NOVEMBER 2013 QST Vol 97 No 11

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

November 2013 WWW.ARRL.ORG

QST reviews:

Inside:

November Sweepstakes

CW—November 2-4

Phone—November 16-18

$4.99 US $6.99 Can.

11>

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Official Journal of ARRL The national association for AMATEUR RADIO®

Exciting New C4FM/FM Digital Mobile Transceiver

C4FM
Clear and Crisp Voice Technology

C4FM 144/430 MHz DUAL BAND
50 W DIGITAL/FM TRANSCEIVER

FTM-400DR

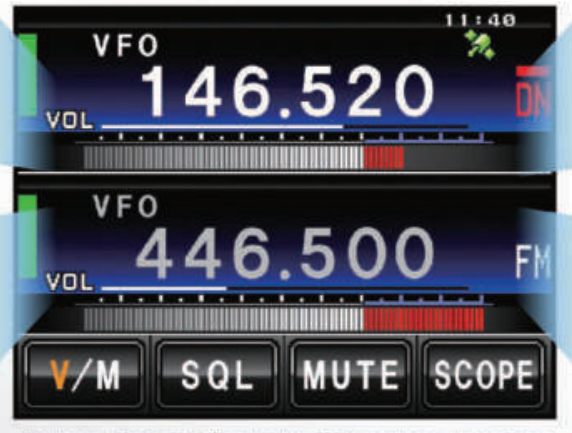
- Digital Group Monitor (GM) Function
- Smart Navigation Function
- Snapshot Function (Image Data Transmission)
- Built-in GPS with Antenna in the Controller
- Wideband Receive (108 MHz – 999.99 MHz)
- Equipped with microSD Card Slot

Advanced visibility and operability with full color touch panel Operation

Band Scope Screen

Altitude Screen

3.5-inch full color touch panel operation



The icon symbols, multi-function key display and pop-up messages are all displayed in high-resolution color thanks to the full-color, high luminance TFT liquid crystal screen.

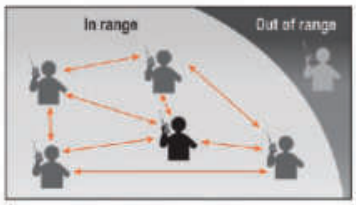
Smart Navigation Screen

Frequency Direct Input Screen

New Functions Enabled by C4FM Digital Communication

Digital Group Monitor (GM) Function

- Automatically checks whether members registered to a group are with the communication range.
- This function can be used to send messages data between group members.



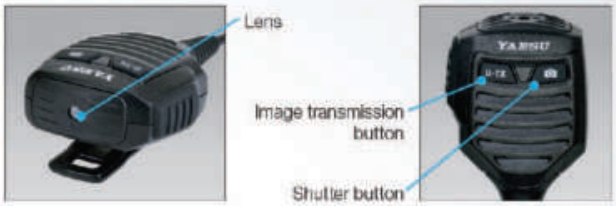
Group Monitor Function

Smart Navigation Function

- Real-time navigation function enables Location checking at any time.
- Backtrack function that starts navigation facing a registered point.

Snapshot Function (Image Data Transmission)

- Image data can be displayed on the screen.
- Image data can be sent easily to other C4FM FDMA digital transceivers.



Additional operating and support features

Wideband Receive Capability

Covers 108 MHz - 999.990 MHz (A(Main) / B(Sub) Band), VHF Marine, Aircraft, Public service channels, etc.

Hands-free operation

Hands-free operation is available by using the optional wireless Bluetooth® unit and headset.
(Optional Bluetooth® unit (BU-2) and Headset (BH-2A) are required.)

C4FM Clear and Crisp Voice Technology

C4FM 144/430 MHz DUAL BAND
5 W DIGITAL/FM TRANSCEIVER

FT1DR

- Digital Group Monitor (GM) Function
- Smart Navigation Function
- Snapshot Function (Image Data Transmission)
- Built-in GPS with Antenna in the top
- Wideband Receive (504 kHz – 999.99 MHz)
- Equipped with microSD Card Slot

YAESU The radio

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

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Cushcraft

R9

80-6 Meters!
No Radials!

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

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

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

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

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

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

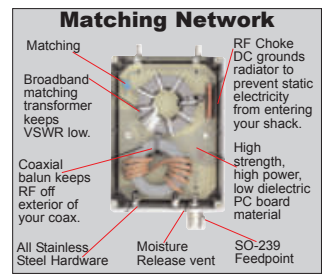
Rugged Construction: Thick fiberglass insulators, all-stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

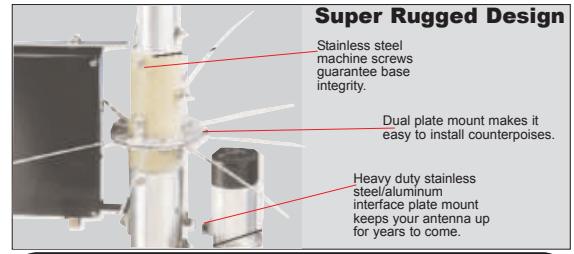
31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

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

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

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





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Life is a JOURNEY. Enjoy the ride!

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

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

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

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

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

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

Length: Approx 13 ft (assembled horizontally)

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

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

CAA-500 *Cross Needle SWR and Impedance Analyzer*

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

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

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

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

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

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COMET™

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

In This Issue

November 2013 Volume 97 Number 11

Technical

News and Features

Our Cover
November is the month of Sweepstakes! Here, ARRL's Contest Branch Manager Mike DeChristopher, N1TA, gets warmed up at W1AW in the hope of working a Clean Sweep in this double-trouble event: CW on November 2-4 and phone on November 16-18. [RJS Photography, photo]

Radiosport


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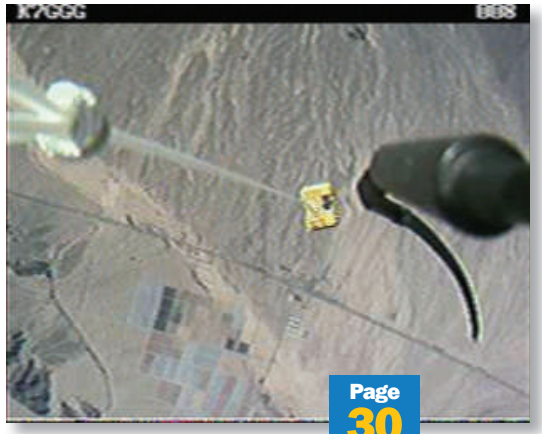

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50 W 2 m/70 cm* DUAL BAND FM TRANSCEIVER

*70 cm 45 W

FT-7900R

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

2 m/70 cm DUAL BAND

The King of Mobile

75 WATTS

Best Selling, Reliable Mobile

55 WATTS

2 m MONO BAND

HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

FT-2900R

NEW

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

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

2 m MONO BAND

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

Commercial Grade Field Radio Submersible Construction

Compact Field Radio with Top Mounted LCD and Loud Audio

ULTRA-COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-250R

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

2 m MONO BAND

NEW

COMPACT 5 W 2 m FM HANDHELD TRANSCEIVER

FT-270R

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

2 m MONO BAND

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HF/VHF/UHF Portable Operation Powerful Transceiver

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- 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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The radio... YAESU

HF/50MHz 100W Transceiver

FT DX 1200

This medium-price HF Transceiver Excels on all fronts. The High Frequency Design Technology it has inherited, ensures "Best in Class Performance". The Outstanding Operability is Perfect for the DX Scene.

Superior triple conversion receiver, and optimum gain distribution at each IF stage will eliminate out of band unwanted signals.

The 1st IF frequency is set at 40 MHz and is protected by selectable 3 kHz, 6 kHz and 15 kHz roofing filters, which effectively attenuate interfering signals.

Similar to the high end series Yaesu transceivers, it uses the 32-bit high speed floating point DSP, TMS320C6727B by Texas Instruments, for its IF DSP.
The acclaimed superior Yaesu DSP algorithm is highly effective in weak signal processing and enhancement.

The Full Color, 4.3 inch TFT display on the left side of the front panel, has a wide viewing angle and provides excellent visibility. It beautifully displays the various functions unique to this high class HF transceiver.

An optional built-in FFT-UNIT supports advanced functionality, including the AF-FFT Scope, RTTY/PSK31 Encode/Decode, CW Decode and CW Auto Zero-in.

For latest Yaesu news, visit us on the Internet:
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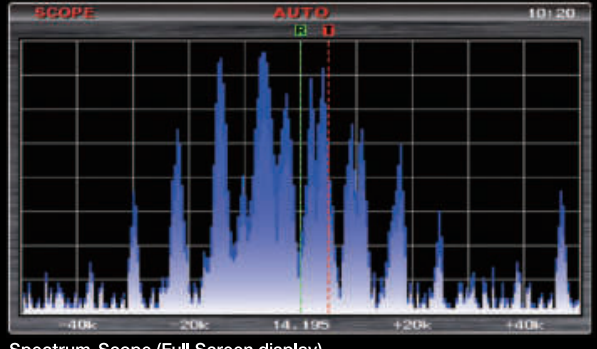
The Full Color 4.3 inch TFT display



Spectrum-Scope (Full Screen display)

YAESU
The radio

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It Seems to Us

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

Distracted Driving Legislation: Proceed With Caution

"For decades, radio amateurs have been operating while driving without being perceived as a threat to highway safety. In the face of legislation to ban unsafe practices such as texting while driving it is natural to want clear exemptions for Amateur Radio — but beware of unintended consequences."

Guiding a motor vehicle down a busy street or highway is serious business. Drivers must cope with constant distractions on the roadside, in their vehicles, and even in their own heads. A moment of inattention to what's happening in the road ahead can have tragic consequences.

While it clearly is impossible to legislate all such distractions out of existence, highway safety advocates and legislators do their best to discourage what they regard as unsafe practices. When cellphones came into general use, a number of states and municipalities moved to prohibit hand-held cellphone use while driving. Radio amateurs have a long record of driving responsibly while operating mobile, so we were understandably concerned that such legislation differentiate two-way radio operation — which we and others have combined successfully with driving for many years — from the more distracting activity of holding a phone against one's ear and carrying on a full-duplex conversation, or, even worse, reading text messages. In 2009 the ARRL Executive Committee, acting on instruction from the Board of Directors, adopted a policy statement on mobile Amateur Radio operation that includes recommended statutory language for state motor vehicle codes.

In Connecticut, where ARRL Headquarters is located, drivers' use of hand-held mobile telephones and certain other electronic devices was prohibited in 2005. The definition of prohibited devices was sufficiently specific and did not include Amateur Radio equipment, but some amateurs were pulled over anyway. They then had to explain to the officer that they weren't violating the law and, failing that, had to either take the time to appear in court or pay the fine.

Understandably, some Connecticut amateurs decided to seek a specific exemption for Amateur Radio mobile operation. In 2011 they found a sympathetic state senator who in the following year guided an exception for "the use of a hand-held radio by a person with an amateur radio station license issued by the Federal Communications Commission," through the legislative process. While this legislation was under consideration, we had our fingers crossed that no amendment would be proposed to limit the exception to emergency situations; that had happened elsewhere and had made things worse, rather than better, for routine mobile operation. But that didn't happen in 2012 in Connecticut, and we were relieved when the exception was signed into law and became effective on October 1 of that year.

Our relief was short-lived.

While this was going on at the state level, Congress was working on federal legislation called the Moving Ahead for Progress in the 21st Century Act (MAP-21). Included in the provisions of this 584-page transportation bill was funding for a new Distracted Driving Grant Program to encourage states to enact and enforce distracted driving laws. MAP-21 was signed into law on July 6, 2012 as Public Law 112-141.

To qualify for a grant, a state must enact and enforce statutes prohibiting "texting through a personal wireless communications device while driving," as well as any use of such a device by a driver under the age of 18. The law appropriately defines "personal wireless communications device" as a device through which "commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services" are transmitted. This should leave Amateur Radio equipment in the clear. However, the law also provides for three exceptions that a state may include in its statutes, one of which is "a driver who uses a personal wireless communications device to contact emergency services."

When the State of Connecticut applied for a grant to the National Highway Traffic Safety Administration (NHTSA) it was advised that its distracted driving statute was not in compliance with the conditions of the program because its Amateur Radio exception was not one of the three exceptions permitted under the law. And sure enough, the Notice of Funding Availability issued by NHTSA lists the three permitted exceptions and goes on to say, "No other exceptions are permitted under MAP-21." The state was not about to turn away federal money, so in its 2013 session the Connecticut General Assembly amended the statute to limit the use of a hand-held radio by a licensed amateur to emergencies only — exactly what we were hoping to avoid.

We have made the argument to NHTSA that because an Amateur Radio transceiver is not a "personal wireless communications device," as defined in the law, an exception for Amateur Radio — in other words, to permit something that wasn't prohibited anyway — should not affect a state's eligibility for a grant. We have not received a reply. We made the same case to the friendly Connecticut legislator who took up the cause in the first place, but while he remains sympathetic there is nothing else the state can do if it wants to receive a grant.

While not a disaster for Connecticut amateurs — the "emergencies only" limitation only applies to hand-held radios — the outcome is far from what was sought two years ago.

The season for new state legislation will soon be upon us. As you consider what you might ask of your legislators, keep Connecticut's experience in mind — and proceed with caution.

David Sumner, K1ZZ

hy-gain® HF VERTICALS

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

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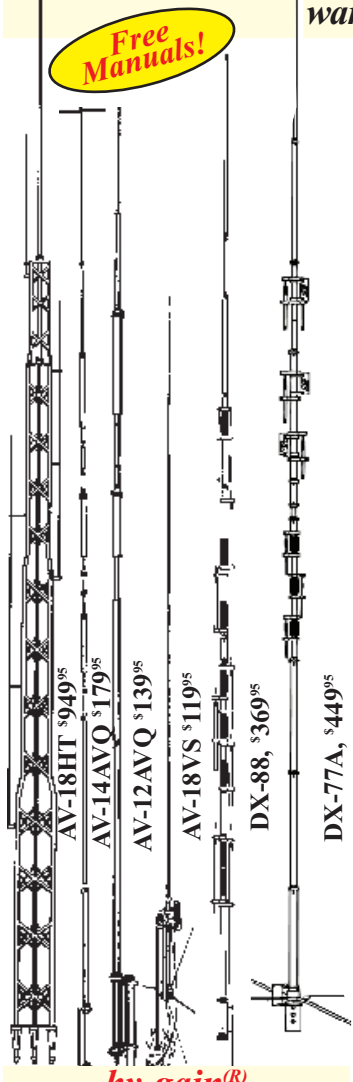

hy-gain(R) Classics

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 are 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 - 80 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 40 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

80-6 Meters

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

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

Highly Efficient

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

Each band individually tunable

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

Sleek and low-profile

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

Built-to-last

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

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

hy-gain(R) warranty

Two year limited warranty. All replacement parts in stock.

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

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

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Call your dealer for your best price!

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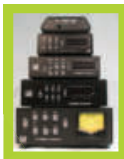

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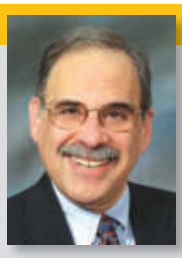
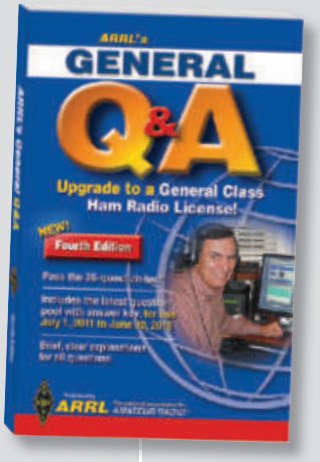


Harold Kramer, WJ1B – hkramer@arrl.org, ARRL Chief Operating Officer/*QST* Publisher

Upgrading Your License

Upgrading From Technician to General Class

There are many reasons to upgrade your Amateur Radio license. The most important reason is that each class of license gives you additional operating privileges, including more bandwidth, frequencies, and operating modes. A Technician class licensee who upgrades to a General class license obtains additional spectrum, including the use of voice, code, and digital mode privileges on all 10 HF amateur bands. Being able to operate on HF frequencies opens up a new world of Amateur Radio communications.



You will be able to participate in many additional Amateur Radio activities, events, and contests. Even if you are just interested in casual conversations, a General class license is a major step up from a Technician license. If you are interested in Public Service Communications, the additional spectrum privileges are also useful since many EOCs (Emergency Operating Centers) and emergency nets use HF frequencies.

In order to upgrade to a General class license from a Technician license, you need to pass Exam Element 3. The Element 3 Question Pool has about 350 multiple choice questions — the same number as the Technician exam. The exam itself is comprised of 35 multiple choice questions. You need to answer 26 correctly to pass. You will have seen all the questions and answers ahead of time before you take the exam, because the Question Pool is public information.

Upgrading to an Amateur Extra Class License

When you upgrade to an Amateur Extra class license, you will be able to use the entire spectrum of frequencies allocated to the amateur bands. Amateur Extra class licensees receive additional bandwidth on the lower edges of both the CW and Phone segments of 80, 40, 20, and 15 meters. Many of the rarer stations operate in the Amateur Extra class segment of a band because it is a less cluttered area.

You will need to pass a multiple choice exam based on the Element 4 Question Pool to obtain an Amateur Extra class license. Element 4 is a bit more challenging, but certainly not insurmountable, because over 130,000 amateurs hold the Amateur Extra class license. The Amateur Extra class Question Pool has about 750 multiple choice questions. The exam itself is comprised of 50 multiple choice questions. You need to answer 37 questions correctly to pass the exam. An Amateur Extra class license conveys status and respect in the Amateur Radio community because of the effort required to obtain the license and the presumed expertise and knowledge of the operator.

More Reasons to Upgrade

General or Amateur Extra class licensees who are interested in giving something back to the Amateur Radio community can become an ARRL Volunteer Examiner, join a Volunteer Examiner team, and participate in exam sessions. General class licensees can give Technician exams, and Amateur Extra class licensees can preside over examinations for all license classes. To learn about becoming a Volunteer Examiner, **www.arrl.org/volunteer-examiners**.

You can obtain an FCC assigned or vanity call sign that is shorter and easier to send and receive. Except for a very few FCC-limited choices, Amateur Extra class licensees can choose virtually any vacant, but valid, US call sign. Details are at **www.arrl.org/vanity-call-signs**.

The most important reason to upgrade is that you engage in a rewarding learning process, either by studying on your own, with a group of friends, or by attending a license class. Amateur Radio operators are lifelong learners. We need to be, because equipment, operating modes, regulations, and practices change constantly. Studying the Question Pool gives you an opportunity to review previous material and learn about new topics. Remember how you felt when you passed your first license exam? Upgrading your license will give you the same feeling of pride and achievement.

The ARRL publishes some excellent study materials, including License Manuals for each license class, which provide comprehensive information about the topics covered in the Question Pool. Each License Manual includes a CD with exam practice software. For those who just want to review the question pool, we also publish the ARRL Q & A Guides.

If you need to find a licensing class, a database of licensing classes is located on our website at **www.arrl.org/class**. Many local Amateur Radio Clubs also offer license instruction. Our club finder can be found at **www.arrl.org/find-a-club**. When you are ready to take the exam, testing locations can be found on our website at **www.arrl.org/exam**.

Let us know here at HQ if there are any other ways that we can assist you in upgrading your license. Good luck.

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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.

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

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
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* ARRL Group Benefit Programs are offered by third parties through contractual arrangements with ARRL. The programs and coverage are available in the US only. Other restrictions may apply.

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

Community

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

Licensing, Education and Training

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

Quick Links and Resources

QST – ARRL members' journal – **www.arrl.org/qst**
QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
Support for Teachers – **www.arrl.org/teachers**
ARRL Volunteer Examiner Coordinator (ARRL VEC) – **www.arrl.org/vec**
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The American Radio Relay League, Inc.

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

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

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

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

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

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ARRL Section Managers

www.arrl.org/sections

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

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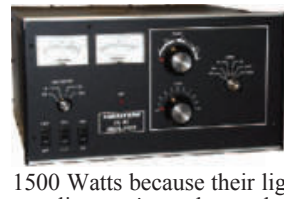

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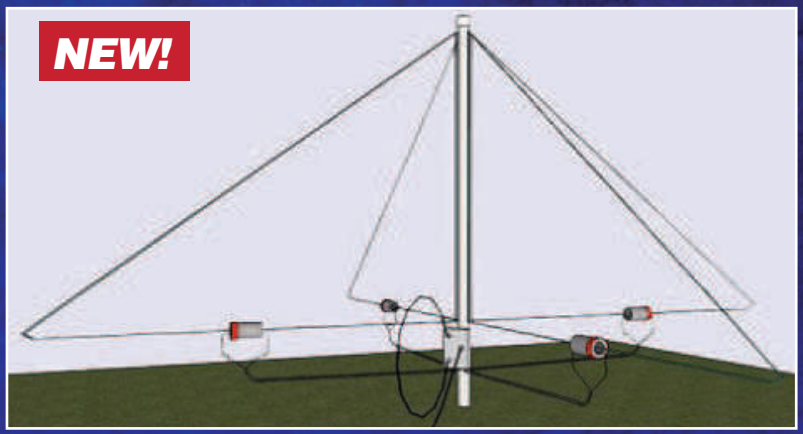

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Have Trike Will Travel

Leo Comeau, K1JAO
lrc40@comcast.net

I've enjoyed cycling for years, but in recent times my back, neck, and arms have rebelled. My solution was to purchase a three-wheeled bike known as a *recumbent trike*. With the trike I'm still able to hit the road, but with much less physical stress.

At first I took a 2 meter handheld transceiver on my journeys, but soon I decided that I wanted more. So, I converted the trike to a rolling HF ham station!

The main components are a Yaesu FT-857D transceiver, a Yaesu ATAS-120A automatically tuned antenna and a Comet CF-706A diplexer, which passes dc for the operation of the ATAS-120A and accessories. Everything is powered by a 35 Ah gel cell battery housed in a commercial enclosure with Powerpole connectors. The battery charge is maintained by a 20 W solar panel and charge controller.

The battery and the ATAS-120A are mounted on an aluminum plate that is attached to the trike's rear carry rack. The FT-857A and the diplexer are installed on another aluminum plate with springs to cushion the blows from bumps in the road. To minimize potential power fluctuations, I added an N8XJK battery boost regulator that maintains the voltage a 13.8 V dc for the transceiver.

My microphone/headset is a Heil PMS-6 with a push-to-talk switch mounted on the left handlebar. The microphone picks up little wind noise and reports of my transmit audio have been good.

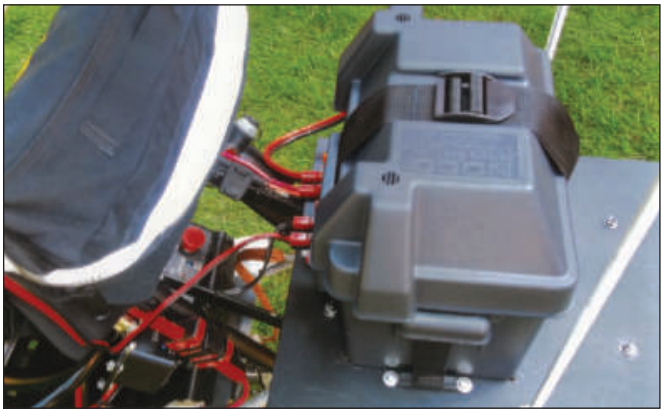
I've been having a ball with this setup, making many stateside contacts and working a fair amount of DX. I'm grateful for the help I received from Tim Factor, KT7F, Dave Barker, N1EDU, and Larry Lemoine, N1EPE, while assembling my unique station on wheels. Not only am I still able to keep pedaling, I enjoy the pleasure of having Amateur Radio along for the ride.

A view of the trike showing the rear panel and ATAS mobile antenna.

An 8.5 A solar charge controller installed below the solar panel.

The trike's 20 W polycrystalline solar panel.

The control head of the Yaesu FT-857D transceiver attached to the right handlebar.



The battery is housed in a commercial enclosure with PowerPole connections.

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Letters from Our Members

Musical Morse

My recent work with the musical standard for middle "A" tuning got me thinking. If you polled all the CW operators you could, what would be their preference when it comes to BFO pitch? If the band is congested or noisy and a CW filter is in use, they may not have much choice.

If you search the web using the phrase, "432 tuning," you will see a number of websites that discuss the differences between middle "A" at 440 Hz and the much-preferred 432 Hz standard. While it may seem crazy to some, as a musician I have to agree that a 432 Hz tone is much more pleasant to listen to.

Readers might try a little experiment. Try copying Morse code with the received pitch set to 432 Hz instead of what you're accustomed to hearing, and see whether you experience less fatigue. If you can get your hands on a music instrument tuning meter, measure the pitch of your "normal" CW copying tone and see if it is a harmonic of 432 Hz. Tone generating and tuning apps are readily available in the iTunes App Store, and are probably available for Android devices as well.

My hypothesis is that some hams will find copying CW at 432 Hz, or a musical multiple, to be more pleasant overall.

Bob Schroeder, N2HX
Ewing, New Jersey

Encryption in Amateur Radio: Pro and Con

There is no need to encrypt Amateur Radio communications for any reason. As for concerns about adhering to HIPAA regulations and preserving patient privacy, this can be achieved by other means. For example, because of HIPAA, and because fire and rescue service channels are monitored by many civilians, emergency responders in my area assign numbers to each patient. This number follows the patient from initial contact to the hospital (if he or she is transported). No names are ever broadcast by emergency services — only numbers. Such a system could be put in place by an ARES net control based at the receiving hospital.

When local agencies don't encrypt their communications, there is no valid reason for us to do it, either.

Jim McKenzie, KFØSY
Malcolm, Nebraska

♦It seems that many people, the ARRL now included, have missed the point about encryption for emergency and disaster communications.

HIPAA and personal health information should not be the concern. The concern should be for communications that could compromise the security of critical operations. Our group has had this issue come up during exercises and we have been asked by our local emergency management to implement encryption.

I do think encryption is an important capability, and I find it unfortunate that most people are focusing on the medical information concerns rather than the real security issues.

In a situation where no other resources are available to pass vital information, it should be incumbent upon amateurs to fill the gap by any means necessary, including the ability to encrypt our communications.

Chuck Scott, N8DNX
Petoskey, Michigan

Battle of Gettysburg Special Event

I was privileged to operate the special event station N3S, which commemorated the 150th anniversary of the Battle of Gettysburg last July. I want to pass along my thanks to each one of the 545+ contacts that were logged during that time.

I found, without exception, that the hams we worked were polite, patient, and more than appreciative. That is what this avocation is all about!

So, while I'm filling out the commemorative QSL cards (my postman is giving me strange looks), I hope that my modest effort paid proper tribute to the 150,000 Americans who met on those fields all those years ago.

Bryan Boyle, WBØYLE
Morrisville, Pennsylvania

Dumbing Down...Or Not

I read with pleasure the letter from Joe Vlk, W8DCQ, that appeared in the August issue of *QST*. Thank you, Joe, for having the courage to state the truth!

Indeed, much of what I see in "The Doctor is In" column should be known by the time a ham gets his or her General ticket. Sometimes my mouth drops open in disbelief at what I'm reading.

As for the Amateur Extra licensees, it is now almost routine for small children to achieve this level of accomplishment. In an era of openly published, multiple choice exams, it is easy to understand why. Kids excel at memorization, so they can pass these exams and earn the top license — all without even knowing how to plug in a rig!

Perhaps it no longer matters. The majority of amateurs barely understand how their radios work anyway. That's the result when you lower standards: you get appliance operators.

Mike Kitsko, K6VGQ
Grove, Oklahoma

♦I am a fairly new Amateur Radio operator, licensed in early 2012. I have observed that many older licensees complain about the lack of code requirements and the alleged incompetence of new operators.

I don't know Morse code, and don't care to know it. This fact is not a reflection on my worthiness to be an amateur.

From a technical standpoint, others allege that new hams don't even know how to cut wire dipole antennas to the appropriate lengths. While failings such as these may afflict a few of us, it is an inaccurate generalization when applied to the new ham community as a whole.

When it comes to behavior on the air, my experience on HF, VHF, and UHF has been positive. I have only occasionally encountered rude behavior, and that has come mostly from operators licensed more than 10 years ago.

Let us celebrate the fact that new operators are getting licensed and getting on the air. Amateur Radio is not dying, and is indeed growing. For those who insist on bringing back Morse code testing, coupled with exams that require knowledge approaching that possessed by an electrical engineer, I submit that if you got your wish Amateur Radio would be dead in 10 years. I think it is high time that these crotchety old timers lighten up.

Sean Cowdrey, KJ6TTR
Camarillo, California

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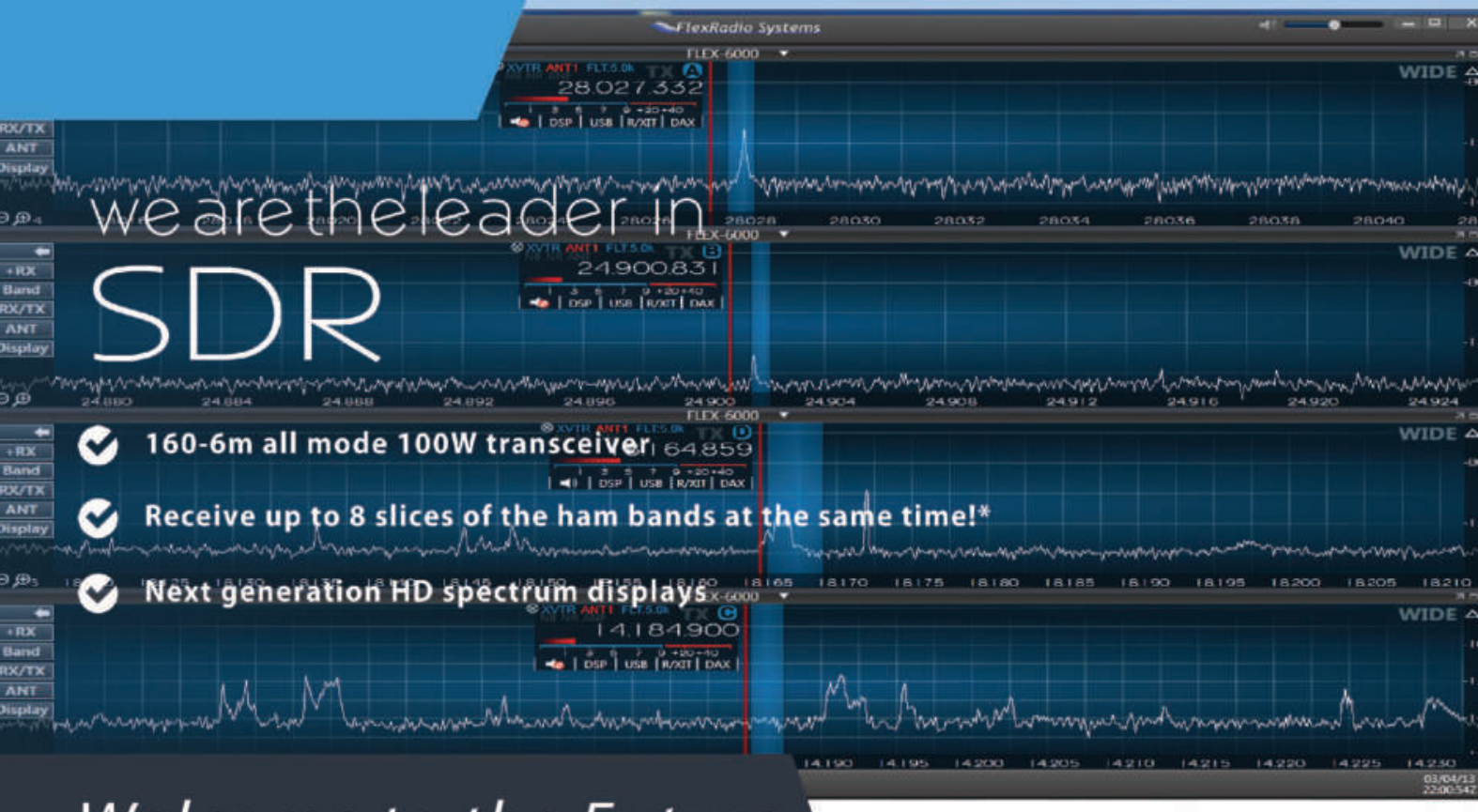

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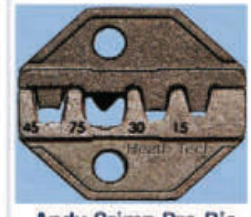

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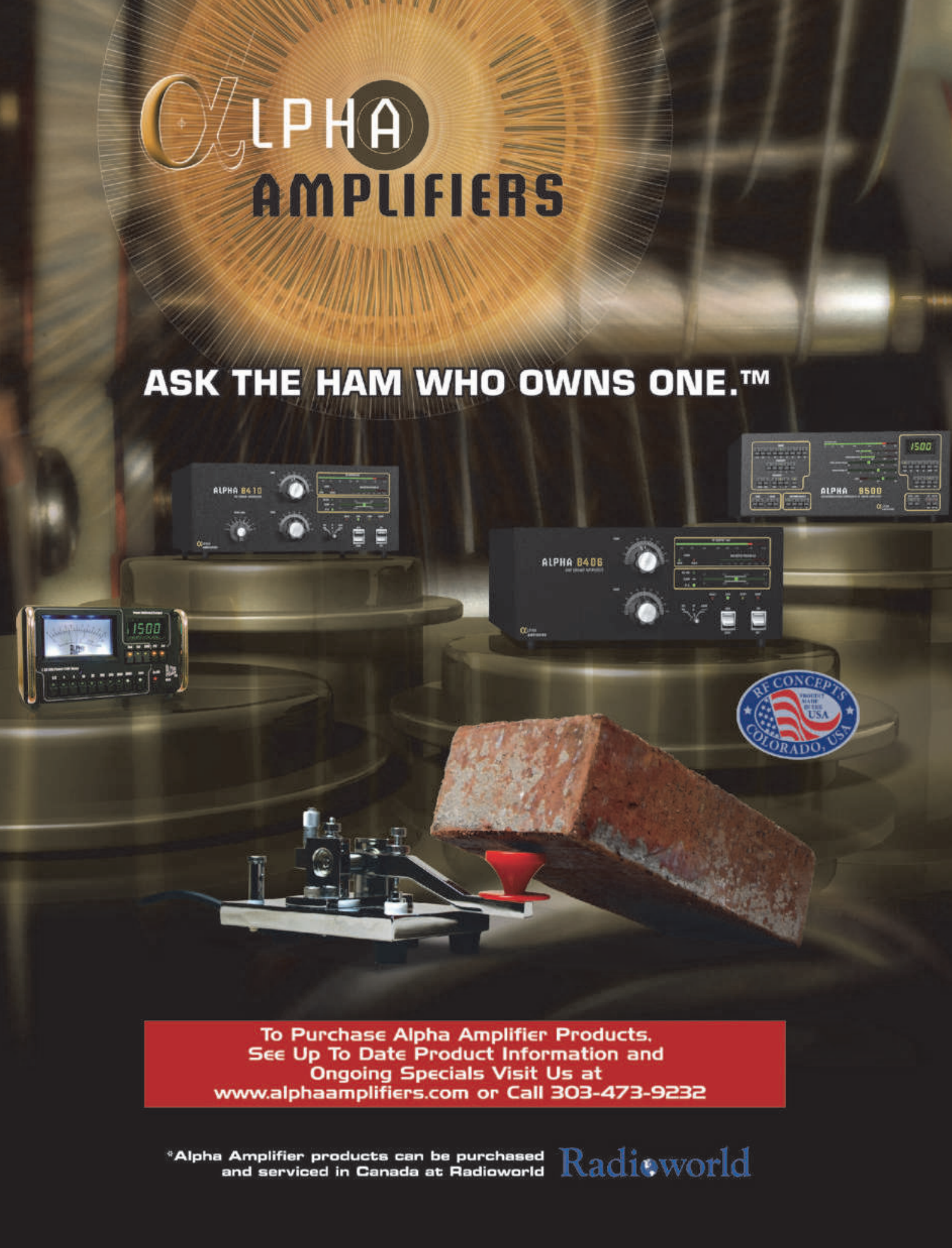
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SSTV Video Beacon at 88,000 Feet

See spectacular views from an Amateur Radio high altitude balloon flight.

Gary Miller, K7GGG

My slow scan television (SSTV) video beacon package tagged along 88,000 feet on an Amateur Radio high altitude balloon flight. My video beacon's peak altitude was 59,000 feet higher than even Mt Everest in Nepal, which stands 29,035 feet above sea level. The flight coincided with the 2012 ARRL Southwest Division annual convention in Yuma, AZ during mid-February 2012.[1] An experienced high altitude balloon crew from the Arizona Near Space Research Amateur Radio club conducted the flight.[2] Two experiments for atmospheric study, built by college students, and a physical geography survey package accompanied the video beacon (seen second from the bottom in the lead photo). Three APRS beacons (one using the W1AW-7 call sign) were able to broadcast GPS-based tracking data for balloon recovery.

Video Beacon Flight Package

The video beacon comprised an SSTV package hanging beneath the balloon and trailing a J-pole antenna, shown in Figure 1. The package includes an Argent Data Systems SSTVCAM camera and SSTV encoder module.[3] The module audio routes to a Wouxun KG-833 UHF handheld radio.[4] A 7.4 V 2200 mAh lithium polymer (LiPo) battery powers everything.

[1]Notes appear on page 33.

Figure 1 — Bubble wrap painted black encloses the video beacon package, and a J-pole antenna trails below. [Gary Miller, K7GGG, photo]

[Bob Thompson, KC8BOB, photo]

The SSTVCAM module, radio and battery mount on an aluminum backplane, which is encased in an 8 inch fiberglass tube with a 3 inch diameter, and fitted with acrylic disks at each end. Figure 2 shows the radio board on the right and the SSTVCAM module on the left. A serial adapter connector (red) near the lower left provides access for programming text seen at the top of the images. The antenna (black cable) attaches through the left end. A bubble wrap blanket painted black slips over the outside for added solar heat generation and heat retention (see Figure 1).

Figure 3 shows the beacon and ground station components. The digital camera turns the image into pixel information about color (chrominance) and brightness (luminance) and stores it in a memory matrix. The Argent Data SSTVCAM processor combines this pixel data with the proper SSTV framework "The Scottie2 SSTV Mode," and generates precisely timed audio tones for transmission by the UHF FM radio. The ground station receiver demodulates the received audio signal and sends it via a sound card interface to a computer where a software program (MMSSTV) converts the audio back to image pixels.[5] The computer display shows the resulting reproduced image as seen in Figure 4.

The SSTV Module

You can customize two functions of the Argent Data SSTVCAM: (1) choice of one of four SSTV modes and (2) one of four camera activation rates. I stored my call sign, K7GGG, chose the Scottie2 video mode, and selected a camera rate of one image every 5 minutes in the SSTVCAM module. The call sign appears in a line of text superimposed on the top edge of every image received from the video beacon as seen in Figure 4. The computer also displays the received image identifiers and a time stamp seen just below the image.

Four available SSTV mode selections allow the user to trade off image transmission time for robust image encoding. The modes with longer transmit times for a given image resolution have an advantage in poor transmission paths. Table 1 shows the image resolutions and transmission times for the four available modes. Scottie2 mode provides a slightly higher image resolution than the Robot modes, and it is suitable for UHF FM transmission over the unobstructed path from the balloon. The 5 minute image interval would produce 18 to 24 images during a 90 to 120 minute balloon flight. In testing I found that more frequent image transmissions caused the radio to heat excessively.

Radio, Antenna and Battery

The radio transmits FM with approximately 4 W RF power on 432.950 MHz.

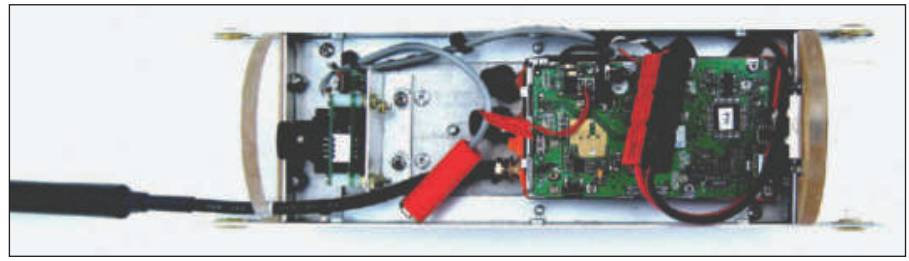


Figure 2 — SSTVCAM is at left and radio board is at the right side. The battery is on the reverse side. [Gary Miller, K7GGG, photo]

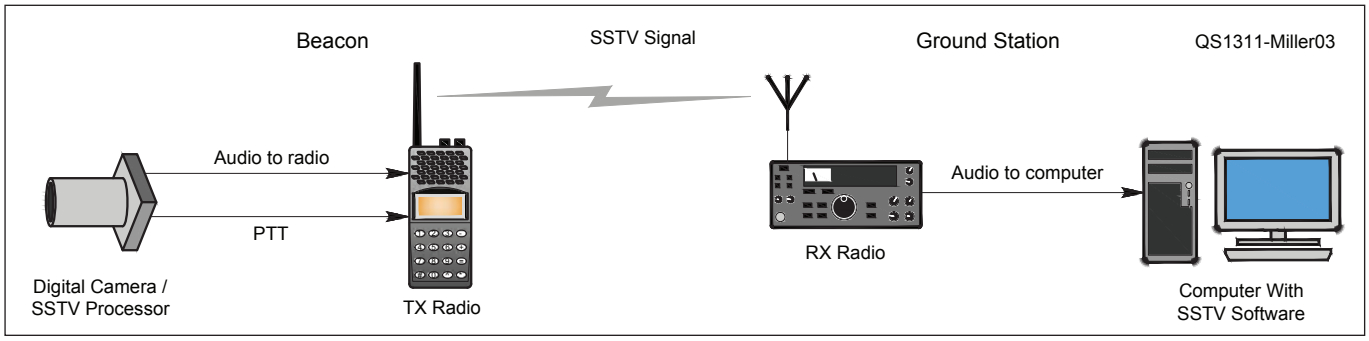


Figure 3 — Video beacon and ground station components.

The radio circuit board, stripped of its case and battery, fits inside the package as seen in Figure 2. I soldered the cables from the SSTVCAM and battery to the radio circuit board. I also installed a non-polarized (also called bi-polarized) 50 V 1µF electrolytic capacitor (Mouser Electronics, Inc. P/N: 647-UMP1H010MDD) between the microphone input of the radio and the audio output of the SSTVCAM to block the dc current in the radio microphone circuit. While the stripped-down Wouxun KG-833 worked very well in the video beacon, in retrospect I'd start with a slightly larger package diameter with room to preserve the radio in its original condition.

I made a J-pole antenna from 300 Ω twin-lead transmission line according to a design by Jack Belrose, VE2CV (SK).[6] Instead of Belrose's coax wound choke I used three mix 61 ferrite beads (Amidon Inductive Components P/N: FB-61-4852).

I set the radio to POWER SAVE mode to reduce power consumption during idle times between transmissions. You can't replace a discharged battery after it has left the ground! Table 2 shows the power budget for the SSTV image transmissions. Each transmit/idle cycle consumes 331.32 mAh. At 9.7 transmit/idle cycles per hour the 2200 mAh battery provides up to 6.64 hours of operation.

The SSTV Images

Two other hams and I captured images from three different receiving locations. I stayed at the launch site while the balloon traveled

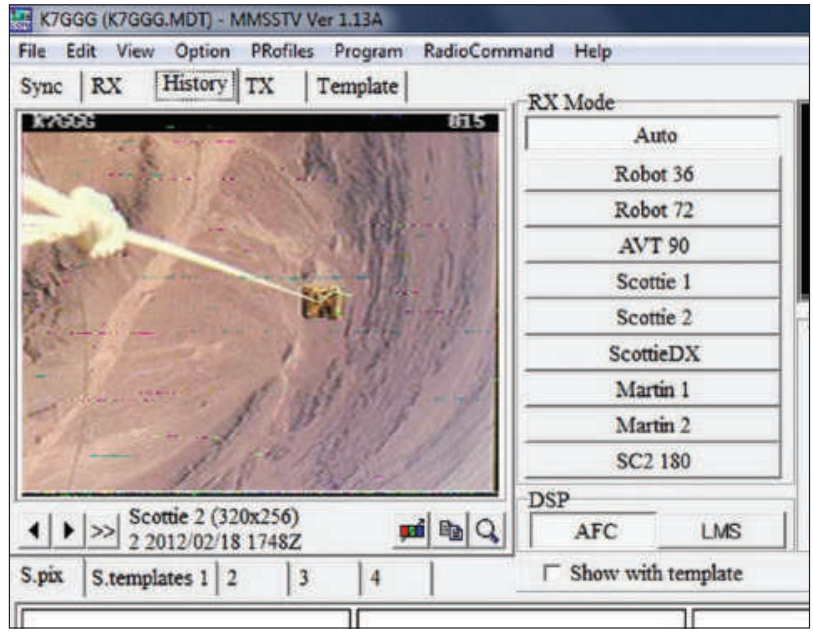


Figure 4 — Images contain a time stamp which can be matched with the APRS time position data. [Gary Miller, K7GGG, image]

Table 1
Image Modes and Their Transmission Times

SSTV mode	Resolution (pixels)	Time (s)
Scottie1	320 × 256	110
Scottie2	320 × 256	71
Robot36	320 × 240	36
Robot72	320 × 240	72

The Scottie2 SSTV Mode

A transmission begins with a 300 ms signal containing a code (VIS code) indicating the SSTV mode. The code for Scottie2 is decimal 56. A 9.0 ms starting sync pulse at 1200 Hz precedes the beginning of the image data. Table A lists the 7 image elements of each image line. Audio frequency of a color scan varies with brightness, and 1500 Hz indicates none of a color in that pixel. The first 16 lines of each image contain grayscale only and usually contain text such as the call sign and image number. See the paper by Jim Barber, N7CXI, for more SSTV information.[A] See also the Slow Scan Television section in the *ARRL Handbook*.

Table A
Each of the 256 lines of the image comprises 7 elements.

Element	Description	Length (ms)	Audio frequency (Hz)
1	Separator pulse	1.5	1500
2	Green scan	88.064 (0.2752 ms/pixel)	1500 to 2300
3	Separator pulse	1.5	1500
4	Blue scan	88.064 (0.2752 ms/pixel)	1500 to 2300
5	Sync pulse	9.0	1200
6	Sync porch	1.5	1500
7	Red scan	88.064 (0.2752 ms/pixel)	1500 to 2300

[A] www.barberdsp.com/files/Dayton%20Paper.pdf

Table 2
Power Budget

Function	Seconds per TX/idle cycle	Usage (seconds per hour)	Current drain (mA)	Consumed battery capacity (mAh)
Transmit	71	688.9 (19%)	1505 mA	288.06
Idle	300	2911.1 (81%)	53.5 mA	43.26
Total	371	3600	—	331.32

Figure 5 — Farm land and an interstate highway from 54,620 feet. [Gary Miller, K7GGG, image]

A	B	C	D	E	F	G	H	I	J	K
UTC - hours	minutes	seconds	latitude	longitude	altitude (m)	altitude (ft)	GPS Status	dop	tracked sats	Speed
17	44	15	33.65983	-113.5545	26687.55	87559	0	1.6	11	
17	44	16	33.65985	-113.5545	26691.92	87572	0	1.6	11	
17	44	17	33.65987	-113.5545	26696.19	87586	0	1.6	11	
17	44	18	33.65989	-113.5545	26700.45	87600	0	1.6	11	
17	44	19	33.65991	-113.5545	26704.68	87614	0	1.6	11	
17	44	20	33.65993	-113.5544	26708.84	87627	0	1.8	10	
17	44	21	33.65996	-113.5544	26712.67	87640	0	1.6	11	
17	44	22	33.65999	-113.5544	26716	87650	0	1.6	11	
17	44	23	33.66003	-113.5544	26716.1	87654	0	1.6	11	
17	44	24	33.66005	-113.5543	26716.2	87651	0	1.6	11	
17	44	25	33.66008	-113.5543	26712.4	87541	0	1.6	11	
17	44	26	33.66009	-113.5543	26706.4	87521	0	2	9	
17	44	27	33.6601	-113.5543	26698.1	87592	0	1.8	10	
17	44	28	33.66011	-113.5543	26686.89	87565	0	1.8	10	
17	44	29	33.66009	-113.5543	26673.18	87510	0	2.3	8	
17	44	30	33.66008	-113.5543	26657.05	87458	0	1.8	10	
17	44	31	33.66006	-113.5542	26638.69	87397	0	1.8	10	
17	44	32	33.66004	-113.5541	26618.17	87330	0	1.8	10	
17	44	33	33.66002	-113.5541	26393.58	86593	0	1.8	10	
17	44	34	33.66003	-113.554	26373.94	86529	0	2.4	8	
17	44	35	33.6601	-113.5538	26354.17	86464	0	2.1	9	
17	44	36	33.66019	-113.5538	26334.57	86400	0	2.1	9	
17	44	37	33.66026	-113.5538	26315.2	86336	0	1.6	10	
17	44	38	33.66031	-113.5538	26296.7	86272	0	1.6	10	
17	44	39	33.66029	-113.5539	26157.4	85818	0	2.5	8	
17	44	40	33.66021	-113.5539	26137.41	85753	0	1.9	8	

Figure 6 — The APRS log of GPS position shows the time that the maximum altitude was reached. [Image courtesy Gary Miller, K7GGG]

50 to 60 miles east, pushed by the westerly jet stream wind. Chris Johnson, K6OZY, received images from Yuma, AZ, while Gary Goetz, K7WZX, received images in Phoenix, AZ, more than 100 miles from the balloon. Together we captured 14 of the 15 images transmitted during the flight.

The SSTV images are low resolution (320 × 256 pixels), but you can still see farm land and the interstate highway from 55,000 feet in Figure 5. On the right side of that image you see the J-pole antenna, and slightly to the left you can see one of the yellow APRS beacons hanging below. While hanging from the balloon, the camera twists and swings so some of the images are turned as much as 180 degrees. The balloon had burst just before image number 15, seen in Figure 4, which forced all of the packages hanging below to oscillate violently. As a result the camera points sideways, nearly showing the horizon in that image.

In addition to transmitting tracking data, the APRS beacons also recorded detailed GPS data once each second. You can see a sample of that data in Figure 6. We can find the balloon burst time, 17:44:23 UTC, by looking for the change between increasing altitude and decreasing altitude, circled in red. By comparing the time stamp on the received images with this data we can determine the location and altitude of an image. As seen in Figure 4, I received image 15 at 17:48 UTC, just four minutes after the balloon burst.

The balloon flight path from the APRS data can be seen superimposed on the *Google Earth* image in Figure 7.[7] Jack Crabtree, W7JLC, founder and president of Arizona Near Space Research provided the APRS data for the flight path. The path color encodes altitude. You can also see images, left to right, of Quartzite, AZ from 9,882 feet (K6OZY image), geographic features from 43,636 feet altitude, farm land and Interstate Highway from 65,506 feet, and noise lines in an image from 41,315 feet on the way to landing.

In February it is too cold for me to go to the top of Mt Everest in Nepal with a video beacon. I was happy to stay in Arizona where the ground level temperature was above 70°F. Fortunately, the balloon and electronic equipment took the cold temperature at altitude better I could. Even in Arizona, it was –60°F above 48,000 feet altitude according to the National Weather Service's Aviation Weather Center.

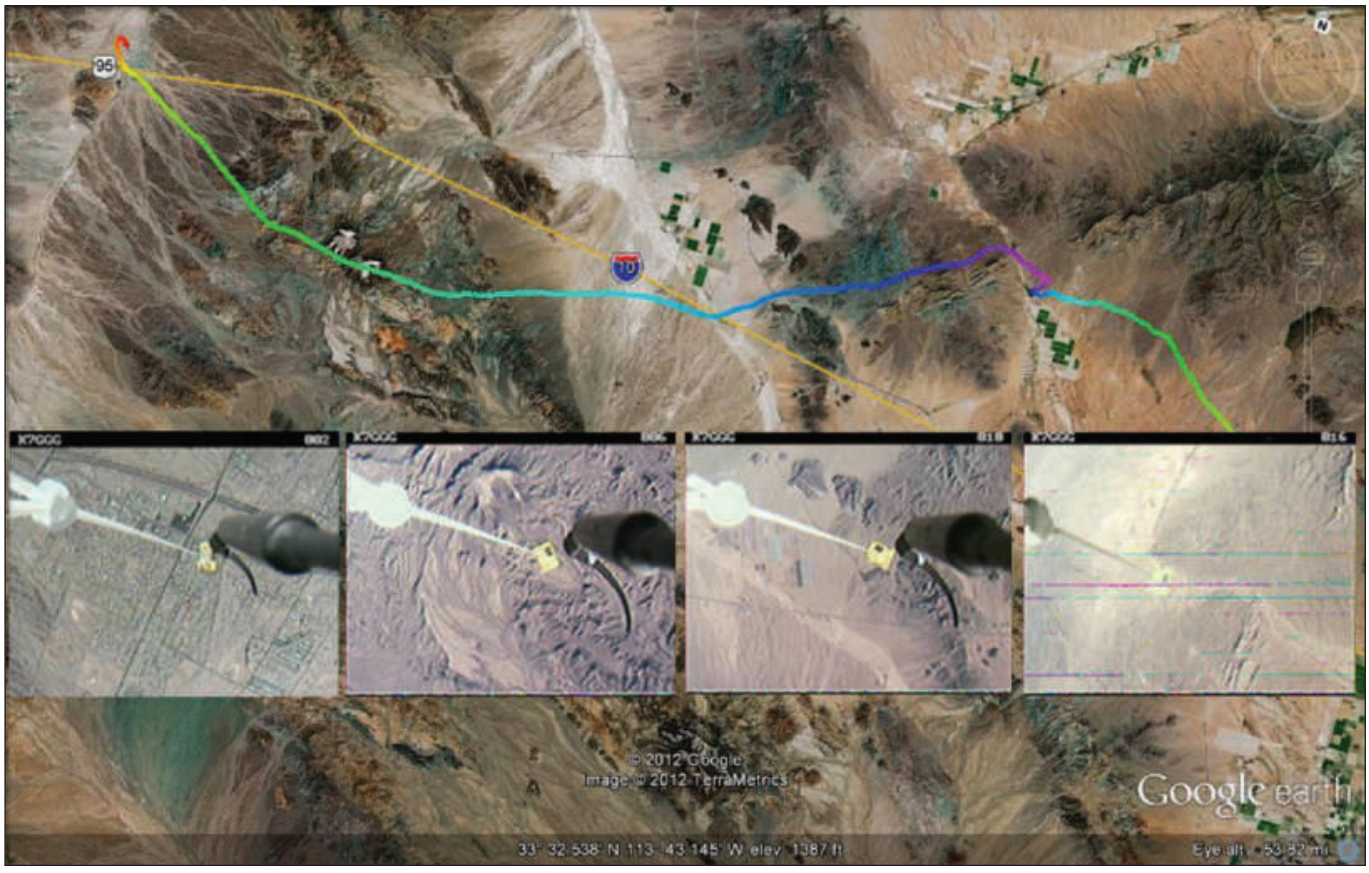


Figure 7 — The flight path with images of Quartzite, AZ from 9,882 feet (K6OZY image), geographic features from 43,636 feet altitude, farm land and Interstate Highway from 65,506 feet, and noise lines in an image on the way to landing from 41,315 foot altitude. [*Google Earth* image, data courtesy Gary Miller, K7GGG, Jack Crabtree, W7JLC]

Notes
[1]**www.yumahamfest.org**
[2]**www.ansr.org**
[3]**wiki.argentdata.com**, also "Argent Data Systems SSTVCAM (Short Takes)," *QST*, Dec 2011, p 55.
[4]**www.wouxun.com/Two-Way-Radio/KG-833.htm**
[5]**www.hamsoft.ca/pages/mmsstv.php**
[6] "Technical Correspondence," *QST*, Jun 2003 p 69.
[7]**www.google.com/earth/index.html**

Gary Miller, K7GGG, holds an Amateur Extra class license and has been an ARRL member since 1988 when he received his Novice class license, KB7DJN. Gary graduated from the University of Arizona. He started working as a computer programmer in 1965, which led to a career as systems analyst, network manager and IS consultant. In 1977 he co-owned a retail store selling microcomputer kits. This sparked an interest in electronics. He participated in Field Day for many years and has a variety of other Amateur Radio interests including DX hunting for African stations, ragchew schedules and many homebrew hardware and software projects. You can reach Gary at PO Box 1346, Payson, AZ 85547 or **k7ggg@arrl.net**.

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

See the Digital Edition of *QST* for a video showing how SSTV images are received and processed.

Strays

Piscataquis Amateur Radio Club Supports Sled Dog Race

The 30 Mile Dog sled Race in Brownville Junction, Maine took place January 26, 2013 and the Piscataquis Amateur Radio Club provided communications along the course with net control set up in the local American Legion Post. Several of the "mushers" were hams. Brownville Junction is an historic railroad town and parts of the sled trails utilize an abandoned rail bed.

Terry, N1RCU, an avid musher, leads his team across the finish line. His 2 meter hand held is tightly positioned on his chest. [K1PQ club photo]

Resonate Your Mobile Antenna with a Variometer

This variable inductance device from radio's early days can tune your 75 meter mobile antenna.

A variometer resonates the 75 meter band vertical antenna mounted on my mobile home.

Harold F. "Hal" Potter, K7RQ

I combine ham radio with motor home camping, so I needed an antenna that would be easy to erect and remove from my mobile home, as well as adjustable across my favorite band — 75 meters. My solution was an eight foot antenna section permanently mounted on the rear of the motor home seen in the lead photo. It is topped with a loading coil, which has a quick-disconnect fitting for a removable five foot top section. I made the antenna sections from half-inch copper water pipe and painted them to match the motor home.

Building a variometer was my solution for the loading coil. The variometer consists of a pivoting smaller coil mounted inside an outer coil. By rotating a shaft the inner coil "tumbles" end over end inside the larger coil. Since the two coils are connected in series, the inner coil adds or subtracts inductance depending on its angular position inside the outer coil.

