SPECIAL DIY ISSUE

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

January 2012 WWW.ARRL.ORG

QST reviews:

Inside:

Winter...

...The Perfect Time of Year to Build Something!

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Official Journal of ARRL The national association for AMATEUR RADIO®

JANUARY 2012 QST Vol 96 No 1

Rugged Emergency HF/VHF/UHF Portable Operations

FT-897D

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

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

Rugged
Portable
Reliable
Proven
Manpack

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

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

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

Vertex Standard U.S.A. Inc.
6125 Phyllis Drive, Cypress, CA 90630 (714) 827-7600

http://www.yaesu.com

FT-270R

...when we say submersible, we mean submersible!

The 16-key FT-270R includes direct keyboard frequency entry and direct DTMF input, along with quick one-touch access to YAESU's exciting and fun WiRES-II™ VoIP Internet Linking system!

Submersible, Rugged, High Performance, Compact, FM Mono-Band 2 Meter Handheld

The FT-270R is a high-performance FM hand-held providing up to five Watts of RF power, along with big audio output (800 mW) and unmatched protection against the elements!

Protected against water ingress to IPX7 specifications (submersion for up to 30 minutes at a depth of 3 feet), the FT-270R features long operating time, thanks to the supplied 1400 mAh NiMH Battery Pack.

- 5 Watts Output
- Submersible!
- Large Backlit LCD Display
- Outstanding Receiver Audio
- 1400 mAh Battery Pack
- Power Saving Circuit Design
- Expanded Receiver Coverage
- User Password
- 200 Memory Channels
- Keyboard Frequency Entry
- Weather Broadcast Channels
- EAI (Emergency Automatic ID) Feature

Yaesu Submersible HT's

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

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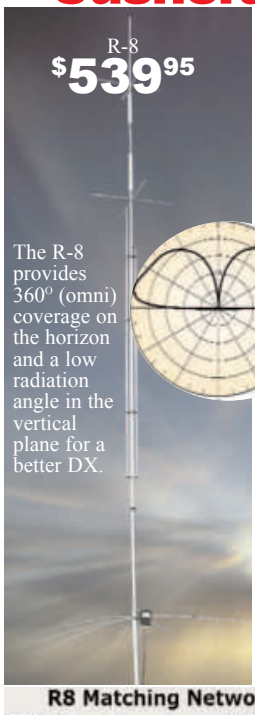
Cushcraft R8 *8-Band Vertical*

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



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

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

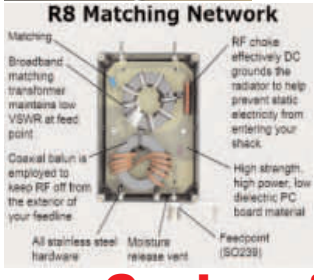
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

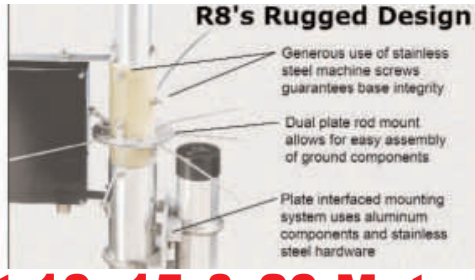
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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

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

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





MA-5B *5-Band* Beam

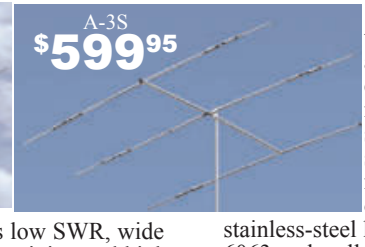
Small Footprint -- Big Signal

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

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

Cushcraft 10, 15 & 20 Meter Tribander Beams

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

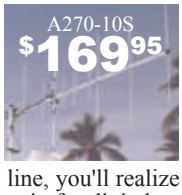


It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components, stainless-steel hardware, and aircraft-grade 6063 make all the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

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

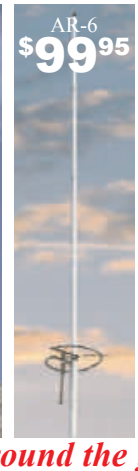
Cushcraft Dual Band Yagis

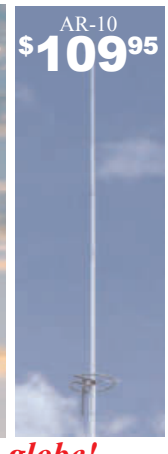
One Yagi for Dual-Band FM Radios



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

Cushcraft Famous *Ringo* Compact FM Verticals





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

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

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

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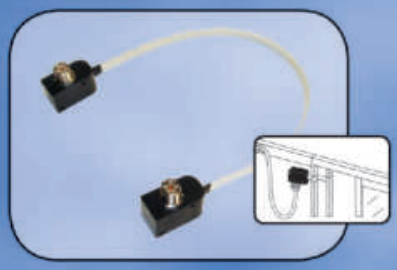
Life is a JOURNEY, Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

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

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

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

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

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

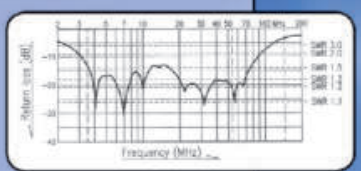
COMET CHA-250B
Broadband HF Vertical!

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

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

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

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



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

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

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

COMET and Maldol

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

Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
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Our mission: To promote and advance the art, science and enjoyment of Amateur Radio.

In This Issue

January 2012 Volume 96 Number 1

Technical


Page 40

News and Features

Our Cover
When the weather outside is frightful, ARRL Lab Test Engineer Bob Allison, WB1GCM, heads to the workbench. Here, he can not only repair his existing gear, he can build new and exciting things for his shack, such as this QRP SSB/CW receiver kit. Whether you are an experienced homebrewer or are using that soldering gun for the first time, you are certain to discover something that will inspire you to go to your workbench as you thumb through this special DIY issue of *QST*. Happy building!

Radiosport

Columns

Departments

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

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Volume 96 Number 1

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Choice of the World's top DX'ers℠

Choice of the

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

FT DX 9000MP

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

FT DX 9000D

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

FT DX 9000 Contest

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

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

FT-2000 and FT-2000D

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

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Top DXing Rig Picks

World's top DX'ers

FT DX 5000 Series

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

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

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

FT DX 5000MP
Station Monitor SM-5000 included; 0.05 ppm
OCXO included; 300 Hz
Roofing Filter included

FT DX 5000D
Station Monitor SM-5000 included; 0.5 ppm
TCXO included; 300 Hz
Roofing Filter optional

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

FT-950

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

FT-450D

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

Advanced Dual Band Mobile Radio
5.2" x 1.6" Large dot matrix (264 x 64 dots) LCD display
GPS / APRS® / Bluetooth® Features

FTM-350AR

New Vacuum Cup-Mounting Bracket permits Angle Adjustment
New APRS® Operation Capability, and newly Expanded User Friendly Functions

144/(220)*/430 MHz 50 W FM Dual Band Transceiver

FTM-350AR NEW

220 MHz 1 W (USA version only)

New Features of The FTM-350AR

1. New Vacuum Cup-Mounting Bracket with Angle Adjustment

The new MMB-98 Mounting bracket allows easy installation of the radio control display to your Dashboard by placing the vacuum mount in the desired location and pressing a lever. You may then adjust the display to the optimum viewing angle.

2. Expanded APRS® functions

- **Uses the worldwide-accepted GPS NMEA data format**
- **Navigation to another APRS® BEACON station is possible, even if the beacon station is moving.**
- **Waypoint data (Data in/out) is available from the ACC connector on the rear of the main unit.**
- **Sub-Band APRS® operation may be active in the background, even when operating in Mono-Band Display mode.**
- **Newly added Voice Alert function**
- **Re-allocated often used keys to more convenient positions for easier operation**
- **Programmable keys on the DTMF Microphone provide direct access to APRS® functions**

*APRS® is a registered trademark of Bob Bruninga WB4APR
*SmartBeaconing™ from HamHUD Nichetronix

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

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

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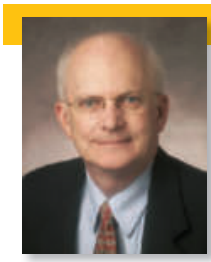


It Seems to Us

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

The Year Ahead

"The year 2012 promises to be a busy, varied, and interesting one for Amateur Radio. Here are a few of the highlights we are looking forward to."

The waning months of 2011 have blessed us with the best HF radio propagation conditions in at least eight years, but the best is yet to come. With the sunspot peak is expected to occur sometime in 2013, 2012 should be a great year to surf the radio waves.

Even before New Year's Day dawns there will be a new ARRL video in circulation. *The DIY Magic of Amateur Radio* compresses into eight minutes a wide array of activities likely to appeal to a new generation of Do It Yourself hobbyists. Page 75 has the details about this new tool we will be using to explain the hands-on, creative dimension of Amateur Radio to this target audience. In every generation there are people who are curious about how things work, both natural and manmade. We want them to know that in Amateur Radio they will find kindred spirits and constructive outlets for their inquisitiveness.

On January 23 the World Radiocommunication Conference (WRC) kicks off in Geneva, the climax to four years of discussions and negotiations about dozens of possible amendments to the international Radio Regulations. Among the more than 2,000 participants will be an experienced group of radio amateurs credentialed as members of their national delegations, including that of the United States, or as observers for the International Amateur Radio Union (IARU). Four weeks later we will know whether our arguments for a new amateur allocation just below the AM broadcast band have carried the day. We will also know more about how global developments in telecommunications, particularly the skyrocketing demand for mobile broadband services, may affect our future access to the radio spectrum. Our work to ensure that Amateur Radio is represented effectively at the International Telecommunication Union never stops; preparations for the next WRC in 2015 will begin as soon as the final gavel brings WRC-12 to a close on February 17.

In April we can expect to hear a lot about the most famous radio distress call in history as the world marks the 100th anniversary of the sinking of the RMS *Titanic*. The *Titanic* tragedy led to major improvements in maritime safety, including but not limited to maritime radio procedures, and cemented in the public mind the role of radio communications in preventing or responding to such disasters.

On a happier note, World Amateur Radio Day, April 18, will be an occasion to celebrate the theme "Amateur Radio Satellites: Celebrating 50 Years in Space." The launch of the first Oscar satellite on December 12, 1961 was followed by the second just six months later. An even greater thrill would come in 1983 when radio amateurs the world over spoke with Owen Garriott, W5LFL, as he orbited the Earth aboard STS-9! Dozens of amateur-constructed satellites and licensed astronauts and cosmonauts have followed these pioneers into orbit, with no end in sight.

The annual flocking of the faithful to the Dayton Hamvention® will occur once again in May, followed a few weeks later by the largest on-the-air operating event in North America: ARRL Field Day, June 23-24. Around this time we anticipate launching the online, digital edition of *QST*. You will be hearing more about this new membership benefit, to be offered at no additional cost, in the coming months. Unless you don't want it to, the printed copy will continue to arrive in your mailbox as it does now — but even if you prefer your reading material to be on paper, we think you will also like being able to access the enhancements we're planning for the digital version.

August 13 will mark another centenary: the approval of the Radio Act of 1912 that required for the first time that radio stations must be licensed. Today we take great pride in being a federally licensed radio service that can only be entered by examination, but at the time it was widely regarded as the end of Amateur Radio. Enacted two years before the founding of the ARRL, the legislation was intended to curb amateur activity not only by requiring licenses but also by placing severe restrictions on private, non-commercial stations. In the four months following its passage just 1,185 amateur station licenses were issued in the United States, representing but a fraction of the stations known to be active at that time.

As we now know, the amateurs of that era overcame the supposed handicap of being relegated to wavelengths shorter than 200 meters (that is, frequencies above 1.5 MHz) and in the following decade would demonstrate that shorter is in fact better. One wonders what the architects of the more draconian provisions of the Radio Act of 1912 must have thought in the ensuing years as they watched the spectacular record of Amateur Radio unfold.

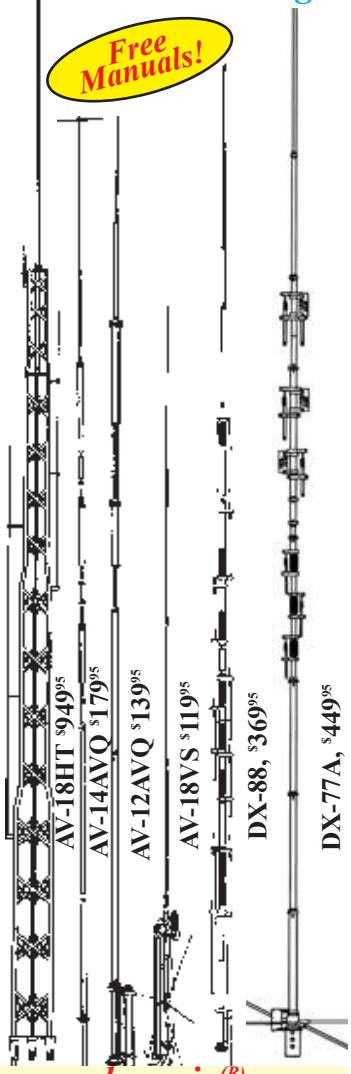
Finally, as is the case every year there will be many opportunities for ARRL members to meet in person during 2012. A very special occasion will occur in October when the ARRL National Convention will be held on the West Coast for the first time since 1992. Put Santa Clara, California on your calendar for October 12-14!

hy-gain® HF VERTICALS

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

Two year limited Warranty . . .

Free Manuals!



hy-gain® Classics

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

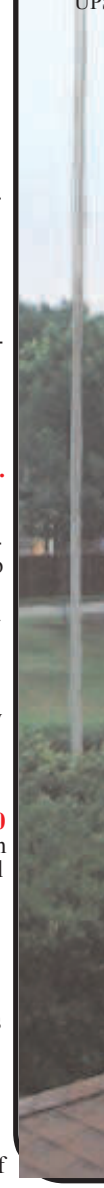
Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$949.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$179.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$139.95	10,15,20 M	1500 W PEP	13 feet	9 pounds	80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

Hy-Gain 160-6 Meters Self-Supporting Vertical

Full 1500 Watts, 43 feet, includes base mount

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

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



Exceptional Performance

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

Just talk with automatic tuner!

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

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than ½ dB 60-6 Meters and less than 1 dB 160-80 Meters with good quality, low-loss coax).

Extremely low wind loading

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

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

Assembles in an hour

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

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

In Brief

- Elections for the ARRL Board of Directors were held November 18. Details are in Happenings, this issue.
- An ARRL Ad Hoc Committee is looking for recommendations until December 15 for updates to the ARRL band plans for the amateur bands between 902 MHz and 3.5 GHz.
- Ninety-six first year electrical engineering students at California Polytechnic State University passed the Technician exam in early November.
- Following a rare October snowstorm that knocked out power to many who live in five northeastern states, radio amateurs provided critical services to the National Weather Service as well as local, state and federal emergency management and non-governmental organizations.
- Three new crew members, including Dan Burbank, KC5ZSX, have joined the crew aboard the International Space Station.
- The FCC issued an *Order* on November 1 that terminated hundreds of proceedings, including six that members of the public, including the ARRL, had asked not to be terminated.
- In coordination with FEMA and NOAA, the FCC conducted the first nationwide test of the Emergency Alert System in November.
- President Obama has nominated two new FCC Commissioners, Jessica Rosenworcel and Ajit Varadaraj Pai.
- In October, the FCC released the *Second Report and Order* in its BPL proceeding.
- The FCC has issued a Florida man a *Notice of Apparent Liability* for Forfeiture in the amount of $10,000 for operating a radio transmitter without the requisite FCC authorization.
- A volunteer tour guide at ARRL HQ, David Kaplan, WA1OUI, will also be administering the ARRL A-1 Operator Club.
- The Sixth Annual ARRL On-Line Auction took place in October.
- Kirk Pickering, K4RO, has been named Editor of the *National Contest Journal* (*NCJ*), effective with the January/February 2012 issue.
- In October, a team of California hams and others launched a balloon that reached more than 136,000 feet above ground level, a new altitude record.
- Entries must be postmarked by February 29 in the Second Annual ARRL Video Contest.
- The winner of the *QST* Cover Plaque Award for October is Joe Ostrowski, KI5FJ, for his article "A Simple Remote Impedance Matching Network."

Media Hits

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

- If you have not seen it already, the ARRL has launched a new campaign targeted at the growing Do It Yourself (DIY) and Maker groups. There is a natural affinity between hams and hackers. Both populations love to make things and explore new ways to use technologies. They do not want to be mere "users" of mass produced products, but to also understand how and why they work. You can read more about this initiative and the supporting materials available to members for presentations at **www.WeDoThat-Radio.org**.
- While October will be remembered here for the terrible ice and snow that hammered New England, the majority of the month was a good one for Amateur Radio media hits. There were many hits from all over the country that showed the friendly and creative aspects of ham radio such as the business students becoming licensed in the Monroe Star News (LA) and the Fannin County ARC holding a "Radio in the Park" event reported in the North Texas E-news. Californians held boating seminars about ham radio and made *The Log Newspaper*. Kansas students aimed high, very high, when Holy Family Catholic School demonstrated moonbounce before reporters from the *Grand Junction Sentinel*. There were even "feel good" pieces such as the Macon ARC hams' "Ramp built for 96-year-old vet" reported by the *Jones County News* and "99-year-old Ham radio operator still tuned in" in the Frontiersman (AK).
- We've heard the warning, "Be careful what you wish for." Bill Hillendahl, KH6GJV, and Don Carlson, KQ6FM, had just finished a Pacificon seminar about unexpected media requests when minutes later they were suddenly called to be interviewed live on KGO Radio (CA).
- The Scouts' Jamboree On The Air got media notice in many places. *The Record* of Orange County, Texas; KMVT-TV in Idaho; KYW Newsradio in Philadelphia; *Daily Dunklin Democrat* (MO); *North Country Now* (NY); *Twin Falls Times-News* (ID) and *NewsOK.com*. NT3V, Mark Abrams of KYW Newsradio, reported on it for CBS in Philadelphia. But the real "I have to read this one" story came from Coral Gables, Florida with the headline "Troop 7 Prepares for Zombie Attack during Scouting Radio Jamboree" seen on PRWeb.com.
- The FCC's actions (or lack of action) on the BPL issue did not get great media coverage as it appears that BPL technology has already been outdated for large public deployment. But *TV Technology* ran two stories about it, "FCC Finalizes Rules for Broadband From Wall Sockets" and "FCC Affirms BPL Rules, Makes Minor Refinements." *Radio World* also reported it in "Hams Not Happy With Latest BPL Changes." Even The *CGC Communicator* by the Communications General Corporation reported "The Federal Communications Commission has affirmed its rules for Broadband over Power Lines or Access BPL with only minor modifications that do little to protect the Amateur Radio service and other High Frequency users from severe to intolerable interference."

Hams Jam in Roswell, Georgia

More than 300 amateurs and visitors attended HamJam 2011 on October 22 at the Roswell Cultural Arts Center in Roswell, Georgia. The event, sponsored by the North Fulton Amateur Radio League (NFARL) and the Southeastern DX Club (SEDXC), featured prominent speakers from the Amateur Radio community.

Featured speakers were ARRL President Kay Craigie, N3KN, Tom Rauch, W8JI, renowned antenna and RF expert, and Eric Swartz, WA6HHQ, co-founder of Elecraft. — *John Tramontanis, N4TOL, President, North Fulton ARL*

STEVE MAYS, KS4KJ

ARRL President Kay Craigie, N3KN, presented North Fulton ARL members with a DXCC award for the club call sign, NF4GA. Club members attained the award by using the club call sign to make DX contacts and confirming all entities via Logbook of The World. From the left: N7BU, KD4LZL, AE4CW, KM4IK, K4YJI, W4QO, Craigie, KD4ICT, KK4BQC, W3WL and W4JDS.

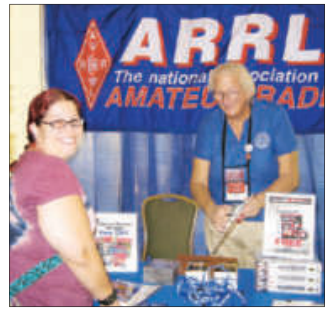
Pacificon 2011

ARRL volunteers and staff helped make Pacificon, also known as the ARRL Pacific Division Convention, another success in mid-October. Former ARRL First Vice President Steve Mendelsohn, W2ML, was the special guest of the Mount Diablo ARC. He was recognized "for his numerous and distinguished contributions to the US Navy, broadcast engineering and Amateur Radio." In early November, Steve manned the communications center for the 36th running of the New York City Marathon — for the 36th time! — *tnx John Ronan, K3ZJJ*

PETE HARRIS, KE6ZIW

➢At Pacificon in Santa Clara, California, Gordon West, WB6NOA, and Chip Margelli, K7JA, presented Steve Mendelsohn, W2ML (left), with an award for his many years of service to Amateur Radio, his profession of broadcast engineering and his many volunteer activities.

BOB INDERBITZEN, NQ1R



New ARRL member Josie, KJ6MKN, with ARRL Maxim Society member Ti-Michelle, NJ6T, behind the ARRL booth at Pacificon.➢

SEEDing Ham Radio in South Carolina

"When the kids' eyes lit up and the adults smiled you knew it was a worthwhile day." — *Dag Evans, W8LVL, age 91*. Dag was clearly enjoying talking to kids about ham radio at the annual Science Education Enrichment Day (SEED) at the University of South Carolina in Aiken on October 15. The retired senior engineer was volunteering with the North Augusta Belvedere Radio Club and the Aiken County ARES® for the presentation "Wireless Communication, Then and Now."

That was just one of dozens of presentations, exhibits and interactive programs that drew a record 3312 children and adults to this past year's event, which was free and open to the public.

Dag's summary of a full day of SEED and ham radio: "A fun day for the children and adults, and I can tell it was the same for the hams!" — *Kent Hufford, KQ4KK*

KENT HUFFORD, KQ4KK

SEED in SC: A few of the more than 3300 children and adults who attended October's SEED Day in Aiken, South Carolina. Twelve hams participated in this event and shared their enjoyment of Amateur Radio with the community they serve.

Inside HQ

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

DIY

Welcome to our annual Do-It-Yourself issue — and some design changes

Welcome to our third annual DIY (Do It Yourself) edition. Doing and making things ourselves run deep in the ham community. In this spirit, we're making a few changes to *QST* ourselves. Starting with this issue, we are initiating some design and editorial changes that will be phased in during the next couple of months. An in-house team of editors and graphic and layout artists has been hard at work on this project. This team includes Production Supervisor Shelly Bloom, WB1ENT; Graphic Designer Diane Szlachetka, KB1OKV; Assistant Production Supervisor Jodi Morin, KA1JPA; along with *QST* Editor Steve Ford, WB8IMY, and *QST* Managing Editor Joel Kleinman, N1BKE.

We believe that these changes will make *QST* easier to read, easier to follow and more contemporary looking. The first changes that we will notice are in the very front section. For example, the revised Table of Contents makes it easier to find your favorite article, feature or column.

While these changes affect the look of the print edition of *QST*, some of these design changes are being made in anticipation of the digital edition of *QST* that we expect to debut sometime around mid-year. To make it easier to read on a PC screen or mobile device, the digital edition will require a little more "white space" in the text than the print edition, so our designers are modifying the new design accordingly. We are also using some slightly different fonts, changing a few colors and modifying our graphics and schematics to make *QST* easier to view and read in the digital realm. In the digital edition, all of the hundreds of web links and e-mail addresses become live, so we are working on making those as easy to read and click through as possible.

We are adding some new design elements to accommodate additional multimedia content in both the print and digital edition. Here in the print version, we have been using QR codes to direct readers to specific video content such as our Product Review videos (page 51 of this issue). We'll continue using these in the print edition, but we will be adding more direct links to multimedia content in the digital edition. There will also be additional text and multimedia content in the digital edition that we need to accommodate.

Don't worry. As an ARRL member, you will still receive the print version of *QST* in the mail every month. The digital edition will be provided to members at no extra charge as a membership benefit. I know that there are a lot of questions about the upcoming Digital *QST*. We don't have all the answers yet, since digital publication is still, in many ways, uncharted waters, but we will keep you updated both here in the print edition of *QST* (it's strange to use that phrase) and online through our website and newsletters as we progress toward the launch of the digital edition.

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Quick Links and Resources

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QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
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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.

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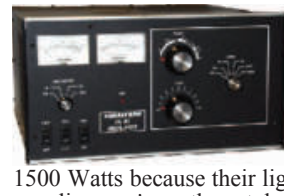

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Commemorating Marconi's Atlantic Triumph of 1901

Juergen Gerpott, DL8HCI

The only Nobel Prize for wireless communication was given in 1909 to the German scientist Professor Ferdinand Braun and the Italian inventor Guglielmo Marconi. During the 2009 centenary of the Physics Nobel Prize, the Professor Braun Day event organized a special crossband activity to commemorate the Prize and the first wireless signals to cross the Atlantic.

In December 1901 Marconi and his crew erected their receiving apparatus at a hospital near Signal Hill, Newfoundland. Marconi's most powerful transmitting station in Britain was at Poldhu, Cornwall. At preset times, it was agreed to send the Morse letter S. The letter S was chosen so as not to overheat the transmitter's induction coils. To further reduce the chance of overheating the S was keyed very slowly. On December 12, 1901 Marconi and his men confirmed reception of the S signal.

For the Nobel Prize Day of the 1909-2009 Centenary, the Professor Braun Day event organized a longwave-shortwave ham activity. The National Weather Service transmitter, DDH47, was available for 2 hours from 2300 UTC December 9 to 0100 UTC December 10. The frequency was 147.3 kHz, which is in the range of the Marconi tests in 1901. The names of famous wireless pioneers were sent in slow Morse code, keying one dot every 3 seconds.

The DDH47 transmitting site near Hamburg, Germany generated about 20 kW into a T-shaped antenna at 300 feet. This event was sponsored by the National Weather Service Deutscher Wetterdienst, the technical staff at the Pinneberg transmitting site and members of the Professor Braun Day crew. The DDH47 was keyed by hand from Pinneberg using a remote telephone connection.

Reception reports and direct contacts on the 80 and 160 meter bands took place between two American and two Canadian stations. The two Canadian contacts, The Marconi Radio Club station, VO1MRC, and Joseph Craig, VO1NA, were located in Torbay, near St John's. Their signal reports of 579 to 599 show that there is still a readable signal at a distance of 3800 nautical miles. One reception report was received from Laurence Howell, KL1X, from Tianjin, China some 4080 miles distant. Today's receivers are much better than those of Marconi's day but in his day there were no other man-made signals to interfere. One could imagine Marconi was able to hear the S.

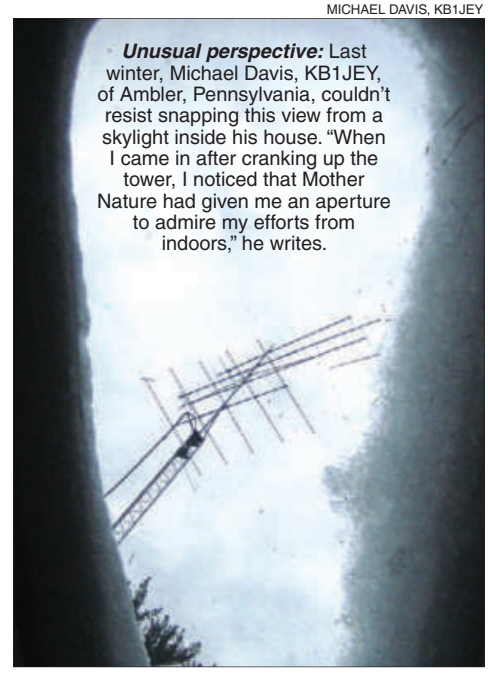
To commemorate the Centenary of the Physics Nobel Prize of 1909, the Professor Braun Day event issued the "Braun & Marconi Nobel Prize Centenary Award." You can find a list of contacts and reception reports at the Professor Braun Day Event website **www.doese-apprt.de/mmqtc**. Select the "Events/ Nobel Prize" link.

The Braun & Marconi Centenary Award certificate.

JUERGEN GERPOTT, DL8HCI

Edmund Ramm, DK3UZ, at the key operating DDH47.

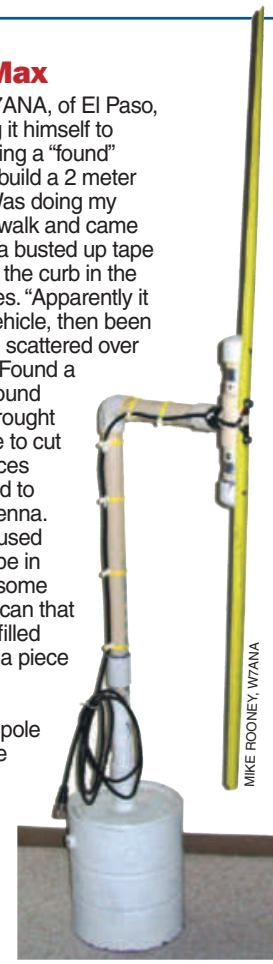
MICHAEL DAVIS, KB1JEY



Unusual perspective: Last winter, Michael Davis, KB1JEY, of Ambler, Pennsylvania, couldn't resist snapping this view from a skylight inside his house. "When I came in after cranking up the tower, I noticed that Mother Nature had given me an aperture to admire my efforts from indoors," he writes.

DIY to the Max

Mike Rooney, W7ANA, of El Paso, Texas, took doing it himself to a new level by using a "found" tape measure to build a 2 meter vertical dipole. "Was doing my old man's health walk and came across pieces of a busted up tape measure lying by the curb in the roadway," he writes. "Apparently it had fallen off a vehicle, then been run over and was scattered over a short distance. Found a useable piece around 4 feet long and brought it home. Was able to cut two 18½ inch pieces that could be used to construct the antenna. Found some old used pieces of PVC pipe in the garage, plus some coax and a paint can that had earlier been filled with cement with a piece of PVC pipe — and made the 2 Meter Dipply Dipole pictured here. The antenna works great — thanks to Ron Harger, WD8BCS, for his interesting and helpful article, 'Does Your Ground Radial Kit Measure Up?' [Apr 2011 *QST*, p 38]."



MIKE ROONEY, W7ANA

Mike Rooney, W7ANA, did it himself using a tape measure he came across on the street and other "found" materials.

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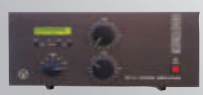

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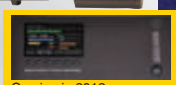

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Letters from Our Members

Keeping it Simple

The editorial by Frank Columbus, WA2KWR ["Op-Ed: No Nonsense Radio," Nov 2011, page 101] was in my opinion the most profound article I've read in *QST* for years! Unfortunately, I believe this article is too late: Pandora's Box has been opened and it's doubtful if it can be closed.

I have a high-end handheld transceiver that I have never been able to program. I also have a mobile VHF/UHF transceiver that I can program only by using the manufacturer's expensive proprietary cable. I have literally spent hours following the step-by-step instructions on how to program each radio and have failed miserably. What's more, I never use 90% of either radio's capability. I would normally chalk this up to my ineptness, but after talking to several other hams, I see the programming/menus/features problem is very widespread. This would be a major problem if a disaster management organization bought amateur equipment for ARES®/RACES and nobody knew how to use it!

Would it create a new market for the manufacturers to "reverse-engineer" some of their products, eliminating most of the bells and whistles so that a ham can set down and logically and methodically put the unit online as Frank illustrates?

Allen R. Poland Jr, K8AXW
Keyser, West Virginia

Keeping in Touch

My name is Cora, my call sign is KK4ECV and I am 10 years old. I wanted to tell you about this amazing experience I had with ham radio while my dad was gone on a trip to Boston, Virginia for about a week. He told us that he would call when he arrived there in the evening. But the cell phone connection there was terrible. It was so bad that we couldn't even hear him when he called.

That's when I thought to try ham radio. The next morning, I tried announcing my call sign on the Culpeper repeater. Just when I was about to say CLEAR, I heard a muffled voice that seemed to be coming from my dad, NG2E, who had heard me and tried to contact me!

What a relief that we had some means of communication. Over the next few days and through the rest of the week, I served as control operator while every single member of the family talked with my dad through ham radio. It was amazing to think that our one and only means of communication was the radio that most people think is now old-fashioned and long-gone, the radio made for amateurs, not professionals, who just want to build radios and make contacts and talk.

Cora Haefner, KK4ECV
Fort AP Hill, Virginia

Bears Repeating

The letter by Terry Nixon, WBØVQP ["Correspondence: Interoperability and Amateur Repeaters," Nov 2011, page 24] mentions his observation that we are not listening to the 2 meter repeaters any longer. I tend to agree. Nixon also indicated that the requirement for CTCSS tones on repeaters may be part of the problem. The use of CTCSS tones on repeaters is a requirement in order to maintain adequate control of the repeater. Adequate site locations for repeaters are oftentimes heavily populated with various radio equipment, all of which contributes to high levels of RF energy that affects the repeater. This can easily lead to unwanted keying of the repeater, making CTCSS tones a necessity. Also consider that signals in the 2 meter band can easily travel 50-100 miles or more without a terrific amount of effort. This, too, mandates the use of a CTCSS tone to weed out traffic intended for a distant repeater. I have seen times on 146.940/146.340 where I keyed down, gave my call and heard no less than a half-dozen repeaters transmitting in response to my call. Talk about the QRM! Yes, programming many of the new 2 meter rigs is quite trying, to say the least. When making a road trip, I like to research my route to identify repeaters along the way so I can program the radio ahead of time. Absent that, I will program it or dial up the desired repeater while on a rest stop.

