miguel Garate, KJ4YVN, Box 452253, Miami, FL 33245; 305-590-8523; **MiamiHamfest@gmail.com**; **miamihamfest.net**.

### Coming ARRL Conventions

**January 6**
New York City/Long Island Section, Bethpage

**January 15-25**
Quartzfest, Quartzsite, AZ

**January 18-19**
North Texas Section, Fort Worth

**January 19**
Southern Florida Section, Fort Myers
Georgia ARES, Forsyth

**January 25-26**
Mississippi State, Jackson

**January 26-27**
Puerto Rico State, Hatillo

**February 2**
South Carolina State, North Charleston
Virginia State, Richmond

**February 8-10**
Southeastern Division, Orlando, FL

**February 15-16**
Arizona State, Yuma

**February 16**
Arkansas State, Hoxie

**February 23**
Vermont State, South Burlington

**March 8-9**
Oklahoma Section, Claremore

## SOUTHEASTERN DIVISION CONVENTION
**February 8-10, Orlando, FL**
D F H Q R S T V

*Spr:* Orlando ARC. Central Florida Fairgrounds, 4603 W Colonial Dr (SR 50). Friday noon-6 PM; Saturday 9 AM-5 PM; Sunday 9 AM-2 PM. Commercial booths ($300), tailgating ($35 for the weekend, plus admission), RV camping with water and limited electricity ($25 per night, advance reservations highly recommended), VE sessions (pre-registered only; Joe, N4UMB, **testing@hamcation.com**), Special Event Station. *Tl:* 146.76, 147.015. *Adm:* $10 advance (by Jan 19), $12 door (under 12 free with paid adult). Swap tables $45 (plus admission). Orlando HamCation®, Box 547811, Orlando, FL 32854-7811; 407-841-0874 or 800-214-7541; **info@hamcation.com**; **www.hamcation.com**.

### Florida (Tampa) — Jan 12 F H Q R T V
*Spr:* Tampa ARC. TARC Clubhouse, 7801 N 22nd St. TARCFest XXIX. 8 AM-1 PM. *Tl:* 147.105 (146.2 Hz). *Adm:* $3. Tables: $15. Bill Bode, N4WEB, 14302 Capitol Dr, Tampa, FL 33613; 813-382-9262; **n4web@hamclub.org**; **www.hamclub.org**.

## GEORGIA ARES CONVENTION
**January 19, Forsyth**
H S

*Spr:* Georgia ARES. Georgia State Public Service Training Center, 1000 Indian Springs Dr. 9 AM-4 PM. *Tl:* 146.58. *Adm:* free. Contact Gene Clark, W4AYK, 1604 Lynwood Ln, Albany, GA 31707; 229-344-1895; **w4ayk@arrl.org**; **gaares.org**.

### Georgia (Lawrenceville) — Jan 12
F H Q R S T V

*Spr:* Gwinnett ARS. Gwinnett Medical Resource Center, 665 Duluth Hwy (GA 120). 9 AM-2 PM. *Tl:* 147.075 (82.5 Hz). *Adm:* Free. Tables: Free for registered exhibitors. Norm Schklar, WA4ZXV, 480 N Peachtree St, Norcross, GA 30071; 770-313-9410; **norman@schklar.com**; **www.gars.org**.

### Illinois (Collinsville) — Jan 26 D F H R V
*Spr:* St Louis & Suburban RC. Gateway Convention Center, One Gateway Dr. 8 AM-1 PM. *Tl:* 146.76, 146.94 (backup). *Adm:* $6 advance, $7 door. Tables: $24. Bill Coby, KBØMWG, c/o St Louis & Suburban RC, Box 2233, St Louis, MO 63139; 314-504-1104; **bcoby@sbcglobal.net**; **slsrc.org**.

### Illinois (St Charles) — Jan 20 D F H R S V
*Spr:* Wheaton Community Radio Amateurs. Kane County Fairgrounds, 525 S Randall Rd. 8 AM-1 PM. *Tl:* 145.31 (107.2 Hz), 146.52. *Adm:* $8 advance, $10 door. Tables: $25. Kurt Rubin, KB9RTO, 585 Gundersen Dr, Carol Stream, IL 60188; 630-604-0157; **kb9rto@yahoo.com**; **www.w9ccu.org**.

### Kansas (LaCygne) — Feb 2 D F H R
*Spr:* Mine Creek ARC. Community Building, 204 Commercial St. 9 AM-1 PM. *Tl:* 147.285. *Adm:* Free. Tables: $10. Ron Cowan, KBØDTI, Box 36, LaCygne, KS 66040; 913-757-3758; **kb0dti@arrl.org**.

### Louisana (Hammond) — Jan 19
D H R S T V

*Spr:* Southeast Louisiana ARC. Quality Inn and Conference Center, 2000 S Morrison Blvd. 8 AM-2 PM. *Tl:* 147.0 (107.2 Hz). *Adm:* Free. Tables: $15. Carol Redmond, KE5GOC, 11097 Martin Ln, Tickfaw, LA 70466; 225-567-2100; **redmondqnt@charter.net**; **www.selarc.org/selarchamfest.htm**.

### Maryland (Odenton) — Jan 27 D F H R V
*Spr:* Maryland Mobileers ARC. Odenton Volunteer Fire Company, 1425 Annapolis Rd (Rte 175). 7:30 AM. *Tl:* 146.805 (107.2 Hz). *Adm:* $5. Tables: $13. Frank Winner, N3SEO, 283 Oak Ct, Severna Park, MD 21146; 410-647-3335; **n3seo@aol.com**; **sites.google.com/site/marylandmobileers/hamfests-1/hamfest-2**.

### Michigan (Negaunee) — Feb 2 D F R
*Spr:* Hiawatha ARA. Negaunee Township Hall, 42 Hwy M-35. 9 AM-2 PM. *Tl:* 147.27 (100 Hz). *Adm:* $5. Tables: $7. John Veiht, N8RSE, 1609 Altamont St, Marquette, MI 49855; 906-228-9417; **carczar@gmail.com**.

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

## MISSISSIPPI STATE CONVENTION

**January 25-26, Jackson**

D F H Q R S V

*Spr:* Jackson ARC. Mississippi State Fairgrounds Trade Mart Building, 1200 Mississippi St. Friday 5-8 PM, Saturday 8 AM-4 PM. VE sessions (Saturday, 8 AM, $15 fee; Bill White, K5BLL, **VE-testing@msham.org**). *Tl:* 146.76 (77 Hz). *Adm:* $6. Tables: $16 (flea market), $26 (dealers/vendors). Gary Young, K5GCY, 5354 Brookhollow Dr, Jackson, MS 39212; 601-260-8214; **k5gcy@att.net**; **www.msham.org**.

### Missouri (Kansas City) — Jan 19

D F H R S V

*Spr:* Northland Emergency Response. Hillside Christian Church, 900 NE Vivian Rd. 8 AM-2 PM. *Tl:* TBA. *Adm:* $5. Tables: $20. Alan Altis, KCØSCT, 209 E Washington, Kearney, MO 64060; 816-204-5962; **info@northkchamfest.com**; **www.northkchamfest.com**.

## NEW YORK CITY/LONG ISLAND SECTION CONVENTION

**January 6, Bethpage**

H Q R S V

*Spr:* Long Island Mobile ARC. Briarcliffe College, 1055 Stewart Ave. 7:30 AM-4 PM. "Ham Radio University 2013," Keynote Speaker Bill Cross, W3TN, Special Event Station W2V, VE sessions (1:30 PM, no pre-registration required). *Tl:* 146.85 (136.5 Hz). *Adm:* $3 suggested donation. Tom Carrubba, KA2D, 226 Sheffield Ave, W Babylon, NY 11704; 631-422-9594; **ka2d@arrl.net**; **hamradiouniversity.org**.

### New York (Lockport) — Jan 26 D F H R

*Spr:* Lockport ARA. South Lockport Fire Company, Transit and Ruhlman Rds (Rte 78). Setup 7 AM; public 8 AM. *Tl:* 146.82 (107.2 Hz). *Adm:* $5. Tables: $5. Gary Smith, WB2GLU, 850 Willow St, Lockport, NY 14094; 716-433-3132; **g8smith@juno.com**; **www.LockportARA.us**.

### New York (Marathon) — Jan 12 D F H R V

*Spr:* Skyline ARC. Lovell Field Civic Center, 40 W Main St. 7 AM-noon. *Tl:* 147.18 (71.9 Hz). *Adm:* $3. Tables: $5. Patrick Dunn, KC2BQZ, 1302 Rams Gulch Rd, Jamesville, NY 13078; 315-456-8955; **kc2bqz@gmail.com**; **www.skylineradioclub.org**.

### Ohio (Elyria) — Feb 3 D F H R

*Spr:* Northern Ohio ARS. VFW Post 1079 (New Location), 500 S Abbe Rd. 9 AM-1 PM. Free pancake breakfast with admission. *Tl:* 146.7 (110.9 Hz). *Adm:* $6. Tables: $10. Darlene Ohman, KA8VTS, 4122 Bush Ave, Cleveland, OH 44109; 216-398-8858; **dohman@roadrunner.com**; **www.NOARS.net**.

### Ohio (Nelsonville) — Jan 20 F H R V

*Spr:* Sunday Creek AR Federation. Tri-County Vocational School, 15676 State Rte 691. 8 AM-3 PM. *Tl:* 147.15. *Adm:* $6. Tables: $6. Jeramy Duncan, KC8QDQ, 10847 Walnut St, Glouster, OH 45732; 740-767-2554; **duncan10847@embarqmail.com**.

### Ohio (Strasburg) — Jan 27 D H R

*Spr:* Tusco ARC. Wallick Auction House, 965 N Wooster Ave. 23rd Annual Hamfest. Set up 6 AM; public 8 AM. *Tl:* 146.73 (71.9 Hz). *Adm:* $5. Tables: $10 (plus admission). Janice Green, KB8YDK, 32210 Norris Rd, Tippecanoe, OH 44699; 740-922-4454; **k8wfn@tusco.net**; **www.tuscoarc.org**.

## PUERTO RICO STATE CONVENTION

**January 26-27, Hatillo**

D F Q R S V

*Sprs:* Caribbean AR Group, the Puerto Rico AR League, and the Radio Operadores del Este. Convention will be held at Cancha Bajo Techa Francisco "Pancho" Deida, Carr #1. Saturday 8 AM-5 PM, Sunday 9 AM-3 PM. Special Event Station at booth #26, VE sessions (first-come, first-served basis, $15 fee; Victor Madera, 787-789-4998). *Tl:* 146.52. *Adm:* free. Jose Vicens Rodriguez, NP4G, Box 758, Humacao, PR 00792; 787-633-6847; **otispr@yahoo.com**; **www.arrlpr.org**.

### South Carolina (Greenwood) — Jan 12

D F H R S T V

*Spr:* Greenwood ARS. Piedmont Technical College (Multipurpose Building N), 620 N Emerald Rd. 9 AM-5 PM. *Tl:* 147.165 (107.2 Hz). *Adm:* $7. Tables: $10 (electricity $10 extra). Tedd Davison, AI4WN, 116 Mountain Shore Dr, Greenwood, SC 29649; 864-377-1872; fax 864-223-6125; **ai4wn@arrl.net**; **w4gwd.org**.

## SOUTH CAROLINA STATE CONVENTION

**February 2, North Charleston**

D F H R S T V

*Spr:* Charleston ARS. Armory Park Community Center (new location), 5000 Lackawanna Blvd. Setup Friday 5-9 PM, Saturday 6:30 AM; public 8 AM-3 PM. Tailgating ($8 per space, plus admission), VE sessions (on site at 1 PM, walk-in basis, $15 fee; Sheila, KT4YW, 843-871-4368, **kt4yw@sc.rr.com**). *Tl:* 146.79, 145.25, 147.045, 145.41. *Adm:* $5 (12 and under free). Tables: $10 advance, $12 door (if available); chairs $2 each. Jenny Myers, WA4NGV, 2630 Dellwood Ave, Charleston, SC 29405; 843-747-2324; **brycemyers@aol.com**; **www.wa4usn.org**.

## NORTH TEXAS SECTION CONVENTION

**January 18-19, Fort Worth**

D F H R S T V

*Spr:* Lockheed Martin ARC. Lockheed Martin Recreation Area, 3400 Bryant Irvin Rd. Friday 3-8 PM, Saturday 8 AM-3 PM. Tailgating ($5 per space), VE sessions (both days). *Tl:* 147.28 (110.9 Hz). *Adm:* $8 advance, $9 door. Tables: $35. David Forbes, KC5UYR, 2721 Marigold Ave, Fort Worth, TX 76111; 817-925-5126; fax 817-877-0826; **kc5uyr@compuserve.com**; **www.cowtownhamfest.com**.

### Texas (Schertz) — Jan 12 D F H Q R S T V

*Spr:* San Antonio RC. Schertz Civic Center, 1400 Schertz Pkwy. 8 AM-2 PM. *Tl:* 146.94 (179.9 Hz). *Adm:* $8 advance, $10 door. Tables: $10. Lewis Archer, WØYVY, Box 34263, San Antonio, TX 78265; 210-415-5733; fax 210-256-6840; **usxpop@gmail.com**; **w5sc.org**.

## VIRGINIA STATE CONVENTION

**February 2, Richmond**

D F H Q R S V

*Spr:* Richmond Amateur Telecommunications Society (RATS). Richmond Raceway Complex, 600 E Laburnum Ave. Setup Friday 10 AM-8 PM, Saturday 6:30-8 AM; public 8:30 AM-3:30 PM. VE sessions (10 AM-1 PM, walk-ins only, all license classes, $14 cash only), RV camping ($45 per night with electrical hookup). *Tl:* 146.88 (74.4 Hz). *Adm:* $10, under 18 free (online tickets; "Early Bird" tickets for early admission into the event). Tables: $30 (plus admission; electrical hookups $40 extra). Tray Murphy, N4PAT, Box 14828, Richmond, VA 23221; 804-657-7038; **ffcomm@frostfest.com**; **www.frostfest.com**.