Making the Variometer Components

This is not a kitchen table project — some of the work requires machining on a metal lathe and drill press and threading taps (⅜-24 and 6-32). An antenna analyzer such as the MFJ 259 helps with setup and calibration. The machinist should work with samples of the copper pipe and PVC outer sleeve material so that the machined parts accurately match the pipe diameters. I wound the main coil on a 6 inch piece of white 1½ inch inner diameter (1⅞ inch outer diameter) schedule 40 PVC pipe. I fitted machined brass inserts (seen in Figure 1) into each end of the PVC section, then drilled and tapped the centers of the brass fittings with ⅜-24 threads. I used about 4 inches of 2 inch diameter brass rod stock to make the end fittings. The inside of the brass fitting is seen in Figure 3. I also fabricated inserts from ⅝ inch brass stock and then threaded them with ⅜-24 threads, which I then soldered into the ends of the copper pipe antenna sections.

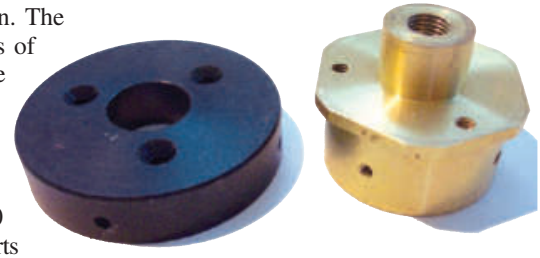


Figure 1 — Details of the black plastic and brass end fittings for the variometer.

Plastic spacers, the black toroid-shaped pieces seen in Figure 1, support the outer PVC protective sleeve. The spacers are attached to the brass fittings by three flat-head 6-32 by ¾ inch stainless steel screws. In Figure 2, you can see the completed coil assembly, before I enclosed it in a protective plastic sleeve. The outside diameter of the black plastic spacer was machined to fit the inside diameter of the protective plastic sleeve (see Figure 4). For this sleeve, I used a 2.5 inch inner diameter thin-wall class-160 PVC pipe; the protective sleeve helps keep out moisture and stabilizes the variometer performance. I wound the inner variometer coil on a one inch piece of ¾ inch diameter schedule 40 PVC pipe. This length is short enough to allow the inner coil assembly to tumble freely inside the main coil, as seen in Figure 5.

A 3 × 6 inch piece of machinable half-inch thick plastic such as Teflon® or Delrin® can be used to fabricate the two end spacers (see Figure 1). Thin brass shim stock cut into 5/16 inch wide strips makes up the contacts at the pivot points. The brass inserts are then attached to the main coil form with four 6-32 × ½ inch stainless pan-head screws at each end. I made the control shaft that engages the inner coil from a 2 inch piece of ¼ inch brass stock. I then drilled a hole into one end of the shaft

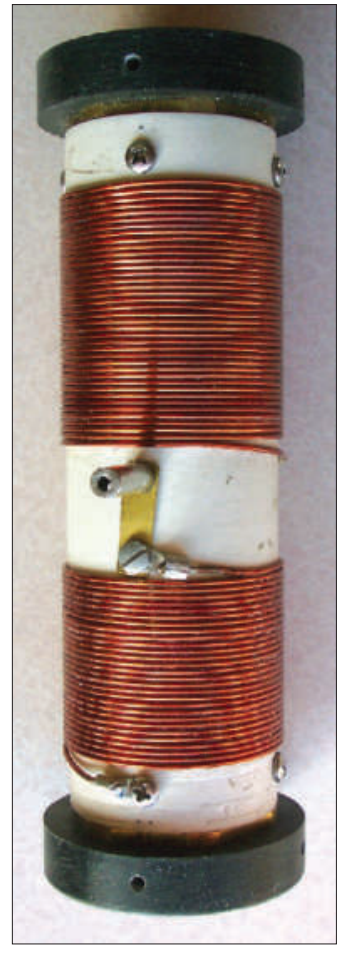


Figure 2 — Wind the outer coil in two sections, one above and one below the center shaft.

Figure 3 — Detail of the inside of a brass end fitting.

Figure 4 — An outer sleeve protects the completed variometer. You can also see my calibrated tuning knob.

and a short section from a brass 6-32 screw was soldered into the hole. This assembly must be removable in order to later install the protective sleeve. Fabricate the metal and plastic parts first, then drill and tap the holes. Then, to ensure that everything fits, dry-fit assemble the parts. Remember: not all PVC pipe is perfectly round, so select your material carefully, or true it on the lathe.

Note that the lower coil in Figure 2 terminates at a 6-32 tapped screw about ¾ inch vertically below the pivot point. The upper coil is similarly connected to the other side of that pivot point. The coil is connected to the pivot points by pieces of shim stock. The holes for the control shaft drilled through the outer PVC coil form must be precisely drilled to ensure proper tracking of the moving inner coil.

Winding the Coils

Wind both the inner and outer coils in two sections to allow room for the shaft assembly to pass through the coil mid points. The outer ends of the main coil are connected to the brass inserts at top and bottom. The inner coil is wound on a six inch piece of ¾ inch PVC pipe for ease of handling, and cut to size.

The moving inner coil should be accurately centered inside the outer coil on two spacer bushings with internal 6-32 threads, each about ¼ inch long. These can be made from the ¼ inch brass shaft stock. The bushings are fastened in place by two short screws that pass through the solder lugs connected to the inner coil ends. These screws must reach only about halfway through the bushings, leaving threads to receive the attaching screw on the back side and on the control shaft on the front. The length of these screws (use brass screws) must be exact, so cut them to size.

I wound the inside coil with eight turns of #18 AWG enameled copper wire. The simplest way to do this is to attach the supply of wire to a point across the room, then roll the coil form while walking toward the wire supply, maintaining a steady tension on the wire. On both coils, it is important to continue the second half of the windings in the same direction as the first half. When winding the big coil, have some duct tape or plastic electrician's tape handy to temporarily hold the windings in place while making your connections. Caution: do *not* solder to a lug that is attached to a screw in the PVC form, as the heat will melt the PVC plastic. All but the windings should be masked off and secured with three or four coats of clear acrylic spray. The outer and inner coils connect in series via the pivots at the midpoint, as seen in the Figure 6 diagram.

I wound 80 turns of #16 AWG enameled copper on the outer coil form, half on each side of the pivot holes. Some of these windings will later be removed in the coil pruning process. With the windings temporarily secured at each end and the brass end inserts not yet in place, the brass shim stock contact should be installed at the rear pivot hole. To ensure a good contact with the screw head, it should be bent out a bit. The inner coil is placed inside the larger coil and secured at the rear pivot point with a #6-32 screw that is short enough not to bottom out. It should be tightened just enough to compress the shim. This will hold the coil in position so that the opposite hole is approximately in line with the hole on the face side of the main coil. The shim contact is installed on the face side. The shoulder formed by the end of the ¼ inch shaft rides on the shim.

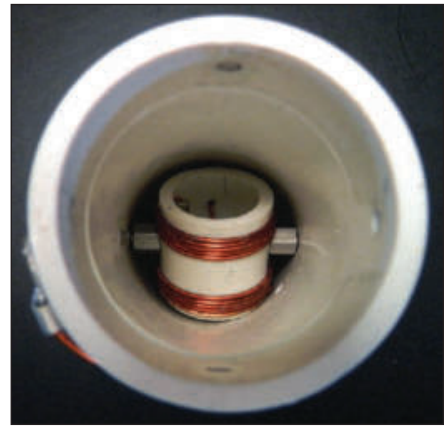


Figure 5 — The inner coil pivots to tumble end over end inside the outer coil.

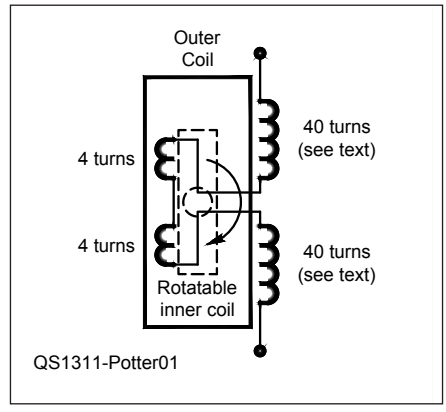


Figure 6 — The variometer coil windings are wired so that the inner coil inductance can buck or boost the outer coil inductance depending on the inner coil rotational angle.

The antenna elements should be fabricated in order make them ready for coil installation. To keep rain out, a copper end cap needs to be soldered onto the upper end of the top section. For now, the outer plastic sleeve can be left off and the control shaft can be temporarily installed. A pencil placed through the center of the assembly will align and anchor the inner coil while it is tightened.

The simplest way to align the two coils is to hold the coil up to the light and sight through it like a telescope (see Figure 5). Then, the shaft can be turned until the two coils are in perfect alignment. A small dot of paint or red nail polish is then placed on the side of the shaft facing one end of the coil, right next to where it emerges from the outer form. This is a reference point for pruning and for future positioning of the control knob.

After the antenna is installed on the vehicle it should be connected by coax cable to an antenna analyzer. With the red mark facing the top or bottom, find and note the resonant frequency. After turning the shaft

180 degrees, note the frequency again. The readings are likely to be below the desired frequency range, which means that the coils need to be pruned. The turns can be secured against unwinding by wrapping them with tape, then removing a couple of turns before reinstalling it on the vehicle. Note how much the frequency range has changed. This will give you an idea of how much more pruning may be needed. This process should not be hurried, because it's a lot harder to put turns back on than to remove them. As the turns on the main coil are removed, the effect of the inner coil increases, so check your progress at each end of the tuning range. The number of turns above and below the shaft does not need to remain equal. I removed all of my turns from the lower half of the coil. I ended up with enough adjustment to cover 3,750 to 4,000 kHz. For more tuning range, start with an extra turn or two on the moving coil. After pruning, 69 turns remained on my main coil. Once the calibration is complete, the sleeve can be installed. I used superglue to then attach a dial indicator as seen in Figure 4.

Final Words

I've found minor resonance variations at different campsites. The VSWR is typically between 1.5 and 1.8:1. While I described an installation on a mobile home, this process could be adapted to any vehicle. Also, this could be adapted to other bands. So if you need a tunable monoband vehicle antenna, consider giving the historic variometer a try. It has worked very well for me.

Harold F. "Hal" Potter holds an Amateur Extra class license, K7RQ. First licensed as W7MYG in 1948, he has operated as OE13HP from Linz and Salzburg. Hal also holds an FCC First Class Radiotelphone license and worked in broadcast stations for a number of years. His last job in broadcasting was as chief engineer at the Portland Public Schools educational radio station. Hal taught electronics in night school and built high powered RF generators to heat-treat the rivets. He holds US Patent 3,748,425 for his heat-treating apparatus. Hal has been an ardent homebrewer, designer and builder of ham gear for himself and others in the Portland area. He served in the US Army in Austria working in communications and running a code school. Hal left the broadcast business in 1967 to open an avionics business at a Portland area airport. He enjoys DXing and ragchewing, and after 65 years as a ham, the magic is still there! You can reach Hal at 23751 S Rondevic Dr, Canby, OR 97013-9751, or by e-mail: **potters@canby.com**.

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

New Products

Cushcraft R9 Vertical Antenna

The Cushcraft R9 vertical adds 75/80 meter coverage to the popular R8 model. It is specified to cover 75/80, 40, 30, 20, 17, 15, 12, 10 and 6 meters with low SWR, and no radials or antenna tuner are needed. Power rating is 1500 W SSB/CW. The R9 uses fiberglass insulators, stainless steel hardware and aluminum tubing. The antenna is 31.5 feet tall, weighs 25 pounds and requires a 1.25 to 2 inch mounting mast. Price: R9, $639.95; R-8TB tilt base, $79.95; R-8GK guy kit, $56.95. For more information, to order, or for your nearest dealer, call 800-973-6572 or see **www.cushcraftamateur.com**.

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/phone 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**.

A Digital Dial Update for the Kenwood TS-520S Transceiver

This microprocessor project can be adapted to bring your favorite radio into the 21st century with a digital readout.

Allen Wootton, VE7BQO

As far as I was concerned, my venerable TS-520S had only one flaw — no digital frequency readout. I was able to correct this in part by connecting a frequency counter to the VFO output jack on the transceiver's back panel. I say "in part" because as the VFO frequency decreases, the operating frequency increases. To get the correct frequency required some mental arithmetic; I had to subtract the four digit frequency counter readout from 500.0 kHz and then add the difference to the frequency indicated by the BAND switch. Finally, I decided it would be worth the effort to program a small microprocessor to handle both the frequency counting and arithmetic tasks and provide a true readout of the radio's frequency offset from the band bottom. The resulting device is shown in Figure 1. Like the analog dial, it is used in combination with the radio's BAND switch.

Tuning the TS-520S

On the TS-520S, the BAND switch shows 1.8, 3.5, 7, 14, 21, 28, 28.5 and 29.1 MHz. The radio's frequency is the BAND switch value plus that from the analog dial. For example, if the BAND switch is set to 1.8 MHz and the dial readout is 035, then the frequency is 1.835 MHz. With the BAND switch set to 7 MHz this same dial readout would correspond to a frequency of 7.035 MHz. My digital display supplements this analog measurement while giving one more digit of precision (to 100 Hz). Also, unlike the analog dial, it does not need to be recalibrated after each large frequency change.

Measuring Frequency with a Microcontroller

More elaborate digital displays like the Kenwood DG-5 or the aftermarket AADE C520 measure the VFO, heterodyne and carrier frequencies of the radio so in addition to the four digits of my display, they also show the megahertz digits.[1] They also change frequency with mode to account for the shift from lower to upper sideband or to CW. In practice, I find my simple display perfectly adequate and easy to use.

No modifications to the TS-520S are required to use this digital frequency display — jacks on the back of the TS-520S provide the necessary connections (see Figure 2). Power for the unit is available from the 13.8 V dc connector intended for the DG-5 digital display. The VFO output jack, also intended for the DG-5, provides a signal to the display.

An Atmel ATtiny2313A microcontroller set up as a frequency counter is central to the operation of this digital display. All frequency counters require a counter to count pulses and a timer to measure the time interval over which the pulses are counted. The

[1]Notes appear on page 39.

Figure 1 — The digital dial on top of my TS-520S transceiver. The analog dial shows .036 MHz. The digital dial gives a more precise .0356 MHz. Adding this to the BAND switch frequency gives the operating frequency.

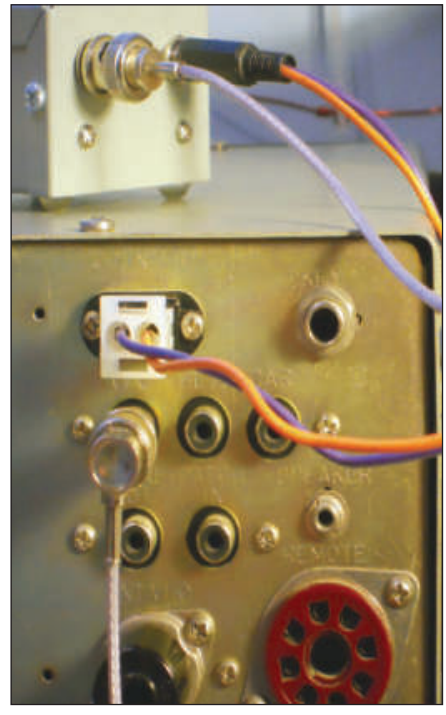


Figure 2 — The TS-520S power (labeled COUNTER) and VFO output jacks intended for the Kenwood DG-5 provide the necessary connections for this digital display. I used an RCA to BNC adapter on the VFO output and a salvaged 2 pin connector on the power output jack.

ATtiny2313A contains two timer/counters that can be used for these purposes; I used one to count the pulses from the VFO and the other to measure a time interval of 0.1 second. This 0.1 second time interval is derived from the microcontroller's crystal controlled 20.48 MHz clock; it is stable and accurate, and the count begins and ends precisely at the beginning and ending of the interval. For these reasons the VFO's frequency could be measured to greater precision than the 100 Hz display resolution of this digital display.

Initially, the frequency is stored by the microcontroller in binary digital form, that is, as a series of 0s and 1s. This information could be displayed in that form, but it certainly would not make for an easily deciphered frequency readout. With a software routine, however, the binary digits can be converted to the decimal units with which we are most familiar, and then stored in binary coded decimal (BCD) format. Since only four digits are displayed on the digital frequency display, only the digits corresponding to the hundreds, tens and units of kilohertz, and hundreds of hertz are then selected from the data available. They are subtracted from 5000 and displayed on a four digit, seven segment, common cathode LED display that is driven by the microcontroller. Each segment of each digit is controlled by one of the microcontroller's pins and each digit by another so that the digits are turned on and off sequentially and quickly enough that there is little flicker of the digits.

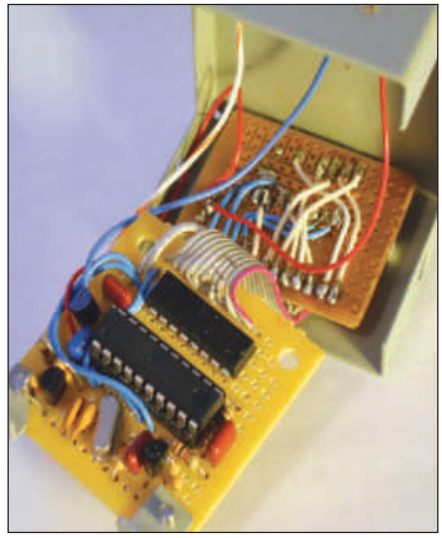


Figure 3 — Internal view of the digital display. The LED display and power switch are mounted on the smaller prototyping board inside the box while all the rest of the circuitry shares the microcontroller board.

Construction

Because almost all of the operation of the digital frequency display takes place within the microcontroller, the circuitry of the display is quite straightforward. Figure 3 shows how I constructed most of the circuit on a small perforated prototyping board (Figure 4 shows the schematic). Each segment of the LED display requires a current limiting resistor. Individual resistors could be used, but I used a resistor array consisting of eight in-

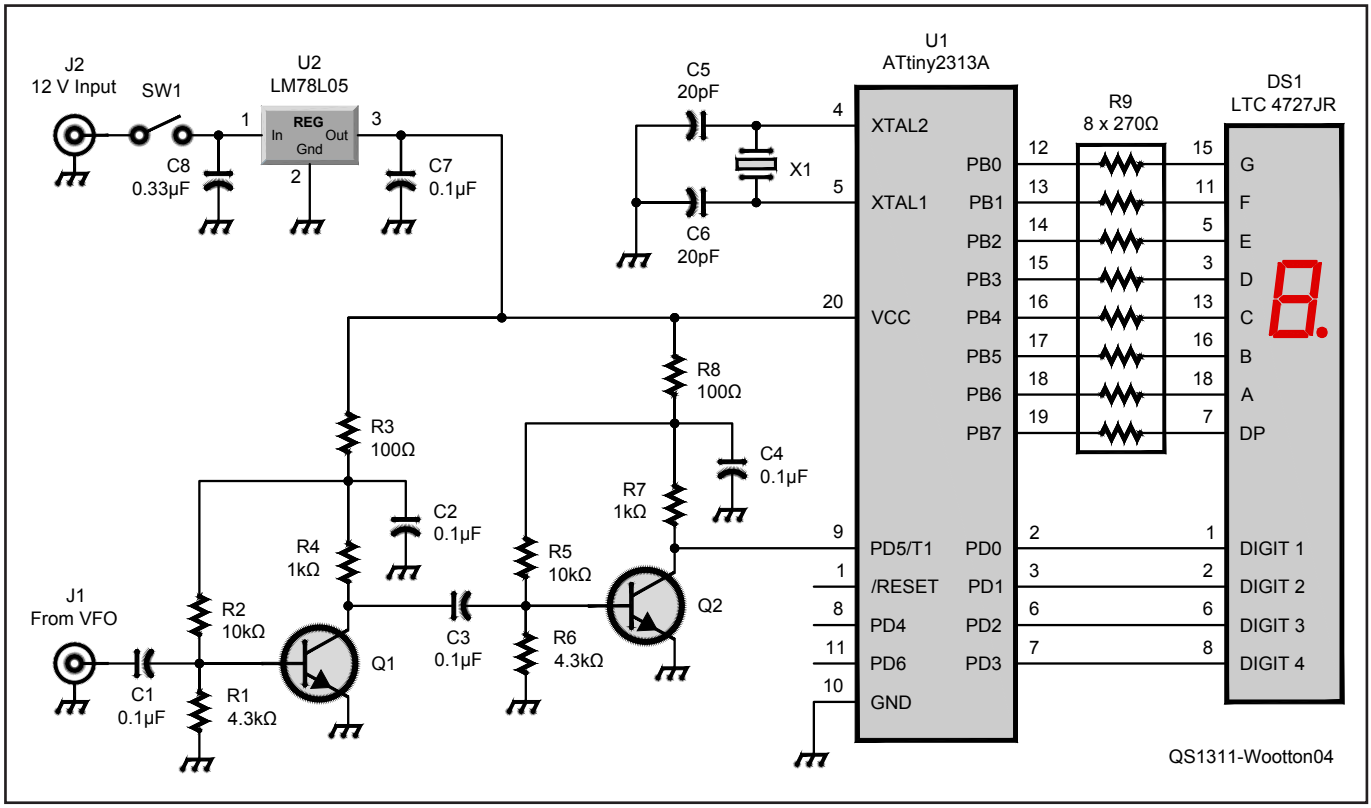


Figure 4 — Schematic diagram and parts list for TS-520S digital dial. Digi-Key part numbers are shown in parentheses and parts are available from **www.digikey.com/**.

C1, C2, C3, C4, C7 — 0.1 µF, ceramic capacitor (490-3859-ND).
C5, C6 — 20 pF, ceramic capacitor (399-8916-ND).
C8 — 0.33 µF, ceramic capacitor (399-4299-ND).
DS1 — 4-digit, 7-segment LED display (160-1551-5-ND).
Q1, Q2 — 2N3904, NPN transistor (2N3904FS-ND).
R1, R6 — 4.3 kΩ, ¼ W resistor (4.3KQBK-ND).
R2, R5 — 10 kΩ, ¼ W resistor (10KQBK-ND).
R3, R8 — 100 Ω, ¼ W resistor (100QBK-ND).
R4, R7 — 1 kΩ, ¼ W resistor (1.0KQBK-ND).
R9 — 8 × 270 Ω, ¼ W resistor array (4116R-1-271LF-ND).
SW1 — SPDT slide switch (CKN10397-ND).
U1 — ATtiny2313A, microcontroller (ATTINY2313A-PU-ND).
U2 — LM78L05, 5 V regulator IC (LM78L05ACZFS-ND).
X1 — 20.48 MHz crystal (X1039-ND).
IC Socket — 20 pin DIP (A100208-ND).
Enclosure — Hammond 1411B (HM315-ND).
J1 — BNC jack (A97548-ND).
J2 — Barrel connector (CP-5-ND).

dependent 270 Ω resistors instead. I found it very helpful to align the resistor array close to the microcontroller so that Pin 19 on the microcontroller is adjacent to Pin 1 on the resistor array. This made connection between the microcontroller and the LED display much easier. In my digital display, the LED display and a small on-off switch are mounted on a separate circuit board. I cut a tight friction fit hole for the LED display in the front of the small box I used to house the digital display so that no fasteners were required to hold the LED display and the on-off switch in place.

I mounted the ATtiny2313A in a socket. It could be soldered in place, but I like being able to add the microcontroller after checking voltages and ensuring that other parts of the circuit are working properly. Also, by using a socket, it is easy to remove the microcontroller for reprogramming.

Input Circuit

I adapted the input circuit to the digital display from the frequency counter presented in *Experimental Methods in RF Design*.[2] Initially I used just one 2N3904 in the same way as was used in that circuit, but I found that I couldn't get enough drive for the microcontroller at the high end of the frequency range for reliable operation. The count was fine up to about 5.3 MHz, but above that the readings were incorrect. The addition of a second 2N3904 connected in the same manner as the first cured this problem and I found that measurements to slightly more than 7.5 MHz were possible. This upper limit of frequency is a consequence of the microcontroller's 20.48 MHz clock frequency — the time between transitions on the input to the counter must be somewhat less than half the clock frequency.[3]

Programming the Microcontroller

With the right equipment and software, programming a microcontroller is straightforward. For the digital display, first download and save the digital display program from the ARRL files web page. Then download and save the free program *Studio 4.19* from the Atmel website.[4] With *Studio 4* running, open a new project. The program will ask you for PROJECT TYPE. Choose ATMEL AVR ASSEMBLER. I used TS520S_FC for the project name, but you can use any name you like as long as it is acceptable to the *Studio 4* program (periods and spaces are not permitted). For DEBUG PLATFORM select AVR SIMULATOR and for DEVICE choose the ATTINY2313A.Now copy and paste the digital display program into the project space. Once you have done this, if you select the assemble and run icon from the tool bar, you will be able to work through the program line by line, if you so desire, by pressing the F11 key.[5]

To download the program to the ATtiny2313A microcontroller I use an AVR Dragon, an economical programming/debugging device made by Atmel.[6] The AVR Dragon makes downloading a program to the microcontroller easy, and it also provides simulation and debugging. To use this device to program the microcontroller you need to change DEBUG PLATFORM from AVR SIMULATOR to AVR DRAGON and the AVR Dragon must be connected as shown in the *Studio 4* HELP. I have found the AVR Dragon indispensable as I've learned to use the Atmel microcontrollers. Except for the cost of an AVRDragon, the whole project, including a case, can be built for about $20. (In the time since this article was written, *Studio 6* has been released. This project can be completed with *Studio 6*, if desired.)

In Conclusion

The circuitry and program for this digital display could be adapted quite easily to other radios that use a VFO in the range of frequencies over which the counter functions. With a prescaler, the frequency range could be greatly extended. I have annotated the program extensively so that adaptations and changes to it should be relatively easy. As it stands, this digital frequency display is easy to build and to use, and I have found it to be a worthwhile addition to this fine old radio.

Notes

[1]AADE, **www.aade.com/C520/C520.htm**.
[2]W. Hayward, R. Campbell and B. Larkin, *Experimental Methods in RF Design*, ARRL 1st ed., 2003, p 4.30.
[3]**Atmel.com**, *Application Note AVR205: Frequency measurement made easy with Atmel tinyAVR and Atmel megaAVR*.
[4]**Atmel.com**.
[5]Further explanation of how to use *Studio 4* is provided in *Novice's Guide to AVR Development* available from **www.ceid.upatras.gr/faculty/alexiou/ahts/projects/project04/ylikoAskisewn/Evdomada1/B2/Programming%20novice.pdf**.
[6]Atmel Dragon **www.atmel.com/tools/AVRDRAGON.aspx**.

Allen Wootton, VE7BQO, received his license in 1964 at the age of 15. Since then, Amateur Radio has been a significant part of his life, providing him with a means for learning and good fellowship. After a period of inactivity, when he was busy with work and family commitments, he became active again through the much appreciated encouragement of his friend Austin Candy, VE7KX, and it was through him that he purchased the TS-520S featured in this article. Since his retirement he has enjoyed having more time for operating and experimenting with radio. You can reach him at **awootton@uniserve.com**.

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

New Products

DXFlights

DXFlights is a free app for Android and iOS devices that maps long distance flights according to radio beacon information. The app displays actual airline flights taking place during the previous two hours. Click or touch any plane icon and its flight call sign appears along with the time of last contact between the airplane and the ground (Air Traffic Control), as well as the originating airport and other information. See the Apple iTunes or Google Play stores. More information is available on the web at **http://DXFlights.com**.

Easy Operation of the G5RV Antenna on 160 Meters

Flip a switch and the G5RV becomes a vertical with capacitive top hat suitable for Top Band.

Martin Huyett, KØBXB

At the end of World War II, Louis Varney, G5RV, was itching to get back on the air as soon as the government gave word. In fact, he had his antenna already designed and erected when UK amateurs were allowed back on the air in February 1946. It was a multiband job and covered all the HF bands of the day — that is, 80, 40, 20 and 10 meters with the exception of 160 meters. In spite of problematic operation on the newer bands that would be introduced over the years, the antenna became a classic and is known simply by his call sign — the G5RV (see Figure 1A).

Varney first described his antenna with a workaround for 160 meter operation in an article in the July 1958 issue of the 1958 *RSGB Bulletin*.[1] The workaround involved connecting the two legs of the 34 foot matching section at the station end and feeding them against a good ground connection. The importance of a good ground radial system to the performance of a vertical monopole cannot be overemphasized. The subject was well covered by Rudy Severns, N6LF, in the March 2010 issue of *QST*.[2] Reconfiguring the G5RV this way turns it into a 34 foot vertical with a 102 foot capacitive top hat.

Well, the rub for me was reconfiguring the feed line — it was just too much of a procedure and ended up being a deterrent to getting onto 160 meters. It occurred to me that since the matching section came into the shack, I could use a DPDT switch to change between the standard G5RV and the top hat vertical configuration.

Design and Construction

Since Varney's original paper shows the antenna being driven by either the balanced output of an antenna tuner or an unbalanced coax (Figure 1A), I decided to take my chances with my 100 W automatic antenna tuner, which has an unbalanced output. Figure 1B shows how I connected the unbalanced output to the switch box with a six foot piece of RG8X coax. If your antenna tuner has a balanced output or you are using a balun, you should use the wiring scheme in Figure 1C and replace each SO-239 connector with a pair of screw connections.

Constructing the switch box was straightforward. Since the earth ground would have to be switched for the vertical configuration, keeping the shells of the SO-239s isolated from one another was a key design requirement. To accomplish this, I cut two 1½ inch square, half inch thick wood blocks and drilled a ⅝ inch hole through the center of each to accept the back side of a SO-239 connector mounted onto the block face. Before mounting the connectors, I soldered short in-

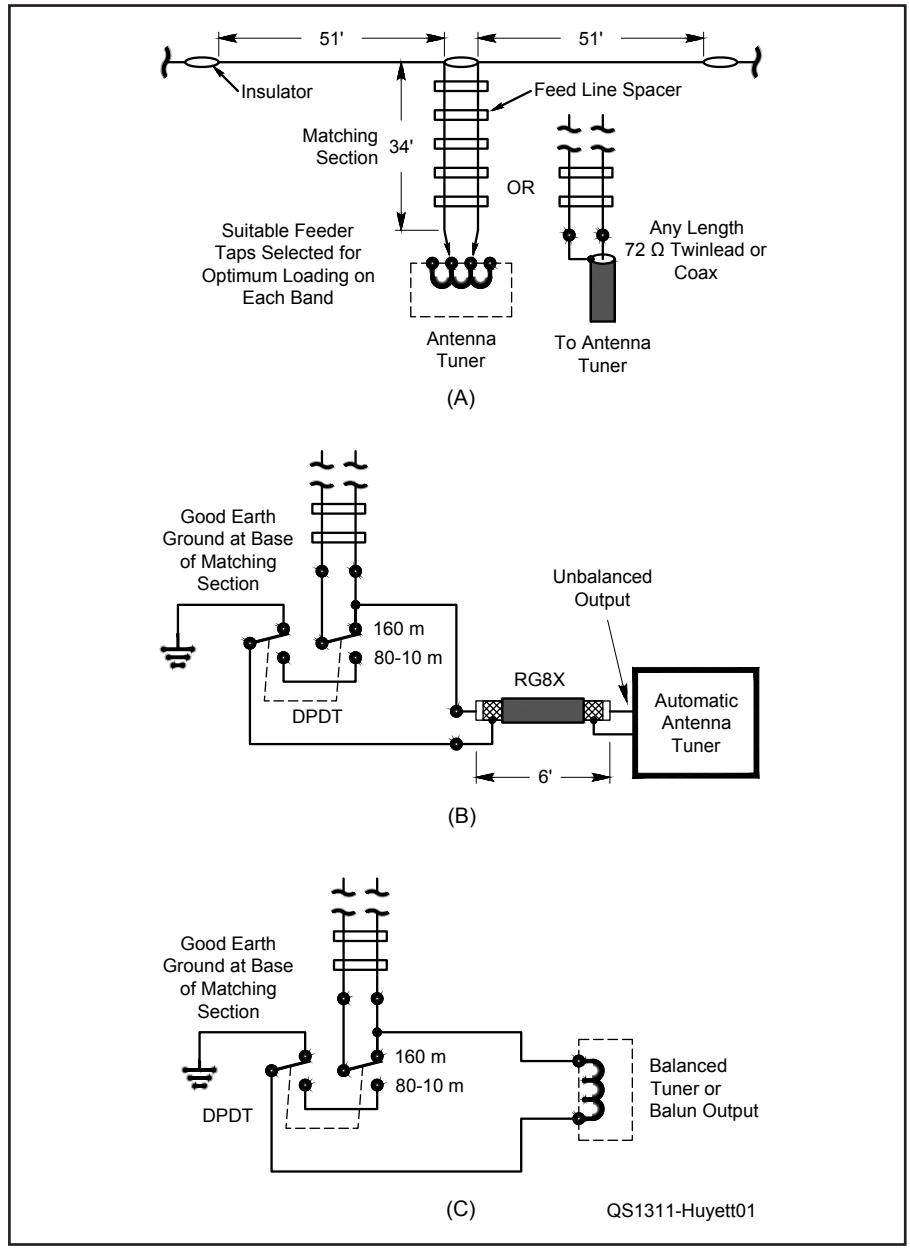


Figure 1 — At (A), the G5RV multiband antenna. At (B), the author's installation where the G5RV is driven by an unbalanced antenna tuner. At (C), suggested wiring schematic when the antenna is driven by a balanced source.

Figure 2 — Completed G5RV switch box.

sulated wires to the ground and center of each to connect to the switch. I then cut pieces of sheet metal 3 × 1½ inches to connect the two end blocks together physically but not electrically. In one of the sheet metal plates I drilled a hole to mount the DPDT switch. In another I drilled a hole for a ground terminal. I then mounted the plates to the blocks forming a neat little box (see Figure 2). [Alternatively, a small plastic box could be substituted by amateurs wishing to forgo the metal work. This would also alleviate any potential problems associated with high moisture content of the wooden end blocks. — *Ed.*]

I have had a number of CW contacts using the switch box to configure my G5RV for 160 meter operation. I even worked several stations on the QRP ARCI Top Band Sprint with the setup using 5 W.[3] Now, working Top Band is as simple as any other band — I simply throw the switch, hit the tune button on my antenna tuner and QSO away!

Notes

[1]L. Varney, G5RV, "An Effective Multi-band Aerial of Simple Construction," *R.S.G.B. Bulletin*, July 1958, pp 19-20. (Available on the CD-ROM accompanying *The ARRL Antenna Book*, 22nd Edition.)

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

[3]QRP ARCI (low power Amateur Radio Club International), **www.qrparci.org/**.

Martin Huyett, KØBXB, was first licensed in 1958 as a high school student in Topeka, Kansas as KNØBXB and now holds an Amateur Extra class license. He has a BS degree in Electrical Engineering and worked several years as an engineer before moving into management. He recently became Executive Director of Aramaic Bible Translation which is translating the Bible into five modern Aramaic languages. Martin has been an active ham most of his life. His special ham radio love is practical technical activities including homebrewing things he designs himself, as well as others' ideas and kits. You can contact Martin at 7735 Big Pine Lane, Burlington, WI 53105 or via e-mail at **k0bxb@arrl.net**.

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

Strays

AARA Celebrates its Centennial

The Albany Amateur Radio Association (AARA), arguably one of the oldest Amateur Radio organizations in the United States, celebrated its 100th anniversary last year. Founded in late 1912 as the Hudson Valley Wireless Association, the avowed purpose of the new organization was, "to further the exchange of information and cooperation between members; advance the general interest and welfare of Amateur Radio; and provide services to the community when needed."

The centennial was celebrated at the 2012 AARA Annual Dinner held at the Pinehaven Country Club in Guilderland, New York, where the ARRL presented a plaque to the club to commemorate the event. Shown receiving the plaque are (left to right) AARA Treasurer and Master of Ceremonies, Saul Abrams, K2XA; AARA President John Fritze, K2QY; former Hudson Division Director Joyce Birmingham, KA2ANF, and ARRL Chief Executive Officer David Sumner, K1ZZ.

I would like to get in touch with...

…Amateurs with radar expertise who can assist in the development of a ground-level tactile radar imaging system for the visually impaired. Contact Dr Marco Bitetto at **drmbitetto@verizon.net**.

Feedback

In "Hands-On Radio," October 2013 *QST*, in the formula at the bottom of page 63, left column, the second line should read: $Z_c = Z_2 Z_3/\Sigma Z$

CW Skimmer

When it comes to contesting and chasing DX, a little technological assistance goes a long way.

Eric Manning, VA7DZ

It can be frustrating trying to wade through a CW pileup to work a DXCC entity. The frustration is no doubt complicated by the fact that most DX stations work *split*, meaning their transmit frequencies are not the same as their receive frequencies. This technique spreads the calling stations — and the interference — across a given bit of spectrum while leaving the transmit frequency clear. It is an effective approach to managing chaos, but it means that we have no clue where the DX station is also listening from one moment to the next. All we can do is tune through the pileup and hope to hear the lucky stations that receive an answer. When the rare one calls "QRZ" once again, we transmit on or near that listening frequency and hope for the best. All too often, however, our hopes are dashed.

Further frustration can occur in a contest operation that includes stations that have value as score multipliers — stations from certain states, countries, zones, and so on. We can patiently tune across the band, listening to one exchange after another in the hope of finding multiplier gold, but in doing so we will likely miss the station that only began transmitting after we left his frequency.

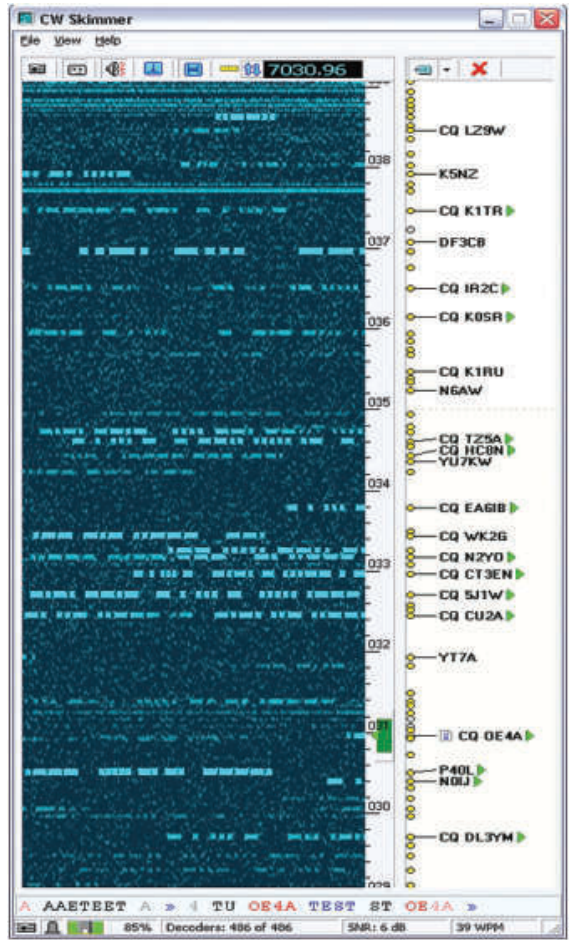
The answer to both problems would be to receive and comprehend many CW signals at once, but that's impossible...or is it?

A Software Solution

Alex Shovkoplyas, VE3NEA, has a modest station — just 100 W and not a lot of aluminum in the air. Even so, he enjoys chasing DX and contesting. As a result of his background in electrical engineering and love of computer programming, he created a *Windows* program that would let him see all of the CW activity in a given chunk of spectrum within a single display.

First, he fed the audio output of his receiver to his computer sound card, where it was digitized and converted to a stream of data. With the data in hand, Alex designed a software module that accurately decodes and displays CW call signs. More software sorts the call signs and displays them in vertical ascending order by frequency.

The software also displays the actual transmitted CW for each call sign in an adjacent waterfall display. The signals appear as strings of dots and dashes. The strings scroll to the left, allowing the user to read the CW visually. The result was christened *CW Skimmer* for its ability to skim through the audio passband, decoding CW signals as it goes.



CW Skimmer decoding 22 signals simultaneously. The green arrow along the right-hand edge of the waterfall display indicates the receive frequency. Not all decoded signals are labeled with call signs, and some call signs are outside of the screen boundaries.

Another challenge, at least from a DX hunting standpoint, is figuring out which station in a pileup is actually communicating with the rare one. Alex solved this dilemma by programming *CW Skimmer* to watch for any signals that contained the numerals *599*. Why? Well, if an operator is sending 599, he's very likely giving a signal report to a DX station, so he's very likely working the DX! *CW Skimmer* displays the 599 in bright red numerals next to the sender's call sign. Presto! If a red 599 suddenly pops up on the screen, you're probably looking at the guy who is in QSO with the DX *right now*.

Addressing the Bandwidth Problem

Of course, *CW Skimmer* can only skim through a portion of the band equivalent to the audio bandwidth of the receiver. For most receivers that is about 3 to 6 kHz and that's often insufficient. Fortunately, there is a solution.

Most filtering in modern receivers is done in the IF stages, or after the IF. The receiver bandwidth at the input to the IF stages is generally 10-17 kHz or more. So, if we could get at that IF signal, we could easily decode and display enough of the band to cover most pileups. Some radios make the IF signal available at an accessory port; with other rigs it isn't difficult to devise a homebrew tap (a thin cable connection at the proper point through a 0.01 µF ceramic capacitor will often do).

However, you can't feed an IF signal directly to a computer sound device. These devices expect audio in a range of 0 to 20 kHz; the IF signal is RF centered on the first IF frequency of your receiver — possibly as high as 10 MHz or greater.

So, before we can feed this signal to a PC sound device, we need to mix it down, or convert it, to audio (sometimes called *baseband*). We also need a sound device capable of processing a broad range of signals.

When it comes to sound devices, the good news is that modern models, including those

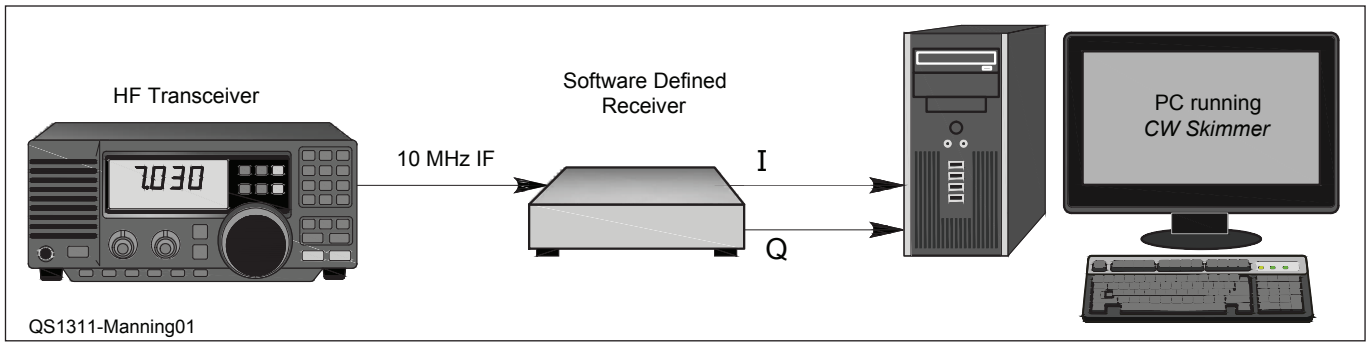


Figure 1 — Diagram of a typical *CW Skimmer* system using a Software Defined Receiver to process the IF signal from the transceiver. In this example, the 10 MHz IF signal is brought to the Software Defined Receiver, which is tuned to 10 MHz. The SDR processes the IF signal to I and Q baseband audio, which in turn is sent to the stereo LINE INPUT of the computer sound device. The sound device converts the I/Q signals to data for *CW Skimmer*.

that probably came with your PC, can handle bandwidths of 48 kHz with many topping out at 96 and even 192 kHz. These sound devices — external USB units and internal motherboard cards — can be very affordable. The caveat is that your chosen device must offer *stereo* audio inputs, for reasons to be explained shortly.

This downconversion issue used to be tricky to resolve, until the advent of Software Defined Radios (SDRs). High-end SDRs sample RF signals directly — almost at the antenna input — and convert them to data, but less expensive models such as the SoftRock receivers (**http://fivedash.com**), or the Funkamateur FiFi that was reviewed in the September 2013 issue of *QST*, use a different approach. They take the signals arriving at the antenna port and mix them with the output of a local oscillator. The result is two baseband audio signals that comprise the so-called *In-Phase* (I) and *Quadrature* (Q) channels.

If you feed these I/Q audio signals to the right and left stereo inputs of your sound device, *CW Skimmer* will take it from there. Depending on the audio bandwidth of your sound device, *Skimmer* will be able to display many kilohertz of spectrum simultaneously. See Figure 1.

Talking to Your Radio

If you want *Skimmer* to display actual RF frequencies on the screen, it needs to know the frequency your receiver is tuned to. Also, if you want *Skimmer* to re-tune your receiver automatically when you click on a call sign — and you should, if you're serious about contesting — the software needs to send frequency change commands to your radio. This means that you will need a radio that can send and receive frequency information and other data, and a cable to connect the transceiver data socket to your computer. Depending on the radio, you may need a data interface between the radio and the PC.

Moreover, if you also run other software

An economical Software Defined Receiver such as the Funkamateur FiFi can be used to receive and process the IF signal from the transceiver.

which needs to send and receive radio data — a logging program, for example — you will need a module to share the stream of radio data among all of the programs that need it. This is called a *multiplexer*; a popular one is Telepost's *LPB2* (**www.telepostinc.com**).

The Challenge and the Reward

To get all of this hardware and software connected and playing together requires some patience. Just dealing with *Windows'* management of COM ports can be trying.

And there is a financial price to be paid as well. *CW Skimmer* itself costs $75. Adding a lower-end SDR receiver and a wide-bandwidth sound device can total $260, depending on your frugality and shopping skills.

Finally, it is worth noting that *CW Skimmer* uses a lot of CPU cycles and memory; you will need at least a 2.5 GHz Pentium PC with 1 GB primary memory. *CW Skimmer* is graphically intense, so your PC's video adapter card must have its own video data memory.

All that said, when everything is working properly the results are astonishing. Many computer savvy contesters and DXers consider *CW Skimmer* to be an invaluable tool. In fact, the Reverse Beacon Network, which aggregates activity reports from throughout the world, is based on *CW Skimmer*.

You'll find *CW Skimmer* at **www.dxatlas.com/cwskimmer/** along with the excellent *CW Skimmer* tutorial by Pete Smith, N4ZR, at **www.dxatlas.com/CwSkimmer/Files/Skimmerintro.pdf**.

Eric Manning was first licensed in 1954 as VE3DPV. He holds Canadian Amateur and Advanced Amateur certificates and is a Fellow of the IEEE. Eric was trained as an Operator at the Wireless & Line at Signals School, Canadian Army Signals Corps, CFB Borden. Eric enjoys building, CW contesting, DXing, and antenna farming. He is retired from the University of Victoria, where he was Dean of Engineering. You can contact Eric at 1431-440 Simcoe St, Victoria, BC, V8V 1L3, Canada; **va7dz@arrl.net**.

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

Your Portable Generator to the Rescue

Get hooked up, the right way and the safe way!

Mike Gruber, W1MG

The recent *QST* Product Review of small portable generators proved very popular.[1] Hams like them for good reasons — they are not only affordable and readily available, but they can provide kilowatts of ac power in a small package. Unlike batteries, generators produce 60 Hz ac in standard 120 or 120/240 V ac directly — just as your power company does.

Portable generators are great for a variety of amateur uses, including ARRL Field Day as well as portable and emergency operations. In addition, generators are ideal for non-amateur use. I've used them for powering tools and other equipment at several remote locations, including at camp, and at home just beyond the reach of my longest extension cord. For me, as for most amateurs, being able to operate my station during a power outage has also been a major benefit.

It Takes More Than Just a Generator!

Whenever an extended power outage strikes, especially under adverse conditions, your portable generator may seem like the obvious answer. However, remember that your generator must be located outdoors, while your power needs are usually indoors. You'll need some means of bringing your generator's power into your home and routing it to appliances and other critical systems. Some form of a hookup is required, and it must be ready when you need it. Without preparation, a sudden or unexpected outage may lead to a desperate situation in which you are tempted to cut corners. Improper hookups are not only illegal but can be dangerous. Don't wait for the lights to go out before taking action. Be prepared and do it right, as will be described in this article.

If and when your power goes out, using a legal hookup can quickly, safely, and easily switch you over to generator power. It also eliminates what in many cases is a fire and shock hazard (see the sidebar "What Not to Do, and Why"). It's cheap insurance, and after the ordeal of several prolonged outages, I can personally say it provides peace of mind, especially during cold weather. To paraphrase an old TV commercial: "Don't leave your home without it."

[1]B. Allison, WB1GCM, "A Look at Gasoline Powered Inverter Generators," *QST*, June 2012, pp 49-53.

What Not to Do, and Why

One of the most common illegal generator hookup arrangements is called *back feeding*. This technique typically involves turning off the main breaker in the service entrance panel, then connecting the generator to a 30 A dryer or similar receptacle. This is not only illegal but dangerous.

First, failure of a main breaker to isolate an electrical system from a utility's line can put utility personnel at serious risk. The very people trying to help restore power during an outage may be injured or killed as a result of back feeding. Your generator may potentially be powering other homes in your neighborhood and beyond. Damage to your generator can result. Should power be restored at this time, a catastrophic failure can result.

A couple of examples that I've personally observed were also alarming. In a pinch during the December 2012 ice storm, a jury rigged zip-cord was used to back feed from a receptacle located on a lawn light. Overheating was readily apparent by melted and charred insulation. In another case, a neighbor attempted to back feed through a receptacle for an arc welder in his garage. Since his welder was exclusively a 240 V device, the cable neutral was left open inside the connector. Overvoltage to appliances resulted in widespread (and expensive) damage throughout his home, including his furnace. See the sidebar entitled "The Importance of Being Neutral" for details on what happened in this case.

It should also be pointed out that failure of the main breaker to isolate your service entrance panel from your utility's hookup may not necessarily be operator failure. Unlike a circuit breaker, a legal "transfer switch" must break the connection to the utility before connecting to the generator. It must be physically constructed in such a way as to make it impossible to connect your generator to your utility's hookup. Another important concern and code violation is exposed "hot pins" on the plug. Since power is being "back fed" into your home's electrical system, the pins on the plug connected to the generator cable become live, possibly with 240 V ac. Obviously, this is a very dangerous and potentially lethal situation.

Another possible and often overlooked back feeding problem is the circuit breakers. In many cases, breakers are used as switches in order to control and manage the electrical load to the generator. Not all circuit breakers, however, are intended to function as switches. Mine are not, but yours may be. In either case, I always try to avoid doing this as a matter of principle.

Bottom Line: don't even think about back feeding your generator into your home — ever! Fortunately, with a little common sense and planning, you won't be tempted to.

Figure 1 — These can help determine power requirements. Shown are an AmWatt™ Appliance Load Tester (bottom left), Kill A Watt (top) and clamp-on ammeter (right). [Bob Allison, WB1GCM, photo]

Note that this discussion pertains only to portable generators. Whole house and back-up stationary generators are a viable, if more expensive option, but are beyond the scope of what we are covering here.

Assessing Your Requirements

Whether you have a generator, or are thinking about getting one, your first step is to determine your most essential needs in the event of a power outage. If you already have a generator, you must adjust your expectations to match its capability. Most portable generators do not have sufficient capacity to completely take the place of commercial power for a typical household. Some compromises may be necessary. First, think in terms of "essentials only." You could also limit the generator load at any given time. While you may be able to adequately power each of several appliances separately, you will not necessarily be able to power all of them at once. Even a relatively small generator can handle an essential item such as a furnace.

In addition to your Amateur Radio needs, start by making a list of the essentials you'll want to operate during the outage. In our case, for example, this included our oil-fired furnace, the refrigerator (and freezer, if you have one), our water well and sump pumps, enough lighting by which to accomplish important tasks, entertainment and information providing devices including a radio, television, and a PC.

While not a consideration for us, medical devices, such as an oxygen concentrator, can be a serious concern. Heating wires on a roof to melt ice dams may also be essential in the event of heavy snow or a blizzard.

Next, determine and tabulate the load of each device, either in watts or amperes. For each critical load, make a note of the circuit breaker or fuse that provides the power — this will be an important consideration in sizing a transfer switch. Manufacturers' specifications often appear in owner's manuals, but sometimes they are stamped on the device's name plate. You can also try contacting the manufacturer. Another approach is to measure the load of each device (see Figure 1). Some common instruments capable of doing this include the Reliance Controls AmWatt™ Load Tester (**reliancecontrols.com/ProductDetail.aspx?THP103**). The Kill A Watt® by P3 International. (**www.p3international.com**) also measures frequency, a handy feature while the generator is running. A clamp-on ac ammeter can also be used.

You may also be able to estimate the power consumption or current. Helpful charts are also available from various sources, including the US Department of Energy at **energy.gov/energysaver/articles/estimating-appliance-and-home-electronic-energy-use**.

Some devices, especially motor powered devices, have a high start or inrush current. In our case, the well pump was the most challenging load. A motor may draw as much as three times more current during starting than while running smoothly at normal operating speed. Keep track of both the start and run current for each device.

Next, determine the generator size you need, leaving plenty of headroom. Simply add up the total power requirements for all the devices you'll want to run simultaneously. For example, you may want to run both your well pump and furnace if you want a hot shower while on generator power. Finally, select at least one size larger generator than what you expect to need at any given time.

Location, Location, Location...

It goes without saying that generator location is an important consideration. Internal combustion engines produce deadly carbon monoxide. Don't put youself or your family at risk. Use a generator only in a well ventilated area. Never run a generator in a home, basement, or garage. Be sure to keep it away from windows, doors, and any air intake for your furnace. Each of the many senseless and needless

The Generator Connection

Most smaller portable generators, such as those discussed in the June 2012 *QST* Product Review, come with a 120 V ac, 20 A receptacle. In addition, most medium and larger generators also include a four terminal twist lock connection. These connectors can accommodate a split phase 120/240 V ac hookup, which is preferable when powering multiple circuits or loads. See the sidebar, "The Importance of Being Neutral," for an explanation. Note: some older generators may have a split phase output with a standard 240 V ac receptacle.

Table A
Color Codes for Generator Wiring

Terminal	Label	Conductor	Notes
Ground	G or Green	Green	
Neutral	W	White	
X Phase	X	Red[1]	Hot
Y Phase	Y	Black[1]	Hot

[1]In this case, the black and red connections are interchangeable. Since most transfer switches come with one connector already attached to the generator cable, I typically maintain the same color scheme throughout the hookup. Maintaining consistency can help if troubleshooting is required.

Twist lock connectors can either be rated for 20 or 30 A. Figure A shows the pattern for each connector. Obviously they are not interchangeable. Be sure to select the correct connector for your generator. The color codes are shown in Table A.

If your generator does not have a split phase output, you may need to limit your electrical hookup to one phase only. This may limit your ability to power multiple circuits. For example, only half the circuits will be powered with a load manager switch. If you are using a service disconnect transfer switch, only half the circuits will be live. You may also be unable to connect to your generator with a gen-cord. Be sure to consult with a qualified electrician if you wish to power both the X and Y phases from a single ended generator output.

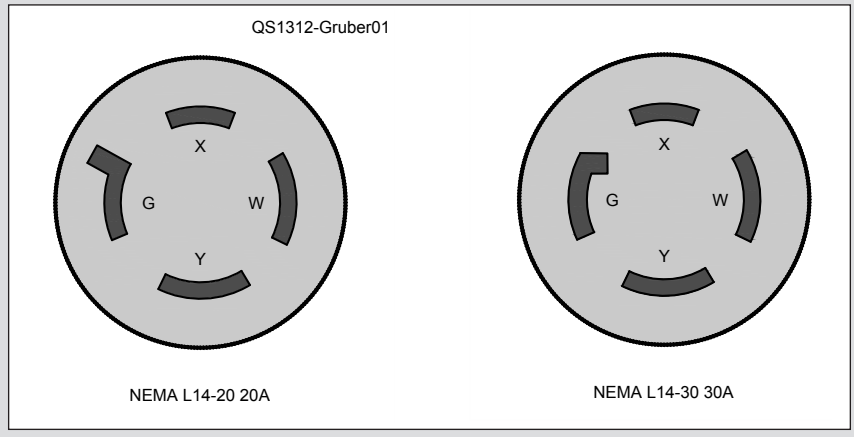


Figure A — The terminal patterns for four-terminal twist lock type 20 and 30 A connectors.

The Importance of Being Neutral

The familiar three wire "split phase" system used for residential electrical distribution has been around for a long time. In fact, it's the ac equivalent of the original Edison three wire system used in early dc distribution systems. Most middle sized generators and larger have a split phase output. As shown in Figure B, this system includes two phases that are 180° from each other. Each phase shares a common conductor bonded to earth ground at the service entrance, typically referred to as the *neutral*.

In the case of split phase generator and home power distribution, each phase is 120 V ac with respect to neutral. One significant advantage of this system, however, is that the voltage between phases is doubled or 240 V ac. Furthermore, no single conductor is greater than 120 V with respect to ground. Potential ground fault currents are therefore reduced when compared to a 240 V two wire system. Probably the most significant advantage of the split phase system, however, is improved efficiency.

As illustrated in Figure C, the phase currents in the neutral conductor are opposite in polarity. The total current in this conductor, therefore, becomes the difference between the two phase currents. Thanks to Ohm's law, less current flowing in the neutral conductor also means there is less voltage dropped across it. As a result, less power is wasted in the neutral conductor (in the form of $I^2 \times R$ losses) and the voltage increases at the load. In fact, if we consider the case in which the two phases are perfectly balanced, the neutral current (and any associated conductor losses) would go to zero.

Let's now consider a case in which the neutral conductor is open or simply not connected. If the loads are perfectly balanced, the two phase currents are equal and opposite in the neutral conductor. Removing the neutral would have no effect in this case. However, a perfect balance between the two phases is very unlikely to occur in a real life situation. Once the system becomes unbalanced, a high voltage will appear across higher impedance loads. The greater the imbalance — the higher the voltage. In fact, it can approach two times normal voltage in an extreme case. This likely will result in an expensive and dangerous situation. As a minimum, widespread damage to household appliances will likely occur. Never underestimate the importance of the neutral conductor. If your generator has a split phase output — verify the neutral connection in any cable before using it.