Matthew Harker, KC5DBH
Rose, Oklahoma

Queuing Up

I'd like to take mild and friendly exception to OM Rick Lindquist's, WW3DE, airy dismissal of Q signals as "often inappropriately" used on phone ["CW — the Old Twitter," Oct 2011, page 71]. Q signals are efficient. QSL, QRU and the others often heard on phone take one second and are friendly. "I acknowledge your message" is stiff and formal and takes three times as long. Q signals are traditional. Don't dismiss tradition; it's the heart of any culture, including the Amateur Radio culture. And remember, if we decide to deny ourselves Q signals, this periodical will have to change its name from *QST* to *Calling All Amateurs*. And that just doesn't sound right.

Frank Gue, VE2GUE
Burlington, Ontario, Canada

Back to Basics

The letter by James Cole, N3ZJ ["Correspondence: A 'Simple' Quest," Nov 2011, page 24] was spot-on when he urged the Amateur Radio community not to forget the basics when considering emergency communications capabilities. It brought to mind the comments made by FEMA Administrator Craig Fugate ["Happenings: FEMA Administrator Calls Amateur Radio 'The Last Line of Defense,'" Aug 2011, pages 66-67] which says it all: When talking about the public service communications means that are required to meet the needs of disaster survivors, he stated that "we can never fathom that they'll fail. They do. They have. They will." Administrator Fugate referred to radio amateurs as "the ultimate backups" and "our last line of defense." Let's not disappoint him — or our communities — by building amateur systems that more and more mimic the commercial infrastructure that can, does and will fail in emergencies.

Paul Savidge, N4PSS
Linden, Virginia

Splitting the Difference

The article by Steve Sant Andrea, AG1YK ["Splitting Up Isn't Hard to Do," Nov 2011, page 75] missed one very important point: listen, listen and listen again on the calling frequency. I usually work the DX with the first or second call, but I spend a lot of time listening. This is obviously a lot easier if you have a radio with dual receive capability, but even if you don't have this, you have to work that A/B button until you have the exact frequency where the DX station is listening. When you do this properly, it usually takes only one or two calls to get the DX to come back to you.

Sebastian Wessels, NSØW
Longmont, Colorado

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When to Use TNF

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

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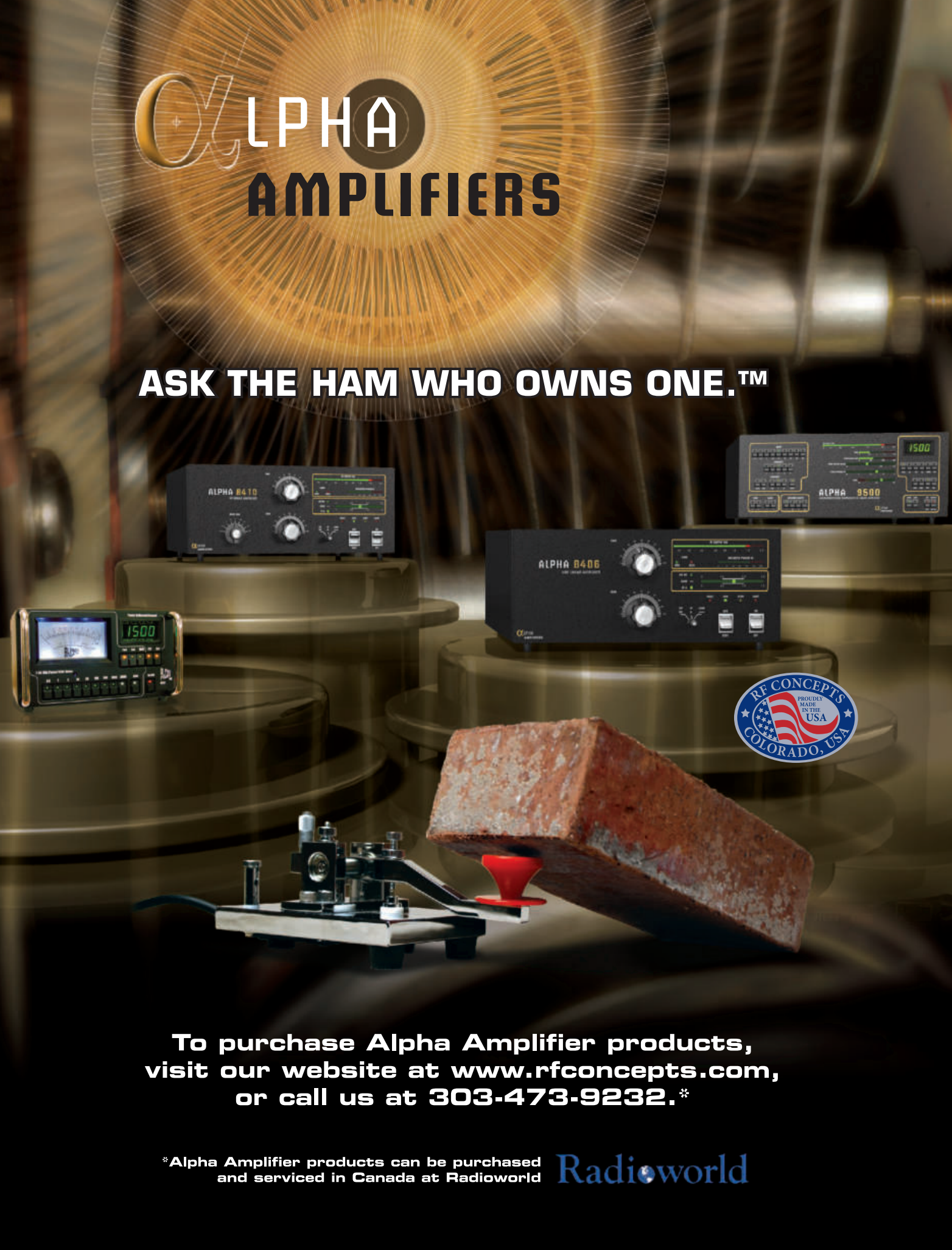
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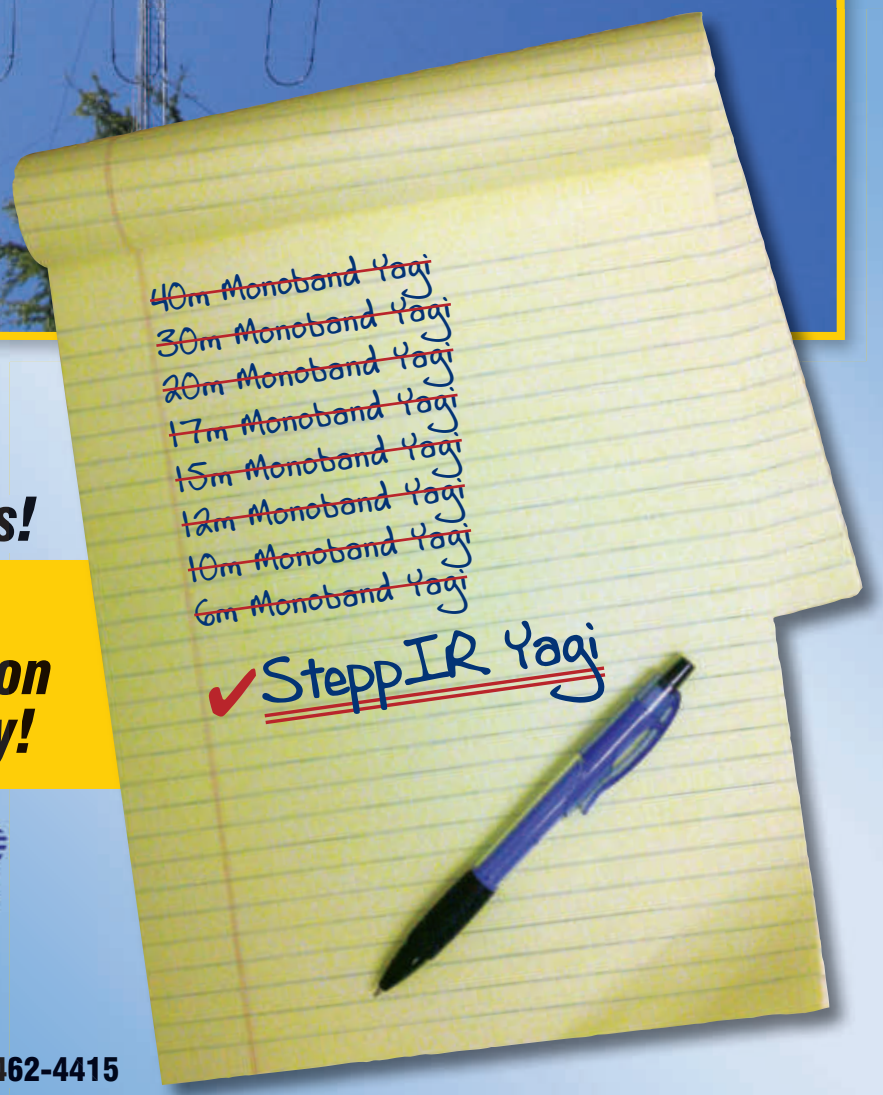

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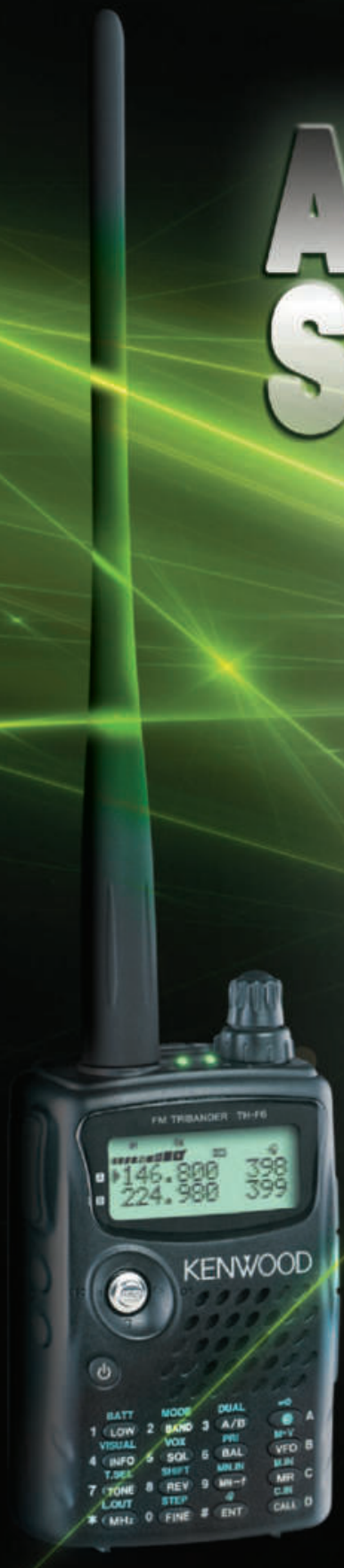

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[1]Note that certain frequencies are unavailable. [2]5W output

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A Transistor Tester in a Tin

Don't guess whether a transistor is good or not — test it so you know.

Alan Bloom, N1AL

Here is a basic "good/bad" tester for standard bipolar transistors. The operation is simplicity itself. To test an NPN or PNP transistor, just remove the corresponding test set's NPN or PNP transistor from its socket and replace it with the device to be tested. If you hear a tone in the headphones the transistor is good, otherwise it is bad.

Just Enough to Know Whether or Not It's a Keeper

More elaborate instruments can measure various transistor parameters such as current gain, breakdown voltage and high-frequency performance. The reason this simple tester is useful is that when transistors fail, they normally fail catastrophically. It is rare to damage a transistor in such a way that it still works but no longer meets its specifications. When testing a batch of transistors of unknown condition you can quickly sort them into good and bad piles and be fairly confident that the ones in the good pile are working correctly.

This tester is small enough to carry in your shirt pocket as you amble through an electronics flea market so you can try before you buy those bargain devices. Metal-can TO-5 transistors are shown in Figure 1, but small plastic transistors work just as well if you bend the leads a little. I chose the TO-5 parts because they can be pressed down flat on the PC board, so they are less likely to fall out in my shirt pocket.

The Details — Not that Many

The circuit in Figure 1 is simply two transistors connected with positive feedback through a frequency-selective network, forming an oscillator at a frequency of approximately 500 Hz. Each transistor is configured for a voltage gain of about 2.0 and the feedback network has a gain of about ⅓, so that the total loop gain is a little greater than unity, the condition for oscillation. It should be nearly impossible to damage a transistor by plugging it in wrong or into the wrong socket because the supply voltage is less than the base-emitter breakdown voltage of a bipolar transistor and the current is limited to a few milliamps. No ON/OFF switch is included —

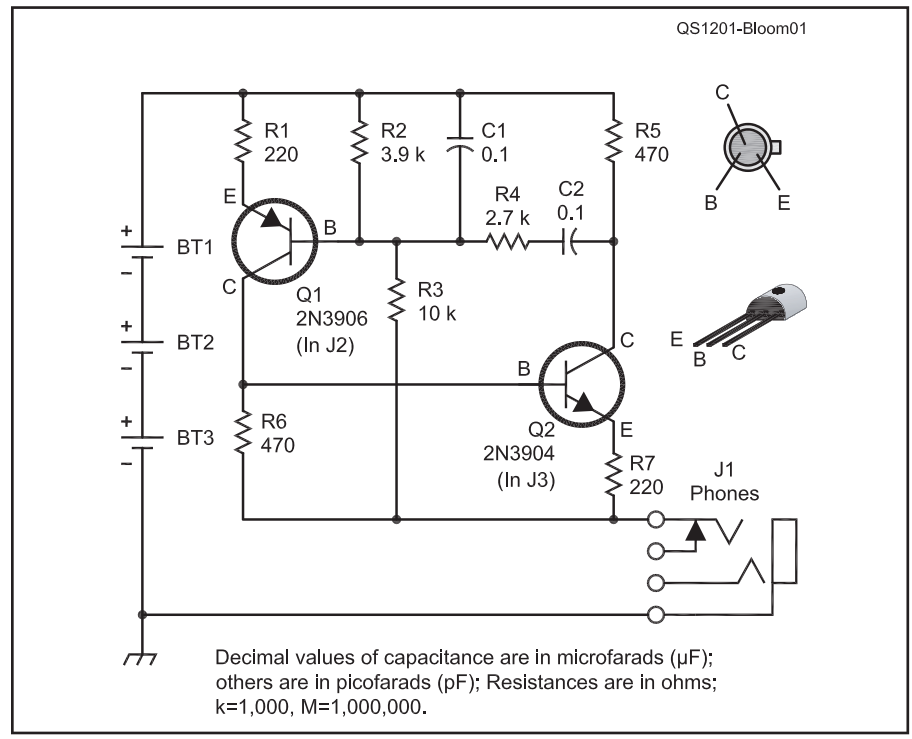


Figure 1 — Schematic diagram and parts list of the transistor tester. All parts can be obtained from Digi-Key at www.digikey.com except for the printed circuit board, available from FAR Circuits at www.farcircuits.net.

BT1-BT3 — AA size alkaline battery
C1, C2 — 0.1 μF ceramic capacitors (Digi-Key 490-3873-ND).
J1 — Stereo 3.5 mm phone jack (Digi-Key CP1-3554NG-ND).
J2, J3 —TO-5 size, three pin transistor sockets (Digi-Key ED2150-ND).
Q1 — 2N3906 PNP transistor (Digi-Key 2N3906FS-ND).
Q2 — 2N3904 NPN transistor (Digi-Key 2N3904FS-ND).
R1, R7 — 220 Ω, ¼ W, 5% resistor (Digi-Key 220QBK-ND).
R2 — 3.9 kΩ, ¼ W, 5% resistor (Digi-Key 3.9KQBK-ND).
R3 — 10 kΩ, ¼ W, 5% resistor (Digi-Key 10KQBK-ND).
R4 — 2.7 kΩ, ¼ W, 5% resistor (Digi-Key 2.7KQBK-ND).
R5, R6 — 470 Ω, ¼ W, 5% resistor (Digi-Key 470QBK-ND).
Battery clips, AAA size, six required (Digi-Key 82K-ND).
Printed circuit board (FAR Circuits).

Figure 2 — Transistor tester circuit board mounted inside the case.

Hamspeak

Bipolar transistor — Analog device made by sandwiching a layer of doped semiconductor between two layers of the opposite type: PNP or NPN.

TO-5 — A cylindrical metal can type package typically used as the housing for small signal transistors and other devices that may require a heat sinking thermal connection. The nominal diameter is 0.36 inches. A tab on the bottom circumference is used to identify the leads.

simply unplug the headphones when you're done testing.

Putting it in the Can

In time-honored amateur tradition, the prototype was built in an Altoids tin, as shown in Figure 2, but any handy enclosure would do. If you do decide to use an Altoids tin, the bare board can serve as a template for marking the four mounting holes and the two clearance holes for the transistor sockets. The front of the board should be about ⅛ inch from the outside front edge of the box. You may need to round the corners with a file to allow the lid to close. Don't forget to make a hole in the front of the box to clear the headphone jack. Line the inside bottom with some insulating material such as electrical tape to prevent the case from shorting to the battery clips.

The board is spaced from the top cover by means of a nut and washer on each of the four 4-40 mounting screws. All components are mounted on the top side of the printed circuit board except the battery clips and the headphone jack, which go on the bottom. Leave a little extra lead length on the two 0.1 μF capacitors, as they may need to be bent over to clear the top cover. The PC board from FAR Circuits (**www.farcircuits.net**) does not have plated-through holes, so the leads of R5 and R6 must be soldered on both sides. If you would rather roll your own board, drawings are available on the QST-in-Depth website.[1]

The transistor sockets are designed for TO-5 metal-can transistors but the smaller TO-18 or TO-92 plastic cased devices can also be tested by bending the leads to fit. Nearly all TO-92 bipolar transistors have the same pinout. Bend the center (base) lead toward the flat side of the transistor body, spread the three leads a little, and it should plug right in. Additional solder pads are provided for the base, emitter and collector of each transistor in case you wish to wire up additional sockets for other case types such as TO-220 or TO-3 power transistors.

[1]**www.arrl.org/qst-in-depth**

Use and Enjoy

I built the first version of the transistor tester several decades ago and have used it many times ever since. Of all my homebrew projects, I think it wins the prize for the highest ratio of utility to effort expended. Build one yourself and see if you don't agree.

Alan Bloom, N1AL, was first licensed while in high school, in 1968. He received a Bachelor's degree in physics, then a Master's degree in electrical engineering, the latter while working as a W1AW operator. While at the ARRL he co-authored both The ARRL License Manual *and* The ARRL Operating Manual. *He designed amateur and commercial equipment for the R. L. Drake Company and has spent the last 26 years at Hewlett-Packard, designing RF and microwave test equipment. Alan has written several articles for* QST, *including two cover plaque award winners.*

Mainly a CW operator, Al is on nearly all of the amateur frequencies from 1.8 to 2450 MHz, including satellite operation. He is a life member of the ARRL and an ARRL Technical Advisor. You can contact the author at **n1al@arrl.net**.

New Products

ECHOLINK MULTIMODE INTERFACE FROM W5TXR ELECTRONIC LABS

The W5TXR Electronic Labs EchoLink/Multimode interface works with analog or digital voice transceivers. It includes passive soundcard operation for digital modes such as RTTY, WSJT, PSK31, SSTV or WEFAX and no configuration changes are required when changing modes. SSTV and RTTY software is included or use one of the many available packages from other sources. All audio and control lines are available via 3.5 mm (⅛ inch) jacks and the unit uses an RS-232 interface via a standard DB-9 female connector. An auxiliary control relay can be turned on and off using DTMF tones from on a remote radio. A high-pass filter in the transmit audio line reduces hum and CTCSS subaudible tones. Internal trimmers are used to adjust receive and transmit audio levels. Options available include a USB interface (pending), rack mount, 600 Ω line audio output, and special DTMF features. Price: kit version, $79; assembled and tested, $95. For more information, or to order, visit **www.w5txrlabs.com**.

Revisiting the Four Stage 75 Meter SSB Superhet

Compact homebrew gear isn't just for CW operators.

David Harrison, W6IBC

In the May 1989 issue of *QST*, the late Doug DeMaw, W1FB, proposed a simple superhet receiver for the 75 meter phone band.[1] His design utilized leaded dual gate MOSFETs for the first mixer and product detector stages. It also included a very simple single crystal IF selectivity filter to provide some rejection of the unwanted sideband and adjacent channels. A JFET VFO included a variable capacitor and vernier dial with a calibration table on the front panel. The audio stage featured the ubiquitous LM386 integrated circuit audio amplifier. Quiescent power supply drain was stated to be about 10 mA at 9 V dc. While the design arguably provided "the most for the least," it had some drawbacks as noted by its author, including lack of selectivity and lack of sensitivity for weak signal reception. All said, the design was, and remains, a classic gem, a reminder of the genius manifested by Doug DeMaw over his lengthy and prolific ham radio equipment designing and writing career.

Into the Next Century

Times have changed. Variable tuning capacitors are now hard to find and expensive. While dual gate MOSFETs with wire leads are no longer being made, several RF and audio ICs have shown considerable staying power, including the Philips (NXP) SA602 and the National LM386 circuits. Surface mount dual gate MOSFETs are presently available at surprisingly low cost and provide outstanding performance, assuming you can find a way to connect them into your circuit. With the arrival of the Small Wonder Labs PIC®-based Frequency Mite, inclusion of a low cost frequency counter has become a practical way to eliminate the calibration table or calibrated dial (the Frequency Mite uses Morse coded audio annunciation for the frequency readout).[2]

Patterned After the Original

The present design goals follow and extend those set forth in the original W1FB article. These include low noise performance with enhanced selectivity, available components, enough audio gain and output power to drive a speaker with gain limiting on the loudest of signals and minimal power drain enabling portable or battery operation. This project revisits W1FB's earlier work and adds some new wrinkles, including substituting a SA602 IC for the product detector/BFO and providing a four crystal filter for improved selectivity. The lead photo of the receiver front panel shows (clockwise) the frequency display, large TUNING knob, red COUNT push button, smaller GAIN control and AUDIO jack.The schematic and parts list are shown in Figure 1.

In addition, a permeability tuned, stable "soda straw" VFO is used. A passive automatic gain control (AGC) circuit is also included to develop a negative control voltage from the audio output. The AGC voltage reverse biases the first gate of a Philips BF998R depletion mode dual gate MOSFET serving as the first mixer.

An optional frequency counter with a visual display is described to replace the calibration table. While the circuit design employs familiar principles, a number of mechanical issues are addressed as well, including forming a mounting substrate for the BF998R MOSFET and constructing a mounting and linkage assembly for the permeability tuned VFO coil and its plastic tube coil form.

The circuit elements fit very comfortably within a small clam-shell box with room to spare on the circuit board and elsewhere for such other circuitry as the builder may desire to include, such as a CW transmitter, or a low level SSB exciter.

Receiver Circuit Description

Signals from the antenna pass through 500 Ω gain control potentiometer R15 and a band-pass filter comprised of transformers T1 and T2, resonated by capacitors C1 and C3. The tuned transformers are coupled together by inductor L3 to expand bandwidth to cover the current 3.6 to 4 MHz 75 meter phone band. The filtered RF is applied to the first gate of Q1, a BF998R dual gate FET. The VFO, using a single 2N5485 JFET or equivalent, borrows the well known "soda straw" circuit described in a prior article.[3] It is important that all of the frequency determining capacitors (C31-C35) be

[1]Notes appear on page 36.

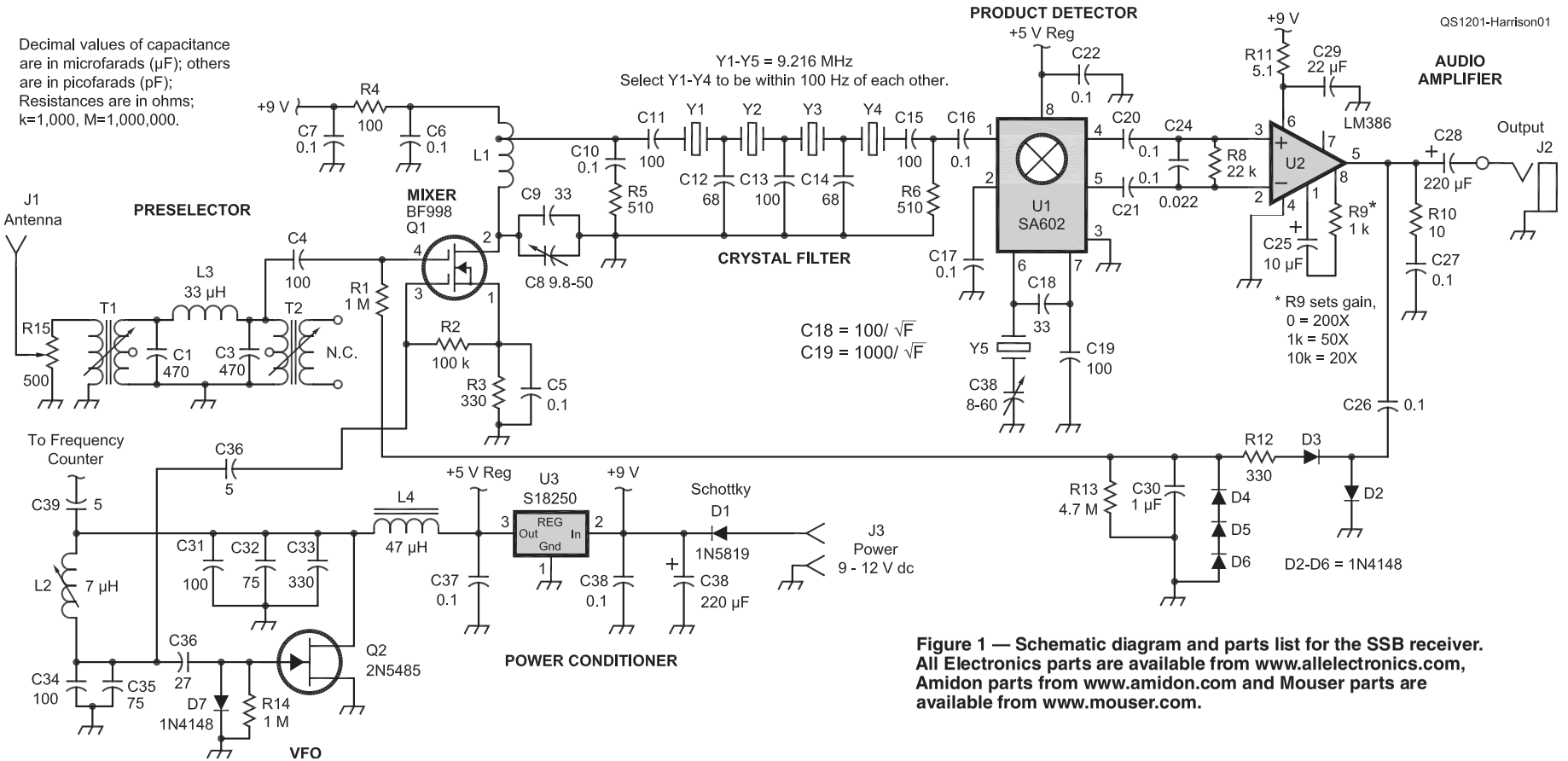


Figure 1 — Schematic diagram and parts list for the SSB receiver. All Electronics parts are available from www.allelectronics.com, Amidon parts from www.amidon.com and Mouser parts are available from www.mouser.com.

C1, C3 — 470 pF radial lead NP0 ceramic capacitor.
C2, C22, C23, C29 — Not used.
C4, C11, C13, C15, C19, C31, C34 — 100 pF radial lead NP0 ceramic capacitor.
C5-C7, C10, C16, C17, C20, C21, C26, C27, C37, C38 — 0.1 µF ceramic capacitor.
C8 — 9.8-50 pF trimmer capacitor, Xicon (Mouser 242-9850).
C9, C18 — 33 pF radial lead NP0 ceramic capacitor.
C12, C14 — 68 pF radial lead NP0 ceramic capacitor.
C24 — 0.022 µF ceramic capacitor.
C25 — 10 µF, 25 V electrolytic capacitor.
C28, C38 — 220 µF, 25 V electrolytic capacitor.
C30 — 1 µF ceramic capacitor.
C32, C35 — 75 pF radial lead NP0 ceramic capacitor.
C33 — 330 pF radial lead NP0 ceramic capacitor.
C36 — 27 pF radial lead NP0 ceramic capacitor.
D1 — 1N5819 diode, Vishay (Mouser 844-1N5819).
D2-D7 — 1N4148 diode, Fairchild (Mouser 512-1N4148).
J1 — BNC panel jack.
J2 — Mono phone jack, 1/16 inch.
J3 — Coaxial dc power jack.
L1 — 28 turns #24 AWG enameled wire on Amidon T50-2 toroid. Tap at 7 turns (Amidon Associates).
L2 — 7 µH adjustable tuning inductor. Closewound 42 turns on ⅜ inch outside diameter hollow tube permeability tuned by a brass screw (see text).
L3 — Molded RF choke, 33 µH (Mouser 542-5300-19-RC).
L4 — Molded RF choke, 47 µH (Mouser 542-5300-21-RC).
Q1 — NXP BF998R (Mouser 771-BF998R-T/R).
Q2 —2N5485 transistor, Fairchild (Mouser 512-2N5485).
R1, R14 — 1 MΩ, ¼ W, 5% resistor.
R2 — 100 kΩ, ¼ W, 5% resistor.
R3, R12 — 330 Ω, ¼ W, 5% resistor.
R4 — 100 Ω, ¼ W, 5% resistor.
R5, R6 — 510 Ω, ¼ W, 5% resistor.
R7 — Not used.
R8 — 22 kΩ, ¼ W, 5% resistor.
R9 — 1 kΩ, ¼ W, 5% resistor.
R10 — 10 Ω, ¼ W, 5% resistor.
R11 — 5.1 Ω, ¼ W, 5% resistor.
R13 — 4.7 MΩ, ¼ W, 5% resistor.
R15 — 500 Ω potentiometer (Mouser 755-308N500).
T1, T2 — IF transformer, Xicon, 10.7 MHz (Mouser 421F123-RC).
U1 — Integrated circuit, NXPSA602 (Mouser 771-SA602AN/01).
U2 — Integrated circuit, NJM386D (Mouser 513-NJM386D).
U3 — Integrated circuit, Seiko S81250 5 V regulator (All Electronics S81250). LM78L05 may be used.
X1-X5 — Microprocessor crystal, ECS HC49 (Mouser 520-HCU921-20X).
PCB — Twin Industries 8100-45 LF (Mouser 589-8100-45-LF).
Case — LMB-Heeger CR-643 (Mouser 537-CR-643).

negative positive zero (NP0 or C0G) ceramic monolithic units.

The 10 V_{P-P} output of the VFO, using a single JFET (Q2), is applied to the second gate of Q1 through C36, and the desired mixing product at the IF frequency of 9.216 MHz is selected by an output resonant tank circuit comprised of L1, C8 and C9. The IF signal is taken from a tap on the 28 turn tank coil, L1, and fed into a four stage crystal filter via capacitor C11. A crystal frequency of 9.216 MHz was chosen, although another frequency could be used, depending upon availability of a supply of suitable microprocessor clock crystals.

Impedance fixing resistance R5 is coupled via dc blocking capacitor C10 to the seven turn tap to reduce the Q of L1 as well as to match to the design input impedance of the crystal filter. The values for filter capacitors C11, C12, C13, C14 and C15 were derived by using the crystal characterization process and *XLAD* program provided in the ARRL's *Experimental Methods in RF Design* (*EMRFD*) masterpiece.[4] The filter's 3 dB bandwidth has been measured at about 2.5 kHz.

The output from the crystal filter is applied to an input of U1, a SA602 double balanced modulator circuit. U1 also includes an oscillator that provides a crystal controlled BFO signal set to the upper edge of the filter passband by variable capacitor C38. While the performance of the SA602 IC is known to be suboptimal in first mixer service, it works well in its designed for role as a product detector.

The dual differential output from U1 is applied to the differential inputs of audio amplifier U2, a LM386N-3, via blocking capacitors C20 and C21. Capacitor C24 and resistor R8 provide some high frequency audio roll off, and the combination of resistor R9 and capacitor C25 set audio gain at 50 times the signal input. Audio is then applied directly to a speaker or headphones through a jack on the front panel. The gain provided by this circuit arrangement is more than adequate to drive a small 8 Ω loudspeaker to full volume, even with the inclusion of the four stage crystal filter. The loudspeaker can be included within the clamshell box, or connected externally via front panel jack J2.

Since virtually no current is drawn through the control gates of MOSFET Q1, it is practical to use an AGC circuit without any amplifiers to generate a suitable control voltage. Accordingly, output audio is also applied through blocking capacitor C26 to a half-wave-rectifier voltage doubler of diodes D2 and D3. These generate a negative dc control voltage proportional to the audio output level, in accordance with an approach suggested in an earlier *QST* article.[5] This negative voltage is stored in a sample and hold circuit made up of capacitor C30 and resistor R13 having a relatively long time constant. Diodes D4, D5 and D6 clamp the negative-going AGC control voltage to no greater than approximately –1.8 V.

The control voltage is applied through resistor R1 to the first gate of the first mixer (Q1) and is effective to automatically limit amplitude of all signals to a maximum level without need to adjust the gain control, R15. Occasional "popping" is caused by very strong signals, as is typical of audio derived AGC circuits.

An efficient low voltage regulator U3, such as the Seiko S18250, puts out regulated 5 V dc to VFO Q2 and to the product detector chip, U1. Low voltage drop Schottky barrier diode D1 protects the receiver circuitry from inadvertent reversed power lead connections. The coaxial power jack J3 is provided to enable the power supply to be connected to the receiver. No ON-OFF switch is included, but one could readily be included if desired. With the circuit arrangement shown in Figure 1, quiescent power consumption is about 10 mA at 9 V dc. Power consumption is about 15 mA, with the counter in sleep mode. The current does increase with audio peaks because of the class AB operating characteristics of the LM386 audio chip U2.