### To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

*For hamfests:* Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **January 1** to be listed in the **March** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL Web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

Maria Somma, AB1FM, VEC Manager, ab1fm@arrl.org

# Exam Fees, Question Pools and VEC Stats

## 2013 ARRL VEC Examination Fee Remains at $15

The ARRL VEC exam fee for 2013 will remain at $15. Remember that a $15 fee is charged to every person seeking a new license or upgrade as listed on your ARRL VEC Candidate Roster. That single fee pays for one attempt at each of the three exam elements. If an applicant retests an exam element that was failed moments earlier, another $15 fee is charged (and another Roster entry is created).

ARRL VE teams may retain up to $7 of this fee to directly reimburse their team's out-of-pocket examination expenses incurred in setting up and conducting examination sessions. As long as the expense is warranted, has been prudently incurred and the expense is specifically related to exam administration, then the fee can be retained. The team should keep a record of the expenses paid (with receipts) for two years. Records must be made available to ARRL VEC upon request. Costs not related to exam session processes or paperwork are not reimbursable.

The FCC allows VECs to collect an examination reimbursement fee from each candidate who takes one or more exam elements. VEs and VECs may be reimbursed by examinees for out-of-pocket expenses incurred in preparing, processing, administering or coordinating an examination for an amateur operator license (FCC Rule §97.527). These exam fees help the VEC recover the costs of providing its services.

## Skip This Year, Then Tech Review is Here

The Technician, General and Amateur Extra question pools are reviewed and updated on a four year rotation. The pools are designed to test comprehension of FCC rules, operating procedures, radio wave propagation electrical principals, circuits, signals and emissions, antennas and transmission lines and safety. All Amateur Radio exams are created from these pools.

No question pool updates or releases will take place in 2013. The next pool review is scheduled for 2014 and that's for the Element 2 Technician exam. The National Conference of Volunteer Examiner Coordinators (NCVEC) Question Pool Committee (QPC) has already begun work on this pool and they welcome comments and suggestions. Please e-mail your input to the QPC at: **qpcinput@ncvec.org**.

## 2013 ARRL National Exam Day Weekends

ARRL sponsored National Exam Day weekends are held annually on the last full weekends of April and September. This year the dates are April 27-28 and September 28-29.

## Current Amateur Radio Question Pools

- Technician class (Element 2): effective July 1, 2010 and valid until June 30, 2014. The Technician class question pool contains seven diagrams or symbols.
- General class (Element 3): effective July 1, 2011 and valid until June 30, 2015. The General class question pool contains one schematic diagram.
- Amateur Extra class (Element 4): effective July 1, 2012 and valid until June 30, 2016. The Extra class question pool contains 12 schematic diagrams.

All current question pools can be viewed on the ARRL website at **www.arrl.org/question-pools**.

### ARRL VEC Exam Sessions Conducted

**Per Year: 1984 to October 2012**

| *Year* | *Sessions* | *Year* | *Sessions* |
|---|---|---|---|
| 1984 | 157 | 1999 | 5495 |
| 1985 | 1761 | 2000 | 6968 |
| 1986 | 1883 | 2001 | 5528 |
| 1987 | 1927 | 2002 | 5532 |
| 1988 | 1983 | 2003 | 5496 |
| 1989 | 2196 | 2004 | 5350 |
| 1990 | 2487 | 2005 | 5275 |
| 1991 | 3483 | 2006 | 5319 |
| 1992 | 4861 | 2007 | 6439 |
| 1993 | 5667 | 2008 | 6152 |
| 1994 | 6136 | 2009 | 6369 |
| 1995 | 6554 | 2010 | 6294 |
| 1996 | 6519 | 2011 | 6352 |
| 1997 | 6385 | 2012 through October | 5513 |
| 1998 | 4426 | **Grand Total** | **138,685** |

## Web-Based Resources for ARRL VEs

- ARRL VEC VE support page at **www.arrl.org/resources-for-ves**.
- ARRL VEs can register Amateur Radio license exam sessions and order exam supplies via our interactive web form at **www.arrl.org/register-an-amateur-radio-license-exam-session**.
- VE Teams officially field-stocked by the ARRL VEC with a bulk quantity of our exam materials should periodically check our VEC Exam Booklets page at **www.arrl.org/vec-exam-booklets** to ensure your VEC printed exam booklets are up to date. You may restock exam supplies via the online VE team restock form at **www.arrl.org/field-stocked-ve-teams**.

## VEC Facts and Figures

Since 1984, ARRL VEC has been busy meeting the needs of the Amateur Radio community and serving the FCC. To give you an idea of what the ARRL VEC has been up to, here are a few statistics.

Over the past 28 years, ARRL has accredited 62,698 General, Advanced and Amateur Extra class licensees as ARRL Volunteer Examiners (VEs). Currently, there are 36,383 VEs in our program. These VEs have conducted 138,685 exam sessions and served 1,079,015 examinees. From those examinees 669,604 have had their successful applications submitted to the FCC for new and higher class licenses.

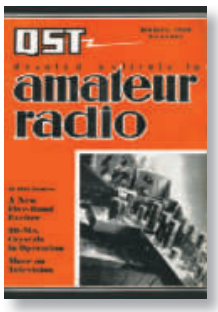
Over the course of our VEC program, we have grown to become more than just exam administrators. We are special event call sign coordinators, club call sign administrators, question pool writers, international Amateur Radio permit issuers and a knowledgeable information source for a wide range of licensing issues.

Yes, we've been busy!

## 75, 50 and 25 Years Ago

**Al Brogdon, W1AB**

### January 1938




- The cover photo shows equipment described in this month's article, "Circuit Elements in Modern Television Reception."
- The editorial squashes an erroneous rumor started by a new ham who misunderstood an F.C.C. order. The ham then put his kilowatt 'phone rig on 160 meters to spread the rumor. After admonishing us to check stories before we spread untrue rumors, the editor notes, "We've always had rumors; we always will."
- A. L. Budlong, W1BUD, explains how we got our present bands in his discussion of the Cairo Conference and earlier Radio Conferences, in Part 1 of the article titled simply, "Cairo."
- Donald Exner, W8ZU, describes his new homebrew rig, "A Five-Band Exciter with Front-of-Panel Band-Changing."
- "The New PITC," by Lew Bellem, W1BES, tells of Pitcairn Island's maritime station retiring its faithful old spark transmitter and replacing it with modern tube equipment and accessories donated by U.S. manufacturers.
- Antenna guru John Kraus, W8JK, relates the results of experiments using "Directional Antennas with Closely Spaced Elements."
- J. M. Wolfskill, W8QKT, tells us how to get "56-Mc. Crystal Control with 28-Mc. Crystals."
- "Circuit Elements in Modern Television Reception," by Marshall Wilder, W2KJL, gives us an outline of basic circuit considerations in the video receiver.

### January 1963


- The cover photo show a LORAN pulse blanker for 160 meters, described in this issue.
- The editorial looks back at the year 1962, just finished: The number of U.S. hams reached a quarter million, and the world total climbed past the 350,000 mark. ARRL membership reached and surpassed the 100,000 mark. The first two non-government satellites, Oscars I and II, were placed into orbit; both were designed and built entirely by hams! And more…
- Martin Kaiser, W2VCG, tells us about "An All-Nuvistor Converter for 420 Mc."
- R. D. Curtis, W4JWV, describes his 90-watt exciter for multiband operation, in "The W4JWV Exciter," an article that fills 9+ pages of *QST*.
- Herbert Hoover, Jr, W6ZH, reports on the effectiveness of his noise-silencing circuit optimized for Loran pulses, in "Minimizing Interference from Loran on 160 Meters."
- John Troster, W6ISQ, again makes us laugh out loud as he tells the story of occurrences that many of us have heard on the bands, "S4 + 30 Db."
- Ed Tilton, W1HDQ, reports on "Using the 4X250B as a Frequency Multiplier to 432 Mc."
- In "A Novice 40-Watter," Lew McCoy, W1ICP, tells us about a two-band transmitter that's easy to build.
- Bill McKay, W7QBR, adds more features to W6TC's popular homebrew receiver to provide "Added Versatility for the HBR-16."

### January 1988


- The cover photo montage shows Chinese and American amateurs, with the caption, "Chinese hams visit the US!"
- The editorial, "Challenges for the 1990s," looks at upcoming international radio conferences, pointing out areas the ARRL will be carefully watching.
- Gary Breed, K9AY, tells us how to build a direct-conversion receiver, in "A New Breed of Receiver."
- Steve Powlishen, K1FO, presents "An Optimum Design for 432-MHz Yagis."
- Doug DeMaw, W1FB, describes "Accessories for Your VFO," that will provide two-band operation and greater power output for our homebrew VFOs.
- Butch Bussen, WAØVJR, wraps up his series on "Amateur Radio and the Blind" with Part 4.
- Dave Sumner, K1ZZ, reports on the recent visit of Chinese hams, officials of the Chinese Radio Sports Association, to the US, in "Official Visit Strengthens US–China Amateur Radio Link."
- This month's "Public Service" column describes the part Amateur Radio played in San Antonio on "The Day the Pope Came to Town."

## Field Organization Reports

### OCTOBER 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**.

536
KI4KWR

512
W5KAV

510
KØIBS

495
KT5R

470
KB2RTZ

395
WB9FHP

370
W5DY

355
KT2D

330
W4SEE
WE2G

300
WB9YBI

285
KB2ETO

277
KK5NU

260
KA2ZNZ
KB2BAA

246
WS6P

235
AG9G

229
W2MTA

228
KB2LFG

220
K7BFL

216
KJ4JPE

210
K9LGU
K2HAT
WM2C

209
W7FQQ

201
K2ABX

200
N7CM

195
VE7GN

190
K7EAJ
W4DNA

185
W8DJG

182
WØRJA
WA2BSS

175
WA3EZN
KB2KOJ

170
KK4BVR

165
KF5IOU
W8KWG

162
KC2SFU

161
KA8ZGY

160
KGØGG
K6HTN

159
N4ELI

155
N9VC
KE5HYW
KD8HSV

154
AD4BL

151
N2GJ

150
KV4AN
KK3F

145
WB9WKO
N8IO
K1HEJ

140
KB5SDU
WK4P
WØLAW

136
W9WXN
KB3LNM

135
NX9K
WB4ZIQ
W3YVQ

132
KB8VXE

130
N5NVP
W7EKB
K6JT
KC5OZT
WB2FTX
N8SY
KW1U
K4IWW
WI2G
NM1K

129
KJ4G

126
KB3GJT
NN7H

125
KD2AXP
N2JBA

124
KE7QPV

123
W3CB

121
KE5YTA

120
KE4CB
KA4FZI
K6FRG
W9BGJ
K4BG
K4GK
NA7G

119
WB8YYS

118
K4VWK

117
AL7N

115
N3RB
KD7THV
N1IQI

111
AK4RJ

110
N7EIE
W7QM
WA4BAM
KJ6IJJ
W7GB
KA1G
N9MN
N7XG
N7YSS
WA5LOU
W2EAG
KB1RGQ
K7BDU

108
AE5VY
KK7DEB
KB1NMO
106
KB5PGY

105
KØVTT
WB6UZX
K1YCQ

104
K7MQF

103
KJ7NO

100
WØCLS
NØMEA
WAØVKC
KB5KKT
N5OUJ
K4SCL
KB3BAA
N3SW
W3TWV
N1JX
NU8K
WB8HHZ
KA8IAF
WG8Z
WB8SIQ
W8MAL
WD8Q
N1TF
N1LKJ
KJ4RUD
W4TTO
KB2YAA
N2WKT
AA3SB
K3IN
N7IE

99
K4JUU

97
K6GPZ

95
K5AXW
N8CJS
WAØCGZ
WB4BIK

94
W7YV

93
W2CC
WDØGUF

92
KB3MTW

91
NC3F
N2RTF
WB3FTQ

90
WA1STU
K4MSG
N3KB
KA5AZK
KI4AAN
W3GQJ
KJ4HGH
W8IM
KB8HJJ
W4OTN
N3ZOC
AA2SV

88
KC5MMH
N9WLW
N2VC

87
W8CPG
N2VQA

86
WB6N

85
KB9KEG
KC2EMW

83
N2DW

82
K1PJS

81
NC8V

80
KØDEU
NIØI
NØMHJ
KFØXO
KCØZDA
KC4PZA
KZ8Q
WB4RJW
KS4PG

79
N3FKR

78
N2GS
KF4OCU

77
W5GKH
KBØDTI

74
KD8OEE

70
KDØAYN
KØDLK
NØDUW
NØDUX
WØFUI
N3NTV
KØPTK
KD7ZUP
KK7TN
W1PLK
N2YJZ

### Section Traffic Manager Reports

The following Section Traffic Managers reported: AL, AR, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IL, IN, KS, LA, LAX, MDC, ME, MN, NC, NFL, NNJ, OH, OK, OR, ORG, SD, SFL, SJV, STX, TN, UT, VA, WCF, WI, WNY, WPA, WV.

### Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: DE, EWA, GA, IA, ID, IN, LAX, MDC, MO, MT, NLI, NM, NTX, OK, STX, SV, WTX.

### Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on Amateur Radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W5KAV 3544, NX9K 3265, WB9FHP 3226, KK3F 2131, WB2FTX 1769, N9VC 1345, K6HTN 1228, WØRJA 1089, WD8Q 848, N1IQI 816, K6FRG 691, K7BDU 642, K6JT 604, KW1U 591, N8IO 540, W9WXN 505.

The following station qualified for BPL with Originations plus Deliveries: NM1K 120, KJ4HGH 102.