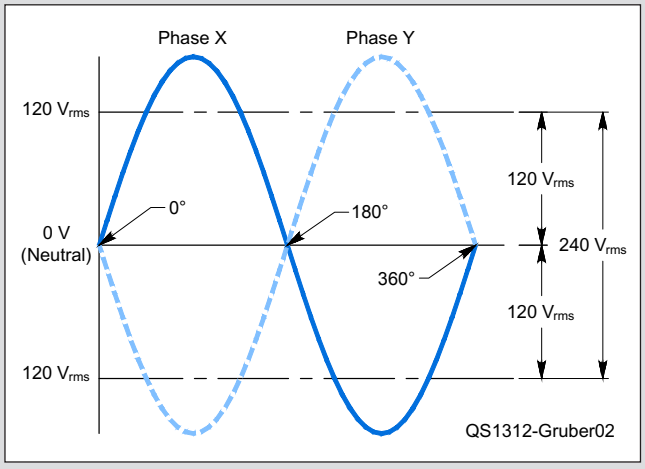


Figure B — The two phases of the 120 V circuits in a split phase arrangement. Note that they are 180° apart.

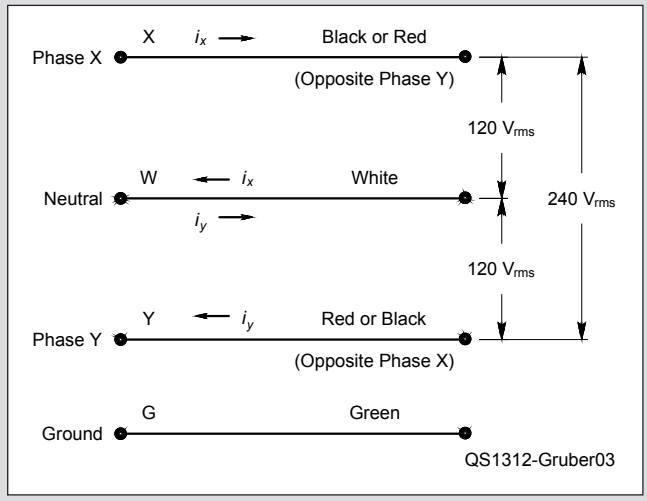


Figure C — Wiring diagram of a 120/240 V split phase system. The electrical code requires a single point bond between neutral and ground in the service entrance panel.

tragedies that happen each year were preventable with the use of a little common sense and good judgment. Consider installing a carbon monoxide detector to provide early warning.

Another consideration when selecting an optimum generator location is cable routing. This can vary somewhat, depending on the hookup option you choose. For example, if you plan on running a temporary cable or cord through a door or window, you might select an outside location convenient to both the opening and the target area inside your home (but make sure it's far enough away so that exhaust can't come in the same opening). A permanent hookup, however, may afford additional options, particularly with regard to cable routing and power access inside your home. Some of these options will be discussed later in this article.

A prolonged power outage means a lot of trips to the generator, many of which occur in the dark — the lights go out when the gas is gone. Depending on circumstances, a visit to the generator may also involve snow, rain, high wind, and cold. Shoveling a long pathway after a blizzard may create unwanted delays, not to mention health hazards. Convenience would also dictate that gasoline and other necessities be located nearby.

A running generator can also be quite noisy. Plan to locate it in such a way as to minimize the noise inside your and your neighbors' homes. I always direct the generator's exhaust toward the woods and away from homes, including my own. Your generator should also be protected from the elements. A level paved surface prevents it from sinking into mud or moving due to vibration. Avoid theft by securing your generator, as well as by not letting it be visible.

Hookup Options

Since we're only considering portable generators, we'll only be considering manual (as opposed to automatic) type switching op-

Figure 2 — An example of a specialized gen-cord used to get power from the generator to multiple loads. [Mike Gruber, W1MG, photo]

Figure 3 — One type of transfer switch is the whole house service disconnect switch. This box would go between the usual service entrance (circuit breaker) box and the input line. [Photo courtesy Reliance Controls Company]

tions. Setting up a typical portable generator already requires you to move, connect and start it when the power goes out. Automatic switching adds little benefit or convenience in this case. Manual switching is less expensive and offers the possibility of load control and management. See the sidebar, "The Generator Connection."

Let's now take a closer look at the basic options.

Extension and Generator Cords

Extension cords are probably the cheapest option. Special *gen-cords* are really made for the job (see Figure 2). They offer all weather convenience and come in both 20 and 30 A versions that connect directly to your generator's 240 V output. If considering a gen-cord, simply select the size that accommodates the outlet on your generator. The load end of a gen cord typically splits into four 120 V receptacles. In this case, the voltage drop in the gen-cord's common neutral wire can be reduced by balancing the loads between the two phases. See the sidebar entitled "The Importance of Being Neutral" for more explanation.

Grounding requirements when using an extension or gen-cord can vary. Generally, most generator manuals that I've seen recommend grounding the generator. I would also suggest that you consult with your local building inspector for any additional local code requirements. If not specifically addressed, we generally recommend bonding the generator to your home's electrical system ground, especially if your generator has GFCI protection. Also see the OSHA Fact Sheet Grounding Requirements for Portable Generators at **www.osha.gov/OshDoc/data_Hurricane_Facts/grounding_port_generator.pdf** for additional information.

Using an extension or gen-cord for a home generator hookup is straightforward. Simply run the cable through an open window or door to the chosen appliances. Once the cable is inside your home, additional household items and appliances can be accommodated with more extension cords. This approach is good for running a small number of appliances and loads. On the down side, it can't be used to power hardwired items, such as a furnace or well pump. In addition, if you're not careful, the voltage drop in the cord or cords may become excessive, especially during a high current demand. If this happens, the cords can get hot and create a fire hazard. Other considerations may also involve the cable path into your home. The opening may create additional security concerns or other issues, especially during temperature extremes or other severe weather. Be very careful that the opening doesn't allow exhaust fumes to enter the dwelling.

One big advantage of an extension or gen-cord approach is that it requires minimal preparation and expense before an outage. Inside your home, however, it may become inconvenient and time consuming during an actual outage. It may, for example, seem like a particularly inopportune time to be moving and plugging in a refrigerator. And if you wish to power more than just a few appliances, too many extension cords can create a trip hazard, especially if lighting is compromised in your home during the blackout. I make it a point to keep a gen-cord handy just for nonemergency and general purpose uses.

The Service Disconnect Type of Transfer Switch

The *service disconnect* transfer switch is installed between the power meter and circuit breaker panel (see Figure 3). This typically two pole switch controls the power source that feeds the entire electrical panel. The switch must be rated for the capacity of your electric service, typically 100 or 200 A for a modern residence. This is a one-switch-does-it-all option. Installation of a service disconnect switch requires the meter be pulled and it must be done by a licensed electrician.

Some might argue that a service disconnect type switch is generally best suited for larger generators. One advantage is that you can power any circuit in the house, provided the total load does not exceed your generator's capacity. Since the capacity of a portable generator is usually not sufficient to simultaneously power everything in a typical home, loads that were on at the time of the outage will still be on and your generator circuit breaker will likely trip immediately upon transfer.

In addition, surge currents can also be a significant consideration. Unless precautions are taken, a single "service disconnect" switch will apply power to all loads, all at once, unless they are otherwise turned off. Without such precautions your generator may be forced to simultaneously accommodate multiple surge currents, something which may exceed its capability.

Some means to control or manage the load is needed, and switching circuit breakers may seem like a convenient way to go. As previously noted, however, your breakers may not be rated to function as switches. And, speaking from experience, manipulating breakers (and switches) can be inconvenient and confusing, especially if there are many of them and the lights are out. Also, some power robbing devices may not be apparent or forgotten, especially in areas of the house that are seldom used.

The Load Side Type of Transfer Switch

The next option is a switch between the circuits in your home and the circuit breakers in your service entrance panel. This type of transfer switch is sometimes referred to as a load manager, load side, or power transfer system. It's actually a bank of several of switches, one for each circuit you want to power with a generator. Typically a load side can connect to 6 to 16 mission critical circuits, depending on model. Modern switches of this type also include a 15 or 20 A breaker for each circuit. Older switches without integral circuit breakers will, however, require a separate sub-panel. Each switch in a load side is wired between a breaker in your electrical panel and the circuit. Since each switch controls only one circuit at a time, this approach allows you to gradually increase the load over time and control it by turning circuits on and off.

Six circuit versions of the load transfer switch are available at local big box stores for around $300. Typically, these can provide six 120 V circuits, or one 240 V plus four 120 V circuits.

Since the meter does not need to be pulled, these can be installed by a homeowner, if comfortable wiring in the service entrance panel. A switch made by the Reliance Controls Company (**www.reliancecontrols.com**) comes with a how-to DVD and instructions. This is not, however, a beginner's project. It requires extensive wiring inside your service entrance panel. Depending on your specific installation, it may also require running a cable through the side of your house to a hookup box mounted on the outside of your home. If in doubt, seek the services of a licensed electrician. Installation of a transfer switch may also require a permit. Be sure to check with a building inspector.

If considering a load side switch, a good first step is to survey your home's electrical system. Start by mapping out the breaker circuits and identifying the items you want to power. Remember, you can only power as many circuits as you have switches, and any 240 V circuits require two ganged switches.

Next, balance your 120 V loads as well as you can by dividing them into two approximately equal groups, one for each phase. Keeping each phase balanced will help minimize the current (and any resulting voltage drop) in the neutral line. See the sidebar entitled "The Importance of Being Neutral" for details.

A load side switch is typically installed next to your breaker panel. If located in your basement, a typical installation requires a cable from a power inlet box (typically located outside, near your generator) be connected to the load manager switch (see Figures 4 and 5). For a 30 A load side you'll need a cable with three #10 AWG conductors plus ground. Some switches, such as the 30216A made by Reliance Controls, can be wired to accept a cable directly from a generator. This may work well for a breaker panel located in a garage. Simply run the cable outside under the garage door.

The disadvantages of a load manager compared to a service disconnect switch are obvious. Unless your load manager has at least as many circuits as you have in your home, not all circuits can be powered by your generator. You will still experience a mini-blackout while on generator power. This disadvantage, however, may become an advantage, depending upon your specific circumstances. Assuming that your generator is too small to power everything at once, you can start each circuit one at a time. This avoids a large initial current surge from devices and appliances, including motors. Once your generator is up and running, you can then operate each circuit independently of the others, thus preventing overload. Heavy loads can also be powered one at a time, if necessary.

Another advantage of the load manager approach is that you can balance the loads for approximately equal current on each phase. Some load managers even have power meters to monitor each phase for proper balance. Since critical loads and circuits have all been predetermined, they can easily be identified on a small bank of dedicated switches, as opposed to having to find them on a large and confusing breaker panel. This also makes it less likely you'll be wasting power (and pre-

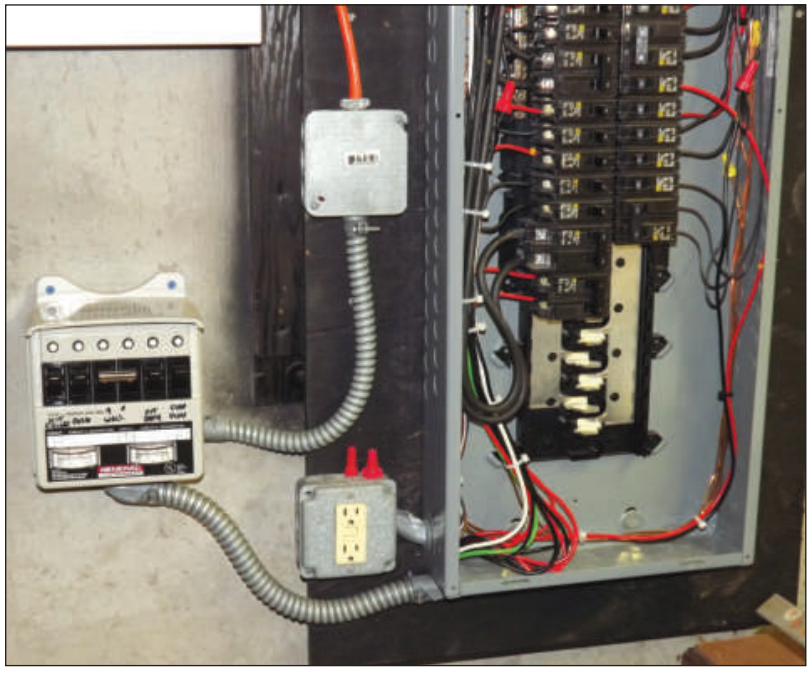


Figure 4 — A Generac load side connected to the service entrance panel. The orange cable extends to the generator connector mounted outside the house). [Mike Gruber, W1MG, photo]

Figure 5 — An outdoor twist lock connector for generator connection. See the sidebar entitled "The Generator Connection" for more information.

The Trouble with Gasoline

The outage caused by Storm Alfred in 2011 extended across much of Connecticut. Many gasoline stations were closed, and it quickly became apparent that gas was in short supply. Cars (presumably without gas) were stranded in snow banks along roads and highways. The nearest open gas stations were a considerable distance away. Long lines extended for blocks, and the wait could be hours; drivers ran out of gas. People were going as far away as Rhode Island to fill their tanks. A year later, almost to the day, Superstorm Sandy created a similar scenario in the Northeast. Once again, the need for preparation was apparent, particularly during the beginning phases of the outages.

One obvious solution is to keep a few extra tanks of gasoline on hand for just such an emergency. Storage, however, can lead to stale gas over time. Stale gasoline can make your generator difficult to start and run. Even worse, the resulting varnish can also gum up carburetors and fuel lines. In an extreme case, you may need to disassemble and clean the fuel system.

Keeping Gasoline Fresh

Gasoline shelf life can depend on a variety of factors, including its formulation, which can vary by region, air volume in the tank, storage temperature, and age when purchased. You can help maximize storage time by using clean designated gasoline rated containers with a tight cap. If your generator's gas cap has a vent, be sure to keep it closed when not in use. For long term storage, keep gasoline in designated containers with enough gas to minimize its exposure to air. You must, however, allow sufficient room for expansion and contraction due to temperature. It's also best to store gasoline in a cool place (but not inside your home or basement) to reduce evaporation and oxidation. In some cases, a valve can be added to the fuel line to help facilitate draining the generator's tank before storage. Be sure to check with your local fire department for any regulations that apply to the storage of gasoline at home.

Figure D — STA-BIL® fuel stabilizer. [Bob Allison, WB1GCM, photo]

Keeping a supply of gasoline fresh can be a real hassle, but fortunately, there are a number of additives that you can use to help extend its shelf life (see Figure D). For example, STA-BIL Fuel Stabilizer (**www.goldeagle.com/brands/stabil/products.aspx#stabil**), made by the Gold Eagle Company, is commonly available in many hardware and automotive retail outlets. When used according to the manufacturer's instructions, STA-BIL is guaranteed to keep fuel fresh for up to 12 months. In my case, I keep at least a two-day supply of gasoline on hand in 5 gallon containers. I also use a gas stabilizing additive and cycle the fuel every year through our car or lawnmower. Without a stabilizing additive, I use the gas within two months of its purchase. I know that there are varying opinions on the gasoline shelf life, but so far, this has worked well for me. Just remember — stabilizers can only prevent gasoline from going bad.

Heavy Lifting

Be aware that gas weighs approximately 6.1 pounds per gallon. This might not seem like much, but a full 5 gallon container weighs over 30 pounds. Consider using smaller tanks if your back is not up to the task. And don't forget a suitable funnel. I've found that a big funnel with a wide mouth gets the job done faster with less spillage. Less time pouring may also be easier on your back.

Conserving Gasoline

Another problem with gasoline may be its impact on your budget. At today's gas prices, even a few gallons a day can really add up during a prolonged outage. If gasoline cost or availability is an issue, conservation can help. Use only essential items. Keep everything off unless needed or in use. Use the generator only for the minimum time it is needed. In my case, I try to keep the house warm and reasonably comfortable. Refrigerated items are kept cold enough so that they don't go bad. Obviously, freezer items should not be allowed to thaw. If at all possible, I only open the refrigerator or freezer door soon after starting the generator.

cious gasoline) by powering forgotten and unnecessary items in your house. Only the most critical circuits are targeted with a load manager.

Conclusion

Your portable generator can not only keep you on the air but be a real lifesaver in a time of need. Proper preparation, however, is essential. I hope this article helps promote such proper and safe use of generators. Don't wait for a disaster to strike — prepare your generator now.

Mike Gruber, W1MG, is the ARRL Lab RFI/EMC Engineer. You can reach Mike at **w1mg@arrl.org**.

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

Center Feed Support for a Dipole Antenna

Use inexpensive PVC fittings to make this dipole and balun for low power portable operating.

Ron Davis, WB5TGF

I constructed a portable dipole antenna and its balun assembly after being inspired by a T-shaped PVC shower fitting that caught my eye in the hardware store. My design is for use in low power operation. I made my antenna for use on 40 meters, to complement a Yaesu FT-817 low power radio in my emergency communications grab-and-go box, but you can build yours for use on any of your favorite bands between 40 and 6 meters. Here's how I built mine.

The Antenna Components

Needed for the assembly of my antenna was a 1:1 balun, a PVC shower fitting and plug, wire for the dipole legs, and a coax receptacle. I used a panel type BNC receptacle (**www.mouser.com** part number 565-2451A) but you can use other coax receptacles as well. I wound the balun on a 0.500 inch diameter by 0.188 inch thick toroid (**www.kitsandparts.com** part number T50-43) using #22 AWG enameled magnet wire (**www.radioshack.com** catalog number 278-1345). The toroid must be small enough to fit in the 0.625 inch diameter non-threaded opening of the ½ inch diameter 90 degree elbow CPVC shower fitting (**www.lowes.com** item 9734 model 53055N). You will also need a ½ inch PVC schedule 40 plug (**www.lowes.com** item 23526, model 450005RMC).

Building the Balun

I then made the 1:1 common mode balun, which transitions from the unbalanced coax line side connection to the balanced antenna dipole side connection. More information about baluns can be found in *The ARRL Handbook for Radio Communications* and *The ARRL Antenna Book*.[1] I folded a 24 inch length of #22 AWG enameled wire in half and fed the folded end of the wire through the center hole of the toroid, leaving leads a few inches long. I then pulled the folded end around and pushed it through the hole in the same direction, repeatedly, until I had wound 9 turns of bifilar wire. I made the last turn come out on the same side as the starting two wire leads, resulting in the balun in Figure 2. The starting two wire leads are the balanced side of the balun, and the folded end of the bifilar wire is the unbalanced side of the balun. Remember — this balun and fixture were designed for low power operation.

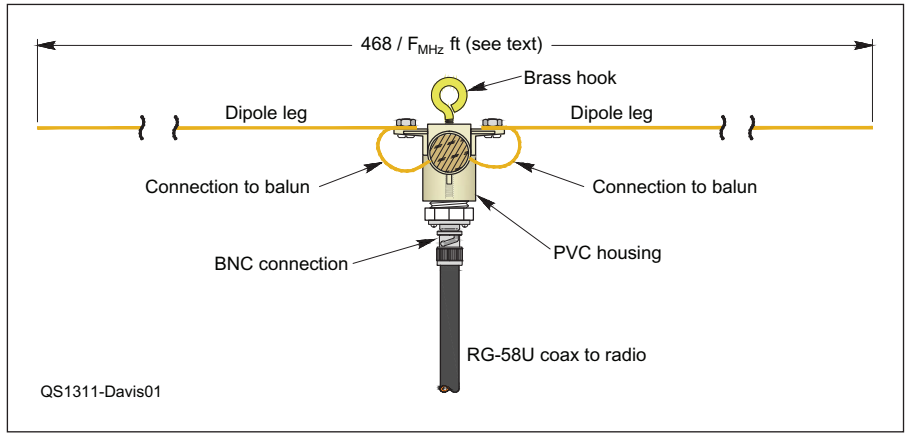


Figure 1 — A PVC shower fixture component houses a balun and supports the center of a dipole.

Assembling the Components

The PVC shower fitting has a threaded and a non-threaded opening. I drilled a 1/16 inch hole in each side near the bottom of the non-threaded opening to pass one each of the two wires from the balanced side of the balun. I drilled a ¼ to ⅜ inch hole centered axially in the PVC plug fitting as seen in Figure 2. I centered the BNC receptacle on the end

Figure 2 — A PVC shower fixture, a PVC plug, a balun and BNC receptacle make up the dipole center support. [Ron Davis, WB5TGF, photo]

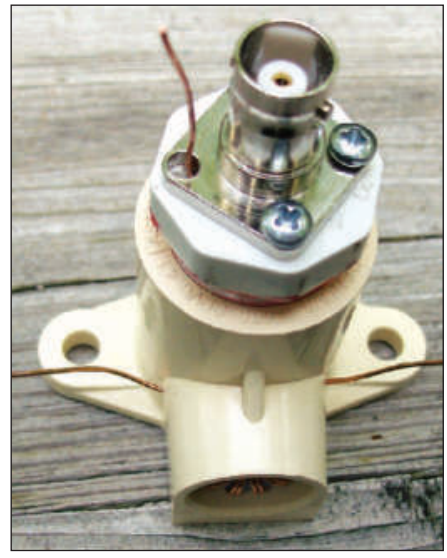


Figure 3 — The one wire from the balun protrudes through the BNC receptacle flange. You can also see the balanced side wires at the PVC flange. [Ron Davis, WB5TGF, photo]

[1]Notes appear on page 51.

Figure 4 — The assembled center section for the dipole. [Ron Davis, WB5TGF, photo]

Figure 5 — You can attach an optional hook on top of the PVC fixture. [Ron Davis, WB5TGF, photo]

Figure 6 — My emergency 40 meter band grab-and-go antenna system. [Ron Davis, WB5TGF, photo]

of the PVC plug, and using the BNC receptacle flange holes for a pattern, drilled holes which I tapped for screws to hold the BNC receptacle to the PVC plug. I made a slot for one wire on the unbalanced side of the balun using a hot soldering iron tip (see Figure 2). I used needle nose pliers to push each of the balanced side wires out the holes I drilled in the unthreaded part of the fitting. I pushed the folded end wires out the threaded part of the fitting, pushed the balun down into the hole of the PVC shower fitting while pulling gently on the two balanced side wires. The balun should fit snugly place as shown in Figure 2.

I passsed the folded end of the wire through the PVC plug fitting and screwed the PVC plug into the PVC shower fitting. (It does not have to be very tight. You will use silicone sealant to waterproof everything.) Next, I installed the BNC receptacle. I cut the folded end of the wire and pulled one wire over to the side. This end will connect to the BNC receptacle flange. I cut the other end off, leaving about ¾ inches of wire protruding from the fitting. Be careful here and do not cut it too short. With a sharp knife (an X-ACTO® knife works well) I scraped the enameled coating from the wire and tinned the scraped portion of the wire with my soldering iron. Next I soldered the tinned wire to the center conductor of the BNC receptacle.

I fed the remaining wire up through one of the BNC receptacle flange holes and gently pushed the receptacle down until I could get a screw started, but I did not tighten at this point. I put two more screws into the BNC receptacle flange, leaving the hole with the wire sticking out until last, as shown in Figure 3. I scraped the coating from the end of the ground wire where it would go under the screw, and wrapped the wire around the last screw after starting it. Finally, I tightened all four flange screws.

Finishing Touches

I installed two small bolts with washers and nuts in the PVC shower fitting flanges as seen in Figure 4. After removing the enamel coating from the two balanced side wire ends, I secured one wire under the nut on each side of the PVC flange. A second nut secures the dipole antenna wire. You can solder terminals on the ends of the balanced side wires for a neater connection. I sealed the whole package with a silicone sealant. I put a cork in the hole over the toroid (see Figure 4) but a dab of sealant will also work. I put some sealant where the wires exit the PVC fixture, and around the BNC receptacle flange as well. You can install a hook as shown in Figure 5 if you want to support the antenna from the center.

Making the Dipole

Cut a dipole antenna shown in Figure 1 for your favorite band. The length in feet is 468 divided by the frequency in megahertz [See *The ARRL Antenna Book* for dipole lengths on different amateur bands. — *Ed.*]. Cut each leg several inches too long and then "trim" the antenna by folding some of the wire back on itself. Martin Meserve, K7MEM, provides an online calculator to determine the length of a dipole.[2] My space was limited, so I used Meserve's short antenna design using two inductors. Because mine was not a permanent installation, I made up the portable antenna kit shown in Figure 6. I hope you have as much fun as I did building the PVC shower fitting antenna.

Notes

[1] Available from your ARRL dealer, or from the ARRL Store, ARRL order no. 8217. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[2] **www.k7mem.com/**.

Ronald (Ron) Davis, WB5TGF, holds an Amateur Extra class license. He was originally licensed as a Novice, WN5HVO, in 1963. He earned a Bachelor of Science in Aviation and an Associate of Science in Aviation Maintenance Technology. Ron also holds a General Radio Operators License and a Commercial Pilot Certificate with instrument, single, and multi-engine land ratings. He is a flight instructor for single and multi-engine, land, and instrument ratings, and has an FAA mechanics license with airframe and powerplant ratings. Ron also has a patent pending for an aviation related electronic device. He currently flies scientific research aircraft and works freelance doing aircraft, avionics maintenance, and writes the occasional magazine article. He is interested in experimenting with antennas, as well as programming and building microcontroller devices. At the age of 67, Ron admits to be still trying to figure out what he wants to be when he grows up. You can reach Ron at **wb5tgf@gmail.com**.

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A Cascaded Current Transformer RF Coupler

Accurately sample high power RF current at the 40 dB level.

Ralph Crumrine, NØKC

I needed to sample and measure RF power over the 1.8 to 220 MHz frequency range at up to 1500 W more accurately than was currently possible with the available VSWR or watt meters. In the "Technical Correspondence"[1] column of the May 2011 issue of *QST*, Tom Thompson showed how to build an RF sampler with a hybrid method involving a current transformer followed by a resistive divider. Instead, I used cascaded current transformers to accomplish the task.

[1]Thompson, Tom, WØIVJ, "Technical Correspondence: A High Power RF Sampler," *QST*, May 2011, pgs 52-54.

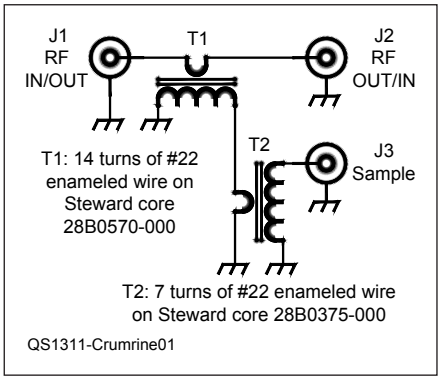

Figure 1 — This schematic diagram shows how to connect two current transformers to obtain coupling at the 40 dB level.

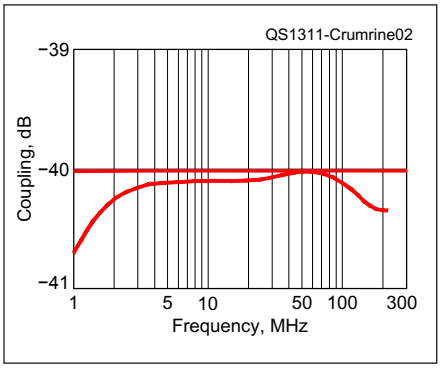

Figure 2 — Coupling remains flat from 1.8 to 220 MHz.

Cascaded Current Transformers

A single coupling transformer needs a 1:100 turns ratio to achieve a 40 dB down coupling level in the sampled output. The coupling level is $P_{coupled} = 10 \log (1/n^2)$ where n equals the number of secondary turns with one primary turn, and with matched 50 Ω loads on both the primary and secondary circuits. At the 40 dB coupling level, $N = \sqrt{10^{40/10}}$ = 100 turns. This is a difficult transformer to build by hand. More importantly, in my judgment and past experiences, the bandwidth will most certainly be unsatisfactory because of the leakage reactance and inter-winding capacitance of the large number of turns. However, n in the equation could be a product like $n = n_1 \times n_2$. Therefore, two cascaded 10 turn transformers in the circuit of Figure 1 would produce exactly the 40 dB coupled result. Many products of n_1 and n_2 will exactly (or very nearly) equal 100. Realizing that, I settled on 14 turns for the first transformer and seven turns for the second transformer (7 × 14 = 98) which provided a theoretical 39.8 dB coupling. In Figure 2, the coupling is 40 dB, +0.3/-0.0 dB, from 1.8 MHz to 220 MHz. Compared with the hybrid method, the cascaded transformers have a slightly smaller insertion loss, and no heat rise concerns, even at a continuous 1500 W power level.

Building the Coupler

Figure 3 shows the finished unit, while Figure 4 shows the underside of the printed circuit board before installation in the box. Figure 5 is a view of the top side (transmission line side) of the finished unit. Don't operate the unit at high power without a cover because, when unshielded, the coupler radiates significantly.

You can build the circuit on a 1.9" by 2.4" piece of 1/16" thick single or double sided FR-4 or G10 printed circuit board. The board is a ground plane between the input and output connectors; it also holds the transformers in place and receives the several ground connections. If you use a double-sided board, pin through the board in several places so the two foil planes become one ground plane. Cut clearances at each end of the board for the coaxial connectors. You can

Figure 3 — The sampler uses a BNC connector for the 40 dB port and UHF connectors for the high power RF ports.

use either a Hammond 1411BU or Bud CU-3000A Mini box to house the unit. Use #22 AWG enameled wire to wind 14 turns onto a Steward 28B0570-000 core, and seven turns onto a Steward 28B0375-000 core. Distribute the windings around the entire circumference of the cores to minimize inter-winding capacitance. A straight piece of #12 or #14 AWG wire connects the input to the output and passes through the center of the first transformer. Place an insulating sleeve over this primary turn wire. Ground one side of the first transformer's secondary winding. The other lead of the first transformer secondary passes through the core of the second transformer and then connects to ground as seen in the schematic diagram of Figure 1. The one end of the secondary of the second transformer connects to the center pin of the sampled output coaxial connector J3, the other end connects to ground. Keep all leads very short — to the point that you feel that they will be almost impossible to assemble.

Final Adjustments

I found that the attenuation at 220 MHz is slightly sensitive to the position of the first transformer. If I had to do this all over, I would center the first transformer along the length of the wire transmission line. There are a few tenths dB variation at 220 MHz, depending on which end of the coupler is used as the input. The sampler accuracy depends on the RF load and sampler port load. If either of those loads diverges

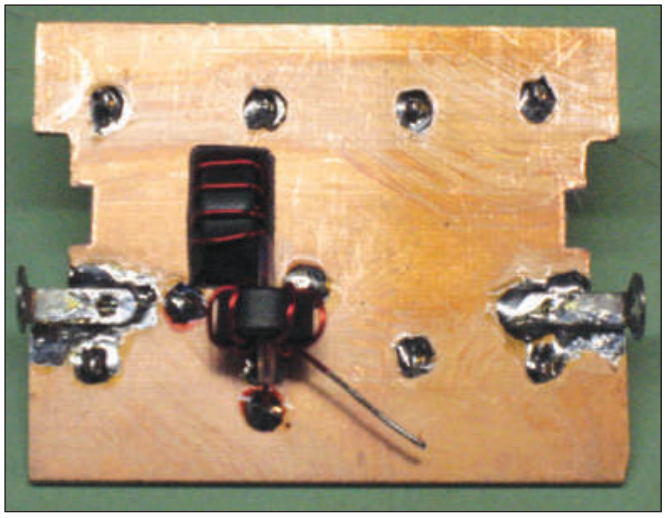

Figure 4 — The two RF transformers can be seen on the bottom side of the circuit board.

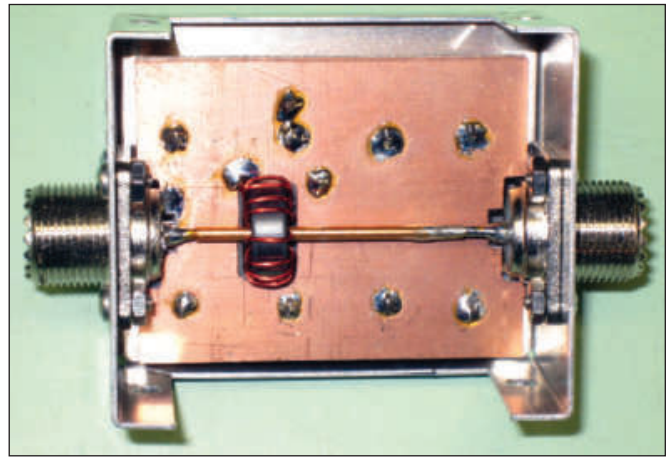

Figure 5 — The finished unit with cover removed.

from 50 Ω, the coupling varies from 40 dB.

Connectors

A BNC coaxial connector is satisfactory for the sampled (coupled) output J3. However, you should use connectors rated for high power for the transmission line connectors. I used UHF SO-239 connectors. You may be tempted to use Type N connectors in place of the UHF connectors, but the N connector center pin might not handle the more than 5 A current at full legal limit RF power.

Ralph J. Crumrine, NØKC, holds an Amateur Extra class license. He was first licensed in 1953 as a Novice, WN3WFZ. He enlisted in the USAF to work in radio and navigation equipment repair. After military service, he attended Pennsylvania State University and earned a BSEE degree, graduating with honors. A career followed in the design and development of avionics equipment, beginning at King Radio Corporation and finally retiring from Honeywell Avionics Division. Ralph is a member of ARRL and has been an active ham in retirement, earning the WAS and DXCC awards in 2002. He is particularly interested in antenna design and has written several articles on the subject for ARRL publications. He can be contacted by e-mail at **Ralph.Crumrine@sbcglobal.net**.

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

New Products

TEN-TEC Amplifier Keying Interface

The Model 318 amplifier keying interface provides a means of keying a non-QSK amplifier from a full QSK transceiver. The interface allows for either closure to ground or positive key voltage during transmit. The manual dropout DELAY control allows for 100 ms to 2 seconds of transmit delay, and the KEY LED provides a visual indication that a key signal is applied to the amplifier. The DELAY/BYPASS switch eliminates delay and keys the amp relay directly from the radio transmit line. The PTT button provides a convenient means of keying the radio while tuning or testing the amplifier. Although this interface was designed for direct connection to a TEN-TEC Eagle transceiver, it is adaptable to other models. Price: $89. For more information, or to order, visit **www.tentec.com**.

Tower Safety Stand from KF7P Metalwerks

The KF7P Metalwerks Safety Stand for crank-up towers is a lightweight platform that provides a flat, comfortable place to stand while doing antenna, cable and rotator work. It is a universal design that bolts on to most crank-up towers and does not interfere with tower operation. The Safety Stand is adjustable in height and has provision to capture the top of your extension ladder to prevent the ladder from moving while climbing. Safety Stand is only used when tower is nested, and a safety harness is required during use. Price: $395. For more information, or to order, visit **www.kf7p.com**.

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

SPE Expert 2K-FA Solid State Linear Amplifier

This legal-limit amplifier combines features that are not available in any other single package.

Reviewed by David Sumner, K1ZZ
ARRL Chief Executive Officer
k1zz@arrl.org

The SPE Expert 2K-FA is the legal-limit big brother of the Italian-made 1K-FA linear amplifier that was reviewed in the September 2009 issue of *QST*.[1] That model, a nominal 1 kW output unit covering 160 to 6 meters, has been on the market for several years. It is quite popular in Europe but, until recently, has had limited distribution in the United States. Since 2011, SPE Expert amplifiers have been distributed in the Western Hemisphere by Bob Irish, K5ZOL, and "Frosty" Frost, K5LBU, under the name Expert Amps USA. Standing behind the SPE product line back in Rome is Dr Gianfranco Scasciafratti, IØZY.

As you would expect, the 2K-FA is bigger and heavier than its older brother. Unlike the 1K-FA it cannot be powered by 120 V ac; the only option is 190-255 V ac. The active devices are six MRF151G MOSFETs. The 2K-FA offers automatic selection from among six antenna connections versus four with the 1K-FA. Otherwise the two models are similar, from their outward appearance to the switching power supplies that keep their size and weight down. Both have an SO2R connection about which we'll have more to say later. There would be no learning curve involved in upgrading from the 1K to the 2K.

At the time the 1K-FA was introduced, its competitive advantage was its small physical size compared to other solid state amps in its power class. The 2K-FA goes head to head with legal-limit vacuum tube amplifiers and offers three features that are not available all in combination in any other legal-limit amp we know of: 6 meter coverage, automatic tuning and "instant on." The amplifier can be integrated seamlessly into a station with two separate transceivers and an extensive antenna system, and it can be configured for remote operation.

Installation and Programming

The 2K-FA comes in a padded "carry bag," but at 55 pounds it's unlikely you will want to tote it very far. Once it's in position on your operating desk, the hookup is straightforward. There are separate sets of RF, relay, ALC and computer control connectors to interface with two transceivers, but only the RF and relay connections are essential. However, don't let the simplicity fool you; this is not a piece of equipment that you should try to use without first reading the user's manual *thoroughly*. Figure 1 is a view of the rear panel connections.

Once you have plugged it into a 240 V outlet and have connected your station ground and at least one transceiver and antenna, you're ready to turn it on. That involves two switches, one on the rear panel and a push-button on the front. The next step is to program the amplifier, which will take some time. First you select the proper antenna connector for each band, or N for "no antenna" if you don't happen to have a suitable one for a particular band; in the latter case a "band not permitted" message will appear on the display if you try to operate on that band. Up to three different antennas for the same band can be programmed for selection with a front-panel pushbutton.

There is an internal tuner that is designed to match loads with an SWR of up to 3:1 (2.5:1 on 6 meters). Tuning is automatic and is done with exciter power only while the amplifier is in standby. The amplifier will store the tuner settings for each antenna and for multiple sub-bands within each amateur band. A nice feature is that the SWR on both sides of the internal tuner can be displayed simultaneously. If you have to use an external tuner to handle a greater mismatch, the internal tuner must be programmed to be disabled on that antenna and band. Via the PORT connector, the amplifier can be interfaced with the controller for a tunable antenna such as a StepIR so that the antenna and amplifier settings

Bottom Line

If you like the idea of having full-power capability on the HF bands along with 6 meters in one package you will want to give the 2K-FA a close look.

[1] M. Wilson, K1RO, "SPE Expert 1K-FA Linear Amplifier," Product Review, *QST*, Sep 2009, pp 44-47. Past *QST* reviews are available to ARRL members at **www.arrl.org/product-review**.

follow the transceiver frequency automatically. A menu setting tells the amplifier that the antenna connected to a specific antenna jack is tunable. The manual notes that it can take several seconds for tunable antennas to come to resonance and recommends use of circuitry to inhibit transmission while the antenna elements are moving to avoid damage to the antenna system or station equipment.

Once the antenna settings are programmed, the next step, if you have a modern transceiver and the right interface cable, is to program the CAT connection so the amplifier will follow the frequency selection from your transceiver. The manufacturer recommends using this feature if you can. If not, you can change bands simply by tapping your key or doing something else to make a very brief transmission. The amplifier will sense the RF and immediately select the right antenna and tuner settings for that frequency.

With the antenna(s) and transceiver interface(s) set up, operation is fully automatic and requires little or no attention from the operator. Band changes, antenna changes and antenna tuner adjustments are all handled by the amplifier, smoothly following the transceiver's operating frequency.

The 2K-FA has USB and RS-232 ports on the rear panel that can be used to connect the amplifier to a PC for upgrading the amplifier firmware or for controlling the amplifier. Software is available from the SPE website that displays a replica of the amplifier's front panel LCD and control switches to allow remote monitoring and control.

About SO2R...

After the lab tests confirmed that the review unit met FCC requirements (see Table 1), it was installed at the K1ZZ station for real world operation. The station is normally set up for single operator, two radio (SO2R) contest competition. The idea is to enable the operator to transmit on one band while listening on another, thus making use of transmitting time to find multipliers and QSOs. This requires two transceivers (or at least a separate receiver) and for high power operation typically requires two amplifiers as well, along with a lot of antenna separation and/or filtering and the ability to switch quickly from transmitting on one band to the other.

Expert Amps USA advertising claims that its products are "SO2R compatible" and they are, but only to a point. SO2R compatibility implies that one could operate SO2R with just one amplifier, which of course would be a substantial cost savings. However, the 2K-FA (and 1K-FA) provides only limited SO2R capability without additional external antenna switching.

Table 1
SPE Expert 2K-FA, serial number 124000183

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz, 50 to 54 MHz.	160, 80, 40, 30, 20, 17, 15, 12, 10, 6 meters.
Power output: Up to 2000 W PEP (SSB, CW) Max setting; 1000 W Mid setting, 500 W Low.	As specified. Tested up to 1500 W output.
Driving power required: Not specified.	36-48 W typical (HF), 35 W (6 meters) for 1500 W PEP output.
Spurious and harmonic suppression: HF, >60 dB; 6 meters, 65 dB.	HF, typically 57-68 dB, 49 dB worst case (15 meters); 6 meters, 63 dB.* Meets FCC requirements.
Third order intermodulation distortion (IMD): <–36 dBc typical. TR switching time: 6.5 ms max.	14 MHz, 3rd/5th/7th/9th: 32/39/49/<60 dB below PEP. Amplifier key to RF output on, 5 ms; 7 ms until relays settle. Amplifier un-key to RF output off, 2 ms; 17 ms until relays settle.**
Power requirements: 190-255 V ac, 47-63 Hz.	Tested at 240 V ac, 60 Hz.
Size (height, width, depth): 7.2 × 15 × 16.9 inches; weight, 55 lb.	
Price: $7300.	

*During initial testing, second harmonic suppression was 54 dB on 6 meters. The amplifier was returned to Expert Amps USA for adjustment of the bandpass filters.
**The relay settling time is the time required for the contacts to connect and stop bouncing.

Figure 1 — The rear panel of the SPE Expert 2K-FA amplifier features connections for six antennas and two transceivers.

As previously noted, two transceivers can be connected to the amplifier. Tuned to different bands, either one (but not both at the same time!) can be used to transmit; the amplifier will switch automatically to the correct band and antenna. However, there is no signal path from any of the other five antenna ports to the other transceiver. In order to hear anything with the second transceiver it is necessary to connect a different antenna to the SO2R connector on the rear panel of the amplifier. The user's manual suggests that this should be a multiband antenna, used only for receiving and physically isolated from all of the antennas used for transmitting to avoid damage to the receiver. The idea is to use the second transceiver and receive-only antenna to find a station on another band that you want to work and then to switch that transceiver to the main transmitting antenna for that band in order to make the call.

While this capability is somewhat useful, it is not as versatile as how SO2R is typically implemented with monoband antennas and a switching system that permits the second transceiver to be connected to any of the antennas that are not at that moment being

used for transmitting. With two amplifiers, the switching system can be quite simple and can even be operated manually. Time-sharing one amplifier is considerably trickier. The user's manual refers to an optional external "SPE SO2R1" unit that would provide the necessary automatic sequencing and switching capability while being controlled and powered from the AUX port on the amplifier's rear panel. However, in a conversation at Dayton in May 2013, Gian, IØZY, indicated there were no immediate plans for SPE to produce such a unit. The bottom line is that SPE disclaims responsibility for any damage caused to equipment during SO2R operation.

The Road Test

We didn't take the 2K-FA literally on the road — it's a bit big for that — but we did enjoy taking it for a few spins around the bands. The transceivers used were an Elecraft K3 and an older Yaesu FT1000MP. The amplifier package includes connectors and detailed instructions for interfacing with various transceiver brands, but we used preassembled cables purchased from Array Solutions (**www.arraysolutions.com**).

Right after hooking it up at home, the first signal heard was Eric, K9GY, calling CQ on 40 meter CW while operating as T6MO from Afghanistan. One quick call put him in the log. There was nothing extraordinary about the QSO — Eric has good ears — but it seemed to be a good omen. The amplifier performed flawlessly over a 3 month period, including some spurts of contest activity, amounting to about 2700 QSOs in all.

The operator can choose among three power output levels, MAX, MID and LOW, and can even program different power levels for different bands — a useful feature if one or more of your antennas can't handle 1500 W. At the MAX level the power supply delivers about 48 V dc to the MOSFETs, which is reduced to about 35 V and 30.5 V respectively for the two lower levels. The review unit easily delivered maximum legal power on all bands, although the efficiency on 6 meters was a bit lower than on the HF bands. If you transmit a steady carrier or a mode such as RTTY at the MAX level, the amp will automatically downshift to MID, which limits the output to about 1100 W. LOW is about 600 W. By the way, the voltage regulation is excellent at all three levels.

The amplifier needs about 50 W of drive to reach the legal limit. The user's manual strongly recommends using ALC to regulate the transceiver's output power. Via a PC connection, the ALC threshold can be adjusted separately for each band and power level. Because the required drive power varies a bit from band to band this is very helpful, although transceivers such as the K3 allow different output powers to be set on a band-by-band basis.

The internal wattmeter in the review unit was slightly optimistic, meaning that it indicated a bit more output power than was actually being delivered to the antenna connector. The wattmeter is located on the input side of the tuner, which may account for the difference as no tuner can be totally lossless. In any case the observed difference was less than 1 dB.

The 2K-FA is well protected against operator error and other hazards. Among the features not already mentioned that are designed to prevent damage to the amplifier, the fan speed is automatically regulated to keep the internal temperature under control. The user's manual says that if the temperature limit of 76 °C is reached, the power output level is reduced automatically. At K1ZZ the internal temperature never went above 55 °C, even during CW contest operation at the legal limit. Fan noise was not an issue — the fan comes on when you push the OPERATE button but it's quiet. Even when it shifts to higher speed it's still rather quiet.

The 2K-FA is capable of QSK operation and includes control circuitry to avoid hot switching the relay contacts. TR switching times are shown in Table 1. A vacuum relay option is available if you need faster switching or quieter operation, although I didn't find TR switching noise to be an issue.

Summing Up

I have two legal-limit, manually tuned vacuum tube amplifiers with which I've been satisfied for years. It would be nice to replace them both with one box, but while the 2K-FA comes close to offering that capability, it would require substantial re-engineering of my antenna switching system to implement it reliably and safely. Someone assembling a SO2R station from the ground up might well consider designing it around one.

It was a joy having the 2K-FA in the shack. Now I have to retrain myself to do the band-switching and retuning that my old amps require. On the other hand, if one of them requires maintenance, I'm not reluctant to unplug it, take the cover off and fix it myself. With a unit as complex as the 2K-FA, other than to clean the air filter — which just involves removing the grid from the front panel — I wouldn't be tempted to do the same. I would keep the shipping carton handy, just in case. Service is handled by Expert Amps USA so international shipping is not required should service be necessary.

Manufacturer: SPE (Societa Per l'Elettronica), Via di Monteverde, 33, 00152 Rome, Italy; **www.linear-amplifier.com**. *US distributor*: Expert Amps USA, 3311 Hilton Head Ct, Missouri City, TX 77459; tel 281-682-6093; **www.expertampsusa.com**.

See the Digital Edition of *QST* for a video overview of the SPE Expert 2K-FA Solid State Linear Amplifier.

Peaberry V2 Software Defined Transceiver

Reviewed by Steve Ford, WB8IMY
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The Peaberry V2 transceiver attracted considerable attention from software defined radio (SDR) enthusiasts when it appeared at the 2013 Dayton Hamvention. This was due in large part to its compact, open-source design — and its $149 price tag.

For just under $150 you get a multiband, multimode software defined transceiver that you build yourself. The Peaberry generates only a single watt of RF on several HF bands, but as QRP aficionados will assure you, all it takes is the right antenna and a little cooperation from the ionosphere to make plenty of contacts at that power level. The Peaberry also offers a 96 kHz digital I/Q interface, a SoftRock control interface, open source firmware and support for the Elecraft T1 automatic antenna tuner — all in the case that measures only 5.75 × 3 × 1.25 inches. Unlike some SDRs that require connections to your computer sound card for digitizing and processing I/Q signals, the Peaberry does everything on a single board and provides data directly to your computer through a standard USB connection. No sound card devices or cables are required.

The Peaberry Kit

This SDR transceiver is a surface mount technology (SMT) kit. Surface mount components present challenges for many amateurs. You'll need sharp eyesight (or a magnifier) and steady hands to assemble the Peaberry, especially when many of the parts are smaller than grains of rice. The finished board (Figure 2) is nicely designed and features a BNC antenna connection and ports for the USB connection, 12 V dc power, and jacks for a paddle key, an automatic antenna tuner connection and an amplifier keying line. Note that neither the dc power cord nor the USB cable are provided with the kit. You'll have to come up with your own enclosure, if desired. The Peaberry website offers a couple of acrylic case options, and a labeled case similar to the one shown in the photos is available from **http://km5h.softrockradio.org**.

Detailed assembly instructions are available for downloading in PDF format. As you get started the first thing you'll notice is that the Peaberry can be built for operation on one of five sets of bands: 160, 80 and 75 meters; 80, 75, 60 and 40 meters; 60, 40, 30 and 20 meters; 30, 20, 17 and 15 meters; or 17, 15, 12 and 10 meters.

Figure 2 — The compact Peaberry V2 PC board makes extensive use of surface mount components.

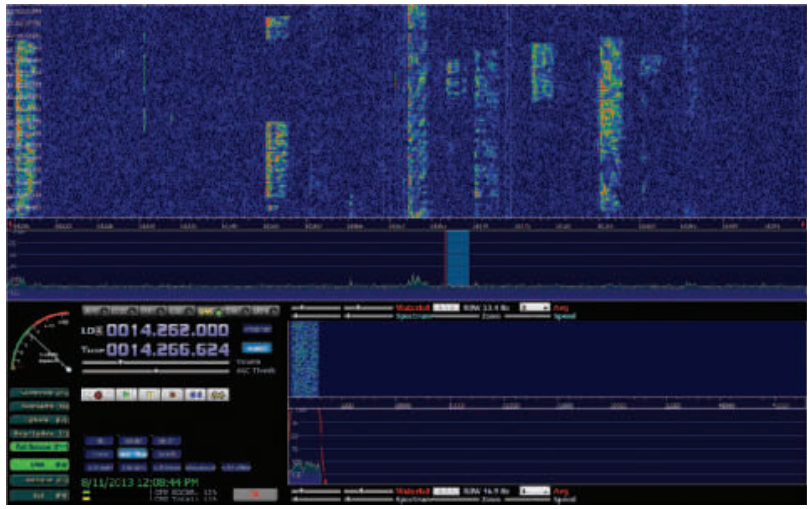

Figure 3 — *HDSDR* on the air with the Peaberry transceiver on 20 meter SSB.

Bottom Line

The Peaberry V2 software defined transceiver kit can be built for a variety of bands, uses readily available software and offers a nice introduction to SDRs. Assembly requires working with surface mounted components.

Table 2
Peaberry V2, serial number SF-0001

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: 30, 20, 17, 15 meters.	Receive & transmit, 9.0 to 21.5 MHz.
Power requirement: 12 V dc.	Receive, 200 mA; transmit, 700 mA (max) at 13.8 V dc.
Modes of operation: SSB, CW, AM, FM.	SSB, AM, FM; CW transmit not supported by *HDSDR* software.*
Receiver	**Receiver Dynamic Testing**
Sensitivity: Not specified.	Noise floor (MDS), 400 Hz DSP filter BW: 10.1 and 14.2 MHz, –115 dBm 18.1 and 21.2 MHz, –114 dBm.
Noise figure: Not specified.	14 MHz, 32 dB.
AM sensitivity: Not specified.	10 dB (S+N)/N, 1 kHz, 30% modulation, 9 kHz DSP filter BW: 14 MHz, 23.4 µV.
FM sensitivity: Not specified.	For 12 dB SINAD: 14 MHz, 8.9 µV.
Spectral display sensitivity: Not specified	–115 dBm (spectrum); –119 dBm (waterfall).
Blocking gain compression dynamic range: Not specified.	Gain compression, 400 Hz DSP filter BW: 14 MHz, 20/5/2 kHz offset: 105/105/105 dB.†
Reciprocal mixing dynamic range: Not specified.	20/5/2 kHz offset: –105/–93/–87 dBc.
Two tone, third-order dynamic range: Not specified.	20/5/2 kHz spacing: 99 dB.**
Second-order intercept point: Not specified.	14 MHz, +77 dBm.**
DSP noise reduction: Not specified.	Variable, 5 dB maximum.
Notch filter depth: Not specified.	Manual notch: 48 dB.
S-meter sensitivity: Not specified.	S9 signal: 50 µV.‡
Squelch sensitivity: Not specified.	At threshold: SSB 7.0 µV.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth) CW (400 Hz): 498-905 Hz (407 Hz); Equivalent rectangular BW: 397 Hz; USB: (2.4 kHz): 125-2760 Hz (2635 Hz); LSB: (2.4 kHz): 125-2760 Hz (2635 Hz); AM: (9 kHz): 67-4539 Hz (8944 Hz).
Image rejection: Not specified.	Image rejection, 90 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: 1 W at 14 MHz.	SSB, AM, FM, 10.1 MHz, 2.2 W; 14.2 MHz, 2.4 W; 18.1 MHz, 0.9 W; 21.2 MHz, 0.85 W at 13.8 V dc.
Spurious-signal and harmonic suppression: Not specified.	47 dB worst case (30 meters); 58 dB typical. Meets FCC requirements.
SSB carrier suppression: Not specified.	>60 dB.
Undesired sideband suppression: Not specified.	>60 dB.
Third-order intermodulation distortion (IMD): Not specified.	2 W PEP, 3rd/5th/7th/9th order, –28/–42/–51/–56 dB (20 meters).
Size (height, width, depth): 1.5 × 6.0 × 3.5 inches (including protrusions); weight, 8.8 oz.	
Price: $149 (kit only, enclosure not included).	

*During testing, *HDSDR* version 2.62 software was used with the Peaberry V2.
†No blocking occurred up to the point of ADC overload (–10 dBm).
**No third-order intercept point was reached; two-tone IMD level maximum is –16 dBm at ADC overload threshold. Second order intercept points were determined using S5 reference.
‡Adjustable via *HDSDR* software.

Parts for all bands are included with the kit. You simply choose the band set you prefer and proceed accordingly. For this review we chose 30, 20, 17 and 15 meters.

Putting the Peaberry on the Air

Like all SDRs, the features and performance you enjoy with the Peaberry are determined to a great extent by the software you select to use with it. *HDSDR* by Mario Taeubel, DGØJBJ, is the recommended *Windows* application and that is what we chose for this review. You'll find *HDSDR* software at **www.hdsdr.de**.

Configuring the software to work with the Peaberry can be tricky, so you must follow the manual carefully. For instance, *Windows* will likely require a USB driver. The assembly manual recommends the PEØFKO driver, the same one used for SoftRocks and similar radios. You'll need to download and install the Peaberry version, which is available at **http://AE9RB.com/forum/viewtopic.php?f=4&t=96**.

Before you install the *HDSDR* software, you must download and install PEØFKO's *CFGSR* program from **http://pe0fko.nl/CFGSR/**. Oddly enough, you won't be running this software. The whole purpose of installing it is to acquire a DLL file known as *ExtIO_Si570*. Once you've found the file and copied it into the *HDSDR* folder, you can uninstall the *CFGSR* program entirely.

After jumping through these hoops you finally reach the point where you're ready to start *HDSDR* and get the Peaberry V2 on the air. The Peaberry manual explains how to configure the Sound Card Selection window to route the incoming and outgoing signals. For this review I used a Plantronics microphone headset that features its own sound device. All I had to do was highlight it in the selection window and I was on my way.

The Peaberry came to life as soon as I clicked the START button on the *HDSDR* screen (Figure 3). Even after testing several SDRs, I still get a kick out of tuning through signals for the first time. *HDSDR* is a "friendly" application, which makes it even more enjoyable to explore the bands, adjust filters and so forth.

With the Peaberry connected to my 20 meter inverted V antenna, I selected the USB mode and searched among the stronger signals. With just 1 W output I didn't expect anyone to hear me, but to my astonishment I received an answer from a fellow in Missouri who had just called CQ as I tuned past. He said I was weak, but copyable, with excellent audio.

By using *Virtual Audio Cable* (VAC) software I was able to "share" the Peaberry audio pathways with *JT65-HF* software. Switching

the *HDSDR* application to 15 meters, I completed several JT65 contacts in this fashion with little difficulty. According to comments on the Peaberry forums, other amateurs have been taking the same approach to using the Peaberry with *DigiPan* and *Fldigi* for other digital modes.

I mentioned that the Peaberry has a paddle key jack for CW operating, but *HDSDR* doesn't support CW transmit functions at this time. Some have had luck getting *PowerSDR* software to work on CW with the Peaberry, but my attempts ended in frustration. The great thing about software defined radio, however, is that the software applications are constantly evolving. Chances are, an application that more easily supports CW with the Peaberry is just around the corner.

Conclusion

The Peaberry V2 transceiver is designed to appeal primarily to SDR experimenters, and it does a good job in that regard. It has the kind of flexibility and performance that make it an ideal foundation for further exploration, especially considering the Peaberry's economical price.

Because of its surface mount component design and software complexity, I wouldn't necessarily recommend the Peaberry V2 for new hams or those not familiar with computers and software defined radios. This is not a plug-and-play transceiver; it requires a certain amount of patience and a willingness to learn new concepts. Once it is up and running, however, it is great fun and a good performer. I can see the Peaberry being paired with an HF amplifier to kick the output to a full 100 W.

Manufacturer: AE9RB, 3539 SE Cora Dr, Portland, OR 97202; **http://AE9RB.com**.

West Mountain Radio CBA-IV Battery Analyzer

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There has been more emphasis on battery power of late, particularly for those of us interested in portable operation. And while it is easy to find the amp-hour battery specifications, it is not always clear as to what this means when it comes to the true battery operating time you can expect, as well as the overall health of your battery. The West Mountain Radio CBA-IV battery analyzer can help answer these questions.

Overview

The CBA-IV battery analyzer consists of a 3 × 3 × 3.5 inch software-controlled constant current load box with an integral heat sink and fan. Your computer powers it via the included USB cable. Anderson Powerpole connectors provide the battery interface.