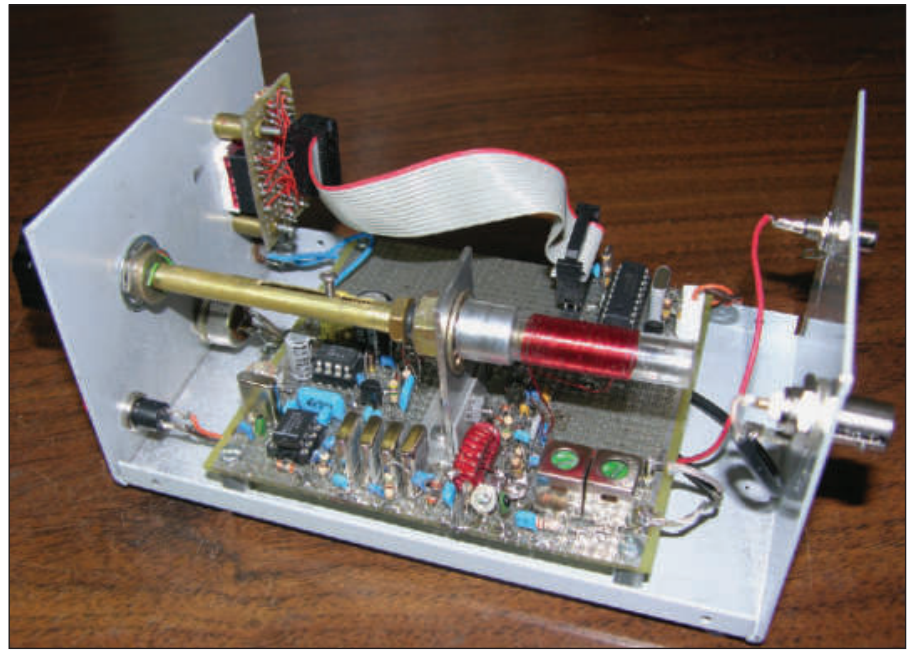


Figure 2 — Inside of 75 meter receiver showing assembly locations.

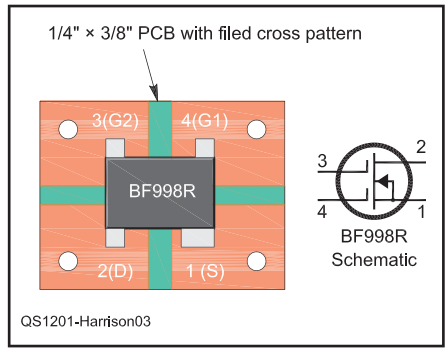


Figure 3 — Drawing of mounting method for the BF998R MOSFET on the mounting substrate.

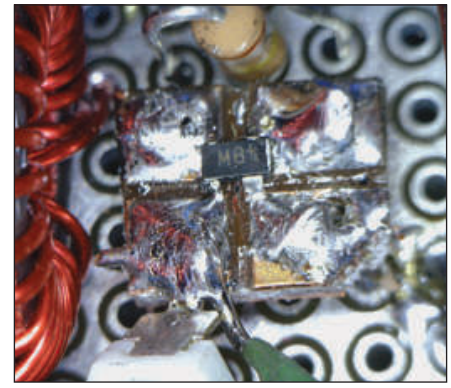


Figure 4 — Enlargement of BF998R MOSFET and mounting substrate installed in the 75 meter receiver.

Optional Frequency Counter Circuit Description

A single digit LED serial display frequency counter may be included to provide on-demand readout of the receive frequency. Circuit details and a source code listing of the control program is included in the QST-in-Depth website.[6] (The program will have to be adapted to the particular IF frequency and then assembled into object code and loaded into the PIC processor before becoming useful.) In this particular example of an IF fre-

quency above the receive frequency and the VFO frequency, a software subroutine subtracts the VFO frequency from the IF BFO frequency to yield a binary value corresponding to the present receive frequency.

Construction Notes

Figure 2 shows the location of the major subassemblies in the receiver. One of the key implementation challenges concerns mounting and connecting Q1, the minutely sized BF998R two gate MOSFET. Since the package is rectangular with four leads, I chose to form a cruciform pattern on a small rectangle of circuit board material, using a sharp edge of a needle file to remove copper in a cross-pattern, as shown in Figures 3 and 4. I drilled 0.040 inch holes in each resultant quadrant for later inclusion of connector wires.

I tinned one quadrant with solder using a temperature-controlled needle-point soldering iron. Then, with the aid of tweezers and a stationary-mounted magnifying glass, I placed the exceedingly small chip onto the patterned board and melted the solder to attach one electrode. Once the chip was properly positioned, I flowed solder on the remaining three quadrants to connect the other electrodes.

Since the electrode for pin 1 (source) is larger than the other three, I cut off a corner of the mounting substrate connecting the larger electrode to identify the respective Q1 electrodes. I then passed small wires with L shaped ends through the holes and soldered them in place to provide connection leads for later assembly to the circuit board. The BF998R and its mounting substrate as constructed are shown installed and connected within the circuit in Figure 4.

In the current project, I employed a small prototyping circuit board having pads and plated through holes on 0.1 inch centers and a single ground plane that I faced upwardly, so as to ease the task of soldering interconnects on the underside. All ground connections were made by simply folding over a component's ground lead to be parallel with the upper ground plane surface. The lead is then soldered to the ground foil and the lead cut to about a quarter inch length. A Twin Industries 4 × 5 inch prototyping board works very well, but may have to be cut down to 3.5 inches to fit into the preferred clamshell Crown Royal box made by LMB-Heeger. The board is attached to the inside of the box by four ⅜ inch threaded standoffs or spacers.

In laying out the circuit, a linear approach was followed, with the RF input at one end and the audio output at an opposite end. The front panel was laid out and holes and openings formed before circuit construction so that placement of mechanical features, such as a metal bracket for supporting the VFO coil L2, could be established at desired locations. It is especially helpful to form and attach the L shaped VFO bracket to the circuit board before the circuits are constructed. Once a journal opening for the VFO shaft is established in the front panel, the circuit board and bracket may be installed, and a brass shaft may be inserted through the front panel journal to aid locating and marking a drill center for the VFO coil support diagrammed in Figure 5.

Hamspeak

Automatic gain control (AGC) — Receiver system in which the gain is automatically adjusted for different input signals in order to maintain a constant output regardless of input level.

JFET — Junction field effect transistor. Transistor type characterized by high input and output impedances.

MOSFET — Metal oxide semiconductor field effect transistor. Active solid state device in which the current is controlled by application of a voltage resulting in an electric field. This is in contrast to the more common *bipolar* transistor in which the current flow is controlled by the input (usually base) current.

Product detector — Receiver demodulator that uses a local beat frequency oscillator (BFO) to heterodyne the information to audio frequencies. This is particularly well suited for SSB and CW reception.

Superheterodyne — Classic receiver architecture in which an incoming signal is beat with, or heterodyned with, a signal generated by a local oscillator (LO) to translate the incoming signal to an intermediate frequency (IF) for processing. The receive frequency is changed by moving the LO to shift a different incoming frequency to the same IF. This allows the same circuit elements to process signals of different frequency providing a consistency of operation and performance. In some receivers this happens more than once, with the resulting receiver dubbed double or even triple conversion superheterodyne.

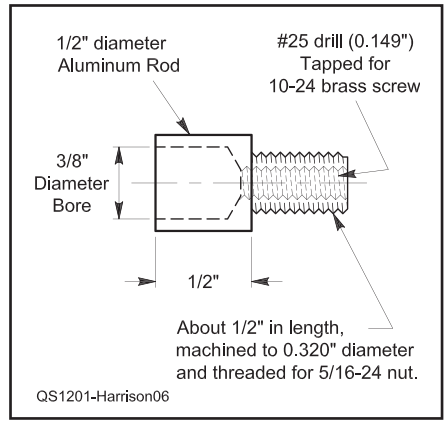


Figure 5 — Fabrication drawing of the VFO coil support.

The VFO coil support is most readily made if one has access to a small engine lathe. If a lathe is not available, it can be formed by using a drill press and a precisely clamped drill press vise holding a tool such as a drill in a precisely centered, vertical orientation. A cutting tool may likewise be mounted to a clamped vise and the chucked aluminum rod lowered onto the cutting tool to reduce the diameter of the rod where it will be threaded to receive a 5/16 × 24 nut. Figure 5 shows the relative dimensions of one implementation I've used successfully in this project.

The 9.216 MHz IF frequency fixed the VFO frequency range to be from 5.616 MHz (3.6 MHz receive) to 5.216 MHz (4.0 MHz receive). This relatively high VFO frequency resulted in a coil length of about ⅞ inch, a length found necessary to enable brass screw permeability tuning over the 400 kHz band range. Accordingly, a coil of 42 turns of #26 enameled copper wire is wound around a plastic tube having an outer diameter of ⅜ inch. After the coil is wound and secured by a suitable dielectric such as Teflon plumbers tape or plastic adhesive tape, the plastic tube is inserted in a snug fit into the drilled ⅜ inch recess of the VFO coil support. Teflon tape can be wrapped around the plastic tube to tighten the fit if necessary. The coil windings are moved together or apart during initial calibration to obtain the desired band spread and then secured with the tape.

A standard 10-24 round head brass screw, cut off at a suitable length, is threaded into an appropriately tapped central opening in the VFO coil support. A nut and O-ring threaded onto the tuning screw and snugly seated against the front of the coil support may be used to provide a desired level of drag on the screw relative to the coil support to reduce vibration and enable precise tuning. The head of the screw is ground down to a cylinder sized to slide comfortably within a ¼ inch thin wall brass tube forming the tuning shaft. The ground-down end is then drilled and tapped for a small 2-56 guide screw.

An elongated axial slot having a width to accommodate the 2-56 screw is cut into the brass tube. The length of the slot should correspond to the distance the tuning screw will extend in passing through the length of L2, as shown in Figure 6. One approach I used successfully was to use a ganged set of three thin slitting saws mounted in a standard ⅜ inch drill press mandrel to cut the slot into a properly aligned brass tube clamped in a relatively massive drill press vise. I hand manipulated the vise slowly and carefully to cut the axial slot as shown in Figure 7 after having marked the slot length. Removal of burrs and general cleanup of the slot was performed with a flat bladed thin needle file. A hole is drilled through the brass rod adjacent the inward edge of the panel journal to receive a locking pin or wire. With the arrangement shown, the

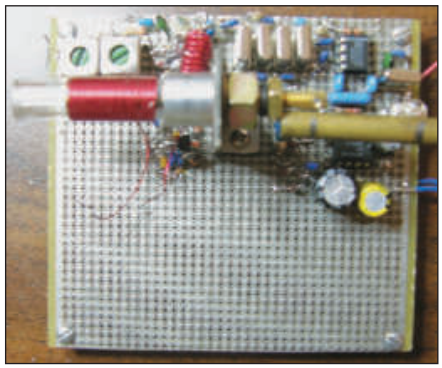


Figure 6 — Detailed view of the VFO assembly before installation into the receiver.

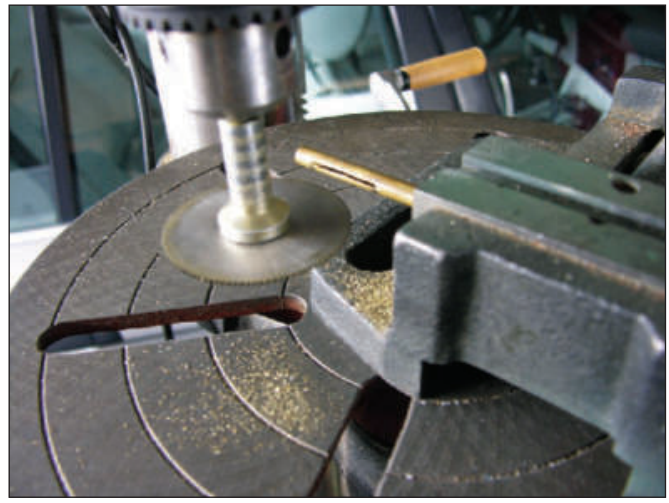


Figure 7 — Ganged slitting saws mounted on drill mandrel to form slot in VFO linkage ¼ inch brass tube.

tuning knob holds the shaft in place in the journal, and when rotated, rotates the tuning screw into and out of the coil. This avoids any axial displacement, thereby replicating the conventional ham radio tuning knob.

Some Final Thoughts

The performance of this simple receiver surprised and delighted me. I hear every signal from my antenna system that is heard by my ICOM IC-756PRO. Signals approaching –130 dBm begin to be too weak to be distinguished from system noise in headphones (as measured with a HP8640B, a very subjective measurement of noise floor demonstrating sensitivity and low noise). The receiver is incredibly quiet in the absence of signals.

Construction using the plated-through hole circuit board proved to be straightforward and effective. Alternative methods, including "ugly" construction over an unpatterned copper circuit board substrate could be used, as described, for example, in *EMRFD* and in my previously referenced article.[7] Use of a PCB having a ground plane undoubtedly resulted in improved circuit stability and interstage isolation. I personally like the flashing visual readout from the single digit counter.

While the principles are well established, this particular design is not optimal and includes many compromises made to keep it simple, to match parts on hand in my junk box and otherwise minimize parts count. Adaptations to CW with inclusion of a small transmitter and use of the well established "Freq-Mite" signal counter are obvious. At 20 meters and above, a low noise RF gain stage between the input band-pass filter and the U1 mixer stage would no doubt improve sensitivity. The microcontroller's processing power is clearly underutilized, and other routines could easily be included such as a keyer routine during transmit, if a CW transmitter were included in the project. In all, this was a fun project, and I encourage anyone with questions, comments or suggestions to contact me directly. I hope this article will encourage you to try homebrewing a project yourself.

Notes

[1]D. DeMaw, W1FB (SK), "A Four-Stage 75-Meter SSB Superhet", *QST*, May 1989, pp 25-28.

[2]D. Benson, NN1G (now K1SWL), "FREQ-Mite — A Programmable Morse Code Frequency Readout," *QST*, Dec 1998, pp 34-36. At the time of writing, the FREQ-Mite counter remains available from Dave's company, Small Wonder Labs (**www.smallwonderlabs.com**).

[3]D. Harrison, W6IBC, "Simple Sideband, Another Approach," *QST*, Nov 2007, pp 39-44.

[4]W. Hayward, W7ZOI, R. Campbell, KK7B, and B. Larkin, W7PUA, *Experimental Methods in RF Design*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8799. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

[5]D. Metzger, K9JWR, "Build the 'No Excuses' QRP Transceiver," *QST*, Dec 2002, pp 28-32.

[6]**www.arrl.org/qst-in-depth**

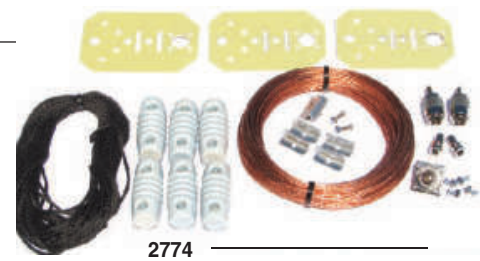
[7]See Note 3.

ARRL member David Harrison, W6IBC, holds an Amateur Extra class license and has been a ham since 1957. After completing a career as a patent attorney in Silicon Valley, California, Dave and his wife, Joy, KI6ASJ, retired to Windsor, California, a small town nestled among the vineyards of Sonoma County. He remains keenly interested in Amateur Radio and keeps his soldering iron warm. Dave is currently active on HF, VHF and in local ARES activities.

You can reach Dave at 9459 Vinecrest Rd, Windsor, CA 95492-2298 or at **harrisod@sonic.net**.

New Products

DIPOLE ANTENNA KITS FROM MFJ



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♢The MFJ-2772K Basic Dipole Antenna Kit includes everything needed to make one 80 to 10 meter dipole antenna or up to three different dipoles for 40 meters and up. The package includes 142 feet of AWG 14 stranded copper antenna wire, nine ceramic insulators and six aluminum wire clamps with stainless steel nuts and screws. The wire clamps allow easy adjustment of wire length. The MFJ-2774K Deluxe Dipole Antenna Kit has everything that is included in the MFJ-2772K plus three multipurpose center insulators, 100 feet of ⅛ inch nylon rope, two PL-259 connectors, two RG-58 reducers, two SO-239 connectors, and stainless steel screws and nuts. The kit can be used to make a G5RV multiband antenna or dipole antenna for 80 to 10 meters. The multipurpose center plates have prepunched holes designed to secure and relieve stress on your coax or parallel wire feed line. The center plate also has a prepunched hole for an SO-239 connector. Price: MFJ-2772K, $39.95; MFJ-2774K, $59.95. For more information, to order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

A 2 Meter and 70 CM Portable Tape Measure Beam

Work the OSCAR ham satellites or go transmitter hunting with this inexpensive portable dual band handheld tape measure Yagi.

John Portune, W6NBC

Figure 1 — Dual purpose, dual boom portable tape measure Yagi for 2 meters and 70 cm.

Many hams have made 2 meter tape measure beams for transmitter hunting. In this article we'll take that design two steps farther. First, we'll reduce cost and then we'll add OSCAR satellite Mode J capacity. A bonus is that a double boom design lets you fold the antenna up conveniently for transport or storage.

Keeping the Cost Down

When I first saw a tape measure 2 meter beam for transmitter hunting, I said: "What a great idea." So I bought a kit with tape measure material, PVC pipe, PVC X fittings and stainless steel hose clamps. It worked very well. Later I thought: "This would make a great ham club project if I could just get the cost down." Lightning struck — there's an easy approach that doesn't use expensive stainless steel hose clamps or PVC X fittings.

Simply drill 7/16 inch holes through a ½ inch inside diameter PVC boom and push the tape measure elements through. (See Figure 1.) It works just as well and is much less expensive. The long elements do need a short length of ⅜ inch wood or fiberglass dowel and a couple of tie wraps to stiffen them in the wind. The dowels push through the same holes. Now the most expensive parts of the beam is the RG-58 coax and the connector. Since then, local club members have made many 2 meter tape measure beams for transmitter hunting.

Working the OSCARs as Well

More recently I became interested in working Mode J OSCAR satellites — 2 meter FM phone toward the satellite, 70 cm FM phone from the satellite. What kind of antenna should I use? At a local club meeting I learned that there are several commercial handheld satellite beams on the market. The lecturer gave us a live demo of one during an actual satellite pass. But were there any good homebrew designs?

Then I remembered my handy little 2 meter tape measure transmitter hunting beam. Why not just add a 70 cm beam to it? The one shown is the result. I did not make any changes to the existing three element 2 meter transmitter hunting beam. For though it is a little shorter than most commercial satellite beams, and is optimized more for front to back ratio, it works just fine for the "birds" and of course still for transmitter hunting. I did, however, optimize the new 70 cm beam for forward gain. Figure 2 shows *EZNEC* elevation plots for both, with the beams turned vertically.

As just a bit of simple theory, the 70 cm beam needs to be rotated axially 90° from the 2 meter beam. This makes the two invisible to each other. I've seen designs in which they are in the same plane. I tried this and found it unsatisfactory. The reason, I believe, is that a 2 meter Yagi has a third harmonic resonance near 70 cm. The directivity of the 2 meter Yagi on UHF is poor. If you mount the two beams in the same plane, the patterns clash. I modeled this with *EZNEC* and saw that it is a poor idea.[1]

Folding for Storage

A particularly handy feature of this design is the dual boom. I had at first thought to just drill extra holes in the existing single boom for the 70 cm Yagi. In terms of performance, that would have been fine. But on the 2 meter only version I had been folding the element ends back under tie wraps for transport or storage (see Figure 3). Had I added a 90° fixed position UHF beam, the whole structure would have become cumbersome. Two rotatable booms is a better approach. By holding the booms together with two tie wraps one can easily rotate the beams into

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

the same plane for storage or transport. Most of the figures in the article show them in that mode. The folded-up dual-band beam is now no bigger than before.

Compatible Element Spacing

One of the slightly tricky parts was to design a 70 cm beam with elements that fit well between the existing elements of the 2 meter beam. Fortunately, the spacing of Yagi elements isn't critical. Experience has shown me that one can select almost any spacing, within limits, and by simply then adjusting element length, you get pretty much the same performance. Figure 4 gives placements and sizes. The elements are made from ordinary small-width tape measure material.

Baluns and Feed Point

The impedance at the center of the 2 meter beam will be less than 50 Ω. By shortening the driven element and inserting an inductive hairpin in shunt with the feed point, the impedance will be raised to 50 Ω resistive. Make an inductive hairpin as shown in Figure 5 from #12 AWG solid copper wire, 8½ inches in length. It yields reasonable SWR and is easily adjusted. The 70 cm Yagi's driven element naturally matches 50 Ω with-

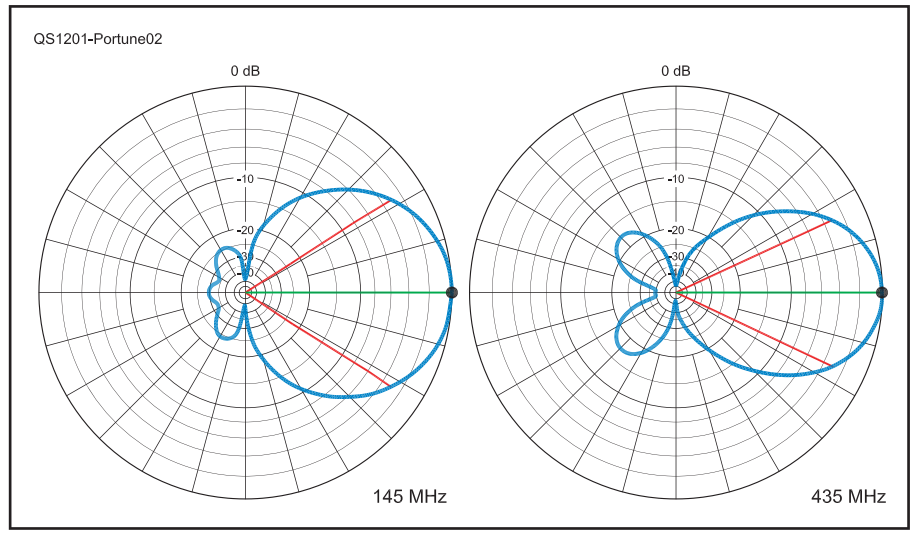


Figure 2 — *EZNEC* elevation plots with both Yagis vertically polarized. As shown, the 145 MHz gain is 7.5 dBi, the front-to-back ratio is 29 dB. For 435 MHz, the gain is 10.4 dBi, the front-to-back ratio is 38 dB.

Figure 3 — Booms rotated 90° and 2 meter elements folded back. Note tie wraps to hold ends.

Hamspeak

Diplexer — Passive device that accepts energy from two sources on different frequencies and combines them into signals on a single port. Alternately, it can accept signals on two frequencies combined into a single stream and separate them into signals on two ports based on their frequency.

EZNEC — Antenna modeling software that provides a user friendly interface to the powerful *Numerical Electromagnetic Code* (NEC) calculating engine. Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.

OSCAR — Orbiting Satellite Carrying Amateur Radio. Name given to a set of Amateur Radio satellites. The number following the name indicates the deployment sequence.

OSCAR Mode J — Amateur satellite mode referring to a single channel FM repeating satellite that has a 2 meter uplink and a 70 cm downlink.

Yagi — Multielement directive antenna array in which one or more elements are driven by connection to a transmission line and the others are parasitically coupled. Yagis are generally characterized by high gain for their size accompanied by narrow operating frequency range.

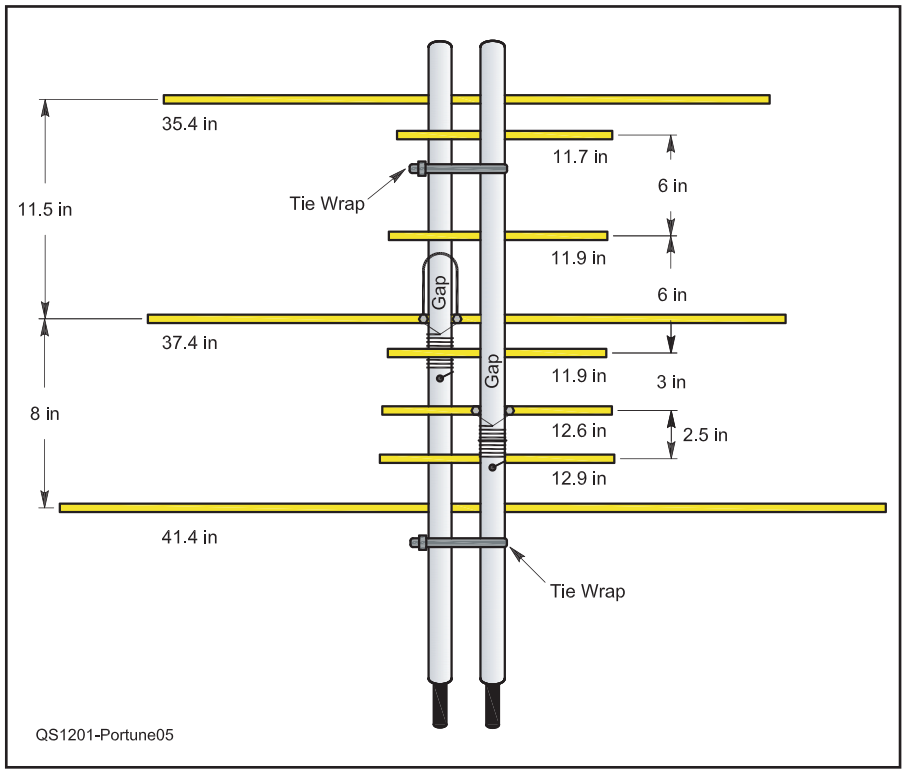


Figure 4 — Dimensions with booms rotated. Note the boom rotation tie wraps.

out any added tuning elements.

As with most coax fed antennas, baluns on both beams is highly recommended. Shown are choke baluns made by wrapping the RG-58 feed coax around the boom several times. Secure the ends through holes in the boom. For 2 meters, six turns is adequate; for 70 cm, use four turns. Run the coax down the inside of the boom and out the end. Use two 6-32 screws and four nuts to connect to each driven element. Leave a ¼ inch gap in the middle. Scrape the paint off the tape measure material and tin the area with solder to provide a good connection. Separate out a short length of the coax's inner and outer conductors and crimp on ring terminals.

Using the Yagi with a Dual-band Radio

I normally make my OSCAR contacts using two separate handheld transceivers, one for each band. You may, of course, use a dual band handheld, but in that case you will need a diplexer to connect the two antenna feed lines to the radio's antenna port. There are also several satisfactory homebrew diplexer designs on the Internet.

I claim no special magic for this antenna design. The Yagis are classical designs and the tape measure method well known. The charm is the mechanical arrangement. By eliminating PVC X fittings and stainless hose clamps, it is inexpensive, and by also using two booms it folds up neatly. I now can seamlessly combine two of my favorite ham radio disciplines, transmitter hunting and ham satellites in one handy portable antenna.

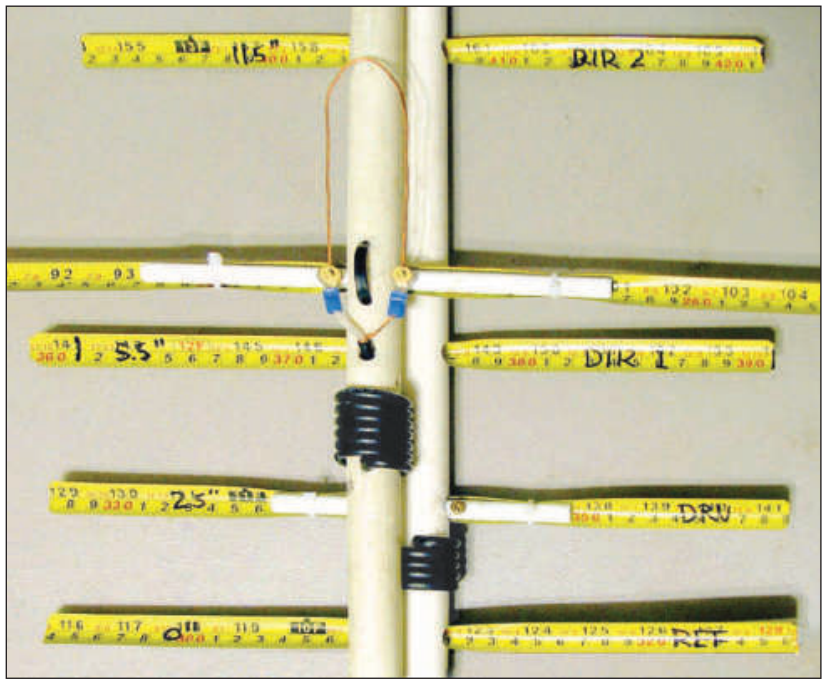


Figure 5 — Feed-point detail showing choke baluns, element stiffeners and hairpin match on the 2 meter beam. The booms have been rotated into storage mode.

Photos by the author.

ARRL Member John Portune, W6NBC, received a BSc in physics from Oregon State University in 1960, his FCC Commercial General Radiotelephone license in 1961 and his Advanced class amateur license in 1965. He spent five years in England as G5AJH and upgraded to Amateur Extra class in 1985. John retired, first as a broadcast television engineer and technical instructor at KNBC in Burbank and then from Sony Electronics in San Jose, California.

John is active on many bands and modes, predominantly from his HF equipped RV mobile station. He has written various articles in ham radio and popular electronics magazines and remains active as a VE team leader, ham license teacher and website designer. You can reach John at 1095 W McCoy Ln #99, Santa Maria, CA 93455, or at **jportune@aol.com** *or via his website at* **w6nbc.com**.

Moving Yet Another Band Lower with that HF Loop

Through clever matching techniques, you can operate on 160 meters with your 40 meter loop.

Dave Robertson, KE5QWP

A couple of years ago *QST* published my article describing a method for using a selected transmission line length and a single capacitor to make a half wavelength HF loop resonate.[1] The original motivation was my desire to work 80 meters by way of the single 40 meter full wave loop I had managed to squeeze into the attic. That was after my initial attempts to make the loop bigger had resulted in putting my foot through the kitchen ceiling and a subsequent family ban on more attic wiring adventures.

Don't ask me why, but for some reason 160 meters, the band that I could not yet work, became my next *failure is not an option* tuning project. I started to stare at the *EZNEC* impedance characteristics of the full wave 40 meter loop at 1.8 MHz to figure out what the challenges might be to add that band.[2] Note that the perimeter of the loop is a quarter wavelength at this frequency. The model predicted impedance is in the vicinity of 6-7 Ω resistance and around 1000 Ω of inductive reactance ($6 + j1000$).

Part of the reason I went to the single capacitor method described in the earlier article is that I prefer capacitors versus inductors for the tuning of compromise antennas. That makes me like loops versus dipoles (short dipoles are capacitive and require series loading coils while short loops are inductive). Big, continuously tunable capacitors are still pretty easy to find and are not prone to the same resistive losses as the big coils needed at low frequencies to tune dipoles or verticals. I also like loops because a big array of ground radials is not required, as one would require for a 160 meter vertical monopole.

Sizing and Gathering the Pieces

Anyway, back to 6 Ω of resistance and 1000 Ω of inductance per the *EZNEC* model. I knew that a material part of this would be loss resistance (versus radiation resistance) but I resolved to make the best use of whatever radiation resistance was there.

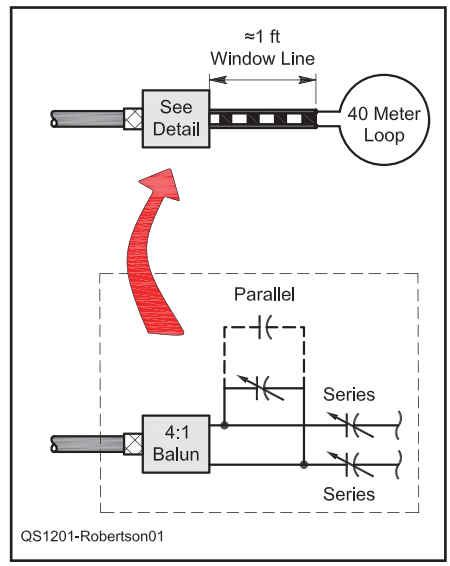


Figure 1 — Schematic layout of capacitor tuned 160 meter ¼ wave loop.

The challenge would be to cancel the inductance by adding series capacitance. What one needs to watch out for is high voltage and somewhat high current. If we want to get all the power into the 6 Ω, the current will be $\sqrt{(P/6)}$. For a power of 100 W, the current will be in the vicinity of 4 A. Due to the 1000 Ω of inductive reactance, there will be 4 kV between the antenna terminals.

With a voltage of 4 kV applied to the series capacitance, it helps to reduce the stress on the capacitors by splitting the voltage across two, one per feeding side. As I've visited swap meets and searched around on the Internet, I've found it relatively easy to gather an inventory of doorknob type and transmitting variable capacitors rated for several kilovolts and 5-10 A. I knew that I would need to fine tune the total series capacitance, but I decided not to be so concerned about exact balance and went for a reasonably close value fixed capacitor on one side of the antenna feed and a beefy air variable on the other. The required capacitance on each side would (in theory) be in the vicinity of 200 pF — a nice round value for fixed capacitors and nicely in the range of most of the air variables I've collected over time.