## Silent Keys

**Silent Keys Administrator, sk@arrl.org**

**It is with deep regret that we record the passing of these amateurs:**

W1BFY **Wadsworth**, James, Beverly Hills, FL
N1BMC **Bagnall**, Richard S., Bloomfield, CT
W1BSG **Moran**, David E., South Dennis, MA
W1ECO **Frelich**, Paul D., Brattleboro, VT
W1HA **Johnson**, Walter A., Abington, MA
W1JIU **Johnston**, Robert C., Lake Bonaparte, NY
♦N1JS **Santangelo**, Joseph, Waltham, MA
KB1MML **Christy**, Raymond C., Boothbay Harbor, ME
K1NWE **Young**, Robert C., Florence, MI
KA1PMP **Loomis**, Elaine F., Concord, MA
W1RZF **Holmes**, Arthur W. Jr, Mendon, MA
W1VL **Manti**, Andrew C. Jr, Windham, NH
WB2BOU **Woldin**, Alfred, Hamilton, NJ
N2CT **Talbot**, Chuck D., Auburn, NY
W2FJT **Sommerfield**, Edward H., Fountain, CO
N2GDQ **Dickey**, Frank R. Jr, Dewitt, NY
KB2HBN **Stanecker**, Arlette M., Goode, VA
N2IMH **Casto**, James, Williamstown, NJ
W2NOM **Allen**, Joseph G., San Jose, CA
♦WA2NPD **Gehring**, Douglas G., Wenonah, NJ
WB2QAP **Milne**, A. B., New Bern, NC
K2SAU **McLaughlin**, R. D., Tinton Falls, NJ
K2SCQ **Holdt**, Edgar W., Hickory, NC
KB2SVL **Cobb**, Bruce S., Ellisburg, NY
KC2TYZ **Minnichbach**, Howard R., Egg Harbor Township, NJ
W2UKE **Mohr**, Jacob C., Williamsville, NY
W2YKG **Tyrrel**, William T., Huntington, NY
W2ZCA **Jablonka**, Lucian, Hudson, FL
W3AFH **Goldblatt**, Barry, Norfolk, VA
WA3BVQ **Stahlman**, Joseph E., Slippery Rock, PA
KB3CE **Biggs**, Patricia A., Freeland, MD
K3DW **Beck**, Kenneth H., Newtown, PA
KA3FVB **Wittman**, David, Kennett Square, PA
K3HOX **Hager**, Robert E., Elizabethtown, PA
W3HUV **Maurstad**, Raymond B., Coon Rapids, MN
♦W3QAN **Shaffer**, Wayne G., Waterford, CT
KA3WYC **Herholdt**, Michael D., Milford, DE
♦WA3ZAO **Goodrich**, Robert, Polland, OH
KI4AOQ **Thompson**, Ralph L. Jr, Kingstree, SC
K4DHB **Byrd**, Dean H., Cahaba Heights, AL
AG4DL **Grummell**, Bernard M., New Smyrna, FL
KB4EAT **Leddy**, Delia J., Cookeville, TN
K4IPC **Goldsten**, Joseph, Lexington, VA
WA4IQL **Burnett**, William L. Jr, Memphis, TN
KV4JC **Bean**, Louis K., Christiansted, VI
N4OKG **Turner**, Almon C. Jr, Mobile, AL
KD4QHY **Carr**, Penny, Gainesville, FL

AA4RF **Black**, Deward B. Jr, Columbus, GA
WM4SG **Martin**, William H., Marietta, GA
WA4TPX **Hulett**, Lawrence W., Winston Salem, NC
N4UPF **Hill**, Samuel M. III, Hoover, AL
KF4VDT **Horton**, Harry E., Lecanto, FL
W4YXO **Puckett**, Calvin, Greensburg, KY
K5BAO **Montgomery**, Stanley R., Choctaw, OK
W5CEG **Lawrence**, John C., Pantego, TX
K5CRC **Elston**, Betty J., Albuquerque, NM
KE5DWE **Rhodes**, Winfred A., Pineville, LA
WK5G **Turner**, Robert E., Fort Worth, TX
KD5GC **Evans**, Joe D., Clinton, AR
KD5H **Hale**, Don C., Fayetteville, AR
K5JAK **Keelin**, Joseph A., La Luz, NM
WB5KCK **Huckaby**, Roger L., Fort Worth, TX
K5LLZ **Joines**, Norman E., Tulsa, OK
KC5OKS **Campfield**, Phyllis A., Cleveland, OK
WA5PZI **Burns**, William B., Hattiesburg, MS
W5STX **McPeak**, Michael L., Port Isabel, TX
♦WA5UIL **Wheeler**, Thomas L. Jr, Dallas, TX
KG6AR **Williams**, Chris, Callaway, VA
WB6BOF **Leutza**, Bud A., Santa Cruz, CA
KA6DLI **Belcher**, Glen E., Pacifica, CA
N6DZM **Pearson**, Walter H. III, Torrance, CA
WD6HEE **Marcotte**, Paul N., Riverside, CA
KA6HGA **Shearer**, William F. Sr, Visalia, CA
♦W6IA **Hirst**, William B. Jr, Point Loma, CA
KE6KQC **Ek**, John R., Fortuna, CA
KG6LNL **Lindly**, Craig, Sacramento, CA
KE6NAF **Leslie**, JoAnn, El Monte, CA
WA6NCA **Stiner**, John G., Fresno, CA
KB6NS **Jorden**, Robert L., Coalinga, CA
♦N6OU **Brown**, Edgar W., Sylmar, CA
W6SAY **Lai**, Eugene G., Fresno, CA
W6SMW **Sortors**, Dee O., Ventura, CA
AC6WS **Rhoy**, Leland G., Fresno, CA
KA6YFD **Keyes**, Bob, Ventura, CA
KC7BPW **Martin**, Le Roy A., Bellingham, WA
K7DAF **Witt**, Donna D., Hillsboro, OR
W7HQO **Henzen**, Allen L., Cornelius, OR
♦KA7KLH **Colony**, William M., Kalispell, MT
KD7LFT **Rosten**, Albert, Las Vegas, NV
K7MMC **Tolladay**, Lorren P., Reno, NV
W7MYD **James**, John D., Bellevue, WA
KB7RRR **Warren**, Frank W., Yakima, WA
WA8BHO **Pierson**, Edgar J., Toledo, OH
KD8DAS **Band**, Rudolph, East Lansing, MI
W8FWX **Crider**, Henry F. Sr, Leland, NC
KB8HUW **Geronimo**, Pacifico S., Toledo, OH
WD8JPP **Maguire**, Thomas E., Ludlow Falls, OH
ex-K8YI **Tabler**, Thomas N., East Lansing, MI

WB8KVM **Mertz**, Willard W., Lima, OH
W8RHS **Flanagan**, Elbert E., Nitro, WV
N8XTB **Kaarre**, Paul W., Osprey, FL
W9AAB **Covert**, Steven J., Zionsville, IN
N9ELK **Kline**, Edward L., Groveland, IL
W9LBS **Cleveland**, La Rue, Greenwood, IN
♦K9LJP **Stotler**, Joseph M., Greendale, IN
W9LNL **Oehler**, Thomas A. Sr, Milwaukee, WI
K9MAU **Balkwill**, Charles, Grafton, WI
N9VZJ **Price**, Scott A., Fort Wayne, IN
W9WL **Rateno**, A. Ronald., Pickerington, OH
K9YXW **Schroeder**, John M., Madison, WI
K9ZVU **Gershon**, Ernest J., La Crosse, WI
WØAEX **Rennolet**, Robert A., Parkston, SD
WØBVB **Childs**, Larry N., Lees Summit, MO
KØEWW **Goddard**, Joseph F., Dodge City, KS
AGØI **Gonzalez**, Richard, Arden Hills, MN
KAØLWU **Deppe**, Phyllis J., Ely, MN
NØMKI **Hamilton**, Howard E., Boscobel, WI
WBØNFL **Emerson**, Percy A., Olathe, KS
NØOKS **Kachel**, Mark W., Brown Deer, WI
KCØPUB **Hilsenbeck**, Gladys M., Marion, IA
KØRO **Trampler**, Arthur R., Springfield, MO
KØTHY **Lord**, Katharine D., Aitkin, MN
♦KØUJG **Burlew**, Wayne A., Fort Worth, TX
WAØVED **Woodring**, James A., Monroe, TN
NØXIR **Kaufman**, Edward J., Green Valley, AZ

♦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.

## Feedback

In the 2012 ARRL DX CW Contest Results (August 2012 *QST*, pp 78-81), KH6FP was incorrectly listed as the Oceania Continental Winner in the Single Operator, Low Power category. The correct winner was E51NJB (N5JB, op).

In the 2012 June VHF Contest Results (December 2012 *QST*, pp 83-86), the Cold Brook Contest Club of the Western New York Section was inadvertently left out of the Affiliated Club Competition table. CBCC scored 149,720 points with 5 logs submitted. The ARRL Contest Branch regrets these omissions.

## Strays

John Reisenauer, KL7JR, on the publication of his new e-book *Stealth and Portability: Using CB Antennas on the Amateur Bands*. The book is available for $12.95 (via PayPal) with an e-mail request to John at **KL7JR@yahoo.com**.

### I would like to get in touch with...

John Hawkins, VK6AU, would like to hear from veterans who served in Germany at the end of World War II and operated an amateur radio station or club station there. You can contact John at 17 Shasta Rd, Lesmurdie, WA 6076, Australia; **bushcarp@westnet.com.au**.

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- Band scope built-in • 500 Memories


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50/2M/220/440 HT
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- Li-Ion Battery
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- Built-in CTCSS/DCS
- Internet WIRES compatible

**Now Available in Black!**


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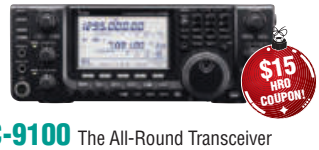


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• HF/50MHz 144/430 (440) MHz and 1200MHz*[1] coverage • 100W on HF/50/144MHz, 75W on 430 (440) MHz, 10W on 1200MHz*[1] • Double superheterodyne with image rejection mixer

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### 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


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• 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


### 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 repeater) mode • Free software download • GPS A mode for easy D-PRS operation • One touch reply button (DV mode) • Wideband receiver


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• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation


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*[1] Optional UX-9100 required. QST JAN 2013. The Icom logo is a registered trademark of Icom Inc. 70017

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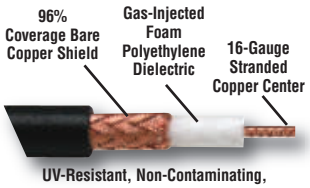



UV-Resistant, Non-Contaminating, Black PVC Jacket

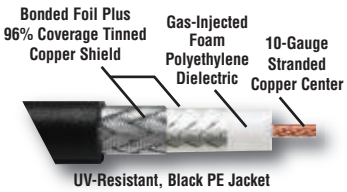
### *DXE-8X Low-Loss Foam Dielectric Cable (also known as RG-8X or Mini-8)*

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

| Attenuation/ 100 ft. | Power Rating | Efficiency % |
|---|---|---|
| 0.6 dB @ 5 MHz | 3.0 kW | 86% |
| 0.9 dB @ 10 MHz | 2.2 kW | 81% |
| 1.4 dB @ 30 MHz | 1.2 kW | 69% |
| 2.0 dB @ 50 MHz | 0.9 kW | 62% |
| 3.8 dB @ 150 MHz | 0.4 kW | 42% |

| Cable Only | | |
|---|---|---|
| DXE-8X | By the foot | **$.31/ft.** |
| DXE-8X-1000 | 1,000 ft. | **$259.99** |

| Pre-cut Cable with Connectors | | |
|---|---|---|
| **Part Number** | **Length/Ft.** | **Price** |
| DXE-8XDU003 | 3 | **$9.88** |
| DXE-8XDU006 | 6 | **$10.88** |
| DXE-8XDU012 | 12 | **$12.88** |
| DXE-8XDU025 | 25 | **$17.88** |
| DXE-8XDU050 | 50 | **$26.88** |
| DXE-8XDU075 | 75 | **$35.88** |
| DXE-8XDU100 | 100 | **$44.88** |
| DXE-8XDU150 | 150 | **$62.88** |




UV-Resistant, Black PE Jacket

### *DXE-400MAX Low-Loss Cable*

- Low-loss, gas-injected foam polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density polyethylene jacket is UV resistant, ideal for outdoor use
- Direct-bury

| Attenuation/ 100 ft. | Power Rating | Efficiency % |
|---|---|---|
| 0.3 dB @ 5 MHz | 6.9 kW | 93% |
| 0.5 dB @ 10 MHz | 4.8 kW | 90% |
| 0.8 dB @ 30 MHZ | 2.8 kW | 83% |
| 1.1 dB @ 50 MHz | 2.1 kW | 79% |
| 1.8 dB @ 150 MHz | 1.2 kW | 65% |
| 3.3 dB @ 450 MHz | 0.7 kW | 47% |

| Cable Only | | |
|---|---|---|
| DXE-400MAX | By the foot | **$.82/ft.** |
| DXE-400MAX-500 | 500 ft. | **$364.99** |

| Pre-cut Cable with Connectors | | |
|---|---|---|
| **Part Number** | **Length/Ft.** | **Price** |
| DXE-400MAXDU003 | 3 | **$11.88** |
| DXE-400MAXDU006 | 6 | **$14.88** |
| DXE-400MAXDU018 | 18 | **$26.88** |
| DXE-400MAXDU025 | 25 | **$33.88** |
| DXE-400MAXDU050 | 50 | **$58.88** |
| DXE-400MAXDU075 | 75 | **$83.88** |
| DXE-400MAXDU100 | 100 | **$100.88** |
| DXE-400MAXDU150 | 150 | **$158.88** |

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- Hi-Pot, high-voltage tested
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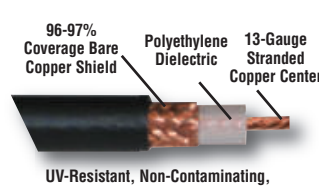
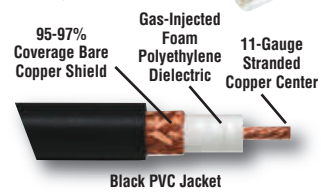