The software permits testing and analyzing most batteries up to 55 V, regardless of chemistry. Battery voltage versus time is measured under a continuous load of up to 100 W, and up to a 150 W load for short periods of time. The CBA-IV software automatically senses the battery cell count, provides a safety check of the proposed test rate, and recommends a minimum safe discharge voltage. The data is displayed graphically in amp-hours (Ah), watt-hours (Wh) or minutes. You can overlay multiple battery graphs for comparison. Finally, there is a "calibrate current" adjustment for improved accuracy at very low discharge rates or for critical applications, as well as a means to compensate for test lead resistance for maximum accuracy.

Determining Battery Test Requirements

My main interest is portable battery operation of my Elecraft KX3 transceiver. So to begin, I made some KX3 current measurements during receive and with 5 W and 10 W transmit power. The typical measured currents are shown in Table 3.

When operating portable, I turn on my radio with the specific purpose of making QSOs. So my portable operation is approximately 50% listening and 50% engaging in QSOs. This is a much higher duty cycle than my typical non-contest home operation — at home, I spend more time just listening.

During a QSO, I assume 50% receiving and 50% transmitting times. Finally, the CW duty cycle using the standard PARIS format is 44% (meaning key-down 44% of the transmitting time, and key-up 66% of the transmitting time during the transmission). Sample calculations are shown in Table 3 for 50% of the time just listening (with the backlight on), and 50% time engaged in QSOs with 5 W and 10 W transmit power.

With backlight on and semi break-in operation, the average current requirement is 382 mA at 5 W. (From Table 3: 0.105 A listening, plus 0.053 A receive, plus 0.224 A transmit.) That goes to 489 mA at 10 W. I rounded these to 400 mA and 500 mA, respectively, to provide some margin. Note that you can save

Bottom Line

The West Mountain Radio CBA-IV permits detailed battery analysis for anyone interested in portable or battery backup applications.

Table 3
Typical Measured Currents and Power Budget Calculations

Elecraft KX3 Requirements

Receive: backlight on, 210 mA; backlight off, 170 mA.
Transmit, key-up: semi break-in, 540 mA; full break-in, same as receive current.
Transmit, key-down: at 10 W output, 2200 mA; at 5 W output, 1230 mA.

Operating Style Current Assumptions (see text for explanation)

Requirement while listening:	0.50 × 0.21 A = 0.105 A
Requirement while in QSO:	
Receive:	0.25 × 0.21 A = 0.053 A
Transmit 5 W semi break-in:	0.25 × [(0.44 ×1.23 A) + (0.66 ×0.54 A)] = 0.224 A
Transmit 5 W full break-in:	0.25 × [(0.44 ×1.23 A) + (0.66 ×0.21 A)] = 0.170 A
Transmit 10 W semi break-in:	0.25 × [(0.44 ×2.2 A) + (0.66 ×0.54 A)] = 0.331 A
Transmit 10 W full break-in:	0.25 × [(0.44 ×2.2 A) + (0.66 ×0.21 A)] = 0.277 A

Table 4
Batteries Analyzed

Chemistry/Make	#cells/Amp-Hr	Nominal Voltage	Discharged Voltage	Charged Voltage
Alkaline/Utilitech	10 AA cells/— Ah*	15 V	10 V	16 V (new)
NiMH/Tenergy	10 AA cells/2.6 Ah	12 V	10 V	13.5 V
Lead Acid/Power Kingdom	6 cell/7 Ah	12.6 V	10.5 V	13.8 V
LiPo/Sanyo	4S2P/5.2 Ah	14.8 V	12 V	16.8 V

*Generic batteries sold at local home center. No amp-hour rating is specified.

about 80 mA if you keep the backlight off and operate full break-in.

The batteries I had available to test are shown in Table 4. The lead-acid and LiPo (lithium polymer) batteries were tested at 500 mA (10 W transmit power) as these batteries easily source the required 2.2 A required. The AA alkaline and NiMH batteries were tested at 400 mA (5 W transmit power) as these have a lower amp-hour rating and, at 2.2 A current drain, there is considerable voltage drop from the AA holder's steel spring contacts.

Using the CBA-IV

The software is included on a CD, but check the West Mountain Radio website for the latest updates to the software. Installation is trivial, involving just a few prompted mouse clicks. Once the software is installed, you may need to install the appropriate driver (which is also included on the CD). Driver installation occurred automatically when I connected the CBA-IV to both my *Windows 7* and *8* computers.

I first evaluated the lead-acid and LiPo batteries. My lead-acid battery has been used heavily over the last five years, and I've suspected that it is far from meeting its 7 Ah rating. The LiPo battery is new, and I plan to use it for my future portable operation because it is very lightweight for its capacity. Figure 4 shows the setup menu for the lead-acid battery. While most of the test information is auto-sensed and suggested, I did set the actual battery amp-hour and test current discharge rates for my specific batteries and application. Once you press START, the CBA-IV software will check the battery and begin the test.

When the lead-acid test was complete, I started the LiPo test. I elected to append the two graphs together since both batteries could be used in a 10 W application. As I suspected, the lead-acid battery needed to be retired as it only measured 3.6 Ah of capacity. The LiPo battery is new, and delivers 5.11 Ah of capacity — nearly identical to its 5.2 Ah specification. Figure 5 shows the battery voltage versus time at 500 mA average current. It is easy to change the graph to display amp-hours if desired.

Next I measured the NiMH and alkaline AA batteries. I've always been interested in the capacity of generic alkaline batteries because they can be purchased anywhere. Figure 6 shows the results. As you can see, while the NiMH batteries don't quite meet their 2.6 Ah specification, they still have twice the capacity

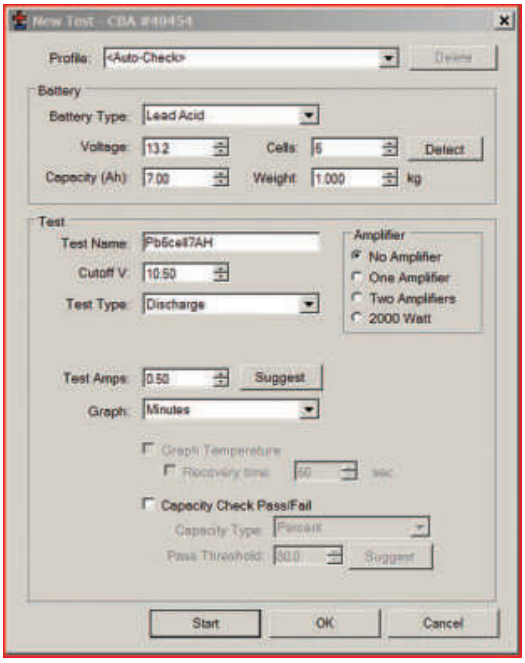


Figure 4 — Lead-acid battery setup screen.

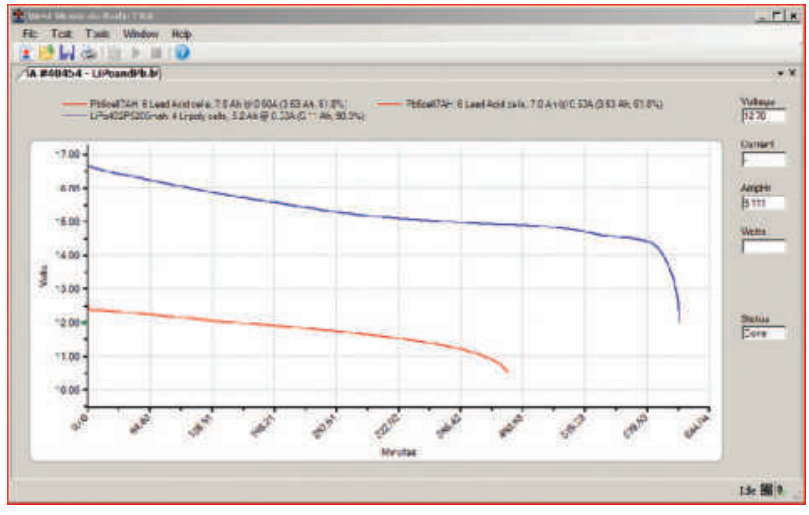


Figure 5 — LiPo (blue trace) and lead-acid (red trace) battery testing showing minutes of use at 500 mA average current.

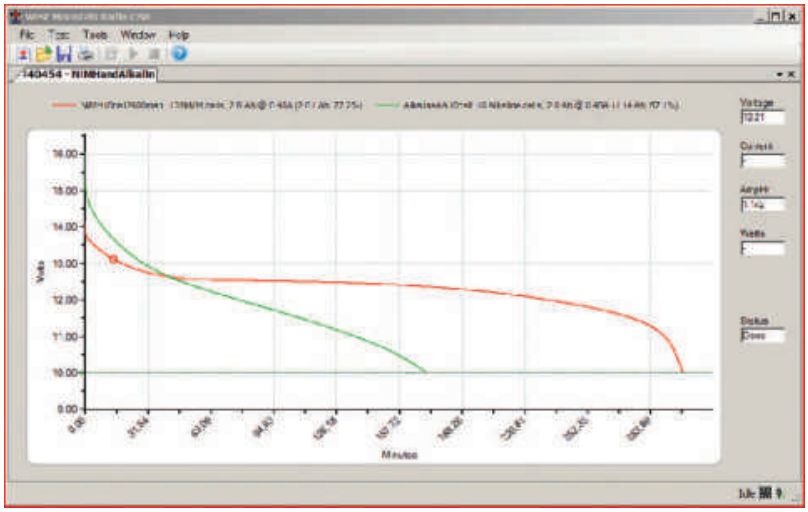


Figure 6 — NiMH (red trace) and alkaline (green trace) battery test results at 400 mA average current.

See the Digital Edition of *QST* for a video overview of the West Mountain Radio CBA-IV Battery Analyzer.

of the alkaline batteries. In addition, they hold a more constant voltage over most of the discharge time.

Some Options

While the basic CBA-IV is more than adequate for most ham applications, there are several options available that extend the CBA-IV's capabilities for industrial applications:

- Optional amplifiers permit testing in 500 W load increments up to 2000 W and optional external temperature probe permits automatic over-temperature test termination.
- Optional interface between the CBA-IV and a user-provided battery charger to switch automatically between charge and discharge cycles for battery lifetime testing.
- Optional extended software license adds duty cycle, constant power, multiple discharge and constant resistance test capability, and adds the ability to graph the battery temperature when the optional temp probe is connected.

Conclusion

The West Mountain Radio CBA-IV is a sophisticated, yet relatively inexpensive battery analyzer suitable for both amateur and commercial battery evaluation. If you really want to know what your batteries are capable of, and where they are in their lifetime, the CBA-IV is worth considering.

Manufacturer: West Mountain Radio, 1020 Spring City Dr, Waukesha, WI 53186; tel 262-522-6503; **www.westmountainradio.com**. Price: $159.95.

Section Manager Nomination Notice

To all ARRL members in Eastern New York, Eastern Pennsylvania, Louisiana, North Carolina, Pacific, San Diego, South Dakota and Virginia. 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 sections 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 December 6, 2013. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before January 2, 2014, to full members of record as December 6, 2013, which is the closing date for nominations. Returns will be counted February 18, 2014. Section Managers elected as a result of the above procedure will take office April 1, 2014.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 2014. If no petitions are received from a section by the specified closing date, such section will be resolicited in the April 2014 *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*

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

More Citizen Science

RSGB Noise Measuring and Reporting Campaign

Last year, Gwyn Williams, G4FKH, announced the start of the Noise Measuring Campaign in the July 2012 edition of *RadCom*. His scheme is to have folks around the country measure their local noise and send him regular results. The idea is to facilitate a simple progress report to cover the country with long term measurements. His concern is to validate, or catch, any changes in the ITU Recommendation PI.372, July 1993. He hopes to determine if there is a relationship between the noise floor and noise pollution emanating from devices such as plasma TVs, power line adapters [BPL to readers in the US — *Ed.*], RF emission from switch mode power supplies, and so on. Gwyn maintains a website with information about the project and graphs of measurements that are being submitted.[1]

I read his article with great interest, but I foresaw difficulties, as did he, with consistency of measurement. I was aware of the work of Chris Moulding, G4HYG, who makes SDR receivers and has an APRS system. I called him and suggested he might design an SDR receiver specifically for noise monitoring on set channels and with a known attached antenna to make a complete calibrated system. Chris was keen on the idea and said he could make the combination traceable to national standards.

It seemed to me right from the start that an unattended, automatic system would be best. This would have a number of advantages:

- Once placed and left unattended, the measurements would be consistent with that site and all measurements relative to the start position.
- The equipment is calibrated, making extrapolations meaningful and valid for site-to-site comparisons.
- Noise figures would be sent in from all over the country so that noise maps could be easily and automatically generated on a regular basis.
- Reports of man-made noise to the authorities could simply be referred to the website and similar noise sources might be spotted, for example, in clusters.
- Independent verification of the results could be made at any time and added to the website as checking samples.
- Several of these receivers could be placed in known quiet areas to give a base noise background level across the country.
- Comparisons with time and place could be made as new technologies are introduced in defined areas, such as LED street lighting, the rise of broadband over power line (BPL) data transmission, solar generators becoming inactive at night, a new factory start-up, or any number of new sources.
- A new research tool is made available to track natural events such as solar storms as their effect is seen progressing across the country.

The Sentinel SDR Receiver and Antenna

Chris's design elaborates on my original idea to measure not just one frequency but five specific frequencies spread throughout the HF bands, placed where there are no man-made transmissions. In other words, the receivers would be measuring noise only. The frequencies are 3.499, 5.258, 6.999, 10.090, and 13.399 MHz. Measurements are taken every 10 minutes and three samples are averaged at each event.

Chris also designed an active antenna, which is made with resilience in mind. It uses a heavy duty enhancement-mode pseudomorphic-high-electron-mobility-transistor (E-pHEMT) device in the front end to avoid overload and intermodulation, which would spoil the readings from some nearby transmitters.

Roger Pettett, G7TKI, wrote software to display the data submitted by participating stations. Graphs from many stations can be displayed on his website.[2]

The Sentinel receiver and active antenna are more expensive than we had envisioned at the start of this project (about $290 for each, including shipping to the US — the price for US customers will vary according to the exchange rate between US dollars and British Pounds Sterling — check with Chris Moulding for current prices before ordering).[3] Figure 1 shows the Sentinel receiver and Figure 2 is the active antenna designed to provide the calibrated measurements.

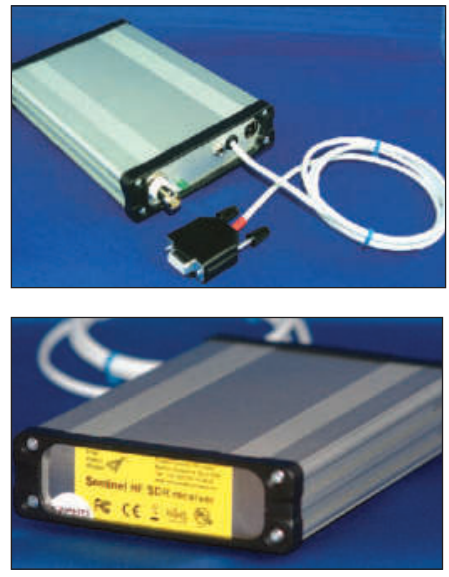


Figure 1 — The front (top) and back (above) of the Sentinel SDR receiver. [Chris Moulding, G4HYG, photo]

Figure 2 — The active antenna designed to provide calibrated signal strengths when used with the Sentinel SDR receiver for the noise campaign. [Chris Moulding, G4HYG, photo]

For many potential users these prices might be

[1] g4fkh.co.uk/projects/noise-measuring-campaign

[2] psyphi.net/cgi-bin/hfnoise

[3] www.crosscountrywireless.net

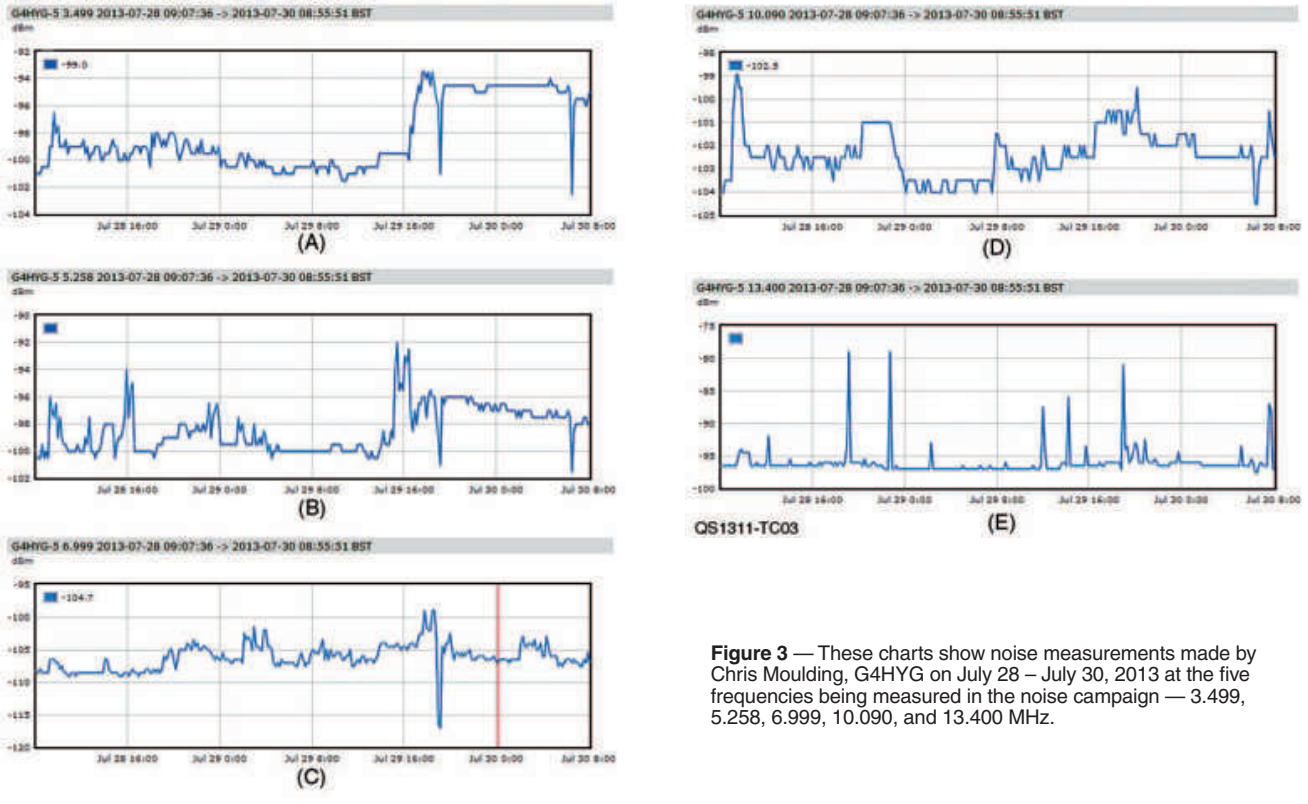


Figure 3 — These charts show noise measurements made by Chris Moulding, G4HYG on July 28 – July 30, 2013 at the five frequencies being measured in the noise campaign — 3.499, 5.258, 6.999, 10.090, and 13.400 MHz.

outside their normal Amateur Radio budgets. I have bought one for my radio club and loan it to members on a weekly basis so that we can all have our local noise signature monitored for comparison on a regular basis. I am hopeful that other clubs will follow suit.

The Sentinel is also a general coverage receiver covering from 1 to 15 MHz. The software only works on older computers running either *Windows XP* or *Windows 2000*. This means older (obsolete) computers can be used for the monitoring program. The receiver comes with its own software and only an internet connection is needed for data transfer. The data output is transformer coupled to minimize common mode currents, which would adversely affect the readings.

Chris Moulding, G4HYG, and Gwyn Williams, G4FKH, both have Sentinel Receivers running 24/7, with the data being displayed on the APRS.FI website. See **aprs.fi/telemetry/a/G4HYG-5** and **aprs.fi/telemetry/a/G4FKH-1**. Figure 3 is a typical day's measurement of background noise at the five frequencies that are the focus of this study. Note that the measurement for Part E was made at 13.400 MHz rather than 13.399 MHz as mentioned earlier. That frequency change was made recently because of other signals being heard on 13.400 MHz. — *73, David Cutter, G3UNA*, Chairman, Ripon And District Amateur Radio Society, *34 Greengate Lane, Knaresborough, North Yorkshire, HG59EL, United Kingdom*; **d.cutter@ntlworld.com**

Computer Headset Microphone Wiring ("The Doctor is In," November 2012)

I was very interested in the answer to the question on electret microphones on page 68 of the November 2012 issue of *QST*. While I liked the answer to the question posed, I believe you might also have mentioned two very important considerations in the application of computer style electret microphones and typical Amateur Radio transceivers.

1) Reducing bias voltage:

While it is not necessary, I believe it is best to reduce the voltage supplied by many radios, to the voltage supplied by common computer sound cards. This gives the microphone a little more dynamic range. While these little electret capsules are often designed to operate with as little as 2 V or as much as 15 V bias, the higher voltage tends to reduce the capsule's overall dynamic range.

Most Amateur Radio transceivers produce 8 to 10 V of dc bias on one pin of an 8-pin round microphone input jack, or sometimes on one conductor of an RJ45 / 8P8C-45 jack. In contrast, gaming headsets are generally designed to work with industry standard internal computer sound cards and external audio interface devices, which supply 2.5 to 5 V on the ring conductor of the microphone input jack. Rarely, a gaming headset microphone cable is terminated with a 2-pole 3.5 mm phone plug. (This is not industry standard, and generally appears on older microphones, or similar microphones intended for related, but different, applications.)

To that end, I use a resistor or voltage divider pad to drop the mic bias voltage a bit. That allows the capsule to operate more smoothly and with less stress, and with greater dynamic range. A pair of resistors as a voltage divider does the job well, a single resistor is less elegant. It does the trick, but with less exactitude or predictability.

2) 10 dB attenuation of open signal voltage:

I think it is *very important* to attenuate the mic input signal strength because most computer type microphones overpower a dynamic microphone input, on the order of, say, –37.0 dB/Pa (typical electret condenser) compared to –54.5 dB/Pa (typical performance type dynamic mic, like Shure SM-58 or the Heil line of dynamic microphones.)

If the microphone signal is not attenuated, the rig input volume is often set as low as 2 to 3% and the ALC/AGC light is either on or off all the time. This is very important to users, because it significantly alters the way

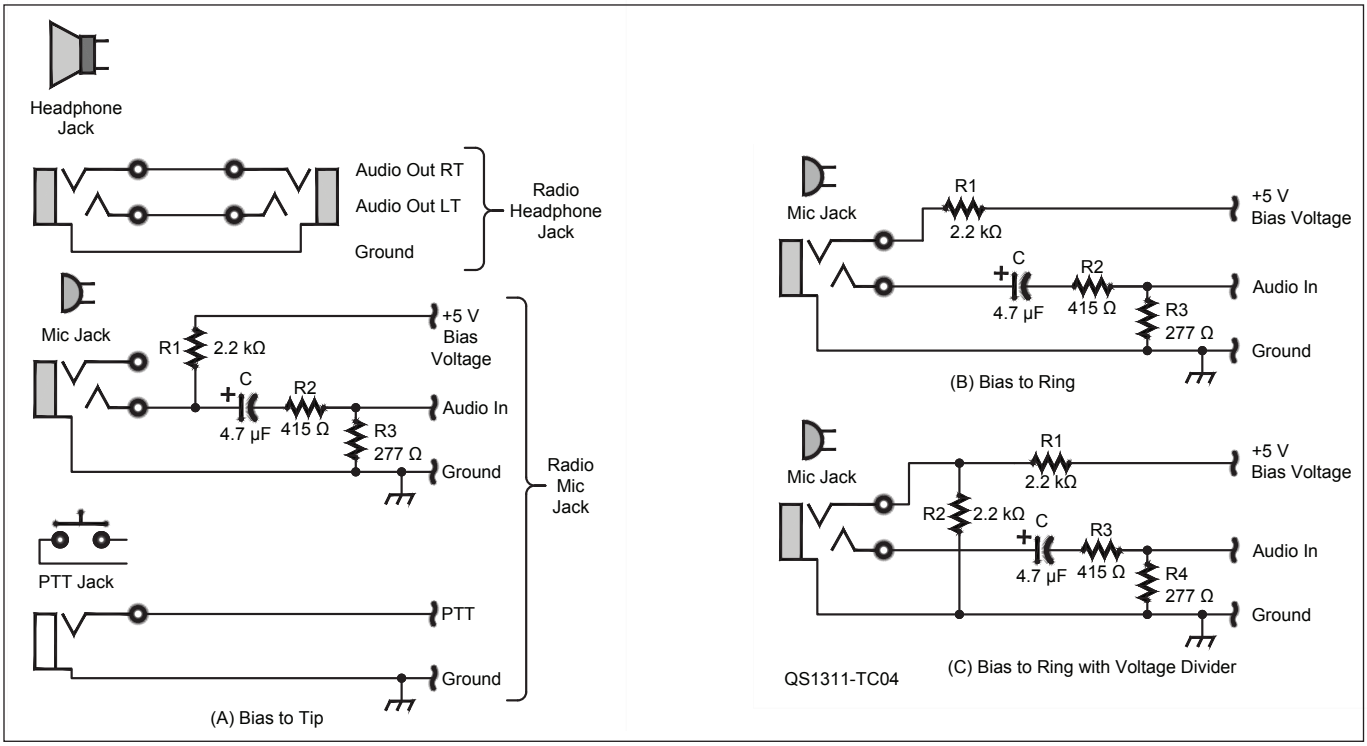


Figure 4 — You can wire the electret microphone bias voltage to the tip or the ring of the microphone jack. You can also connect the bias voltage through a simple current limiting resistor, or use a voltage divider. Part A also shows how I used straight-through wiring of the radio audio to the headphone jack in the adapter box I built to use a computer headset microphone with my Amateur Radio transceiver. Also shown in Part A is the wiring for a PTT jack on that box, to which I can connect a simple push and hold switch. Parts B and C show the other two ways to connect the microphone bias voltage. All three diagrams show a simple voltage divider signal attenuator to reduce the microphone audio to a level more suited to the transceiver.

Figure 5 — The RadioShack circuit board fits neatly inside a small project box (RadioShack 270-1802). Here you can see the jack for the radio audio input, and the wiring straight through to the headphone jack. You can also see the back side of the microphone and PTT jacks. The 5 wires go to a microphone plug wired to match my radio.

Figure 6 — The front of the completed computer microphone/headset adapter box. I added press-on labels for all the jacks later.

the radios operate, and hampers or impedes the proper operation of the AGC/ALC circuits.

To this end, I employ a 10 dB attenuator pad (voltage divider) to attenuate the open signal voltage (microphone output signal strength) to better match the lower signal strength of a dynamic microphone as expected by the radio. That gives the operator more latitude in setting the mic input volume and gives the radio more latitude to flex its audio input AGC or ALC circuitry.

More recent Icom rigs do not suffer this problem, as they are designed with electret condenser microphones in mind, but other brands typically expect a dynamic type microphone cartridge at the near end of the audio chain, and putting a condenser type mic on that circuit crowds the input volume setting and AGC/ALC circuits as mentioned herein.

I always use the capacitor to prevent dc on the audio input line as was suggested, even though many (most?) radios provide for this inside the transceiver.

I built an adapter that allows me to plug a computer gaming headset into the adapter and then plug the adapter into my radio. The bias components are built into a small RadioShack project box. Figure 4 shows three different ways to wire the microphone jack. In Part A the microphone bias voltage is applied to the plug tip and the audio output signal attenuator is also connected to the tip. This drawing also shows the wiring for the radio headphone jack so the radio audio will be fed to the headset. In addition, there is a jack included for a simple push-to-talk switch. Note that the specific wiring to the radio must match your particular rig.

In Figure 4 Part B, the electret mic bias voltage is connected to the ring of the adapter mic jack and the audio output attenuator connects to the ring as in Part A. For the third method, shown in Part C, the bias voltage is applied through a voltage divider to the mic plug ring.

I used RadioShack parts. The circuit board is Part no. 276-148, which snaps apart to make two boards. I cut one of them in half using a scroll saw. Figure 5 shows how the circuit board fits inside a RadioShack 270-1802 plastic project box, which is 4 × 2 × 1 inch. This view is from the back of the box, with the radio received audio input, which is fed through to the phones jack on the front of the box. The completed project is shown in Figure 6. — *73, James Richards, K8JHR, 5787 Charolais Dr, SW, Wyoming, MI 49418*; **k8jhr@arrl.net**

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

Why Match Impedances to Deliver Maximum Power?

Q Sandy, KA9BBV, asks: Why is it that impedance matching allows maximum transfer of power between a source and a load? If one thinks of the load as a sink, then one would expect that lowering the impedance of the sink would enhance the flow of power unless this creates some form of turbulence that is obstructive. Does this "water analogy," work in electronics also?

A First, the water analogy, while easy to visualize, is not always directly applicable. So, while a lower "impedance" does indeed allow more water volume to be transferred, and may allow more current to flow, electrical power is the product of current *and* voltage. The lower impedance will result in lower voltage, all things being equal.

The classic "matched impedance" situation involves an ideal voltage source (zero impedance) in series with a source impedance, that together form the "source," considered a two terminal black box. The two terminals are connected to a load (see Figure 1) that can be real or complex. It is fairly easy to show that maximum power transfer takes place if the source impedance and load impedance are matched, or for complex impedances, are the complex conjugates of each other (reactances of equal magnitude but opposite sign).

As a simple example to illustrate the point, consider the source to be an ideal 100 V dc voltage source in series with a 50 Ω resistor. Table 1 examines a number of outcomes for different resistive load impedances. The power delivered to the load is just P = E × I.

Table 1
The Outcomes of an Ideal 100 V, 50 Ω Voltage Source with Different Loads

Load (Ω)	Current (A)	Load Voltage (V)	Power to Load (W)
0	2	0	0
10	1.7	17	28.3
25	1.33	33.3	44.4
50	**1**	**50**	**50**
75	0.8	60	48
100	0.67	67	44.9
200	0.4	80	32

Thus we can see that while lower impedance loads result in higher current, the correspondingly lower voltage results in less output power. For higher impedance loads, the situation is reversed. The maximum power is delivered to the load if the load impedance is matched to the source impedance (shown in bold).

For complex impedances, it works the same way, except the arithmetic is more complex. Still, we know that at a particular frequency, if an inductor and capacitor are in series, and their reactances are the same, but of opposite sign, the net impedance is zero. Thus, for any reactance that we make part of the load, inserting a reactance of the same magnitude, but of opposite sign, in series, will return us to the simple resistive model at that particular frequency. If the resistances are also equal, that is what is meant by complex conjugates.

This is all well and good, but only applies if our source acts like an ideal voltage source with a fixed source impedance. While this configuration represents how some equipment behaves, for example, some equipment including some solid state amplifiers may act more like an ideal current source — delivering a constant current no matter what the load (over a limited range, of course). In that case, the output power will be higher for higher load impedances! The danger is that the transmitter is designed and rated to deliver its power into a certain load, typically 50 Ω. If it will deliver twice the power into a 100 Ω load, it probably won't do it for long before something melts (been there, done that)!

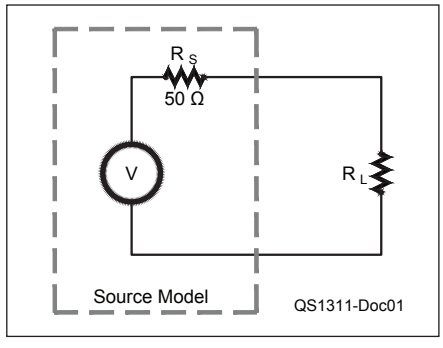


Figure 1 — Electrical circuit used to analyze the transfer of power between a source with fixed source impedance and different values of load impedance.

Q Bob, VE7BS, asks: What is the extent of the error in the SWR reading if using an analyzer designed for 50 Ω to measure a system composed of 75 Ω cable? What considerations are involved in using 75 Ω cable?

A Well, 75 Ω coax is generally useful and has the benefit of being readily available because of its wide use in cable TV distribution systems. Often, surplus cable is available for the asking from installation crews. This kind of cable is fine for feeding antennas, and all things being equal, has slightly less loss than 50 Ω cable, if everything is properly matched. In order to meet stringent FCC radiation standards, it is usually well shielded, but the shields are generally part aluminum foil. which can make soldering difficult.

Before we talk about accuracy of measurement, it's important to decide what we actually *want* to measure. Consider that you are using a transmitter designed to feed a 50 Ω load, and you are measuring at the transmitter end of a cable coming from your antenna system. In this case, from the transmitter's perspective, what you really want to know is how close to a 50 Ω load your antenna system presents to the radio. If the 50 Ω SWR meter reads 1:1, that means the transmitter is seeing a 50 Ω load, just what you want.

That also means that if you're using 75 Ω coax, it is operating at a 75/50 or 1.5:1 SWR — you can't have this both ways. That kind

of mismatch is usually not significant, at least at HF. The loss on the coax will be slightly higher than if the SWR on the coax were 1:1.

If you have an antenna with a 75 Ω feed fed with your 75 Ω coax, the SWR on the coax will be 1:1, resulting in minimum coax loss. On the other hand, the transmitter will see 75 instead of 50 Ω and "think" that the SWR is 1.5:1. This usually isn't a problem either, although at some SWR, the transmitter will usually start to reduce its power output — though not generally 1.5:1.

Another interesting case frequently occurs if you feed a 50 Ω antenna with 75 Ω coax. In this case the SWR on the coax itself is 1.5:1. The impedance at the bottom will vary with line length around the 1.5:1 SWR circle on a Smith chart (if you think graphically). Every ¼ wave it will be resistive, one time with a Z = 75/1.5 or 50 Ω, the next half circle 75 × 1.5 = 112.5 Ω. If the 112 Ω length is plugged into the 50 Ω transmitter, it will *think* that the SWR is 2.3:1. Some transmitters are likely to fold back and reduce power at this SWR — not a good thing. Of course, if you add an additional ¼ wave of coax it will be back to 50 Ω, and the transmitter will be happy as a clam. The limitation here is that it is pretty much a one band arrangement.

Now, as to the actual measurement situation. A 50 Ω SWR bridge will read the SWR as if the system were the 50 Ω transmitter in the above example. This is great for tuning the system so it works well with the radio, but doesn't give you the actual SWR on the 75 Ω transmission line.

A true forward and reflected wattmeter, such as the popular Bird Thruline, doesn't really care what the line impedance is — it gives you the actual forward and reflected power at that point in the line no matter what impedance system you are using. Thus with this type meter, the 75 Ω coax feeding a 75 Ω antenna would look like 1:1, even though the transmitter will perceive it as a 1.5:1 SWR.

Q Randy, K5GJR, asks if having his vertically polarized 2 meter Yagi on the same aluminum mast as his other beam antennas will degrade its performance, and if so, what he can do about it.

A A conductive mast can make a big difference in the performance of a vertical Yagi. The exact amount will depend on exactly where the mast is with respect to the elements and could be modeled to find out. On the other hand, it may be better pick a configuration that will avoid the problem all together.

As an example, I modeled a five element vertical Yagi in free space without a conductive mast and obtained the azimuth plot shown in Figure 2.[1] The addition of a mast at its balance point resulted in the pattern shown in Figure 3. I have seen much worse effects, and didn't try for the best or worst case, but it's clear that its performance is degraded.

Surprisingly, just using a nonmetallic mast doesn't usually help because the dangling feed line in the middle has the same effect as a metal mast. However, there are a number of good solutions. A popular arrangement is to mount the vertically polarized Yagi on a horizontal cross T. In order to maintain balance, it is often extended to the other side of the mast and used to support either a vertical Yagi for another band, or a second Yagi for the same band fed in phase for additional directivity and gain. Figure 4 shows the pattern with the mast offset by ½ wavelength to the side of the balance point. While there is a slight pattern distortion, the gain is within 0.15 dB of that in Figure 2.

Another approach that works well with short boom (three and four element 2 meter antennas, for example) Yagis is to have the antenna entirely in front of the mast. Figure 5 shows the pattern of our Yagi with the reflector 0.15 wavelengths in front of the mast. The mast appears to act like an additional reflector, reducing the rear signal. Again, it is important to dress the coax so it goes along the Yagi's boom until it gets to the mast.

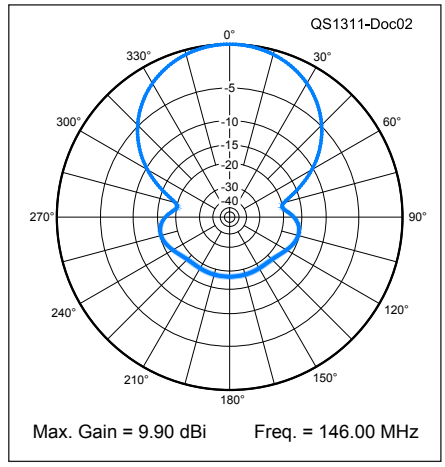


Figure 2 — Modeled free space azimuth pattern of a five element vertical Yagi in free space without a conductive mast.

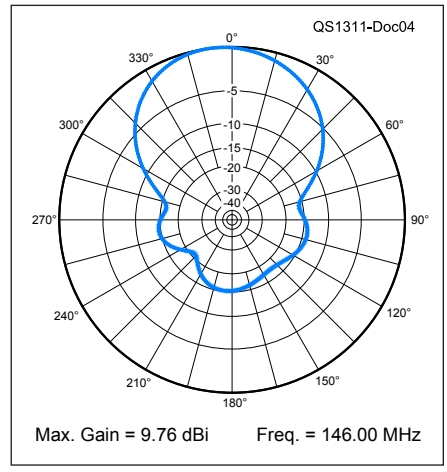


Figure 4 — Result of moving the mast of Figure 3 a half wavelength to the side of the Yagi boom.

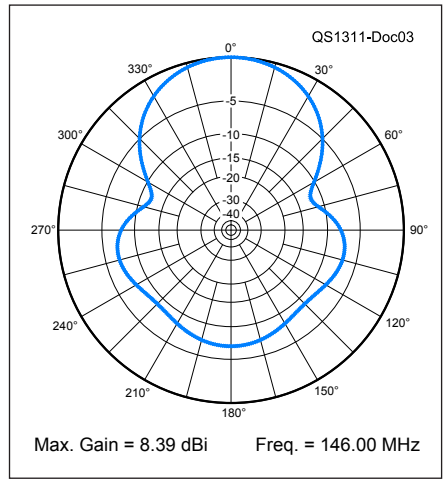


Figure 3 — Antenna of Figure 2 modeled with a conductive mast at its balance point.

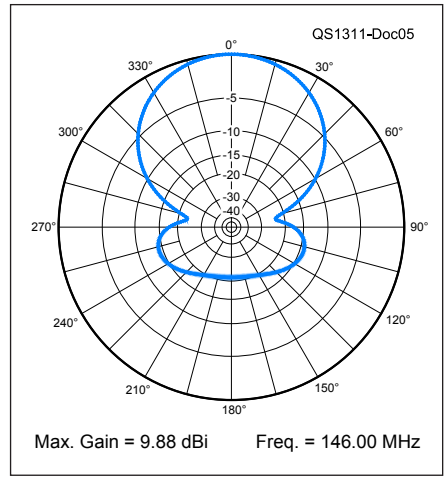


Figure 5 — Result of moving the mast 0.15 wavelength to the rear of the Yagi reflector.

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

Steve Ford, WB8IMY, wb8imy@arrl.org

The AlexLoop Walkham Portable Antenna

Phil Salas, AD5X
ad5x@arrl.net

A small loop antenna can be an effective radiator if it is properly designed so as to overcome issues associated with its high RF currents and voltages, and its very low radiation resistance. Alexandre Grimberg, PY1AHD, has experimented with loop antennas for more than 12 years, with low power, efficient, portable operation in mind. His work has resulted in the AlexLoop Walkham portable loop antenna.

Description

The Walkham is rated at 20 W PEP/10 W continuous transmit power and covers 7 to 30MHz. It comes in a small cushioned bag and consists of a DLC-213 flexible coax loop, a feed-loop assembly, a middle section and a manual tuner assembly. The DLC-213 coax is similar to LMR-400, but holds a circular shape better. The manual tuner uses a split-stator capacitor to avoid mechanical contact losses. Internal gearing permits smooth and easy tuning from 6.9 to 30 MHz over the 270 degree rotation angle of the variable capacitor. Assembly takes just 1 to 2 minutes and consists of slipping three tubes together, unrolling the coax loop, snapping the loop's center to the upper end of the feed loop assembly and attaching the loop's coax connectors to the tuning assembly. Just connect the pendant coaxial cable to your transceiver and you are ready to operate!

The AlexLoop Walkham packs into this small carrying case.

The Walkham is ready for assembly.

On the Air with the Walkham

When vertically oriented, the Walkham radiates a bi-directional signal with maximum radiation in the plane of the loop and deep nulls perpendicular to the loop. And because the antenna is very high Q, you will need to re-tune after even fairly small frequency changes. Alex recommends operating while sitting in a chair or bench, holding and tuning the Walkham with one hand and operating your radio with the other hand. I found it easier to support the Walkham on an inexpensive camera tripod. That way I could easily tune the antenna, orient it for best signal strength, and then concentrate on operating my radio.

The Walkham works well at just 3 to 4 feet above ground level, and is easy to tune since the tuning assembly is located at the base of the loop. To tune the antenna, adjust the tuning capacitor for maximum receiver noise and then transmit and touch up the tuning for best SWR. I found this easy to do with my Elecraft KX3 transceiver. After peaking receiver noise, pushing the TUNE button enables a continuous carrier and displays SWR. Within seconds I could tweak the loop for a minimum SWR of 1.3 to 1.4:1 on 40 to 12 meters, and 1.6:1 on 10 meters. Incidentally, I found that the proximity of my hand to the tuning capacitor did *not* noticeably impact the tuning. As a matter of fact, after tuning for minimum SWR, removing my hand from the tuning knob often resulted in a slightly lower SWR.

I operated primarily on 40, 30, 20 and 17 meters due to band conditions during the review. Transmit power was 10 W. Overall, I thoroughly enjoyed Walkham operation. I found that when operating CW (my preferred mode), I could work anyone that I could hear. SSB was challenging on 40 meters, though I did have success calling S9-level stations. However, SSB QSOs were easy to make on 20 meters, and a real joy on 17 meters. Due to the higher efficiency of the antenna on the higher bands, I can only imagine that performance on 15 through 10 meters would be outstanding when those bands are open.

The author enjoying outdoor QSOs with the Walkham and a battery-powered Elecraft KX3 transceiver.

Conclusion

The Walkham is an effective antenna worth considering for lightweight portable operating at low power levels. It would also be an attractive option for hams living in apartments, or in homes with severe antenna restrictions. While it may not be as efficient as a much larger antenna, its directive nature, compact size, low-height performance and easy tuning can equalize any efficiency trade-off.

Manufacturer: Alexandre Grimberg, PY1AHD, PO Box 33.120 22.440-970 RJ, Brazil; **www.alexloop.com**. *Available in the United States from GigaParts (***www.gigaparts.com***) and W4RT Electronics (***www.w4rt.com***). Suggested list price: $366.*

H. Ward Silver, NØAX, n0ax@arrl.org

Experiment #130

A Double-Duty Communications Speaker

Okay, okay — enough with the math and the phasors and the coordinates! Several columns dedicated to phase rotation and spinning around at the carrier frequency is enough to make anyone a bit dizzy, the author included.[1] I'm sure we all need something more on the order of drilling and soldering, so let's return to the workbench and cobble together an accessory that has a home in every mobile station — the communications speaker. But we'll jazz it up a bit.

We all get speakers built into our mobile rigs. However, they are often chosen simply because they will fit in the box and not because they are the best solution for competing with wind and road noise in a vehicle, usually while trying to understand the limited fidelity speech of another operator, who may also be driving.

An external communication speaker is substantially larger and able to reproduce speech with better fidelity at volumes that can overcome ambient noise. Many vendors offer fine products in this regard and if what you need is only one speaker for one radio, that's probably the right solution.

But as our friends and family well know, one radio is rarely enough! Getting separate speakers for each rig leads to clutter, as well as a volume arms race as each radio is turned up louder and louder to be heard.

The most common multi-radio mobile installation has a pair of rigs, perhaps a ham radio and a scanner (or, as in the author's car, a VHF/UHF mobile FM transceiver and an HF rig). If you only have a single speaker, it's simple to add a switch and select one or the other. Yet it's pretty common to have both radios on at the same time — perhaps you are operating HF and keeping an ear out for a call on the repeater or vice versa.

Passive Mixers

The simplest way of being able to satisfy the requirement of listening to either or both radios at the same time is to substitute a *balance* control for the A/B switch. By adjusting the balance control, you can listen to either radio A, radio B or a combination of both. Balance should not be confused with *pan* (from "panoramic") which refers to positioning a particular audio source in multiple audio channels (**thedawstudio.com/Tips/PanPots.html**).

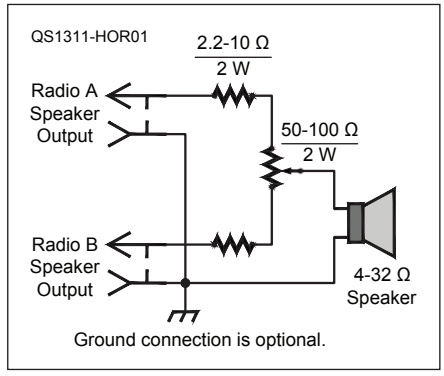


Figure 1 — A basic passive mixer isolates the radio audio outputs with the fixed resistors. The radio volume controls determine overall level and the potentiometer acts as a balance control. Small-value resistors insure the radio outputs aren't connected directly together.

Figure 1 shows a very simple way of being able to listen to either or both radios in a single speaker using a passive balance control. The speaker outputs of most radios can supply a few watts of audio power into the typical communications speaker impedance of 4 to 32 Ω. A fixed resistor is in series with each speaker output to isolate the individual radio audio outputs from each other. The variable resistor is connected so that when the wiper is at either end, the speaker gets full output from one radio and very little from the other.

Because of differences in radio audio outputs, available speaker impedances, and your personal volume preferences, a range of values is shown on the schematic. If you want a lot of volume, choose lower values for the fixed resistors, with the tradeoff being higher minimum volume for the undesired channel. Wirewound resistors are fine in this low-frequency application. This simple circuit can be installed inside the speaker housing, too.

It may take a couple of tries before you get the right combination of volume settings on the radios and resistor values in the mixer. Because the radios are different, the fixed resistor values may need to be different, too. In fact, the fixed resistors can be replaced by potentiometers if you like.

Active Mixing

A more flexible method of controlling the volume from more than one source through a single speaker is to use an *active mixer* — an amplifier that combines audio from multiple inputs with each level adjustable in the output. There are many types of active mixers, ranging from a simple summing circuit based

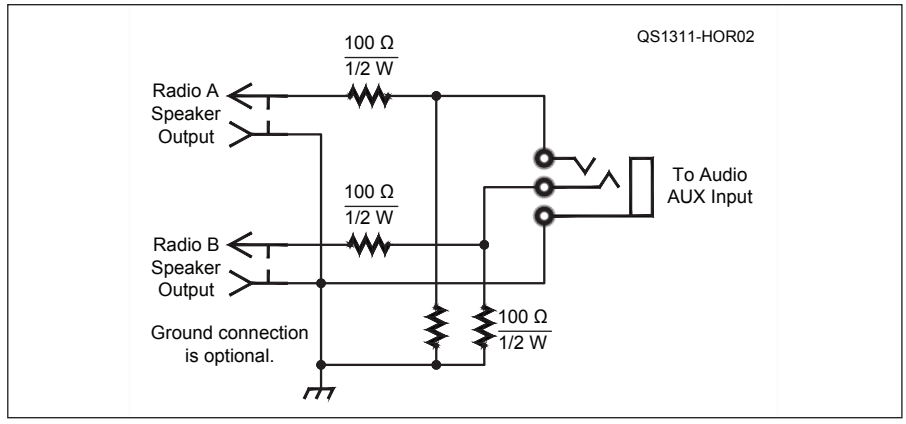


Figure 2 — This fixed attenuating divider limits signal level into a vehicle audio system's AUX input. Audio system volume and balance controls are used to adjust audio volume.

on an op-amp[2] to sophisticated designs with two or more output channels that have pan, balance, and frequency equalization on each input. These may have a place in the well-rounded shack at home but we're talking about your mobile station, so let's not go overboard.

You probably already have a type of mixer in your vehicle — it's part of the audio entertainment system. A standard feature on most vehicle audio systems these days is an AUX (auxiliary) input with a three-conductor, stereo and a ⅛ inch phone jack mounted somewhere on the dashboard or console. Plug in your stereo audio player or smartphone and away you go. The audio from your ham rigs can be plugged into the stereo, too, if you make sure to keep the signal levels down. Figure 2 shows an audio attenuator circuit suitable for use with the audio system's AUX input.

In this circuit, both radio outputs are still connected to a fixed resistor but now they are not connected together in the output balance control. Instead, a resistive divider limits the signal level into the AUX input. If the load connected to the resistive dividers is 32 Ω, typical of small headphones or earbuds, the voltage from each channel is attenuated by about 14 dB. How did I determine that? Since 32 Ω // 100 Ω ≈ 25 Ω (// is used to indicate "in parallel with"), the output is reduced by 20 log (25 / (100+25)) = 13.9 dB. If you need more volume, decrease the input fixed resistor value. A high audio system input impedance reduces attenuation to 6 dB.

With the output of the divider connected to audio system's AUX input you can listen to one radio in the left channel and the other in the right channel. The fidelity of my car's stereo system is a lot better than that of the speakers in the radio! Non-hams find the audio system's output a lot easier to listen to, as well. Hams have gotten used to really poor mobile audio with lots of distortion and no bass. You might be surprised at how good a radio can sound if its output isn't trying to overdrive a minimal speaker over the road noise.

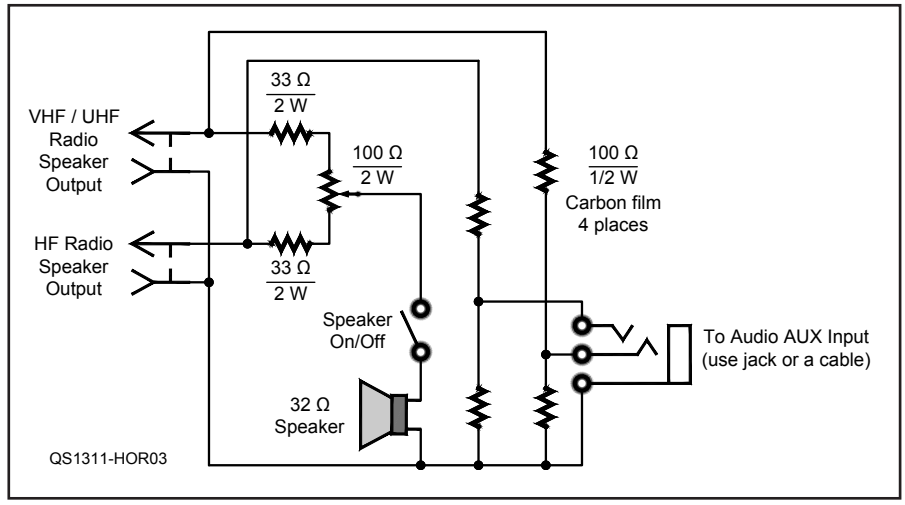


Figure 3 — The author's combined system that allows monitoring through the speaker or through the vehicle audio system.

Figure 4 — The completed speaker with the volume control, on-off switch, and cables for connection to the radios and vehicle audio system (white connector). [Ward Silver, NØAX photo]

Customize It!

Don't stop here — add more features. You can use a splitter at the AUX input for your audio player, but why not add a parallel jack and switch on the speaker housing? Add a headphone jack or adjustable resistors for independent level setting. Don't be afraid to experiment with different resistor values and configurations.

In my vehicle, I wanted to be able to switch the speaker on or off independently of the audio system so I could listen to both radios and some entertainment at the same time. Figure 3 shows how I have my circuit configured and Figure 4 shows a photo of the final product. The circuits of Figures 1 and 2 are connected "in parallel" to the radio audio outputs so that they can act independently.

I used what I had in my junk box. These values were "close enough" for reasonable radio volume settings. It got the job done and let me proceed with hamming it up. As a bonus, I have to say that listening to a big CW pileup with the widest IF filters when it's played through a powerful audio system is some kind of amazing. It's not quite opera, doc, but it's close!

Notes

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

[2]Silver, Ward NØAX, "Experiment 3: Basic Operational Amplifiers," QST, April 2003, pp 63-64.

Steve Ford, WB8IMY, wb8imy@arrl.org

Yet Another APRS Client

Park your 2 meter FM transceiver on 144.39 MHz, back off the squelch control and listen. If you hear a burst of sound that many describe as "*brraaaaap*," there is good chance that you have Automatic Packet Reporting System (APRS) activity in your area.

What you're hearing is a packet radio data transmission at 1200 baud. The data includes position coordinates (often supplied by a GPS receiver) as well as text and even telemetry. To decode and display these mysterious signals you'll need…

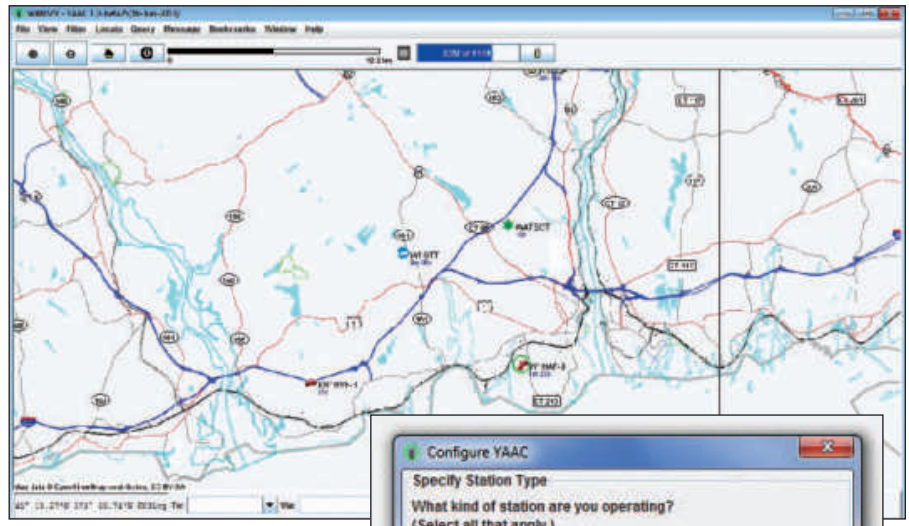
- A terminal node controller (TNC), assuming your radio doesn't have one built in. Popular models include the Kantronics KPC-3 (**www.kantronics.com/products/kpc3.html**) and the Timewave PK-96 (**www.timewave.com/products/pk96.html**).
- A computer
- APRS software

Among *Windows* users the most popular APRS software has been *UI-View* (**www.ui-view.org**) by the late Roger Barker, G4IDE. When coupled with mapping software such as Undertow's *Precision Mapping*, *UI-View* will "talk" to your TNC and display the locations of the ARPS signals you are hearing. It will also transmit, adding your station to the local APRS network.

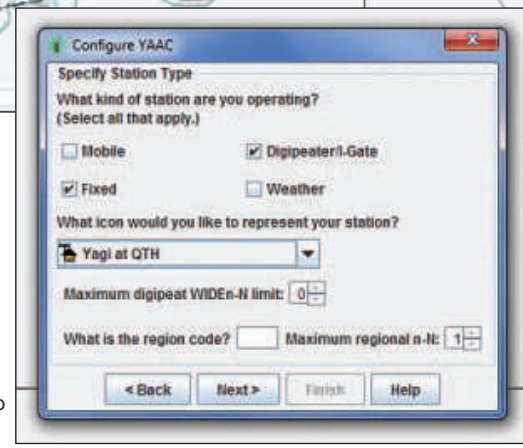
The only problem with *UI-View* is that it is becoming somewhat outdated. The software still works well, even in *Windows 8*, but there has been some pressure to develop APRS client software that is more flexible and usable across different platforms.

That's where *YAAC — Yet Another APRS Client* — comes in. *YAAC* was developed by Andrew Palvin, KA2DDO, and one of its most interesting attributes is the fact that it is a *Java* based application. This means that *YAAC* can run on any computer that has *Java* installed. It could be a *Windows* computer, a *Linux* machine or a Mac — it doesn't matter. As long as *Java* is present (see **www.java.com/en/**), *YAAC* will run.

When you start *YAAC*, a "wizard" steps you through the initial setup. It asks about the TNC you are using and which COM port it is connected to, your call sign and your station's latitude and longitude.



A *YAAC* view of the southeastern Connecticut shoreline showing icons for several stations.



YAAC has a built-in "wizard" to help you set up the program.

From a *Windows* perspective, you don't "install" *YAAC*. Instead, you download the zip file, extract all the files to a folder on your hard drive and then look for the *YACC* executable *jar* file. Assuming you've already installed *Java*, you just double click on the *jar* file and you're on your way.

YAAC worked quite well for me, especially considering the price — *free*. You can learn more at **www.ka2ddo.org/ka2ddo/YAAC.html**.

OpenAPRS App

If you don't own a 2 meter FM radio, but you *do* own an Apple iPhone or iPad, you can still enjoy APRS via your nearest Internet connection with the *OpenAPRS* app.

The OpenAPRS network (**www.openaprs.net**) is a two-way Internet portal to the APRS world. By establishing a free account, you can not only view position information and data from RF based users, you can use the *OpenAPRS* app on your tablet or smartphone to beacon your own position and even exchange APRS text messages.

The app is only $3.99 in the Apple iTunes store, so I purchased a copy and loaded it onto my iPhone before taking an Amtrak train to Washington, DC. The *OpenAPRS* app used my iPhone GPS to acquire my position information and beacon it to the local APRS network. I changed my beacon icon to a locomotive symbol, which attracted some attention — along with a couple of APRS text messages!

Android users may want to check out a similar app called *APRS Messenger* created by Chris Moulding, G4HYG. Go to **www.crosscountrywireless.net/aprs_messenger_android.html**.