The Bulb Comes On

Then the "aha moment" based on my learning from the half wave loop exercise appeared. Having resonated the large inductance, matching to 50 Ω via a standard tuner would be practical but somewhat loss prone with the usual commercial T-network configuration. When I was tuning the half wave loop, I'd adjusted the length of the transmission line to achieve a relatively small inductive component, then used a single large parallel capacitor to achieve a final impedance match. What I came to realize was that I could add just a little less series capacitance than was needed to cancel all of the inductance (for the quarter wavelength loop), then use a single parallel capacitor to do the final matching. In effect, we create a balanced L network with series L and parallel C, a well known configuration for efficiently matching a very low impedance to a higher transmission line impedance. The L is leftover inductance of the antenna itself, once most it is offset by series capacitance.

So now I have two big air variables, one in series with one antenna leg and the other in parallel with the input. I also have a big fixed capacitor in the opposite antenna leg. Off I went to try for a match (see Figure 1). After lots of experimentation, juggling and more than a few sparks and minor RF burns (I eventually learned to wear gloves and safety glasses), I managed to get a nice match with capacitances somewhat higher than 200 pF per side and a parallel capacitance of a few thousand picofarads (see Figures 2 and 3). The size of the series capacitors implied that the actual inductance of my particular loop was somewhat lower than that predicted by the simulation. No doubt this has something to do with the fact that it is in an attic and wraps around all manner of other attic stuff.

[1]Notes appear on page 42.

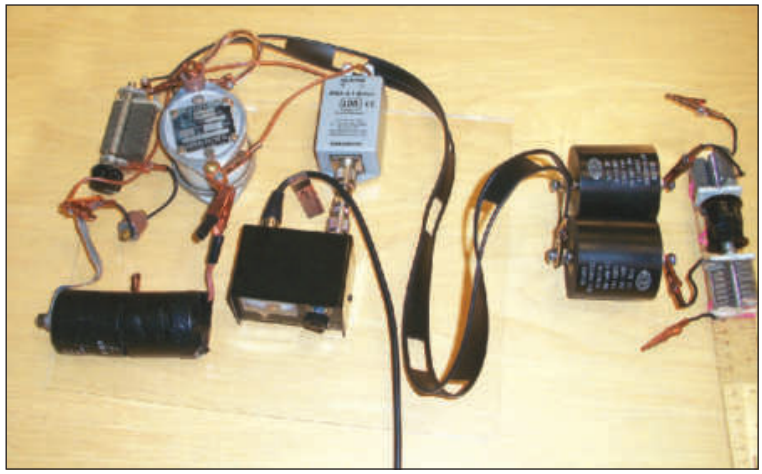


Figure 2 — Plexiglas breadboard contains series and parallel capacitors I normally use as well as balun and an SWR bridge for tuning feedback. The additional capacitors were added to reduce overall series capacitance and spread out the higher voltages (to the right of the window line) when I fed the temporary 200 ft loop.

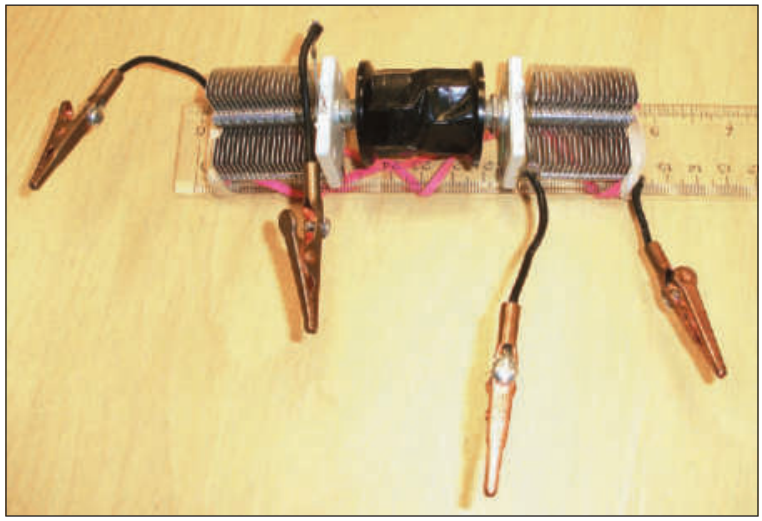


Figure 3 — I found a way to fudge a balanced, isolated pair of variable capacitors for series-C adjustment. The tuning knobs are taped together.

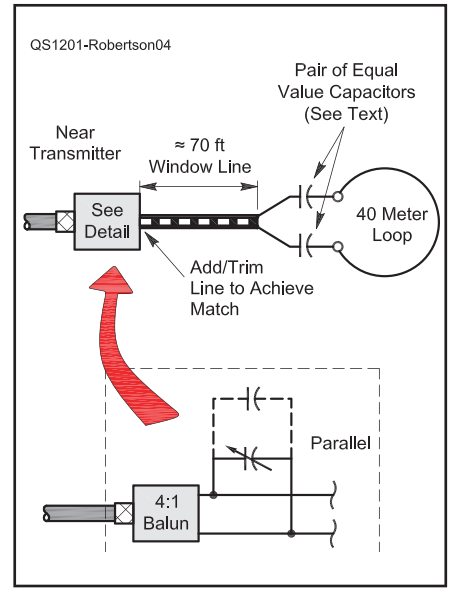


Figure 4 — Schematic of the remotely tuned loop antenna system.

Practical Simplifications and Generalization

One thing I learned was that trying to build the high value capacitor with a significant variable component can take quite a few parallel parts. The required capacitance can be significantly reduced by matching to a higher Z_0. I found insertion of a 4:1 balun prior to the capacitors (on the radio side) made life much easier. The size of the series capacitors hardly changes as this is done, since they are needed to cancel almost all of the antenna's inductance, in either case.

The above raises an entire range of medium size loop design options. There has always been something of a gray area in antenna literature between *large loops*, loops with perimeters greater than a half wavelength, and *small loops,* loops much smaller than a half wavelength. The latter, often referred to as magnetic loops, are often built with pipes and welds so as to minimize loss resistance — generally the major performance limitation of small loops with fractions of an ohm of radiation resistance.

Loops smaller than a half wavelength are always inductive so can be resonated with capacitors. Inductance and resistance decrease as the loop's size decreases. The smaller the loop, the more constant the radiating current around it. This leads to radiation pattern attributes that resemble the attributes of small magnetic loops. As the loop becomes smaller (relative to a half wavelength), where it is fed (side or bottom) becomes less and less important and some good low angle radiation characteristics can be achieved without a big ground radial array. Somewhere around a quarter of a wavelength, the radiation resistance drops to less than 1 Ω and wire and connection losses get to be an overwhelming factor with efficiency quickly dropping below 10% and the magnetic loop effects predominate.

More recently, I had opportunity to use some temporary space, sufficiently large to hang an oddly shaped, side fed 200 foot loop. This is nearly a half wavelength on 160 meters, and *EZNEC* predicted around 2500 Ω inductance plus around 10 Ω of resistance at the feed point. The analysis above helped me to tune this up in a snap. In this case, given even higher series capacitor voltages, I started using three layers of series capacitors (the additional two layers are to the right of the window line in Figure 2) in order to divide the high voltage.

All of the loop systems I tuned had a wide enough SWR bandwidth to allow operation over the most useful part of the 160 meter CW band without constant tuning. This is a plus for medium loops versus the small magnetic loops, which need to be tuned for even small frequency excursions but is also an indicator of lower efficiency, something the original choice of wire leaves me the victim of.

Getting the Tuner Closer to Home

The above three-capacitor discussion was all in the context of tuning elements placed at the loop feed point. That means elimination of all transmission line loss due to mismatch and simple calculations. Unfortunately, it is not always convenient or even possible to place a bunch of adjustable tuning components right at the feed point. My feed point is up in the attic and going in there every time I want to tune to a new frequency range gets old very fast. Here's the remote tuning strategy I chose,

Figure 5 — With the single tuning element used at the antenna feed point (see Figure 4), I can tune the system in the shack (letting ladder line do some of the tuning job). A little less power efficiency but fewer "moving parts."

which made use of all of my learning:

- Link the loop feed location to the shack (or wherever the variable tuning components are best located) via window line, so that power loss due to the high SWR can be minimized. The length of the 400 Ω line I started with was about 70 feet (around an eighth of a wavelength at 160 meters). I had quite a bit of slack and found myself trimming off several feet to achieve my final tuning objective, as described below.
- Put a fixed high voltage capacitor in series with each wire at the feed point. The capacitance is small enough to cancel all of the antenna inductance and add even more capacitive reactance to offset the phase and impedance shift imposed by the transmission line. My choice of a 150 pF capacitor added to each leg (for 75 pF total effective series capacitance) more than offsets approximately 1000 Ω of antenna inductive reactance (moving R + *j*1000 to R – *j*180). This impedance is then transformed to one with a positive reactance component after the transmission line is added. Note (again) that the antenna-capacitor-transmission line combination needs to present a net (and relatively small) inductance for the L tuning technique to work.
- Apply the L tuning strategy as described above. This is where I applied my earlier lesson that fine adjustment of transmission line length and parallel capacitance is a practical alternative implementation of the L matching network for impedances in the range of interest, the range of impedances on the top left quadrant of a Smith Chart (see Figure 4).

In my case, care in calculating the size of the feed capacitors considering the antenna impedance and transmission line length allowed me to just trim the length of the transmission line to a point at which an optimum inductive reactance plus resistance combination for matching was reached. Then I was able use a single variable capacitor, connected in parallel with the antenna side of my balun (an alternative could have been a large doorknob capacitor in parallel with a smaller air variable) to achieve the match. This was trial and error, though the math told me that my starting point was close.

In general, as long as R is well below the characteristic impedance one is trying to match to (200 Ω for my case, because of the 4:1 balun inserted prior to interface with the 50 Ω rig) and a relatively small residual inductive reactance, it will be possible to just trim or add transmission line (see Figure 5). This will mostly adjust the inductive component, though there is some small change in the real part as well. The parallel capacitance is adjusted at the end in order to achieve a perfect match.

Although window line minimizes loss pretty well, one wants to be mindful of the fact that some significant power loss will occur as a result of the high SWR on the run to the shack even with low loss line. This is a cost of this remote tuning design and sacrifices something on the order of 30% of the available power in order to provide tuning convenience.[3] Larger loops (with higher R values) or shorter transmission line runs would help reduce this. I thank Steve Hunt, G3TXQ, for bringing my attention to this type of transmission line tuning loss following my previous article and leading me to the referenced tool for estimation of transmission line impacts. I take 30% seriously, so I go to the trouble to remove this compromise and go back to the full tuner, right at the antenna, when conditions are not great or I'm going for maximum distance.

I've really enjoyed exploring top band (160 meters) with these compromise loops. My 100 W have allowed me to reach the farthest continental states and a couple neighboring countries — not so bad for an indoor 160 meter antenna. I am thankful for all of the big gun stations with Beverage receive antennas, kilowatt transmitters and huge outdoor antennas who offset my compromises. Locals are easy, as NVIS-type radiation is included at no additional cost.

Notes

[1]D. Robertson, KE5QWP, "Squeezing the Next Lower Band Out of Your Big HF Loop," *QST*, Oct 2009, pp 36-38.

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

[3]Calculated using tool at **www.vk1od.net/calc/tl/tllc.php**.

Photos by the author.

ARRL member and General class licensee Dave Robertson, KE5QWP, received his first US call sign in October 2007, after multiple decades away from the hobby. His original experience with ham radio occurred when he was a teenager in the early 1970s using his original Canadian call, VE3HHR.

Dave has a Bachelor's Degree in Electrical Engineering from the University of Waterloo and a Master's Degree in Electronics Engineering from Carleton University, Canada. Dave is Vice President of Engineering at ZixCorp (**www.zixcorp.com**)*, a provider of secure, hosted e-mail encryption services.*

Dave lives in Richardson (near Dallas), Texas with his wife and two daughters. He enjoys skiing and fishing when he's not moving wires and trying for DX. You can reach Dave at 3906 Sharp Ln, Richardson, TX 75082 or at **drobertson@zixcorp.com**.

Providing Power for Your Pet Project

Don't let the power supply tail wag the project dog — there are many ways to skin a cat!

Joel R. Hallas, W1ZR

Most radio projects, with a notable exception of typical antennas, require dc power to operate the devices with the circuit. Sometimes the project designer includes the power source within the project but, more often than not, a terminal is provided for you to hook your power source. Now what do you do?

AC Operated Power Supplies

The Transceiver Power Supply

Many projects require a nominal 12 V dc for operation. If you have a recent HF or VHF transceiver in your shack, the chances are good that it is powered by a power supply, typically 13.8 V at 20-25 A for a 100 W transceiver or perhaps 5-10 A for a VHF set. If your power supply is an aftermarket unit, chances are it includes terminals you can tie some leads to in order to power your project while you are developing it. I suggest that you put an additional fuse in the lead going to your project, perhaps a 1-2 A fast responding fuse. Otherwise that 25 A supply could quickly turn your project board and its sensitive parts to toast.

If your power supply is a dedicated type, it may have a proprietary connector type that requires an additional step. You will need to get a mating connector to bring out power to your project instead of the transceiver. These may be available at electronic retail stores, or directly from the manufacturer.

If you are going to want to operate the project as part of your station while the transceiver is in operation you will need another piece — a power distribution strip.[1] This acts a lot like the typical power strip that your PC, monitor and printer may be plugged into, except it is designed for 12-14 V dc. You will need to make up a cable to plug your power supply into it, as shown in Figure 1, then terminate the transceiver power cable to go into the strip. Additional accessories and projects can be connected to the strip, each with a dedicated fuse. This will only work if your transceiver's power supply has some extra capacity, usually the case. Let's say you have a 25 A supply and your transceiver draws a maximum of 22 A. That means you have at least 3 A available for accessories. Since many accessories don't draw much current, this usually works — but plan to check the numbers before you commit to doing it.

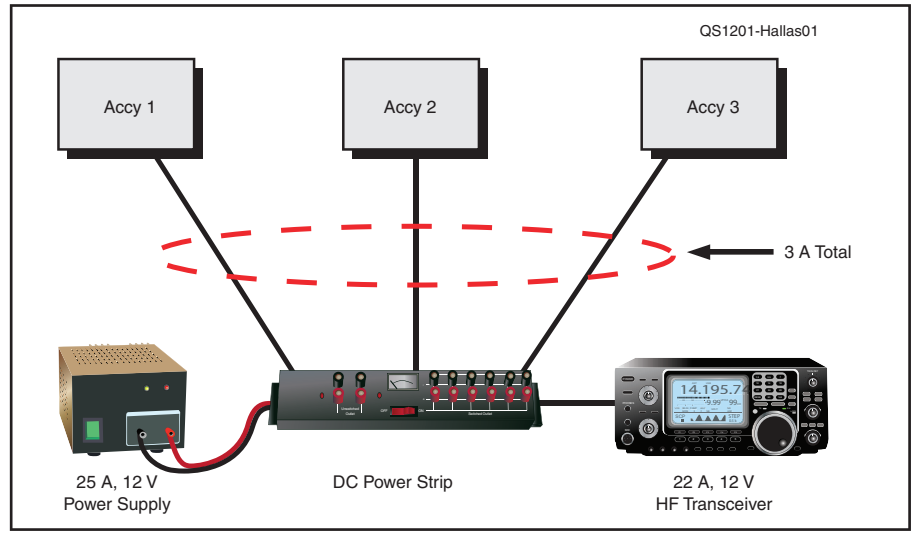


Figure 1 — Connection arrangement to power accessories or projects from your transceiver's nominal 12 V power supply. The sum of all simultaneous currents should be less than the supply's current rating. This has the added advantage of displacing all those pesky wall warts — if the devices can be run from 12-13.8 V.

Table 1
Typical Alkaline Battery Capacity[2]

Battery Type	*Capacity (mAh)*	*Typical Drain (mA)*	*Hours to 50% at Typical Drain*
D	12,000	200	30
C	6,000	100	30
AA	2,000	50	20
AAA	1,000	10	50
9 V	500	15	17
6 V Lantern	11,000	300	18

[2]Data from **www.techlib.com/reference/batteries.html**.

A Dedicated Bench Supply

Since many projects don't have high current requirements, a big transceiver power supply may be overkill. A very handy kind of supply is a variable voltage output (typically 0-15 V) with a current rating of a few amperes. While such a power supply can get pricey if also rated at high current, I got my 0-25 V, 1.25 A bench supply with switchable VOLTAGE/CURRENT meter for a few dollars at a flea market. It has served me well for many projects and if I need more oomph, I know where to get it.

Primary (Nonrechargable) Batteries

Alkaline Batteries

Don't sell drug store batteries short, either. With a few battery holders, such as those that take a pair of D cells, or perhaps four AA batteries, various combinations of voltage can be made available to meet the needs of a project during development. The trick with these batteries is to match them to the task. Alkaline batteries have made the

[1]Notes appear on page 44.

earlier leak prone carbon-zinc dry cell batteries of years past obsolete.[2]

Their rated capacity (see Table 1) doesn't tell the whole story. For one thing, they will discharge more rapidly than their rating if the current is higher than that shown. For another, at 50% capacity they will still have half their energy but their voltage will drop from 1.5 to 1.25 V, and keep going down from there. Still if matched to their load, they can be useful. For example, a 12 V source made of 8 AA batteries in series and delivering 25 mA should go 40 hours until it drops to 10 V. The same pack can deliver 100 mA for about 12 hours until it reaches 10 V.

Note that unlike ac operated power supplies, batteries don't include protection from excessive current unless you provide proper fusing. This is very important because all batteries can deliver very large currents for at least a short time. This current can potentially damage your project and in some cases result in a fire or explosion.

Lithium Batteries

Another choice in the primary battery marketplace is the lithium battery — not to be confused with the lithium-ion secondary battery described below. Lithium batteries are designed for high capacity, long life service in applications such as heart pacemakers, but also are used in cameras and clocks. While there are multiple chemistries available, with different voltages up to about 4 V/cell, most consumer lithium batteries provide 1.5 V/cell and are in familiar sized packages, allowing direct replacement for alkaline batteries.

They do cost more per watt than alkaline batteries and probably don't offer any real advantage in this application, if you buy a bunch. As an example, a 3 V lithium cell delivering 3.3 Ah, about 50% more than a pair of alkaline AA batteries, costs about $8, compared to about $2 for the alkalines.

Secondary (Rechargeable) Batteries

Nickel-Cadmium (NiCd) Batteries

For many years, rechargeable batteries for electronics were almost always NiCds. They worked well, kept their charge for long periods if not used and typically were available in similar size containers to those listed in Table 1. They can be used in place of the alkaline batteries, but they start out at a lower voltage per cell. A NiCd battery will have a fully charged voltage of 1.2 V/cell — starting out below the point at which the alkaline is down to 50% capacity. This is not necessarily a major issue — just be sure to take it into account while planning your supply.

Of course the advantage is cost — the NiCd batteries can be recharged over and over, but keep enough on hand so one set can be used while the other is in the charger. Figure about 12-14 hours for a full recharge — not too bad if you sleep at night. Of course, if you start out with the alkaline cells, you can transition to NiCds later once you get a charger and some batteries. Keep in mind that you can probably find a bench supply for less than the cost of batteries and a charger.

Nickel-Metal Hydride (NiMH) Batteries

NiCd batteries fell from grace largely due to the problem of disposing of the hazardous cadmium, a heavy metal not well suited for landfills. The NiMH eliminates the cadmium in a similar sized and similar energy rated series of batteries. They are usually available in AAA and AA sizes, with AA cells having a capacity rating from 1.5 to as high as 3.1 Ah, about twice a NiCd. They also typically provide 1.2 V/cell, so can be used to power equipment as a direct substitute for NiCd cells in many applications.

NiCds have an edge for higher discharge rate applications, and the NiMH cells require a different charger to properly regulate the charge level and can cause fires if improperly charged — so do get the correct charger. NiMH cells also do not keep their charge as long while not being used. Still, eliminating the hazmat issue is important.

Lithium-Ion (Li-Ion) Batteries

Most current electronics with recharagable batteries now use lithium-ion batteries instead of the nickel based type. These are less expensive than nickel batteries, but are not a direct substitute. The fully charged Li-Ion delivers about 3.6 V. This is a bit less flexible in terms of providing voltages for experimenters than the previous types.

Li-Ion batteries can be made in various shapes and sizes — suitable for manufactured goods from cameras to autos, however, they are not terribly well suited to workbench use, although perhaps will fit in some special applications.

Lead-Acid Batteries

Small (typically 4.5 Ah) sealed nominal 12 V lead-acid batteries (AGM or gel types for indoor use) can often be obtained at low cost, or even for free from those who routinely replace computer backup or emergency lighting batteries. These can be useful in the shack and on the test bench, once charged up. Again, the cost of the charger is likely to be more than a bench supply, although a variable voltage bench supply can make a good charger as well, if you want to eliminate power leads on your bench.

Conclusion

Don't let lack of a suitable power supply keep you from tackling an interesting do-it-yourself project. There are many ways to make it happen without breaking the bank.

Notes

[1]Suitable dc power strips are manufactured by MFJ (**www.mfjenterprises.com**), West Mountain Radio (**www.westmountainradio.com**) and Powerwerx (**www.powerwerx.com**).

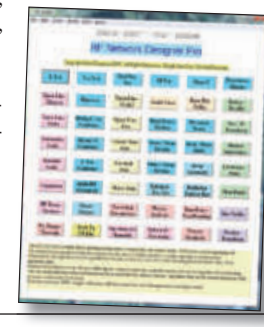
[2]*The ARRL Handbook for Radio Communications,* 2012 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 6672 (Hardcover 6634). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**. Pages 7.32 to 7.38 cover batteries.

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

New Products

RF NETWORK DESIGNER PRO SOFTWARE

◊*RF Network Designer* by Grant Bingeman, KM5KG, is a suite of RF design engineering tools useful to both amateurs and professionals. The latest version provides several enhancements of the many functions built into the program. For example, the general network analysis tool allows the user to specify which branch currents are of special interest, and highlights and normalizes them. This is very useful for advanced studies of antennas having more than one driven element. Another feature is automatic design of phased array networks, including user-specified adjustment range, providing component current and voltage stress analysis over that range. Bandwidth and adjustment sensitivity can be analyzed in each of the many network design modules, such as T, Pi, L, power amplifier output circuit and so on. All component losses are calculated and the effects evident in all design modules. Many of the design results can be plotted automatically as linear graphs or on a Smith chart. A typical design module interacts with other design modules such that data are transferred in the background. Free upgrades to the latest version are available for two years after purchase. Price: Amateur Radio version, $70; Pro version, $150. A demo version of the program is available for download. For more information, or to order, visit **www.km5kg.com**.



A Low-Impact Mobile Installation

You don't have to take a chain saw to the family chariot to have an effective mobile installation.

Thomas E. Nolan, W3EX

Figure 1 — Rear view of the Highlander with ATAS120 mounted on left side of the hatch door.

One of the challenges and frustrations for mobile operators comes when you change to another vehicle. In addition, many of us have family members who don't necessarily share our love for wires, radio equipment, antennas and the like — either in our homes or especially in our vehicles.

After I recently upgraded from my previous auto to a 2008 Toyota Highlander crossover, I faced the task of installing my FT-857 HF/VHF/UHF transceiver, an ATAS120 motorized HF antenna and ClearSpeech DSP speaker in as unobtrusive a manner as possible. As mobile operators know, most newer vehicles do not have adequate provisions for mobile installations. Therefore, careful planning is needed to complete a functional and esthetically pleasing installation. Also, I promised my wife that the equipment would be as invisible as possible and would not compromise the integrity of the car. The following describes how that promise was kept while maintaining a mobile installation that I could enjoy operating and be proud of.

The Rubber Hits the Road

The first order of business was to determine the location for the main body of the transceiver and the front panel. Due to space constraints, I considered it necessary to mount the main body somewhere in the rear of the vehicle and the front panel in the front seat area. I also wanted the main body close to the antenna to minimize transmission line length. With the antenna mounted in the left rear of the vehicle (see Figure 1), one choice was to remove the plastic storage boot in the left rear of the vehicle and mount the unit beneath the storage area. A similar area on the right rear of the vehicle was not available due to tire change jack storage, so left rear was the logical location for the antenna.

Unfortunately, with the radio in place in the area below the left boot there was no room to replace the boot. I was running out of options. I knew I would need some assistance running cables so I visited the local auto stereo store and presented my problem to the installer. It turns out that the installer's

Figure 2 — Luggage compartment showing access panel to tire change tools.

Figure 3 — Mounting of the main body of the transceiver, diplexer and associated cabling.➢

Figure 4 — Mounting of the front panel, DSP speaker and microphone on front console.

Figure 5 — Stealth mode location of speaker and microphone in front seat boot.

father, Frank, had been a ham, so Frank had a very good understanding of the dilemma and a simple solution to my problem. [Auto alarm installers are another potential source of knowledge and necessary skills. — *Ed.*]

Find Someone Who Knows

Located across the back floor of the vehicle is an access panel to the tire change tools stored below (see Figure 2). After about 2 minutes of surveying the situation, Frank recommended that the main body, antenna diplexer and associated cabling would fit nicely in the small space just beneath the access panel. He also said that he could easily run the control, microphone and speaker cables to the front of the vehicle from that space. In addition he could easily provide a dedicated fused cable from the positive post of battery in the engine compartment to the radio. Figure 3 shows the mounting location of the main body, diplexer and associated cabling.

The next step was to determine the location for the front panel, speaker and microphone. I had decided that the front panel needed to be in a location that I could get to it while ergonomically stabilizing my right elbow on the boot between the seats while driving. I also wanted the ability to get access to the panel while riding in the passenger seat. I had purchased an air conditioner vent radio mount, but was not satisfied with the device because it was somewhat unstable and was in a position from which I could not rest my elbow. So I purchased a beverage cup mount that worked out well. The radio panel was more stable and allowed positioning of the panel so that I could rest my elbow on the boot (see Figure 4). There remained the issue of where to terminate the cabling for the panel, microphone and speaker.

It All Comes Together

With Frank's help, I decided that the front panel cable should terminate in the glove compartment and the microphone and speaker cables in the boot between the front seats. In these locations it was possible to go stealth if off the air and have minimum visibility of wires while operating. In the stealth mode the front panel is stored in the glove compartment and the microphone and speaker in the boot. Figures 4, 5 and 6 show the locations of the various components of the installation.

To prepare for operation, the panel is removed from the glove compartment and snapped into position on the cup mount. Figure 7 shows the routing of the control cable from the glove compartment during operating mode. The DSP speaker is removed from the boot and positioned, with the help of hook and loop tape and rubber pads. The microphone is removed from the boot and stored in the rear beverage cup for handy access.

I had decided early on that I did not want to tackle the wiring project. So for a reasonable fee Frank accomplished the job in a very professional manner. The panel control, microphone and speaker cables were skillfully run to the appropriate locations. A direct run of #6 AWG fused unswitched

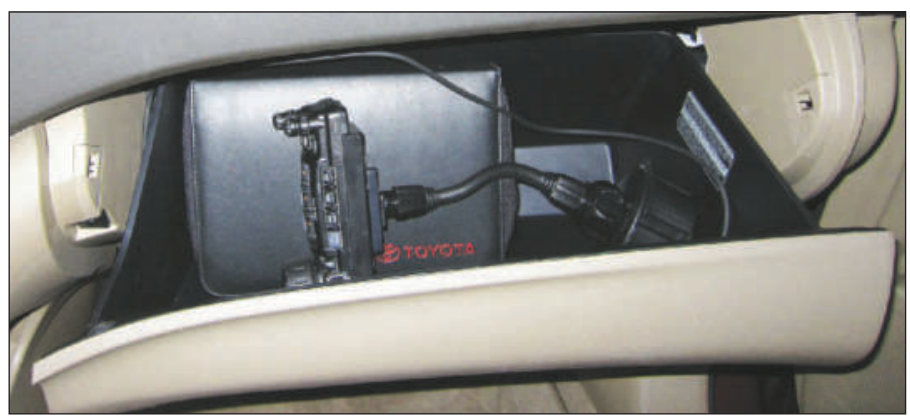


Figure 6 — Stealth mode location of front panel in glove compartment.

Figure 7 — Operating mode location of front panel showing routing of control cable from glove compartment.

Figure 8 — Dedicated fused power cable installation in engine compartment.

cable was run between the engine compartment battery to the main radio body (see Figure 8). An ignition-switched circuit was supplied to the DSP speaker. Since the FT-857 has an auto-off mode, switching of the power cable was not necessary. On the other hand, I had learned from personal experience that the DSP speaker can drain the car battery during a 2 week vacation in the Bahamas during mid winter.

The ATAS120 antenna was mounted to the vehicle using a Diamond K400C UHF base with 6.5 feet of RG-316 teflon coax and a PL-259 coax plug. With the ATAS120 antenna mounted on the left rear of the car it was possible to make a direct run of the short feed cable to the diplexer. The antenna manual suggests that the base of the antenna be thoroughly grounded to the vehicle body in order to provide efficient operation and low SWR. In my installation there was no need to provide any additional grounding between the hatch and the vehicle body as the antenna loads perfectly on all bands on which it is designed to work. Other operators may find it necessary to provide additional grounding depending upon the body design of the vehicle.

This installation has proven to work well for me and has provided many hours of enjoyable mobile operation. My wife has accepted the installation as a necessary evil. I hope that the ideas described in this article will be helpful to fellow hams contemplating a mobile installation.

Photos by the author.

ARRL member Thomas Nolan, W3EX, was first licensed in 1956 as KN2UZI and upgraded to Amateur Extra class in 1974. After high school, he enlisted in the US Navy and following electronics school served as an airborne radio operator with Patrol Squadron 22 based in Hawaii. After his military service, he received an Associate of Applied Science from Delhi College and then a Bachelor of Science and Doctor of Medicine Veterinary Medicine degrees from Cornell University.

After three years of small animal medicine, he joined Merck Research Laboratories where he worked as a research veterinarian for 22 years. He then was a founding partner in Solomon Scientific, a company manufacturing medical devices for animal research. He retired in 2010. You can reach Tom at 624 Store Rd, Harleysville, PA 19438 or at **nolantho@verizon.net**.

New Products

YAGIS FROM INNOVANTENNAS

◊InnovAntennas offers a wide variety of high performance HF, VHF and UHF Yagis. Designs include LFA (loop-fed array) and OP-DES (opposing phase-driven element system) Yagi antennas created by Justin Johnson, GØKSC. The accompanying photo shows a vertical array of six 7-element 50 MHz LFA Yagis at the station of Lew Sayre, W7EW. Many other antennas are available. For more information visit **www.innovantennas.com**.

PRODUCT REVIEW

WiNRADiO WR-G31DDC Excalibur Software Defined Receiver

Reviewed by Steve Ford, WB8IMY
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The march of technology is relentless. Less than a decade ago we marveled at first-generation software defined receivers that sampled a small slice of RF spectrum and sent the resulting information to a computer sound card as analog I and Q (In-phase and Quadrature) signals for subsequent conversion and demodulation. The hardware simply mixed the RF to baseband audio and the computer took it from there. The result was the ability to demodulate just about anything you could receive. Better still, you could process it with razor-sharp filtering well beyond what any hardware receiver could hope to achieve.

Within five years technology had advanced to the point where it was possible to sample a wide swath of RF spectrum and instantly convert the analog signals to digital data. The data was then passed directly to the computer for processing — no sound card analog-to-digital conversion required. This came about as high-speed analog to digital converters (ADCs) and digital downconverters (DDCs) became available at reasonable prices. One product that benefitted from this advance was the Microtelecom Perseus software defined receiver, which we reviewed in these pages back in December 2008.[1] At that time the Perseus retailed for about $1300. Today it sells for just under $1000.

The WiNRADiO WR-G31DDC Excalibur receiver takes advantage of the technological refinements that have occurred since then. The $899.95 price tag may seem intimidating when compared to most consumer-grade analog desktop receivers, but the performance and features may justify the difference for many.

[1]S. Ford, WB8IMY, "Microtelecomm Perseus Software Defined Receiver," Product Review, *QST*, Dec 2008, pp 40-44. *QST* Product Reviews are available to ARRL members online at **www.arrl.org/product-review**.

Bottom Line

WiNRADiO's WR-G31DDC Excalibur software defined receiver offers excellent performance. Despite the wealth of features found in the accompanying software, it's easy to set up and enjoy.

Features and Functions

The Excalibur is housed within a shielded 6½ × 3¾ × 1½ inch box encased in translucent plastic and powered by a 12 V dc supply. At the business end you'll find an SMA antenna connector. (WiNRADiO thoughtfully includes an SMA-to-BNC adapter.) That's where the story of the Excalibur's signal processing technology begins.

The antenna jack is connected to a hardware stage that includes a bit of analog preamplification and filtering. The output of this stage is fed to a high-speed ADC at which point the entire RF spectrum, from about 5 kHz to almost 50 MHz, is chopped to bits (so to speak). Let that idea sink in for a moment — nearly 50 MHz of RF bandwidth, and everything contained within, rendered to data in tiny fractions of a second!

Now it follows that you'd want to immediately funnel all that data right to your computer for processing, but that isn't possible with current technology, or at least with technology that doesn't require the net worth of Bill Gates to purchase. So, the Excalibur gets around this limitation by using a digital downconverter to channel only up to 2 MHz worth of spectral data to your computer at any given time. The Excalibur sends the downconverted data to the computer through a USB 2.0 connection at which point the WiNRADiO software takes the final step of demodulating the desired signals.

The layout of the WiNRADiO software interface reflects this process (see Figure 1). The large window along the bottom shows the complete RF spectrum all the way to either 30 or 50 MHz (selectable). The window at the upper left displays the output of the DDC, the bandwidth of which is adjustable from 2 MHz down to 20 kHz. The window at the upper right is devoted to the software demodulator. Here the bandwidth is continuously adjustable from about 62 kHz down to just 10 Hz.

The current version of the WiNRADiO software will demodulate USB, LSB, CW, AM, synchronous AM, FM and FSK. You can also receive and decode Digital Radio Mondiale (DRM) signals if you purchase a license key from WiNRADiO. More about DRM reception later.