UV-Resistant, Non-Contaminating, Black PVC Jacket




Black PVC Jacket

***Gas-Injected Foam Won't Absorb Water.***

### *DXE-213U MIL-Spec Cable*

- .405" Type II jacket is non-contaminating and UV-resistant, suitable for outdoor use
- Direct-bury

| Attenuation/ 100 ft. | Power Rating | Efficiency % |
|---|---|---|
| 0.4 dB @ 5 MHz | 4.9 kW | 90% |
| 0.6 dB @ 10 MHz | 3.4 kW | 87% |
| 1.0 dB @ 30 MHz | 2.0 kW | 79% |
| 1.3 dB @ 50 MHz | 1.5 kW | 73% |
| 2.4 dB @ 150 MHz | 0.9 kW | 57% |

| Cable Only | | |
|---|---|---|
| DXE-213U | By the foot | **$.89/ft.** |
| DXE-213U-500 | 500 ft. | **$409.99** |

| Pre-cut Cable with Connectors | | |
|---|---|---|
| **Part Number** | **Length/Ft.** | **Price** |
| DXE-213UDU003 | 3 | **$11.88** |
| DXE-213UDU006 | 6 | **$14.88** |
| DXE-213UDU012 | 12 | **$20.88** |
| DXE-213UDU025 | 25 | **$33.88** |
| DXE-213UDU050 | 50 | **$57.88** |
| DXE-213UDU075 | 75 | **$80.88** |
| DXE-213UDU100 | 100 | **$99.88** |
| DXE-213UDU150 | 150 | **$144.88** |

### *DXE-8U Low-Loss Foam Dielectric Cable*

- .405" high-flex PVC jacket
- Low-loss foam dielectric

| Attenuation/ 100 ft. | Power Rating | Efficiency % |
|---|---|---|
| 0.3 dB @ 5 MHz | 5.4 kW | 93% |
| 0.5 dB @ 10 MHz | 4.1 kW | 90% |
| 0.9 dB @ 30 MHZ | 2.2 kW | 81% |
| 1.2 dB @ 50 MHz | 1.8 kW | 77% |
| 2.2 dB @ 150 MHz | 1.0 kW | 60% |

| Cable Only | | |
|---|---|---|
| DXE-8UDU | By the foot | **$.79/ft.** |
| DXE-8UDU-500 | 500 ft. | **$359.99** |

| Pre-cut Cable with Connectors | | |
|---|---|---|
| **Part Number** | **Length/Ft.** | **Price** |
| DXE-8UDU002 | 2 | **$10.48** |
| DXE-8UDU003 | 3 | **$11.48** |
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| DXE-8UDU025 | 25 | **$30.48** |
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*Continued from page 108*

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*Dimensions in Inches.*

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| Part Number | Nominal Size | Thread Bolt Size | Price |
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*Dimensions in Inches.*

***Clamps with black powdercoated saddles are also available in U-Bolt and V-Bolt styles, designed and sized to fit ½" to 2" tubing.***

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- Stainless Steel Saddles, serrated to secure hard pipe surfaces
- Stainless steel V-bolts and hardware

| Part number | Nominal Size | Price |
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*Dimensions in Inches.*
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| | | |
|---|---|---|
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|---|---|---|
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*Dimensions in Inches.*

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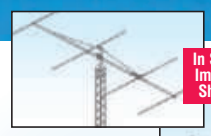

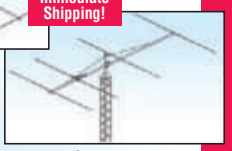

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| MSQ-EB432RK70CM | Eggbeater Satellite Antenna, 420-450 MHz | **$180.00** |
| MSQ-SATPACK1 | Eggbeater Satellite Antennas Package | **$378.00** |
| MSQ-44018 | 70cm Yagi Antenna | **$165.00** |
| MSQ-OR2800PX | Super-Duty HF Rotator Unit | **$1,592.00** |
| MSQ-OR2800PXAZ | Super-Duty HF Rotator Unit and Controller | **$1,906.00** |

### Super Duty Saddle Clamps

Super Duty Saddle Clamps are designed for maximum clamping strength to control large or unbalanced loads.

- A356-T6 cast aluminum saddle, with rough, as-cast finish for high-torque grip on masts, etc
- Cast stainless reinforcement plate included
- Armor coated bolt sets sold separately

| Part Number | Tube O.D. | Price |
|---|---|---|
| DXE-SDS-200P | 2.00 | **$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

## 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)**
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Tech/International: **330.572.3200** Country Code: **+1**
Sale Code: **1301QS**
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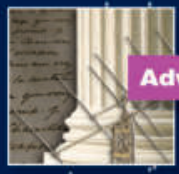
**Order by 4 pm ET (US) for Same-Day Shipping**

## We Will Beat Any Competitor's Price!





# Join or Renew!

**Devoted Entirely to Amateur Radio**

Includes QST

**www.arrl.org/join**

Great Gift Idea!

## Give the Gift of Ham Radio

### ☑ Membership options (circle your choice/s)

| | 1 Year | 2 Years | 3 Years | |
|---|---|---|---|---|
| Regular | $39 | $76 | $111 | Monthly *QST* via standard mail for US members |
| Canada | $49 | $93 | $132 | Monthly *QST* via standard mail for Canadian members |
| International *QST* | $62 | $118 | $167 | Monthly *QST* via air mail for international members |
| International – no printed *QST* | $39 | $76 | $111 | Digital *QST* only |
| Family | $8 | $16 | $24 | Reside at the same address as the primary member, no additional *QST*. Membership dates must correspond with primary member. |

Membership includes $15 per year for subscription to *QST*. Dues subject to change without notice and are nonrefundable.

Blind and youth rates are available. Contact ARRL for more details.

Additional membership options available online at www.arrl.org/join.

Name _____ Call Sign _____

Street _____ City _____ State _____ ZIP _____

E-mail _____ Phone _____

Family Member Name _____ Call Sign (if any) _____

### ☑ Payment Options

☐ Visa ☐ MasterCard ☐ Amex ☐ Discover ☐ Check Enclosed

Card Number _____ Expiration Date _____

Cardholder's Signature _____

☐ Total enclosed payable to ARRL $ _____

☐ I do not want my name and address made available for non-ARRL related mailings.

## Join Now

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**ARRL•225 Main Street•Newington, CT 06111-1494**
**Phone: 860-594-0338 • FAX: 860-594-0303**

Source Code: QST 12/2012

# DX ENGINEERING®

ICOM · Cushcraft Amateur Radio Antennas · hy-gain · CQ · HUSTLER · MFJ · AMERITRON · BELDEN · Tigertronics · VIBROPLEX · PLASTI DIP · The BetterRF Company · VECTRONICS ...World Class Quality · PolyPhaser · ROHN Products LLC · JSC WIRE & CABLE · LOCTITE · butternut · MIRAGE Communications Equipment · LDG ELECTRONICS · HEIL SOUND · DIAMOND ANTENNA · BENCHER, INC. · STI · RADIO · COMTEK SYSTEMS

**And More!**

# Winter DX is Here—Upgrade Your Station Now!

## IMPROVED Receiving!

### 100 kHz-30 MHz Receive Four-Square Packages

A patented*, sophisticated receiving system with time delay phasing for broadband performance. Optimized to produce wider and deeper rear nulls and a narrower main lobe. Noise and undesirable signals are greatly reduced by a superior front-to-rear ratio (F/R). Better control of phase and currents provides a cleaner pattern than found on available TX four-square arrays.

- Less susceptible to high angle signals compared to EWE, Flag, Pennant, and K9AY antennas
- Excellent directivity with better signal-to-noise ratio
- Switchable in four 90 degree-spaced directions
- Usable over a very wide frequency range with DXE-ARAV3 active elements
- Requires less area than a Beverage antenna
- Active elements require minimal ground system
- Enhanced relay contact reliability

The complete system includes all electronics, four ARA active antennas, TVSU sequencer, 1,000 feet of F6 flooded cable, connectors, and assembly tools.

| | | |
|---|---|---|
| DXE-RFS-SYS-4P | Complete System with antennas | **$1,650.00** |
| DXE-RFS-SYS-2P | Controller and Switch only | **$389.95** |
| DXE-RFS-SYS-3P | 160/80/40M Electronics | **$799.00** |

*US Patent Number 7,423,588*

### Full Size 75/80 Meter Quarter-Wave Vertical Antennas

These 68 foot tall, high-performance, full size antennas have rugged base sections (2, 3 or 4 inch diameter) made from aircraft-grade aluminum tubing. The VA-1 requires simple guying. The VA-2 and VA-3 models are very stout and don't require guying. The VA-2 and VA-3 antennas are supplied with a Heavy Duty Plus Stainless Pivot Base and can be lowered easily with the optional, DXE-VRW one-man, manual winch.

- 2:1 bandwidth up to 500 kHz
- DX Engineering structural design + high strength tubing custom manufactured to our rigid specifications **= Highest Wind Ratings**
- High strength, UV-protected Extren® insulator **= High Power Handling Capacity**
- Specially manufactured stainless steel and aluminum saddle clamps, stainless steel bolts, and precision machining **= Reliability Second to None**
- Specially manufactured Pivot Base supplied with VA-2 and VA-3 antennas **= Easy Tilt Up and Down**

| | | |
|---|---|---|
| DXE-7580FS-VA-1 | Vertical Antenna, standard HD, 2 inch O.D. base section | **$379.50** |
| DXE-7580FS-VA-2 | Vertical Antenna, Heavy Duty, 3 inch O.D. base section | **$825.00** |
| DXE-7580FS-VA-3 | Vertical Antenna, Super Duty, 4 inch O.D. base section | **$1,775.00** |

### DXE-VRW-1 Manual Winch

A great option, this winch allows one person to easily raise or lower a VA-2 or VA-3 vertical antenna.

DXE-VRW-1 Manual Winch.....**$169.99**

## Ameritron Amplifiers

Ameritron gives you the ability to command consistent and reliable power using these rugged units. Match these amplifiers to your transceiver and achieve impressive power and clarity. DX Engineering even stocks export models. For more Ameritron products at incredibly low prices, visit DXEngineering.com.

**AME-ALS-600**
***Only $1,269.00***

**AME-ALS-500M**
***Only $779.00***

**AME-AL-1200**
***Only $2,999.00***
**AME-AL-1500**
***Only $3,299.00***

**AME-AL-572**
***Only $1,679.00***

**AME-AL-811**
***Only $709.00***

**AME-AL-80B**
***Only $1,329.00***

| | | |
|---|---|---|
| AME-ALS-600 | 600 Watt Solid State Amplifier | **$1,269.00** |
| AME-ALS-500M | 500 Watt Solid State Mobile Amplifier | **$779.00** |
| AME-AL-1200 | 1,500+ Watt Single-Tube Amplifier | **$2,999.00** |
| AME-AL-1500 | 1,500+ Watt Single-Tube Amplifier | **$3,299.00** |
| AME-AL-572 | 1,300+ Watt 4-Tube Amplifier | **$1,679.00** |
| AME-AL-811 | 600 Watt 3-Tube Amplifier | **$709.00** |
| AME-AL-80B | 1,000 Watt Single-Tube Amplifier | **$1,329.00** |

## Low Sale Price!

### SignaLink™ USB Unit from Tigertronics

Made in USA

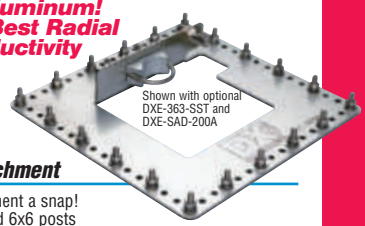
- Software included on CD ROM
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Easiest installation and setup—for Mac or PC
- Supports all sound card digital and voice modes, including MT63, EchoLink®, PSK-31, SSTV, CW and RTTY

TGR-SL-USB.....**$84.50**

- **Requires a radio interface cable**

Any radio interface cable is only **$12.95** when purchased with a SignaLink™ unit

## Not Cheap Aluminum! Guarantees Best Radial System Conductivity Over Time




### Stainless Radial Plate with Coax Attachment

Makes radial attachment a snap!

- Fits 3" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

***Now fits up to 3" O.D. mount***

| | | |
|---|---|---|
| DXE-RADP-3 | Complete with 20 stainless bolt sets | **$54.50** |
| DXE-RADP-1HWK | 20 sets of 1/4" stainless hardware | **$7.50** |
| DXE-SSVC-2P | Stainless Saddle Clamp for attachment to steel tube 1" to 2" O.D. | **$11.95** |

### Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

| | | |
|---|---|---|
| DXE-UT-8213 | Cable Stripper for RG-8, RG-213, etc | **$39.95** |
| DXE-UT-808X | Cable Stripper for RG-8X, 9258, etc | **$39.95** |
| DXE-UT-80P | PL-259 Assembly Tool | **$22.95** |
| DXE-UT-80N | 2-Piece N Connector Tool | **$22.95** |
| CNL-911 | Coax Cable Cutters | **$23.75** |
| DXE-170M | Precision Shear Side Cutters | **$7.95** |

**Now available in cost-saving tool kits with carrying case**

| | | |
|---|---|---|
| DXE-UT-CASE | Molded carrying case only | **$22.95** |
| DXE-UT-KIT1 | Basic Coax Cable Prep Kit | **$99.95** |
| DXE-UT-KIT2 | Complete Coax Cable Prep Kit | **$174.95** |


**TOTALLY FREE SHIPPING ON COMTEK BALUNS***

### COMTEK W2FMI Series Baluns

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# We Will Beat Any Competitor's Prices—Call Us for Details!

# The #1 Line of Autotuners!

## Antennas

**FREE!** ***RBA-1:1 Balun or RU-4:1 Unun When You Buy A S9V 43', 31' or 18' Multiband Antenna***

*Purchase an S9v 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!*

### S9v43 $199.99
**80-6 meters** *Fixed Operation*

The S9v 43' is a high-performance lightweight telescoping fiberglass vertical. The best value in high-performance 'tall' verticals!

### S9v31 $99.99
**40-6 meters** *Fixed or Portable Operation*

### S9v18 $49.99
**20-6 meters** *Fixed or Portable Operation*

The S9v 31' and 18' are tapered, ultra-lightweight fiberglass vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

### S9rp $39.99
**Aluminum Radial Plate**

Includes 20 sets of stainless steel nuts & bolts

***Designed to handle the higher power of the Tokyo Hi Power HL-45B.***

### NEW! Z-817H
The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal Alkaline batteries (not included). 2000 memories cover 160 through 6 meters.