Steve Sant Andrea, AG1YK, hk@arrl.org

Splicing, Reeling, and Tubing

Wire Joining Techniques

If you have ever needed to solder tinsel wire, then you know it's not an easy task. Tinsel wire is formed of spiral conductors made of foil (like copper) wrapped around fibers. These conductors are extremely flimsy and sometimes melt when soldering. You are likely to find tinsel in self-coiled cords (like microphone and telephone handset cords), modular telephone set cords, headphone cords, wires with cloth insulation, switchboard cords, and some musical instrument cords.

The secret to soldering these wires is to wrap the flimsy conductor with a stiffer conductor before soldering. The best wire for this splinting job is 24 AWG solid bare copper.

Start with a 10 inch piece of solid wire and strip about 6 inches. Carefully strip about an inch of the tinsel wire. Next, wrap the solid wire in a tight coil around the tinsel wire (see Figure 1). You will find that the bare copper coil supports and stiffens the tinsel so the coil looks a little like a segment of heavier solid copper when it is finished. When you have about ¼ inch of coil in place, you can trim the ends of the solid wire, leaving only the coil. When you tin the coil, it will bond with the tinsel and will become stiffer. Now you can solder the coil to a solder terminal, secure it with a screw terminal or even add a crimp on connector.

Sometimes I find I need to solder a stranded conductor to a terminal that is too small or too full to fit all the strands. Using the same wrapping technique, I can wrap the stranded wire for ¼ inch and then leave a short pigtail of 24 AWG wire (see Figure 1). This little pigtail will fit though all but the tiniest holes and can be soldered. Unless you are talking about high currents, the reduction in diameter for ⅛ inch will not be an issue.

In none of these cases will the wrapping provide a very strong mechanical connection. The boundary between the end of the solder and the start of the insulation will be a bit weak and you may need to improvise a mechanical support above the solder joint. A small zip-tie around the tinsel insulation and a nearby anchor will often work.

Another application for this technique is in parallel splices. This is similar in concept to the Western Union splice, but much neater. Expose about a half inch of conductor on two wires to be joined, then lie the clean, exposed parts next to each other (see Figure 2) and join them with the 24 AWG solid wire (see Figure 3). Tin the coil and you have a neat joint that is stronger than the original wire. When finished, cover the joint with a piece of heat-shrink tubing for a nearly invisible splice (see Figure 4).[1] — *73, Frank Ingle, KG4CQK, 2580 Park St, Jacksonville, FL 32204*, **kg4cqk@comcast.net**

Figure 1 — Coil solid copper wire around the tinsel (red lead) then trim and tin the coil (black lead). The remaining solid wire pigtail can be trimmed off or used to make connections. [Frank Ingle, KG4CQK, photo]

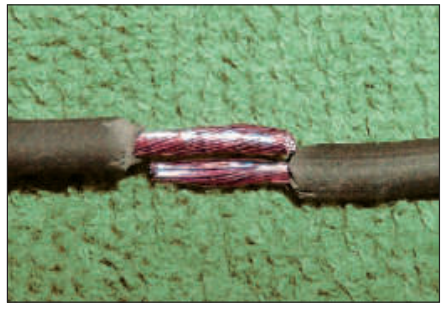


Figure 2 — To prepare a parallel splice, strip the ends of the wire and position them alongside each other. [Frank Ingle, KG4CQK, photo]

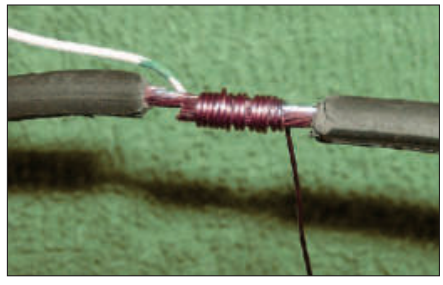


Figure 3 — Wrap both exposed wires with #24 AWG solid copper, then solder. [Frank Ingle, KG4CQK, photo]

Chalk Reel Antenna

I do a lot of portable operating from hotels or while backpacking. I have found that a reasonably effective antenna for 40 meters and above is a simple long-wire antenna of approximately 50 feet in length. It tunes well with a simple L network or with the internal tuner in

[1]For more on splicing and terminating techniques, see the following NASA Standard, Section 19; **www.hq.nasa.gov/office/codeq/doctree/87394.pdf**.

Figure 4 — Finish the splice with a piece of heat-shrink tubing for a neat and sturdy splice. [Frank Ingle, KG4CQK, photo]

Figure 5 — An inexpensive chalk reel is a convenient way to carry an end-fed long wire. [Alan Amos Jr, KN1O, photo]

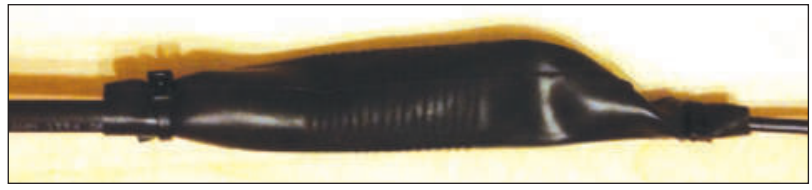


Figure 6 — A short piece of bicycle inner tube makes an inexpensive weatherproof seal for coax connections. [Stephen Burns, N5VTU, photo]

my K1. When operating from a hotel, I typically try to get a second or third floor room and use a tree or my car to support the antenna. Generally, I use the air conditioner to provide a ground reference. When backpacking I feed the antenna from the low end and get the other end as high up a tree as I can and simply lay another wire on the ground (where no one will trip over it) as the ground reference.

The biggest problem has always been keeping the wire from becoming a tangled mess. I have tried a variety of methods, some of which were more successful than others. While walking through the tool section of our local hardware store, an item caught my attention; a chalk line reel. The intended use is to hold 100 feet of string along with powdered chalk and the string is used to mark a straight line. I had just acquired a reel of Teflon-coated fine wire (#26 I believe) for portable antennas and the diameter isn't much greater than the string in the chalk reel. The reel is quite compact and is light enough to be practical even for backpacking.

I opened the reel and removed all but about a foot of the string and also removed the end cap that the string feeds through. I simply tied the remaining piece of string to the wire as shown in Figure 5. I fed the wire through the internal felt ring, which provides a little bit of drag on the wire to help it wind evenly on the spool. To connect the transmitter, I simply stripped off a short section of the insulation a few inches from the spool end of the wire to provide a place where I could use a small alligator clip to attach the transmitter. This solution has truly made me a "happy camper" when operating portable; no more tangled wires! — *73, Alan Amos Jr, KN1O, 30 Bromfield St, Newburyport, MA 01950*, **radiokn1o@gmail.com**

Inner Tube Weatherproofing

I've successfully used this method for a few years during the course of antenna installations to protect coax connections from the elements. Rather than using electrical tape, coax seal or some of the more traditional methods of sealing coax connectors and splices, I cut up a bicycle inner tube and use it as a sleeve over the connection. A generic 26 inch bicycle tube can be purchased for about $3 at the local bike shop or discount store and will yield enough material for about a dozen connections.

I cut the sleeve to extend about 2 inches beyond each side of the joint then slip it over the connection, completely covering the joint. Then I secure it tightly to the coax on each end with a tie-wrap (see Figure 6). I always treat the sleeve with a protective coating such as Armor All or a similar product to prevent UV damage. The best part is that the connection remains flexible and watertight and the sleeve is easily removed and may be reused multiple times. — *73, Stephen Burns, N5VTU, 10208 S Summerlin, Conroe, TX 77302*, **n5vtu@arrl.net**

RFI from Electronic Lighting Ballast

I use F96 T12 lamps in my shack that required the older Advance Transformer Company # SM-2E75-S-1-TP light fixture ballasts. I decided to replace the old ballasts with the newer Philips Advance Model ICN-2P60-SC electronic ballasts. When I turned on the lights I was confronted with an S9+ signal on several 2 meter radios, which appeared to cover the entire band. The "electronic ballasts" also interfered with X10 modules used to control other lighting in the house.

I was able to eliminate the interference by installing a single Fair-Rite (**www.fair-rite.com**), type 43 split core material ferrite snap-on filter (p/n 0443164151) on the power cable to the lamps. — *73, Dwight Holtzen, N3ARU, 795 N McComas St, Wichita, KS 67203-4832*, **n3aru@cox.net**

EchoLink on Linux

My radio desk computer uses the *Ubuntu* operating system (currently ver.13.04). It works very well and I decided to install EchoLink. Here are a few setup tips that may help in experimenting with EchoLink or other *Windows* programs, on *Linux* computers.

1. Download *EchoLinkSetup_2_0_908.exe* (or other version) from **www.echolink.org**.

2. Check to see that *Wine* (a compatibility layer that allows *Windows* programs to run on *Linux*) is installed. If not, download the current version from **www.winehq.org** and install it by opening a terminal window and entering the command: "wine control [ENTER]." Select the install file and follow the program's installation instructions.

3. An EchoLink startup icon will be installed on the desktop; click it to start the program and complete the normal setup. After that, you will be hard pressed to tell if you are using EchoLink on a *Windows* or *Linux* platform. — *73, Tom Hart, AD1B, 54 Hermaine Ave, Dedham, MA 02026*, **tom.hart@verizon.net**

Off the Shelf Expander

Belkin's RockStar, marketed to "connect up to five pairs of headphones," functions well for connecting bugs, keys, and paddles to the transceiver. I have a Begali Sculpture paddle (**www.i2rtf.com**), which I use most of the time, a Vibroplex Original Standard (**www.vibroplex.com**) and a Begali Blade straight key, which are in place and ready to immediately be put in the game. An extra 3.5 mm plug to 3.5 mm plug cable is included in the package (see Figure 7). — *73, Bob Mayo, W2TAC, 113 Taconic Lake Way, Petersburgh, NY 12138*, **bobmayo@outlook.com**

Figure 7 — The Belkin RockStar splitter is an inexpensive and neat method for connecting multiple accessories in your shack. [Bob Mayo, W2TAC, photo]

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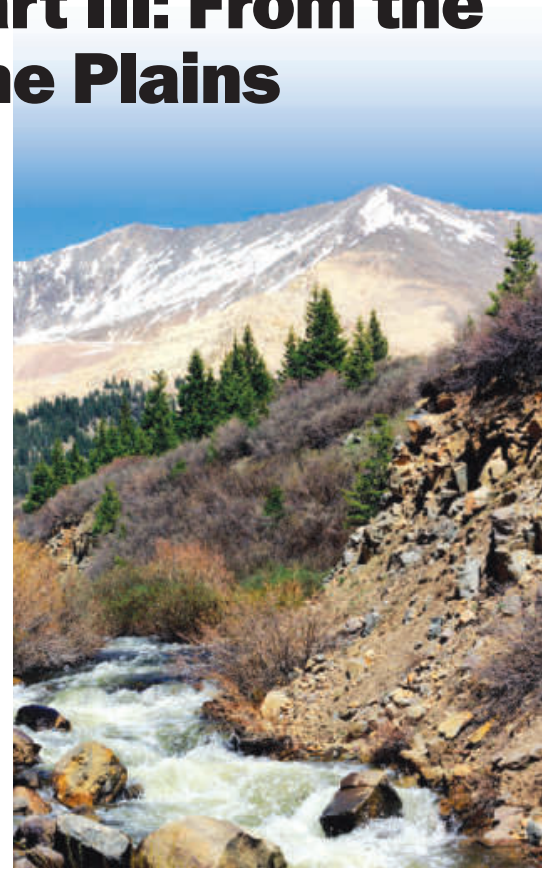
QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **hk@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number and e-mail address on all correspondence.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

Adventure Portable, Part III: From the Headwaters to the Plains

In the final installment, Max reflects on his journey down the river and on the air.



Max McCoy, KCØMAX

There's a water-stained map of the Upper Arkansas River Valley on the wall above my desk. The map is crumpled and creased because it was on the dash of my Jeep or strapped to the bow of my kayak as I followed the river from its headwaters near the Continental Divide in Colorado. It was a journey of joy, frustration, and personal discovery that included operating QRP from the mountains to the plains.

My goal, as an author and professor of journalism, was to explore the natural and cultural history of what I believe is our country's most fascinating river. This project has continued to evolve, becoming less abstract and more personal. Hiking a mountain trail or paddling a kayak gives one an unmediated connection to nature. It also affords an understanding of how environment has shaped society. A bust-and-boom mining town like Leadville, located in a volatile subarctic climate two miles above sea level, has evolved much differently than Pueblo, a former steel mill city located in a semi-arid desert.

As a ham and a QRP enthusiast, my desire was to operate from many different places along the river, on a variety of bands. With Amateur Radio, getting out of the shack and operating in nature offers a refreshing perspective and cultivates an appreciation for simplicity, skill, and just plain luck.

Filling in the Map

Gradually, taking a week or so to do each 5 to 10 mile section, I filled in the map with experiences, not only of the river but also of the radio contacts I made. Amateur Radio was a happy side project, a diversion which was, at turns, rewarding and frustrating — but never boring.

While my log wouldn't impress many, it reflects the nature of my approach to Amateur Radio. My goal was to have fun, improve my operating skills, and make friends on the air. I worked stations from across the country, using a variety of modes, with five watts or less. I also operated on my way to and from Colorado, especially when my route paralleled the Arkansas River. During the Kansas QSO Party in August, I set up one morning not far from the river at Great Bend, Kansas, where I made nine contacts. Not a lot, but I enjoyed them all, especially a PSK exchange with Stephen, K5ABQ, from Albuquerque — just because "Breaking Bad," my favorite television show, is set there.

Operating trailside with a headset, Max McCoy, KCØMAX, calls CQ on 20 meter phone during a midday rest in late July along the Arkansas River near Buena Vista, Colorado. McCoy has used a variety of antennas and modes while operating, and found SSB portable among the most challenging. [Karl R. Gregory, photo]

Too Many Kits, Not Enough Key

For me, kit building has been one of the most rewarding things about Amateur Radio. I have built all sorts of kits — keyers and dummy loads and SWR meters and transceivers — and most of them fit into an Altoids tin. I have a shelf full of completed kits, and another shelf of kits waiting to be built.

But what I discovered when I began the Arkansas River project is that I had devoted too much attention to kit building, and it was at the expense of my operating skills. I should have put down the soldering iron and spent more time at the radio.

My code was too slow to be practical for most contacts, so I began working every day to bring up my speed. I managed a meager 13 wpm. Although I'm still more comfortable with phone and digital, I kept pushing myself to improve my code. Because of efficiency — and history — I don't think you can be a well-rounded QRP operator without it.

Pausing for a photo where US Highway 24 crosses the Arkansas River between Crystal Lakes and Hayden Meadows, Colorado, Max McCoy, KCØMAX, reflects on the journey ahead. McCoy kayaked, and operated QRP portable from, this section of river in July. [Karl R. Gregory, photo]

Max kayaks on the Arkansas River as it meanders across an alpine meadow between Kobe and Granite, Colorado. In the hold of the kayak was a complete QRP station — radio, antenna, tuner, and accessories — in a waterproof Pelican case. [Karl R. Gregory, photo]

Wired for Radio

The biggest challenge of all, however, was learning to embrace a cardinal rule of QRP operation: your signal is only as good as your antenna, and with low power operation you don't have the luxury of wasting watts. I hadn't completely forgotten this rule, but I did have a tendency to bend it.

Because my operating locations were often dictated by the opportunity that a spare hour or two presented, instead of careful scouting, I had to rely on chance. Sometimes it worked out, and there was a 30-foot pine tree nearby. At other times, I found myself setting up next to a rock cliff or in a spot where the tallest tree was really only a bush.

So, I tended to make compromises, especially when I was tired or hungry. I sometimes operated with my wire antennas too low, or folded at an angle that was too sharp — or when using verticals, I failed to get enough radials out. Every antenna is a compromise of some type, but I learned that a little extra thought and care in setting up pays off.

Because it was important that my antennas and related gear were compact enough to fit in a pocket (or, at most, a backpack) I was fairly limited when it came to antenna deployment. Even my old fishing reel/slingshot launcher was too big to carry, so I would pitch antennas into trees by tying lines onto water bottles and slinging them as far up as they would go. Any type of mast, of course, was too cumbersome to haul with me. Even the vertical I used had to be broken down into short sections. The vertical worked, and was necessary when there was absolutely nothing to hang an antenna from, but it wasn't nearly as efficient as a simple dipole.

Mapping the Route

If you're thinking of having your own radio adventure in the Upper Arkansas Recreation Area, the map that I mention is a good guide. I got mine for free at the Leadville Ranger Station of the San Isabel National Forest, but the map is also available as a full-color PDF download from the Colorado Parks and Recreation website, **www.parks.state.co.us**. Published by the Arkansas Headwater Recreation Area — a partnership among the Colorado Parks and Wildlife, the Bureau of Land Management and the US Forest Service — the map lists 40 recreation sites along the 150 miles of river between Leadville and Pueblo.

I used 24-gauge speaker cable for my wire antennas. It was light, strong, and more than sturdy enough for the five watts or less I loaded it with. When I needed to change the length of the antenna to work a different band or to add a bit of length for tuning, I used wire nuts. The gray ones are the right size and made a strong enough connection for temporary use. I discovered this in desperation, after trimming an antenna too short. Also, I used an old 35 mm plastic film canister as an insulator and center support.

This antenna fit in a sandwich bag, which kept it from getting tangled in my pocket. It also had the advantage of being cheap to make; a 75-foot spool is only a few dollars at RadioShack, and once you separate the strands, it's long enough to make a dipole for up to 80 meters.

I also carried a roll of orange flag tape with me, to mark the antenna. It's light and cheap, and is a handy way to mark the antenna, for safety's sake. The precaution was as much for me as anybody else, because I'm prone to walking into things.

The River Ahead

I've already discussed some of the practical things I've learned about operating radio in the wild, but there's something deeper I want to share.

It's a philosophy, really. It comes down to actively seeking challenges.

I'm not a great amateur operator, but I'm better now than when I started the journey. I love the hobby and I work to improve my skills. When the opportunity for this adventure presented itself, in the form of a sabbatical project to follow the Arkansas River from the headwaters to the plains, as well as to make Amateur Radio a part of it, I jumped. I knew it would be a challenge, and that I might look foolish at times, but I did it anyway.

So, that's my message. Say yes to adventure. Cultivate friendships, both on and off the air. And never stop learning.

Max McCoy, KCØMAX, is an associate professor of journalism at Emporia State University in Emporia, Kansas. He can be reached at **max@maxmccoy.com**.

The Telegrapher's "Mill"

The mill was an essential tool for receiving high-speed CW.

Stan Levandowski, WB2LQF

During the heyday of military and commercial CW operations, professionals used very little paper. Instead, they typed their copy on special typewriters called "mills." Mills were distinguished from standard typewriters in several ways. With standard typewriters the lowercase letter "l" and the figure "1" were used interchangeably. The letter "O" and the figure "0" were identified contextually.

Context, however, was not always present. Military and commercial operators routinely copied cipher groups and coded messages. Hence the need for a very special typewriter arose, a typewriter dedicated to CW operators — the mill. Mills had only capital letters and commonly used a sans serif 9 point sfont. There was a "real" figure 1 and a "Ø" on the top row. Figure 1 shows the prominent positions of the two mills in radio central aboard the museum ship USS *Slater* (**www.ussslater.org**). Figure 2 demonstrates the mill's distinguishing font features on an interesting US Navy dispatch circa 1941.

Today, the majority of Amateur Radio CW operators handwrite their copy. Some print, some use cursive. Some copy each character, while others only jot down the highlights. Traffic handlers need to get every character down with absolute accuracy.

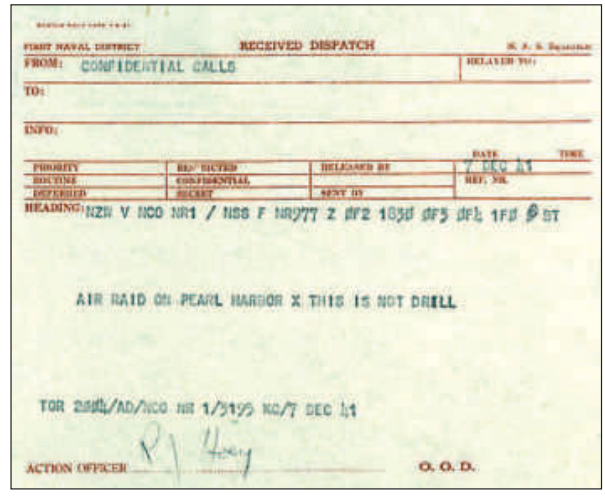
The experience is a common one. The blank space on your sheet of paper steadily shrinks. You simultaneously scan for more open areas while trying to keep pace with the CW. At the most inopportune moment, you finally cast the sheet aside and grab a fresh one. Wait — where'd that call sign go? What was the op's name again? Which sheet is it on?

Figure 1 — Mills occupy prominent positions at the two local operating positions aboard the museum ship USS *Slater*. [Stan Levandowski, WB2LQF, photo]

The Way We Were

There is the usual lore surrounding how the mill got its name but none of it is verifiable, except that "mill" is *not* shorthand for "military." According to Richard "RD" Dillman, W6AWO, who is Chief Operator, Coast Station KSM of the Maritime Radio Historical Society (**www.radiomarine.org**), mills were found not only in radio central aboard naval warships but at the operating positions of coastal stations, as well as the radio rooms of merchant vessels on the high seas.

RD reports that at the present time, "We have two fairly modern Royal mills that were in use at KPH. We also have two Underwood mills that, while not native to KPH, are seen in historic photos of the station. We've had one restored and use the other 'as received.' I use one of the Underwoods to keep my log. Mike Payne, N6BBF, senior Morse operator, uses an Underwood and a Royal to keep the log and copy traffic. Steve Hawes, WB6UZX, the transmitter supervisor uses two mills for log keeping and progress reports at the transmit site."


FIRST NAVAL DISTRICT RECEIVED DISPATCH

FROM: CONFIDENTIAL CALLS

TO:

INFO:

PRIORITY / ROUTINE / DEFERRED — CONFIDENTIAL / SECRET — DELIVERED BY — SENT TO — DATE 7 DEC 41 — TIME — REF. NR.

HEADING: NZR V NCO NR1 / NSS F NR977 Z DF2 183d DF5 DF1 1FB ØST

AIR RAID ON PEARL HARBOR X THIS IS NOT DRILL

TOR 2ØØL/AD/NCO NR 1/3199 NC/7 DEC 41

ACTION OFFICER O. O. D.

Figure 2 — A historic message from the National Archives showing the 9 point sans serif mill font, slashed zero and all capital letters. [Ryan Adney, KC7RZR, photo]

Ryan Adney, KC7RZR, is an antique typewriter collector and educator. Ryan maintains a fascinating typewriter blog called Magic Margin (**www.magicmargin.net**). He believes, "The true appellation might be lost to the sands of time, but I have an educated guess. Radio rooms on ships were probably pretty busy places. Messages were probably constantly going out and coming in. As a result, the all-caps model typewriter for radio transcription was kept pretty busy — almost like a mill with transcribed, typed messages going out all the time. That's my feeling where the term came from. Transcriptions were churned out — milled — at a prodigious rate."

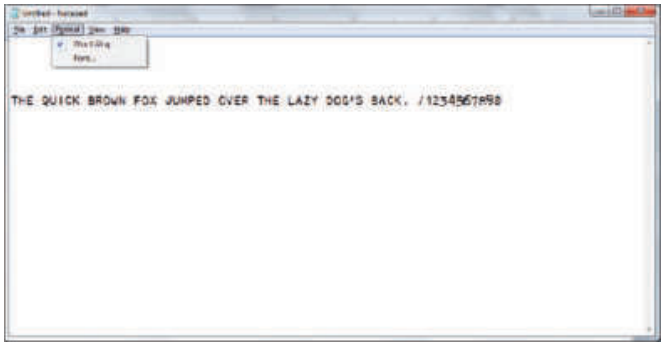


Figure 3 — *Notepad* text lines can be made to wrap around and alternate fonts (here the downloadable N1EA MILL font) can be specified by checking the appropriate boxes in the Format window. [Stan Levandowski, WB2LQF, photo]

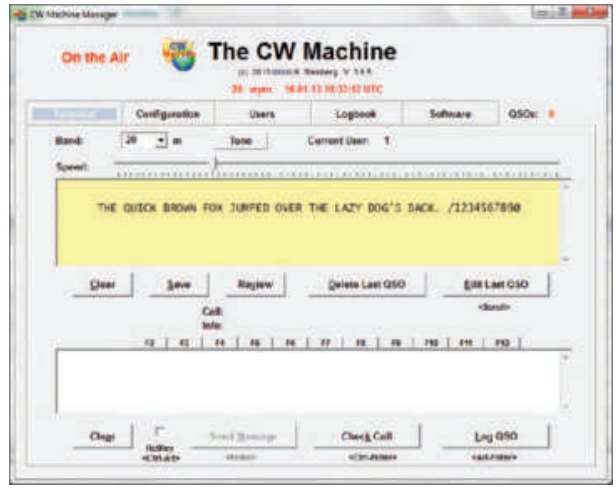


Figure 4 — The Begali *CW Machine* monitor screen showing mill font and non-proportional spacing. [Stan Levandowski, WB2LQF, photo]

Love at First Sight

I met up with my first mill in 1967 at Class "A" Navy Radioman School, San Diego. By this time, I had already been a ham for several years and had earned my ARRL® 20 words per minute (WPM) code proficiency endorsement in June 1965. Because I had taken a year of typing in high school, I was not totally unfamiliar with a typewriter.

Every character became a single keystroke. Gone was the fury of writing out characters in longhand, most of which required complex and multiple pencil strokes. Gone was the confusion afterward — is that a figure "1" or an "l" or a "/"? Is that the letter "S" or the figure "5"? Did I write a "2" or a "Z"? Did I just forget to slash that zero or is that really the letter "O?"

I also discovered that typing my copy seemed to give me more thinking time and increased my copy speed by a couple of WPM. Perhaps, with the burden of handwriting multistroke letters on paper gone, my anxiety level dropped and my self-confidence jumped, increasing my efficiency and accuracy.

Locating and purchasing an authentic mill today can be a trying and expensive proposition. Keeping it in good health and well fed with new ribbons can be equally challenging. Fewer mills were produced than standard typewriters. The primary mill producers were Royal, Underwood, Remington, and later, Smith-Corona.

Mills were frequently subjected to use in harsher environments and their attrition rates were correspondingly higher. Scarcity drives up prices and their uniqueness makes them attractive to collectors. This means that even if you find one, the price will be "up there." A vintage collectible (non-mill) typewriter in good condition can easily go for $50-75. A mill will command $150-200 dollars. While eBay is a popular outlet, the packing and shipping expense will add to the purchase price. Don't rule out yard sales, thrift shops and estate sales.

Back to the Future

But there are alternatives! *Windows Notepad*, for example, is a simple text editor that accurately tracks the operator's keystrokes without the random delays inherent in more sophisticated word processors. *Notepad* is essentially an online typewriter that will keep up with you no matter how fast you type! *Notepad's* ".txt" format is as basic as it gets and you can store it, print it, modify it or just delete it after a CW session. *Notepad* is included with all Microsoft operating systems so you've already got it on your computer if you are using *Windows*.

If you want to try it, click on FORMAT after you've started *Notepad* and check the WORD WRAP box. See Figure 3. This will ensure that you will get an automatic "carriage return" and one line feed when your copy reaches the right margin. You'll also want to lock the keyboard into uppercase to simulate a real mill because there is no case in CW.

If you want to take the realism a step further, you can download an authentic mill font for use with *Notepad*. The mill font was created by David J.J. Ring, N1EA, a former merchant radio officer and a key player in the rescue of the MS *Prisendam*[1] off the coast of Alaska in 1980. David made this font based on a scan of his Royal Manual Telegrapher's typewriter. A download is available free of charge for your noncommercial use at David's website (**www.qsl.net/n1ea**). Once you've downloaded it, you can select it for use in *Notepad* via the FORMAT box. See Figure 3.

Notepad's speed and lack of any hesitation between keystrokes is a result of intentional bare bones programming in which the task has been whittled down to the absolute essentials. Practically all operating systems have similarly minimal text editors. In addition to *Windows*' *Notepad*, there are about a half dozen in Linux and the Mac comes with *TextEdit*. An Internet search will deliver a variety of options for software typewriters and "typing tutors." Many of these are free downloads.

If you are at all comfortable around a keyboard, copying CW on a mill is really quite easy. The conventional standard speed for a "touch typist" is around 60 WPM, but few of us can copy CW that fast. I'm usually happiest somewhere between 18 and 25 WPM. It should be apparent that to copy CW on a typewriter at around 20 WPM requires little more than a hunt-and-peck skill level. Copying accurately by hand on paper generally becomes more of a challenge above 20 WPM and requires cultivating some creative handwriting techniques. In fact, the FCC allowed applicants for the (now defunct) First Class Radiotelegraph Operator's Certificate to bring their own mechanical typewriters or mills into the examination room for the 25 WPM plain text exam.

The Cadillac of Software-Defined Mills

A software upgrade to the Begali *CW Machine* (**www.i2rtf.com**) now provides an electronic mill with some interesting twists. The designer, Ulrich Steinberg, N2DE/DJ5US, uses the common *Windows* control element — a text box (see Figure 4). But the behavior of this control element is managed

[1]Recordings of the SOS sent by the MS *Prisendam* on 500 kHz, October 4th, 1980 can be heard at **archive.org/details/SosMsPrinsendamOctober41980**.

The Maritime Radio Historical Society

The Maritime Radio Historical Society (MRHS) is a group of dedicated volunteers working to restore and preserve the historic artifacts at coastal station KPH together with other radio station sites that are of historical interest. The MRHS began in 1999 when the group inherited KPH, the last remaining Morse code station in North America. Long off the air, KPH turned out to be an intact time capsule.

KPH was an RCA coast station located at Point Reyes about 50 miles north of San Francisco. It is now part of the Point Reyes National Seashore. With the full support of the National Park Service, the station was restored, documented, and returned to operation.

Figure 5 — This is operator position 6, K6KPH, ready for any visiting ham who might like a taste of an earlier time in radio history. Note the period mill on the left ready to handle traffic. [Photo courtesy MRHS]

As part of the objective to bring KPH back to operational status, a ham station, K6KPH, has been added to the site. K6KPH (see Figure 5) uses fixed-frequency transmitters and commercial procedures to give the visiting operator, and those who he or she may contact, a taste of the commercial radio operations of the past. It uses Henry 5 kW commercial units (operating at 1.5 kW) installed at KPH in 1990. For special historic occasions several of the restored 1950s vintage RCA transmitters are used. The transmitting antennas are double extended Zepps for 4 MHz and 7 MHz. H over 2 antennas are used for 14 MHz and 21 MHz. Antennas at the receive site include TCI omnis, rhombics, and V beams, all switchable from the operating positions. If you would like to know more about KPH and maritime radio history visit **www.radiomarine.org**.

The MRHS focuses on maritime radio heritage, specializing in the coast stations, ships, and companies of the West Coast. The overall mission of the MRHS is to assure that the culture, techniques, and traditions of the radio operators who came before us are not forgotten.

by original programming, which provides for the translation to all capital letters, the rejection of certain invalid CW characters such as "<" and creation and archiving of a text file. Ulrich also implemented a realistic mill font, which includes a slashed zero and removal of proportional spacing to simulate typewriter output. Because this common control element is not embellished with many functions, there is very little processing going on while you type. This makes the *CW Machine*'s "mill" feel very fast, very responsive and very natural.

The *CW Machine* can function as either a CW Trainer or a full function keyer depending upon which firmware you load. When operating as a CW Trainer, the person learning CW can type, rather than write, the copy. The student types the characters heard into the lower text box while the *CW Machine* simultaneously prints what it sent in the upper text box. The student may elect to hide the contents of the upper text box while receiving. Afterward, the student may again show the upper text box. Now the typed copy can be compared to what was generated during the learning session to gauge accuracy and progress. One can concurrently learn — or improve — two skills: typing and Morse code.

When operating as a keyer, the *CW Machine* provides a full range mill with some interesting features that vintage operators could never have imagined. When transmitting, every character sent, whether by manual key, paddle, or keyboard is displayed on the mill screen, which is highlighted with a pale yellow background. When receiving, the operator types the characters on the same screen. The software automatically spaces two lines between sent and received text. The amount of text that can be copied and sent per contact is virtually limitless. At the end of the session both the transmitted stream and the typed copy are written to an annual file, sequenced by date. This results in the operator being able to archive an entire year's worth of the actual full text contacts in an easily readable ".txt" format.

Summary

If you are contemplating learning CW, you might find that typing it accelerates your learning. By the time you get on the air and start to make contacts, typing CW will have become second nature. If you are already an experienced CW operator but find you've hit your upper limit in terms of your handwriting speed and legibility, then transitioning to a mill is your next logical step. Whether you track down a vintage mechanical mill to complement your boatanchor station, use a free text editor that is already part of your computer's software suite, download alternative freeware from the web or decide to invest in the state-of-the-art Begali *CW Machine*, typing your CW copy will reward you with a new skill as well as a connection to wireless history.

Stan Levandowski, WB2LQF, is an ARRL member and volunteer examiner. He earned his Novice license, WN2LQF, in the early '60s and now holds the Amateur Extra Class license, The GROL with Ship Radar Endorsement, The GMDSS Maintainer license and the Second Class Radiotelegraph Certificate. He retired from IBM where he was a software development manager and from Nyack College where he taught business and management courses for 17 years. He now splits his time between operating 100% QRP HF CW and volunteering aboard the museum ship USS *Slater* where he serves as a tour guide, a member of the "radio gang", and an operator of WW2DEM, the ship's own amateur radio station. He can be reached at 6 Chatham Ct, Fishkill, New York 12524, **wb2lqf@arrl.net**.

Green Power Sparks Radio Excitement

Young Romanian hams use sunlight and running water to power their portable wilderness station.

David Anderson, KRØCK

This story began with a World Genesis Foundation (**www.worldgenesis.org**) program on a small island in the Danube Delta in Romania. The World Genesis Foundation's goal is to create opportunities for the moral, physical, and intellectual development of youths in areas of the world where opportunities are limited or do not exist today.

A youth group was attending a Technician license class outside under the trees as part of a summer academy of learning (see Figure 1). During the lecture a student asked, "Why aren't all of these radios green?"

His question caught everyone's attention and during the 10 day program "green" energy became a part of virtually every discussion. The powerful reaction of the students intrigued me, and I sought help to explore methods of integrating clean energy into various Amateur Radio education projects.

I turned to my Elmer, Jerry Pyle, WB7S, who helped us design and test several different concepts for projects that have brought more excitement and participation to all of the foundation's Amateur Radio programs — much more than we ever expected.

Our foundation has coordinated Amateur Radio youth education projects covering radio theory and design for just about every mode and operating protocol. To our surprise the integration of clean energy into our projects brought a higher level of excitement and greater youth involvement. In the two projects that follow, the addition of clean energy more than doubled participation.

Figure 1 — Young students gathered on an island in the Danube Delta for a summer academy, part of which was a Technician licensing class.

Water Power Keeps Station Afloat

Cezar Lesanu, YO8TLC, had an idea for one of the first programs. The program was a series of ham radio contests that would also challenge our students to build an effective hydroelectric power source for their radio gear.

This particular program involved a series of field trips wherein the students would travel into a wilderness area, set up and operate a portable station. This real trick was that batteries were not allowed. The students had to plan, design, test, and transport a working

Figure 2 — A close up view of the hydropower generator the students designed to power their portable station.

Figure 3 — Cezar Lesanu, YO8TLC, operates the portable station using only power provided by the hydro generator.

portable hydroelectric power system to power all their gear and activities, day and night.

The students worked in teams for weeks. Then they transported everything — including the water conduits, turbines, generators, and power converters — to the site. As a final hurdle, they had to do this with virtually no budget. It was quite a challenge and in order to be successful, the teams had to develop all of their skills, not only in mechanical and electrical engineering, but also planning and teamwork. It required very creative imaginations to source parts from automobiles, home appliances, and old ham radio gear.

The best design, planned by Adrian Done's, YO8AZQ, team, successfully powered the station throughout the competition. It is illustrated in Figure 2. Two people were required to transport the system and it provided all the power for the portable station (see Figure 3), operating nonstop throughout the excursion. It was quite a sight to see all the ham radio gear operating, powered by the natural energy of a nearby stream (see Figure 4).

The Sunny Side of Ham Radio

Another contest that produced remarkable results and higher youth participation was a solar power project. In this project each team had to build a personal solar power plant. It had to be small enough to be carried by one person along with their radio gear, and simple enough to be quickly and easily deployed to operate their radio for emergency communications both day and night. Those who participated were given basic components and then challenged to work in competing teams to plan, design, test, and demonstrate their systems. Figure 5 is the design that best captures many of the creative ideas developed for the project.

The system shown, including the flexible solar panel, is designed to be fully contained and carried in a single pistol carrying case (see Figure 6). The design uses components that are lightweight and strong, including high impact plastic and aerospace grade aluminum. The solar panel uses Copper Indium Gallium Selenide (CIGS) technology, which provides a high power output from a panel that is both weather resistant and can be folded and stored easily within the same case.

A user simply opens the case and removes the accessory box, removes and attaches the solar panel, selects the proper voltage and attaches the connector for their radio equipment. What is unique about this design is that the accessory box not only covers the foldable solar array, but also includes all instructions, specifications, and accessories for the system. The step-by-step instructions laminated on the top of the box make it possible for anyone to

Figure 4 — The hydro generator at work. Since the water flows all the time, no batteries were required.

Figure 5 — The solar power system designed by the students. The solar panel is deployed and the system is charging the author's VX-8DR handheld transceiver.

Figure 6 — The solar power system is completely contained in a modified pistol case. The rectangular area at left is the accessory box. The foldable solar panel stores underneath it.

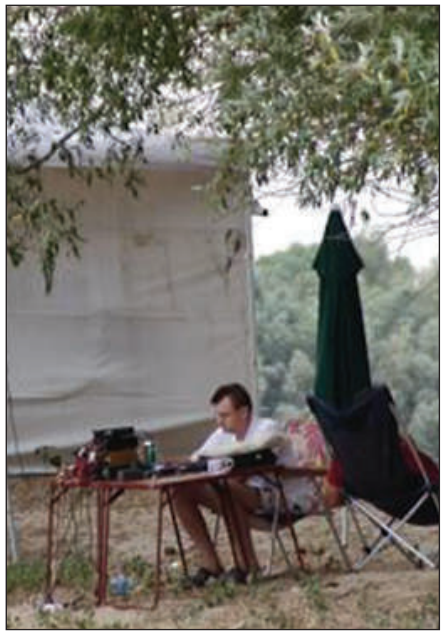


Figure 7 — Cezar Lesanu, YO8TLC, operates one of the portable stations during the summer academy.

Figure 8 — Misu, YO9HQW, (left) and Vali, YO2LIC, use the solar power unit's battery reserve for some nighttime operating.

deploy or store the system very quickly with little or no training.

Since the system was required to power ham radio gear at night, the team built in a rechargeable battery reserve. Whenever the solar array was deployed it also charged the battery, allowing the system to power equipment at night or during cloudy periods (see Figure 7). The battery could also be charged before beginning an expedition or contest.

Virtually any device can be powered by the system. A user can select from up to five different output voltages and the removable accessory box includes a connector for attaching nearly any USB or other device that has an external power jack.

Figure 9 — After sundown, the solar power system's battery reserve keeps the station on the air.

As the contest continued, the flexible design of this personal solar power plant caused it to become the camp charging station for GPS systems, telephones, and cameras. It was a real pleasure seeing the students present their designs and how proud they were to be operating the contest using only solar power (see Figure 8).

Radio's Bright Green Future

Some of the best ideas come from the most unusual places. In our case a young boy asked a simple question, which started a chain reaction and led to a series of new clean energy concepts for portable operations. The result could not have pleased us more as we have seen youth participation increasing dramatically in nearly all of our ham radio programs.

In Closing

It is a wonderful experience to see the moment when a young person realizes that they've just discovered their path in life, what they want to do for their careers and for society. For me it is always a special joy when that spark comes from Amateur Radio.

In these projects, the integration of clean energy as part of the ham radio activities has created a new excitement and energy that has inspired both students and teachers. I don't know if this will achieve the same for everyone, but we have been convinced that clean energy may not be just a solution for a brighter future but also for the future world of Amateur Radio.

Figure 10 — Gabriela, YO8TLD, and Cezar, YO8TLC, operate the hydro station on 80 meter SSB.

All photos courtesy of the author.

David Anderson, KRØCK, is the founder and an active member of the not-for-profit World Genesis Foundation. Two years ago he met Jerry Pyle, WB7S. Jerry taught David about Amateur Radio, inspiring him to get his Technician license followed last year by his General and Amateur Extra class licenses. David began developing Amateur Radio projects for different United Nations Youth Academies about 15 years ago. David can be reached at 223 N Guadalupe, # 485, Santa Fe, NM 87501, **jumpstart@WorldGenesis.org**.

New Products

MacDoppler 2.13 Satellite Tracker from Dog Park Software

MacDoppler Version 2.13 satellite tracking software for the Mac incorporates a number of new features. *MacDoppler* was rewritten to take advantage of *Cocoa* capabilities in OS X (Intel only, OS 10.6 or later, including Mountain Lion). *MacDoppler* will provide station automation from assisted Doppler tuning and antenna pointing to fully automated satellite gateway operation. Some of the new features include addition of MO-72 and STRaND-1 modes and an improved Modes editor. Keplerian element imports and downloads merge instead of overwriting, and the most recent element set is used for each satellite. Keps may be exported as well. Price: $98 to register. This is a free upgrade for all *MacDoppler* for *Cocoa* registered users. For more information, to download a demo version, or to purchase and register, visit **www.dogparksoftware.com**.

The Bill Leonard, W2SKE, Professional Media Award

You can honor media efforts to promote Amateur Radio.

Sean Kutzko, KX9X,
ARRL Media and Public Relations Manager
kx9x@arrl.org

So far in 2013, Amateur Radio has received a lot of excellent publicity covering our response to numerous natural disasters, our educational programs like Amateur Radio on the International Space Station (ARISS), and the goodwill we foster in many communities. In professional media appreciation for these publicity efforts, ARRL sponsors the Leonard, Award to honor media professionals for helping to present Amateur Radio in a positive light.

Who Was Bill Leonard?

The award was created in 1999 as a tribute to Bill Leonard, W2SKE, an avid Amateur Radio operator who was a longtime employee of CBS as a reporter, manager, and ultimately President of CBS News. He was the author of the famous 1958 *Sports Illustrated* article about contesting called, "The Battle of the Hams," hosted a weekly program on the Voice of America in the 1950s, which focused on Amateur Radio news, and narrated a documentary on Amateur Radio contesting in the 1980s called, "To Win The World." Leonard became a silent key in 1994. He was posthumously inducted into the Broadcasting & Cable Hall of Fame in 1996.

The Award Process

The Leonard Award has three categories: Audio, Visual, and Print/Text. Amateurs are welcome to nominate members of professional media outlets; the ARRL Public Relations Committee will review the nominations. Recipients must be professional journalists in print, electronic media, or multimedia. "Professional" is defined as full or part-time journalists, stringers, freelancers, and contract journalists. In the case of a group project, only one prize will be awarded on behalf of the group. The piece must be truthful, accurate, concise, and reflect the highest of journalistic standards. The award will be granted to works deemed the best reflection of the enjoyment, importance, and public service value of Amateur Radio.

Bill Leonard, W2SKE

The final decision will be made by the ARRL Board of Directors at their January 2014 Meeting. Winners of the Leonard Award receive an engraved commemorative plaque, and a $250 donation will be made in their name to the charity of each winner's choice.

Who should you nominate? Perhaps your club or group got great coverage for Field Day, a public service event, your efforts during an emergency, or an educational outreach. This is a way to thank the journalist that gave you that great exposure. Media professionals may submit their own work, but it's preferred that a member of the Amateur Radio community submit the work.

Submission Criteria

Send us a letter or e-mail that includes the name of the journalist, the media outlet they work for, and why you feel they should be considered. A copy of their work must be included with the submission.

Audio: Submit a CD with audio file(s) in MP3 or WAV format with the name of the candidate written on the CD.

Video: Submit a CD with the file in MP4 format or a DVD of the work with the name of the candidate written on each disk.

Print: Submit clear, easily readable copy of printed text, any related web addresses, and 8.5 × 11 inch sheets displaying the writing exactly as it appeared to the public. Photocopies are acceptable.

Deadline: All nominations and supporting materials must be received at ARRL HQ by the close of business on Friday, December 6, 2013. No late entries will be accepted. Mail entries to:

Sean Kutzko, KX9X
Media and Public Relations Manager
ARRL
225 Main St
Newington, CT 06111

For more information on the Bill Leonard Award, complete rules and nomination forms, visit **www.arrl.org/bill-leonard-award** or call the ARRL Public Relations Department at 860-594-0238.

Strays

Canadian Cubs Learn the Magic of Morse

On the evening of April 3, 2013, Cub Scouts from Sparta, Ontario were joined by the 1st Aylmer Cub pack and the 18th Cub pack from St Thomas for an evening of craft and learning. Scouters Bill Bynsdorp and Jim Platt put together code kits that consisted of a board, battery, light bulb, and a steel strap (the "key") and some wire and hardware. This allowed them to send messages in Morse code to other Scouts in the room.

They were then introduced to Amateur Radio by guests Worth Chisholm, VE3BTC, Dietmar Fichter, VE3CG, and Bill Park, VE3WMP, who had set up three radio stations in the basement of the Sparta Community Center.

From left to right, Dietmar Fichter VE3CG, along with Scouts Clark Miller, Corey Chretien and Scott Van Haren. In the background, Worth Chisholm VE3BTC. [Jim Platt, photo]

Rick Lindquist, WW1ME, ww1me@arrl.org

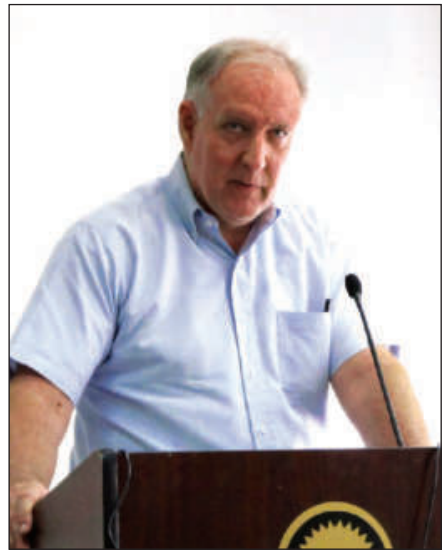
Pending Rule Changes Not on Back Burner, FCC Assures VECs

Amateurs assist in the massive effort to fight the Rim Fire, incumbents are challenged for re-election in the Southeast Division, and the League calls for nominations for the George Hart Distinguished Service Award.

Bill Cross, W3TN, of the FCC's Wireless Telecommunications Bureau (WTB), assured attendees at the 28th annual National Conference of Volunteer Examiner Coordinators (NCVEC) teleconference in late July that pending proposals to modify the Amateur Service Part 97 rules are not on the back burner, but still under review. FCC personnel who addressed the group were unable, however, to predict when the Commission would take action on the *Notice of Proposed Rulemaking and Order* (*NPRM*) in WT Docket 12-283 (**hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-12-121A1.pdf**).

Among the FCC proposals: granting exam credit for expired and beyond-the-grace-period licenses; shortening the grace period during which an expired ham ticket may be renewed; correspondingly revising the time a call sign remains unavailable to vanity applicants; and reducing the number of volunteer examiners needed to administer examinations. The docket also seeks comment on amending the rules to permit remote test administration and proposes allowing Amateur Radio stations to transmit certain emission types.

FCC Program Analyst Rebecca Williams of the FCC's Gettysburg Office told meeting participants that the FCC will not remove or conceal a licensee's name or address from its public database. She reported receiving numerous complaints from licensees about their information being public. According to §97.23, licensees must provide a valid mailing address — but as Williams pointed out, that can be any US address where the licensee can receive mail, such as a work address or a post office box. Licensees can protect their privacy and remain within the rules, she said.



The FCC's Bill Cross, W3TN, at the 2011 NCVEC Conference. [Perry Green, WY1O, photo]

She also reminded the gathering that since February 14, 2011, a licensee may serve only as a trustee for a single club and may not be a trustee for an additional club. The rules also prohibit clubs from having more than one vanity call sign. Amateurs who served as trustees for more than one club, and clubs holding more than one vanity call sign before the change in policy may continue to do so, she said.

NCVEC Question Pool Committee (QPC) Chair Roland Anders, K3RA, told the cybergathering that the new Technician question pool will go into effect next July 1. Anders said the QPC has been reviewing the entire question pool with a goal of fixing and removing outdated or poorly worded questions and to develop questions as new technology is introduced.

NCVEC Chair Larry Pollock, NB5X, presided over the teleconference. ARRL VEC Manager Maria Somma, AB1FM, VEC Assistant Manager Perry Green, WY1O, and Regulatory Information Manager Dan Henderson, N1ND, represented the ARRL VEC for the session. Representatives from 12 of the nation's 14 VECs took part in the meeting.

ARES-RACES Volunteers Activate for Rim Fire

Amateur Radio volunteers stood down after 16 days on duty in August and September, supporting the Red Cross and local government as the gigantic Rim Fire raged in and near California's Yosemite National Park and the Stanislaus National Forest. The Rim Fire claimed nearly 250,000 acres and more than 100 structures, including a few homes. Tuolumne County ARES Emergency Coordinator Carl Croci, NI6Z, said the initial ARES callout responded to a request to assist the Red Cross in setting up an evacuation center in Groveland, California. Shelter operations relocated the following day to the Tuolumne County Fairgrounds in Sonora. At about the same time the Tuolumne County Office of Emergency Services subsequently requested RACES assistance to staff the Sonora Red Cross shelter and the community information telephone system at the county emergency operations center. Croci and Tuolumne County RACES Radio Officer Phil Fish, WB6GGY, handled the callout and soon had volunteers for both locations as well as some on standby. The joint activation ended September 4, when the Rim Fire was considered 80 percent contained and evacuation orders lifted. At one point the County Fairgrounds sheltered some 100 evacuees.

More than two dozen radio amateurs were involved in the Rim Fire callout. Croci said the US Forest Service Type One Team told him that the combined operation conducted by Tuolumne County OES, ARES-RACES and the Tuolumne chapter of the Red Cross, with the cooperation of county residents, "will serve

as an example for future operations." Volunteers from Calaveras County ARES took part. To the south, Fresno County ARES assisted the Central Valley Red Cross with communications, relaying information from a shelter to the Red Cross headquarters in Fresno. For a time, Mariposa County ARES staffed a shelter at Greeley Hills Community Center, ready to pass traffic to Red Cross Headquarters. ARRL San Joaquin Valley Section Manager Dan Pruitt, AE6SX, said volunteers set up August 26 at the Red Cross office in Fresno, where they installed a station capable of operating on emergency power and established contact with Mariposa County ARES at the Greeley Hill shelter. Pruitt said eight volunteers turned out for that activation.

During the activation, Fresno County ARES used *Fldigi* and *Flmsg* — a forms management editor — on PSK125 to pass traffic from the shelter and the Red Cross Headquarters. "We found that the faster speed and wider signal [resulted in] fewer errors," Pruitt said, adding that the Red Cross, "was very impressed," with their ability to send and receive traffic in the Incident Command System general message form (ICS-213), filled out and printed.

"Ham Video" Transmitter Now Aboard the ISS

A Japanese cargo spacecraft delivered the "Ham Video" digital TV transmitter to the ISS in early August. The equipment, intended for the Amateur Radio on the International Space Station (ARISS) (**ariss.rac.ca/**), was being stored in the space station's Columbus Laboratory, reports ARISS-Europe Chair Gaston Bertels, ON4WF.

"Installation will be done by US astronaut Michael Hopkins, KF5LJG, who has been trained for the commissioning of the Amateur Radio digital video equipment," Bertels said in a report posted on the ARISS-EU website. Hopkins was scheduled will join the ISS crew this fall. Transmissions to commission the gear are set to take place when the ISS is over Southern Italy, with a series of tests performed over the course of three or four orbits. "The transmissions will be performed in automatic mode, without requiring crew time," he noted. The 10 W EIRP S-band (2.4 GHz) Ham Video transmitter will use one of the L/S-band patch antennas installed on the Columbus Laboratory.

Astronaut Sandra Magnus, KE5FYE, works in the Columbus Laboratory of the International Space Station during a 2011 mission. The Ham Video transmitter will be installed in the Columbus Laboratory. [NASA image]

Receiving the actual DATV signal from space will be the greater challenge, Bertels says. "[D]ecoding should be possible for a ground station equipped with a 1.2 meter dish, when the ISS is within a range of about 800 to 1000 km," he said in an overview paper on the project (**www.ariss-eu.org/HamTV.pdf**). "ISS tracking will be far more demanding than it is for receiving VHF signals," he added. According to Bertels, Kayser Italia will provide five ground stations in Europe.

Once the Ham Video transmitter becomes operational, it will be used for ARISS educational contacts with schools in Europe. — *Thanks to ARISS-EU Chair Gaston Bertels, ON4WF; ARISS-EU; Kayser Italia*

FCC News

More CB Retailers Come Under FCC Scrutiny

The FCC has continued to put pressure on Citizens Band retailers for marketing unauthorized RF equipment. The Commission issued a *Citation and Order* (**transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0815/DA-13-1755A1.pdf**) August 14 to DNJ Radio of Fremont, California, for violating FCC rules by marketing non-certified amplifiers and kits via its Internet website. The FCC's San Francisco office investigated complaints and, "confirmed that DNJ Radio was offering for sale non-certified… amplifiers and amplifier kits capable of operation with both CB 11 meter transceivers and [Amateur Service] 10 meter transceivers," the *Citation* recounted.

The FCC discounted DNJ Radio's website disclaimer that the devices it's marketing, "are for industrial, scientific, medical, or export use only," and that using them on 11 meters would violate FCC rules. "The amplifiers…are being offered for sale from within the United States, and anyone within the United States could buy the devices regardless of the disclaimer," the FCC said.

On August 20, the Commission cited Radio Master, a CB shop catering to truckers — for a related violation. According to a *Citation and Order* (**hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-1780A1.pdf**), FCC agents in February inspected the Radio Master shop at a truck stop in Rockwall, Texas, where they observed a used Palomar 250 RF amplifier offered for sale.

"The unit did not have an FCC identification number to confirm that the model had been granted an FCC certification," the *Citation* said, noting that under its Part 2 rules, external RF power amplifiers capable of operating below 144 MHz, "may not be offered for sale unless they have first been authorized in accordance with the Commission's certification procedures."

In June, the FCC cited The Enterprise Group Inc, doing business as ePowerAmps, a Nebraska-based online retailer, for, among other things, marketing unauthorized 10 and 12 meter amplifiers capable of putting out up to 8200 W — in violation of FCC rules.

The FCC told all three retailers to immediately discontinue marketing unauthorized RF devices and to respond to the citations in writing.

Ham Radio Publications Pioneer, Visionary, Iconoclast Wayne Green, W2NSD, SK

Wayne S. Green II, W2NSD, of Hancock, New Hampshire, passed away on September 13 at the age of 91. Green was a well-known and often outspoken figure during what some consider Amateur Radio's "golden years" in the 1950s and 1960s. He helmed *CQ Magazine* for 5 years before becoming the self-proclaimed "El Supremo and Founder," of *73* magazine, which he published from 1960 until 2003.

Wayne Green, W2NSD

"The purpose of [*73*] at that time was to get more hams building equipment," Green recounted in a radio interview several years ago. A hallmark of *73* was Green's "Never Say Die" editorials, in which he rarely missed an opportunity to tweak the ARRL and his magazine's competitors for their perceived shortcomings. ARRL CEO David Sumner, K1ZZ, said Green maintained his membership in the ARRL despite being a persistent critic. "Wayne will be remembered in many different ways by many different people, but he will be long remembered," Sumner added. "In the early days of packet radio he gave me some good advice as to how the ARRL should promote the new technology: 'Talk about it as if everybody's doing it, and eventually they will be.'"

Indeed, Green often was ahead of the curve in promoting such technologies as single sideband phone, solid-state, FM, and the marriage of computers and ham radio. He went on to found and publish *Byte* and other computer-oriented publications. "I live mostly in the future," Green was quoted as saying.

ARRL Publications Manager and *QST* Editor Steve Ford, WB8IMY, got his start writing for Green. "Wayne published my first article way back in 1975," he said, "I still have a photocopy of the check he sent."

Green maintained a larger-than-life presence even in the years after he faded from the Amateur Radio spotlight, and he never did really retire. "Hey old buddy, I will miss you," radio talk show host Art Bell, W6OBB, posted to Wayne Green's blog, "'NEVER SAY DIE,' is a phrase that will be with me till it's my time" (**www.waynegreen.com/wayne/news.html**). Green was an occasional guest on Bell's "Coast to Coast AM" overnight talk program. There was hardly an issue that Green would not confront, and he expounded a variety of unconventional science, health, and medical theories — from cold fusion and the moon landing to AIDS and cancer cures. He continued to publish and speak frequently on these topics and others, as well as on public policy, even at hamfests where he was a guest.

The "Final" on his blog sums up Green's overarching philosophy: "Wayne Green passed away September 13, 2013 in a peaceful, painless transition from this life on Earth. An eternal optimist, and one who loved to share his never-ending zest for life, he was a friend to many and will be missed greatly. Wayne was not afraid of dying and was very much ready to embark on his next great adventure to the afterlife."

Vanity HQ Website Pulls the Plug

After serving the US Amateur Radio community for 14 years, Mike Carroll, N4MC, has shut down his Vanity HQ website. Carroll wrote, "It's been a good 14 years. Thank you everyone for participating, sending bug reports and comments, and I especially thank all the Elmer volunteers who have helped me over the years. It is time for me to move on. Regards to all."

Over the years Vanity HQ was often the first stop for radio amateurs seeking a vanity call sign. Among other information, it provided a list of recently issued vanity call signs, as well as available call signs, and active vanity call sign applications.

After Carroll announced he was shutting down in 2004, Eldon Lewis, K7LS, inaugurated his RadioQTH (**www.radioqth.net/**) website, which offers essentially the same information Vanity HQ did.

The AE7Q Query site of Dean Gibson, AE7Q, begun in 2003, also offers similar information, including call sign histories and applications, available Amateur Extra call signs, and vanity call sign predictions via the FCC Amateur Radio license and application databases.