You can tune the Excalibur in a number of ways. You can enter the frequency directly via the keyboard, tweak the virtual tuning knob found in the upper portion of

the user interface, or click and drag a filter window. Tuning in 1 kHz steps is the norm, but 1 Hz, 10 Hz or 100 Hz tuning steps are available if you press and hold the CNTRL, SHIFT or ALT keys respectively.

One noteworthy feature of the Excalibur is the ability to receive three signals at once. In this sense you can say the Excalibur offers three independent receivers. The receivers are selected via three buttons in the upper left corner above the frequency display (see Figure 2). If the signals in question all fall within the selected bandwidth of the digital downconverter (as shown in the DDC BW window), you can do some creative things with the Excalibur audio mixer. For example, one receiver can be sent to the left audio channel and another to the right channel. For the ultimate in listening madness, you can listen to all three receivers at once in both channels!

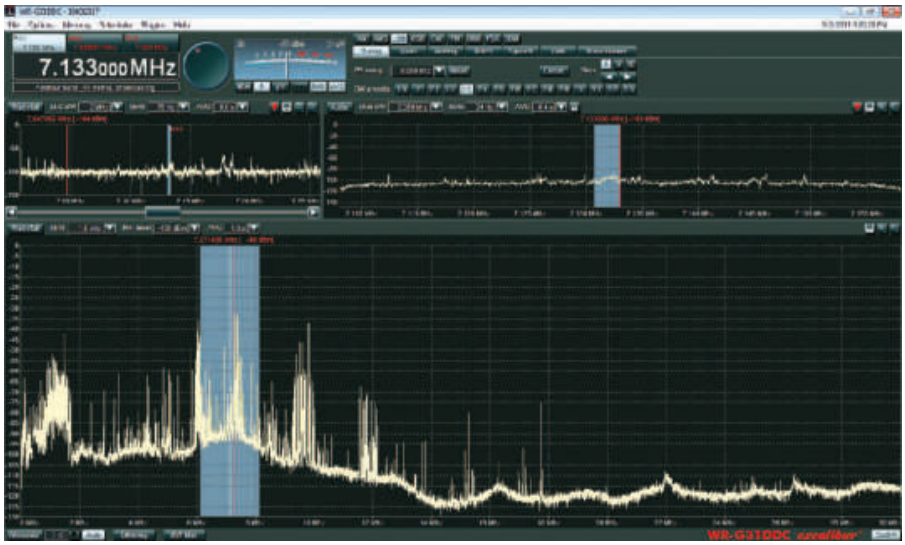

Figure 1 — The Excalibur main screen. The entire received spectrum is shown in the lower window. The DCC spectrum appears in the upper left window and the demodulated spectrum is displayed in the upper right window.

Figure 2 — The bar along the top allows you to select from one of three receivers and includes the frequency display, S meter and the mode and demodulator bandwidth controls.

Figure 3 — The Excalibur recording function includes a full-featured scheduler.

Figure 4 — Close-up of the demodulator window showing the drop-down audio recording window.

The S meter is calibrated in dBm, µV or S units and can be set to show the peak, RMS or average values. The meter will alert you to strong signals that result in ADC clipping. Should this happen, you can configure the Excalibur to automatically activate an input attenuator.

In addition, you have a fully adjustable AGC system with fast, medium and slow presets as well as three user presets. You can set the attack and decay times together with a reference level and maximum gain. Or, you can disable the AGC altogether and ride the gain manually.

As I mentioned previously, you can set up some astonishingly sharp filters. A software function known as *filter length* determines the sharpness of the filter edges. The default setting is 200, but you can take it all the way to 5000 and create true "brick wall filtering" if your computer has the processing muscle to support it. With my 3 GHz dual-core PC, I was able to take the range to 5000 without sluggishness, but slower processors will likely be limited to a much lower range. It was a fascinating exercise to create ultra-narrow filters to pull weak CW signals out of crowded bands.

The Excalibur includes a notch filter with adjustable frequency and width, and a noise blanker with adjustable threshold. They've even thrown in an audio filter with adjustable low and high cut and selectable deemphasis.

With the Excalibur you have the ability to store and recall an almost limitless number of frequencies. The memory storage is limited only by the size of your hard drive. You can tag each memory with a label (such as VATICAN RADIO, for example) and the label will appear on the spectrum display whenever you tune near the frequency. You can also download and store the free HFCC (**www.hfcc.org**) or EiBi (**www.eibispace.de**) broadcast frequency databases.[2] This is particularly handy for shortwave broadcast browsing.

With the built-in recording feature (Figure 3) you can record the entire DDC

[2]See **www.hfcc.org** and **www.eibispace.de** for more information about these databases.

Table 1
WiNRADiO WR-G31DDC, serial number 10K02117

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive only, 9 kHz-49.975 MHz.	5 kHz to 49.975 MHz.
Power requirement: 11-13 V dc, 500 mA, 45 mA (power save on).	416 mA (on screen power switch on), 50 mA (power switch off) at 12 V dc. Drop out voltage, 7.7 V dc.
Modes of operation: SSB, CW, FM, AM, AMS (synchronous AM), UDM (user defined mode), DRM (optional).	As specified.
Receiver	**Receiver Dynamic Testing**
Sensitivity: CW, –123 dBm at 10 dB S+N/N, 500 Hz bandwidth; SSB, –116 dBm at 10 dB S+N/N, 2.1 kHz bandwidth.	Noise floor (MDS), 500 Hz BW:* 0.010 MHz –108 dBm 0.137 MHz –127 dBm 0.505 MHz –130 dBm 1.0 MHz –130 dBm 3.5 MHz –130 dBm 14 MHz –130 dBm 28 MHz –129 dBm
Noise figure: 14 dB.	14 MHz, 17 dB
AM sensitivity: 2.0 µV at 10 dB S+N/N.	10 dB (S+N)/N, 1 kHz tone, 30% modulation, 6 kHz BW: 1.0 MHz 2.00 µV 3.8 MHz 2.00 µV 29.0 MHz 2.980 µV
FM sensitivity: 0.56 µV at 12 dB SINAD, 3 kHz deviation, 12 kHz bandwidth.	For 12 dB SINAD, 3 kHz deviation, 15 kHz BW: 29 MHz, 1.15 µV
Spectral display sensitivity: –140 dBm.	–141 dBm.
Blocking gain compression: Not specified.	Gain compression, 500 Hz BW:† *20 kHz offset 5/2 kHz offset* 3.5 MHz 127 dB 127/127 dB 14 MHz 128 dB 128/128 dB 28 MHz 129 dB 129/129 dB
Reciprocal mixing (500 Hz BW): Not specified.	20/5/2 kHz offset: better than 128 dBc.††
Spurious free dynamic range: 107 dB.	Third order IMD dynamic range: Up to 107 dB.†
Third order intercept point: +31 dBm.	Up to +27 dBm at MDS, +32 dBm at S5 (–97 dBm).†
Adjacent channel rejection: Not specified.	20 kHz spacing, 80 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 29 MHz, 80 dB (noise limited).
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz, 69.6 µV.
Squelch sensitivity: Not specified.	29 MHz, 0.4 µV.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth):‡ CW (500 Hz): 296-799 Hz (503 Hz). Equivalent Rectangular BW: 519 Hz. USB: (2.4 kHz): 295-2712 Hz (2417 Hz). LSB: (2.4 kHz): 295-2712 Hz (2417 Hz). AM: (6 kHz): 300-3283 Hz (5964 Hz).
Size (height, width, depth): 1.6 × 3.8 × 6.5 inches; weight, 1.15 lbs.	
Price: WR-G31DDC receiver, $899.95. DRM license, $49.95. Virtual Sound Card s/w, $49.	

*Filter length set to 3000. An MDS of –134 dBm with a noise figure of 13 dB was achieved with longer filter lengths and deemphasize set to –1.0 dB/octave.
**Blocking level exceeds the threshold of ADC clipping.
†Dynamic range dependent on total RF power at receiver jack. See February 2010 *QST*, page 52.
††No reciprocal mixing occurred up to the threshold of ADC clipping (–2 dBm at 14 MHz).
‡Adjustable with audio filter settings.

spectrum and play it back later for analysis. For instance, you could set the DDC bandwidth to cover the entire 20 meter band and record it for several hours. Later, you can tune through the signals just as though you were listening in real time. Bear in mind, however, that wide-bandwidth recording will eat through a considerable amount of hard drive space. Alternatively, you can record selected signals in the demodulator window as standard WAV audio files.

A scheduler (Figure 4) is available to set up recordings in advance. You can program the Excalibur to record broadcasts while you sleep or when you are away from home.

The Excalibur is capable of "sharing" demodulated signal audio with other software applications such as a PSK31 or RTTY decoders. However, this requires the separate purchase of the WiNRADiO *Virtual Sound Card* (VSC) software at a cost of $49.

Hands On

Excalibur software is provided on a CD-ROM for *Windows XP*, *Vista* or *7*. On my 64 bit *Windows 7* system it installed smoothly and quickly. Setting up the Excalibur receiver itself was as easy as connecting the dc power cable, plugging in the antenna system coax and connecting the USB cable. When I double clicked on the EXCALIBUR icon, the radio instantly sprang to life.

As you'll see in the accompanying screen images, the user interface is well designed and easy to navigate. That said, it pays to read the Excalibur manual before diving in. Topping out at 108 pages, the manual is well written and informative.

With so much RF at my fingertips, more than an hour sped by as I browsed the bands for the first time. Every time I saw a portion of the spectrum spike with unknown activity, I'd click on that portion of the screen and listen to whatever I found.

Listening to shortwave broadcasts with *synchronous AM* was a rare pleasure. If you're unfamiliar with the term, synchronous AM is a reception technique in which the receiver creates a stable RF carrier to replace the fluctuating received station carrier, thereby reducing or eliminating the distortion caused by selective fading. If you click the AMS button you may hear a heterodyne tone. Simply click and slide the demodulator bandwidth window until the tone goes to zero beat and — *voilà!* — the signal is suddenly clear. Yes, it can still fade, but it will do so without the irritating distortion. This does wonders for casual shortwave listening.

A number of shortwave broadcast stations today transmit digital signals using the Digital Radio Mondiale (DRM) format. You'll recognize these signals from their "square" appearance in the demodulator display as well as their characteristic roaring sound. Unlike other software defined receivers, DRM reception is fully integrated into Excalibur software; you don't have to purchase a separate decoding application. However, you *do* have to purchase a DRM license key from WiNRADiO at a cost of $49.95.

With the license key installed I was able to receive DRM broadcasts with little difficulty. It is remarkable to hear clean, FM quality audio from a shortwave broadcast signal. You often receive streams of text at the same time. The Excalibur offered the best DRM performance I've experienced to

date. It even managed to maintain a decoding "lock" during signal fades.

Overall, the Excalibur offered outstanding performance, albeit with lower IMD dynamic range at very weak signal levels as noted in Table 1. That notwithstanding, I was fascinated to see that the Excalibur did a superb job way down at 5 kHz with an MDS of –100 dBm. The "basement" of radio is very noisy at my location, but I have a feeling at the Excalibur would be an excellent receiver for listening to "natural radio" (Dawn Chorus, whistlers, and others) in quiet environments.

Conclusion

The WiNRADiO WR-G31DDC Excalibur is an astonishing piece of technology. From a user standpoint, I'm tempted to compare the Excalibur experience to working with a lump of unformed clay on a potter's wheel. The radio makes a vast range of RF spectrum (the "clay") available to you and by carefully tweaking the functions in the Excalibur software you can create whatever reception characteristics you desire. Best of all, as the software improves over time, you'll be able to upgrade the Excalibur's features and performance by simply downloading the latest version.

Manufacturer: WiNRADiO Communications, 15 Stamford Rd, Oakleigh 3166, Australia. *North American representative*: Radixon Inc, 12708 Riata Vista Circle, Suite A-105, Austin, TX 78727; tel 512-608-4070; **www.winradio.com**.

WiNRADIO WR-G31DDC Excalibur

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

http://www.youtube.com/watch?v=UuiySRhgHRk

AvMap G6 APRS Navigation System

Reviewed by Howard Robins, W1HSR
ARRL Contributing Editor
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A disclaimer is in order: I am not an expert on the many mass market GPS navigation devices in the hands of millions today, so please do not expect a comparative analysis. As far as I know, AvMap is the only maker of GPS navigation systems with hardware and software specifically designed to support APRS, the Amateur Packet/Position Reporting System developed by Bob Bruninga, WB4APR — end of comparative analysis.

The Geosat6 (G6) is the latest in a series of GPS navigation systems by the Italian maker AvMap that are designed to be integrated into mobile APRS installations. The G6, like its predecessors the G4 and G5, has a serial port to interface with Kenwood APRS capable radios, the Byonics TinyTrak4 (TT4, see the accompanying sidebar), or pretty much any 2-meter radio and terminal node controller (TNC) with APRS capability.[3] The G6 includes several significant differences compared to the G4 and G5. In addition to smaller overall size; it has much higher display resolution and an awesome magnetic mounting system.

My first impression when I opened the box was "Oh no! — They made the G6 too small." I really liked the relatively large display of the G5. After I got the G6 working, I realized that its display is unbelievably sharp, and it's controlled by a touch screen so there are no hard buttons taking up space on its face. These two factors support the reduced size with virtually no reduction in readability. The fonts used scale up and down or disappear depending upon map zoom level, and they are quite readable. APRS positions have crisp icons and a block font that does not wash out or get lost in the background. Normal fonts are black with white background, so they also stand out on the map. Clarity is supreme on the G6.

Bottom Line

The AvMap Geosat6 APRS navigator builds on the success of the G4 and G5. The new version is smaller and more capable than previous models, yet it is still easy to hook up and use.

Overview

The G6 measures 3¼ × 5¼ × ¾ inches (height, width, depth) compared to 4⅛ × 5½ × 1½ inches for the G5. The LCD is 4³⁄₁₆ inches wide by 2⁵⁄₁₆ inches high, has a resolution of 480 × 272 pixels, and supports 65,536 colors. By the way, the display is actually 4.8 inches diagonally in a widescreen format — not really much smaller

[3]H. Robins, W1HSR, "AvMap G5 Personal Navigator," Product Review, *QST*, Feb 2008, pp 48-49. *QST* Product Reviews are available to ARRL members online at **www.arrl.org/product-review**.

Figure 5 — The AvMap G6 magnetic mount holds the unit in place while driving yet makes it easy to remove and take with you.

Adding Capability with the Byonics Tiny Tracker 4

The Byonics Tiny Tracker 4 (TT4) is an APRS capable TNC available as a kit or built and tested. It is supported by a host of available interface cables for computer and radio, free downloadable firmware, keyboard and display options, and downloadable documentation. The TT4 is a relatively inexpensive way to turn any 2 meter radio into an APRS station.

While the AvMap GeoSat 6 APRS is designed to work with all Kenwood APRS capable radios, Kenwood does not support all of the messaging capabilities of the G6. Kenwood does support message sending via the mic keypad, only. With a capable TNC such as the TT4 connected between the G6 and your radio, it is possible to select a received station from the G6 APRS contact list and send that station a message. When such a station is selected a soft keyboard appears on the screen. The "keys" are about the size of my finger tips and make message creation as easy as one could imagine. The G6 keeps a log of messages sent, received, and pending, much like an email application.

For a full description of features and related information, see **www.byonics.com/tinytrak4**.

than the G5, yet in a smaller, handier overall package.

The connectors and hard controls are mostly on the right flange and include I/O SERIAL port, USB port, AUDIO OUTPUT, POWER jack and POWER switch. There are also internal SPEAKER ports on both sides of the frame. The bottom flange has the main power ON/OFF switch, RESET and SD CARD slot. The rear panel has a daylight sensor and proprietary keyed four point POWER connector that mates with the magnetic mount (more later). The CPU runs at 520 MHz, and is supported with 64 MB of RAM. The operating system is *Windows CE*. It weighs in at 9.7 ounces.

What Comes in the Box

The G6 comes with everything you need to power the unit and charge the internal Li-ion battery, and interface with Kenwood APRS capable radios and computer. There is an ac charger in addition to the dc cigarette lighter cord. The ac charger plugs into the POWER port on the side of the G6. The dc cord plugs into the included magnetic mount, which contains a voltage regulator circuit that converts a 12 V source to 5 V. An included CD-ROM contains the instruction manual and desktop software called *Geosat Suite*. A 4 GB SD card containing Navteq mapping for North America and Mexico comes with the G6. The G4 and G5 use TeleAtlas mapping. An on-the-glass suction cup mount is also included.

More on the Magnetic Mount

The magnetic mount has four slots on its rear that mate with the on-the-glass mount. On its front, there are four powerful magnets around electrical contacts that mate with the keyed gold contacts on the rear of the G6 (see Figure 5). There are actually two sets of contacts in a recessed socket that allow the G6 to be viewed in either portrait or landscape mode by simply rotating the G6 in the mount accordingly (Figure 6). The magnets are strong enough to hold the G6 tight, even on the bumpiest roads, but it is easy to pull the G6 off the mount and take it with you when you leave your vehicle.

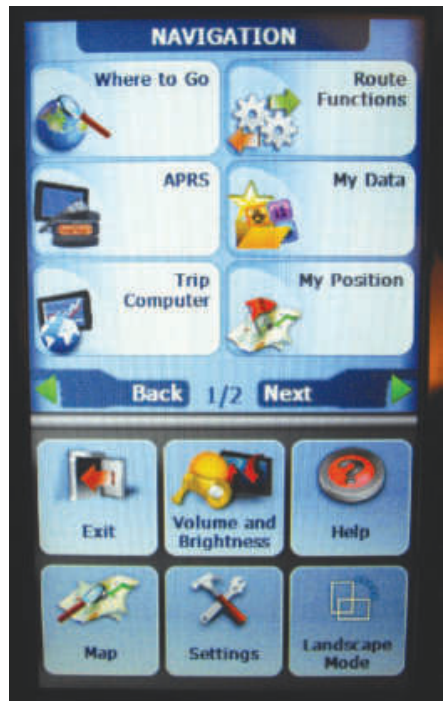

Figure 6 — The G6 can be operated in landscape or portrait mode by rotating it in the magnetic mount.

Power

I mentioned that there is a main power switch on the bottom flange in addition to a power button on the side. When the main switch is off, the G6 is completely off. When the main power switch is on and the G6 is connected to an external power source, the internal battery will charge. In this mode the G6 senses the presence or absence of external power and will go into standby mode — display off, but GPS receiver engine and position cache memory remain on — until external power is sensed.

This conserves power while allowing for faster position acquisition by using the internal battery for power. This mode is great when you are in and out of your vehicle as you do not have to start from complete power off position each time you restart. On the other hand, when you are parked for the night or any length of time, turning off the main power conserves the internal battery. I could not wear down the battery from normal use.

Geosat Suite

Geosat Suite is the desktop software that recognizes your G6 when it is connected to your PC via the USB port. It reports the status of the G6's software and automatically checks for available updates. The following functions are supported by soft buttons: Software Update, Map Update, User Manual, Change Welcome Page, Explore Device, Add Contents from PC, POI (points of interest), Change Text-to-Speech Voice, Backup and Restore.

Navigation Features

The G6 has a number of navigation features that make it useful for normal driving:

- You can choose 2D, 3D or night view.
- Multiple destinations, up to 10 waypoints.
- Thousands of preloaded points-of-interest (POI) in numerous groupings can be displayed on the map. POI management is quite powerful. The G6 will take you to

Figure 7 — The APRS contact list can store up to 1000 contacts.

any location that you select with a touch of a finger.

- The "Where To Go" page lets you choose among the following: Address, POI, Contact, Drive me Home, Lat/Lon, Favorite POI, Save Routes and Pick on Map.
- You can ask for the fastest or shortest route and customize the route to avoid toll roads, walkways, ferry routes, U turns, highways, unpaved roads or built-up areas.
- Lane Assistant visually warns you what lanes are good, and which to avoid, to get to your destination. This is to keep you on course, not warn you of construction or accident obstructions. This is a smart feature as it only displays when a potential detour is coming up.
- A Stop Planner helps organize meal breaks and gas stops.
- Trip Computer — provides data and graphics for speed, altitude, etc.
- Turn-by-turn voice instructions with text-to-speech.

Highway speed limits are usually displayed in the info bar below the map, and they changed, for example, from 50 to 55, just when I saw the posted speed limit sign.

I drive I-95 between Connecticut and South Florida quite frequently, and can tell you that some states are better than others about giving advance warning for rest areas. So, I did an internet search and found a POI website that actually had a file of all the rest areas on the interstate highways in the US. *Geosat Suite* can convert and import such files in most standard formats. In the process I found a bitmap file of a rest area sign that I doctored to suit me for an icon and uploaded that with the associated POI file. I am writing this portion of this review in Fayetteville, North Carolina (my trip midpoint), and can tell you that this has worked quite well so far.

I know this route well, so really did not need a navigator. However, for this review I decided to see how the G6 would get me into Broward County, Florida, and take me to my destination from the first exit on I-95 in Florida. It could have taken me straight down I-95, but it did not. Since I did not tell it to avoid toll roads, it did exactly what I would have done — it directed me to Florida's Turnpike when I reached the crossover in Fort Pierce. This crossover takes you off of I-95 to surface streets that take you to the turnpike's entrance. (This route avoids the traffic tie-ups that are typical around the Palm Beach airport on I-95.) The G6's Lane Assistant pointed out the right lanes for me to be in throughout the transition. The navigator brought me right to my door in a gated condo community in northern Broward.

Unique Capabilities

I tested text messaging using the Byonics TT4 and G6 with a handheld radio. The TT4 is a way to turn any 2 meter FM set into an APRS radio. Check **www.byonics.com/tinytrak4**. With this setup I received my APRS weather station beacon — W1HSR. I went into the G6 functions menu and found my station on the APRS contact list and selected it. Then I pressed the SEND message button and used the soft keyboard that came up to compose and send a short message. My message was received at my weather station. I sent a reply and received it on the G6. The G6 has a text-to-speech capability, so I had my reply message read to me. Pretty cool.

I tested the Target function (aka Tactical Mode) and it worked.[4] I had my friend Mike DeVivo, N1CHP, take a ride with his mobile APRS setup beaconing his position. Once I had his position on the G6 APRS contact list (and display), I pushed the GO TO button. The G6 calculated the route and took me to him, providing audible as well as on-screen turn-by-turn directions. By the way, when he changed position and that was beaconed out and received, the G6 recalculated the route to him. Also — very cool! The G6 lets you set any received position as a target and will route you to that destination.

You can store up to 1000 APRS contacts sorted by call sign or date/time. A secondary screen (Figure 7) shows full information about each contact. You can choose to automatically delete contacts from the list — a great feature when you realize that every contact on this list is displayed on the map. Contacts aged 2 hours, 5 hours, 10 hours or 24 hours can be deleted to eliminate clutter from the screen. No automatic deletion is also an option. All standard APRS icons are supported.

Full bidirectional RS-232 APRS communication is supported. The G6 is compatible with NMEA and Kenwood format sentences at 4800 and 9600 bauds.

Wrapup

The AvMap Geosat6 APRS navigator is really special. It reflects several generations of evolution that makes mobile APRS and APRS for emergency communications easy to implement. Its flexibility in handling APRS contacts, along with its tactical mode and target intercept capability, make practical use of GPS receiver and navigation technology, especially in emergency scenarios. The only weakness I found was with the low level of the audio output. To solve that problem I found amplified stereo speakers (originally designed for an Apple iPod) for less than $10. This speaker system fits in the palm of my hand, and plugs directly into the external speaker jack on the G6.[5]

I did the mobile portion of this review with my Kenwood TM-D710A and was disappointed to learn that Kenwood does not support all of the messaging capabilities of the G6. On the other hand, something as inexpensive as the Byonics TT4 can turn any 2 meter rig into an APRS station with text messaging.

The pull-away magnetic mount and its size make it handy to take the G6 with you when it is not needed. With the landscape and portrait displays and hours of battery life, you could take the G6 along for long walks in a city like New York and use it to navigate your way around.

Manufacturer: AvMap, Viale Zaccagna 6, 54033 Carrara (MS), Italy; **www.avmap.it**. US distributor: AvMap/USA, 133 Falmouth Rd, Mashpee, MA 02649; tel 1-800-363-2627; **www.avmap.us**. Amateur Radio contact: Don Arnold, W6GPS, 410 Cyndica Dr, Chattanooga, TN 37441; **www.geosat.us**. Price: $499.95.

[4]See **www.youtube.com/w6gps** for a more complete demonstration of tactical mode.

[5]Available from **www.amazon.com/gp/product/B00065XSP8**.

TE Systems 1410G 2 Meter Linear Amplifier

Reviewed by Joel R. Hallas, W1ZR
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Ever since my review of the Elecraft internal 2 meter transverter for the K3, I have been on the lookout for an amplifier that would boost its 10 W PEP output up to a level corresponding to its excellent (0.5 dB noise figure) receiver.[6,7] In every VHF contest I participated in, I was frustrated at hearing many hams who couldn't hear me. I was the opposite of an "alligator" (all mouth and no ears) — perhaps an elephant or a rabbit?

What It's All About

The TE Systems 1410G 2 meter linear appears to be a well made "brick" type of amplifier. This model is rated for 160 to 200 W output for a drive level of 4 to 10 W. It is designed for 13.8 V dc power, although some of their amplifiers are for use with 28 V supplies, a good option if you have the power available. The dc connections are via Anderson Powerpole connectors on the rear panel, a good choice in my view. Their website (**www.tesystems.com**) lists no fewer than 22 different models of 2 meter amplifiers with power outputs ranging from 50 to 600 W, so whether you are looking to boost the output of a 1 W handheld or an 80 W transceiver, chances are they have a model that fits. They offer a similar range of amplifiers for 6 meters through 70 cm.

This amplifier includes a preamp, which I wasn't looking for, but it can be switched off if not needed. Alternately, the preamp can be used without the power amplifier as they are separately controlled. The whole top of the amplifier is a heat sink with no fan (or noise) apparent while on the air — a real blessing. The amplifier has a thermal sensing protection circuit to shut down if there is excessive heat. We didn't experience any shutdowns or indications of thermal issues — it didn't even get warm during CW/SSB mode contesting. A fan kit is an option for those who will be operating in heavier duty modes, as are continuous duty rack mounted versions.

Transmit-receive (TR) control, often an issue with amplifiers, is available either through RF sensing or by use of contacts available on an accessory connector — a modular RJ-45 type. A front panel MODE switch selects between FM and SSB/CW. The TR delay in the SSB/CW position is adjustable from the minimum to about 1/10 of a second via a rear panel screwdriver adjust control. This can be set to allow thinking between syllables during SSB without switchover, if desired. I found just above minimum suitable for semi break-in CW. If the switch is turned to FM the minimum delay is provided. Thus you can have two delay positions available, selectable from the front panel. I found that the RF sensing worked flawlessly without any noticeable TR delay either with SSB or CW.

If you use the accessory contacts for TR switching, the RF sensing is still engaged unless you clip a capacitor on the PC board. If it were my amplifier, I would probably do that, but it wasn't, so I didn't. In my experience semi break-in is sufficient for most CW operation on VHF, but you may think otherwise. The RF connectors are UHF type, although you can special order with type N if desired.

On the Air

I received the amplifier just in time for the September 2011 ARRL VHF QSO Party event. I was now able to operate with 100 W PEP or more output on both 6 and 2 meters. In addition, we had our 6 meter Yagi add-on running, so we could aim both our 6 and 2 meter signals — what a concept![8] I hooked the supplied Powerpole pigtail lead to the terminals of my compact 25 A switching supply that I use for vacations and was ready to go.

The amplifier worked flawlessly and seamlessly, although as noted below, I had to throttle back the power output to the minimum (about 4 W) from my K3 with K144XV transverter to avoid overdrive. With this amplifier, if I heard them, they heard me too — much better!

The only negative I observed was that in CW operation, the noise of the TR relay closures was quite noticeable. By extending the delay just a tad, it didn't drop out as often during exchanges and was not bothersome. Because of its design, the amplifier doesn't really need to be on the operating desk where I had mine, so it might be easily moved out of earshot. I tried moving it and the power supply to the other side of my basement adjacent to the antenna feed-through panel, and I never knew it was there — except now I had another ½ dB of power going to the antenna because of the shorter feed line! If you feel the need to keep track of things from the shack, the REM-10 remote control kit is available with a duplicate of the front panel controls and indicators. It includes a 12 foot cable with RJ-45 plug to match the REMOTE connector on the amplifier. We didn't have one to test, but I would expect to be able to extend it using computer networking cable.

A Bit of History

I became of aware of the TE Systems 1410G 2 meter linear amplifier early last year. It seemed a good candidate with an input drive power requirement of 4-10 W and an output of up to 160 W. We ordered one for lab testing. Unfortunately, our first sample had a second harmonic that was higher than FCC specs, so we returned it for repair. It came back and did meet the

Bottom Line

This is a very nice amplifier in terms of construction and operation. There is some room for further optimization of its preamp configuration and transmit IMD levels.

[6]J. Hallas, W1ZR, "Elecraft K144XV 2 Meter Transverter for the K3," Product Review, *QST*, Aug 2010, pp 48-51.

[7]J. Hallas, W1ZR, "A Pair or Mirage 2 Meter Amplifiers," Product Review, *QST*, Aug 2010, pp 52-53.

[8]J. Hallas, W1ZR, "Add 6 Meters to Your Tribander," *QST*, Sep 2011, p 36.

Table 2
TE Systems 1410G, serial number C1388

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: 144 – 148 MHz.	As specified.
Power requirements: 13.8 V dc, 22 A nominal.	Transmit, 22 A (at 160 W out); receive, preamp off, 28 mA, preamp on, 100 mA at 13.8 V dc.
Driving power required: 4-10 W.	0.3-10 W; corresponding power output, 35-183 W.
Spurious and harmonic suppression: Not specified.	68 dB. Meets FCC requirements.
Transmit intermodulation distortion: Not specified.	3rd/5th/7th/9th order: –17/–29/–37/–44 dB.
Receive preamp gain: 15 dB.	144 MHz, 7.4 dB; 147 MHz, 10.8 dB.
Receive preamp noise figure: Not specified.	144 MHz, 1.9 dB; 147 MHz, 1.7 dB.
Size (HWD): 3.0 × 5.8 × 10.5 inches (including protrusions).	
Weight, 4.15 pounds.	
Price: $496.	

spec, but the power transistors failed during subsequent testing. There was some delay in getting it repaired, reportedly due to lack of availability of the devices.

The unit that was returned worked fine, but had 3 dB more gain than the first — reaching 160 W output with 3.5 W drive and saturation with just 5 W of drive. This was workable with my Elecraft K3 transceiver, which I could just throttle back to that output level. Fortunately, TE Systems offers amplifiers at multiple power levels — both in terms of drive and output power, so you can pick one that fits your needs. This is important because the manual cautions that overdriving the amplifier will destroy the first amplifier stage devices.

Lab Testing Results

Table 2 shows the results of our lab tests. As noted, the amplifier operates at a somewhat different power range than was expected. Still, it met my requirements and didn't challenge my 25 A power supply. At full output, transmit intermodulation distortion (IMD) products are higher than we'd like to see and could interfere with nearby stations.

The preamp was more of a disappointment. The TE Systems website noted that the device used could realize a 0.5 dB noise figure (NF) and 18 dB third order intercept. In real life, the NF of the device itself is degraded to some extent by associated circuitry, particularly the TR relays included in the amplifier. Although preamp performance is in line with other VHF/UHF brick amplifiers, I was hoping for better. A preamp of this order would be a great addition for a station with an older or lower performing receiver, or one with a tower mounted amplifier arrangement and a long transmission line run to the station. With the amplifier located at or near the K3 it offered no benefit because the K3 has an excellent NF.

Documentation

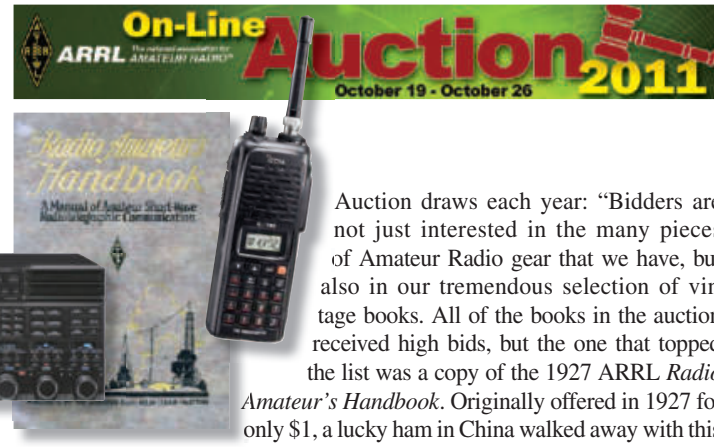
The unit is supplied with a 24 page half sheet instruction manual. It was quite complete, covering setup, operation, cautions and even a schematic and parts list. Unfortunately, it was for the 1412 series amplifier not our 1410 (the 1412 is similar, but requires 25-50 W input). Our manual also had drawings that were too faint to read.

Manufacturer: TE Systems, PO Box 25845, Los Angeles, CA 90025; tel 310-478-0591; **www.tesystems.com**.

The Sixth Annual ARRL On-Line Auction

This annual event drew hundreds of bids on almost 200 items.

S. Khrystyne Keane, K1SFA



After a week of frenzied bidding, the Sixth Annual ARRL On-Line Auction ended with a bang on October 26. The 2011 running of the auction featured almost 200 items, ranging from high-end Product Review equipment to a great assortment of antique books. In addition to bidders from the US, the auction saw winning bids from Canada, Italy, Japan, China and Brazil. According to Auction Coordinator Deb Jahnke, K1DAJ, bidding was fierce for the Yaesu FT-DX 5000D HF/6 meter transceiver that ultimately went to a bidder in China who placed a winning bid of $4925. This rig was featured in the December 2010 issue of *QST* as a Product Review item.