***Suggested Price $159.99***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

### AT-200ProII
The AT-200ProII now includes LEDs to show antenna position and if the tuner is in bypass. A two position antenna switch stores 2000 memories per switch. Handles up to 250 watts SSB or CW on 1.8 to 30 MHz and 100 watts on 54 MHz. Rugged and easy to read LED bar graphs simultaneously show RF power and SWR. Includes a six foot DC power cable. ***Suggested Price $259.99***

### AT-1000ProII
LDG Electronics' new flagship 1KW tuner features: 5 to 1,000Watts PEP; RF Sensing; Auto and Semi Tuning Modes; 1.8 to 54 MHz range; 6 to 800 ohm range (15 to 150 on 6M); simplified operation; and an optional external 4.5" analog meter. With the two position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six foot DC power cable. ***Suggested Price $539.99***

***Optional M-1000 external analog meter $129.99***

### IT-100
Matched in size to the IC-7000 and IC-706, for either manual or automatic tunes, and status LEDs. Control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. For your Icom radio that is AH3 or AH-4 compatible.

***Suggested Price $179.99***

### YT-100
For Yaesu FT-857, FT-897 and FT-100 (and all D models) an integrated tuner, powered by the interface. Press the tune button on the tuner, and everything else happens automatically.

***Suggested Price $199.99***

### KT-100
For AT-300 compatible Kenwood transceivers (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies.

***Suggested Price $199.99***

### YT-450
Designed for Yaesu's newest 100 watt radios. Interfaces directly with the Yaesu FT-450 and FT-950 radios. Press the tune button on the tuner and the rest happens automatically. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1. 2000 memories recall settings in an instant! Seamless connection to a PC. ***Suggested Price $249.99***

### YT-847
YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the tune button on the tuner and everything else happens automatically! ***Suggested Price $249.99***

LDG ELECTRONICS

## *Your Favorite Dealer has these tuners in stock NOW!*

1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

# We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

LDG ELECTRONICS

radio not included

## AT-897Plus
### for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price $199.99***

## NEW! AT-600ProII

Building on the success of the AT-600Pro, we refined and expanded the model with an optional external 4.5" analog meter. The new AT-600ProII keeps many of the same features of the previous model, but simplifies the operation. With the two-position antenna switch, there are 2,000 memories that store tuning parameters for almost instantaneous memory recall whenever you transmit on or near a frequency you've used before. Includes six-foot DC power cable. ***Suggested Price $369.99***

***Optional M-600 external analog meter $129.99***

## Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes six foot DC power cable. ***Suggested Price $159.99***


- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

## AT-100ProII

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch with LEDs, allowing you to switch instantly between two antennas. The AT-100ProII requires just 1 watt for operation, but will handle up to 125 watts. Includes six foot DC power cable.

***Suggested Price $229.99***

## Z-11ProII

Meet the Z-11ProII, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes six foot DC power cable. ***Suggested Price $179.99***

radio not included

## Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required.

***Suggested Price $129.99***

## Don't Miss Out - Call or visit them TODAY!

***Visit our website for a complete dealer list*** **www.ldgelectronics.com**

# hy-gain® Rotators

## . . . the first choice of hams around the world!

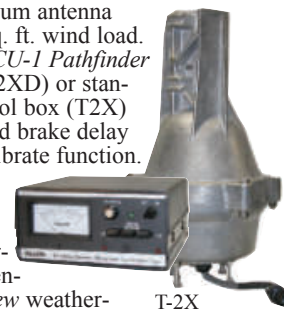
### HAM-IV

HAM-IV **$649.95**

***The most popular rotator in the world!*** For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

| *HAM IV and HAM V Rotator Specifications* | |
|---|---|
| Wind Load capacity (inside tower) | 15 square feet |
| **Wind Load (w/mast adapter)** | **7.5 square feet** |
| Turning Power | 800 in.-lbs. |
| **Brake Power** | **5000 in.-lbs.** |
| Brake Construction | Electric Wedge |
| **Bearing Assembly** | **dual race/96 ball bearings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 26 lbs. |
| **Effective Moment (in tower)** | **2800 ft.-lbs.** |

### TAILTWISTER SERIES II



**For** large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

| *TAILTWISTER Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 20 square feet |
| **Wind Load (w/ mast adapter)** | **10 square feet** |
| Turning Power | 1000 in.-lbs. |
| **Brake Power** | **9000** in.-lbs. |
| Brake Construction | Electric Wedge |
| **Bearing Assembly** | **Triple race/138 ball brngs** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 31 lbs. |
| **Effective Moment (in tower)** | **3400 ft.-lbs.** |

### CD-45II

CD-45II **$449.95**

**For** antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

| *CD-45II Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 8.5 square feet |
| **Wind Load (w/ mast adapter)** | **5.0 square feet** |
| Turning Power | 600 in.-lbs. |
| **Brake Power** | **800 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/48 ball brings** |
| Mounting Hardware | Clamp plate/steel U-bolts |
| **Control Cable Conductors** | **8** |
| Shipping Weight | 22 lbs. |
| **Effective Moment (in tower)** | **1200 ft.-lbs.** |

### HAM-V

HAM-V **$1099.95** with DCU-1

**For** medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

### AR-40

AR-40 **$349.95**

**For** compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

| *AR-40 Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 3.0 square feet |
| **Wind Load (w/ mast adapter)** | **1.5 square feet** |
| Turning Power | 350 in.-lbs. |
| **Brake Power** | **450 in.-lbs.** |
| Brake Construction | Disc Brake |
| **Bearing Assembly** | **Dual race/12 ball bearings** |
| Mounting Hardware | Clamp plate/steel bolts |
| **Control Cable Conductors** | **5** |
| Shipping Weight | 14 lbs. |
| **Effective Moment (in tower)** | **300 ft.-lbs.** |

### HDR-300A

HDR-300A **$1499.95**

***King-sized*** antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

| *HDR-300A Rotator Specifications* | |
|---|---|
| Wind load capacity (inside tower) | 25 square feet |
| **Wind Load (w/ mast adapter)** | **not applicable** |
| Turning Power | 5000 in.-lbs. |
| **Brake Power** | **7500 in.-lbs.** |
| Brake Construction | solenoid operated locking |
| **Bearing Assembly** | **bronze sleeve w/rollers** |
| Mounting Hardware | stainless steel bolts |
| **Control Cable Conductors** | **7** |
| Shipping Weight | 61 lbs. |
| **Effective Moment (in tower)** | **5000 ft.-lbs.** |

### ROTATOR OPTIONS

**MSHD, $109.95**. Heavy duty mast support for T2X, HAM-IV and HAM-V.
**MSLD, $49.95**. Light duty mast support for CD-45II and AR-40.
**TSP-1, $34.95**. Lower spacer plate for HAM-IV and HAM-V.

### Digital Automatic Controller

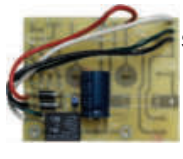
DCU-1 **$749.95**

**Automatically** controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

### AR-303 Rotator/Controller

AR-303 **$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**

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## IC-V80 2M FM Handheld

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 5.5/2.5/0.5W • Memories: 207
- Comes with NiMH Battery and Wall Charger


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## IC-T70A 2M/440 FM Handheld

- TX: 144-148, 430-450 MHz • RX: 136-174, 400-479 MHz
- Power: 5/2.5/0.5W • Memories: 302
- Comes with NiMH Battery and Wall Charger

## IC-718 HF Transceiver

- TX: HF (except 60M) • RX: 0.03-30 MHz
- Power: 5-100W • Memories: 101 • DSP built-in
- SSB, CW, RTTY and AM (2-40W)

## IC-7000 HF/6/2M/440 MHz Mobile

- TX: HF/6/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
- Memories: 503 • 41 band-widths w/sharp or soft filter shape

$10 Instant Coupon! Ends 12-31-12

## IC-V8000 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 75/25/10/5W • Memories: 207

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## 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-2300H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207

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## IC-7410 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- 15kHz 1st IF filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
- Automatic antenna tuner • USB connector for PC control

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## 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

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## IC-9100 HF/6/2M/440 MHz All Mode

- TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
- Power: 2-100W HF/6/2M & 2-75W 440 MHz
- Memories: 297 • Optional D-Star Board • Auto Tuner
- USB Port for CI-V Format PC Control & Audio In/Out

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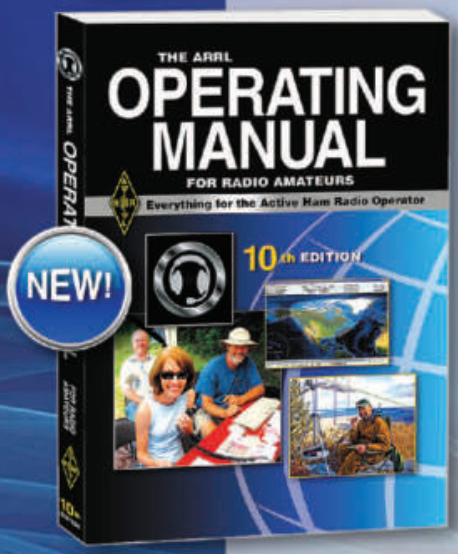


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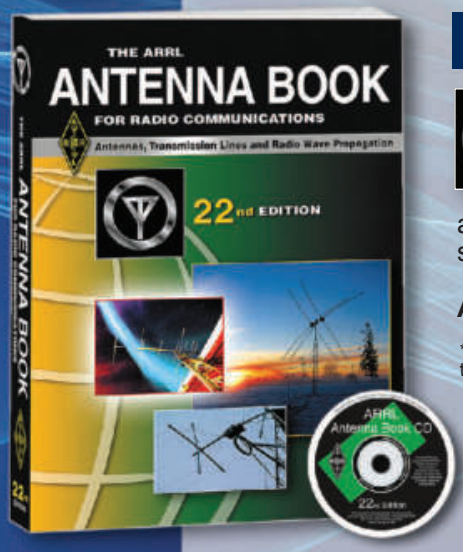


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## FT-250R 2M FM HT

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 5/2/0.5W • Memories: 209

## VX-6R 2M/440 FM Dual Band HT

- TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
- Power: 5/2.5/1/0.3W (1.5W on 220) • Memories: 900
- Submersible 3 feet for 30 minutes

## VX-8GR 2M/440 FM HT Built-in GPS

- TX: 144-148, 430-450 MHz • RX: 108-999 MHz (cell blocked) • Memories: 1200+ • Power: 5/2.5/1/0.05W
- GPS unit and antenna is built-in for APRS® data


## FT-1900R 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 55/25/10/5W • Memories: 221


## FT-2900R 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 75/30/10/5W • Memories: 221


## FT-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-857D 100W HF/VHF/UHF Mobile

- TX: HF/6M/2M/440 MHz • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200 • YSK-857 included!

## FT-897D 100W HF/VHF/UHF Portable

- Same band coverage and power output as the FT-857D
- Can operate 20W using optional FNB-78 13.2V Ah NiMH battery packs


## FT-950 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner
- 32-bit Floating Point DSP • Built-in high stability TCXO


## FTDX-3000D HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 5-100W
- Large color display with high speed spectrum scope
- High end receiver based off the FTDX-5000
- Built-in USB interface • High speed auto tuner


**FTDX-5000MP**

Covers HF and 6M; Three different configurations all running 10-200W on CW, SSB, FM, RTTY and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" also comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

**FTDX-5000** - Basic Model & ±0.5ppm TCXO
**FTDX-5000D** - With Station Monitor & ±0.5ppm TCXO
**FTDX-5000MP** - With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

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## 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 power supplies) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band

**TS-480SAT** 100W version with built-in automatic antenna tuner.


## TS-2000 100W HF/VHF/UHF Transceiver

- TX: HF/6/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz) • Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

**TS-B2000** Same as the TS-2000 with no front panel controls. Includes PC control software.

**TS-2000X** The TS-2000 with 1.2 GHz @ 10W.

## TS-590S 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz
- Power: 5-100W (5-25W on AM)
- Memories: 110 + 10 Quick Channels
- HF/6M Auto Antenna Tuner
- Full/semi break-in CW • 10 Hz Dual VFO Display
- USB connectivity for PC and remote control

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# MFJ-259B *World's* most popular Antenna Analyzer is super easy-to-use!

MFJ-259B
**$289.95**

***The MFJ-259B is the world's most popular Antenna Analyzer and the easiest to use! Just select a band and mode. Set frequency. Your measurements are instantly displayed!***

### Handheld Antenna Lab

**Owning** the MFJ-259B is like having an entire antenna lab in the palm of your hand!

**Measure** SWR quickly or make sophisticated measurements such as Return Loss, Reflection Coefficient, Resonance, Complex Impedance (R+jX), Impedance Magnitude (Z) plus Phase in degrees. Covers 1.8 to 170 MHz -- no gaps.

### Coax Analyzer

**Determine** coax cable velocity factor (Vf), loss in dB, coax length, distance to open or short plus detect wrong coax impedance.

### Frequency Counter

**Measure** frequency of external signals using the separate BNC counter input.

### Signal Generator

**Use** as a signal source 1.8-170 MHz with digital dial accuracy for testing and alignment.

### Inductance and Capacitance

**Measure** Inductance (uH) and Capacitance (pF) at RF frequencies not at audio frequencies used by most L/C meters.

### Digital and *Analog* Meters

**A** high-contrast backlit LCD gives precision readings and *two* side-by-side *analog meters* make antenna adjustments intuitive.

### Smooth, Stable Tuning

**Velvet-smooth** reduction drive tuning and precision *air-variable capacitor* makes setting frequency easy and stable.

### Battery Saver & More

**Battery-saver**, low-battery warning, battery voltage meter and charger are all built in. Use ten Alkaline, NiCad or NiMH AA batteries (not included) or 110 VAC with MFJ-1312D, $15.95. 4Wx6¾Hx2D inches.