Nominations Closing for the George Hart Distinguished Service Award

Nominations close November 1 for the George Hart Distinguished Service Award. The ARRL Board of Directors established the award in 2009, to be given to an ARRL member whose service to the League's Field Organization is of the most exemplary nature. The Award's namesake, George Hart, W1NJM (SK), was a long-time Communications Manager at ARRL Headquarters and chief developer of the National Traffic System (NTS). He died earlier this year at age 99.

George Hart, W1NJM, SK

An ARRL Charter Life Member, Hart spent more than four decades as a member of the ARRL Headquarters staff and continued to be an active amateur and regular Field Day participant in his retirement. In 1984, the ARRL Board of Directors named Hart as an ARRL Honorary Vice President.

Award selection criteria include: operating record with the National Traffic System, or participation within the Amateur Radio Emergency Service® (ARES®), or station appointments and/or leadership positions held within the ARRL Field Organization. Nominations should document as thoroughly as possible the candidate's lifetime activities and achievements within the ARRL Field Organization. Nominees are expected to have 15 or more years of distinguished service. Recipients receive an engraved plaque and cover letter, and will be profiled in *QST*.

Nominations for the George Hart Distinguished Service Award, including any related supporting material and letters of recommendation, may be e-mailed to ARRL Headquarters to the attention of ARRL Membership and Volunteer Programs Manager Dave Patton, NN1N, or to ARRL Field Organization Team Supervisor Steve Ewald, WV1X. Nominations and supporting materials must be received no later than November 1, 2013. The Programs and Services Committee will serve as the award review committee. The Board of Directors will make a final determination at its Annual Meeting in January.

Rick Palm, K1CE, k1ce@arrl.org

Editorial Strikes a Chord

ARES® leaders speak out on challenges posed by human and organizational behavior.

The editorial in the August 2013 issue of the ARRL®'s monthly periodical *The ARES E-Letter* seemed to strike a chord with readers, so I will repeat it here for those who might have missed it:

> I was reminded once again of the old adage, 'It only takes one person to screw things up for everybody else,' when I had a sad conversation with an emergency coordinator (EC) who had had his ARES program and volunteers removed from their emergency operations center (EOC). One member had undermined the entire organization's relationship by continuing a campaign of complaints and demands to the emergency manager about how Amateur Radio must be positioned and incorporated in the EOC. Incredibly, the individual's campaign ratcheted up to include complaints to the county commissioners.
>
> Although relatively rare occurrences, these things do happen. And that is why we need to reevaluate and renew our understanding of our role in the emergency management structure and EOC from time to time, which is the following: It is a privilege, not a right, to be in the EOC. We are there to provide a transparent service to the emergency manager, who is the professional. We take orders from, and provide communications for, messages only authorized by the professional emergency management team. We are not there to tell them how to run the emergency management function, nor are we there to make demands…. We need to be quiet assets, heard only when requested by the professionals, and not liabilities.
>
> Most understand these principles. But, often it is just one individual who can destroy all of the long and hard work of ARES members and leaders to gain the trust and consequent invitation — and privilege — to serve in the EOC.
>
> The daunting challenge to the ARES EC is to identify these individuals and contain them before they can severely damage the most critical relationship in all of Amateur Radio: the solemn relationship between ARES and the EOC. And that is not an easy challenge to meet. — *Rick Palm, K1CE*

It is a privilege, not a right, to be in the EOC.

Reader Responses to the Editorial

"Your reminder of that old adage is well taken here," Oregon ARES District 1 Emergency Coordinator James Bryant, KD7WZI, wrote. "When I was the newly minted EC for Multnomah County, Oregon, I was warned about a particular individual who was very much like the subject in your essay." Bryant said the key to managing challenging individuals is in the "relationships that the EC develops with the Emergency Manager — letting him/her know that the relationship is top priority and that there are procedures and policies in place for dealing with such individuals."

The key to managing challenging individuals is in the, "relationships that the EC develops with the Emergency Manager…"

The response can range from removing the problematic individual from the EOC to letting him or her know that their services are no longer needed. Bryant said, "Knowing that there is a problem resolution path helps the emergency manager know that the volunteers that they receive are assets and not liabilities. The volunteers know what is expected of them and that there is an appropriate process for addressing inevitable issues without upsetting the relationship with the emergency management professionals."

Bryant concluded, "Your editorial underlines the importance of communications with local volunteers. It also points out that volunteers can, and sometimes do, present challenges to local endeavors. How you deal with them is an important responsibility in managing volunteers. Thank you for your editorial. It was an enjoyable and educational read."

Herb Lacey, W3HL, ARRL North Carolina Section Emergency Coordinator 1975-1976, offered this analogy to ARES operators: "Ham communicators, in an emergency situation, are like a piece of telephone wire. The wire doesn't get involved, it doesn't hold any information, it doesn't require any recognition, and it doesn't exhibit a personality. It merely does its job without fanfare."

The Volunteer as Manager

Lacey and Bryant both make good points. Part of every Emergency Coordinator's job is to manage his or her volunteers, and to identify issues with certain individual members before they become full-scale conflagrations. That is not an easy task. ECs perform their managerial role as volunteers themselves, unpaid and on their own free time; they do it out of a sense of service but also for enjoyment and fulfillment of their hobby — ham radio. They, like everyone else, would prefer not to deal with the types of management issues and stress that they experience in the workplace.

The other characteristic most of us share is that when dealing with others, we tend to focus on their good points and marginalize their liabilities — or in other words, we look the other way. No one likes discord and disagreeable people — it's often easier to just walk away.

Unfortunately, these characteristics of human nature conspire to allow some miscreants to create disturbances as seen in the example of the opening editorial. Part of the solution is to do as the writers above suggest: build a working relationship with the EOC and emergency manager that is solid to the point where it can't be broken by one or two malcontents. The relationship will withstand the occasional misaligned campaigns of the few. The emergency manager and EC will be able to work together to contain the damage and get on with business.

It is, after all, also in the best interests of the EOC and emergency manager to maintain a good relationship with ARES volunteers because of their long history of disciplined, positive, critically important support of the emergency management function. Both the emergency manager and the EC have vested interests in seeing the relationship develop.

Tips for the EC: The key to success in meeting these kinds of problems lies in what we already do best: communication. Communi-

cate closely with the emergency manager and his team on one side of the equation and with your ARES volunteers on the other. Take a hard look at each of your members and communicate closely with potential problem sources (in private and with respect) to avoid potential problems. Take a hard look at yourself, too, to see if you have what it takes to be assertive enough to address problems. You may have to communicate with civic officials to inform them that individuals who complain do not speak for your group as a whole. Identify these individuals to emergency managers and the elected officials they report to.

But, above all, the most critical thing to bring to the table in such matters is your own example: Your behavior and communications should be beyond reproach. Your professionalism, sense of fairness, and work ethic for your EOC and your ARES team, will lead them to respect you as a leader, and will instill in them the same values that you display. That way, we as ARES members will be kept in the EOC looking out, not the other way around. — *Rick Palm, K1CE*

Be Ready for Winter Weather

As this is being written we are just approaching fall, but by the time you read it many parts of the country will be starting to experience the first signs of winter. Amateurs usually think of weather related ARES and SKYWARN activations for severe thunderstorms, tornadoes, flooding, and hurricanes, but winter weather also requires us to be vigilant and ready to help when called upon. The National Weather Service can benefit through our reporting of dangerous winter weather conditions such as heavy snowfall and high winds. In our communities, power lines may go down, leading to a communications emergency. This is a good time to familiarize yourself with basic winter weather preparedness guidelines. You can find them online at **www.nws.noaa.gov/om/winter**.

IARU Region 2 Emergency Communications Workshop

The International Amateur Radio Union (IARU) Region 2 General Assembly was held September 23-27 in Cancun, Mexico. In conjunction with the triennial General Assembly of IARU member societies, an Emergency Communications Workshop was held to bring together IARU emergency coordinators, leaders of Amateur Radio emergency communications organizations, and delegates from government organizations. The workshop was proposed by the ARRL and is the first of its kind within IARU Region 2.

Presenters at the workshop represented the Salvation Army Team Emergency Radio Network (SATERN); National Hurricane Center, WX4NHC; VOIP WX Net; International Telecommunications Union; IARU, and the ARRL. Special presentations were made on the role of Amateur Radio during the 2010 Vancouver Olympic Games and a report on the 2013 Global Amateur Radio Emergency Communications (GAREC) conference held in Zurich, Switzerland.

Attendees and presenters also participated in a tabletop exercise designed to focus on international cooperation during a communications emergency.

A final report from the workshop was delivered to the IARU Region 2 General Assembly and will also be presented at the 2014 GAREC conference to be held in Huntsville, Alabama.

Amateur Radio Provides Critical Communication in Colorado Flooding Response

About five dozen Amateur Radio Emergency Service (ARES) volunteers have deployed in and around flood-stricken counties of Colorado, providing critical communication for Red Cross shelters, and state and local emergency operation centers. Recent heavy rains have caused rivers and streams to overflow their banks, ravaged roads and property, and displaced an undetermined number of residents. At least six people are known to have died. ARRL Colorado Section Manager Jack Ciaccia, WMØG, says that with power cut off to affected communities and many cell telephone towers along the Thompson River toppled by the flooding, ham radio is providing medical and health-and-welfare traffic between evacuation centers and the EOCs.

"Every EOC is being staffed by ARES people," Ciaccia told the ARRL. "Almost every evacuation center has an ARES communicator, doing either voice or packet communications between EOCs and shelters."

The isolated towns of Estes Park, Lyons, and Jamestown were, or still are, relying solely on ham radio for contact with the outside. Jamestown has since been evacuated. "Everybody was huddled into the high school there," Ciaccia told the ARRL. He was in contact with the mayor there and was trying to get the community necessary resources as soon as possible. Hams in Estes Park have been working out of the EOC in the Town Hall, which is on high ground. "There's no place to go. Everything's flooded," Ciaccia said. "The only ham in Lyons was working out of an evacuation center at the local elementary school." He said the National Guard has been relocating some evacuees, as the shelter has become overcrowded.

Boulder County has deployed miniature drone aircraft carrying amateur TV cameras to survey the more remote regions to spot individuals who may need to be rescued. "We're still in a search-and-rescue mode," Ciaccia said. "Not really in a damage-assessment mode."

Ciaccia said the drones — a fixed-wing aircraft and a hybrid gas/electric-powered helicopter — have been transmitting ATV video via UHF to the ground and simultaneously recording the video on a memory stick. The helicopter can remain in the air for more than 5 hours at a clip, recording images for officials at the EOC to evaluate. Ciaccia said Boulder County Emergency Coordinator Al Bishop, KØARK, owns Reference Technology, the company providing the drones.

Eyes and Ears

Ciaccia said that during the past year the Boulder County ARES team created the Mountain Emergency Radio Network on its own time and money, and put up two repeaters — one at Allenspark and another in Gold Hill. "The intent was to start educating people in the mountain regions to become hams," Ciaccia said. Some 65 individuals have gotten their licenses, and the team provided each with a radio. "Those radios and those people — they became the eyes and ears for their communities," Ciaccia explained.

As power was lost, the only remaining means of communication were the two repeaters operating on propane-powered generators. "The system worked," Ciaccia added, "and we were able to utilize it for emergency communication purposes." Those communities have since been evacuated.

You can follow the action on the Colorado Section Facebook page, which includes updates on the ARES activation.

Contest Corral – November 2013

Check for updates and a downloadable PDF version online at www.arrl.org/contests

Refer to the contest websites for full rules, scoring information, operating periods or time limits and log submission information.

Start - Finish Date-Time		Date-Time		Bands HF / VHF+	Contest Title	Mode	Exchange	Sponsor's Website
1	0230Z	1	0300Z	1.8-14 / -	NS Weekly Sprint	CW	Serial, name, and S/P/C	www.ncccsprint.com
2	1200Z	3	1200Z	1.8-28 / -	Ukranian DX Contest	Ph CW	RST and serial or Ukraine oblast	urdxc.org
2	1200Z	3	1200Z	3.5-28 / -	Himalayan Contest	Ph CW	RS(T) and Indian state or power	www.arsi.info/contests/himalayan
2	1700Z	3	0500Z	3.5-21 / -	Radio Club of America QSO Party	Ph	RST, QTH, name, equipment	www.radioclubofamerica.org
2	**2100Z**	**4**	**0259Z**	**1.8-28 / -**	**ARRL November Sweepstakes**	**CW**	**Serial, category, call, check, ARRL/RAC sec**	**www.arrl.org/contests**
2	2100Z	4	0300Z	1.8-28 / -	Collegiate ARC Championship	CW	See ARRL Sweepstakes	www.collegiatechampionship.org
3	1100Z	3	1700Z	28 / -	DARC 10-Meter Digital "Corona"	Dig	RST and serial	www.darc.de/referate/ukw-funksport
4	1600Z	4	See website	3.5 / 50, 144	OK1WC Memorial Contest	Ph CW	RS(T) and serial	www.hamradio.cz/ok1wc
5	0200Z	5	0400Z	3.5-28 / -	ARS Spartan Sprint	CW	RST, S/P/C, and power	www.arsqrp.blogspot.com
9	0000Z	10	2400Z	3.5-28 / -	Worked All Europe DX Contest	Dig	RST and serial (see web for QTC rules)	www.waedc.de
9	0001Z	10	2359Z	28 / -	10-10 Fall Digital QSO Party	Dig	Call, name, 10-10 number, S/P/C	www.ten-ten.org
9	0700Z	10	1300Z	3.5-28 / -	Japan International DX Contest	Ph	RST and JA prefecture or CQ Zone	jidx.org
9	1200Z	10	1200Z	1.8-28 / -	OK-OM DX Contest	CW	RST and serial or OK/OM district	okomdx.crk.cz
9	1200Z	10	2359Z	3.5-28 / -	Straight Key Weekend Sprintathon	CW	RST, S/P/C, name, SKCC nr or "none"	www.skccgroup.com
9	1400Z	10	0200Z	1.8-28 / 50	Kentucky QSO Party	Ph CW Dig	RST and KY county or S/P/C	www.wkdxa.com
9	1900Z	11	0500Z	1.8-28 / 50-440	CQ WE (Western Electric)	Ph CW Dig	Call, name, Bell QTH, yrs of service	cqwe.cboh.org
13	1300Z	14	See website	1.8-28 / -	CWops Monthly Mini-CWT Test	CW	Name and member number or S/P/C	www.cwops.org/onair.html
14	0130Z	14	0330Z	3.5-14 / -	NAQCC Monthly QRP Sprint	CW	RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
16	**0000Z**	**17**	**2359Z**	**- / 50-1296**	**ARRL EME Contest**	**Ph CW Dig**	**Call signs, sig rpt, acknowledgement**	**www.arrl.org/contests**
16	1200Z	17	1200Z	3.5-28 / -	LZ DX Contest	Ph CW	RST and ITU Zone or LZ district	lzdx.bfra.org
16	1600Z	16	1800Z	3.5-28 / -	Feld-Hell Turkey Shoot Sprint	Dig	RST, S/P/C, Feld-Hell member nr	www.feldhellclub.org
16	1600Z	17	0700Z	1.8 / -	All Austria 160 Meter Contest	CW	RST, serial, OE district	www.oevsv.at
16	**2100Z**	**18**	**0259Z**	**1.8-28 / -**	**ARRL November Sweepstakes**	**Ph**	**Serial, category, call, check, ARRL/RAC sec**	**www.arrl.org/contests**
16	2100Z	18	0300Z	1.8-28 / -	Collegiate ARC Championship	Ph	See ARRL Sweepstakes	www.collegiatechampionship.org
16	2100Z	17	0100Z	1.8 / -	RSGB Second 1.8 MHz Contest	CW	RST, serial, UK district	www.rsgbcc.org
17	1300Z	17	1700Z	3.5-7 / -	Homebrew and Oldtime Contest	CW	RST, serial, and category	www.qrpcc.de/contestrules/hotr.html
18	0200Z	18	0400Z	1.8-28 / -	Run For The Bacon	CW	RST, S/P/C, Flying Pig nr or power	www.fpqrp.org
23	0000Z	24	2359Z	1.8-28 / -	CQ World Wide CW Contest	CW	RST and CQ zone	www.cqww.com
27	0000Z	27	0200Z	1.8-28 / 50	SKCC Straight Key Sprint	CW	RST, S/P/C, name, SKCC nr or power	www.skccgroup.com
28	0000Z	28	0600Z	1.8 / -	Top Band Sprint	Ph CW	RST, S/P/C, ARCI number or Power	www.qrparci.org/contests

All dates refer to UTC and may be different from calendar dates in North America. Times given as AM or PM are local times and dates. No contest activity occurs on the 60, 30, 17 and 12 meter bands. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity. XE = Mexican state. Publication deadline for Contest Corral listings is the first day of the second month prior to publication date (October 1 for December *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.

Frequency Measuring Test — November 2013

What's the "real" frequency? Time to find out!

Ward Silver, NØAX

The annual Frequency Measuring Test, also known as the FMT, will give amateurs yet another opportunity to evaluate their time-and-frequency testing talents. The FMT will be held on November 13 at 10 PM Eastern Standard Time (EST), which is 0300 UTC. The schedule is shown in Table 1. These times were chosen to provide good reception across most of North America for signals transmitted on 40, 80, and 160 meters.

You do not necessarily need to have a basement full of surplus atomic frequency standards to get good measurement results. Given an opportunity to warm up and stabilize, the frequency accuracy and stability of modern radios rivals lab-quality test equipment of years past. Check your radio's manual to see how its master oscillator can be calibrated with respect to a standard frequency station such as WWV (**www.nist.gov/pml/div688/grp40/www.cfm**) or CHU (**www.nrc-cnrc.gc.ca/eng/services/time/short_wave.html**). There are more articles and instructions available from the ARRL FMT web page at **www.arrl.org/frequency-measuring-test**. You can find more about frequency measuring techniques on K5CM's website (**www.k5cm.com**) as well.

The Roundtable Format

All of the transmitting stations will be *close* to the same frequency but not *exactly* on the same frequency, retaining the popular "roundtable" format. There will be four test-signal stations: K5CM (Oklahoma), W8KSE (Ohio), W6OQI (California), and WA6ZTY (California — 40 meters only).

K5CM will lead off with an initial call-up that lasts for three minutes (subsequent call-ups last for two minutes). The call-up is then followed by a two minute key down period and a handoff announcement. The frequency is then turned over to W8KSE who repeats the process before handing it off to W6OQI and then WA6ZTY (40 meters only). The final transmission is either a notice of band change or the FMT end announcement. Your challenge is to measure and report the frequencies of as many of the signals you can receive.

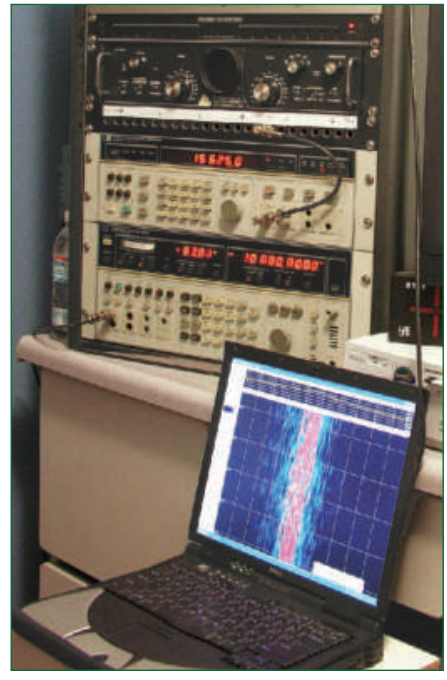
The test will begin on 40 meters near 7055 kHz at 10:00 PM EST. The test will then move to 80 meters near 3598 kHz beginning at 10:30 PM and then to 160 meters near 1845 kHz at 10:45 PM. The 80 meter stations will be K5CM, W8KSE, and W6OQI in that order. K5CM will be the sole station on 160 meters. The results from previous FMTs in this format (**www.b4h.net/fmt**) show that stations from across the continent will be able to hear the signals well enough to participate. In recent years, stations have even submitted measurements from Europe!

For more information and any updates in procedure, check the ARRL's FMT web page. Submit your measurements and soapbox comments by 10 PM EST on November 17 using the data entry website provided by Bruce Horn, WA7BNM, at **www.b4h.net/fmt/fmtentry.php**. Results will be tabulated online immediately following the end of the report submission period.

Table 1
November 2013 FMT Schedule in Eastern Standard Time

(10 PM EST is 0300 UTC)

40 Meter Time Line (near 7055 kHz)		
K5CM	10:00 PM	call up (3 min)
K5CM	10:03	key down (2 min)
K5CM	10:05	turnover announcement (1 min)
W8KSE	10:06	call up (2 min)
W8KSE	10:08	key down (2 min)
W8KSE	10:10	turnover announcement (1 min)
W6OQI	10:11	call up (2 min)
W6OQI	10:13	key down (2 min)
W6OQI	10:15	turnover announcement (1 min)
WA6ZTY	10:16	call up (2 min)
WA6ZTY	10:18	key down (2 min)
WA6ZTY	10:20	end 40 meter test, announce change to 80 meters
80 Meter Time Line (near 3598 kHz)		
K5CM	10:30 PM	call up (3min)
K5CM	10:33	key down (2 min)
K5CM	10:35	turnover announcement (1 min)
W8KSE	10:36	call up (2 min)
W8KSE	10:38	key down (2 min)
W6KSE	10:40	turnover announcement (1 min)
W6OQI	10:41	call up (2 min)
W6OQI	10:43	key down (2 min)
W6OQI	10:45	end 80 meter test, announce change to 160 meters
160 Meter Time line (near 1845 KHz)		
K5CM	10:55 PM	call up (3 min)
K5CM	10:58	key down (2 min)
K5CM	11:00	end FMT announcement



Part of the frequency standard gear at W6OQI. You can see an HP3336B signal generator atop a HP3586B calibrated receiver. The computer is running *Spectrum Lab* software by DL4YFH to display the received signal audio spectrum in which you can clearly see the effects of Doppler shift and fading. You can see more of Marvin's equipment at **k5cm.com/W6OQI%20%20FMT%20NEW.htm**. [W6OQI, photo]

FMT During the ARRL Centennial

In 2014, not only will there be a Frequency Measuring Test (FMT) in April with an "interesting" format, but the November FMT will be conducted using the call sign W1AW/5! Be sure to take part in these unique editions of the FMT.

2013 ARRL 10 Meter Contest

0000 UTC Saturday, December 14 - 2359 UTC Sunday, December 15

The ARRL 10 Meter Contest continues to be a popular event in the contest year, and with Technician privileges on 10 meter phone, new contesters have the chance to score well. This year's event will no doubt find the 10 meter band unpredictable and surprising. Participants from around the globe will take part in what is sure to be a busy weekend.

- The contest is the second full weekend of December. It starts 0000 UTC Saturday and runs through 2359 UTC Sunday (**December 14-15, 2013**).
- Single operators may enter CW-only, Phone-only, or Mixed mode. If you use spotting assistance, you must submit your score in the multioperator category.
- US and Mexican states, Canadian provinces, and DXCC countries (excluding the US, Mexico, and Canada) count for multiplier credit.

Full rules, multiplier lists, and forms can be found at
www.arrl.org/10-meter

Tom, K8CX, operates as P4ØCX from the P49V QTH in the 2012 ARRL 10 Meter Contest. [Photo courtesy K8CX]

2013 ARRL 160 Meter Contest

2200 UTC Friday, December 6 - 1559 UTC Sunday, December 8

The action returns to the Gentleman's Band for the 2013 ARRL 160 Meter Contest. Top Band enthusiasts old and new will find plenty to work, even with modest antennas. Past entrants have operated from superstations as well as city lots — so string up that wire and get ready for fun on 160!

- The contest starts 2200 UTC Friday and ends 1559 UTC Sunday (**December 6-8, 2013**). This is a 42-hour period with no time limitation.
- Entrants must operate using CW only.
- DX stations work ARRL/RAC Sections.
- W/VE stations work ARRL/RAC Sections and DXCC countries.
- KL7, KHØ-KH9 (including KH6), and KP1-5 stations count as US sections and may be contacted by DX, US, and VE stations.

Full rules, multiplier lists, and forms can be found at
www.arrl.org/160-meter

Paul Bittner, WØAIH, at his operating position for 160 meters. Paul's impressive station can be heard well in most contests — particularly well on 160 meters. [Ward Silver, NØAX, photo]

Special Event Stations

Maty Weinberg, KB1EIB, events@arrl.org; www.arrl.org/special-event-stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Oct 19, 1400Z-2300Z, N4M, Mount Dora, FL. US Coast Guard Auxiliary, District 7, Flotilla 43. **74th Anniversary of USCG Auxiliary**. 14.285 14.275 14.265. QSL. David A. Pennell, 2031 Bayside Ave, Mount Dora, FL 32757.

Oct 19, 1600Z-2100Z, W5I, Denison, TX. Grayson Country Amateur Radio Club. **27th FAI World Aerobatic Championships Special Event Station**. PSK31 14.070; 7.250. QSL. Grayson County Amateur Radio Club — K5GCC, 718 Hwy 82 E #198, Sherman, TX 75090. **www.qrz.com/db/W5I**

Oct 19, 1600Z-2300Z, W4W, Starke, FL. US Coast Guard Auxiliary District 7. **US Coast Guard Auxiliary 74th Anniversary**. 14.340 3.855. QSL. Kenneth L. Seipp, W4W, 1511 E Brownlee St, Starke, FL 32091.

Oct 19-Oct 20, 0000Z-2300Z, W7M, Maricopa, AZ. Maricopa Amateur Radio Association. **Maricopa Scouting Jamboree On The Air**. 449.125 145.210. Certificate. Robert Howard, PO Box 951, Maricopa, AZ 85139. **copahams.org**

Oct 19-Oct 20, 1200Z-1400Z, N1J, Andover, MA. Cub Scout Pack 77 Andover MA. **JOTA 2013**. 147.540 14.290 7.190. QSL. ARS KA1NXH, 10 Binney St, Andover, MA 01810. **www.qrz.com/db/N1J**

Oct 25-Oct 26, 2300Z-0600Z, W9BSP, Olathe, KS. Marshall Ensor Memorial Organization and Johnson County Radio Amateurs Club. **Ensor Museum Auction and Tailgate Special Event**. 14.240 7.240 3.940. QSL. Brian Short, 12170 S Prairie Creek Pkwy, Olathe, KS 66061. **www.w0erh.org/ensor_flyer_2013.pdf**

Oct 26, 1400Z-2000Z, WØYFZ, Anoka, MN. Anoka Radio Club and Emergency Services. **Anoka Halloween Capitol of the World Special Event Station**. 28.375 21.315 14.245. QSL. Anoka County Radio Club, PO Box 982, Anoka, MN 55303. **www.anokaradio.org**

Oct 26, 1700Z-2300Z, K6SON, Santa Rosa, CA. Sonoma County Radio Amateurs. **Bay Area Science Festival**. 14.200 7.290. QSL. Darryl M Paule, 1705 Bryden Ln, Santa Rosa, CA 95404. **www.bayareascience.org/festival**, **www.socoham.org**

Oct 27, 1530Z-1159Z, NS6OI, San Diego, CA. Star of India Amateur Radio Club. **Sinking of HMS Bounty**. 20 and 40 meter SSB CW. QSL. Baron Thomas, K6VWL, 4595 Mt Bigelow Dr, San Diego, CA 92111.

Oct 31-Nov 10, 0001Z-2359Z, K7E, Pine, AZ. Area Amateurs. **100 Years of Elk in Arizona**. 80 through 10 meters, CW SSB and Digital. QSL. Bret Conner, 36408 N Black Canyon Hwy 389, Phoenix, AZ 85086.

Nov 2, 1600Z-2000Z, N4BRF, Delray Beach, FL. The Boca Raton Amateur Radio Association. **Third Annual Station Open House**. 14.325 14.243 145.29 (pl 110.9) Talk-in. QSL. Walt Dreyfus, 21512 Woodchuck Ln, Boca Raton, FL 33428. **www.brara.org**

Nov 2-Nov 3, 1500Z-2345Z, WØJH, Stillwater, MN. Stillwater Amateur Radio Association and Radio City. **Remembering the Edmund Fitzgerald (Split Rock Lighthouse)**. 21.360 14.260 7.260 3.860. Certificate. WØJH (SARA), 1618 W Pine St, Stillwater, MN 55082. *WØJH certificates will only be sent via e-mail in PDF format; requests to* **SplitRock2013@radioham.org**. *WØJH is operating from Split Rock Lighthouse (ARLHS: USA 783; Grid Square: EN47).* **www.radioham.org**

Nov 3, 0000Z-0600Z, W8BAP, Chillicothe, OH. Scioto Valley Amateur Radio Club. **Extra Hour Special Event Station**. 28.445 14.280 7.250 3.860. Certificate. Jim Boyce, KD8BWV, 604 W 5th St, Chillicothe, OH 45601. **boycejr4@roadrunner.com**

Nov 8-Nov 11, 0114Z-1401Z, W8F, Livonia, MI. Livonia Amateur Radio Club. **38th Anniversary Sinking of Edmund Fitzgerald**. 14.240 7.240 7.040 3.540. Certificate. Bruno Walczak, 16601 Golfview, Livonia, MI 48154. **www.livoniaarc.com**

Nov 9, 0000Z-1800Z, WC5C, Azle, TX. Tri-County Amateur Radio Club WC5C. **NCTECH Sweet Sixteen Operation**. 28.316 14.160 7.160 3.916. Certificate. Tri-County ARC WC5C, NCTECH Sweet Sixteen, 820 Wood Lane, Azle, TX 76020. **www.wc5c.org**

Nov 9, 1300Z-2100Z, W8VP, Cambridge, OH. Cambridge Amateur Radio Association. **203rd Anniversary of Formation of Guernsey County, OH**. 14.260 7.235. Certificate & QSL. Cambridge Amateur Radio Association, PO Box 1804, Cambridge, OH 43725. *11th Special Event in CARA's year-long 100th Birthday Celebration. Certificate available for anyone who works all 12 of CARA's 2013 monthly Special Events.* **www.w8vp.org**

Nov 9-Nov 10, 1400Z-0200Z, W4NJA, Paducah, KY. Paducah Amateur Radio Association. **60 Years as an ARRL Affiliated Club**. 14.250 14.070 7.259 3.580. QSL. Walt Welch, 771 Fairview Dr, Paducah, KY 42001. **www.w4nja.org**

Nov 9-Nov 10, 1500Z-0200Z, N6SJV, Lodi, CA. Lodi Amateur Radio Club. **Stuck in Lodi Again — 50th Anniversary of the Lodi ARC**. 28.385 21.285 14.285. QSL. Lodi Amateur Radio Club, PO Box 455, Lodi, CA 95240. **N6SJV@arrl.net**

Nov 9, 1500Z-2200Z, WØFSB, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club. **Honoring Veterans on Veterans Day**. 21.240 14.240 7.240. Certificate & QSL. Five Sullivan Brothers Amateur Radio Club, 3186 Brandon Diagonal Blvd, Brandon, IA 52210. *For QSL card: Send card and #10 SASE; For Certificate &QSL: Send QSL, address label and three Forever stamps; For eQSL & Certificate: Send eQSL, then an e-mail, requesting a .jpeg file of the certificate that you can print yourself.* **w0fsb@outlook.com**

Nov 9, 1600Z-2359Z, N4F, Dadeville, AL. Lake Martin Amateur Radio Club. **Smith Mountain Fire Tower Anniversary**. 28.340 14.330 7.280. Certificate & QSL. N4F, PO Box 955, Alexander City, AL 35011. *Send three stamps and mailing label for certificate, send SASE for QSL.* **www.k4ywe.com**

Nov 9, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum. **US Veterans Day; US Marine Corps Birthday established 1775**. 14.320 7.250 SSB; 14.070 PSK31; DSTAR wide area reflectors. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101.

Nov 9-Nov 10, 1400Z-2100Z, NB9QV, Manitowoc, WI. USS *Cobia* Amateur Radio Club. **Veterans Day from WWII Submarine USS *Cobia* AGSS-245**. 14.240 7.250. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220. **www.qrz.com/db/nb9qv**

Nov 9-Nov 10, 1700Z-0100Z, W9WWI, Jeffersonville, IN. Clark County Amateur Radio Club. **60th Anniversary**. 14.250 7.250. Certificate & QSL. Clark County Amateur Radio Club, 1805 East Eighth Street, Jeffersonville, IN 47130. **www.qsl.net/w9wwi**

Nov 9-Nov 11, 1600Z-2300Z, NS6OI, San Diego, CA. Star of India Amateur Radio Club. **150th Anniversary of Sailing Ship *Euterpe/Star of India***. 14.275 14.030 7.275 7.030. Certificate. Star of India Amateur Radio Club, 1492 N Harbor Dr, San Diego, CA 92101. *Also operating SSB 18.150 and 21.300 as conditions permit, and occasionally CW 18.075 and 21.030. Pacific Daylight hours only.* **sdmaritime.org**

Nov 9-Nov 11, 1800Z-2300Z, K8V, Iron Mountain, MI. Mich-A-Con Amateur Radio Club. **Veterans Day**. 14.280 14.090 7.230 21.090. Certificate & QSL. Thomas Martin, 812 West B Street, Iron Mountain, MI 49801. **tmartin@chartermi.net** *or* **www.qsl.net/ka1ddb**

Nov 11, 1100Z-1800Z, W4NPT, Warm Mineral Springs, FL. North Port Amateur Radio Club. **Veterans Day**. 14.230. QSL. North Port Amateur Radio Club, PO Box 7716, North Port, FL 34290. **www.w4npt.org**

Nov 11, 1400Z-2100Z, W9L, Indianapolis, IN. **The American Legion Amateur Radio Club. Veterans Day Tribute**. 14.275 7.200 IRLP Node 4816 146.46 145.17. Certificate. The American Legion Amateur Radio Club, 700 N Pennsylvania St, Indianapolis, IN 46204. **www.legion.org/hamradio**

Nov 16-Nov 18, 1400Z-0200Z, K2JJI, Gloversville, NY. TRYON Amateur Radio Club. **40th Anniversary**. 7.195; 20 meters 10 meters SSB CW digital EchoLink. Certificate. TRYON Amateur Radio Club, PO Box 335, Gloversville, NY 12078. Live operator schedules, contact logging and certificate information at **k2jji.org**

Nov 17, 1500Z-2400Z, K7NRA, Paulden, AZ. Yavapai Amateur Radio Club. **NRA's 142nd Birthday Party**. 21.335 14.250 14.050 7.250. Certificate. YARC, PO Box 11994, Prescott, AZ 86304. **www.w7yrc.org/special_events.htm**

Nov 17-Nov 24, 0000Z-2100Z, W4D, Mayaguez, PR. Western Amateur Radio Club. **Discovery Day of Puerto Rico**. 28.350 21.350 14.345 7.150. QSL. Jose Nazario, WP3S, PO Box 6362, Mayaguez, PR 00681.

Nov 16, 1600Z-2100Z, WE7GV, Benson, AZ. Green Valley Amateur Radio Club. **Gammons Gulch Old West Movie Set Special Event**. 14.246 14.244 14.242. Certificate & QSL. Green Valley Amateur Radio Club, 601 La Canada Dr (SAV), Green Valley, AZ 85614. **gvarc.us**

Nov 18-Nov 20, 1400Z-2359Z daily, W3KGN, Gettysburg, PA. Adams County Amateur Radio Society. **150th Anniversary of the Gettysburg Address**. 145.63 14.263 7.1863 3.863. Certificate. Perry Wood, 255 Chapel Rd, Gettysburg, PA 17325. **www.w3kgn.org**

Nov 23, 1500Z-1900Z, W4ABZ, Ringgold, GA. Ringgold Amateur Radio Club. **150th Anniversary of the Battle of Ringgold Gap**. 14.265 7.265. Certificate. Jim Skeen, 224 Smith Liner Rd, Chickamauga, GA 30707. **www.qrz.com/db/w4abz**

Nov 23-Nov 24, 0001Z-2359Z, W6OI, Burlington, WI. Ten-Ten International. **W6OI and VE9TEN and DLØX Special Event**. All modes 10 meters. Certificate & QSL. Jerry Kopstein, N9AC, 8041 W Lakeshore Dr, Burlington, WI 53105. *Special Event QSL cards available on request and certificate given to those that work all US call areas.* **www.ten-ten.org**

Nov 30-Dec 1, 1400Z-2000Z, K4VRC, Lady Lake, FL. The Villages Amateur Radio Club. **Radio on the Square**. 14.266 14.066 7.255 7.033; PSK-31 14.072 7.0360. Certificate. Wayne Brown, 2218 Margarita Dr, Lady Lake, FL 32159. **www.k4vrc.com**

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 **Jan** *QST* would have to be received by **Nov 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 Sep 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

New Books

Reviewed by Rick Lindquist, WW1ME

Entanglement — An International Spy Thriller

By Corbin Coltrane

Corbin Coltrane's *Entanglement — An International Spy Thriller* is an engaging work of futuristic fiction that employs a variety of technical and scientific tropes, some plausible, some maybe not so much. It's a bit of a "buddy book" that incorporates conspiracy, industrial espionage, international intrigue and betrayal, with mayhem, martial arts, and gunplay thrown in to keep things lively. Shane Somers, the handsome, debonair genius-scientist protagonist, has a close, brotherly relationship with Magnus Gunnarsson, his old high school classmate of Icelandic extraction — a bull of a man with, "the body of a world-class power lifter." There's a little hint of Hardy Boys collegiality here, but both are physical people — and *Entanglement* is a physical tale.

A number of related themes fall under the "entanglement" umbrella, including the friends' attachment, which involves a tragic back story, and the subplot involvement of Shane's mother in sundry activities that range from politics to business and financial shenanigans. Something called, "quantum photonic entanglement," is also the underlying theory of Shane's world-changing technology that has attracted the attention of not only the US government but that of China. Perhaps keying off current fears that the government may already know all our secrets, Shane learns that his friend is an operative within a new government organization that's part of the now-notorious NSA. This, "Technology Acquisition Group," or TAG, has expropriated one of his brilliant inventions for national security purposes. Not only that but an industrial spy from China, posing as a lowly custodian has already managed to walk off with knowledge of his time-bending, physics-defying technology.

In a sort of homage to James Bond, Shane drives a "pristine 1970 Plymouth Barracuda," which he has tricked out with all manner of futuristic technology, including an LED display dashboard and an "anti-theft" device that jolts prospective thieves with 50,000 volts. The vehicle runs off an experimental liquefied hydrogen fuel that costs $80 a gallon, but it can do 0 to 60 in 3.8 seconds. As things unfold we discover that there is apparently no end to Shane's talent and savvy.

All of this is the setup for the main plot line of the novel, wherein the pair find themselves captives of the evil Zhou, the custodian-cum-industrial spy who stole Shane Somers's technology secret. As it turns out, though, Zhou's Chinese industrial masters have most, but not *quite* all of it, which is why they need Somers to complete the project, keeping his friend hostage for insurance.

Without giving too much away, a now rather low-tech piece of ham radio equipment — a Collins KWM-2 transceiver — and some mope from New Jersey become the key to resolving a tense scientific standoff and involuntary servitude in China. In true 007 fashion, this plot linchpin *is* a bit of a stretch, but as we all know, "When all else fails…" With the future of the Western World hanging in the balance, you go with what you've got.

In the spirit of Shane's souped-up 1970 Barracuda, *Entanglement* is a snappy read that scoops you up and carries you along effortlessly. Just don't try to take it all too seriously.

Corbin Coltrane, **www.corbincoltrane.com**. *Amazon Digital Services Inc, 2013. ISBN: 1-4912-0609-8, Kindle edition, 333 pp. Available from Amazon.com, $3.99.*

November 2013 W1AW Qualifying Runs

W1AW Qualifying Runs are held at 9 AM EST on Wednesday, November 6 (1400 UTC) and at 7 PM EST on Wednesday, November 20 (0000 UTC November 21). The West Coast Qualifying Runs will be transmitted by station K9JM at 3590 and 7047.5 kHz at 9 PM PST on Wednesday, November 13 (0500Z November 14). Unless indicated otherwise, sending speeds are from 10 to 35 WPM.

Bernie McClenny, W3UR, w3ur@arrl.org

Remote Operation and the DXCC Program

Operating a station remotely is allowed, but you have to follow the rules.

Operating an Amateur Radio station remotely over the Internet has now been possible for over a decade. The range of the remote operation debate varies from completely against the idea, to pushing it to the max; I have been somewhat lost in the middle, and I suspect I am not the only one who can't come to a conclusion. The DXCC 2000 rules, which were released in 1998, did not cover remote operations. In fact, DXCC rules 8 and 9 were modified several years later to address the issue. Rule 9 now states:

"*All stations must be contacted from the same DXCC entity. The location of any station shall be defined as the location of the transmitter. For the purposes of this award, remote operating points must be located within the same DXCC entity as the transmitter and receiver.*"

In laymen's terms, you can operate your station remotely from a room in your house a few feet away or many miles away, and as long as you are still physically within the boundaries of your own DXCC country, it will count for DXCC purposes. So if you have a remote station and you are on a business trip anywhere within your DXCC country, you could theoretically use your remote station to work another DXCC country and have it count for your DXCC award. However, if you are on vacation or away on a business trip outside of your DXCC country and you operate your remote station back in your home country, those contacts will not count for your DXCC and likewise for those who worked you.

Previously, following WWII and the restart of DXCC (November 15, 1945) rule 9 stated that:

"*All stations must be contacted from the same call area, where such areas exist, or from the same country in cases where there are no call areas. One exception is allowed to this rule: where a station is moved from one call area to another or from one country to another, all contacts must be made from within a radius of 150 miles of the initial location.*"

As America and other countries became upwardly mobile in the 1970s, the newly formed DX Advisory Committee (DXAC) reviewed the 150 mile rule and a decision was made to drop the 150 miles and change it to, "anywhere within one's DXCC country to count for DXCC credits." That means an operator can work DXCC countries from anywhere within his own DXCC entity for credit. For example, American operators can count DXCC countries from Maine to Florida to Washington state to Southern California or anywhere in between; in other words, anywhere within the United States DXCC Entity (lower 48 states). For those who live in a smaller country like The Vatican (HV) or Monaco (3A), which both have less than a square mile of territory, it may seem unfair — but those are the rules.

A Close Look at Remote Operating

In the case of remote operating, as with most technological advancements, there are positive and negative aspects. On the plus side, it encourages experimentation and technical advancement, and enables those who are unable to get on the air a means of overcoming their operating limitations.

On the negative side it could (and already has) allowed cheaters to operate remote stations in other countries and gain an unfair advantage over their fellow DXers. For example: someone within the US could use a remote station somewhere in Europe to work a station in Asia, using his call sign (not signing portable) to get DXCC credit for a rare one that he otherwise might not have been able to work from his home station.

Another potential negative aspect is that someone would be able to drop a remote station in a super rare DXCC Entity and operate a DXpedition remotely. Some may think this is a good thing; however it would devalue the DXCC award and the rareness of certain DXCC entities. These rare ones are rare for a reason and that is what adds to the value of the DXCC awards.

During the July ARRL® Board of Directors (BOD) meeting, the BOD asked, "the Programs and Services Committee (PSC) to request the DXAC study and, if warranted, recommend changes to the DXCC Rules for the ARRL Board of Directors to discuss." The PSC has now asked the DXAC to review the rules. It, "has been at least 10 years since the DXCC rules were comprehensively reviewed by the DX Advisory Committee (DXAC) and/or another committee and ratified by the ARRL Board of Directors." If you have recommendations on remote operations and how they affect the DXCC program, now would be the time to contact your DXAC representative. The BOD is requesting the report be given to the "Programs and Services Committee prior to the January 2014 Board Meeting with a final report and recommendations forwarded to the Programs and Services Committee prior to the July 2014 Board Meeting." You can see the complete minutes at **www.arrl.org/files/file/About%20ARRL/Board%20Meetings/2013%20Second%20Meeting%20Minutes.pdf**.

IRCs

If you have any of the soon-to-be worthless Nairobi model International Reply Coupons (IRCs), which expire on December 31 of this year, you should now redeem them at your post office as soon as possible. Despite the United States, the United Kingdom and other nations no longer selling International Reply Coupons (IRCs) it is not yet the end of the IRC. In July of this year the Universal Postal Union (UPU) released the new Doha "Water for Life" model (see Figure 1), which will be valid until the end of 2017.

Figure 1 — The new Doha "Water for Life" IRC, which will be valid until the end of 2017.

DX News From Around the Globe

3DAØ — Swaziland

The 3DAØET DXpedition to Swaziland is expected to take place from November 18-27 and will include the CQ World Wide DX CW Contest. Some of the team includes members from the 2012 7P8D DXpedition to Lesotho. Plans are for the team to meet in Johannesburg, South Africa on November 15, then drive to Piggs Peak, Swaziland. Take down will be on the 28th and then a return to Johannesburg on the following day. The team has a website with more details at **swazidx.org**.

5W and KH8 — Samoa and American Samoa

The Samoa group updates us on their upcoming KH8 and 5W operations. The operators are 9M6XRO, JH3PRR, W6SZN, ZL1GO and ZL3CW. They will be stopping in Samoa (5W) on their way back and have reserved the call signs N8A and W8A for American Samoa and have confirmed 5W8A for Samoa. It should be noted that 5W8A is a reissued call. The dates are: W8A, November 12-22 and N8A November 23-24 in the CQWW CW Contest, multitwo followed by 5W8A November 27-December 2. They have a website at **www.n8a.eu**.

5X and 9X — Uganda and Rwanda

Nick, G3RWF, returned to Uganda on September 24 where he'll be operating as 5X1NH until November 16. He'll be teaming up with Alan, G3XAQ, and heading to Rwanda on November 19 where they will be operating as 9XØNH and 9XØXA for about 10 days — including the CQ World Wide DX CW Contest for single band efforts. They'll return to 5X and then head home on December 2. QSL 5X1NH and 9XØNH via G3RWF and 9XØXA via G3SWH.

CEØY — Easter Island

"Easter Island 2013," will be a DXpedition in November by members of the Uruguay DX Group. A team consisting of CX4CR, CX3AN, CX2AM, CX3CE, CEØYHO (CE3OHY), EA7FTR, and EA5HPX will be operating from Hanga Roa, Easter Island, November 1-7. Plans are to run three stations simultaneously on 1.8-50 MHz on CW, SSB and the digital modes. They will have a website up and running at **www.easterisland2013.com**. QSL via EB7DX.

CEØZ — Juan Fernandez

XRØZR will be operating from Juan Fernandez Island from November 8-20. Activity will be on 1.8-50 MHz. They will be operating 6 meter EME using a K3 transceiver with PR6 preamp and kilowatt amplifier into a 6M8GJ Yagi with elevation as they did at D64K. Find the latest news at **www.juanfernandez2013.com**.

HKØ — San Andres and Providencia Islands

The "DX Friends" are going to HKØ, San Andres, from November 1-11. On the trip will be EA1SA, EA5RM, EA2RY, EA7AJR, EA7KW, IN3ZNR, F6ENO, F8ATS, F9IE, and RG8K. They will be on 160-6 CW, SSB and RTTY with four stations. As of press time there was no word on the call sign for this one. Here are some target frequencies for the operation:

CW — 1824; 3524; 7004; 10,104; 14,024; 18,074; 21,024; 24,894, and 28,024 kHz

SSB — 1845; 3780; 7065/7160; 14,195; 18,145; 21,295; 24,945, and 28,494 kHz

RTTY — 7035; 10,140; 14,080; 18,100; 21,080; 24,921, and 28,080 kHz

6 meters — 50.105 MHz (CW) and 50.115 MHz (SSB)

QSL direct to EA5RM or on OQRS for direct or bureau answers. **www.dxfriends.com/SanAndres2013**.

J8 — Saint Vincent and the Grenadines

J88HL is planned by seven Poles for November 17-29. Equipped with three K3s and three TS-590 transceivers, and four solid state 700 W amplifiers will be SP2EBG, SP3CYY, SP3GEM, SP6EQZ, SP6IXF, SP9FOW, and SP9PT. During their consideration of destinations, they saw that J8 hasn't had a major expedition in recent years, is easy to reach, easy to get a license for, and is a beautiful place too. SP6EQZ says this is not a "holiday operation," but a dedicated radio activity. They will be active on all the HF bands and have a serious effort on 160. The license is in hand and the accommodations and air flights are booked. Their website is **j88hl.dxing.pl**. They will QSL via the bureau and direct. For direct, they strongly recommend OQRS to avoid mail theft, etc.

S2 — Bangladesh

The Mediterraneo DX Club's operation from Bangladesh will take place from November 17-26. They will have more than 20 operators and six stations — two stations each on SSB, digital and CW on 1.8-50 MHz. Bangladesh is between number 54 and 56 on the various most wanted lists. As of press time we did not know the S2 call sign. They plan a 'round-the-clock operation with Icom and Elecraft radios to verticals, dipoles, and three Spiderbeams. QSL via IV2VUC through LoTW, OQRS, direct, or bureau. Their website is located at **www.mdxc.org/bangladesh2013**.

T33 — Banaba Island

Jay Kobelin, W2IJ, is leading a team for the upcoming November T33A DXpedition to Banaba Island. They'll be operating November 5-18 on 1.8-28 MHz on SSB, CW and RTTY. They'll have 19 operators! More details can be found at **www.t33a.com**. QSL via W2IJ including OQRS and LoTW (approximately 6 months after the DXpedition).

Wrap Up

Don't forget to send your DX news, photos and club newsletters to your DX editor at **w3ur@arrl.org**. Until next month, see you in the pileups! — *Bernie, W3UR*

Jon Jones, NØJK, n0jk@arrl.org

Last Hurrah for Solar Cycle 24?

Experts ponder the possibility of another Maunder Minimum.

As you read this, the predicted second peak of Solar Cycle 24 is here, the solar flux is climbing rapidly, and 6 meters is open for worldwide F2 DX — we hope! Solar physicist Dean Pesnell of the Goddard Space Flight Center proposed a theory that Solar Cycle 24 may have a second peak, late in 2013. Sunspot counts jumped in November 2011, which I feel was Cycle 24's first peak. The sunspot number peaked at 153. During mid-November that year there was almost a full week of F2 openings between the East and West Coasts of North America on 6 meters.

On the morning of November 15, 2011 both OX beacons and the TF1SIX/b were loud throughout the Midwestern states, and stations in eastern North America worked Europe via F2. Sunspot numbers dipped in 2012 and Pesnell expects them to rebound again in late 2013 stating, "I am comfortable in saying that another peak will happen in 2013 and possibly last into 2014."

The Gleissberg Cycle

Along with this prediction are other predictions that Solar Cycle 25 and on may be even weaker than 24. Along with the standard 11 year cycle, it's thought that there may be a longer trend of activity and subsidence known as the Gleissberg Cycle.

The Gleissberg Cycle, named after astronomer Wolfgang Gleissberg, is thought to be an 87 year amplitude modulation of the 11 year sunspot cycle. Current thinking is that the Sun's sunspot cycle may be moving into the trough of a Gleissberg Cycle, which, if true, will lead to weaker sunspot activity overall for the next 40 or 50 years.

"If this trend continues, there will be almost no spots in Cycle 25 and 26," observed Matthew Penn of the National Solar Observatory, hinting that we may be on the edge of another *Maunder Minimum*. He notes, "The Maunder Minimum was a period from 1645 to 1715 where almost no sunspots were seen. This corresponded to the medieval period known as the 'Little Ice Age.' During this era, the Thames River in London froze solid, making Christmas 'Frost Fairs' possible on the ice covered river. Several villages in the Swiss Alps were also consumed by encroaching glaciers and the Viking colony established in Greenland perished."

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So what should 6 meter DXers do? If the second peak of Solar Cycle 24 shows up this fall and winter, this may be the last opportunity of this Solar Cycle, and perhaps for many of us in our lifetimes, to work 6 meter DX via F2. I would suggest you maximize your time on the radio with the best station you can build if the second peak occurs. Spring of 2014 may also be good for north-south paths and Sporadic E (E_s)-TEP DX. If Cycle 24's second peak is like the first, it will drop off fairly quickly after the spring of 2014.

As we pass through Cycle 24 into Cycles 25 and beyond, and if we find ourselves descending into a modern Maunder Minimum, we need to consider new methods for working DX on 6 meters. I have some thoughts on this subject, which I will discuss in a future column. I'll just say that the Moon may play a major role.

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Summary of the Summer E_s Season in North America

Sometimes it becomes clearer what transpired in summer E_s season after the band has cooled off. This summary was prepared by Dave, N7DB, with comments by me, and should not be a surprise to anyone who has been active this year. Whether one lives in the Pacific Northwest or other parts of North America, the summer 2013 has been uneven. Sure, there have been a few bright spots here and there, but overall, in my experience, I would give it a 3.7/10 rating. Many in California agree. This summer would have to be rated on the lower end of openings-per-season overall. For readers who may not have been active on VHF very long, this season was an example of poor conditions.

May

The beginning of the season got off to a good start with WB8VLC and W7EW working into CE on May 4. K7CW also worked into South America the first part of May. Speaking of Paul, he did complete 6 Meter DXCC this summer.

First E_s was logged on May 5, which is a typical start date for the summer season. Double hop to the 4s started early on May 10, along with an intense E_s-TEP opening to Argentina for much of North America as far north as Alberta, Canada. E_s continued the next day to KL7 and to KH6 on the 13th and 16th. Conditions were a bit slim until the evening of the 31st when a nice aurora developed, followed a week later in June with another decent aurora.

June

The June VHF Contest was mediocre the first day, though KØGU in Colorado worked ZL3NW and E51WL Saturday night of the contest. Sunday was a little better with E_s from the Midwest to W4 and W7. The first EU to Pacific NW happened on June 12. On June 17, another opening into EU occurred. This opening was late in the morning and connected the Puget Sound area of Washington State and British Columbia to the Scandinavian countries. Nothing was heard in the Pacific DX area.

The summer patterns of recent years have favored operators in the Puget Sound region. This year was the same story. So often there would be reports of openings up north and not a whisper of a signal further south. That pattern is slowly shifting. Late in the afternoon of June 18, W7OUU posted BA4SI. Stations in the Midwest like KØHA worked BV2DQ and NWØW logged BA4AI. This was some

extreme DX for those who were prepared.

Japan has been pretty slim into CN85 for a few years now; last year on the 4th of July, JE1BMJ was barely worked by K7RWT. However, JE1BMJ was in this year on June 22 where a few locals worked Han. BV2DQ was at least heard by K7RWT and W7EW on the June 24. I believe that Mark, W7MEM, worked BV2DQ this summer for DXCC #99. Yes, there was double hop in, but strong short hop was also there. Lance, W7GJ, was well over S9 at my station. This evening the propagation worked into the Pacific with Lance working K6MIO/KH6 and a couple of nights later, KL7 was in.

This summer would have to be rated on the lower end of openings-per-season overall. For readers who may not have been active on VHF very long, this season was an example of poor conditions.

Another good aurora occurred on the evening of the 28th. At times, this aurora was strong enough to cause flutter on local stations.

July

Almost exactly 1 year after K7RWT worked JE1BMJ, Han was in again on the evening of July 3. This time he was much easier to copy and Han became the first JA in my log in many years. Later that evening KL7 was in. The morning of the 4th had good northern tier openings from the Puget Sound area, but not as strong down here in CN85. There was another northern tier opening the next morning. The evening of the 5th of July, WA7GCS had a partial with BA4SI. Also that evening, a lot of E-W propagation was reported.

On the evening of July 15, an opening stretched into the Maritime Provinces. This was a pure northern tier 6 meter opening riding along the US-Canadian border. Although not the strongest I've seen, it did remind me of some of the late-night transcontinental openings I have seen in the past. I was on until after 0600Z and the band was still open when I closed down.

The CQWW VHF weekend was the better of the two VHF contests this summer. Of note was that on Saturday morning NP4A was very loud into the Midwest. On Sunday morning a few 7s in the Pacific Northwest worked him. The band was open both days and I made more contacts during this shorter contest than in June.

The season had one more surprise in late July. Late one afternoon I could see the propagation lines from the middle of NA heading over to Asia. As the late afternoon wore on, the propagation lines became thicker. By early evening, local stations started hearing JAs! Now that was different. By 0201Z I was able to work JE1BMJ with a comfortable 559 on my end. There was a long slow fading that night, so signals would come and go, but the opening just kept going and going. I think just about all JA districts were heard/worked from the Pacific Northwest that night.

W7IV/KL7 was also in that same night. This was the best summer JA opening I have seen in years. I think it is perhaps the latest I can recall for a summer JA opening in the Pacific Northwest. K7RWT reported hearing 49.750 MHz video this evening. This might be a sign of the return of an Asia path into the Pacific Northwest in the future.

On the Bands

50 MHz. There were E_s openings the first week of August to Europe and Africa from North America. Early on the first day of the month K1TOL (FN44) worked MMØAMW (IO75), S57RR (JN65), and SV2JAO (KN10) at 1233Z (see Figure 1). Sam, WA3IUH, reported working ON4IQ on the 3rd at 1332Z for his first overseas 6 meter contact. He runs an IC-756 PRO III and a 4 element Yagi at 30 feet. August 3 was interesting for Russ, K4QI (FM06). He had D44TS (HK75) in solid for 3 hours! He also logged three EA8s, two PAs, two HAs, DL, SP, and five OK2s. D44TS worked as far west as N4QWZ (EM66) at 1331Z.