"The Sixth Annual ARRL On-Line Auction was a great success," Jahnke said. "In the end, all of the items that were up for bid were sold. Not only did we have a lot of new bidders this year, we also had many repeat bidders from the past several years."

Jahnke said that she is always amazed at the interest that the On-Line Auction draws each year: "Bidders are not just interested in the many pieces of Amateur Radio gear that we have, but also in our tremendous selection of vintage books. All of the books in the auction received high bids, but the one that topped the list was a copy of the 1927 ARRL *Radio Amateur's Handbook*. Originally offered in 1927 for only $1, a lucky ham in China walked away with this historical book with a winning bid of $220."

Once results were tallied, the Sixth Annual ARRL On-Line Auction offered 180 items, attracting a total of 1230 bids and 94 winning bidders, many of whom had winning bids on multiple items. "We have certainly grown since we held the First Annual ARRL On-Line Auction in 2006," Jahnke said. "Back then, we only had 109 items for bid. Even though the auction is closed for 2011, you can still view all items that were up for bid and the results at **www.arrl.org/auction**. If you missed out this year, make sure to place your bids in 2012 when we'll do it all over again!"

TECHNICAL CORRESPONDENCE

THE CARE AND FEEDING OF A 3-500ZG AMPLIFIER (OCT 2011)

◊The article by Charles Rankin, WA2HMM, is concerned with getting the maximum life from the 3-500Z tube used in the AL-80B and other amplifiers. The article modifies the AL-80B to reduce the filament voltage to 4.8 V (measured while in standby). Although getting maximum tube life is worthwhile, I think the modification is not the way to go about it. Here's why.

The 3-500Z Tube

The Eimac data sheet says the 3-500Z filament voltage must be 4.75 to 5.25 V for maximum tube life. That's 5 V ±5%, which is fairly common for thoriated-tungsten transmitting tubes.

The tube filament is optimized for electron emission over that voltage range; too cool can be as bad as too hot when it comes to tube life. An electron-emitting filament is not the same as an incandescent light bulb; a thoriated-tungsten tube can light up fine but be useless due to low emission or gas. In amateur SSB operation, the 3-500Z will be required to provide very high peak currents, and running the filament at too-low voltage will result in shorter, not longer, life under such conditions.

For maximum 3-500Z life, the ideal situation would be for the filament voltage to be exactly 5.0 V in operation, which would require a regulated filament supply. The next best, and most practical condition, is for the filament voltage to stay within the 4.75 to 5.25 V range under all conditions, standby to full load.

The procedure described in the article only measures the filament voltage when the amplifier is in standby, not under load. If adjusted for 4.8 V when in standby, the 3-500Z is on the low edge of the recommended voltage range. If the filament voltage drops just 2% from standby to full power, the filament voltage drops to 4.704 V — well below the minimum rating.

Filament Voltage Adjustment

If the line voltage supplying the AL-80B stays reasonably constant with load changes, the 4.75 to 5.25 V range requirement is easily met without any modification to the amplifier. If the line voltage supplying the AL-80B varies widely with load, steps need to be taken to improve the regulation (heavier supply wiring, change to 240 V operation, different power source, or other changes).

The AL-80B power transformer has 14 taps on the primary so that a wide range of line voltages can be accommodated. Changing the tap connection permits operation at line voltages from 90 to 140 V on the low range and 205 to 250 V on the high range, with a choice of 7 voltage settings in each range. The required connections for the various voltage ranges are listed on page 12 of the AL-80B manual. No modification of the AL-80B is necessary.

Safety and Accuracy of Voltage Measurement

The article describes measuring the filament voltage with the cover removed and the interlock bypassed. The AL-80B manual specifically warns *NEVER* to do such things — and with a little care, there is no reason to. Proper selection of the primary taps should put the correct voltage on the 3-500Z filament.

If, despite all of the above, it is desired to measure the actual filament voltage, it can be done simply and safely by the following procedure.

1) After taking all safety precautions, make temporary connections to the tube filament pins and the transformer end of the filament choke. The wires should be well insulated (Teflon insulation is desirable) but don't need to be heavy gauge because they are only used for voltage measurement. Bring the wires outside the AL-80B case, and put the covers back on.

2) Measure the filament voltage at the tube pins and at the transformer end of the filament choke with the amplifier in standby. Subtract the voltage at the tube pins from the voltage at the transformer end of the filament choke; the difference is the voltage drop across the filament choke.

3) After taking all safety precautions, remove the covers and disconnect the temporary connections to the tube filament pins, but leave the connections to the transformer end of the filament choke. Replace all the covers.

4) Measure the voltage at the transformer end of the filament choke with the amplifier running full power. Subtract the choke voltage drop previously obtained and you have the actual filament voltage under load.

5) After taking all safety precautions, remove the covers and disconnect the temporary connections at the transformer end of the choke.

This method measures the filament voltage variation from all sources — wiring resistance, transformer impedance and other factors — not just line voltage changes. The results are both the standby and full-load filament voltages.

Some may object to this simple method because no allowance is made for changes in filament current with voltage changes. The hot tube filament is not a linear resistor; when hot, its current does not change in a linear fashion with small changes in applied voltage. In fact, its current will change very little for the voltage variations encountered. If any error is introduced by this method, it will make the voltage variation appear worse than it really is, so the method gives a worst-case-scenario result.

Conclusions

The AL-80B power transformer was specifically designed for the job; the main set-up tasks in maximizing tube life are to set the primary taps correctly, per the manual instructions, and to have good power source voltage regulation.

Adding resistance to the filament circuit and running with high taps can result in excessive B+ voltage, which isn't good either. The manual specifically states that the high voltage should never exceed 3100 V. It seems to me that the path to longest tube life is to adjust the transformer primary taps as outlined in the manual. If high filament voltage is suspected, adjustment to just under 5.25 V in standby condition by means of the primary taps will do the job.

A copy of the AL-80B manual can be downloaded from the Ameritron website: **www.ameritron.com/pdffiles/AL-80B.pdf**. The Eimac 3-500Z data sheets can be downloaded from a number of sources. I used: **http://tubedata.tubes.se/sheets/088/3/3-500Z.pdf**.

We should remember that what is sometimes done in broadcasting and other fixed-frequency, single-mode applications doesn't neccesarily translate well to Amateur Radio applications. Modes like SSB that have high peak-to-average power ratios may push tubes to or even beyond their maximum ICAS ratings (Intermittent Commercial and Amateur Service). Hams usually change bands and frequencies often. The typical amateur spends at most only a few hundred hours per year transmitting, with lots of off time.By contrast, broadcast and fixed-service transmitters are usually designed to CCS ratings (Continuous Commercial Service), and sit on the same frequency and mode 24/7 for years at a time.

Please note that I have no affiliation with Ameritron or any tube manufacturer. — *73, Jim Miccolis, N2EY, 136 Morningside Circle, Wayne, PA 19087*; **n2ey@arrl.net**

◊I have some thoughts to offer on Charles

Larry D. Wolfgang, WR1B ♦ Senior Assistant Technical Editor ♦ tc@arrl.org

Rankin's October 2011 *QST* article, "The Care and Feeding of a 3-500ZG Amplifier." The basic premise of the *QST* article is sound: high filament voltage shortens tube life. Designers of amplifiers for Amateur Radio service could have addressed the concern of separate filament voltage adjustment years ago, but I believe they don't because of economics.

It's all about cost, competition, and trade-offs: would you rather pay a lot more up front for filament voltage management features, or buy more tubes later? Unfortunately, we tend not to think ahead about the cost of ownership, so the amplifier designers are probably just being practical and price-competitive. The cost of such features wouldn't be trivial, either; a variable autotransformer, such as a Variac, and accurate RMS filament voltage metering would add significantly to the cost of an amplifier. Adding a Sola-type regulating transformer would be truly luxurious.

I have been a broadcast engineer for 45 years. Broadcasters have generally followed the time-tested tube manufacturers' recommendations for getting the best life from their transmitting tubes (usually ceramic triodes and tetrodes, with thoriated tungsten filaments like the 3-500ZG). Generally, here's the drill:

1) Run a new tube (or a rebuilt tube with a new filament) on-air at full rated filament voltage for 200 hours to "condition" the new filament.

2) After this conditioning period, back off the filament voltage until the RF output barely starts to decrease. Then increase the filament voltage (perhaps 0.2 V or so) to a bit above that "knee" (to allow for line voltage variations). Then check this adjustment often throughout the tube's life. I've had single tubes pumping out 30,000 W in broadcast transmitters last for years with this careful filament voltage management.

The basic filament-voltage control circuit is often a rheostat in the (separate) filament transformer circuit, with metering at the socket lugs. There may also have been manufacturers who used a Variac-type variable transformer. A common option was a Sola-type regulating transformer before the filament circuit, so that the rheostat was adjusting pre-regulated voltage. It's also relatively common these days to install a large automatic voltage regulator, such as a Staco AVR for the transmitters and selected circuits.

It's interesting to note that the lower-voltage concept doesn't work properly unless the filament conditioning has been completed properly. Of course, AM/FM broadcast duty is continuous full carrier output. Amateur Radio duty with CW or SSB is almost a drop in the bucket compared to this — our tubes should last forever if only amplifier design features would let us "baby" the tubes! Hence, Mr. Rankin's suggestions in the article are aimed at some degree of filament voltage control.

Also, don't ignore heat, the other major tube killer! Keep fan blades and grille openings dust-free, and allow three inches or so clearance from other equipment so that air intake and outflow can work freely with no back-pressure.

As it happens, I also have an AL-80B, and had the same concerns about filament voltage. The Ameritron AL-80B's all-in-one power transformer (rather than a separate filament transformer) presents a question of how to adjust the filament voltage. As the *QST* article mentions, unless you're prepared to make major modifications, you either add resistance to the filament secondary (which is the main thrust of the article) or adjust the transformer primary taps. I chose to change the taps as recommended in the owner's manual because 1) no modification was needed, and 2) I judged that any changed parameters would not push the tube into any significantly non-linear operation. I did no tests to confirm this, but two years of operation has not turned up any problems.

In my particular installation, I chose to connect the amplifier to a 230 V outlet, not 115. The line voltage in my home is around 232 V, but I set the AL-80B transformer primary taps to the 250 V setting, the highest available. This brought the filament voltage down from 5.4 V to 5.0 V, measured at the socket with a Fluke true RMS voltmeter. I'd like to see this closer to 4.8 V as the article mentions, but this was the best I could do without modifications to the amplifier.

I wonder why the Ameritron transformer yields such a high filament voltage with the line voltage tap set correctly.

As expected, after I changed the transformer taps, the idling anode voltage went down about 10% from 3100 V to 2800 V. Surprisingly, under load, the anode voltage only went down about 50 V (2700 V to 2650 V). The owner's manual mentions that no harm will be done if the anode voltage remains above 2500 V under load, so I think the amplifier is happy with my settings.

I didn't make before and after output measurements. I'm sure the amplifier's output must have gone down a few percent, but I saw no significant difference in the front panel output meter during SSB operation. Let's face it: even if the output went down 100 W, no receiver S-meter will ever see the difference between 900 and 1000 W.

Please realize that I was not trying to do any precise measurements; I was just trying to get an idea of the approximate differences yielded by changing the primary taps, and whether any unwanted operation resulted.

All this having been said, I think that an article such as this for *QST*'s large and varied audience is problematic for safety reasons. Even though the article contained multiple cautionary statements, we have a couple of generations of hams who have never used such tubes, and who have no experience in handling interlocks and the lethal high voltages involved. — *73, Jim Perry, KJ3P, PO Box 73, Schwenksville, PA, 19473*; **kj3p@arrl.net**

Charles Rankin Responds:

I have received many e-mails about my October 2011 *QST* article. The gist of most of them are about the dangers of removing the cover and bypassing the interlock. I guess many newer hams never had to trouble shoot a TV set, or played with some tube radios/transmitters; there is high voltage in those devices, too. I agree most heartily that the procedure is dangerous, and should be done *only* by someone who has a working knowledge of high voltage circuit troubleshooting. Many current hams, and some of us old-timers are afraid of working on 12 V dc circuits. If that is the case, "Don't do it; let someone who knows what they are doing handle it."

Apparently I had some incorrect information about the 3-500 filament voltage, and did not properly document the source of that information. When I looked for it again to answer questions about my article, I could not find the original source of information. I did find an article on a web page by IW5EDI about a 3-500Z amplifier restoration project by W7TDC: **www.iw5edi.com/ham-radio/?ameritron-al-80a-restoration-project,62**. That article also lists 4.8 V as the filament voltage to use, and gives a maximum voltage of 5.0 V. In looking at the Eimac tube spec sheet now, I see that it clearly indicates the proper filament operating voltage as 5.0 V ±5%. I must admit that the article appears to be wrong about the filament voltage. I apologize for that error.

No, I did not try to adjust the primary taps on the AL80B transformer; I probably should have. The article is about what "*I did*." This article was only a suggestion, as are most *QST* articles. Neither I, nor anyone at ARRL, is mandating anyone to modify their equipment.

Is the article wrong about removing the cover and bypassing the Interlock Switch? For some folks, "Yes." — *73, Charles Rankin, WA2HMM, 165 Hickory Ln, Smithtown, NY 11787*; **crankin@dialup4less.com**

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

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

W1ZR

THE DOCTOR IS IN

Q Wayne, AI9Q, asks: I have a four element 6 meter Yagi at about 40 feet. A recent wind storm caused half of the forward director to fall off. What is the effect of the loss of half an element? I notice very little difference in the way it works.

A Basically, your "half director" is almost invisible to the rest of the antenna on 6 meters, since it is much less than a half wavelength. Thus, your antenna is acting like a three element Yagi.

Unfortunately, the dimensions will not be optimum as a three element structure, so it will not work quite as well as if it were designed to be a three element Yagi in the first place. Still, it will likely be within a few dB of the antenna when it was a four element Yagi.

The bottom line is that it will still work. It is very difficult to notice the difference in casual operation since it will be about a third of an S-unit. The only way to really tell is to point the four element Yagi at a steady nearby beacon and then remove (or rotate to vertical) the front director and measure the difference in received signal.

Make sure your S-meter is accurately calibrated. Alternately, first measure with three elements, then add the fourth and use an attenuator to bring the signal down to the same level. The amount of attenuation is then equal to the difference in gain.

Q Frank, AA5IT, asks: In a recent column, you spoke about an antenna with omnidirectional gain. How can you have "gain" from an omnidirectional antennna?

A Antennas don't have gain in the same sense that an amplifier has gain. Antennas may have stronger signals in some directions than others because of a redistribution of the energy either through reflections or through other beam forming methods.

The key is that the gain must be in comparison to something else. A dipole in free space has about 1.8 dB of gain compared to an imaginary isotropic antenna that transmits equally in all directions. That same dipole has 0 dB gain compared to a reference dipole. Put the real dipole above real ground and it will have about 6 dB gain over a free space dipole at some elevation angle, depending on its height.

When we speak of an omnidirectional antenna, what we mean is an antenna that has equal strength at all azimuth angles. A vertical dipole in free space will have an omnidirectional elevation pattern as shown in Figure 1. A pair of vertical dipoles in phase, one above the other, will focus the energy in a narrower elevation pattern with a stronger signal than the single dipole by about 3 dB (depending on separation) as shown in Figure 2. Since it still transmits to all azimuth directions, it is still omnidirectional. Its gain at the horizon provides a stronger signal there at the expense of radiation at the higher angles. It will thus be of benefit at a shore station communicating with ships, but not so good at an airport working with high angle aircraft. It also can be a problem on a ship rolling in heavy seas.

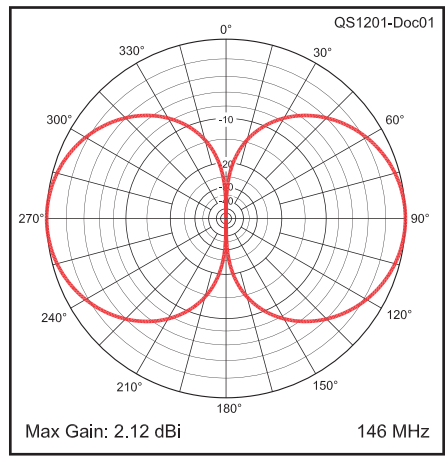


Figure 1 — *EZNEC* free space elevation pattern of a vertical dipole. Since the pattern is the same at all azimuth angles, it is omnidirectional.

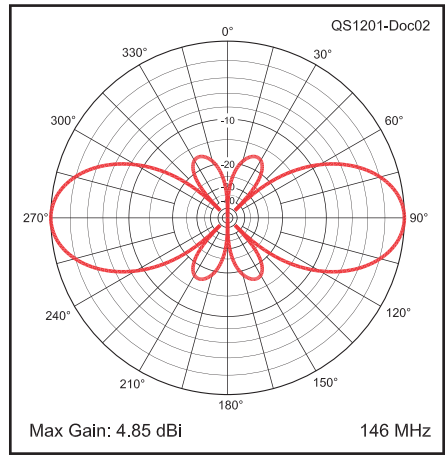


Figure 2 — *EZNEC* free space elevation pattern of a pair of in-phase vertical dipoles, one ¼ wavelength above the other, forming a collinear array. The pattern is the same at all azimuth angles, so it is still omnidirectional, but has a more intense signal at the horizon at the expense of radiation at higher angles.

Q Harold, WJ1B, needs more ac than his inverter can provide and wonders if inverters can be connected in parallel to obtain additional current.

A Inverters can be connected together only if their outputs are in phase. The usual inverter includes a free running oscillator that normally does not have a requirement for any special phase control. Thus, if hooked together in parallel while out of phase, a high current will flow between them, likely damaging one or both, unless they are well protected.

There is no reason that inverters couldn't have a phase locking connection to allow them to operate in phase, under the phase control of one or the other of the inverters. I am not aware of this feature on any of the inverters we've looked at in the ARRL Lab. However, at least one gasoline powered inverter generator set, the Honda EU2000i Companion, provides 2000 W of inverter power and includes a phase locking connection to allow two similar units to be operated together in parallel at twice the capacity of a single unit.

Q Al, WA2VJL, asks: We have power amplifiers to boost our transmit signal strength. That's okay, but, isn't it more cost effective to boost receive? Why don't our amplifiers work both ways?

A In fact many V/UHF power amplifiers also include receive preamps that do exactly that. The reason you don't see preamps with HF transmit amplifiers is that the signal to noise ratio on HF is generally limited by the noise received at the antenna. At V/UHF the external noise is generally less — as a rule, it goes down with increasing frequency. Thus any extra amplification of an HF signal received by the antenna amplifies the signal and the noise by the same amount so the receive signal to noise ratio is unchanged, unless the receiver was of poor design to start with.

Joel R. Hallas, W1ZR ♦ *QST* Technical Editor ♦ jhallas@arrl.org

In addition to not helping, an HF receive preamplifier actually will make the situation worse because the receiver with a high gain preamp is more likely to overload and cause spurious signals to be generated in the receiver.

It wasn't always this way. Until the 1960s, receiver preamps or preselectors were quite popular. They generally also included tuned stages that reduced received images, a problem above 20 meters with most single conversion receivers using a 455 kHz intermediate frequency (IF), a common design in the vacuum tube days. Modern receivers generally have multiple conversions with the first in the HF or VHF range so images aren't a problem. In very quiet conditions even some modern receivers can benefit from a low noise preamp on 10 meters.

Note that an antenna system with gain will generally help both transmit and receive signal strength if pointed in the right direction. The transmit amplifier will make your signal stronger at the far end, which is sometimes just what you need.

Q Jim, KC9BUW, asks: I recently heard the end of a conversation in which some hams were discussing meteor scatter propagation and talking about hearing the resulting "pings." What frequency can I monitor to be likely to hear such pings?

A The effect of meteor trails is actually similar to propagation via the ionospheric E-layer. That is, they support propagation over medium distances in the 500-2000 mile range, depending on their height and your antenna elevation angle. The difference is that the propagation from any trail persists for a short time. The time a path exists is inversely proportional to frequency, such that a burst on 6 meters may be long enough for a good portion of an exchange, while on 2 meters it may be barely enough for a call sign. Thus, multiple bursts are usually required to complete a contact.

You can't hear the trail itself, but you can hear the effect of the trail as a burst of propagation from a station you can't otherwise hear. The propagation supported is in the low to mid VHF range, and a great signal source is FM broadcast stations on frequencies that are not used in your local area, but are in use in the distant region of interest.

Normally you will just hear white noise on the frequency, but as a meteor trail goes through the ionosphere above the middle of the path, you will hear the "pings," bursts of the FM station's carrier, as it passes. If you don't have access to the FM broadcast band on your ham equipment, you could try monitoring the 6 meter SSB calling frequency, 50.125 MHz.

Q Scott, KE6JLE, asks: I just bought a new VHF handheld transceiver. When I got it out of the box, I installed the battery and keyed the radio a few times, to make sure the display was working right. I then started reading the book and found that I was not supposed to key the radio unless there is an antenna attached. Could I have damaged the handheld in the few times I keyed it without an antenna? How can I tell if it was damaged?

A While it is possible that you damaged the transmit output stage, I think it is unlikely. That said, it always a good idea to always have an antenna or dummy load connected if you switch to transmit. If there were any damage, it would likely manifest itself as reduced power output on transmit. Fortunately, that is pretty easy to test for.

A forward/reflected power meter is a good investment that will confirm that your transmitter is still putting out rated power. It can also be used to check for proper operation of antennas. For many hams, it makes a good choice as a first piece of test equipment.

While the precision and price for such equipment varies all over the map, a relatively inexpensive relective power meter will do what you want, as long as you don't expect highly precise answers. I have a number at my station, but sitting on the line to my 2 meter antenna is an inexpensive (under $50) V/UHF forward and reflected power wattmeter that should also work for you. Make sure that it has scales that allow you to see the amount of power your radio can put out.

You will also need a 50 Ω coax jumper cable with connectors that match your radio and the SWR meter and some kind of 50 Ω load on the meter output. It only needs to handle your transmitter power, so a 51 or 47 Ω, 2 W carbon resistor should do for the typical 1.5 W handheld. If you have an outdoor antenna that should work as well. The handheld antenna will probably not provide a good match, without being on the radio, but it should be safe for the test.

Out of the box, it should give you an indication of what's happening — but I wouldn't consider the actual number accurate beyond 20-30% until the calibration is checked. This will be close enough for your purposes. My unit had calibration adjustments for each range, and now that I calibrated it against the ARRL Lab test instruments, I'm more comfortable with its numbers. Any club member with an accurate wattmeter should be able to help you.

Checking on the air can be useful but can be misleading as well. My kitchen 2 meter FM set, connected to a rooftop antenna, worked well into local repeaters even after its final amplifier chip failed. I was quite surprised when I checked it to find it was putting out 100 mW (0.1 W), instead of the rated 50 W!

Q Ron, AB1NN, asks: *The ARRL Antenna Book* includes a map showing soil conductivity values that vary from 1 in New Hampshire to 15 in Minnesota. What height adjustments for a dipole antenna should be made to compensate for this range of soil conductivity relative to antenna height over typical ground? My main focus is 75 and 40 meters *near vertical incidence skywave* (NVIS) for ARES®.

A I don't think you can quite compensate for the difference by changing heights — the different conductivity will just cause the antenna to act somewhat differently. There will be two effects:

1. The feed impedance will change — the extremes for an 80 meter dipole at about 45 feet elevation would range from around 70 Ω with very poor conducting ground — bounded by the free space value and just above 50 Ω for highly conductive ground — bounded by the perfect ground case. This effect is not usually too significant.

2. The highly conducting ground will produce a higher magnitude reflected signal than the poor ground. This will have a more significant effect. The extremes will provide an idea of the range. For NVIS, the reflected wave is important. With perfectly conducting ground, the vertical signal has an intensity of about 8 dBi, while with no reflection the signal is just 2.1 dBi in the upward direction. Typical ground has an intensity of about 6 dBi in the upward direction.

You may be able to compensate by adding conductivity to the soil beneath the antenna by treating it or by frequent watering, or by adding reflective wires. Note that this is a special case for NVIS, since the soil beneath the antenna will impact the upward reflection. For lower angle radiation, usually desired on higher bands, the reflection occurs from much farther away, and only governments can usually afford the miles of wire required for such a ground screen (I once worked on a project with such a ground screen) Interestingly, for low angle radiation, the lack of an intense reflected wave reduces the cancellation that usually limits the low angle radiation from lower horizontal antennas.

Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org.

N0AX

HANDS-ON RADIO

Experiment 108
PCB Layout — *Part 2*

Last month, we designed a circuit that would disconnect a load when battery voltage dropped below a certain level for a specific length of time.[1] There are still a couple of features to add — adjustable disconnect voltage, a means of switching load current and the circuit must latch off in a power down state when the load is disconnected. In addition, I'm going to introduce a new schematic editor as we start down the road toward producing a circuit board. Let's get going by transferring our circuit to the new CAD package.

Fabrication Services

Over the past few years, numerous online PCB *fabricators* have sprung up. One of the best known is ExpressPCB (**expresspcb.com**), which also provides free schematic editor and PCB layout software. You use the ExpressPCB tools to design your circuit and lay out the PCB then submit the resulting files to ExpressPCB for fabrication. You get the boards back by mail in a few days!

ExpressPCB is unique in that the format of the files it uses is proprietary — if you use their software, you'll have to use their fabrication service. Nevertheless, ExpressPCB is an easy way to get used to schematic entry and PCB layout. Once you learn how, you'll be more informed about the basic steps and will be in a better position to use a more advanced package such as *Eagle* (**www.cadsoftusa.com**) or *Kicad* (**www.lis.inpg.fr/realise_au_lis/kicad**), both of which have free versions. They both can generate standard format output files, but are more complex to learn and use. We'll start with the simple and inexpensive *MiniBoard* service from ExpressPCB and you can take it from there!

ExpressPCB Software

Download and install the ExpressPCB schematic editor and layout program as one file (**ExpressPCBSetup.exe**) after clicking DOWNLOAD EXPRESSPCB from the ExpressPCB home page. There is one version for *Windows XP*, *Windows 2000* and *Windows NT* and another for *Windows Vista* and *Windows 7*. Run the file and two programs will be installed: *ExpressSCH* (the schematic editor) and *ExpressPCB* (the PCB layout program).

The first time you run either package, you'll be prompted to read a QUICK START GUIDE. Keep the guide open while you work with the programs or print it out on paper. You'll be able to use it as a handy reminder of how to perform basic functions until you've gotten used to the program.

Entering the Schematic

Run *ExpressSCH*, creating a blank schematic. Maximize the window to full screen and begin by editing the title block at the lower right. Double-click on SCHEMATIC NAME and enter "Low Battery Detector" in the text window that opens, followed by ENTER to place the text on the schematic. You can click and drag to move the text around. See Figure 1 for ideas of what to enter into the other fields of the title block. Now use the FILE menu to save the file with a filename of "Low Battery Detector" or whatever you prefer.

Next, recreate the *LTspice* schematic from last time, leaving out the voltage source, V1, and R6, the resistor simulating the relay coil. Start with the resistors. Click the PLACE A COMPONENT tool button at the left hand side of the screen and click the left-most stick figure button in the toolbar. From the pull down menu at the right side of the upper toolbar, select PASSIVE — RESISTOR. The cursor will change to a double-lined cross. Move it into the schematic area. Each time you click, a resistor symbol will be placed on the schematic. Place five resistors on the schematic then right click anywhere. The cursor will change back to an arrowhead. Select the component tool again and click the second stick figure toolbar button from the left. Place two more resistors on the schematic, noting how they are oriented. These will be the resistors in series with the comparator outputs.

Repeat this general process to create two non-polarized capacitors, one polarized capacitor, a Zener diode and a PNP transistor. (The diode and transistor can be found in the SEMICONDUCTOR group of components.) Select the SYMBOL or LABEL tool and place seven power ground symbols on the schematic. Arrange the components and symbols approximately as in Figure 1.

We're going to change the dual comparator to a more common type, the LM393. The LTC1841 was convenient for simulating in *LTspice* but is not rated for automotive voltages. The LM393 can operate at voltages as high as 36 V and is available as a through hole DIP package. Download the LM393 data sheet for future reference at **www.national.com/ds/LM/LM393.pdf**. Select the symbol IC — NATIONAL — LM393 — COMPARATOR — DIP-8 and place it on the schematic. Both sections of the dual comparator will be placed on the schematic as a pair. Click on one of the sections and it can be moved independently. The Zener diode we'll use here is the more common 1N5234B.

Use the WIRE tool to connect the compo-

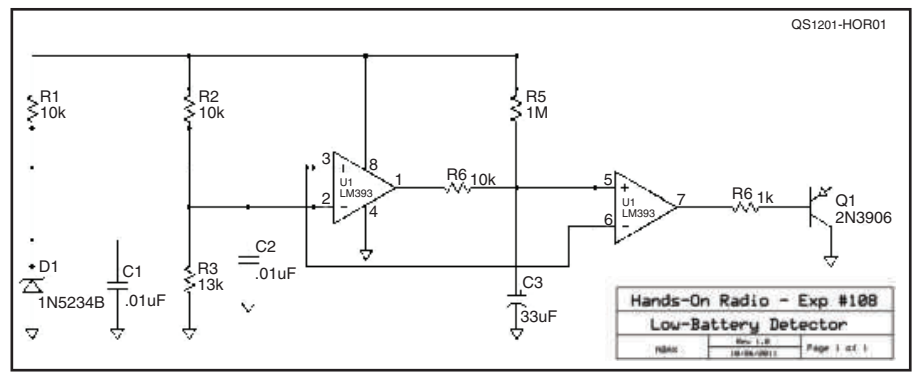


Figure 1 — A partial schematic that results from transferring the *LTspice* design into *ExpressSCH*. [The schematics have been rendered to match the software. — *Ed.*]

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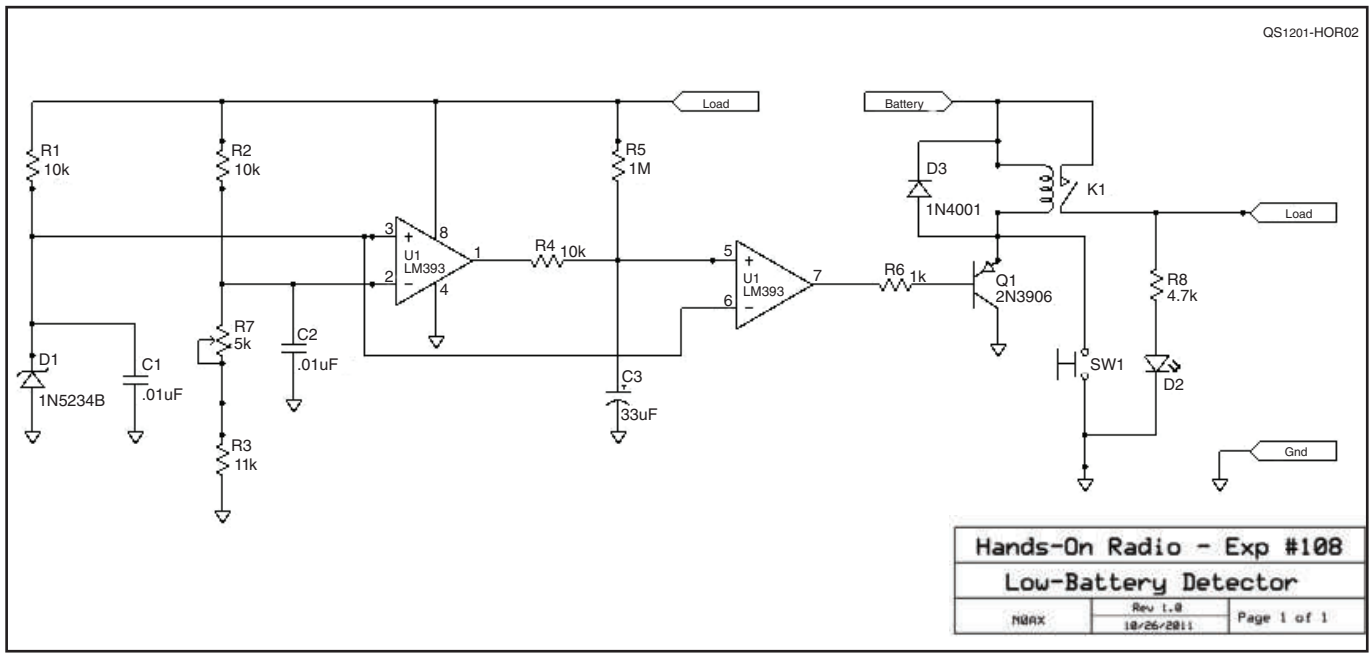

Figure 2 — The final schematic after adding the relay and latching circuits. Ports labeled Battery, Load and Gnd are used to indicate external power connections.

nents together without worrying about their placement on the schematic. The wires will *rubber band* to maintain the connection as the components move. It is important that you make connections between pins of components and not to the lines between components. If you're not sure whether you've made a connection to a pin, select and move the component. If the connection was made properly, the connection will stay connected to the component. Be careful to connect the comparator inputs correctly as the *LTspice* and *ExpressSCH* conventions for orienting the inverting (–) and non-inverting (+) inputs are different. Use the INSERT A CORNER IN A WIRE tool to reroute the wires in the conventional right angle fashion.

To assign component values, right click on the component then select SET COMPONENT PROPERTIES. In the window that appears, enter the component designator (such as R1, C1, D1, U1 and so forth) and the value or part type (1N5234B, 0.01 µF and so on), then click OK. Move the components around so that the labels are in the clear. The result should look similar to Figure 1. Both comparator sections should be designated U1 to avoid problems when linking the schematic and layout.