### Here's What You Can Do

**Find** true antenna resonant frequency
***Tune*** *antenna quickly for minimum SWR*
**Match** complex loads to your feedline
***Adjust*** *mobile whips without stressing finals*
**Determine** safe 2:1-SWR operating windows
***Adjust*** *tuners without generating QRM*
**Find** exact location of shorts and opens
***Cut*** *stubs and phasing lines accurately*
**Check** cable for loss and contamination
***Find*** *value of unknown coils and caps*
**Test** RF transformers and baluns
***Troubleshoot*** *filters and networks*
**Find** self-resonance and relative Q
***Check*** *patterns and compare gain*
**MFJ-259B** does all this and more!

### MFJ Analyzer Accessories

**MFJ-29C, $24.95.** Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Special foam-filled fabric cushions blows, deflects scrapes and protects knobs and meters from harm. **MFJ-39C, $24.95.** Like MFJ-29C, but for MFJ-269.

**MFJ-66, $24.95.** Plug-in coils turns any MFJ Antenna Analyzer into a sensitive and accurate *band switched* dip meter. 2 coils.

**MFJ-92AA10, $29.95.** Ten MFJ *SuperCell*™ Ni-MH AA rechargeable batteries.

**MFJ-99B, $88.90.** ***Save $7!*** MFJ-259B Deluxe Accessory Pack: MFJ-29C Pouch, 10 Ni-MH batteries, dip coils, AC adapter. **MFJ-98B, $88.90.** Like MFJ-99B but for MFJ-269.

**MFJ-99, $60.85.** ***Save $5!*** Like MFJ-99B, less batteries, for MFJ-259B. **MFJ-98, $60.85.** Like MFJ-99 but for MFJ-269.

**MFJ-99C, $40.90.** ***Save $5!*** AC Adapter and 10 Ni-MH batteries for MFJ-259B/269.

**MFJ-917, $29.95.** Current balun lets you make balanced line antenna measurements on HF with your MFJ Analyzer. **MFJ-7702, $3.95.** MFJ-917 to MFJ Analyzer adapter.

**MFJ-731, $99.95.** Tunable RF filter allows accurate Antenna Analyzer measurements in presence of strong RF fields. 1.8-30 MHz.

**MFJ-5510, $9.95.** Cigarette lighter cord.

# MFJ-269 ...1.8-170 MHz and 415-470 MHz plus 12-bit A/D!

***The MFJ-269 does everything the MFJ-259B does - and much more!***

### Expanded Frequency Coverage

**MFJ-269** adds UHF coverage from 415 to 470 MHz -- right up into the commercial band. With it, you can adjust UHF dipoles, verticals, Yagis, quads and repeater collinear arrays with ease -- plus construct accurate phasing harnesses and timed cables. Also use it as a signal source to check UHF duplexers, diplexers, IMD filters and antenna patterns.

### Much Better Accuracy

**New** *12-bit* A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

### Complex Impedance Analyzer

**Read** Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads *parallel* equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

MFJ-269
**$389.95**

### CoaxCalculator™

**Lets** you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

### Use any Characteristic Impedance

**You** can measure SWR and coax loss with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

### Logarithmic Bar Graph

**Has** easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

**Uses** instrumentation grade N-connector to ensure minimum mismatch on all frequencies. Includes N to SO-239 adapter.

### MFJ-269*PRO*™ Analyzer

MFJ-269PRO
**$419.95**

**Like** MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

# MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

***New!***

MFJ-266
**$349.95**

**The** compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

**In** *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

**In** *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

**MFJ-266** also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

**Features** include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

**Use** eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

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## 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.

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# MFJ *IntelliTuner*™ Automatic Tuners

## *More hams use MFJ tuners than all other tuners in the world!*

***World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .***

## MFJ-998 1500 Watt *Legal Limit IntelliTuner*™

***Only the MFJ-998 gives you fully automatic antenna tuning for your legal limit full 1500 Watts SSB/CW linear amplifier!***

MFJ-998 **$699.95**

***Ultra-fast Automatic Tuning***

**Instantly** match impedances from 12-1600 ohms using MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms with over 20,000 *VirtualAntenna*™ Memories.

***Safe auto tuning protects amp***

**MFJ's** exclusive *Amplifier Bypass Control*™ makes tuning safe and "stupid-proof"!

***Digital/Analog Meters***

**A** *backlit* LCD meter displays SWR, forward/reflected power, frequency, antenna selected, an auto-ranging bargraph power indication, and much more.

**Has** quick-glance auto-ranging Cross-Needle SWR/Wattmeter.

***MFJ VirtualAntenna™ Memory***

**MFJ** new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 switchable antenna coax connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total. Has binding post for end-fed long wire antennas.

***Download & Upgrade Remotely***

**Download** from internet and upgrade your MFJ-998 firmware as new features are introduced.

***Plus Much More!***

**Built-in** radio interface controls most transceivers.

**Automatically** bypasses with excessive tuning power.

**Use** balanced line antennas with external **MFJ-912, $59.95**, 1.5 kW 4:1 balun.

**Small** 13Wx4Hx15D inches easily fits into your ham station. 8 pounds. Requires 12-15VDC at 1.4 amps maximum or 110 VAC with **MFJ-1316, $21.95**.

### *for 600 Watt amps*

***AL-811/ALS-600/ALS-500***

**For** 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

***No Matter What*™ Warranty**

**Every** MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

## 300 Watt...Best Seller

***Digital Meter, Ant Switch, Balun***

**The** *world's best selling* automatic antenna tuner is *highly acclaimed the world over* for its ultra high-speed, wide matching range, reliability, ease-of-use! Matches virtually *any* antenna.

MFJ-993B **$259.95**

## 300 Watt...Wide Range

***SWR/Wattmeter, 10000 VA Memories***

***Extra*** *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

## 200 Watt ... Compact

***Digital Meter, Ant Switch, Wide Range***

**World's** fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

## 200 Watt ... Econo

***Small, Ant Switch, 20K VA Memories***

**High-speed**, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

## 200 Watt *MightyMite*™

***Matches IC-706, FT-857D, TS-50S***

***No extra space needed!*** Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

## *G5RV Antenna*

**Covers** all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

**MFJ-1778M, $39.95.** G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

MFJ-1778 **$44.95**

## 200W...Weather-sealed

***for Remote/Outdoor/Marine***

***Fully*** *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926B **$279.95**

## 200 Watt...Remote

***Coax/Wire Ant, No pwr cable needed***

**Weather** protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 **$259.95**

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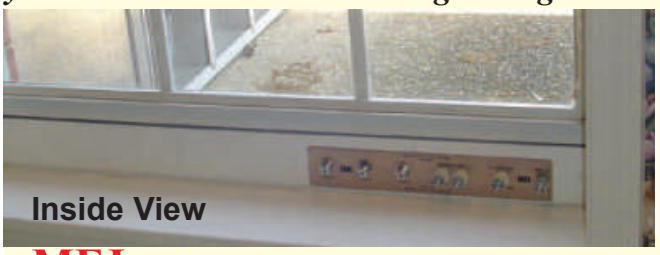
# MFJ Weather-Proof *Window Feedthrough Panels*

***Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!***





**MFJ** Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

**Simply** place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3 1/2 inch high, 3/4 inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

**Inside**/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.


## *MFJ-4603 Universal Window Feedthru Panel*

MFJ-4603 **$89.95**

**Four** 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

**A** 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

**A** 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

**A** pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

**Has** random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

**Stainless** ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

**MFJ's** exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1 1/4X1 5/8 in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.

### *3 Coax, Balanced Line, Random Wire*

**Best Seller!** 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602 **$69.95**

### *6 Coax*

**6** high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601 **$59.95**

### *4 Balanced Line, 2 Coax*

**4** pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

**New!** MFJ-4600 **$79.95**

### *5 Cables, any-size*

**5** *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1 1/4x1 5/8 inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604 **$99.95**

### *All-Purpose FeedThru/CableThru*™

***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605 **$159.95** **New!**

## Bring cables thru eave of your house

MFJ-4616 shown with standard full-size vent (not included) it replaces. For *6 Cables* **$26.95**

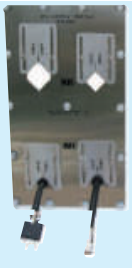
MFJ-4613 shown with standard half-size vent (not included) it replaces. For *3 Cables* **$14.95**

**Replace** your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

**Bring** in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1 1/4x1 5/8 inches!

**Sliding** plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

## *AdaptiveCable*™ Wall Plates



MFJ-4614 *For 4 Cables* **$34.95**

**Bring** nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1 1/4x1 5/8 inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

**Includes** *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612 *For 2 Cables* **$24.95**

MFJ-4611 *For 1 Cable* **$14.95**

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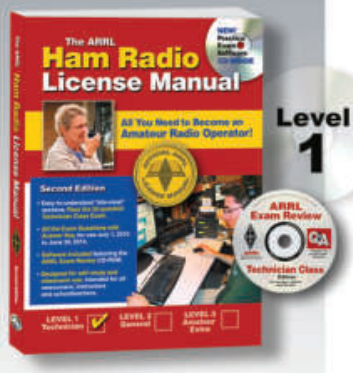


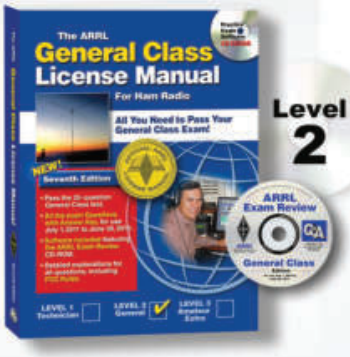


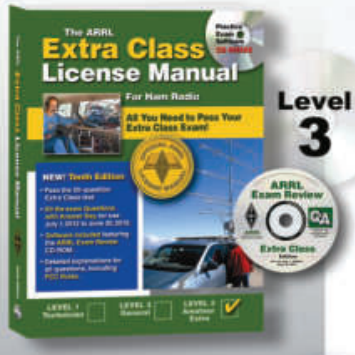


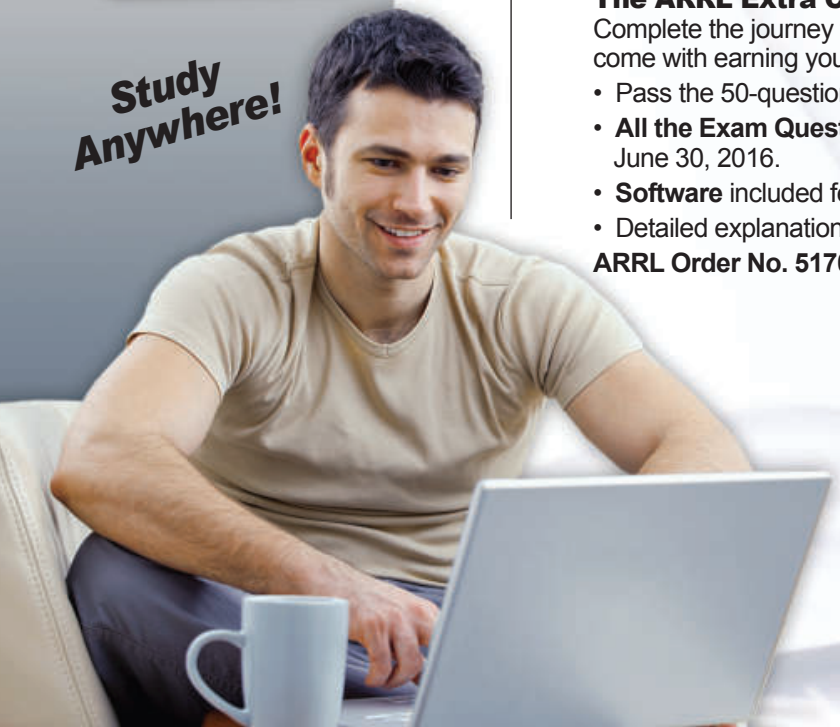


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Each book now includes the ARRL Exam Review CD-ROM. Use the software with your book to review the study material. Take randomly-generated practice exams using questions from the actual examination question pool. Additional features allow you to print sample exams…as many as you like. ARRL Exam Review tracks your progress, giving you the feedback you need to fine-tune your studies. **You won't have any surprises on exam day!**

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# MFJ All-Band G5RV Antennas

## *Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!*

MFJ-1778
**$44.95**

***The** famous G5RV antenna is the most popular ham radio antenna in the world!* You hear strong signals from G5RVs day and night, 24/7.

**And it's no wonder . . .** it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

**Use** as Inverted Vee or Sloper, and it's even more compact and needs just one support.

**With** an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

**MFJ's** fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

**MFJ-1778M, $39.95.** *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

## *MFJ All Band Doublet*

MFJ-1777
**$59.95**

**MFJ-1777** is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

## MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
**$89.95**
80/40 Meters

**MFJ-17758** is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

**MFJ-17754, $59.95.** Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

## MFJ *Single Band* Dipole Antennas

**Ultra** high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A **$69.95** 160M, 265 ft.
MFJ-1779B **$49.95** 80-40M, 135 ft.
MFJ-1779C **$29.95** 20-6M, 35 ft.

## *True* 1:1 Current *Balun & Center Insulator*

MFJ-918
**$24.95**

**True** *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

## RF Isolator

MFJ-915
**$29.95**

**MFJ-915** *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz.

**MFJ-919, $59.95.** 4:1 current balun,1.5 kW.
**MFJ-913, $29.95.** 4:1 balun, 300 Watts.

## Antenna Switches

MFJ-1704
**$79.95**
4-Positions

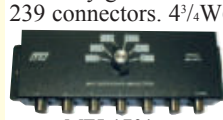
**MFJ-1704** heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D in.