K5CM (EM25) worked Han, JE1BMJ (Q5), at 0015Z August 5, which is late in the summer E_s season for Japan to North America. Also on the 5th, VYØHL (FP53) had an extensive opening to the western states. He worked as far as Arizona KC8CC (DM33) and California N6ORB (CM87) around 0210Z. That same evening XE2X (EL06) was strong in Kansas at 0144Z for NØJK (EM28) (see Figure 2). KB5HMU was active from rare grid EN28 during the Perseids shower. W8BYA logged him on the 11th at 0011Z via WJST. K1TOL (FN44) and K1SIX heard the CS5BAL/b August 19 at 1800Z. VYØHL worked across the southeast states as far as the Gulf Coast on the 28th (see Figure 3). Among his best DX was KD5M

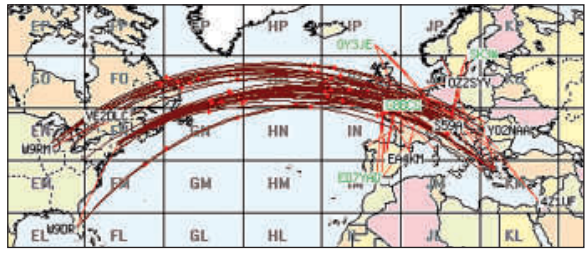


Figure 1 — The first of August brought an excellent E_s opening to Europe. [**dxmaps.com**]

Figure 2 — NØJK caught an E_s that carried him to a contact with XE2X. [**dxmaps.com**]

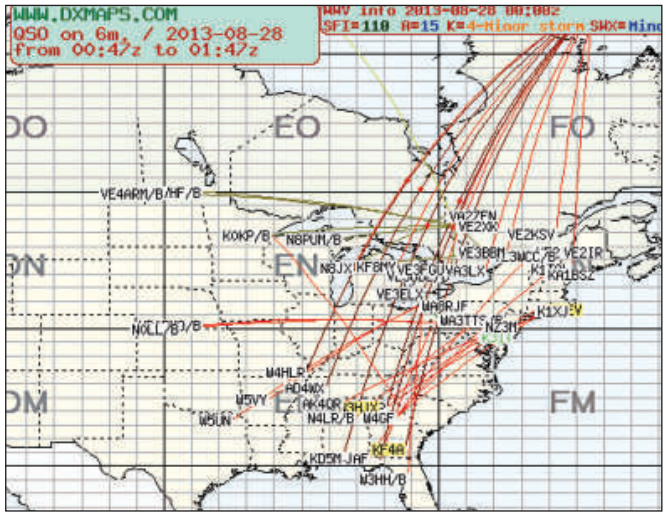


Figure 3 — VYØHL worked into the southeastern states on August 28. [**dxmaps.com**]

(EM60) at 0053Z. This was probably double hop E_s. NX4E (EM70) worked VE2HOY (FN35) on the first hop to VYØ at 0045Z.

144 MHz 2 Meter Perseids DX and Tropo Returns. Gedas, W8BYA (EN70), worked K7NX (DM53) during the Perseids using WSJT at 0505Z August 13. The distance is 2270 km. Lloyd, K7NX, "was running 120 W with an 11 element antenna up 20 feet with a little help from being on top of a 9000 foot high mountain top. I had several really nice 2 second burns from him! I was also able to work EN28, EM82, EN25 and of course DM53 for new ones on 2 meters all in 2 days. The shower was not even intense or what I would call super but it did provide a steady increase in rock density over several days." I noted many contacts recorded on NØUK's Ping Jockey page as well (**www.pingjockey.net/cgi-bin/pingtalk**).

On the 26th, Rick, WØRT (EM27), worked KØPFX (EM48), K9MRI (EN70), W8BYA (EN70), and KYØO via tropo. K5SW (EM25) found K8TQK (EM89), W9RM (EN52), WA9KRT (EN61) and W8KYA (EN70). A more widespread tropo opening took place on the 29th from the Midwest to the southeast. W9RM (EN52) worked N1GC (EM95) at 1354Z. The evening before the tropo was so strong KC9KUK (EN52) Chicago worked NØBLL (EN36) on FM at 0220Z.

222 MHz. K5SW (EM25) worked W5LUA (EM13) on the 28th at 0107Z.

432 MHz. Sebastian, W4AS, reports a low power 70 centimeter EME contact using just 50 W and two 18 element Yagis. "LZ1DX (Ned in KN22mm) was worked on August 24, 2013 at 0225Z on 432.085 MHz using JT65B. Ned did most of the heavy lifting, as he has 16 × 15 (16 total of 15) element Yagi antennas on 432 MHz. His signal report to me was −27 dB, and I received him with −25 dB. I'm limited to 50 W in this part of the country on that band. I don't have elevation control, so we were limited to just a few minutes between the time the Moon was visible above the homes in my suburban lot."

1296 MHz and Up. Sam, K5SW (EM25), worked three grids in the ARRL® UHF contest with his best DX W5LUA (EM13) on 1296. WA8RJF (EN91) heard the VE3TFU/b (EN93) 1296.326 MHz on the 25th.

Here and There

Alan, VK4WR, and Graeme, VK4FI, will once again be active as E6RQ and E6SG, respectively, from the Coral Gardens Motel, Alofi, Niue, December 7-17. Activity will be on the HF bands. Alan says, "Our operation is primarily for 6 meters as we are going in the middle of the southern hemisphere sporadic E season. Hopefully, there will also be TEP into Asia and who knows what else on the magic band." — thanks OPDX.

For 4 meters, Colin, G4ERO, informed me, "There is a very successful 70 MHz conversion for the Elecrafts XV50 transverter to make it an XV70. When used with the K3, it makes crossband operation simple." See Mike Willis' conversion details at **www.mike-willis.com/XV70_Pt1.htm**. [Note that transmitter operation on the 70 MHz band is not legal for US hams. — *Ed.*].

Colin uses a dual band antenna for 4 meters and 6 meters. It is a design by YU7EF (**www.yu7ef.com/efDUOBANDS.htm**). He says, "I built one of these a few years ago. Built carefully they work very well and make a good crossband antenna requiring only one simple coax connection to the 6 meter driven element. The 4 meter driven being a parasitic element."

Brian Justin, WA1ZMS/4 has a 4 meter CW beacon, WG2XPN (FM07fm), in operation at 70.005 MHz. ERP is 3 kW from a horizontally-polarized antenna as the intended "audience" are the weak-signal hams in Europe. The beacon uses a 3 element Yagi at 50 feet above ground level (AGL) and the antenna's ground level is at 4200 feet above mean sea level (AMSL). Take-off angle to Europe is at 60° true is −0.8°! That is the magic of that site!

I have also had many backscatter reports from Texas and Florida. They too were running horizontal Yagis. Now that I am licensed under an FCC Part 5 license rather than a 3 month special temporary authorization (STA) as in past years, I hope to be able to keep WG2XPN running as close to 24/7 as possible. The limitation of the license is that if there are any reports of interference to TV services, I must shut down until a potential schedule or limits on operating times can be worked out. My goal is to *never* reach that point.

The peak transatlantic E_s season is over for this summer but with such excellent world record E_s DX now in the log, I wonder what the minor E_s peak will bring? Maybe there will be nothing, and, as such, that's the goal of the effort. I didn't activate the beacon to make contacts via a non-US ham band, but rather to better understand the E_s mode on 4 meters. — *Brian, WA1ZMS/4*

Strays

Signal Report on a Plate

If you happen to pull up behind Steve Guest, N6NBV, on the highway and call him on the radio, it is safe to say that your signal report is already on the way! [Phil Lonzello, WA6LDI, photo]

Rick Lindquist, WW1ME, ww1me@arrl.org

MARS Pacific Endeavor-13

While running an emergency support drill, amateurs are faced with a real blackout.

The premise of the MARS "Pacific Endeavor-13" was that a small band of amateurs would seek to assist a fictitious disaster-battered Asian nation; for the purpose of the exercise, Nepal stood in as "Pacifica." The Pentagon and US Pacific Command set up the drill as a test of Amateur Radio emergency support in Asia after Japan's tsunami catastrophe. MARS, military stations and amateurs collaborated, using Amateur Radio call signs. However, an unanticipated, real blackout occurred at the outset of the US Department of Defense's globe-spanning exercise August 25-26. A star of the show was PSK31, which performed well, even in the otherwise grim propagation that prevailed.

"We had stations monitoring in the Continental US, Hawaii, Japan, Germany, and Afghanistan," said Army MARS Program Officer Paul English, WD8DBY. "There was only intermittent reception in Germany and the US on PSK, but we had a solid connection between Nepal and Afghanistan." Power was restored in Nepal about two and a half hours into the exercise, enabling "marginal voice communications" from Nepal to Afghanistan and Germany. He said Hawaii could hear, but not talk to, Nepal. Propagation sufficient to support voice modes lasted just a few minutes.

At 9N1AA in Nepal, two Nepalese operators, Sanjeeb Panday, 9N1SP, and station owner Satish Khrishna Kharel, 9N1AA, initially used battery power, running just 25 W. A stroke of good luck provided a low-power digital link to an amateur in Afghanistan. Tim McFadden, KB2RLB/T6TM, a retired Army communicator now helping train Afghan troops as a contractor, had joined Army MARS less than a month before the exercise. He ran 100 W into a delta loop and a G5RV installed as an inverted V.

To avoid unwanted alarm, participants did not use language typical of an emergency. Instead, all communication used terms from the game of cricket. In preparatory exercises, traffic was disrupted by hams seeking to contact Nepal, a "rare one" for many hams. Resorting to abbreviated call signs and dependence upon digital modes during the exercise alleviated this problem, although DX hunters did show up during a brief period of voice transmission. A preliminary count showed 60 stations taking part. — *US Army MARS via Bill Sexton, N1IN*

HAM RADIO 2013 Draws 15,300 Visitors

The 2013 HAM RADIO International Exhibition for Radio Amateurs June 28-30 in Friedrichshafen, Germany, reported a head count of 15,300, up from 14,800 visitors in 2012. "Ham Radio riding on a wave of success," trumpeted a "Final Report," released in July. The theme of the 38th "Friedrichshafen," as the event is familiarly known, was "The Amateur Radio Adventure: DXpedition." Some 200 exhibitors and organizations from 33 countries were present to display and demonstrate their latest products.

The Deutscher Amateur Radio Club (DARC), the noncommercial sponsor of the international Amateur Radio exhibition, said Europe's largest ham radio gathering offers, "… the best opportunity to meet Amateur Radio friends from around the world."

Part of the ARRL team at Friedrichshafen (L-R): Volunteer DXCC card checker Kenton Dean, HB9DOT/NK6F; ARRL staffers Norm Fusaro, W3IZ, and Bob Inderbitzen, NQ1R, and ARRL International Affairs Vice President Jay Bellows, KØQB. The sign, in German, urges visitors, "Become a member now." [Erwin Harbeck, DO1ED, photo]

Australia Ends Higher Power Trial for Radio Amateurs

The Australian Communications and Media Authority (ACMA) has ended an 18 month trial that allowed participating Advanced licensees in that country — currently limited to 400 W PEP — to run up to 1 kW on the HF bands. ACMA reached its decision in August, following a detailed assessment begun last March.

"After taking into consideration all the data obtained as part of the assessment process, the ACMA is of the view that the arrangements put in place for the trial should not continue," the regulatory agency said in terminating the arrangement. ACMA pointed out that fewer than 3 percent of the 10,690 eligible licensees — 297 in all — took advantage of the trial. Operators had to apply for permission to participate in the trial.

"Of the 297 that did obtain the authorization, the ACMA was advised by some participants that they had not used higher power," the agency said in its decision. ACMA said participant comments it received via the Wireless Institute of Australia (WIA) indicated that the benefits of running higher power, "were confined to those respondents and do not demonstrate broader benefits to the wider community." ACMA also said some participants' knowledge and awareness of Australia's RF exposure regulations, "did not meet ACMA expectations."

For some time the WIA has been pushing for higher power limits for Advanced licensees, who feel the current 400 W power limit puts them at a disadvantage, especially in contests, while other countries permit 1 kW or more. ACMA is expected to revisit the issue next year. — *ACMA, WIA, Jim Linton, VK3PC*

John Dilks, K2TQN, k2tqn@arrl.org

A Lost Treasure Returns

The original version of a Novice transmitter is back at home in the ARRL lab.

Once again, John Dilks turns over the Vintage Radio column to ARRL® Test Engineer Bob Allison, WB1GCM, for an intriguing story right out of the ARRL Lab.

The ARRL Radio Amateur's Handbook long ago earned universal acceptance by all segments of the technical radio world for its practical utility and "how-to" content. Nearly 40 years ago, I eagerly studied construction projects, especially the Novice transmitters, since they looked like something I could build with my limited skill set. One project, the "Five Band, 'Fifty Watter,'" was a crystal-controlled CW transmitter featured in the 1968 *Handbook*.[1] It looked simple enough to build, and the front panel had a professional appearance.

Illinois hams Gary Ilker, WB9CLQ (ex-WN9CLQ), and his father, KB9YS (SK, ex-WN9CLR), successfully constructed the same transmitter, using the article and schematic diagram from the *Handbook*. Today, their transmitter is on display at the ARRL Laboratory's "The Evolution of Amateur Radio" exhibit (**www.arrl.org/arrl-vintage-amateur-radio-equipment-exhibit**).

The, "Five Band, 'Fifty Watter,'" was geared toward the beginner or Novice class radio amateur. The Novice class license was the entry level license of the late '60s. It was a 1 year, non-renewable license designed to encourage the holder to upgrade to a Technician or General license. Novices were allowed CW privileges on small segments of the 80, 40, and 15 meter bands, with crystal-controlled transmitters having an *input* power of no more than 75 W.

Forgotten Father

Little was known of the origins of the Five Band, "Fifty Watter," which first appeared as a "Four Band, Fifty Watter," in the 1966 *Radio Amateur's Handbook*. It was common at the time to feature *Handbook* projects without an accompanying *QST* article, so no author was credited for the design of this classic transmitter. Because nearly 50 years had passed since its creation, no one here at the ARRL Lab could recall who had worked on it. A web search proved fruitless and it seemed this transmitter's parentage was lost to history.

Then, last August, I had a visitor at the Lab by the name of Bob Anderson, K1TVF. After a short tour, Bob explained that he had worked here and wanted to donate a Five Band, "Fifty Watter" transmitter to the Lab. I accepted his offer, unaware of his transmitter's importance.

The following week, Bob presented the original Five Band, "Fifty Watter" as pictured in the 1968 *Handbook* (see Figure 1). As a Lab staff member, Bob designed and built this popular transmitter project, along with other notable projects, such as the 80/40 meter "Two Band, Sixty Watter" Novice Transmitter,[2] "A Three-Band Neutralized

[1]ARRL members can see the original *Handbook* article at **www.arrl.org/qst-in-depth**. Select "fifty watter.pdf."

[2]R. Anderson, K1TVF, "Two Band, Sixty Watter for the Novice," *QST*, Mar, 1964, pp 15-18.

Figure 1 — Bob Anderson, K1TVF, and his original Five Band, "Fifty Watter" at ARRL Headquarters.

Figure 2 — The front panel of the Five Band, "Fifty Watter" CW crystal-controlled transmitter.

Figure 3 — The key parts are neatly laid out.

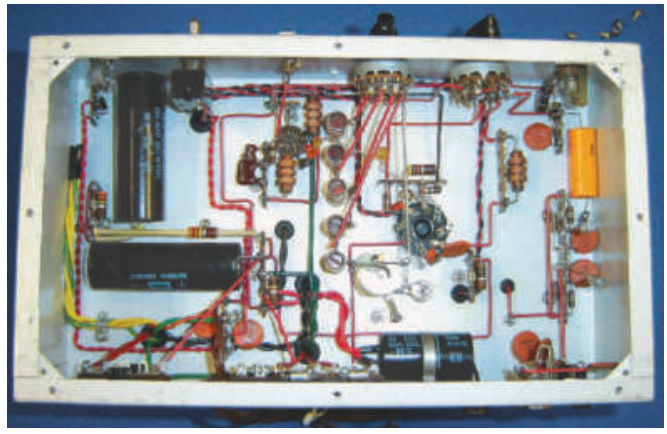


Figure 4 — Bob gets an "A" for his tidy chassis wiring work.

VFO Amplifier,"[3] and other construction articles published in both the *Handbook* and *QST* during the 1960s.

The Lab staff was truly honored to have one of their own returning to the Lab — a "Labby" who worked alongside many talented ARRL Laboratory engineers with memorable names, such as Byron Goodman, W1DX; Ed Tilton, W1HDQ; Ed Handy, W1BDI; Don Mix, W1TS; Lew McCoy, W1ICP; Walt Lange, W1YDS; George Grammer, W1DF; Laird Campbell, W1HQ (ex-W1CUT), and Doug DeMaw, W1FB (ex-W1CER); who are now all Silent Keys.

One Gallon Resume

In 1962, while still in high school, Bob Anderson visited ARRL Headquarters and showed his construction abilities to Senior Lab Engineer Walt Lange with an exact copy of Lew McCoy's "Novice Gallon."[4] With Lab staff impressed, employment was assured after his graduation in June of 1964. While still in school, Bob designed and built the "Two-Band, Sixty Watter," that appeared in *QST*. This simple CW transmitter for the 80 and 40 meter bands used a 6146 final amplifier, 6AG7 crystal-controlled oscillator for an input power of 60 W.

After graduation, Bob became a summer intern. He was first assigned split duties between W1AW under Ed Tilton and the Lab under Ed Handy. One of his first jobs was to dig cable trenches for the W1AW antenna farm. After the summer, Bob entered Worcester Polytechnic Institute to study electrical engineering but continued to work at the Lab during summer and semester breaks — eventually becoming assistant technical editor of *QST*. After graduation, Bob took a commission from the Army Signal Corps.

The 5 and 50

Though his visit was all too brief, Bob promised to return and tell us more about his ARRL experience. Soon after his departure, I couldn't resist making a close inspection of the transmitter and quickly removed both the top and bottom. It became obvious as to why this transmitter was so successful.

The Five Band "Fifty Watter" is a two tube transmitter, superior to the typical one tube Novice transmitter projects of the time. The innovative cabinet combines an aluminum chassis and an aluminum utility box for improved shielding and safety. Referring to Figure 2, on the left of the upper chassis, below the meter, is a rotary switch that allows the user to read the grid, screen or plate current. Next to the meter is the amplifier band switch, along with the LOAD and TUNE control knobs for tuning the plate of the 6DQ6. On the lower chassis are the ac indicator, on/off switch, crystal socket, grid band switch, function switch and key jack.

Design and Construction

Inside, the Five Band, "Fifty Watter" is marvelously simple. Figure 3 shows the upper section. The two power transformers and the choke at the upper left are part of the solid state power supply that provides the 6 and 12 V ac filament, 170 V dc screen and 460 V dc plate voltages. Below the filter choke is the shielded 12BY7 crystal-oscillator tube. The output coil (L6) is supported at left by a ceramic standoff insulator, at right by the plate tuning capacitor. Above the coil is the 6DQ6 final amplifier tube. A one inch by three inch wide strip of aluminum alongside the 6DQ6, together with the plate of the 6DQ6, acts as the neutralizing capacitor. Key down, a plate current of 120 mA creates an input power of 55 W, with the screen current kept between 8 and 10 mA.

Some two stage (vacuum tube) transmitters tend to have a rather chirpy note, since the final amplifier can "pull" the oscillator if there is no buffer stage in between. To get around this problem, Bob created, "differential cathode keying," by placing an electrolytic capacitor across the key line to keep the oscillator running. Bob said, "by luck, the keying waveform was shaped perfectly."

Figure 4 shows a very tidy wiring job inside the lower section, with hookup wires bent to 90° and tie points supporting components. Note the use of rubber grommets to pass leads through to the upper chassis. The use of grommets is still as good of a practice today as it was nearly 50 years ago.

Changing Times, Changing Designs

Bob Anderson explained that the ARRL Technical Director, George Grammer, wanted something new and refreshing for the *Handbook*. At that time, World War II surplus parts were becoming harder to find, so all new parts were employed. The "box-on-chassis" construction minimized metal work. A 6DQ6 was chosen as the final amplifier simply because it was a lot cheaper than a 6146. The simple construction and modest cost of the parts made this a popular configuration, which appeared in the *Handbook* from 1966-69.

As for the construction projects featured in the *Handbook*, it was customary for the designer/builder to take the completed project home to keep. Bob used his Five Band, "Fifty Watter" for 5 years before placing it in dry storage. Now it is "home" at the Lab, the place it was built nearly 50 years ago.

Visitors to ARRL Headquarters can see vintage equipment designed and built at the ARRL Laboratory as part of our "Evolution of Amateur Radio Equipment" exhibit. New projects are still occasionally built and will likely be tomorrow's Vintage Radios.

All photos by the author.

[3]R. Anderson, K1TVF, "Three Band Neutralized V.F.O. Amplifier," *QST*, Aug, 1964, pp 40-43.
[4]L. McCoy, W1ICP, "A Novice 'Gallon' or General 150-Watter," *QST*, Jun, 1962, pp 30-36.

Convention and Hamfest Calendar

Gail Iannone, giannone@arrl.org; www.arrl.org/hamfests-and-conventions-calendar

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Montgomery) — Nov 9
D F H R S T V
9 AM-3 PM. *Spr:* Montgomery ARC. Alcazar Shrine Temple, 555 Eastern Blvd. *Tl:* 146.84. *Adm:* $7. Bruce Jenkins, KI4OZW, 334-396-4229; **publicity@w4ap.org**; or Lew Nyman, K1AZE, 334-354-1933; **hamfest@w4ap.org**; **hamfest.w4ap.org**.

Arizona (Marana) — Nov 9 D F H R S T V
7 AM-1 PM. *Spr:* Oro Valley ARC. Marana Middle School, 11279 W Grier Rd. *Tl:* 146.62, 444.1, 145.19 (all 156.7 Hz). *Adm:* $5 (free with student ID). David Beauchesne, AK2L, **ak2l.radio@gmail.com**; **tucsonhamradio.com/tucson-hamfest**.

Arizona (Queen Creek) — Dec 7
D F H R T V
7:30 AM-4:30 PM. *Spr:* Superstition ARC. Schnepf Farms, 24810 S Rittenhouse Rd. *Tl:* 147.12 (162.2 Hz). *Adm:* $5. Douglas Mitchell, W7ADD, 480-540-4110; **douglasw7add@gmail.com**; **www.SuperstionSuperfest.com**

Florida (Coral Gables) — Nov 16 F T
7 AM-noon. *Sprs:* Flamingo Net and University of Miami ARC. University of Miami, Physics Parking Lot, 5101 San Amaro. *Tl:* 147.15 (94.8 Hz). *Adm:* Free. Bill Moore, WA4TEJ, 305-264-4465; **wa4tej@juno.com**; **www.flamingonet.8m.net**.

Florida (Oakland Park) — Nov 23 F H R T V
7 AM. *Spr:* Broward ARC. Collins Center, 3900 NE 3rd Ave. Cy Harris W4MAQ Memorial Free Flea. *Tl:* 146.91 (110.9 Hz). *Adm:* Free. Robin Terrill, N4HHP, 954-249-5343; **n4hhp@comcast.net**; **browardarc.org**.

Florida (Okeechobee) — Nov 30
D F H R T V
7 AM-3 PM. *Spr:* Okeechobee ARC. Freedom Ranch, 11655 Hwy 441 SE. "Hamfest in the Woods." *Tl:* 147.195 (100 Hz). *Adm:* $5. Charles Whipple, W4PHD, 863-467-2487; **charles.whipple4@gmail.com**; **www.flweather.com/oarc/**.

WEST CENTRAL FLORIDA SECTION CONVENTION

December 6-7, Plant City, FL
D F H Q R S T V
Friday 2-8 PM, Saturday 9 AM-5 PM. *Spr:* Florida Gulf Coast AR Council. Florida Strawberry Festival Grounds, 303 Edwards St. 39th Annual Tampa Bay Hamfest. *Tl:* 146.94 (146.2 Hz). *Adm:* advance $9, door $10. Bill Williams, AG4QX, 813-837-3833; **ag4qx@arrl.net**; **www.fgcarc.org**.

Florida (Starke) — Nov 16 D F H R T
8 AM-5 PM. *Spr:* ARC-Bradford Area. Starke Country Club, 15501 NE 14th Ave. *Tl:* 145.15. *Adm:* $5. Donnie Brown, KC4IUL, 352-468-1439; **kc4iul@windstream.net**; **www.starkehamfest.info/**.

Indiana (Evansville) — Nov 30
D F H Q R T V
8 AM-1 PM. *Sprs:* Electronic Applications Radio Service (EARS) and The Ham Station. Vanderburgh County 4-H Center Auditorium, 201 E Boonville-New Harmony Rd. *Tl:* 145.15 (136.5 Hz). *Adm:* $8. Neil Rapp, WB9VPG, 812-333-4116; **ears@w9ear.org**; **w9ear.org/hamfest.htm**.

Coming ARRL Conventions

October 11-13
Pacific Division Convention, Santa Clara, CA*

October 12
Iowa State Convention, Sergeant Bluff, IA*
Pacific Northwest VHF Conference, Moses Lake, WA*

October 12-13
Florida State Convention, Melbourne, FL*

October 13
Connecticut State Convention, Meriden, CT*

October 18-19
Microwave Update Convention, Morehead, KY*

October 26
Delaware State Convention, Georgetown, DE*

November 2
Fall TechFest, Lakewood, CO*

November 2-3
Georgia Section Convention, Lawrenceville, GA*

November 8-9
Midwest Division Convention, Lebanon, MO

November 9
All Ohio ARES Conference, Reynoldsburg, OH*

November 16-17
Indiana State Convention, Fort Wayne, IN

December 6-7
West Central Florida Section Convention, Plant City, FL

*See October *QST* for details.

INDIANA STATE CONVENTION

November 16-17, Fort Wayne, IN
D F H Q R S V
Saturday 9 AM-4 PM, Sunday 9 AM-noon. *Spr:* Allen County AR Technical Society. Allen County War Memorial Coliseum, 4000 Parnell Ave (corner of Indiana 930/Coliseum Blvd and Parnell Ave). 41st Annual Fort Wayne Hamfest and Computer Expo. *Tl:* 146.88. *Adm:* $6 for both days or $4 for just Sunday (at the door only). AC-ARTS/Fort Wayne Hamfest, 260-579-2196; **chairman@fortwaynehamfest.com**; **www.fortwaynehamfest.com**.

Kansas (Olathe) — Oct 25-26 F R S T V
Friday 5-11 PM, Saturday 9 AM-3 PM. *Spr:* Johnson County RAC. Ensor Museum, 18995 W 183rd St. Auction and Tailgate. *Tl:* 147.24 (151.4 Hz). *Adm:* Free. Brian Short, KCØBS, 913-638-7373; **kcshorty@gmail.com**; **www.w0erh.org/ensor_flyer_2013.pdf**.

Massachusetts (Bourne) — Nov 9
D F H R T V
9 AM-noon. *Spr:* Falmouth ARA. Upper Cape Cod Regional Vocational School, 220 Sandwich Rd. *Tl:* 146.655 (88.5 Hz). *Adm:* $5. Ralph Swenson, N1YHS, 508-548-0422; **depsher911@comcast.net**; **www.falara.org**.

Michigan (Harrison Township) — Dec 8
D F H R V
8 AM-noon. *Spr:* L'Anse Creuse ARC. L'Anse Creuse High School, 38495 L'Anse Creuse Rd. *Tl:* 147.08 (100 Hz). *Adm:* $5. Gregg Crump, N8GEO, 248-670-7021; **n8geo@arrl.net**; **www.qsl.net/n8lc/**.

Mississippi (Biloxi) — Nov 15-16
D F H Q R S T V
Friday 5-9 PM, Saturday 8 AM-3 PM. *Spr:* Jackson County ARA. St Martin Community Center, 15008 Lemoyne Blvd. *Tl:* 145.11 (123 Hz). *Adm:* $5. Dan Miller, AE5JG, 228-539-4930; **danbarb@bellsouth.net**; **jcmsara.com**.

MIDWEST DIVISION CONVENTION

November 8-9, Lebanon, MO
D F H Q R S T V
Friday 6-9 PM, Saturday 8 AM-4 PM. *Spr:* Lebanon ARC. Cowan Civic Center, 500 E Elm St. W1AW/Ø Special Event Station On-The-Air, special guest speakers including Astronaut Steven Nagel. *Tl:* 146.7 (88.5 Hz). *Adm:* Free. Ron Lowrance, K4SX, 636-745-0078; **k4sx@centurytel.net**; **www.arrlmidwestconvention.com**.

Missouri (Raytown) — Nov 16 D H R S V
8 AM-1 PM. *Spr:* Raytown ARC. Our Lady of Lourdes Catholic Church, 8812 E Gregory Blvd. *Tl:* 145.17. *Adm:* advance $2 for 1, $4 for 5, $10 for 10; door $3 for 1, $5 for 3, $10 for 8. Dan Cole, KCØVYT, 816-674-8854; **kc0vyt@arrl.net**; **www.K0GQ.com**.

Nevada (Reno) — Oct 19 F
7-11:30 AM. *Spr:* Sierra Nevada ARS. Tamarack Junction, 13101 S Virginia St. *Tl:* 146.61 (123 Hz). *Adm:* Free. Anthony Marcin, N7ACM, 775-230-7226; **info@renohamswap.com**; **renohamswap.com**.

New Jersey (Fair Lawn) — Nov 29 D H R
6-11 PM. *Spr:* Fair Lawn ARC. Fair Lawn Senior Center, 11-05 Gardiner Rd. Ham Radio Auction. *Tl:* 145.47 (107.2 Hz). *Adm:* Free. Gene Ottenheimer, WO2W, 201-791-3841; **genewo2w@gmail.com**; **www.flarc.net**.

New Jersey (Succasunna) — Oct 25 H R
7-11 PM. *Spr:* Splitrock ARA. Roxbury Senior Center, 72 Eyland Ave. 3rd Annual Fall Auction. *Tl:* 146.985 (131.8 Hz). *Adm:* $3. Tracy Yung, KB2SUM, 866-457-6687; **auction@splitrockara.org**; **www.splitrockara.org**.

North Carolina (Benson) — Nov 17
D H R T V
8 AM-3 PM. *Spr:* Johnston ARS. American Legion Building, 605 N Wall St. *Tl:* 147.27. *Adm:* advance $6, door $7. Michael Callam, KD4UJC, 919-934-9623; **jarsmember@yahoo.com**; **www.jars.net**.

Tennessee (Greeneville) — Oct 19 D F H T V
8 AM-1 PM. *Spr:* Andrew Johnson ARC. Greene County Fairgrounds, 123 Fairgrounds Rd. *Tl:* 145.39 (186.2 Hz). *Adm:* $5. Bob Gass, N4FV, 423-707-7448, **n4fv@yahoo.com**; **greenevillehamfest.com**.

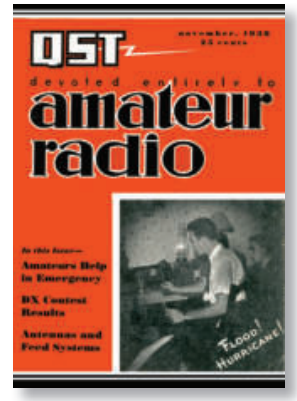
Wisconsin (Appleton) — Nov 3 D F H R V
8 AM. *Spr:* Fox Cities ARC. Monarch Gardens, 2311 W Spencer St. *Tl:* 146.76 (100 Hz). *Adm:* advance $5, door $6. Anthony Mach, AB9IO, 920-722-0482; **ab9io@yahoo.com**; **www.fcarc.us/hamfest.php**.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

75, 50 and 25 Years Ago

Al Brogdon, W1AB

November 1938



- The cover photo shows two hams operating by the light of an oil lamp, with the caption, "Flood! Hurricane!" in reference to the Great New England Hurricane.
- The editorial is a four-page tribute to *QST* Editor Ross Hull, who was accidentally electrocuted while experimenting with a television receiver.
- "Amateur Radio Bests Triple Catastrophe," by Clinton B. DeSoto, W1CBD, tells of the tremendous help amateurs provided following the recent hurricane and flooding on Long Island and in New England.
- Dana Griffin, W2AOE, tells us how to build an E.C.O. in existing rigs, in order to provide "Variable-Frequency Control for Transmitters."
- F. W. Schor, an engineer with the Hallicrafters Company, explains their new "Combined Beat Oscillator and I.F. Amplifier."
- In "A 1.75- to 56-Mc. Crystal-Controlled Low-Power Transmitter," Herbert Gordon, W1IBY, shows us how he built this 'phone, CW rig, and power supply into one cabinet.
- In a report complete with photos of various stations, E. L. Battey, W1UE, reports that the "1938 DX Competition Results," surpassed all previous years, in this tenth running of the contest.

November 1968

- The cover photo shows a collection of QSL cards received by W1TS for contacts made during the past year — a lot of mouth-watering DX, despite spotty conditions.
- The editorial, "League Acts to Strengthen License Structure," reports that ARRL is proposing to the FCC that 'phone subbands be reserved for Advanced and Amateur Extra class licensees, with a phase-in period to allow other classes of licensees to upgrade.
- "The Skew-Planar Wheel Antenna," by Robert Mellen, W1IJD, and Carl Milner, W1FVY, describes a 144 Mc. omnidirectional antenna that is an extension of the Big Wheel Antenna (*QST*, Sep-Oct 1961), but is circularly polarized.
- T. L. Thomas gives us Part II of "The TDCS Communications Receiver," an all-transistor unit that covers the H.F. ham bands.
- In "The ARRL's Official Observers," Ed Handy, W1BDI, describes the role that OOs play and tells us how we can volunteer to be an OO.
- Lew McCoy, W1ICP, tells us how we can use "Neon Bulbs and Dial Lamps," to make inexpensive test devices, code-practice oscillators, and other useful gadgets.
- In "Crystal Control on 10,000 Megacycles," Leonard Garrett, W7JIP, and Ernest Manly, W7LHL, report on their use of narrow-band techniques in microwave communication.

November 1988

- The cover photo shows a beautiful Oklahoma sunset behind one of the Bartlesville ARC's Field Day positions.
- The editorial speaks of Hurricane Gilbert and the role Amateur Radio played before, during, and after its passage.
- Emil Pocock, W3EP, tells us about "Getting from Here to There on 2304 MHz," complete with an explanation of the band's propagation modes.
- Peter Dodd, G3LDO describes "The Mobile Roof-Rack Antenna," a directional discontinuity ring radiator (DDRR) design, reporting that it works well.
- In "Ham Radio Remembered," Wendell Morrill, NV7Y, tells about going through his early QSL cards, finding current addresses for many of those hams, writing them, and receiving appreciative replies — a great example of the ham spirit!
- Steve Ford, WB8IMY, writes of "The Brief Flight of the *Eclipse*," a model rocket test mounted by Steve and Dave Patterson, WB8ISZ, in 1982.

Field Organization Reports

August 2013

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at **www.arrl.org/public-service-honor-roll**.

520
WA7PTM
510
W5KAV
410
KT2D
373
WB8RCR
336
WM2C
295
KB2ETO
278
WB8R
270
W2MTA
264
KB8VXE
260
K7EAJ
N7CM
245
K6FRG
230
WB9WKO
224
N8OSL
220
NX8A
210
K6HTN
KA2ZNZ
N8FVM
K8RDN
215
VE7GN
WK4P
185
KØIBS
183
K4BEH
182
K7GJT
180
KK4BVR
175
KK5NU
170
WA3EZN
KB2RTZ
W4DNA
K2ABX
169
KB1YNE
167
KF7PDV
165
K1PJS
K7OAH
163
W8KWG
KB2KOJ
160
W5DY
159
KC6ZGG
158
WB9FHP
155
K9LGU
150
KB5SDU
N8IO
WB4ZIQ
KK3F
N1UMJ
WD8USA
140
WB9QPM
KJ6IJJ
WA4STO
NE8B
136
KB1UAU
135
K2VT
WE2G
KJ4JPE
W3YVQ
134
W7JSW
132
AE5VY
131
KA8ZGY
130
WB2FTX
N9VC
K7BFL
W9BGJ
W9EEU
KB8QKC
W8DJG
K4IWW
WK4WC
WI2G
KW1U
127
WS6P
126
N2RTF
W1INC
125
W4VX
K9DUR
WA1STU
WV8CH
N2JBA
WO2H
124
KB2BAA
KC2QVT
120
KØVTT
NN7H
KA4FZI
N2GJ
AG9G
KT5SR
WA5LOU
WØLAW
NM1K
KB1RGQ
N2WKT
NA7G
NS7K
WB8WKQ
118
WB8YYS
115
N8CJS
KØPTK
WB6UZX
113
K4JUU
KC2SFU
112
W9WXN
110
WA1MXT
KR6LH
K6JGL
VE3GT
NXØK
K5AXW
W7GB
N7YRT
K7BDU
W7QM
W8MAL
K4GK
KF7GC
AA2SV
W2EAG
N7XG
N7YSS
N1IQI
K1YCQ
N7IE
KA1G
N9MN
KB8RCR
108
NC8F
W9ILF
107
W3CB
105
W5CU
N8SY
N1TF
104
K7FLI
103
KBØDTI
KC8EIA
102
N5NVP
100
N9VT
N2WGF
N3RB
N1JX
KB2QO
KB5KKT
N3SW
K4SCL
N9WLW
KB1NMO
K6JM
WG8Z
WA2NDA
W4TTO
WB4Y
KB3LNM
AA3SB
WB4FDT
N3ZOC
K3IN
W3GQJ
WB8TQZ
K8VFZ
97
KE7QPV
KD7THV
KJ4G
NU8K
96
N7EIE
95
NØYR
WAØCGZ
WB6OTS
AK4RJ
KB2URI
94
AB9ZA
93
W2CC
92
WØRJA
KA2GQQ
KK7DEB
91
KD4SM
90
W7SLS
AB1AV
WD8DHC
WA4BAM
N5RL
K1HEJ
N3KB
KB8HJJ
WD8SIQ
N8IBR
WB4BIK
KJ4HGH
K8KV
89
N2VC
KA9QCW
N2RHL
88
NA9L
87
N2DW
N9EXM
WDØGUF
KC8UR
KAØDBK
86
N3RAY
N3FKR
N3RAY
85
N2YJZ
N1LKJ
KJ7NO
83
KD2DEJ
82
KB9KEG
81
W7YV
80
AJ7B
WA9QIB
W8IM
KB7RVF
KC7ZZ
KB1WXC
WB4RJW
K8ED
79
KK7TN
78
WB3FTQ
KC8QWH
77
KC2EMW
KB3MXM
76
K9LOT
75
K7MQF
73
KJ6PCC
KD4UKT
72
KC2UMX
K2GW
70
K6RAU
W5XX
KA8IAF

The following stations qualified for PSHR in previous months, but were not recognized in this column yet. (June) KB2ETO 275, KA2ZNZ 210, W2MTA 196, KB2KOJ 189, K2ABX 175, WI2G 130, N2WKT 120.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AR, AZ, CT, EB, EMA, ENY, EPA, EWA, GA, IA, ID, IL, IN, KS, LA, LAX, ME, MI, MN, MS, NC, NE, NFL, NH, NLI, NTX, NNJ, MDC, OH, OR, ORG, SD, SFL, SNJ, STX, SV, TN, UT, VA, WCF, WNY, WMA, WPA, WI, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: EB, ENY, EWA, GA, ID, IN, MDC, ND, NH, KS, MI, MN, NC, NLI, OH, OK, STX, SV, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

WB9FHP 1240, WA4STO 1325, KK3F 1231, K6HTN 1072, WB6OTS 1034, K7BDU 757, N1IQI 745, K6JT 742, K6FRG 561, KW1U 520.

The following stations qualified for BPL with Originations plus Deliveries: K8LJG 302, NM1K 114.

Silent Keys

Silent Keys Administrator, sk@arrl.org

It is with deep regret that we record the passing of these amateurs:

K1ADY **Hadley**, Mary C., Orrington, ME
W1BC **Minichiello**, Ray, North Las Vegas, NV
N1BTF **Trecartin**, Frederick B. Jr, Anderson, SC
♦W1COL **Mroz**, Frank M., Ellsworth, NH
W1DKD **Jennings**, Robert W., Scituate, MA
N1DUQ **Murphy**, Raymond J., Manchester, CT
W1DXP **Vetter**, Edward, Eliot, ME
WA1EBJ **Davis**, Richard L., Haverhill, MA
K1EM **Paskus**, Clement P., Terryville, CT
WB1ENV **Plourde**, Joseph Robert, Greenfield, NH
W1FRH **Hughes**, Francis R., Athol, MA
WB1FRP **Baca**, John R., Douglas, MA
WA1FXY **Allen**, Donald F., Athol, MA
W1GMG **Jeffers**, Robert K., Wilton, NH
W1IWT **Salkins**, Burton E., Chelmsford, MA
W1JFT **Morin**, Gerald F. Jr, Johnston, RI
W1KIQ **Haskell**, Sterling E., Hackettstown, NJ
K1NLD **Cornell**, Gerald A., Bridport, VT
N1QQP **Freedman**, Robert H., Hudson, MA
W1RKZ **Harris**, Robert G., Falmouth, ME
KA1RNF **Chellquist**, Carl E., Holliston, MA
K1SK **Kimball**, Steve, Fort White, FL
KB1TUN **Cameron**, John R., Raymond, NH
N1TXK **Tomasiello**, Francis P., Meriden, CT
W1UAZ **Cote**, Edward A., Christmas, FL
W1UB **Rider**, Donald V., Wayland, MA
N1UF **King**, Frederick T., Wallingford, CT
N1YMK **Lindquist**, David W., Gold Canyon, AZ
♦W1ZTK **Seastrom**, Bernard J., Shrewsbury, MA
W1ZXP **Gugliotti**, Louis M., Tolland, CT
KA2APN **Bruno**, Arnold W., Wind Gap, NY
♦N2BBJ **Jacobs**, Harvey, Bradley Beach, NJ
N2BCQ **Murray**, Paul D., Oswego, NY
W2GDB **Sims**, James R. Jr, Webster, NY
KA2HSK **Miller**, William R., Rochester, NY
W2IYE **Faist**, Ralph L., Pensacola, FL
N2JGH **Tidaback**, Michael Sr, Lafayette, NJ
N2KLH **Widrick**, David A., Camillus, NY
W2LCL **Schneeloch**, Paul M., Clemmons, NC
N2LCV **Jenkins**, Ellsworth N., Ballston Spa, NY
W2MJQ **Busharis**, John G., Basking Ridge, NJ
KI2N **Forbes**, Thomas J., Hopatcong, NJ
W2NVR **Ruggiero**, Michael B., Columbus, NJ
K2RI **Keeter**, Raleigh F., Niskayuna, NY
W2TM **Cole**, James G., Pilot Mountain, NC
K2VP **O'Steen**, Michael K., Ormond Beach, FL
KA2YAL **La Guardia**, James V., Saylorsburg, PA
K2YMR **Snyder**, Dederick L., Northampton, MA
WA2ZBV **Pores**, Edwin B., Brooklyn, NY
K2ZE **Vickner**, Edward H. Jr, Ewing, NJ
WB2ZMU **Przebieglec**, Eugene J., North Arlington, NJ
WA2ZTB **Mercuri**, Joseph J., Madison, NJ
WB2ZTY **Franchetta**, David L. Jr, Del Haven, NJ
N2ZZD **Barth**, Janice G., Vernon, NJ
N3ASX **Warunek**, Joseph S., Dupont, PA
K3DXV **Coen**, Charles R., Washington, PA
N3GN **Berg**, Kenneth C., Galena, MD
K3GRS **Bates**, Kenneth J., Sand Springs, OK
KB3HPJ **Jackson**, Harry P., Irwin, PA
W3ICX **Tinker**, Alex K. Jr, Mount Pleasant, PA
W3IOP **Bulgarelli**, Leonard K., Pittsburgh, PA
W3JQY **Gehman**, Lester, Ephrata, PA
W3JRY **Yupatoff**, John R., East Berlin, PA
N3KGO **Sherer**, John A. Jr, Phillipsburg, NJ
WB3KZS **Bell**, Dorothy A., Butler, PA
KB3LZP **Pinyot**, Paul E., Penn Hills, PA
K3NE **Brandt**, Arlan J., West Deer, PA
K3NO **Hensel**, David R., Inchelium, WA
KB3POO **Goldman**, Albert L., Annapolis, MD
WA3PXK **Heath**, Walter C., Charlestown, MD
WA3QEL **Hollister**, Charles G., Gaithersburg, MD
♦K3SW **Kulp**, James D., Middletown, VA
N3VLU **Raynes**, Mona B., Harrisburg, PA
KA3YKU **Spiering**, Glen L., Greensboro, MD
W3ZAA **Bostick**, Frank W., Lancaster, PA
W4AOZ **Thompson**, William A. Jr, Alexandria, KY
N4BRP **Martin**, James L., Shalimar, FL
KD4BZ **Karr**, Bob, Shepherdsville, KY
K4CZT **Madison**, James M.,Knoxville, TN
KD4DAN **Sweazy**, Winford C., Taylorsville, KY
KE4DGW **Carter**, Louise C., Chattanooga, TN
KD4EAT **Felton**, Charles A., Chesapeake, VA
♦W4EHF **Finch**, William C., Greenville, NC
N4FA **Horowitz**, Martin H., Englewood, FL
WD4FIY **Ross**, Henry V., Panama City, FL
WD4GES **Gause**, Solange M., Dale City, VA
K4IPY **Johnson**, Henry E., Mc Lean, VA
KO4IR **Campbell**, Wilbur L. "Pete," Bonaire, GA
WW4KW **Harrell**, Winston P., Debary, FL
K4LSM **Pritchett**, F. J., Crystal River, FL
KK4LWF **Terpin**, Nathan J., Watkinsville, GA
N4NKP **Axtell**, Arthur C., Daytona Beach, FL
KE4OMD **Evans**, Jay C., Ruckersville, VA
N4OZJ **Clauss**, Robert R., Lynchburg, VA
KG4PMC **Ritchey**, C. Michael, Saint Petersburg, FL
♦W4PN **Pennington**, Claude L. Jr, Macon, GA
KB4QYF **Chartier**, Maxine M., Saint Petersburg, FL
♦W4RW **Martin**, Floyd E., Sterling, VA
WA4SHA **Wright**, Frederick C., Birmingham, AL
KG4SLJ **Stephens**, Edward E., Tuscaloosa, AL
K4SYU **James**, Everett F., Satellite Beach, FL
AC4TW **Newman**, Alfred F., Augusta, GA
KE4UEF **Cooper**, Margie L., Carlsbad, NM
K4VFV **Montgomery**, Robert L., Oakland, FL
W4VLH **Holman**, Vern L., Newport News, VA
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K4WLH **Hunt**, Walter L. Jr, Wilson, NC
W4WZR **Sears**, Robert H., Sanford, NC
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K4YL **Grose**, Stephen "Mike," Hendersonvlle, NC
KJ4YMX **Haines**, Audrey D., Bradenton, FL
KF4ZT **Turner**, Scott Jr, Hamlet, NC
♦W5AHS **Hayne**, Frank B. III, New Orleans, LA
KB5ASR **Robinson**, Bill, Meridian, MS
N5AWE **Gregg**, Earl G., Donna, TX
WB5BRD **Hooper**, Raymond D., Ink, AR
KF5CUZ **Winsett**, Jason E., Weatherford, TX
KE5DJ **Burke**, Ransom W., Bisbee, AZ
W5ERH **Sutton**, Betty J., Brookeland, TX
KE5GAG **Overturf**, Eva M., Austin, AR
KA5GEM **Simmons**, Harley V., Maurepas, LA
KC5GRE **Jewett**, Donald A., Bartlesville, OK
K5HTF **Moore**, Bill G., Oklahoma City, OK
K5HZB **Browning**, Harrell Z., Corpus Christi, TX
K5KAZ **Sanders**, Carl H. Sr, Dayton, TX
KE5KQT **Fulton**, Herbert L., Edmond, OK
N5LLK **Foster**, Kerry, Morgan, TX
♦W5LTU **Bryan**, Jerry D., Tipton, OK
W5MXA **Kingsley**, Mitchel L., Beaumont, TX
♦KC5NS **Mc Dole**, Donald L., Elberta, AL
WB5PCT **Mc Minn**, Charles P., Ackerman, MS
N5QPV **Packard**, William M., Vancleave, MS
WA5REB **Smajstrla**, George X., West, TX
N5RFP **Boyd**, Norman V., Little Rock, AR
W5RID **Harris**, Joel L., Dallas, TX
KT5RR **Sparks**, Kenneth B., Bluejacket, OK
KF5TA **Jones**, Marcus C., Dexter, GA
N5TE **Watkins**, Robert W. Sr, Bedford, TX
♦KR5V **Young**, Morris J., Allen, TX
AB5VN **Holder**, Alvah J., Wichita Falls, TX
AC5WI **Merrell**, George W., Kermit, TX
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WB5YRU **Keathley**, Donald W., Russellville, AR
WA5YSZ **Woods**, Charlie J., Haskell, TX
KG6ASO **Stahlnecker**, Robert E., Somerset, VA
ex-KD6AYM **Boag-O'Brien**, Charles "Obie," Wildomar, CA
KH6BBC **Sordillia**, Virgasun A. Sr, Wahiawa, HI
DK6CX **Geng**, Brigitte, Naples, FL
W6EFD **Hall**, Ralph W., Richmond, CA
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KA6SUL **Lee**, James M., Arroyo Grande, CA
W6VEF **Shkurkin**, Vladimir V., San Pablo, CA
KE6WHT **Bock**, Charles H. Sr, Westminster, CA
KI6WUG **McKinnon**, Dan, Santa Barbara, CA
K6YBT **Weaver**, Stanley W., Chico, CA
W6YJG **O'Brien**, H. Carter, Mount Shasta, CA
WA7ADD **Wear**, Harry A., Prosser, WA
N7ADU **Taylor**, Albert D., Kerrville, TX
N7AFR **Hurd**, Richard M., Yuma, AZ
KA7AZS **Pryor**, Joan R., Hayes, VA
KA7BKC **May**, Harold E., Salt Lake City, UT
ex-WB7CYC **Snyder**, Thomas F., Algona, WA
♦K7DNN **Beatty**, Walter E. "Gene" Jr, Phoenix, AZ
W7EMO **Olson**, Walter, Portland, OR
WB7ERU **Masone**, Alexander A., Alexandria, VA
WA7GFS **Cross**, Richard L., Hillsboro, OR
KL7GID **Mockerman**, Eugene M., Big Lake, AK
KB7HQA **Davis**, Arlyn W., Walla Walla, WA
K7ICQ **Riddle**, Linda G., Poulsbo, WA
KL7IX **Kohler**, Claudia K., Helotes, TX
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W7LFI **Chambers**, Charles T., Layton, UT
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W7LV **Kidd**, Ervin J. III, Henderson, NV
KJ7MF **Mitchell**, Boyd L., Parowan, UT
NK7N **Welsh**, Janet, Dallas, TX
W7OXA **Robinson**, Willis A., Las Vegas, NV
KE7PIF **Brown**, Stephen H., Salt Lake City, UT
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KD7WIZ **Taylor**, Howard E. Jr, Vaughn, MT
AC7WS **Horn**, John J., Hillsboro, OR
WO7X **Naugler**, S. Norman, Boise, ID
WD8BTS **Cunert**, Beulah "Polly," Akron, OH
K8CKG **Poling**, Paul J., Lakewood, OH
ex-KD8CLP **Beasley**, Henry W. III, Hopewell, OH
KD8COZ **Rodman**, Gerald J., Marion, OH
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KD8CYW **Hayden**, Jan E., Quincy, MI
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ex-K8EGY **Kasa**, Joseph R., Hudson, OH
N8EYU **Brainard**, Aaron D., East Tawas, MI
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♦W8QGP **Sanger**, John P., Litchfield, MI
W8RAP **Peltoniemi**, Roy A., Dollar Bay, MI
K8TED **Leonard**, James E., Amherst, OH
W8TMS **Iverson**, Arthur L., Troy, MI
KC8TQB **Goodrich**, David R., Manchester, MI
N8TUH **Goodrich**, Stephen F., Detroit, MI
♦WB8TXG **Miller**, Samuel C., Canfield, OH
W8UEU **Schnell**, Dennis R., Vassar, MI
KC8UNW **Hein**, Roy M. Jr, Canton, MI
K8USD **Ruminsky**, Paul, Amherst, OH
K8WNS **Hickenbottom**, Ernest E., Hilliard, OH
W9ABM **Prochaska**, Carl A., Downers Grove, IL
KC9BDI **Biro**, Carlton M., Wheatfield, IN
ex-K9BMC **Brisson**, Donald W., West Salem, WI
ex-W9BNG **Kuhn**, Derwood E., Anderson, IN
KC9CHB **Atkinson**, Dennis M., Montpelier, IN
♦K9CQ **Puglise**, James D., Punta Gorda, FL
K9ECP **Swenson**, Henry M., Indianapolis, IN
N9FQY **Storts-Ege**, Evelyn L., Fulton, IL
AA9HC **Morin**, Joseph A., Cairo, IL
K9HOY **Gleason**, Lawrence, Hoffman Estates, IL
W9JLR **Berg**, William S., Bremerton, WA

KC9JYL **Schroeder**, Mark A., Fort Wayne, IN
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W9KIA **Sjoberg**, Donald V., Rockford, IL
♦W9LYN **James**, William S., Charleston, IL
W9NRJ **Fechter**, George W., Jacksonville, FL
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ND9S **Proudfit**, Robert, Casselberry, FL
W9SFH **Thompson**, Jerry C., Milwaukee, WI
N9SM **Mc Williams**, Stephen G., Greenwood, IN
WB9SSF **Primrose**, Richard W. Jr, Lake Zurich, IL
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WA9TLT **Albertson**, Clarence E., Villa Park, IL
W9UU **Hollowell**, Donald R., Paris, IL
WA9VVV **Garibay**, Arthur S., Lemont, IL
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KW9X **Clark**, James L. Jr, Channahon, IL
KA9YBN **Griffin**, William I., Mundelein, IL
N9YJG **Peterson**, David C., Chippewa Falls, WI
W9ZJZ **Korn**, Thomas F., Heber Springs, AR
K9ZOG **Kubik**, Carl M., Cicero, IL
WD0AFW **Campbell**, Sidney G., Springfield, MO
N0EKQ **Keith**, Thelma G., Raymore, MO
W0EKZ **Maxton**, Robert E., Wichita, KS

KA0EYB **Kettunen**, Ann Marie M., Mountain Iron, MN
KB0FVT **Patterson**, Paul A., Sioux City, IA
K0GOC **Ennenga**, James L., Knoxville, TN
ex-K0HNW **Vanek**, John, Columbus, NE
K0HVA **Chick**, Warren S., Englewood, OH
AB0IQ **Clapp**, Gary E., Kenosha, WI
WB0JGM **Stiles**, Bonnie J., Arvilla, ND
♦WA0KAQ **Ewing**, William E., Pueblo West, CO
ex-N0KGL **Svihel**, Leonard, Le Sueur, MN
K0LDL **Lowrance**, Dean, Camdenton, MO
KA0LIC **Robison**, Holly E., El Dorado Springs, MO
WA0RLO **White**, Virgil M., Sterling, CO
K0RZB **Sawyer**, Milton J. III, Andover, MN
K0SEP **Arnold**, Paul F., Raymore, MO
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KB0VPO **Storm**, Chauncey G., Kansas City, MO
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VE3OUM **Moreton**, A. George, Willowdale, ON, Canada

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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.

The Considerate Operator's Frequency Guide

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

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

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

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

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

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

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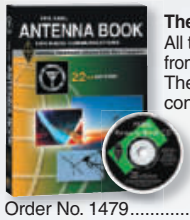

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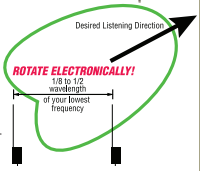

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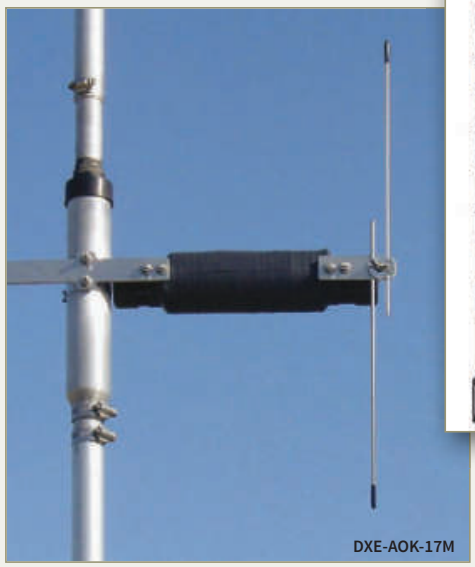

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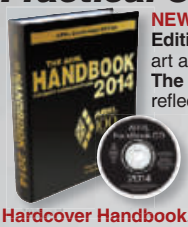

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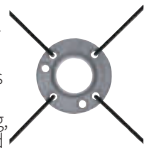

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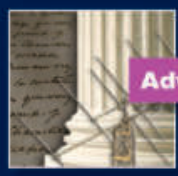

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Bulk Cable	Impedance	Length	Price
Low-Loss Mini-8 Cable			
DXE-8X	50 Ω	per foot	**$0.31**
DXE-8X-1000	50 Ω	1,000'	**$259.99**
Low-Loss Cable			
DXE-213U	50 Ω	per foot	**$0.89**
DXE-213U-500	50 Ω	500'	**$409.99**
DXE-11U	75 Ω	per foot	**$0.52**
Premium Low-Loss Cable			
DXE-400MAX	50 Ω	per foot	**$0.82**
DXE-400MAX-500	50 Ω	500'	**$364.99**
Low-Loss Foam Cable			
DXE-8U	50 Ω	per foot	**$0.79**
DXE-8U-500	50 Ω	500'	**$359.99**
Highly Flexible Cable			
DXE-58AU	50 Ω	per foot	**$0.29**
Flooded Jacket Cable			
DXE-F6-CTL	75 Ω	per foot	**$0.19**
DXE-F6-1000	75 Ω	1,000'	**$149.95**

Multi-Conductor Control Cable

The ideal cable to control your rotator or antenna switch, this color-coded stranded copper cable is reliable and flexible. A vinyl jacket shields it from the elements and it is available by the foot and in bulk spools. Find all the details at DXEngineering.com.

Part Number	Conductors (Gauge)	Description	Price/ Foot
COM-CW3	3 (20 AWG)	Standard	**$0.25**
COM-CW4	4 (20 AWG)	Standard	**$0.28**
DXE-CW8	2 (18 AWG) 6 (22 AWG)	Standard	**$0.48**
DXE-CW8-HD	2 (16 AWG) 6 (18 AWG)	Heavy Duty	**$0.89**
DXE-CW9	9 (24 AWG)	CAT5e	**$0.32**
DXE-CW9S	9 (24 AWG)	Shielded	**$0.36**

DXE-8X BNC Jumper Cables

These male BNC jumper cables use secure, crimped connectors and weatherproof shrink tube strain relief. They are Hi-Pot and high voltage tested. In addition to these 50 Ω assemblies, 75 Ω cables are available as well.