Adding the Features

The threshold voltage should be made adjustable by replacing R3 with a series combination of a 10 kΩ resistor and a potentiometer. Using a spreadsheet, the switching threshold, V_{THR} = 6.2 (1 + R2/R3) was evaluated for several combinations of standard fixed and potentiometer values. I selected an 11 kΩ fixed resistor and a 5 kΩ potentiometer, giving a range of 10.1 to 11.8 V centered close to 11 V. Add the potentiometer to the schematic and change the value of R3. C2 should remain connected to the inverting input of U1A.[1]

An SPST relay will switch the load current. The stock library of schematic symbols that comes with *ExpressPCB* does not include relays so you'll have to add the symbol "SPST — Relay.s" provided on the Hands-On Radio website, obtain one off the Internet (many designers have published collections of symbols for *ExpressPCB* online), or create your own. Assuming you use the Hands-On symbol Relay-SPST.s, download it to the SCHCOMPONENTS_LIBRARY folder where *ExpressPCB* was installed — usually *C:ProgramFiles\ExpressPCB*. You can now select the component and place it on the schematic. Connect one side of the coil to the collector of Q1. Add a 1N4001 kickback diode, D3, across the coil as shown in Figure 2 to protect Q1 when it suddenly interrupts the coil current.

To represent the battery and load connections, create left and right pointing port symbols. From the COMPONENTS menu, select COMPONENT & SYMBOL MANAGER. Click the LIBRARY SYMBOLS check box and select PORT — RIGHT POINTING — 8 LETTERS WIDE, then click INSERT INTO SCHEMATIC. Move the port symbol to a clear spot, then right click it and edit the component properties so that the label is Battery. Connect the symbol to both the coil and the NO (normally open) contact as shown in the figure. Create two PORT — LEFT POINTING — 8 LETTERS WIDE symbols with a label of Load. Connect one port to the relay's remaining contact and the other to the power connection of the comparator electronics. Create one more left pointing port with a label of Gnd and connect it to a ground symbol.

To create the latching function, we've just taken the first step — supplying the sensing circuit from the load voltage means that if the load is disconnected, the sensing circuit is as well, turning off Q1 and keeping the relay contacts open. How does the circuit turn on in the first place? That's where SW1 comes in.

To turn the circuit ON and close the relay contacts, close SW1. This bypasses Q1 and closes the relay, applying power to the sensing circuit. If battery voltage is sufficiently high, Q1 will turn ON and keep the relay closed after SW1 is released. Once battery voltage drops below the threshold, the relay will turn OFF and the circuit will have to be manually activated again. R8 and D2 provide a visual indication of whether the load is powered or not. We are now ready to proceed with circuit board layout!

[1]All previous Hands-On Radio experiments are available to ARRL members at **www.arrl.org/hands-on-radio**. The design spreadsheet is available in the section for this experiment.

Strays

HAVE A *QST* DELIVERY ISSUE?

◊If your copy of *QST* does not arrive by the end of the month before the issue date, please contact the ARRL Circulation Department at **circulation@arrl.org**, tel 860-594-0200. Also contact them if your address changes or your copy of *QST* arrives in damaged condition.

Andy-Crimp Pro™ Crimping Tool

Bob Allison, WB1GCM
ARRL Lab Test Engineer
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The Andy-Crimp Pro with optional dies for various connectors.

It seems that the majority of modern amateur equipment uses low-voltage dc as a power source. Connections from radios and accessories to dc power sources vary. Screw connections, Molex connectors and assorted plugs, even two-wire trailer plugs, can be found in almost every ham shack and mobile installation. Recently, I decided to standardize many of the dc connections at my station with Anderson *Powerpole* connectors in the hope of creating a neater shack and adding flexibility when moving transceivers between my home and car. However, attaching Powerpole connectors to power cords requires an appropriate tool for the job. For the purposes of this review that tool was the Andy-Crimp Pro.

Unique, Rugged Design

The Andy-Crimp Pro is a ratcheting tool with a removable die assembly for 15, 30, 50 and 75 A Anderson Powerpole connectors. It resembles other crimpers you'll see on the market, but the difference is in dies. They're essential to the function of the Andy-Crimp Pro, as you'll see in a moment.

The tool was developed in a joint venture between High Sierra Antennas and Quicksilver Radio Products. They claim that their design prevents connectors from jamming in the tool, unlike the behavior of other crimpers. If you've ever used other crimping tools you'll understand why the anti-jam design is beneficial!

The Andy-Crimp Pro is ruggedly built and weighs in at 1.3 pounds. While some crimping tools have rubber handles that annoyingly slide off during use, I couldn't budge the red handles. The distance between the pivot point and the handle ends is 7 inches, which translates to plenty of squeezing power. The ratchet release is adjustable.

The Andy-Crimp Pro Goes to Work

Using the tool is straightforward. The dies are labeled 15, 30, 75 and 45. I selected a pair of 30 A connectors for the power cord of my small multiband 100 W transceiver. While the connector casings of the 15 and 30 A connectors are identical in size, the diameter of the pin hole is larger for the 30 A connector. The #10 AWG power cord wires from my transceiver fit tightly into the pin holes. After I adjusted the ratchet release, a quick but firm squeeze of the handle completed my first connection, with the pin cleanly falling out of the tool upon release.

Next I followed "the rule of the Powerpole": red right, top tongue. That is, with the open end of the connector pair facing the builder, the red connector is on the right and the tongue of the connector is on the top inside of the housing. Within a minute I had inserted my first-ever homemade Powerpole connector into my newly acquired dc power strip.

The 30 A connector pin accepts #12 AWG wires as well. For my lower-amperage accessories, I used 15 A connectors, which worked well with the #16 AWG wire used in the shack. For some of my #14 AWG stranded wires, I had to remove a few strands to fit the 15 A connector pins.

With the Andy-Crimp Pro all the connections were solid. It is interesting to note that Anderson Powerpole connector pins have a much higher current rating than the wires that are installed to them. When connecting Powerpoles together, the connectors click into place with a "tongue against tongue" action, which provides plenty of surface area for electrical contact.

It is important to adjust the Andy-Crimp Pro's ratchet release properly before starting any project. Out of the box, my Andy-Crimp Pro tool ratchet release was adjusted for very small, non-Powerpole connectors. Even though I have used crimping tools before, in my enthusiasm I forgot to adjust the ratchet release and I couldn't squeeze hard enough to release the pin being crimped! Fortunately, there is a manual release bar which, when pushed firmly in the direction of the die, will release the tool.

This tool is not just for Powerpole connectors. With the removal of two screws the dies can easily be changed for crimping various sizes of other common connectors, including Molex. I bought a die set for crimping PL-259 and N type coaxial cable connectors. Thanks to Andy-Crimp Pro, my shack is neater and more flexible.

Available from High Sierra Antennas, PO Box 2389, Nevada City, CA 95959; **www.hamcq.com**. *Also available from Quicksilver Radio Products, 387 South Colony St, Meriden, CT 06451;* **www.qsradio.com**. $49.73; optional coax dies $18 each.

Andy-Crimp Pro

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

http://youtu.be/5PBBd-ssoeY

AG1YK

HINTS & KINKS

SOLDERING IRON ANTIOXIDANT

♢I have been soldering things for 66 years. During that time the one thing about soldering that irritated me was the constant battle to keep the soldering iron tip clean of oxidation (that hard black scale that builds up). I keep a wet sponge handy and was constantly cleaning the tip.

When building with larger components, it was fairly easy to find a clean spot on the tip to heat the component and solder simultaneously. Working with SMD (Surface Mount Devices) and small printed circuit boards is quite different. The component terminals and solder pads are small. These small components, especially the SMDs, are amazing devices and can withstand quite a bit of heat — for a very short time. Soldering such devices requires that the heat transfer from the soldering iron to the component or pad happen very quickly. A small, clean and properly tinned tip is a must, which was a problem with my old 12 and 25 W irons.

Keeping Out the Air

Oxidation is a result of the hot metal coming into contact with oxygen in the air. It occurred to me that oxidation could be reduced if the tip was not exposed to the air while in the holder. I thought, "Why not keep the tip buried in a pool of molten solder?" As this idea developed, some questions arose.

First, what to use as a cup to hold the molten solder? It needs to be small, shallow, cheap and able to withstand substantial heat. I started walking the aisles of my home improvement store and found a solution. A ⅜ inch Axle Cap Nut (Lowe's part #008236768541). They are used on kids' toys to keep the wheel on the axle. I bought a package of two.

Next, I started to wonder if the soldering iron would generate enough heat to keep the solder molten? And what would I use to hold the cup? Whatever was used had to withstand the heat from the molten solder.

I found a piece of oak board about an inch thick. I cut it to size and bored a shallow hole to hold the cup and another hole to support a soldering iron holder formed from a coat hanger. A couple of screws through the 25 W soldering-iron base into the wooden block and my new soldering station was complete (see Figure 1).

Figure 1 — The 25 W iron in its completed antioxidant holder.

First Heat

As my 25 W soldering iron was heating up, I used my 300 W soldering gun to melt enough solder to fill the cup. I cleaned the tip of the soldering iron and stuck it in the homemade holder. Then I withdrew the iron and the bottom ⅛ inch of the tip was clean and perfectly tinned — no hard scale. I grabbed a few pieces of wire and a PC board and soldered and desoldered a bunch of connections without ever touching the cleaning sponge.

The original holder for my 12 W iron was a small piece of angled aluminum. It didn't have an existing base to work with, so that holder was built completely from scratch. A scrap piece of wood, the other cup, a formed section of coat hanger, a few minutes time and this project reached a successful conclusion (see Figure 2).

WAYNE SMITH, WA4WZP

Figure 2 — Some metal cups, a piece of wood and a coat hanger are all you need to keep your soldering tip shiny and ready for action.

Safety

Remember, even low-wattage soldering irons are *hot*! So too the liquid solder in the cup. Don't use this around children or others who could be burned by the molten solder or iron. Even though the amount of solder in the cup is small, it's enough to cause a serious burn if spilled. The base of my 25 W iron is heavy enough to resist tipping over. Not so for the 12 W iron. For safety purposes, it is attached to the workbench with industrial strength hook and loop fastener. Always use soldering equipment in a proper work area and take steps to keep hot items away from yourself and others.

The solder cups are held in the wooden blocks with epoxy, as well as the lower coat-hanger support of the 12 W iron. Be careful to use an epoxy that can tolerate the heat, such as J-B Weld, which can withstand 600°F.

From a cold start it takes about 10-12 minutes for the solder in the cup to liquefy. A dark layer of rosin will form on the top, but it does not stick to the tip of the iron. — *73, Wayne Smith, WA4WZP, 224 Saint John's St, Arden, NC 28704*, **wa4wzp@arrl.net**

[Note that eventually the solder in the cup will become contaminated and will need to be disposed of. Check your local regulations regarding proper disposal. Also, some modern soldering-iron tips are plated with a protective layer of iron. The tin in the molten solder can dissolve this layer and cause premature failure of the tip. Finally, the cup solder will be an additional heat load on the iron and many shorten its life.— *Ed.*]

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

CUSTOM PANELS FOR YOUR RIG

◊Laser printers make it much easier to create custom panels for home-brewed or modified equipment but you still have to choose an appropriate medium. Paper self-adhesive labels are the most common choice, but they wear out with use and may not stick well to metal, plastic or painted panels.

Avery (**www.avery.com**) makes a line of labels called White WeatherProof, which are made of polyester instead of paper. They take laser printer toner very well producing dark, even colors. They have a permanent adhesive that sticks tightly to most surfaces and the dull lustrous finish matches the panels of most rigs (see Figure 3). Best of all, they do not seem to abrade or peel off after prolonged use, so your equipment remains looking new and professional. Avery White WeatherProof labels are available in a variety of sizes, up to 5½ × 8½ inches (two per sheet), which should handle the most ambitious of projects. I use programs such as *PageMaker*, *Illustrator* or *PhotoShop* for precision placement of text and symbols but there's lots of software that will do the job.

BILL PRINCIPE, K1NS

Figure 3 — The panel of my Dentron tuner is brushed aluminum with a painted background, making the white letters of my wattmeter selector switches' custom label appear slightly brighter.

You can also use White WeatherProof labels to make great bumper or window stickers. I have had some on my car for several years and they do not fade or peel even after many car washings and snowstorms. — *73, Bill Principe, K1NS, 9A Sunflower Ct, Ayer, MA 01886*, **k1ns@arrl.net**

HELPING HAND

◊Here is a little trick I use when soldering and it can be made easily and inexpensively. I have a small device I purchased that aids in soldering, but it is always somewhere out of sight and I spend more time finding where I have it stored than it's worth, usually continuing the job without it.

ROGER ODORIZZI, W7CH

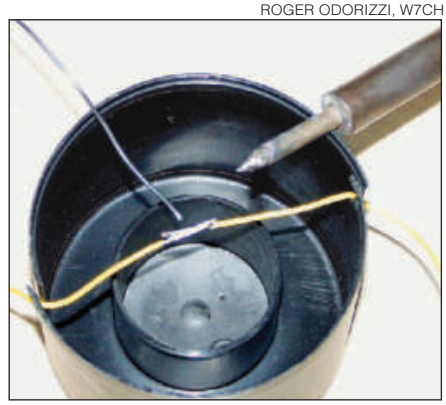


Figure 4 — This simple modification turns any plastic cap into a third hand to help with those soldering projects.

One can make this soldering aid in minutes. If it's a bigger project you can quickly make as many as you need. Using a plastic cap from a spray can, modify the cap using your side cutters to make two slits on opposite sides, as shown in Figure 4.

Next step is to screw the cap to a board or put something heavy inside such as washers or nuts to give it weight and prevent it from moving. If you do put something inside, be aware that it may get covered with solder droppings. Next, insert the wires you are going to solder in the slots and you instantly have a third hand to stabilize your work, leaving your hands free to do the soldering.

This is a quick, easy and very handy way of freeing up your hands for other tasks. After the soldering job you may want to dispose of it instead of storing it. Making another is fast and easy and chances are you already have the parts for another one already on hand. — *73, Roger Odorizzi, W7CH, 195 Ivan Morse Rd, Manson, WA 98831-9429*, **w7ch@arrl.net**

DENTAL FLOSS STRAIN RELIEF

◊A large number of my bench projects require some type of connector such as a mini phone plug, a coax style power plug, DIN plug or any of the others that require some form of strain relief for the cable. I have tried to crimp the built-in strain relief (usually too small and too weak), heat shrink tubing and fine wire or string. All of these methods were less than satisfactory. But now, I have what seems to be the ideal solution: dental floss. The flat unwaxed works the best and is strong, easy to attach, small enough to allow the cover to be installed and survives most solder jobs. Figure 5 shows the dental floss strain relief on a dc coax style power plug. — *73, Dave Keene, W5DBK, 6266 FM 273, Bonham, TX 75418*, **w5dbk@arrl.net**

DAVE KEENE, W5DBK

Figure 5 — Dental floss is thin, strong and heat resistant, making it an excellent choice for strain relief in a miniature connector.

CUTTING BOARD INSULATORS

◊In building a 6 element beam for 6 meters I found that I needed some plastic to insulate the radials from the boom. Locating a source locally seemed to be impossible. But while shopping at a local discount store I saw the perfect material: poly cutting boards. They are readily available in the kitchen department, are very strong, work great and are easily cut with a band saw.

One thing I discovered is that after about a year the sun makes the plastic brittle. Painting the poly board with a paint formulated for plastics (such as Krylon) slows the sun's deteriorating affect. I generally use black or another dark color. If it is painted with a dark (black) plastics-type paint it seems to last much longer. — *73, Terry Halladey, AF7W, 6982 Ash Dr, Cocoa, FL 32927*, **af7w@arrl.net**

TIE YOUR POWERPOLES

◊ In a mobile environment, Powerpoles are subject to considerable vibration. To provide extra security, I use a small plastic wire-tie threaded through the roll-pin holes of a red/black Powerpole pair to secure power connections (see Figure 6). — *73, Dan Steinhoff, W7UP, 820 South 131st Ave, Omaha, NE 68154-2924*, **w7up@arrl.net**

DAN STEINHOFF, W7UP

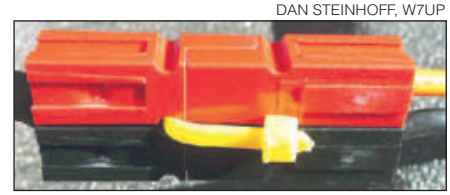
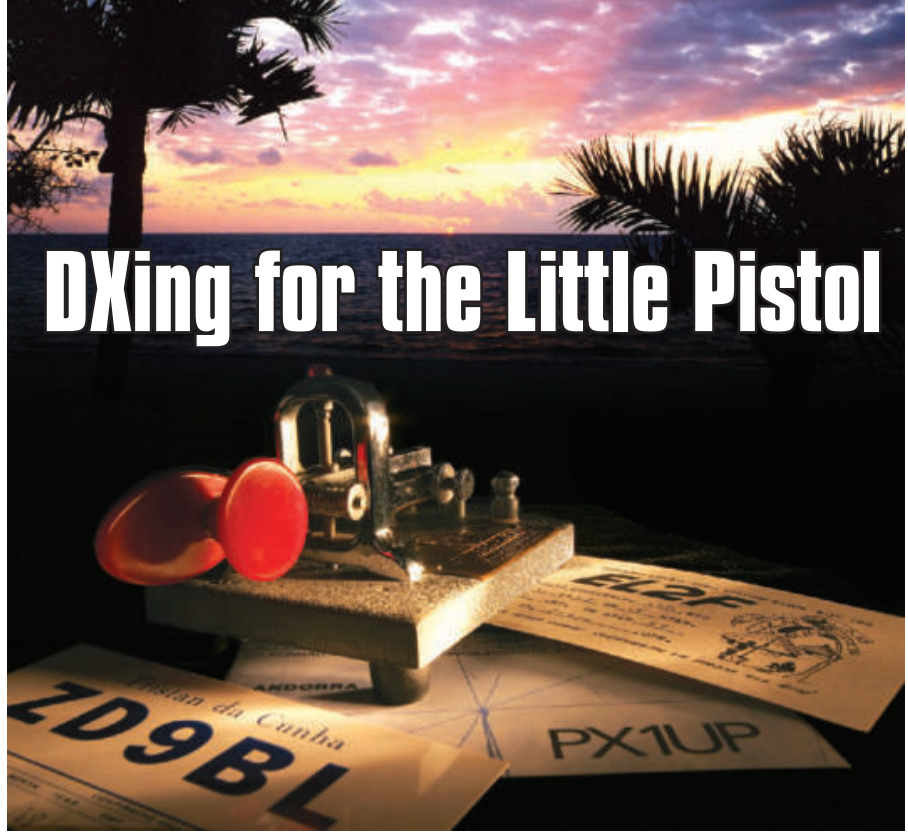


Figure 6 — A wire tie can help keep your rig's power on as it gets jostled in mobile or portable environments.

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

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



STEVEN REYER, WA9VNJ

The right techniques will help a popgun signal snag that rare DX.

Robert S. Logan, NZ5A

After working 5M2TT on 20 meters with 20 W and an 80 meter inverted V at 35 feet, I wrote a congratulatory note to the DXpedition team for their fine effort in Liberia. While scrolling through other comments in their guestbook, I read one response that concerned me. The comment expressed great frustration at failing to work them and concluded by saying there was "no chance with low power." The writer's obvious disappointment compelled me to write this article for two reasons.

First, I wanted to reassure new, and perhaps frustrated, DXers that many people for many years have never run more than 100 W. Many others — including me — have run power levels of 5 W or less and have had great fun, excitement and success in chasing and working DX.

Second, I wanted to describe some basic tips for low power (Little Pistol) and very low power (Popgun) operators on how to hunt and work DX, especially in large pileups. So let's learn a few techniques that should help you work DX with low power. Although slanted more toward CW, the principles apply to SSB operation as well.

Study the Pileup

Study the pileup to determine what range of frequencies the DX station is actually listening to and how he is tuning through that range as he contacts stations.

It is an axiom that rare DX creates a pileup and the rarer the DX, the larger the pileup. To help control the pileup, the DX station gives general directions about where he is listening for calls. If you don't follow his directions, your chances of working him will be small indeed.

Take the time to learn a few techniques and those rare QSLs will be yours.

Typically a DX CW station will send the letter U and perhaps some number after making a contact. The U indicates he is listening up from his frequency and the number indicates how many kHz up he is *starting* to listen. A U 1 indicates that he is listening up no less than 1 kHz higher than he is transmitting. An SSB operator might simply say the words UP or UP THREE. He will not answer if you transmit on his transmitting frequency. Worse yet, you will contribute to the general interference. If you persist, your reputation in the DX community will suffer as well.

The phrase *no less than* is used on purpose because, in a large pileup, calling stations spread themselves out naturally, starting from 1 kHz in this example and ranging up 3-4 kHz or even more for truly massive pileups.

To determine this listening range of frequencies, listen carefully to gather vital information. Figure out how wide the range is so you will not transmit outside it — he isn't listening there. Identify where the largest clumps of loud stations are so you will know where *not* to try to fight it out — you'll be buried. Determine where the clear frequencies are so you will know where the better chances are for making a contact. Observe whether the DX station is extending the listening range by working stations higher in frequency. Don't sit on one frequency like a rock; if he's not listening there, he's obviously not going to hear you. Move if you need to but only to a better place. With this information, you have narrowed the target frequencies to a manageable range that you can quickly scan.

Observe the DX Op's Habits

Study the DX operator's operating habits to see how he makes contacts.

A singular fact often overlooked by newer operators is that the DX operator is the only person who decides to contact you at that particular moment. Working through pileups hour after hour is a wearing, stressful activity. The easier you make it for him, the more likely your chance for a contact.

Is the DX operator controlling the pileup

with discipline? If so, cooperate with any specific instructions about how he wants stations to respond. He may work the states or provinces by call area, different parts of the world at certain times or set aside time each hour for low power stations. Is he moving slowly up the listening range one station at a time or after several contacts in a row? When his ears "move up," you have to move up with him.

As you listen to him work stations, note if he has a method of moving up the range of frequencies. For example, 5M2TT had a nice, steady habit of creeping up to the top of the listening range, starting again at the bottom and then steadily working his way back up to the high end. After each contact or couple of contacts, he seemed to work the next station about 200-300 Hz above the last one. In a relatively clear area near the top of the range, I placed my signal about 400 Hz up from his last contact, waited for him to make one more contact, then called and worked him. Understanding where he will most likely be listening for the next station before the rest of the pileup arrives significantly increases your chances for a successful contact.

Be Different

Study the stations making contacts and determine what makes them stand out.

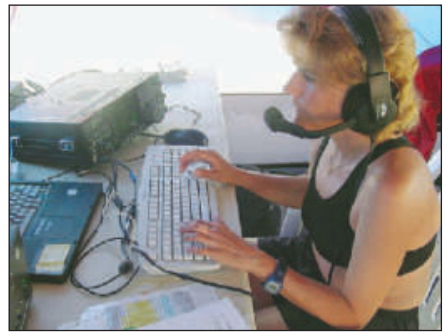
A famous actress once said if she wanted to be noticed in an audition, she wore a red dress. The same principle applies to breaking a pileup. You have to be noticed to make the contact. As a little pistol or popgun, if you sound like everyone else, you will be just part of the noise.

Sit back, put on the headphones, close your eyes and listen to the back-and-forth flow for several minutes until you can distinguish the stations the DX is working from those he is not. Try to guess from the signals calling who will be answered next. It may take you many minutes at first but eventually you will notice that some signals stand out from the crowd for one reason or another. Those are the ones who are answered.

Some stations are simply stronger. Some are weaker but in the clear. Some operators use a hand key or semiautomatic key (a "bug") while everyone else is using keyers that seem to give the same shape and spacing to all those dits and dahs. Some people even introduce a little chirp or weight their keyer for very hard keying on CW. On SSB, you may hear excellent speech processing or a little distortion. Some SSB operators may speak very fast or very slow. In any case, the stations that are worked distinguish themselves in some way from the crowd.

By the way, your use of phonetics should follow his use of phonetics. If he says ALFA, for example, you should say ALFA, if that is part of your call, so he can decipher your call in a microsecond. Make it easier for him to pick you out.

ALAN MAENCHEN, AD6E



Ann Santos, WA1S, working the pileup for the K7C Kure Atoll DXpedition. Everything comes down to the DX operator having a reason to pick *your* signal at that moment.

On CW, try varying your sending speed. If the pileup consists of a horde of speed merchants, send slower. If everyone sends slowly (unlikely but possible), send a little faster. Use a little wider spacing than normal between letters. I called 5M2TT for almost an hour at 30 WPM like the rest of the pileup. It didn't work. I turned down the keyer to about 10 WPM and put in wider spacing between letters. This enabled me to send my call at a speed different from almost everyone else.

Know Your Station

Improve your understanding of the total capability of all that stuff you worked so hard to put together.

Hams are born tinkerers. We're always thinking about ways to improve our stations. The results are better antennas, boxes, software, cabling, switching, sitting, lighting — you name it. We always know and believe we can do better. At any particular moment in time, such as the moment you call a DX station, what you have is what you have. You cannot improve it at that moment.

By thoroughly understanding what combinations of things in your station perform best together in different situations, you can maximize your hearing and transmitting for *each* situation. A beam is not always best; sometimes a monoband vertical will get there faster before the rest of the pileup does, particularly if the DX station suddenly changes to a lower band. A tall antenna with a low angle of radiation will sometimes overshoot a close-in DX station whereas that low wire antenna you just threw in the trees, with its higher angle of radiation, might just drop a stronger signal right on him.

Similarly, with respect to filtering, sharpest is not always the best either. Sometimes a really sharp filter may not allow you to hear what's going on around you. Instead of that good 250 Hz filter, switch in the 500 Hz or SSB filter. On SSB, switch between that 1.8 and the 2.5 kHz filter and you may hear a key development in the pileup that wasn't noticeable before.

You only learn your station's practical capabilities by being on the air a lot and experiencing both success and failure. Regarding my station, for example, I have often noticed a big difference in performance by simply switching between vertically and horizontally polarized antennas. I often see a 10-20 dB difference in received signal levels and much less interference and static between my vertical and my (mostly) horizontal inverted V.

I called the rare one on my vertical because he was consistently strongest on it. But the orientation of my 80 meter inverted V places a major lobe right on central Africa on 20 meters. So even though the DX station was not as strong on the inverted V, I switched to it anyway and worked him on the second call. Why specifically at that moment did the inverted V work better than the vertical? I don't know. I just knew it had in the past in certain situations. So, since the capability was there, I tried it. Don't lock yourself into a single idea and walk away in despair. Try something else whether or not it fits logic or matches theory.

Summary

These four little tips can be implemented immediately and on any band. Studying the pileup, observing the DX station's operating habits, being a little different from the crowd and thoroughly knowing and using the various capabilities of your station will go a long way toward helping you become a more effective DXer. Certainly they are not a formula that you can magically mix to work everyone all the time because persistence and the occasional luck still play a large part in our daily operating successes. But combine them with persistence and practice and you will be as excited and thrilled as the rest of us little pistols and popguns when we snag the rare one in a crowded field.

I would like to thank the 5M2TT crew, particularly Angelo who manned the key on the other end of my contact and maintained discipline in the pileup, which gave this little pistol a chance to work him.

Robert Logan, NZ5A, an ARRL member, was first licensed in 1962 and currently holds an Amateur Extra class license. In 2010 he retired from the City of Austin where he worked as a contract management manager for the local electric utility.

Robert's ham radio interests include homebrewing, restoring vintage radios, low power contesting and building HF wire antennas. He has also written several articles about Amateur Radio history, antenna construction, contest operating and DXing. He is currently enjoying retirement with his spouse, their three children and three grandchildren. You can reach Robert at 8712 Lone Tree Dr, Manor, TX 78653, **bob.logan47@yahoo.com**.

Vintage Low Power Radios

Turn out the lights and enjoy operating QRP with a glow-in-the-dark radio.

Ralph E. Taggart, WB8DQT

This is the author's version of the Don Mix, W1TS, transmitter from the October 1968 issue of *QST*. The shorter tube to the right of the transmit crystal is the 6C4 oscillator. The 5763 final is partially obscured by the plug-in tank coil, the only significant deviation from the original circuit.

Mention low power (QRP) Amateur Radio and most operators will immediately visualize a miniaturized solid-state transceiver optimized for portable operation. While such equipment is a significant part of the current QRP scene, there are a whole range of options for "low-impact" Amateur Radio.

At the one end of the continuum there are the *Minimalists*. The equivalent of medieval monks, they are never sure they are having fun unless everything hurts. They build whole transceivers into Altoids tins or tuna cans and pride themselves on how few parts they use. Given the chance, they will MacGyver transistors out of beach sand and fabricate capacitors from gum wrappers. Likely as not, they will be found on mountain ledges (the higher and colder the better), with thermoelectric generators stuffed under their armpits, working the world while loading the shortest pieces of wire they can lay their hands on. These folks accomplish great things with admirable simplicity, but it's a hard life!

In contrast, at my end of the spectrum are the *Strict Constructionists*. As far as we are concerned, QRP is about low power and nothing else. As long as you stay at or below 5 W, anything else, including full sized transceivers, good antennas, central heat and comfortable chairs are all just fine.

While I may feel a slight twinge of guilt while comfortably working a fellow QRP ham operating from a tent or one of those mountain ledges, I really do appreciate my wide range of equipment options — and that includes classic vacuum tube equipment. It is not generally appreciated that low power transmitters significantly predate the current QRP operating style as a category of operation. In the post-WWII era they were known as low power or beginner gear. Any one of the classic vintage transmitters of that era provides the opportunity to explore a whole new dimension of QRP operation.

In Search of a Vintage Low Power Project

For 24 hours following the start of the New Year (0000Z), CW operators around the world participate in the ARRL's Straight

MARTIN HUYETT, KØBXB

Martin, KØBXB, does like to build transmitters. This is his copy of the W1TS transmitter, which is quite compact since he used an external power supply.

ROBERT BUECKER, N9HAL

Bob, N9HAL, built this fine replica of a '50s 6AQ7 single-tube transmitter. This transmitter keys impeccably with vintage crystals but such designs, including more modern versions using the 6CL6 pentode, tend to have significant "chirp" when using modern crystals.

Key Night (SKN), a celebration of the art of hand-keyed Morse. In addition to the use of keys from times gone by, more and more classic and vintage gear is put on the air as part of the rampant nostalgia of this yearly celebration. I'm certainly not immune and for the past year or so I have been thinking about hooking my Swedish Pump straight key to something with vacuum tubes instead of transistors. Given that I operate QRP the remaining 364 days of the year, I naturally started looking for a project that would be compatible with my power preferences.

If you are going to start such a quest, your first port of call should be the ARRL website (**www.arrl.org**). One of the most valuable benefits of ARRL membership is access to the periodicals search archive — a search engine for the contents of *QST* from 1915 up to the present, with all but the most recent articles available for PDF download. Still another Internet option is to search for GLOWBUGS and check out the many sites that will result. Glowbug is a generic term for simple (often one or two stage), tube type transmitters. While projects on the innumerable glowbug pages are often good options, the *QST* PDF downloads have the advantage of vetting by the ARRL Lab and typically contain a great deal of detailed construction and alignment information.

No matter what your initial list of potential projects contains, there are a number of factors to consider in making your final choice:

■ *The Era*. I suggest a postwar project with a preference for 1955 onward. Parts for older projects can certainly be obtained (even antique tubes), but the project will cost a lot more and there may be problems with meeting the current regulatory standards.

■ *Basic Configuration*. The most common entry-level transmitter back in the day had an integral power supply, operated CW on one or two bands (usually 80 and/or 40 meters) and was crystal-controlled to maximize stability and conform to the FCC Novice requirements of the time. Transmitter power was defined in terms of input power (easy to measure) as opposed to today, where everything, including the regulations, specifies output power. For most of these vintage transmitters, you can assume that the transmitter output power will be approximately half (or a bit less) of the expected input. While some of the transmitters aimed for the 75 W (input) Novice power limit, there were plenty of 10-15 W projects that are ideal for low power operating.

■ *Design Architecture*. Given the incentive to come up with simple and economical transmitters, the design of single-stage, one-tube transmitters was a bit of a cottage industry in those days, even spreading to a few entry level commercial transmitters. In effect, such designs represent a keyed power oscillator connected directly to the antenna. The problem is that oscillator stability — needed to avoid "chirp" (audio frequency shifts in the beat note or received tone during keying) — is rarely compatible with providing significant power into the changing load represented by the antenna. I have worked some high quality keyed oscillators, but most of them were operating at the 1-2 W output level.

The problem is typically the crystals used. Vintage FT-243 crystals are pretty robust, but modern crystals are more delicate and will overheat in most vintage circuits due to excessive crystal current. The result is drift and chirp that is difficult to cure in a single-stage transmitter if you want even 4-5 W of output. For our purposes, the most conservative design is a two-stage transmitter with one stage serving as the oscillator while the second stage functions as a power amplifier (also known as a MOPA or Master Oscillator Power Amplifier layout). This usually means that the design will use two tubes, although some "single-tube" designs use a tube that has two separate sections within a single tube envelope, such as the 6SC7, which contains two separate triodes in one glass envelope.

■ *Safety*. Transmitters in the QRP class will typically use plate voltages in the 200-300 V range. Such voltages can be lethal, so both transmitters and power supplies should be constructed so that it is impossible to come into contact with high-voltage wiring when the unit is powered up. There are several old "budget" transmitters that don't meet such a basic standard. Before beginning any project that employs high voltage, make sure to review the "High Voltage Techniques" section of the "Power Supplies" chapter of the *Handbook*. Also remember, when reviewing potential projects, that the use of an isolation or power transformer with a fused primary should be a basic requirement.