MFJ-1702C
**$39.95**
2-Positions

**MFJ-1702C** Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
**$99.95**

**MFJ-1700C** *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.



MFJ-1701
**$69.95**

**MFJ-1701** *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

## 33 ft. Telescoping fiberglass Mast

### *3.8 feet collapsed, 3.3 lbs.*

MFJ-1910
**$79.95**

**Super** strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

## Make your own antennas

### *Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.*

**MFJ-16C06, $4.56.** 6-pack authentic *glazed ceramic* end/center antenna insulators.
**MFJ-16B01, $19.95.** Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.
**MFJ-18G100, $24.95.** 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.
**MFJ-58100X, $49.95.** 100 ft. 50-Ohm RG-8X with PL-259s on each end.
**MFJ-18H100, $34.95.** 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

### *Lightning Surge Protectors*

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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# MFJ Dummy Load/Wattmeter

## 1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

MFJ-267
**$159.95**


**World's** most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

**You'll** find tons of uses!

**Tune** up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

**Use** for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

**The** 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

**Extra-large** three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

**Reads** *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

**High** accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

**RF** tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with **MFJ-1312D, $15.95.**

## MFJ HF/VHF/UHF Dummy Loads

### *Dry* 300 Watt *HF /VHF* Dummy Load

MFJ-260C
**$39.95**

**Air-cooled**, non-inductive resistor in a perforated metal housing; Has SO-239 connector. Full load for 30 seconds. Silk-screened derating curve to 5 minutes. Handles 300 Watts. SWR is below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz. Compact 2¼x2¼x7 inches. **MFJ-260CN, $49.95.** With type "N" connector.

### *Dry* 1.5 kW *HF/VHF/UHF* Dummy Load

MFJ-264
**$74.95**

**Ham** radio's most versatile 50 ohm *dry* dummy load. Works with all radios from 160 Meters through 650 MHz. SWR below 1.3 to 650 MHz and below 1.1 at 30 MHz. Handles 100 watts for ten minutes, 1500 Watts for 10 seconds. 3Wx3H x9D inches. Has SO-239 connector. **MFJ-264N, $84.95.** With type "N" connector.

### *Oil-Cooled 1 KW CW, 2 KW SSB VersaLoad ™*

MFJ-250X
**$49.95**

**Run** 1KW CW or 2 KW PEP for 10 minutes. Run *continuous duty* with 200 Watts CW or 400 watts PEP. Transformer oil not included. Low VSWR to 400 MHz. Under 1.2:1 to 30 MHz. SO-239 connector. Safety vent with cap, carrying handle. 7½Hx6⅝D inches. **MFJ-250, $69.95.** Includes transformer oil (no PCB).

### 3 GHz, 300 Watts Dry Dummy Load

MFJ-263
**$99.95**

***New high-tech metal film resistor gives low SWR up to 3 GHz at 300 Watts!*** Mounted on large heavy-duty air-cooled heatsink. SWR is less than 1.1 DC to 1 GHz, 1.2 at 1.5 GHz and 1.5 at 3 GHz. Handles 125 Watts *continuous* and 300 Watts for ten seconds. High quality *Teflon*(R) N connector. 10¾Wx2¼Hx5¼D in. **New!**

### *MFJ Frequency Counters*

MFJ-886
**$129.95**

**MFJ-886** covers 1 MHz to 3 GHz with 300 MHz direct count, 0.1 Hz resolution. 4 gate times. 10-digit high-contrast 3/4 inch LCD display. Lock display button. Bargraph shows RF field strength. Includes rechargeable Ni-Cad batteries, charger, telescopic antenna. Black anodized aluminum. 2¾x2¼x1¼ inches.

MFJ-888
**$199.95**

**MFJ-888**, like MFJ-886, but covers *10 Hz*-3 GHz. Measures frequency/ period, has 50/1M Ohm input, auto hold, LED backlight, beeper. 2¾x4¼x1¼ inches

### *Field Strength Meters*

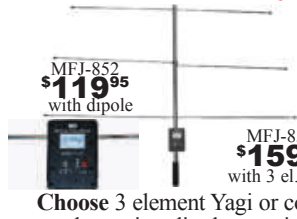
MFJ-802
**$49.95**

**MFJ-802** shows relative antenna field strength. Use to determine radiation pattern. Has large 3 inch meter. Telescoping *dipole* reduces influence of surrounding objects and is more reliable and repeatable than monopole. Sensitivity control. Jack for remote sensor. **MFJ-802R, $34.95.**

MFJ-801
**$29.95**

**MFJ-801** has 1¾ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

### *Find Power Line Noise fast!*



MFJ-852
**$119.95**
with dipole

MFJ-856
**$159.95**
with 3 el.Yagi

**Choose** 3 element Yagi or compact telescoping dipole to quickly pinpoint noise. Walk or drive with these handheld, directional noise finders to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise directly to pole, transformer, insulator or others. Has field-strength meter, headphone jack to listen or record. Operates in optimum 135 MHz region. Sensitive .3uV receiver, 70 dB AGC.

### *81 dB Step Attenuator*

MFJ-762
**$89.95**

**81 dB** Attenuator in 1 dB steps. 50 Ohms. Usable to 500 MHz. 250 milliwatt maximum input. BNC connectors. Shielded stages. Connect between receiver and antenna and use S-meter as a precision calibrated field strength meter. Prevent receiver blocking, cross-modulation. Determine gain/loss, ideal for fox hunting. Evaluate linearity. Isolate circuits. Extend range of sensitive equipment. Measure input/output level differences.

### *Compact Cross-Needle SWR/Wattmeters*

MFJ-822
**$59.95**

**MFJ-822, $59.95.** Large 3-inch *lighted* Cross-Needle meter covers 1.8-200 MHz in 2 power ranges: 30/300 Watts. Read forward, reflected power, SWR *simultaneously*. Compact 3¼Wx3¼Hx3¼D inches takes little space. Perfect for home, mobile or portable use. SO-239 connectors. Use 12 VDC for lamp (cable included). **MFJ-842, $59.95.** Like MFJ-822, but covers 140-525 MHz, 15/150 Watt ranges.

### *25-1300 MHz Discone Antenna*

MFJ-1868
**$59.95**

**Ultra** wide-band antenna receives 25-1300 MHz. Perfect for scanners. Transmit 50-1300 MHz. Handles 200 Watts. Ideal for 6/2/1¼Meters, 70/33/23 CM ham bands. Excellent for testing various transmitters on single coax. SO-239, 50 feet coax, stainless steel elements.

### Free MFJ Catalog

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**Tech Help:** (662) 323-0549
**FAX:**(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

# 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**

**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-1116 **$59.95**

**MFJ-1116, $59.95.** 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112 **$44.95**

**MFJ-1112, $44.95.** 6 pairs binding posts, 15 Amps total.

MFJ-1117 **$64.95**

**MFJ-1117, $64.95.** Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

### *All PowerPoles*™

MFJ-1128 **$104.95**

**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-1126 **$84.95**

**MFJ-1126, $84.95.** 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®*, *extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

MFJ-1129 **$114.95**

### *PowerPoles™ AND 5-Way Binding Posts*

**MFJ-1129, $114.95.** 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, 12½Wx1¼Hx2¾D inches.

MFJ-1124 **$64.95**

**MFJ-1124, $64.95.** 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost*.

## 15 Amp Continuous

**15 Amps** continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. 1½ lbs. Tiny 3¾Wx2¼Hx3¾D inches fits easily in an overnight bag.

MFJ-4115 **$59.95**

## 30 Amps Continuous

### *Linear with 19.2 lb.Transformer*

***No RF Hash!***

**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

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• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ


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# MIRAGE. . .160 Watts on 2 Meters!

***Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer. . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .***

***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 inches.


B-5018-G **$329.95**

**B-1018-G, $409.95.** MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.25-10 Watt rigs.

**B-2518-G, $329.95.** Same as B-5018-G but for 10 to 25 Watt mobile or base. 160 Watts out for 25 Watts in.

**RC-2, $49.95.** Remote Control. On/Off,pre-amp On/Off, selects SSB/FM. With 25 foot 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 |

## 35 Watts for 2 Meter HT

**For** handhelds up to 8 Watts. 35 Watts out for 3-8 Watts in (18 W out/1W in)! 18 dB *GaAsFET* preamp. All modes: FM, SSB, CW. RF sense T/R switch. Reverse polarity protection. Includes mobile bracket, 1 year warranty. 5¼Wx1¾Hx4¾D in.

B-34-G **$129.95**

***35 Watts, $109.95, FM only***

**B-34, $109.95.** 35 Watts out for 2 Watts in. Like B-34-G, FM only, less pre-amp, mobile bracket. 3⅛Wx1¾Hx4¼D in.

## *MIRAGE Dual Band* 144/440 MHz Amp

**Boost** your *dual band* 144/440 MHz handheld to a powerful mobile/base -- 45 Watts on 2 Meters/ 35 Watts on 440 MHz! Works with all FM handhelds to 7 Watts. Includes *full duplex* operation -- lets you talk on one band, listen on other at same time. Auto band selection, RF sense T/R switch, single connector, reverse polarity protection, 5Wx1¾Hx5D in. Mobile bracket. One year warranty.

BD-35 **$199.95**

## 100 Watts for 2M HT

**100** Watts out for 2-8 Watts in! Great for HTs up to 8W. FM, SSB, CW. 15 dB *GaAsFET* preamp, RF sense T/R, high-SWR protected.

B-310-G **$249.95**

***http://www.mirageamp.com***

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***800-647-1800***

**Tech:** 662-323-8287 **Fax:** 662-323-6551

***MIRAGE***

*300 Industrial Park Rd Starkville, MS 39759*

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***MIRAGE . . . the world's most rugged VHF/UHF amplifiers!***

# the *finest* antenna tuner made!

***. . . the VECTRONICS HFT-1500***

- ***High Current Roller Inductor***
- ***SSB*Analyzer Bargraph™***
- ***Cross-Needle Meter***
- ***6 Position Antenna Switch***
- ***Built-in 4:1 Balun***
- ***Gear driven Turns Counter***

***The VECTRONICS HFT-1500 is not just an antenna tuner . . . it's a beautifully crafted work of art, using the finest components available and the highest quality construction.***

***Every*** HFT-1500 aluminum cabinet is carefully crafted with a super durable paint that won't scratch or chip.

**Attractive** two-color Lexan front panel is scratch-proof. Take a quarter. Scratch the front panel. You won't leave a mark!

### *Arc-Free Operation*

**Two** 4.5 kV transmitting variable capacitors and a massive roller inductor gives you arc-free operation up to 2 kW PEP SSB.

### *Precision Resetability*

**A** sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately retune.


HFT-1500 **$479.95**

**Large** comfortable knobs and smooth vernier drives make tuning precise and easy. Bright red pointers on logging scales make accurate resetability a breeze.

### *Absolute Minimum SWR*

**You** can tune your SWR down to the absolute minimum! **Why?** Because all network components -- roller inductor and variable capacitors are fully adjustable.

### *Tune any Antenna*

**You** can tune any *real* antenna from 1.8 to 30 MHz, including all MARS and WARC bands. You can tune verticals, dipoles, inverted vees, Yagis, quads, long-wires, whips, G5RVs, and more.

### *SSB*Analyzer Bargraph™*

**Exclusive** 21 segment bargraph lets you visually follow your instantaneous voice peaks. Has level and delay controls.

### *Accurate SWR/Power Meter*

**A** shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

### *6 Pos. Ceramic Antenna Switch*

**Select** two coax fed antennas (tuned or bypassed), balanced line/wire or bypass.

### *Built-in Balun*

**A** heavy duty two ferrite core 4:1 balun feeds dual high voltage Delrin terminal posts for balanced lines. 5.5x12.5x12 inches. One year limited warranty.

### *Call toll-free, 1-800-363-2922*

**Order** the HFT-1500 from Vectronics. Try it for 30 days. If you are not completely satisfied, return it for a full refund, less shipping and handling -- no hassles.

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HF

VHF

UHF

USB Control Audio

## IC-7410 HF + 6m

100 Watt Output (40W AM)

RX: 0.030–60.000MHz*

32 Bit Floating Point DSP Unit

+30 dBm 3rd Order Intercept Point*

Double Conversion Superheterodyne System

Built-in 15kHz 1st IF Filter (Optional 3kHz/6kHz)

USB Port for PC Control and Audio In/Out

USB Control Audio

## IC-7200 HF + 6m

100 Watt Output (25W AM)

RX: 0.030–60.000MHz*

32 Bit IF-DSP + 24 Bit AD/DA Converter

Digital Twin Passband Tuning

USB Port for PC Control and Audio In/Out

Flexible Selectable Filter Width and Shape

USB Port for PC Control and Audio In/Out

## IC-7000 HF/6m/2m/70cm

100W (40W AM),
50W on 2M (20W AM),
35W on 70CM (14W AM)

RX: 0.03–199.999,
400–470MHz*

Digital IF Filters

Digital Voice Recorder

Front Panel Separation
with Optional 3.5m
or 5m Cable (As Shown)

USB Control Audio

## IC-9100 HF + 6m + 2m + 70cm + 23cm[1]

100/100/100/75/10[1] Watt Output[3]

RX: 0.030–60.000[2], 136.000–174.000[2],
420.000–480.000[2], 1240.000–1320.000[2,3]MHz

AM[3], FM, SSB, RTTY, CW, & DV[1]

Satellite (Mode B/J/L[1])

+30dBm TOI[2]

Two Independent 32-bit DSP Systems

3kHz/6kHz 1st IF "Roofing" Filters[1] (HF/6m)

Double Conversion Superheterodyne
with Image Rejection Mixer

USB Port for PC Control and Audio In/Out

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*Frequency coverage may vary. Refer to owner's manual for exact specifications.
[1]Optional UX-9100 required. [2]HF (14MHz) [3]See manual for AM output power.

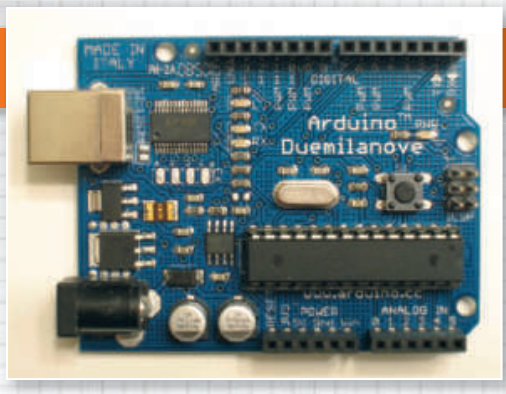
# QST QuickStats

**sta·tis·tics** (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

**Online QuickStats Poll Results for October 4 through November 2, 2012.**
Get on the web and vote today at **www.arrl.org/quickstats**!