DXE-8XDB002 2' Length.....**$14.25**
DXE-8XDB003 3' Length.....**$14.75**
DXE-8XDB006 6' Length.....**$15.75**
DXE-8XDB012 12' Length.....**$17.75**
DXE-8XDB025 25' Length.....**$21.75**
DXE-8XDB050 50' Length.....**$32.75**

Phasing Cables

DX Engineering provides precision, electrically-tuned phasing lines for your 50 or 75 Ω applications. Choose from pre-manufactured four-square and two-antenna array cables or contact us with your custom application.

Multi-Conductor Heavy Duty Tinned Copper Flat Braid

A critical part of any grounding system, this Flat Braid is made with terminals for quick, easy installation. See more sizes and grounding solutions at DXEngineering.com.

Part Number	Length	Price
7 AWG Braid Rated at 85 Amps 1" Wide, for a 1/4" Stud		
DXE-TCB10-RT01	1'	**$5.75**
DXE-TCB10-RT03	3'	**$8.75**
DXE-TCB10-RT05	5'	**$12.75**
DXE-TCB10-RT10	10'	**$18.75**
10 AWG Braid Rated at 53 Amps 1/2" Wide, for a #10 Stud		
DXE-TCB05-RT01	1'	**$4.75**
DXE-TCB05-RT03	3'	**$5.75**
DXE-TCB05-RT05	5'	**$6.75**
DXE-TCB05-RT10	10'	**$9.75**

DX Engineering is the Best Place to Get Coax, Here's Why:

- 100% High Voltage (Hi-Pot) Tested
- Your **Coax Cable Order is Shipped FREE** Anywhere in the Contiguous 48 States
- Weatherproof: Adhesive Shrink Tubing Seals Connections
- Silver-plated PTFE-insulated Connectors
- Hand Crafted by Top Techs

See DXEngineering.com for more connector options.

Black PVC Jacket

DXE-8U Low-Loss Foam Dielectric Cable

- .405" high-flex PVC jacket

Attenuation per 100 feet	Power Rating	Efficiency
0.3 dB @ 5 MHz	5.4 kW	93%
0.5 dB @ 10 MHz	4.1 kW	90%
0.9 dB @ 30 MHZ	2.2 kW	81%
1.2 dB @ 50 MHz	1.8 kW	77%
2.2 dB @ 150 MHz	1.0 kW	60%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-8UDU002	2'	**$13.25**
DXE-8UDU003	3'	**$13.75**
DXE-8UDU006	6'	**$16.75**
DXE-8UDU025	25'	**$41.75**
DXE-8UDU050	50'	**$64.75**
DXE-8UDU100	100'	**$117.75**

UV-Resistant, Non-Contaminating, Black PVC Jacket

DXE-213U MIL-Spec Cable

- .405" Type II UV-resistant jacket is non-contaminating and suitable for outdoor use

Attenuation per 100 feet	Power Rating	Efficiency
0.4 dB @ 5 MHz	4.9 kW	90%
0.6 dB @ 10 MHz	3.4 kW	87%
1.0 dB @ 30 MHz	2.0 kW	79%
1.3 dB @ 50 MHz	1.5 kW	73%
2.4 dB @ 150 MHz	0.9 kW	57%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-213UDU003	3'	**$14.75**
DXE-213UDU006	6'	**$18.75**
DXE-213UDU012	12'	**$24.75**
DXE-213UDU025	25'	**$39.75**
DXE-213UDU050	50'	**$68.75**
DXE-213UDU075	75'	**$95.75**
DXE-213UDU100	100'	**$118.75**
DXE-213UDU150	150'	**$171.75**

UV-Resistant, Black PE Jacket

DXE-8X Low-Loss Foam Dielectric Cable

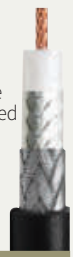
Known as RG-8X or Mini-8

- Very flexible; ideal for short, in-shack jumper cables
- .242" Type II jacket is non-contaminating and UV-resistant
- Direct-bury

Attenuation per 100 feet	Power Rating	Efficiency
0.6 dB @ 5 MHz	3.0 kW	86%
0.9 dB @ 10 MHz	2.2 kW	81%
1.4 dB @ 30 MHz	1.2 kW	69%
2.0 dB @ 50 MHz	0.9 kW	62%
3.8 dB @ 150 MHz	0.4 kW	42%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-8XDU003	3'	**$11.75**
DXE-8XDU006	6'	**$12.75**
DXE-8XDU012	12'	**$16.75**
DXE-8XDU025	25'	**$21.75**
DXE-8XDU050	50'	**$32.75**
DXE-8XDU075	75'	**$43.75**
DXE-8XDU100	100'	**$53.75**
DXE-8XDU150	150'	**$74.75**

UV-Resistant, Non-Contaminating, Black PVC Jacket



DXE-400MAX Low-Loss Cable

- Gas-injected foam, polyethylene dielectric bonded tape foil covered by a braided copper shield
- .405" low-density UV-resistant polyethylene jacket is ideal for outdoors
- Direct-bury

Attenuation per 100 feet	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	0.7kW	47%

Pre-cut Cable with Connectors		
Part Number	Length	Price
DXE-400MAXDU003	3'	**$16.75**
DXE-400MAXDU006	6'	**$18.75**
DXE-400MAXDU018	18'	**$35.75**
DXE-400MAXDU025	25'	**$43.75**
DXE-400MAXDU050	50'	**$66.75**
DXE-400MAXDU075	75'	**$99.75**
DXE-400MAXDU100	100'	**$119.75**
DXE-400MAXDU150	150'	**$179.75**

The #1 Line of Autotuners!

AT-1000ProII

LDG Electronics' 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

NEW! AL-100

The AL-100 is compatible with all Alinco radios including the new DX-SR8T. Includes Alinco interface cable.

The AL-100 is the definitive low cost automatic antenna tuner for the definitive low cost Amateur transceiver! It has been designed from the ground up to provide the power handling you asked for, in a small, lightweight package that is perfect for portable as well as sitting on your desk in your shack!

Suggested Price $149.99

NEW! USB-100

The USB-100 provides serial communication for the AT-1000 and AT-600 over a USB port to your computer. Third party software will be available to provide communication including Army MARS.

Suggested Price $49.99

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***

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

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***

- ***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

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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***

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***

NEW! RT-100

A Technological Breakthrough in Remote Tuning!

The RT-100 is a coax in / coax out tuner designed to be placed near the feedpoint of the antenna. If you're worried about power loss due to SWR in your feedline, the RT-100 is the answer. Place the RT-100 near the feedpoint and virtually eliminate all feed line loss due to SWR.

The RT-100 is DC powered over the coax, so add your own DC injection circuit or use the LDG RC-100 to power and control the tuner from your shack. The RC-100 will provide DC power over the coax as well as control for Auto mode, Lock, and Tune.

Suggested Price $199.99

Optional RC-100 $49.99

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!

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hy-gain® Rotators

. . . the first choice of hams around the world!

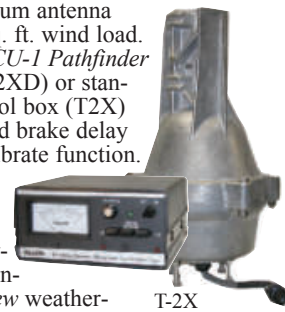
HAM-IV

HAM-IV **$649.95**

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II



For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II **$449.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V **$1099.95** with DCU-1

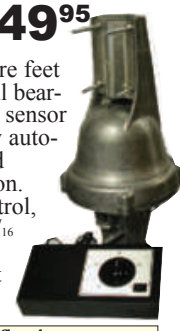
For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

ROTATOR OPTIONS

MSHD, $109.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $49.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

AR-40

AR-40 **$349.95**



For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A **$1499.95**

King-sized antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

Digital Automatic Controller

DCU-1 **$749.95**

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-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.

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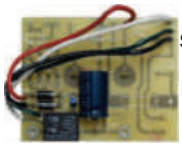
NEW! Automatic Rotator Brake Delay



RBD-5 **$29.95**

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

hy-gain®

Antennas, Rotators & Towers

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All REBATES end 12/31/2013

FT-270R 2M FM HT ($20 REBATE)

• TX: 144-148 • RX: 136-174 • Power: 5/2/0.5W
• Memories: 200 • Extra large LCD display & speaker

VX-6R 2M/440 FM Dual Band HT ($40 REBATE)

• TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
• Power: 5/2.5/1/0.3W (1.5W on 220) • Memories: 900
• Submersible 3 feet for 30 minutes

VX-8DR 4-Band FM HT ($80 REBATE)

• TX: 50-54, 144-148, 222-225, 430-450 MHz
• RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
• Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
• Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand mic provides you with APRS® data

FT-1900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz • Power: 55/25/10/5W • 3W of Audio • 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 Remote Kit included!

FT-8800R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
• Crossband repeat • YSK-8900 Remote Kit included!

FT-8900R Quad-Band FM Mobile

• Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 Rem. Kit included!

FT-857D 100W HF/VHF/UHF Mobile

• TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200 • YSK-857 included!

FT-897D 100W HF/VHF/UHF Portable

• Similar to the FT-857D but can also operate 20W using optional FNB-78 13.2V @ 4.5 Ah NiMH battery packs

FT-950 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 100 • Automatic 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 of the FTDX-5000
• Built-in USN interface • High-speed auto tuner

FTDX-5000MP

FTDX-5000 Series – Covers HF and 6M;

Three different configurations all running 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • "D" and "MP" models have SM-5000 Station Monitor • "MP" has high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000MP With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

CLOSE-OUTS

FTDX-5000 Basic Model & ±0.5ppm TCXO

FTDX-5000D w/Station Monitor & ±0.5ppm TCXO

IC-V80 2M FM Handheld

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 5.5/2.5/0.5W • Memories: 207
- Comes with NiMH Battery and Wall Charger

IC-V80 SPORT 2M FM Handheld

- No NiMH Battery or Charger • Has AA Battery Case

ID-51A 440 FM & D-STAR MOBILE

- TX: 144-148, 420-450 MHz
- RX: 0.495-999 MHz (cell blkd) • Power: 5/0.5W
- Memories: 1304 • D-Star Ready

IC-2300H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207

ID-880H 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blocked) • Power: 50/15/5W • Memories: 1052 • D-Star built-in, ready to go!

IC-7000 Multimode HF/VHF/UHF Mobile

- TX: HF/6M/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 with sharp or soft filter shape

IC-7100 HF/VHF/UHF All Mode Transceiver

- TX: HF/6M/2M/440MHz • RX: 0.03-199.999, 400-470 MHz MHz • Power: 2-100W/2-50W (2M)/2-35W (440) • Memories: 495, 900 D-Star Repeater Channels •Remote Head • Intuitive Touch Screen Interface • D-Star DV Mode • Detachable Angled Screen • SD Memory Card Slot • USB Port • Optional RS-BA1 Remote Control Software • Optional RC-28 USB Remote Encoder

IC-7200 HF/6M Portable Transceiver

- 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 and Audio In/Out

IC-7410 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- 15kHz 1st IF Filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
- Much faster DSP unit compared to the IC-746PRO
- Automatic antenna tuner • USB connector for PC control

IC-7600 HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 101 • 5.8 inch color screen • High-resolution real spectrum scope • Automatic antenna tuner

IC-9100 HF/6/2M/440 MHz All Mode

- TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
- Power: 2-100W HF/6/2M & 2-75W 440 MHz
- Memories: 297 • Optional D-Star Board • Auto Tuner
- +30dBm class third-order intercept point • Optional 3 kHz & 6 kHz Roofing Filters (first IF) • USB Port for PC Control • Optional Remote Control Software • Optional RC-28 USB Remote Encoder • Much More!

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The *Navigator* Sound Card Modem - New at Timewave!

Available November 2013!!

- Single USB connection to computer
- USB Sound Card built-in
- USB Powered
- Universal Rig Control built-in - logic level +/-, CI-V, CAT, & RS-232!
- Software Configuration - No jumpers!
- FSK Controller for Precision RTTY
- K1EL Paddle & Keyboard Precision CW
- Separate COM ports for PTT, FSK, CW, CI-V & RS-232

The *Navigator* joins the PK-232SC+ Multimode Data Controller in Timewave's versatile line of data controllers, TNCs and and sound card modems.

The *Navigator* is a complete USB sound card modem featuring a proven USB audio sound card chip, six FTDI USB serial COM ports, a K1EL WinKey keyer, True FSK and rig control connections for every radio. It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. A second audio input lets you use both receivers in a dual receiver radio. The logic level and RS-232 rig control ports support your Icom CI-V, Yaesu CAT, Kenwood and other radios. Front panel controls set both RX audio levels, TX audio ouput level, audio monitor level and the CW speed. There are no internal configuration jumpers - just conveniently set the software-controlled configuration settings from your PC.

Need Software? Check the new Ham Radio Deluxe & Radio Operating Center bundle!
Optimized for the Navigator, PK-232SC+ and other Timewave/AEA TNCs *www.ham-radio-deluxe.com*

PK-232SC+ with New Dual Port Option!

PK-232SC+ Multimode Data Controller*

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100,000 sold - All-time top selling data controller!

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- Single USB connection to computer
- USB Sound Card built-in
- 3-Way Rig Control built-in - logic level, RS-232 & USB!
- Computer isolated from radio
- Real FSK and high-speed keyboard CW

For the first time in 23 years, we tweaked the PK-232's main PC board! Now with a dual port option, the incredible PK-232SC+ again expands its role in your radio station. The new PK-232SC+ can operate legacy modes on one port and sound card modes on the other - simultaneously! The SC+ connects to your computer with a single USB cable - no audio cables, no RS-232 cables! It has a built-in USB sound card with isolated audio I/O to your radio to prevent ground loops. The logic level and RS-232 rig control is optically isolated for your Icom CI-V, Yaesu CAT, Kenwood and other radios. A new optically isolated DTR PTT option works with legacy sound card software and radios. We even added a pair of USB ports for that new radio with USB rig control and other accessories.

**Upgrade any PK-232 to the PK-232SC with New Lower SC & DSP Upgrade Combo Pricing!*

Customize your PK-232 installation with our complete line of upgrades, accessories and cables.

- **HamLinkUSB™ Rig Control+**
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MFJ ANALYZERS

MFJ-259B . . . World's Most Popular Antenna Analyzer!

MFJ-259B
$289.95

Super easy-to-use!
Dual analog meters, LCD

The world famous MFJ-259B gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance from 1.8 to 170 MHz.

MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/Inductance Meter and more!

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

Determine velocity factor, coax cable loss in dB, length of coax and distance to short/open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

Read inductance (uH) and capacitance (pF) at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

Built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. Use 10 AA or Ni-Cad or Ni-MH batteries (not included) or 110 VAC with MFJ-1312D, $15.95. Rugged metal cabinet only 4x2x6¾ inches.

MFJ *No Matter What*™ Warranty

Every MFJ analyzer is protected by MFJ's famous one year No Matter What™ limited warranty. We will repair or replace your MFJ analyzer (at our option) for a full year.

MFJ-249B, $269.95. If digital display is all you need MFJ-249B does everything MFJ-259B does without analog meters.

More hams use MFJ analyzers than all others in the world!

MFJ-269 1.8-170 MHz *plus* 415-470 MHz, 12-bit A/D

MFJ-269
$389.95

MFJ-269 is a *super* MFJ-259B that adds 415-470 MHz and 12-bit A/D converter that gives you much better accuracy. *Complex Impedance Analyzer* reads series/*parallel* equivalents and magnitude/phase. *CoaxCalculator*™ gives line length from electrical degrees and vice-versa for any frequency, Velocity Factor, coax loss in dB. Use any characteristic impedance 10-600 Ohms. Has LCD log SWR bargraph, N-connector.

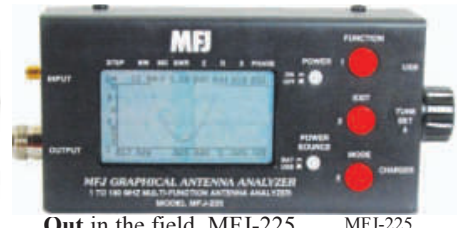
MFJ-266C 1.5-65, 105-230 300-490 MHz -- *all* Ham Bands

New! 220 MHz band!

MFJ-266C
$359.95

MFJ-266C *new* compact *wide-range* analyzer covers HF (1.5-65 MHz), VHF (105-230 MHz, including 220 MHz band) and UHF (300-490 MHz). Antenna Analyzer mode reads frequency, SWR, complex impedance *simultaneously*. 500 MHz freq. counter mode has 100 Hz resolution, measures relative field strength/frequency for tracking interference. Signal Generator mode, solid-state switching, and electronic tuning. Backlight, N-connector.

MFJ-225 1.5-180 MHz *continuous* Two-Port Graphic Analyzer



MFJ-225
$399.95

Out in the field, MFJ-225 is a compact completely *self-contained handheld graphing analyzer*. On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run detailed data analysis and print out stunning color-graphic plots to document your work! Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using full-screen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, return loss, phase angle, more. DDS generator.

MFJ-269*PRO*™ *Analyzer*

MFJ-269Pro, $419.95.
Like MFJ-269, but UHF range covers *430 to 520 MHz* to include commercial and industrial frequencies. Rugged protective shell protects knobs, switches, meters, digital display for commercial, industrial and lab work.

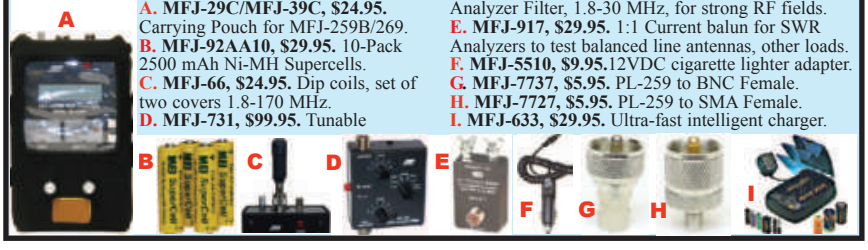
HF/VHF/UHF SWR Analyzer™ *CLOSEOUT!!!*

MFJ-266B, $299.95.
Has all the features of MFJ-266C but MFJ-266B covers 1.5-65 MHz, 85-185 MHz and 300-490 MHz. Does not cover 220 MHz band.

HF/6M SWR Analyzer, 1-60 MHz

MFJ-213, $199.95.
Reads SWR, complex impedance, impedance magnitude. Measures capacitance, inductance, field strength, frequency, generate test signals. Fine tune stubs, analyze coax, test baluns, RF transformers, plus other RF tasks.

MFJ SWR Analyzer Accessories



A. MFJ-29C/MFJ-39C, $24.95. Carrying Pouch for MFJ-259B/269.
B. MFJ-92AA10, $29.95. 10-Pack 2500 mAh Ni-MH Supercells.
C. MFJ-66, $24.95. Dip coils, set of two covers 1.8-170 MHz.
D. MFJ-731, $99.95. Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.
E. MFJ-917, $29.95. 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.
F. MFJ-5510, $9.95. 12VDC cigarette lighter adapter.
G. MFJ-7737, $5.95. PL-259 to BNC Female.
H. MFJ-7727, $5.95. PL-259 to SMA Female.
I. MFJ-633, $29.95. Ultra-fast intelligent charger.

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MFJ TUNERS

New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore™ Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive™* peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D **$389.95**

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What™* Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What™* limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob *Differential-T™*

MFJ-986 **$349.95**

Two knob tuning (differential capacitor and *AirCore™* roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore™* roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$ x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

MFJ-969 **$219.95**

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E *deluxe* 300 Watt Tuner

MFJ-949E **$179.95**

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune™*, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E *super value* Tuner

MFJ-941E **$139.95**

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M *mobile* Tuner

MFJ-945E **$129.95**

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 *portable/QRP* Tuner

MFJ-971 **$119.95**

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B *smallest* Versa Tuner

MFJ-901B **$99.95**

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 *Tiny Travel* Tuner

MFJ-902 **$99.95**

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

MFJ-16010 **$69.95**

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 *6 Meter* Tuners

MFJ-906 **$99.95**

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921/924 **$89.95**

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 *artificial* RF Ground

MFJ-931 **$109.95**

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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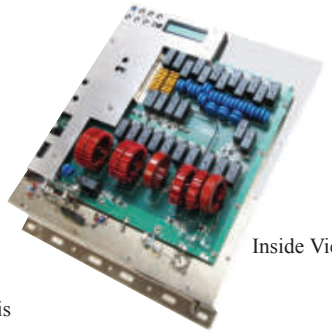
MFJ 1500 Watt *Remote* Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes -- greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$769.95

Bottom Chassis



Inside View

Tune your antenna AT your antenna!

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and *prevent tuning* caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive *StickyTune™ always* tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has *ceramic* feed-through insulator for wire antennas. 2 kV *Teflon*(R) insulated SO-239 -- prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at *full* 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ *InstantRecall*™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ *Intelli-Tune*™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ *AdaptiveSearch*™ searches *only* the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional MFJ-1316, $21.95. Weighs 9.5 lbs. 13¼Wx6¾Hx17½D inches.

600W *Remote IntelliTuner™*

MFJ-994BRT
$399.95

MFJ-994BRT -- perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for outdoor use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet, 9¼Wx3Hx 14¼D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

300W *Remote IntelliTuner™*

MFJ-993BRT
$299.95

MFJ-993BRT handles 300 Watts SSB/CW and matches an *extra-wide* 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully *weather-sealed* for remote outdoor or marine use. Remotely powered through coax. Tough, durable, *built-to-last* cabinet measures 9¼Wx3Hx14¼D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

200W *Remote IntelliTuner™*

MFJ-926B
$279.95

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

200W *Remote Econo Tuner™*

MFJ-927
$259.95

MFJ-927, 200 Watts SSB/CW, 6-1600 Ohms, Coax/Wire antennas, 1.8-30 MHz. Weather-sealed, BiasTee. 7½Wx5¼Hx8½D in.

MFJ-2990
$359.95

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide-range *MFJ automatic tuners* at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you *simply put it up!* Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $34.95.** All band ground radial system.

Free MFJ Catalog
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

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Tech Help: (662) 323-0549
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http://www.mfjenterprises.com

10 Bands: 80-2 Meters

$349.95 MFJ-1799

- ***10 Bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6, 2 Meters including 75/80M***
- ***Handles 1500 Watts PEP SSB/CW***
- ***No ground or ground radials needed!***
- ***Low radiation angle for great DX, omni-directional, automatic bandswitching***

Only 20 feet tall! Mounts anywhere!

Self-supporting and just 20 feet tall. Mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, mobile homes, roofs, tower mounts.

Highly Efficient End-Loading

No lossy traps! *End-loading*, the most efficient loading known -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

High-Q loading coils are wound on tough, low loss fiberglass forms with *Teflon*(R) wire where needed.

Entire Length Radiates

End-loading results in uniform current distribution and the *entire length radiates*. This puts the radiating elements up high giving you more QSOs.

No Feedline Radiation/Distorted Pattern

MFJ's center-fed *balanced* halfwave vertical dipole design is decoupled and isolated from the feedline with MFJ's *AirCore*™ high power balun. It can't saturate, no matter how high your power.

This gives you consistently high performance by killing feedline radiation, pattern distortion, SWR shifts, RFI, noise pickups.

Easy to Tune!

Tuning to your favorite part of one band does not affect other bands and is done at the *bottom* of the antenna by simply adjusting a length of the capacitive hat.

Built-to-Last!

Incredibly strong *solid* 1 1/4 inch diameter fiberglass center insulator and 1 3/8 inch diameter 6061 T6 aircraft strength aluminum tubing will make it the only antenna you will ever need.

MFJ 6-Band Halfwave Vertical Antenna

MFJ-1796 **$229.95**

MFJ-1796, like MFJ-1799, but for 6 bands: 40, 20, 15, 10, 6 and 2 Meters. 12 foot high, 24 inch foot print, mounts anywhere. No ground, no radials, self-supporting.

MFJ's Super High-Q Loop™ Antennas

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed. Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily tuned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its directivity reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some real DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 Meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *G5RV Antenna*

MFJ-1778 **$44.95**

Covers all bands, 160-10 Meters with antenna tuner. 102 feet long. Can use as inverted vee or sloper. Use on 160 M as Marconi. 1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

Free MFJ Catalog

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Prices and specifications subject to change.

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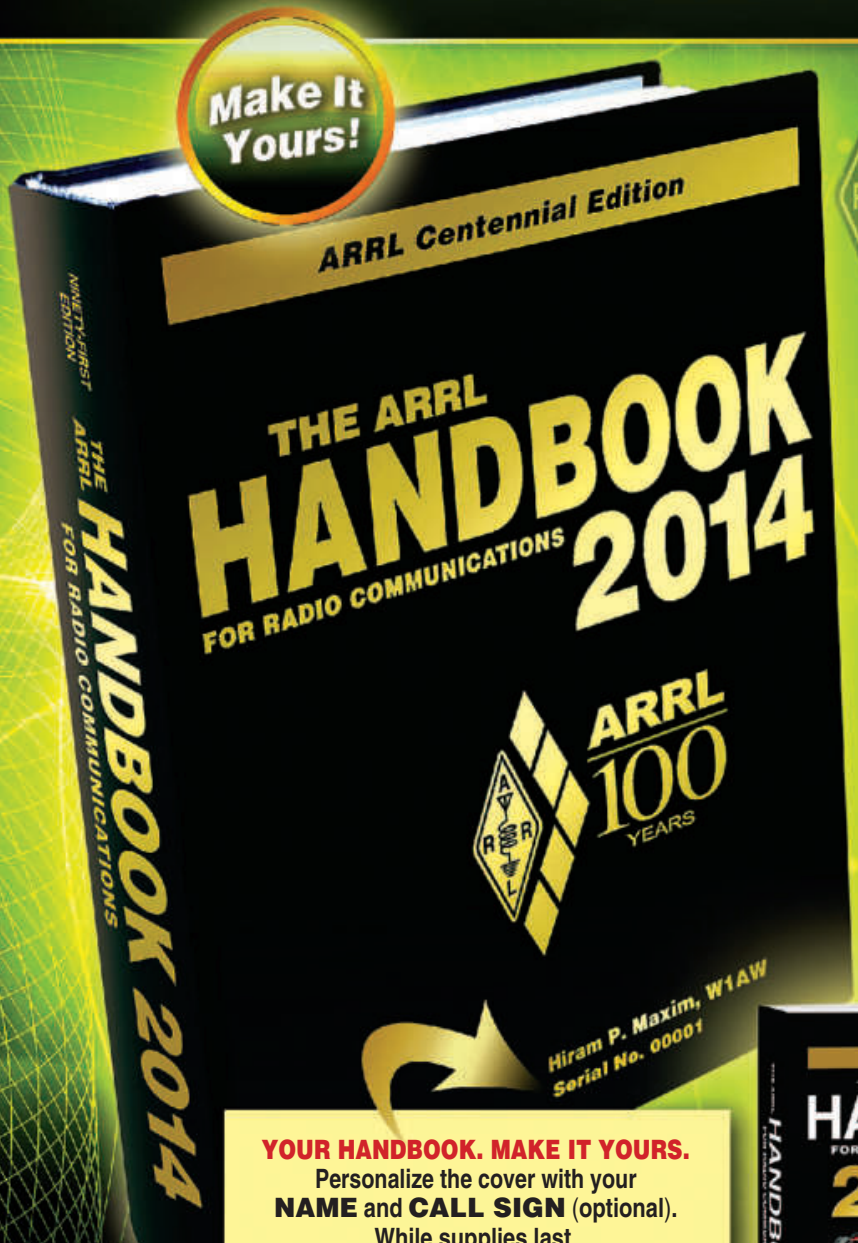
Celebrate 100 years of ARRL with the 2014 Handbook!



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Celebrate ARRL's first 100 years of advancing the art and science of radio with this commemorative **ARRL Centennial Edition of The Handbook**. Always updated, this edition has been extensively revised to reflect the latest technology and innovation in the field of applied electronics and communications. Written by radio amateurs…for radio amateurs, and other experimenters, engineers and students.

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QST 11/2013

MFJ Big Stick™

18 Foot *Portable* Telescoping Antenna

Only 28 inches collapsed . . . Covers 40-6 Meters -- No gaps!

MFJ-2286
$99.95

The MFJ BigStick™ antenna is for the on-the-go Ham who is hungry for the next great QSO anywhere or anytime!

Full Size Performance

For top portable performance, carry a *Big Stick* for the loudest, strongest on-the-go signal on the band!

MFJ's extra long 17 foot stainless-steel telescoping whip gives you *full-size antenna* for full size performance 20 to 6 Meters but collapses to just 28 inches.

An ultra low loss, high-Q adjustable *air-wound* loading coil gives you highly efficient operation 30 and 40 Meters.

This extra long radiator and ultra low loss loading coil is a winning combination that stands head and shoulders above shorter backpack antennas.

True Backpack Portability

Antenna is over 18 feet long fully extended, but disassembles and collapses to 28 inches in seconds. Fits into most backpacks or suitcases! And at just over 2 pounds you'll hardly know you are packing it!

True General Coverage

Tapped loading coil covers 7.0-55.0 MHz without gaps. Great for Ham Bands and outstanding for image-free shortwave broadcast!

Everything you need

Everything is included for instant operation. Pipe/Mast mount quickly and easily mounts to any pipe or mast up to 1/2 inch. SO-239 for coax. 3/8-24 antenna connector.

Counterpoise kit included: Ensures low SWR, high efficiency.

Rugged Construction

All aluminum, stainless steel construction ensures years of excellent performance. *One Killowatt rated* components guarantee electrical safety.

40-2 Meters Apartment Antenna

MFJ-1622
$99.95

MFJ-1622 universal mount/clamp lets you attach it to window frames, balconies and railings. Works great indoors mounted to table/bookshelf. It's not a 5-element yagi, but you'll work your share of exciting DX! Highly efficient air wound *"bug catcher"* coil, telescoping 4½ foot radiator. Collapses to 2½ feet for easy storage and carrying. Includes coax, choke balun, counterpoise wire, safety rope. Operating frequency adjusted by moving "wander lead" on coil and adjusting the counterpoise for best SWR. ***Optional DX-Getter,*** MFJ-1977, $44.95. Stainless-steel 12-ft whip, 26 inches collapsed.

MFJ *BigEAR™*

8-Band Portable Dipole

34 feet Radiators, 7-55 MHz

For hams on-the-go!

Operate anywhere, anytime with a strong QSO grabbing signal!

34-Feet stainless steel radiator gives you *full-size dipole* performance on 20-6 Meters and highly efficient ultra *low loss* loaded dipole performance on 30/40 Meters. Collapses to 27 inches to fit into any suitcase or backpack. No ground or counterpoise needed.

True general coverage -- tunes up with low SWR on any frequency 7-55 MHz. Handles QRP to full killowatt PEP.

Ultra low loss high-Q *air-wound* loading coil. Built-in Guanella current balun kills feedline radiation, pattern distortion, RF shifts, RFI and noise pickup.

Distinctive V-shaped elements are set 45 degrees from the horizon to keep element tips high in the air. This maximizes radiation, minimizes ground loss and prevents hazardous contact.

MFJ's heavy-duty *NoTool™* mast lock lets you easily and quickly mount on any tripod or mast up to 7/8 inches. SO-239 for coax. With fewer parts to assemble, set-up and tune-up is much faster!

18 foot Telescopic Fiberglass Mast with Tripod

MFJ-1919EX, $139.95.

***Put your antennas anywhere and get them up high with this super-strong* 18 foot telescoping fiberglass mast and heavy-duty steel MFJ-1919 tripod.**

QuickClamps™ easily collapses mast to 5 feet. Mast has thick 1/8 inch wall, .75 inch diameter top, 1.5 inch bottom. 15 lbs.

All tripods are black heavy-duty steel with braced triangle base, non-skid feet and mast lock.

MFJ-1918EX, $89.95. MFJ-1918 *tripod with super strong 9.5 foot telescoping fiberglass mast*. Collapses to 3.8 feet. *QuickClamps™*. Mast has thick 1/8" wall, ¾ inch top, 1 inch bottom. Weighs 6.5 lbs.

Tripods Only

MFJ-1919, $89.95, *Large tripod*. Supports 100 lb. antenna. Built-in 1.4 inch diameter mast extends 7.8 feet. Collapses to 4.5Hx.5D feet. Triangle base spreads to 4.8 feet on a side. Weighs 9.75 lbs.

MFJ-1918, $49.95, *Smaller tripod*. Supports 66 lbs. 1 inch diameter mast extends 6 foot. Collapses to 3.2Hx.3D feet. Triangle base spreads to 2.75 feet. Weighs 6.75 lbs.

17 foot *Stainless Steel* Telescoping Whip

MFJ-1979, $59.95. Super-strong, super long *17 foot stainless steel* telescoping whip. 27 in. collapsed. 10 sections. 3/8-24 threaded base.
MFJ-1977, $44.95/12ft;**MFJ-1796, $39.95**/10ft
MFJ-1974, $34.95/8ft;**MFJ-1972,** $14.95/4½ft

Single-band Rotatable *mini*-Dipoles

Use these inexpensive, lightweight, *isolated* mini-dipoles when space is limited for temporary or permanent installations. Rotate to null QRM/noise and to focus your signal. Coax choke balun, mast not included. For 40/30/20/17/15/12/10/6 Meters. Order **MFJ-22XX** (insert band in "XX") **$44.95**. 75/60 Meters, $49.95 each. Total length 14 feet. For mounting masts up to 1.25" OD.

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http://www.mfjenterprises.com ***for instruction manuals, catalog, info***

MFJ Off-Center Fed Dipoles

No antenna tuner needed!

OCFDs professionally engineered for 40/20/10/6; 60/30; 80/40; 160/75 Meters with wide bandwidth, ground-reinforced gain, balun, matching network!

How good are these MFJ *Off Center Fed Dipoles*?
http://www.eham.net/reviews/detail/8917 for reviews by real users.
Visit ***http://www.mfjenterprises.com/ocfd/*** *for more information.*

New MFJ wideband Off-Center Fed Dipoles (OCFD) deliver ground reinforced gain that more expensive multiband verticals can't match. Plus, on second harmonic bands the clover-leaf pattern doubles signal intensity yet again! The MFJ-2010 and MFJ-2012 can even quadruple your signal on the higher bands!

No Tuner Needed!

MFJ's computer modeling determined a feedline offset that gives the *same* feedpoint impedance on every band. MFJ's exclusive *ExactRatio*™ broadband RF transformers convert this impedance to 50 Ohms to give you low SWR on *all* bands.

Use as Dipole, Vee, Sloper

Use as dipole, inverted Vee or sloper. Horizontal mounting up 35-70 feet is ideal. Feed block has attachment points for tower or tree support.

Stealthy -- Low Profile

The single wire radiator and compact matching network are virtually invisible in the air.

Built-in Current Balun

OCFDs *require* excellent current baluns to eliminate feedline radiation. *Built-in* Guanella current-balun has 30-dB of *measured* common-mode rejection 80-10 Meters. Kills feedline radiation, pattern distortion, SWR shifts, RFI, noise pickup.

Best SWR at Typical Height

Feedpoints are compensated for ground proximity at typical backyard mounting height to ensure best SWR at your location.

98 Percent Efficient

MFJ's unique matching network delivers 98% of every watt you apply directly into the antenna's full-sized dipole radiator for unparalleled efficiency.

Handles 1500 Watts

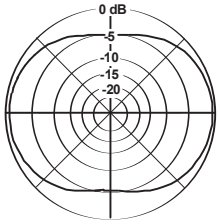
The MFJ-2012/2014/2016 feature heavy-duty high power components to handle 1500 Watts PEP SSB/CW.

Built-to-Last

Rugged 14-guage 7-strand copper antenna wire, porcelain end insulators. Pull-tested to 200 lbs. UV-resistant, stainless-steel hardware, *Teflon*® SO-239 connector -- *built-to-last*.

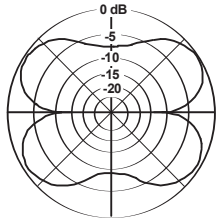
Modeled Azimuth Radiation Patterns, Measured SWR for MFJ-2012/2010*

160M/MFJ-2016, 80M/MFJ-2014, 60M/MFJ-2013, 40M/MFJ-2012/10



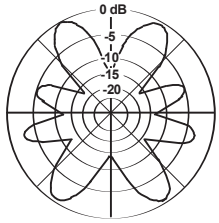
Outer Ring 6.5 dBi

80M/MFJ-2016, 40M/MFJ-2014, 30M/MFJ-2013, 20M/MFJ-2012/10



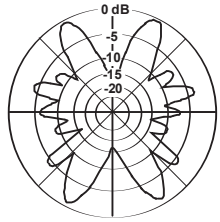
Outer Ring 9.1 dBi

10M/MFJ-2012/MFJ-2010



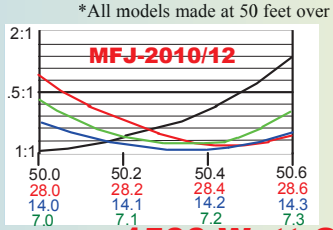
Outer Ring 9.8 dBi

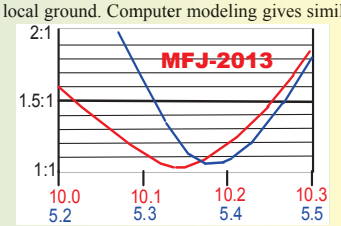
6M/MFJ-2012/MFJ-2010

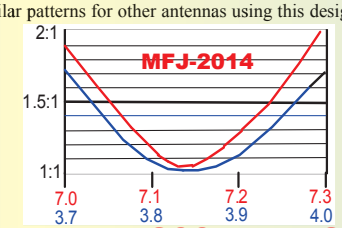


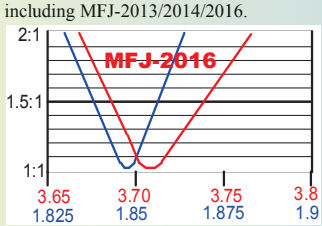
Outer Ring 11.5 dBi

*All models made at 50 feet over local ground. Computer modeling gives similar patterns for other antennas using this design including MFJ-2013/2014/2016.

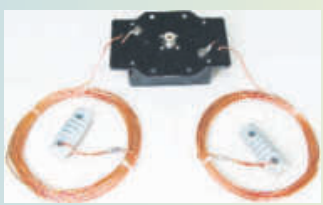








1500 Watt OCFD Models



MFJ-2012, $79.95. For 40, 20, 10 and 6 Meters. Day or night, there's always DX on one of these bands. If you hear it, you'll work it -- even QRP! MFJ-2012 is 66 feet long.

MFJ-2012
$79.95
40, 20, 10, 6M

MFJ-2014, $99.95. DX-Caster for 75 and 40 Meters: Replace your old 75-Meter dipole and add 9-dBi of power-house coverage on 40 Meters for superb DX. 122 feet long.

Normally, a OCFD cut for 3.85 MHz resonates on 7.7 MHz. The frequency compensated MFJ-2014 resonates at *mid-band* on both 75 and 40!

MFJ-2014
$99.95
75, 40 Meters

MFJ-2016, $129.95. For 160 and 75 Meters. Covers low end of 160 Meters plus delivers 9-dBi gain in 75 Meter SSB DX window. MFJ-2016 is 240 feet long with strong porcelain end insulators.

300 Watt OCFD Models

MFJ-2010, $59.95. For 40, 20, 10 and 6 Meters. Perfect for low-profile set-ups, portable, QRP, and DX-peditions.Weighs less than two pounds, tucks easily into a backpack and pulls high in the air with lightweight cord. The 66 foot wire element and compact matching network are virtually invisible in the air.

MFJ-2010
$59.95
40, 20, 10, 6 Meters

MFJ-2013, $79.95. For 60/30 Meters. Get full halfwave dipole performance on 60-Meters plus up to 9-dBi of globe spanning gain on 30M. Brings a whole new meaning to 30-Meter QRP. 86 feet long.

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MFJ . . . The World Leader in Amateur Radio!

MFJ G5RV Antennas

Operate all bands 10 thru 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 will transmit and receive strong signals day and night.

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 a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Ceramic* end and fiberglass center insulators. *Hang and Play™* -- add coax, some rope to hang and you're on 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 *dual band* 80/40 Meter dipole antenna that is only 85 feet. *Full-size* on 40 Meters with ultra-efficient end-loading on 80 Meters. 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 *dual band* 40/20 Meter dipole antenna is only 42 feet. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. 1500 Watts. Center insulator with SO-239 connector and hang hole.

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*® coax and *Teflon*® 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
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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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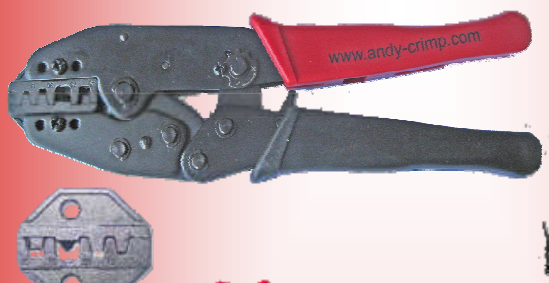

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On Sale $129.73

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Poor quality feedline can easily eat up half of your transmit power. We carry a wide variety of high quality, low loss coax to meet your needs.

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Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603 **$89.95**

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.

3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602 **$69.95**

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601 **$59.95**

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New! MFJ-4600 **$79.95**

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604 **$99.95**

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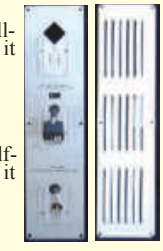
***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605 **$159.95** **New!**

Bring cables thru eave of your house

MFJ-4616 shown with standard full-size vent (not included) it replaces. For *6 Cables* **$26.95**



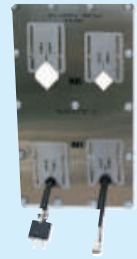
MFJ-4613 shown with standard half-size vent (not included) it replaces. For *3 Cables* **$14.95**

Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ Wall Plates



MFJ-4614 *For 4 Cables* **$34.95**

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612 *For 2 Cables* **$24.95**

MFJ-4611 *For 1 Cable* **$14.95**

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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.

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Online QuickStats Poll Results for August 4 through September 3, 2013.

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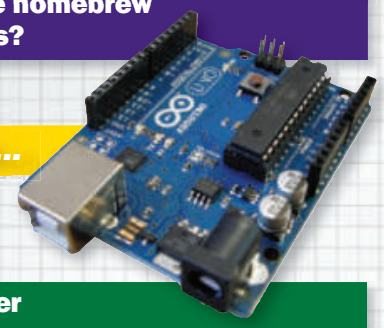
Are you interested in learning more about how to create homebrew microcontroller projects for Amateur Radio applications?

Yes **58%**
No **32%**
I don't homebrew **10%**



How old does a transceiver have to be before you consider it "vintage?"

At least 10 years old **4%**
At least 20 years old **31%**
At least 30 years old **36%**
At least 40 years old **17%**
At least 50 years old **10%**
More than 50 years old **2%**

What is the primary power source for your radio when you're hiking or camping?

Battery only **38%**
Solar panel and Battery **15%**
Other **3%**
I don't take a radio when hiking or camping **10%**
I don't hike or camp at all **34%**

Do you use the weather alert feature on your FM transceiver?

Yes **34%**
No **28%**
My FM transceiver doesn't have that feature **32%**
I don't own an FM transceiver **6%**

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Creating New Standards for HF Mobiles

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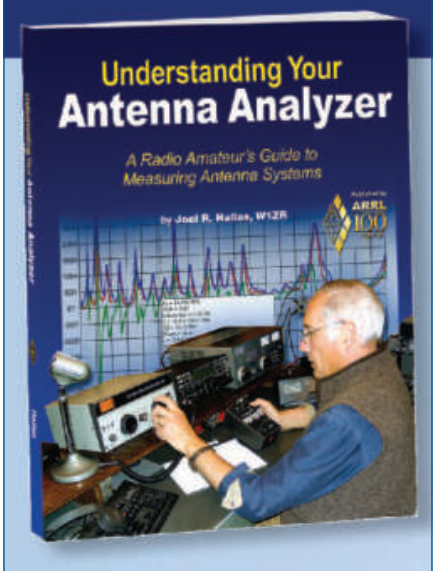

Understanding Your Antenna Analyzer

By Joel Hallas, W1ZR

Fine Tune Antenna Performance!

Antenna analyzers are arguably one of the most important pieces of equipment in an Amateur Radio station. Even the simplest antennas can benefit from using one, and your success on the air may depend on it, but only if you understand and avoid the common pitfalls.

Understanding Your Antenna Analyzer is an introduction to the various types of analyzers available, their component parts, how they operate and how to utilize them to get the best possible data. It discusses how to adjust your antenna, enhance your antenna analyzer and the ways certain analyzers can be used as general purpose test instruments in an Amateur Radio lab. Includes product review testing and an in depth look at representative antenna analyzers available today.

Includes:

- **Why Measure Antennas?**
- **Making Antenna Measurements**
- **Information Available from an Antenna Analyzer**
- **Hooking it Up and Making it Play**
- **Adjusting Your Antenna**
- **Taking the Feed Line Into Account**
- **Other Antenna Analyzer Applications**
- **Enhancing Your Antenna Analyzer**
- **A Survey of Available Antenna Analyzers**

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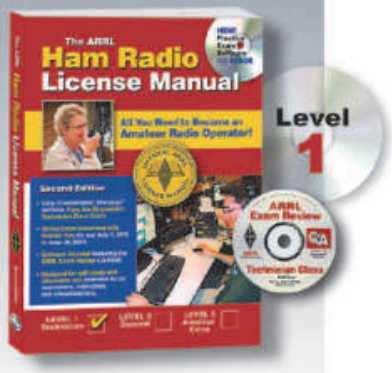

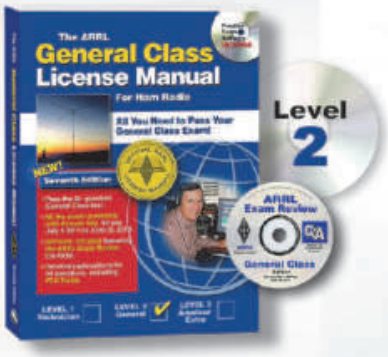

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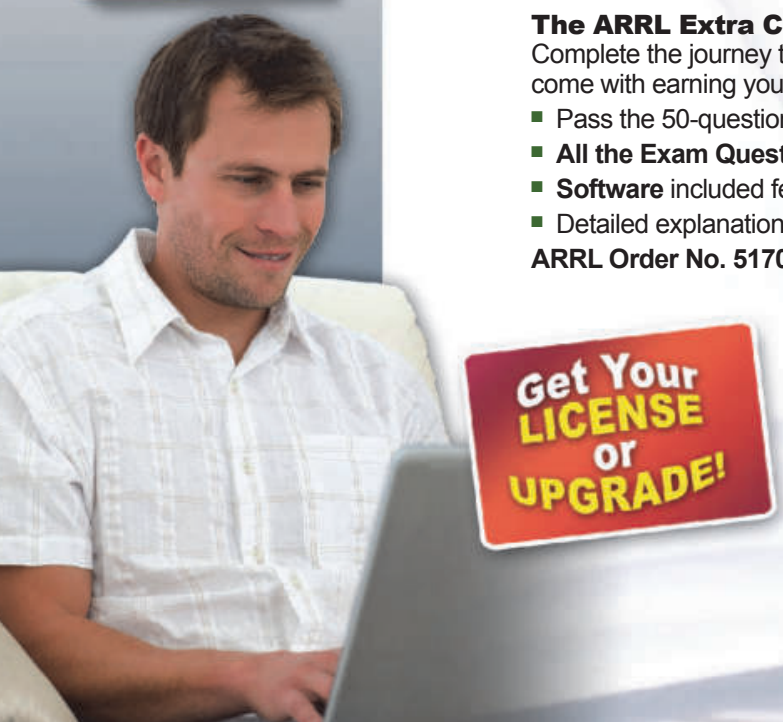

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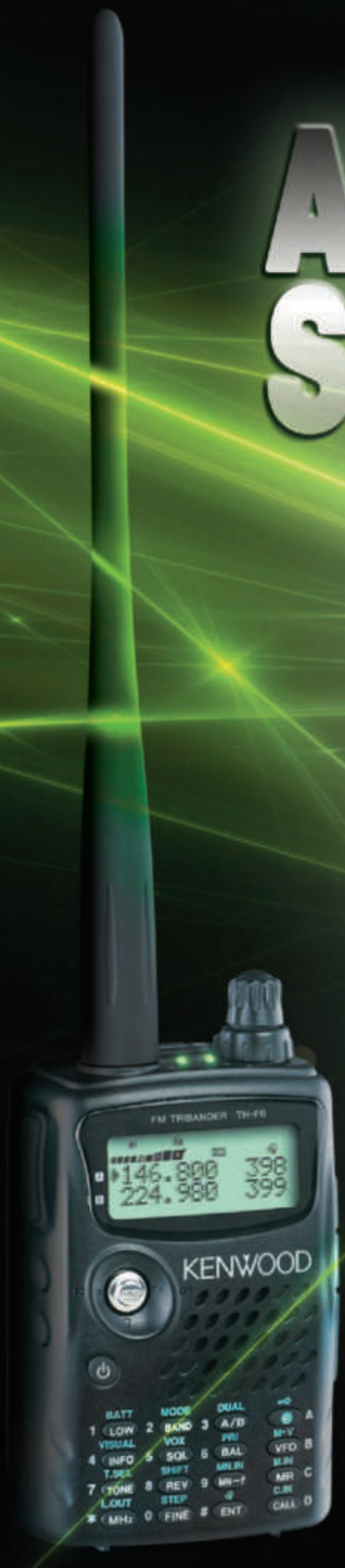

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[1]Note that certain frequencies are unavailable. [2]5W output

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144/440 MHz FM Dual Bander

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DELTA4B •New precision machined switch shaft and quadrant rotating mechanism for more accurate and stable switching performance. •Higher strength, lower resistance silver bearing solder. •Increased housing durability and abrasion resistance with powder coat finish. •New brass ARC-PLUG™ housing for improved gas tube positioning. •Same low loss micro-strip cavity design, positive detent switching, master antenna ground function, front panel removable ARC-PLUG™ surge protection module and excellent HF thru UHF performance as in previous DELTA switches.

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QST 11/2013

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1. Advertising must pertain to products and services which are related to Amateur Radio.

2. The Ham-Ad rate for commercial firms offering products or services for sale is $2.25 per word. Individuals selling or buying personal equipment: ARRL member 1.00 per word. Non-ARRL member $1.50 per word. **Bolding** is available for $2.50 a word. Prices subject to change without notice. You may pay by check payable to the ARRL and sent to: Ham-Ads, ARRL, 225 Main St., Newington, CT 06111. Or, you may pay by credit card sending the information by fax to 860-594-4285 or via e-mail to hamads@arrl.org. The credit card information we need is: the type of credit card, the exact name that appears on the credit card, the credit card number, the expiration date and the credit card billing address.

3. Remittance in full must accompany copy since Ham-Ads are not carried on our books. Each word, abbreviation, model number and group of numbers counts as one word. Entire telephone numbers count as one word. No charge for postal Zip code. No cash or contract discounts or agency commission will be allowed. Tear sheets or proofs of Ham-Ads cannot be supplied. Ads submitted in writing should be typed or printed clearly on an 8 1/2" X 11" sheet of paper.

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6. New firms or individuals offering products or services for sale must check with us to determine if a production sample (which will be returned) should be submitted for examination. Dealers are exempted, unless the product is unknown to us. Check with us if you are in doubt. You must stand by and support all claims and specifications mentioned in your advertising.

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7. AN IMPORTANT NOTICE TO ALL HAM AD POSTERS AND RESPONDERS, FROM THE ARRL ADVERTISING DEPARTMENT Greetings from ARRL HQ! Please note that we have received reports from many ARRL members who have placed classified ads in these listings, and have received responses from individuals proposing "creative" payment schemes. These particular instances involved offers of overpayments for goods by bank check, followed by instructions to deduct the cost of your item from the overpayment, and to transfer the overage back or to another individual. This is a well-known scam. Unfortunately, we have no control over this and other scams of this type. Once your email address is posted, you are vulnerable to those individuals seeking to provide you with questionable information.

QST Ham Ads on the Web
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Advertisers

QST Advertising Deadlines:

Issue	Reservation Date	Materials Due Date
December 2013	Wednesday, October 16, 2013	Friday, October 18, 2013
January 2014	Wednesday, November 13, 2013	Friday, November 15, 2013

For links to the Web sites of all ARRL advertisers, visit www.arrl.org/ads/adlinks.html

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GUY HARDWARE

3/16"EHS, 500 / 1000'	$139/259
1/4"EHS, 500' / 1000'	$159/329
3/16" / 1/4" Big Grip™	$7/8
5/16" Thimble	$1.35
3/8" Thimble	$1.45
3/8x6" EE Turnbuckle	$16
3/8" x6" EJ Turnbuckle	$19
1/2"x9" EE Turnbickle	$25
1/2"x9" EJ Turnbuckle	$28
1/2x12" EE Turnbuckle	$29
1/2"x12" EJ Turnbuckle	$32
#502 Strain Insulator	$8
#504 Strain Insulator	$10

PHILLYSTRAN

HPTG-1200I	$.49/ft.
HPTG-2100I	$.75/ft.
HPTG-4000I	$1.05/ft.
HPTG-6700I	$1.45/ft.
PLP-2738 Big Grip™	$9
PLP-2739 Big Grip™	$12
PLP-2755 Big Grip™	$18

ALUMINUM

O.D.	WALL	$/FT.
6063-T832 DRAWN TUBING		
.375"	.058"	$.65
.500"	.058"	$.70
.625"	.058"	$.80
.750"	.058"	$.90
.875"	.058"	$.95
1.000"	.058"	$1.00
1.125"	.058"	$1.10
1.250"	.058"	$1.30
1.375"	.058"	$1.40
1.500"	.058"	$1.50
1.625"	.058"	$1.65
1.750"	.058"	$1.80
1.875"	.058"	$1.95
2.000"	.058"	$2.10
2.125"	.058"	$2.25

GLEN MARTIN

H2 Hazer (12 sq. ft.)	$609
H3 Hazer (8 sq. ft.)	$459
H4 Hazer (16 sq. ft.)	$589
RT-424, 4.5' (6 sq. ft.)	$319
RT-832, 8' (8 sq. ft.)	$469
RT-936, 9' (18 sq. ft.)	$779
RT-1832, 17.5' (12 sq. ft.)	$1029
RT-2632, 26' (9 sq. ft.)	$1709

ROHN

25G, Middle Section	$119
25AG2, Sleeve Top	$189
25AG4, Flat Top	$239
AS25G, Rotor Shelf	$65
BPC25G, Base Plate	$69
BPH25G, Hinged Base	$279
HB-25AG/BG/CG	$119/129/149
GA25GD, Guy Assembly	$179
SB25G, Short Base	$79
SB25G5, Short Base (5')	$109
SBH25G, Hinged Short Base	$249
TB3, Thrust Bearing	$159

ROTOR CABLE

R62, 6-C (6#18)	$.59/ft.
R81, 8-C (2#18/6#22)	$.49/ft.
R82, 8-C (2#16/6#18)	$.79/ft.
R83, 8-C (2#14/6#18)	$.89/ft.

COAX

9913F7	$1.39/ft.
BuryFLEX	$.89/ft.
LMR-100	$.59/ft.
LMR-200	$.65/ft.
LMR-200 Ultraflex	$.85/ft.
LMR-240	$.69/ft.
LMR-240 Ultraflex	$.89/ft.
LMR-400	$.89/ft.
LMR-400 Ultraflex	$1.39/ft.
LMR-600	$1.59/ft.
LMR-600 Ultraflex	$2.49/ft.
RG-8X Mini	$.29/ft.
RG-213/U	$.79/ft.

The radio...YAESU

HF/50 MHz 100 W Transceiver

FT DX 3000

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

The amazing Crystal Roofing Filter performance

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

Outstanding receiver performance, the heritage of the FTDX5000!

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

IF DSP provides effective and optimized QRM rejection

Independent Frequency display

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

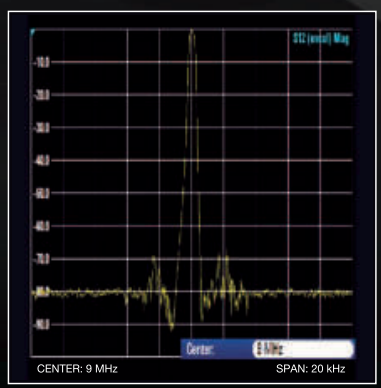
4.3-inch Large and wide color LCD display with high resolution

High Speed Spectrum Scope built-in

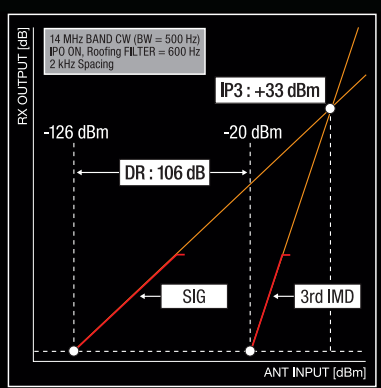
AF SCOPE display and RTTY/PSK encoder/decoder

Other features

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



Characteristics of the Crystal Roofing Filter (300 Hz)



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

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

YAESU
The radio

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The

EVENT HORIZON OF DX

TS-990S

Dual TFT Display & Dual Receiver HF/50 MHz Transceiver

The main receiver has an IP3 in the +40 dB class, and the sub-receiver is the already famous TS-590S receiver. Capable of receiving two signals at once, on different bands. 7-inch and 3.5-inch color TFT displays allow displaying of independent contents. Simplification of complex operations at a glance. Make no mistake, this is not a toy. Finally a serious tool is available for getting the very most from your hobby - of course it's a Kenwood.

- Covers the HF and 50 MHz bands.
- High-speed automatic antenna tuner.
- USB, Serial and LAN ports.
- Various PC applications (free software): ARCP-990 enabling PC control, ARHP-990 enabling remote control, and ARUA-10 USB audio driver.
- Clean 5 to 200 W transmit power through the 50 V FET final unit.
- Built-in RTTY and PSK.
- Three Analog Devices 32-bit floating-point arithmetic DSPs.
- DVI output for display by an external monitor (main screen display only).

KENWOOD

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