## Have you built a project using an Arduino microcontroller?




- Yes, one: **5%**
- Yes, several: **7%**
- No: **50%**
- I've never heard of an Arduino microcontroller: **38%**

## Do you subscribe to any Amateur Radio e-mail lists?

- Yes, one: **12%**
- Yes, more than one: **71%**
- No: **17%**

## Do you prefer extended conversations on the air or short contacts?

- Extended conversations: **35%**
- Short contacts: **65%**

## Was public service your primary motivation for getting your Amateur Radio license?

- Yes: **14%**
- No: **86%**

# Send your voice to the world with a mobile radio.

Work a D-STAR repeater and you're tied in to worldwide communications, whether you're using a D-STAR mobile or handheld radio. Enjoy advanced digital communication with D-STAR transceivers.

## IC-2820H
**FEATURE-RICH 2m + 70cm MOBILE + OPTIONAL GPS RECEIVER**

D-STAR optional

- 50/15/5 Watt Output
- RX: 118–549.995, 118–173.995, 375–549.999, 810–999.990MHz*
- 522 Alphanumeric Memory Channels
- One Touch Reply Function
- Digital Voice/GPS (Optional UT-123 Required)
- Low Speed Data (Optional OPC-1529R Required)

## ID-880H
**ENTRY-CLASS 2m + 70cm DIGITAL MOBILE**

D-STAR ready

- 50/15/5 Watt VHF/UHF
- FM, AM (Receive only), DV
- RX: 118–999.99MHz*
- 1052 Alphanumeric Memory Channels
- Free Programming Software![†]

[†] *www.icomamerica.com/amateur/DSTAR for details about free software*

## ID-1
**GO DIGITAL ON 23cm**

D-STAR ready

- 10 Watt on 23cm (FM, DV, DD)
- RX: 1240–1300MHz*
- 100 Alphanumeric Memory Channels
- USB Rig Control, Ethernet Plug for DD
- Black Box Operation
- Remote Control Head, Remote Speaker and Cables Included
- PC Software Included

## NEW ID-51A
**VHF/UHF + D-STAR IN THE PALM OF YOUR HAND!**

D-STAR ready

- Dualwatch with AM/FM Receive
- Slim, Compact, microSD Ready
- Integrated GPS (Opt. microSD required)
- IPX7 Submersible

The ID-51A has not been approved by the Federal Communications Commission. This device may not be sold or leased, or be offered for sale or lease, until approval of the FCC has been obtained.

D-PRS™

## IC-80AD 2m + 70cm DUAL BANDER

D-STAR ready

- 5/2.5/0.5/0.1 Watt VHF/UHF
- FM, FM-N, AM (Receive only), WFM (Receive only), DV
- RX: 0.495–999.990MHz*
- 1052 Alphanumeric Memory Channels
- Li-ion Battery
- Free Programming Software[†]

[†] *www.icomamerica.com/amateur/DSTAR for details about free software*

## IC-92AD
**2m + 70cm MILITARY RUGGED AND SUBMERSIBLE**

D-STAR ready

- 5/2.5/0.5/0.1 Watt Output
- RX: 0.495–999.990, 118–174, 350–470MHz*
- 1304 Alphanumeric Memory Channels
- Optional GPS Speaker Mic (HM-175GPS)
- IPX7 Submersible

## ID-31A
**UHF/70cm + D-STAR**

D-STAR ready

- 5/2.5/0.5/0.1 Watt Output
- RX: 400–479MHz*
- 1252 Alphanumeric Memory Channels
- Built-in GPS Receiver
- IPX7 Submersible

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*Frequency specs may vary. Refer to owner's manual for exact frequency specs.

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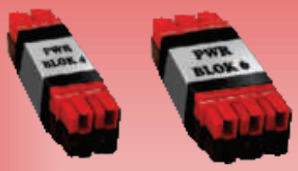
## We Have Holiday Gifts to Fit Every Budget




### Great New Items!

**PWR-Blok™**
**4-6-8-10-12 Way**
**Powerpole Splitters**


### Andy-Crimp *Pro*™

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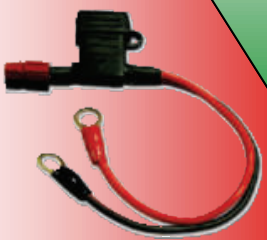

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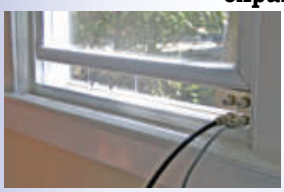

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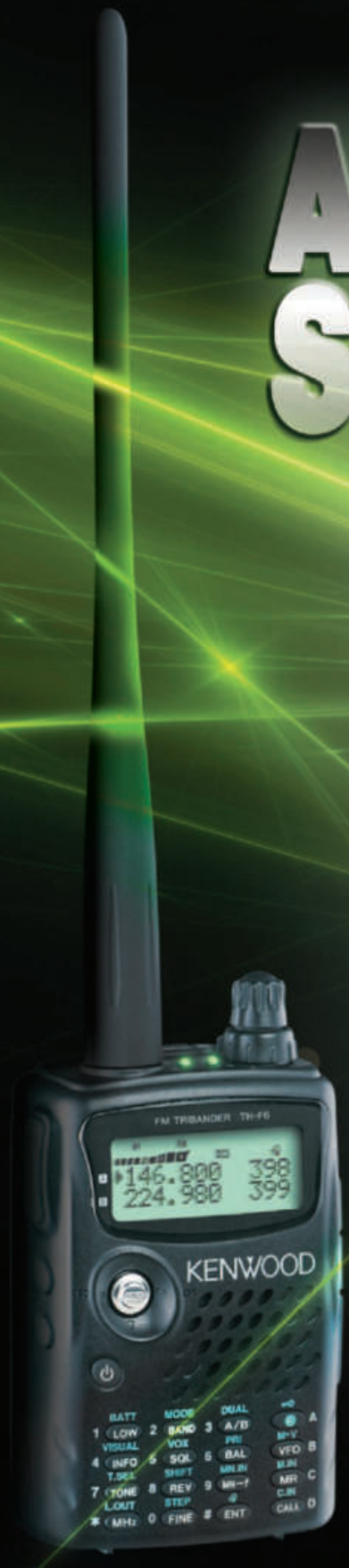


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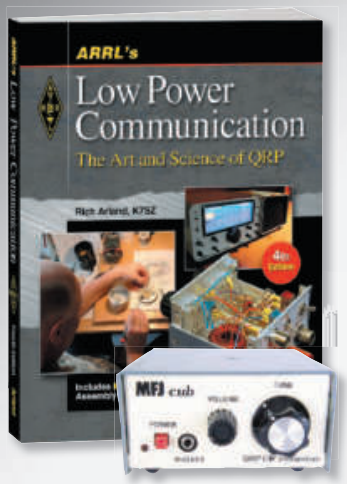


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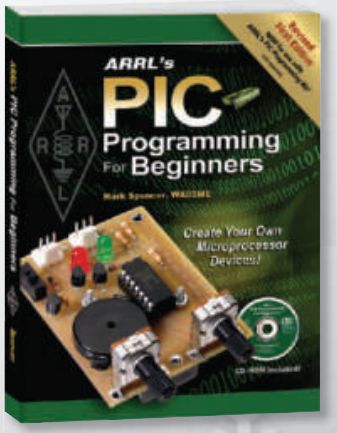


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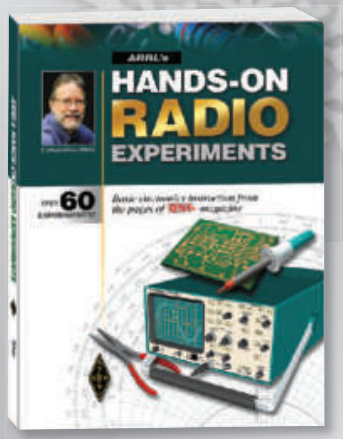


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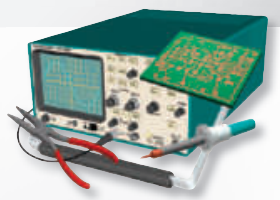

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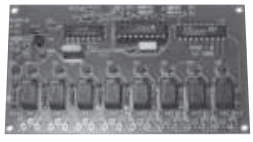

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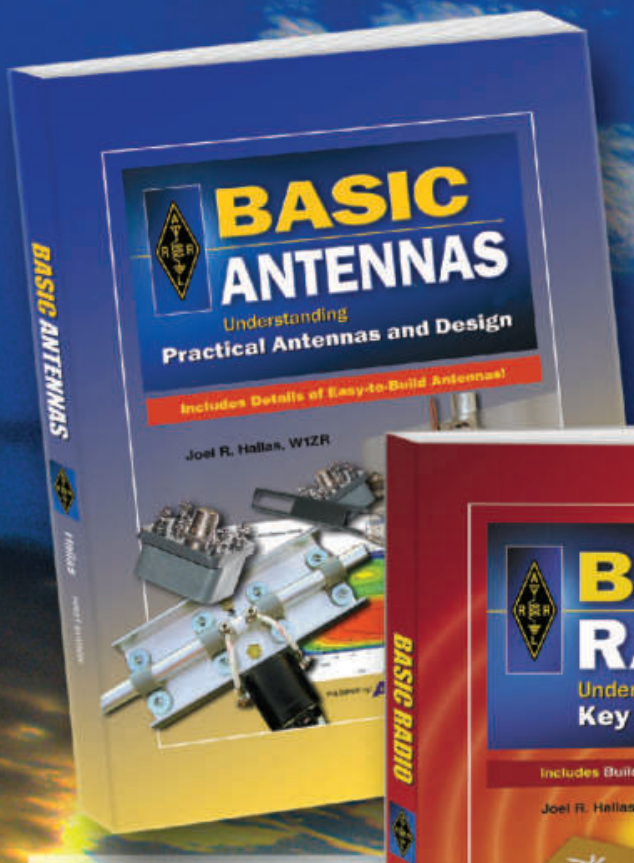


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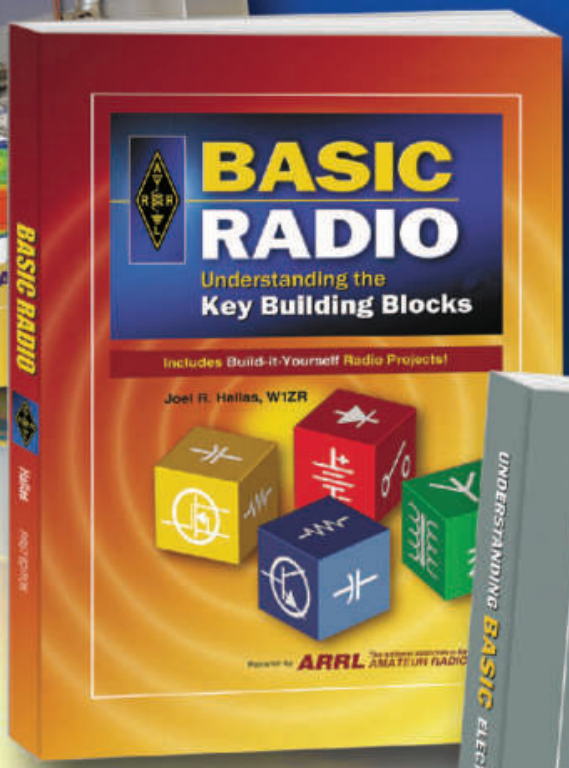


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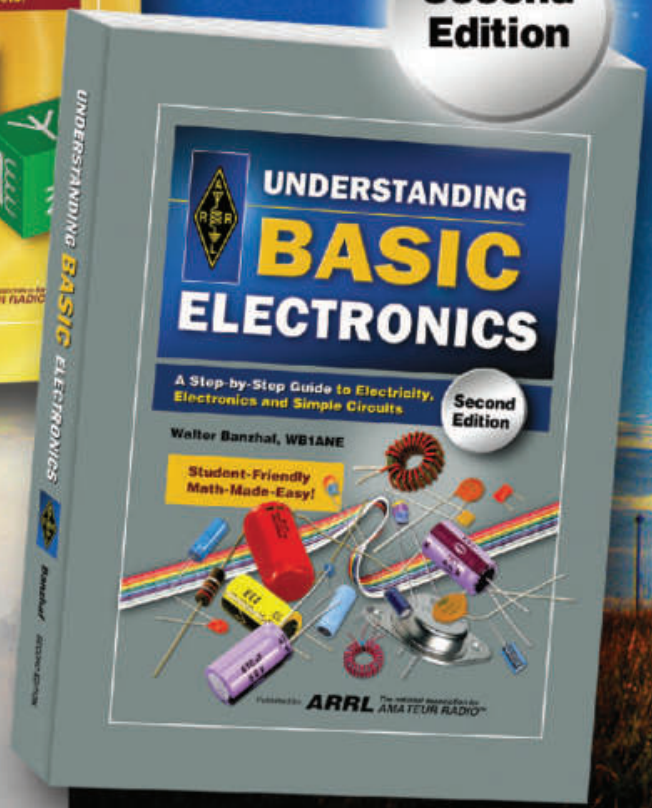


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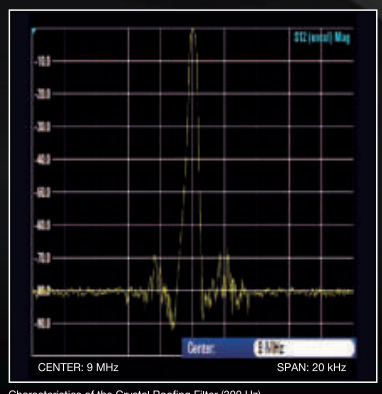
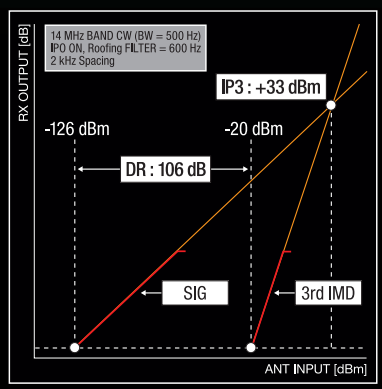



Characteristics of the Crystal Roofing Filter (300 Hz)

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