Another voltage issue is that most of these vintage transmitters used either cathode or grid-block keying, resulting in the presence of high voltage on the cable to the external key. Keys must be wired so that all (or most) of the exposed metal parts are at ground potential when the key is open. Classic keys are designed to facilitate this. If you want to use a keyer, make sure it can handle the high voltage and current. When in doubt, arrange for the key or keyer to control a low voltage relay to handle the actual keying.

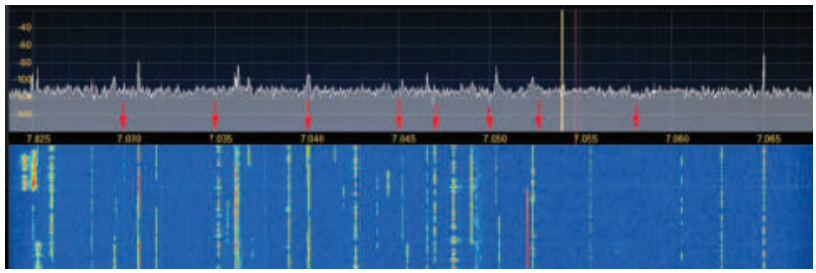
In conjunction with this article there is a list of articles for tube transmitter projects that fit these selection criteria. This list can be found at the QST-in-Depth website.[1] I picked the Don Mix, W1TS, two-tube transmitter from the October 1968 issue of *QST*.[2]

When you start to delve into vintage gear, you often come away with priceless bits of Amateur Radio history as a bonus. Don Mix was such a treasure — a personal history that reads like an "Indiana Jones" of wireless, one of the premier DXers of his era, a long-time member of the ARRL Headquarters staff and the author of over 100 *QST* articles. This was his last construction article prior to his passing in 1973 and I consider it one of the finest articles of its type that I have had the pleasure to read. Obviously build-

[1]Notes appear on page 69.

CHARLES MORRISON, KG4HSY

While most vintage projects are obviously scratch-built, there is at least one current kit on the market. This rig, the AC-1 (www.glowbugkits.com), puts out a 1 W signal and, as a result of the low power, keys beautifully with vintage or modern crystals.



This is the panafall display provided by the FLEX 1500 SDR transceiver showing a segment of the 40 meter band from approximately 7.025-7.065 MHz. The red arrows above the frequency calibration bar show the frequencies of the crystals I had available. When the band is busy it can be a trial to find a crystal that will work, especially when you are running very low power. This type of display nicely highlights any gaps in activity as well as showing activity over time.

ing a vintage transmitter with some history attached can be more than just a simple construction project.

Vintage Construction and Checkout

I have listed a number of parts sources and, using the resources of the Internet, you could probably find others as well, including hamfests and the option to root through the junk boxes of other amateurs. Don't be afraid to improvise — you want the project to look like the era from which it came, but it will be a working rig and not a museum replica. I used a slightly larger chassis and substituted a plug-in coil for the final in place of the fixed air-wound coil in the original article. Receiving variable capacitors were used for both the TUNE and LOADING controls with additional fixed capacitors used across the latter to optimize power output.

Actual construction and checkout will be an easy stroll down memory lane if you have done this sort of thing before. If this is your first project of this sort, there is much that will be new but very interesting. To ease the transition, I have prepared a PDF file that goes over many of the details of transmitter construction. Much of the information should be helpful to those working on comparable projects. Topics include parts acquisition, the mechanical aspects of construction, a bit of theory and a structured check-out procedure that emphasizes safety.

The package also contains information on how to wind final tank coils when you cannot or don't want to duplicate the one in the original project and another on how to get good keying and low power output when using modern crystals in vintage designs. As with the project list and references, the W1TS Project Manual file can be downloaded from the QST-in-Depth website.[3]

Expectations

Transmitters in this power class were designed to attract new amateurs and performance expectations were quite modest. A couple of hundred miles with a good antenna was a common description of what might be expected with most of these designs, but you have to remember that these conservative projections were made in the context of the receivers in use at the time.

Four to 5 W from a vintage design (restored or copied) is precisely equivalent to the same power from any modern QRP rig. In short, a vintage transmitter should perform as well as any piece of low power gear, since radio waves have no preference as to what kind of a device produced them. Depending upon the power transformer you select, Don's design will run at 1.5 W out with 175 V on the plates up to around 5 W at 275 V.

In 2 weeks of casual operating on 40 meters leading up to SKN 2011, I put 19 states into the log and the total is now about 40, including several that bested the 1000 miles per watt threshold. Because the transmitter is crystal-controlled, most of those contacts represented answers to my CQs. Strictly as a matter of convenience, I opted to use my Flex 1500 QRP SDR transceiver as the receiver for this grand experiment. What I had not realized is how valuable the Flex radio's panafall display (combining a waterfall and panadapter display) would prove in simplifying crystal selection. I simply look at the band segment of interest and pick a crystal that fits into a gap in the activity.

I built the transmitter as much for the novelty as anything else, but it has proved to be great fun to operate and I have yet to put it back on the shelf. The original Novice licenses lasted for a single year with no opportunity for renewal. My states-worked tally wasn't all that impressive in my Novice year and I suspect I have already surpassed my early efforts.

I'm quite sure Don, W1TS, would be very pleased to see his little "beginner" transmitter elevated from "a few hundred miles" to serious QRP operation. I have lots of other solid-state QRP gear if I'm doing western field work or digging dinosaurs on the North Slope of Alaska, but I've slowed down a little in recent years and this winter is shaping up as a great opportunity to enjoy the mellow glow of a nice set of vacuum tubes. You might want to consider a similar project — it is guaranteed to generate comments at the other end of your contact.

Notes

[1]**www.arrl.org/qst-in-depth**

[2]D. Mix, W1TS, "A Simple Transmitter For The Beginner," *QST*, Oct, 1968, pp 22-28. A two tube, two-stage design with a power input of 10-12 W. Although designed for 40 and 80 meters, changes to accommodate 20 or 30 meters are easily implemented.

[3]See Note 1.

Ralph E. Taggart, WB8DQT, an ARRL member, was first licensed as a Novice operator in 1958 and currently holds an Advanced class license. He received a BA in Biology from Rutgers University in 1963 and began a long-t erm involvement with Amateur TV. He has authored numerous major articles for QST, Ham Radio *and* 73 *magazines. Ralph also served as an ARRL technical advisor in the area of Image Communications and authored two ARRL books,* Weather Satellite Handbook *and* Image Communications Handbook. *Ralph and his spouse, Alison, live in Mason, Michigan where they raised their three daughters. For many decades he has operated multimode low power on the HF bands and currently spends most of his time operating CW on 30 and 40 meters when not sailing, fishing, doing astronomical imaging or entertaining his two granddaughters. He can be reached at 602 S Jefferson St, Mason, MI 48854,* **wb8dqt@arrl.net**.

Feedback

◊ In "Build Your Own DSP Speaker" [Nov 2011, pp 31-34] in Figure 1, the anode of D4 should connect to J5-3 instead of J5-1. In addition, there have been some problems with obsolete parts, especially the audio amplifier IC. The author has addressed all that he is aware of on his website at **www.kg4jjh.com/dspspeaker.html**.

◊ In "A Four Tone SSB Generator" [Nov 2011, pp 38-41] in Figure 2 and its caption, S2 should be identified as S3.

◊ In "2012 Kids Day Announcement" [Dec 2011, p 91] the date is listed as January 7. The correct date is Sunday, January 8.

◊ In "How About an HF Beam Under Your Holiday Tree" [Dec 2011, pp 61-62] the Spiderbeam Yagi shown in Figure 3 is incorrectly described as a two element Yagi. It actually has three full sized elements on each band. A Product Review of this antenna is in the July 2005 issue of *QST*.

High Tide on Tarawa

A South Pacific DXpedition battles booming bands and swamped antennas to put Tarawa on the air.

Bill Vanderheide, N7OU

Kiribati is located just north of the equator in the Pacific ocean.

With five DXpeditions to the South Pacific under our belts, Bob Norin, W7YAQ, and I had to think a little harder about where to go next. After our rough voyage to Tokelau in 2010, with sleeping arrangements on deck that gave me a chronic pain in the neck, this time we were looking for an easy fly-in. For our operation in February 2011, we decided on Tarawa, Western Kiribati, which has flights aboard a 737 twice a week from Fiji.

The island nation of Kiribati (pronounced *Kiribas*) straddles the equator for 2400 miles. This was actually our second visit — in 2008 we operated from Eastern Kiribati, also known as Christmas Island. Tarawa, Kiribati's capital island, is about 1800 miles southwest of Hawaii and about 1000 miles northwest of Fiji. It is the most populous of the islands with 41,000 people. An atoll, Tarawa consists of narrow islets connected by causeways and surrounding a triangular lagoon about 6 to 10 miles across. The westernmost islet, Betio, was the site of the Battle of Tarawa during WWII.

We made all our travel arrangements online. Even our Kiribati licenses, T3ØYA for Bob and T3ØOU for me, were sent to us as PDF files. By e-mail Tom Meier, K7ZZ, and Gerben Menting, PG5M, pointed us toward the Otintaai Hotel, where they had operated in 2004 and 2009, respectively, and advised us on specific rooms. Jati Maunana, in charge of reservations, assured us that the hotel welcomed ham radio operators and our antennas wouldn't be a problem.

Butternuts on the Beach

When we arrived at Bonriki Airport on Tarawa, Jati was there to greet us and transport us to the hotel. We could tell right away that the hotel's grounds at the edge of the north-facing lagoon would be perfect for our vertical antennas. We had brought two Butternut HF9V verticals and a Cushcraft MA160V for the Top Band.

Gerben suggested that it might be possible to set up our verticals in the shallow water of the lagoon itself. Before the trip I ran this idea past Rudy Severns, N6LF, an authority on ground systems for verticals. In a long e-mail that later became the basis for an article on his website, Rudy pointed out that radials aren't effective when submerged more than a few inches in saltwater. For a multiband vertical you could elevate tuned radials above the water, but for nine bands that sounded like too much trouble. Rudy's advice was to put our verticals on shore at the high tide line and fan out a semicircle of about 32 radials behind them. This was what Bob and I had done in the past with good results.

We decided to set up one of the HF9Vs in an open area alongside a dance pavilion (see Figure 1). We put the other two verticals on a coral ledge that was next to the hotel, near some housing for the hotel staff. All the antennas were within a meter of the sea and had their radial systems spread out behind them.

Transmitting from Tarawa

With the antennas up and tuned, we quickly settled into a daily routine on the radio. Most of our contacts were on CW, with Bob making a small percentage on RTTY. For the first week, in order to minimize dupes, we divided up the most active bands: Bob handled 30 and 20 meters, while I took care of 40 and 17 meters. The hours just before and after sunrise and sunset were the best times for Europe.

At night, on the low bands, signals from North and South America would peak as the grayline moved west. In these late hours we also had excellent openings to Europe on 80 meters. With a solar flux index that went over 100 during our trip, 15 and 12 meters provided action during the day, although 10 meters was usually disappointing. Being just a skip away, Japan was always loud.

During our second weekend we participated in the ARRL DX CW Contest, signing T3ØYA. We took turns in 3 hour shifts, except for a double shift one of the nights so each of us got 6 continuous hours of sleep. Seventy-five percent of our 2864 contacts were on 40 or 15 meters, with 20 meters being dead much of the time. We were happy with our third place finish in the DX multisingle low power category and for first place in Oceania.

Murphy Arrives with a Beat and the Tide

We had two air-conditioned rooms, one for our shack (see Figure 2) and the other for

Figure 1 — HF9V vertical near the dance pavilion, with a view across the lagoon to the north.

Figure 2 — Our two operating positions in the shack.

sleeping. So we wouldn't have to interrupt our European runs in the evening, we had our main meal around noon in the hotel restaurant. The food was good but there wasn't much variety. Each day we got to choose between grilled fish, curried fish or fish chop suey.

Murphy can take many forms on a DXpedition. On two evenings, beginning about 8 PM, music from trunk-sized speakers began booming out of the dance pavilion. Party goers in Kiribati like their music *loud* — think of a jet engine. Complaining to the management got us nowhere. One night we tried putting mattresses against a wall to dampen the noise, but when that didn't work we just had to take a break and wait it out. After a while we got to liking the catchy rhythms and even looked around town for a CD to take home.

Because of a very high tide, two of our antennas ended up in the lagoon anyway. When we set up our antennas on the coral ledge, it appeared to be an area that stayed high and dry. But when the lagoon rose a little higher with the tide each day, we were forced to raise the bases of the verticals with concrete blocks. Eventually at high tide our antennas were surrounded by a foot of water. We held our breath as a boat steered around our guy lines when it came in to deliver fish

On the first day of operation my K3 transceiver failed and would only put out 12 W. Bob let out a groan because this was the same problem he had had when we were on Tuvalu 2 years before. Corroded pins in the PA circuit were to blame. Fortunately, I had my K2/100 along as backup and the little rig performed perfectly for the rest of our stay.

Away from the radios in the middle of the day, when the bands were at their poorest, Bob and I walked in the equatorial heat, running errands, checking e-mail and getting some exercise after so many hours in the chair. Most people on Tarawa live in crowded villages along the one main road. They don't have a lot. Many dwellings are patched together out of plywood, mats and rice sacks, with a roof of thatch or corrugated tin. People often greeted me with a friendly "Howdy" and the braver children used me for practicing their English.

Time for Touring

Tarawa will always be identified with its WWII battle. In November 1943, Americans launched an amphibious assault on the heavily fortified islet of Betio. A high tide was supposed to carry most of the landing craft over a reef 800 yards out. When the tide came in lower than expected, the Marines were forced to wade ashore under the withering fire of 4500 Japanese defenders. After 4 days of combat, an American victory came at the cost of 1700 dead. The Japanese, for their part, refused to surrender and, except for a mere 17 survivors, perished in their bunkers.

We hired a local guide, Molly Brown, to give us a tour of the battlefield. Not much is left in the way of relics — old shells, a wrecked plane, concrete gun mounts — but it's still possible to find bullet casings in the shallow water. The object of the battle, an airfield, now has one of the highest population densities in the Pacific. Each year on the battle's anniversary the local people hold a memorial service on Red Beach 2, the site of some of the fiercest fighting. At low tide a rusting Sherman tank appears just offshore as a monument and reminder.

Goodbye to Paradise

At the end of our 12 day operation we had a total of 22,826 contacts in the log. Ninety-five percent of them were on CW, with Bob making the rest on RTTY. Not counting the ARRL DX CW contest, 27% of our contacts went to Europe, 32% to North America and 39% to those nearby stations in Asia. Of all our operations Tarawa gave us our highest rates per day. Maybe the high tide had something to do with it. Here is a breakdown of our contacts:

Band	*Contacts*
160	647
80	1687
40	4887
30	3386
20	2460
17	3533
15	4415
12	1210
10	601

On departure we filled out a visitor satisfaction survey. We thought they needed to clean up their polluted beaches and lagoon, but gave them high marks for being welcoming and friendly. We liked their slogan too. "Kiribati — for travelers, not tourists."

Photos courtesy of Bill Vanderheide, N7OU, and Bob Norin, W7YAQ.

Bill Vanderheide, N7OU, has been licensed for over 50 years. His main ham radio interests are portable operation, DXpeditioning, CW and contesting. Over the last 6 years he has been a frequent visitor to the South Pacific, both as a volunteer schoolteacher and as a DXpeditioner. He is a member of the ARRL and the Willamette Valley DX Club and is a sorter for the seventh area ARRL DX QSL Bureau. Bill can be reached at 333 NW 9th Ave, Unit 913, Portland, OR 97209, **n7ou@arrl.net**.

Sorry, Old Man, You're Not In the Log

Effective use of the ITU and DX phonetic alphabets can keep you from being lost in the log.

Steve Sant Andrea, AG1YK

For a lot of years now we have all been dealing with a broad array of bad band conditions. Getting our message across to the ham at the other end of the antenna has been a difficult job. Whether we are talking about getting into the log of a rare DXpedition, scoring contest points or moving traffic on an NTS net, making ourselves understood accurately under less than "fair" band conditions is important.

This situation has been around since hams started using AM. As voice communications became more prevalent it quickly became obvious that words sent bouncing through the ionosphere often arrived the worse for the wear.

Even when talking on FM, where copy is usually much better than on the AM modes, indistinct speech, regional or international accents and even hearing disabilities can impact the contact.

Talking With Words

As voice communication became more common, commercial, ham and military radio operators soon developed methods for spelling out message words using other words to represent the individual letters. The theory behind this is that a whole word is easier to understand than a single letter sound. This evolved into what we now call a phonetic alphabet (PA).

As time passed many different PAs developed. In 1954 the ARRL published Operating Aid #1 with the Able-Baker-Charlie PA, which was a carryover from the military. The Amsterdam-Baltimore-Casablanca PA (now known as the DX PA) developed under the theory that a longer word is more easily understood under adverse conditions. (In 1946 the FCC prohibited the use of country, state or city names as phonetics in the belief that the phonetic would be mistaken for the station's location. This ruling met with significant opposition and was withdrawn later that year.) Eventually many different PAs came into use.

Soon it became clear that a standard was needed. Today, in ham radio the standard PA is the International Telecommunication Union (ITU) Phonetic Alphabet. The result of an international agreement, it has been adopted by NATO and the International Civil Aviation Organization. All hams, everywhere, should be familiar with it as a first step toward clear communication. It is a good idea to make a copy and post it in your shack near your operating position. When you are trying to get your call or other contact information across to a receiving station under adverse conditions, your first attempt should be with the ITU PA.

ITU Recommended Phonetics

A — Alfa (**AL** FAH)
B — Bravo (**BRAH** VOH)
C — Charlie (**CHAR** LEE
D — Delta (**DELL** TAH)
E — Echo (**ECK** OH)
F — Foxtrot (**FOKS** TROT)
G — Golf (GOLF)
H — Hotel (HOH **TELL**)
I — India (**IN** DEE AH)
J — Juliet (**JEW** LEE ETT)
K — Kilo (**KEY** LOH)
L — Lima (**LEE** MAH)
M — Mike (MIKE)
N — November (NO **VEM** BER)
O — Oscar (**OSS** CAH)
P — Papa (PAH **PAH**)
Q — Quebec (KEH **BECK**)
R — Romeo (**ROW** ME OH)
S — Sierra (SEE **AIR** RAH)
T — Tango (**TANG** GO)
U — Uniform (**YOU** NEE FORM
V — Victor (**VIK** TAH)
W — Whiskey (**WISS** KEY)
X — X-Ray (**ECKS** RAY)
Y — Yankee (**YANG** KEY)
Z — Zulu (**ZOO** LOO)

No Perfect Solutions

Now this isn't to say that the ITU PA is all perfect. There has been much discussion over the years about its shortcomings. As mentioned above one school of thought is that a PA should be made up of longer words that can't be easily confused. In the ITU PA, Alfa, India, Lima, Oscar, Papa and Sierra all have similar sounds. Under poor or noisy conditions these phonetics may be confusing to the receiving station.

For this reason, many DX stations employ the previously mentioned "DX Phonetic Alphabet." This PA uses country and city names to represent each letter, such as America or Amsterdam for A; Boston, Baltimore or Brazil for B; Canada, Colombia or Chile for C. This PA uses longer, more distinct words, and has more than one word for each letter. This is a more flexible list and allows for the use of several different phonetic words if the first one is not understood. A complete list of the DX PA can be found at **ac6v.com/dxphonetics.htm**. Also, you should be aware that since the Spanish language and its variants are so common a Spanish PA has also developed.[1]

Flexible Phrasing

The bottom line is that if the information you are trying to convey is important and you have any question that it might not be correctly understood, use a PA.

"Okay," you say "but which PA"?

If you are trying to get in the log of a DXpedition or a contest station, start by using the PA that the sending station is using (you are listening first, aren't you?). If the other operator hasn't used any phonetics, start with the ITU PA. If the other operator is having problems understanding the ITU PA, the next step would be to try the DX PA and rotate through the various words as needed until you are sure you have been understood.

Be flexible. PAs are a tool. In any specific situation you may have to find the right one to fit. It is also important to use one of the recognized PAs, one that most operators will be familiar with. Using a "roll-your-own" PA is not a good idea for serious communications, as what might seem to be a clever phonetic word to you might be completely lost or grossly misunderstood by the receiving operator. Keep copies of the most common PAs near your microphone to improve your odds of getting in that important log.

Steve Sant Andrea, AG1YK, is an assistant editor at QST. He can be reached at **ag1yk@arrl.org**.

[1]M. Wilson, K1RO, Ed., *The ARRL Operating Manual* (Newington, CT: 2007), p 13-22. Available from your ARRL dealer, or from the ARRL Store, ARRL order no. 1093. Tele-phone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Building a Dream Novice Station

Kim Johnson, KCØJQH

A project designed to relive ham radio's happy days.

My call sign in the wood and the radio panel lettering were laser engraved. The radio panels are 0.020 inch thick black anodized aluminum sheet attached to a thicker aluminum backing panel with very thin carpet tape. Tom Nickel, KC9KEP, was my inspiration for this idea.

The late 50s was a wonderful time in my life. I was a kid living in a brand new neighborhood on the northern edge of Cedar Rapids, Iowa, within walking distance of Collins Radio. My family was one of the first on the block to have a television set and I remember my parents putting up theater seating in the living room so the neighbors could come over and experience this modern marvel. This was also a time when an 8 year old kid could hop a bus, alone, and go downtown to the hobby shop to buy a model airplane kit or to a dime store to buy a new baseball glove.

Many of the dads in our community were employees of Collins Radio and several of them were also Amateur Radio operators. My best friend was the son of a Collins ham. I quickly became interested in electronics and gradually Amateur Radio. I was well on my way to becoming a serious electronics hobbyist (during those years I had built several crystal radios, a one tube regenerative shortwave set and various other projects).

I remember my well worn Burstein-Applebee catalog that I must have gone through a thousand times. Back then it took 2 weeks to get mail orders and the wait and anticipation was excruciating. I also remember pictures in an ARRL *Handbook* of radio projects with their exotic looking coils and variable capacitors. Unfortunately, earning a Novice license was not in the cards for me at that time. My allowance was 50 cents per week and the idea of learning the code, passing a test and assembling a Novice station was a bit more than I was capable of.

At age 13, my family moved to Des Moines. My drive to become a Novice became sidetracked by a sudden interest in girls (no luck there) and rock and roll. But I never abandoned my passion for electronics and interest in ham radio. In 2001, I finally earned my General class license and began my romance with CW. In December of 2010, I earned my Amateur Extra class license while simultaneously working on this Novice station project.

There are a couple of reasons why I undertook this project. Nostalgia was, of course, a significant part of it. I just felt compelled to experience some of what I missed when I was 10 years old living in Cedar Rapids — the "Novice Experience." I guess you could say I'm reliving my childhood and I cannot deny that. Also, at the same time I was living in Cedar Rapids I developed a love for woodworking. My dad had assembled a woodworking shop thanks to which I have been a lifelong woodworker, both casually and professionally. This project gave me the perfect opportunity to combine two of the hobbies I truly love.

Station Details

I wanted to design a desk that looked period but still had some of my own originality. The desk is made from hard maple, which is not too difficult to work with as long as your tools are very sharp. The thick parts are made up of two ¾ inch thick pieces face-glued together. This makes it easier to select better wood, and the finished parts are stronger and less prone to warp. Most importantly, this also makes it a breeze to cut the mortises in the bottom and top rails of the side panels.

The base side panels are made from ¾ inch boards beveled on all side corners, grooved in the edges and glued together with wood splines. The desk top is butcher block (1½ × 36 × 48 inches) from Old World Butcher Block Furniture, Inc. The top shelf is not attached so an operator can move it to his/her optimum arm length. This desk would work well for a modern station but the shelf depth and height would need to be increased to accommodate a modern rig and a *QST* or two. A detailed drawing can be found on the QST-in-Depth website.[1]

The transmitter is the "Three-Band Oscillator Transmitter for the Novice" taken from plans in a 1963 ARRL *Handbook*.[2] It has three tubes, one of which is a voltage regulator that minimizes the frequency shift of the oscillator when keying. The input power of the transmitter is approximately 30 W. The straight key is a J-38 purchased on eBay.

The receiver is the improved "The 'SimpleX Super Mark II' Three-Tube Receiver."[3] As it turns out, it is worthy of its name. It's a great performer with a super sounding vacuum tube audio amplifier.

The RF voltmeter was built from plans in a 1963 ARRL *Handbook*. This is used to "show when a transmitter is adjusted for optimum output."[4]

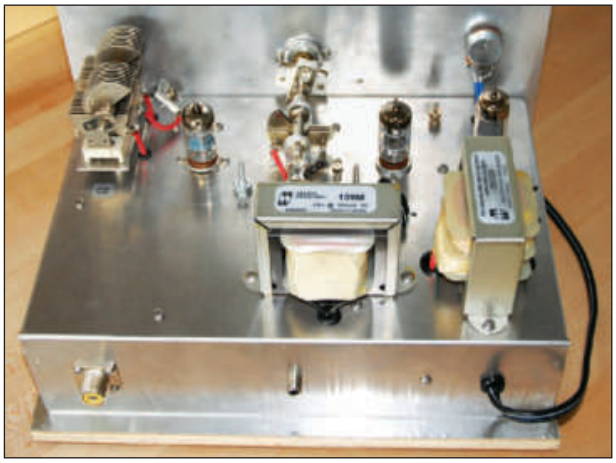
The speaker was homebrewed from an 8 inch driver taken from my 1966 high school graduation present, a GE portable stereo. The case is made from wood and medium-density fiberboard epoxy coated and sprayed with Rust-Oleum textured paint.

The vintage lamp was donated by my mother. It was sandblasted and sprayed with Hammered tone Rust-Oleum paint. The vintage clock is an insert from Woodcraft and the chair was purchased from School Outfitters.

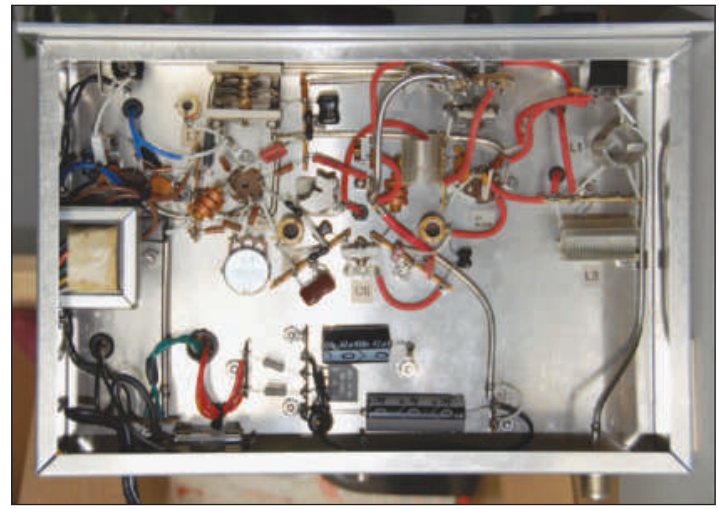
Vintage Reference Library

This was the most important and interesting part of the project. It was the source of the construction articles for most of the

[1]Notes appear on page 74.



The back of the "SimpleX Super Mark II" receiver. This radio needed careful shielding (not shown), especially on the bottom. It has an intermediate frequency of 1700 kHz, which is the frequency of a 10,000 W AM broadcast station within 20 miles from my shack. Without the shielding it is a great single station AM broadcast band receiver.



The bottom of the "SimpleX Super Mark II" receiver. I have done surface mount, Manhattan style and every other kind of construction but I enjoy point-to-point the most. The secret of a good job is to carefully plan ahead and then take your time.

station components. My vintage library consists of 1958 and 1963 ARRL *Handbooks*, three 1957-1958 *QST* magazines and the ARRL publication "How to Become a Radio Amateur." All were fascinating to read and contained useful information that is still relevant today. If you are interested in the roots of Amateur Radio and want to take a trip back in time, I highly recommend them.

Operation

As an initial checkout I scheduled two contacts, which went fairly well. Then the time came to call CQ. That did not go well. I did two sessions in 2 days and only made two contacts. I seemed to be getting out but the signals on my end were very weak. Then, after monitoring my transmitter, I confirmed that I had severe chirping at times. *Back to the bench.* The crystals I was using were HC-49s that I had mounted in FT-243 holders. My Elmer and I tested them and determined that they may be heating up — causing my poor tone. Back on the air with original FT-243s, my tone improved significantly but my receiver still seemed to be weak. After realigning the receiver, I was able to significantly increase the sensitivity. Things were looking up.

Credits

No doubt there were hams young and old who got through the Novice experience with little or no help from other hams. For me, it would have been a struggle at best. A lot of hams must have relied heavily on help from experienced operators — "Elmers." (They didn't call them Elmers in those days. From what I can tell, the term Elmer originated in 1971 in a *QST* article.)[5] I am fortunate to have two great Elmers, Jerry Hall, WØPWE, and Bob Stuhr, WØDJN. Jerry taught me the ham business and helped me troubleshoot the problems I encountered. Bob helped me with the vintage technology, supplied me with some critical hard-to-find parts from his vast collection and worked with me on my CW. Thanks to both of these guys. Their influence on me is enormous.

I need to mention one other person, Tom Nickel, KC9KEP, who had built both these rigs for himself. He and his great website (**www.bignick.net**) were very helpful in many ways. A big thanks to Tom.

Final Thoughts

Being older and wiser at 63 and with a little more money than my 50 cent weekly allowance, it was pretty easy to put together my version of a dream Novice station. But the real challenge of this project was operating it. I have been operating CW for less than 2 years and I am still not totally comfortable making contacts. My situation is probably similar to that of a budding Novice in the 1950s. Having to learn CW while operating vintage Novice gear is quite the challenge. This Novice business is tough and I truly admire all of you who got started this way!

Was all this work worth the effort? Absolutely! Will my "Dream Novice Station" become some kind of museum piece in my radio shack? Absolutely not! The fun factor has been huge and has exceeded all my expectations. My "Dream Novice Station" has become kind of a time machine back to my past when things were simpler, exciting and just plain fun — a place where I can go and imagine it is 1958.

Oh, by the way, that box on the top shelf with the big knob is my "Mystery Crystal Set." Buddy Holly is on the radio tonight and my parents are not too keen about me listening to that "rock and roll" — they don't know about my crystal radio.

A Little Novice History

In 1951, the FCC restructured the then existing A, B and C class licenses into five named license classes called Novice, Technician, General/ Conditional, Advanced and Amateur Extra. The Novice class, designed to be an entry level class, permitted CW operation on designated sections of the HF bands plus voice and CW on 145-147 MHz. Novice operation was limited to 75 W power. Obtaining a Novice license required passing a 5 WPM code proficiency test and a 20 question multiple-choice test.

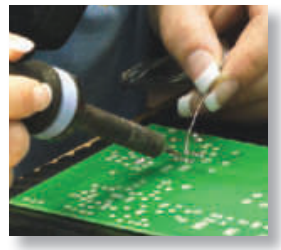
Notes

[1]**www.arrl.org/qst-in-depth**
[2]B. Goodman, W1DX, Ed., *The 1963 Radio Amateur's Handbook* (West Hartford, CT: 1963), pp 169-171.
[3]B. Goodman, pp 116-119.
[4]B. Goodman, pp 530-532.
[5]R. Newkirk, W9BRD, "How's DX?" *QST*, Mar 1971, pp 91-95.

All photos by Kim Johnson, KCØJQH.

Kim Johnson, KCØJQH, an ARRL member, has been licensed since 2001 and currently holds an Amateur Extra class license. His main operating interests are CW, homebrewing vintage radios and modern low power (QRP) rigs plus building and flying radio-controlled model airplanes on 6 meters. Kim is net moderator for the Midwest Modelnet, which meets on 3920 kHz, Sunday at 0830 CT to discuss all aspects of modeling. Kim can be reached at 10620 NE 64th St, Bondurant, IA 50035-1180, **kc0jqh@arrl.net**.

The DIY Magic of Amateur Radio



Let's bring other **Do It Yourselfers** *into the Amateur Radio tent.*

Allen Pitts, W1AGP

The Do It Yourself or "DIY" movement is nothing new to Amateur Radio. For just over a century, hams have been working in basements and attics, taking things apart and putting them back together in new ways for the fun of it. The enjoyment of seeing your own creation work — or even if it fails — always surpasses being a mere user of corporate products. Today's hams continue to use technologies in new and creative ways that can become the consumer products of tomorrow and, in the meantime, they have *fun* doing it!

100 Years of DIYing

Hams were the original Makers and Hackers, using new, used and scavenged parts to make transmitters, receivers, and antennas capable of communicating with other hams anywhere on Earth, and beyond. In our hobby, communicating is the keyword. And, when computers came along, they fit right in to the ham's wide world. Using technical skills and imagination, hams put together advanced communication networks connected by radio waves instead of wires.

Meanwhile, there has been a growing population of Do It Yourself hobbyists who do not know about the opportunities of Amateur Radio. "Maker Faires" have popped up in several areas of the country, from New York to Los Angeles, and look suspiciously like ham radio conventions. *Make Magazine*, the maker community equivalent of *QST*, has grown. It claims to be "The first magazine devoted to DIY technology projects" and is a healthy quarterly publication with a paid circulation of 125,000. Their website gets 5.2 million monthly page views — that *is* a healthy following.

The DIY crowd is as diverse as hams. Many are into computer programming, using new computer chips and open-source electronics prototyping platforms like Arduino that are based on flexible, easy-to-use hardware and software. They are artists, designers, hobbyists, and people interested in creating interactive objects and applications. Other DIY people work with everything from wood and clothing to energy and chemistry projects. Robotics is a great favorite.

The growing DIY groups first rose above the many other contenders for special interest when we spotted the YouTube videos being made by Diana Eng, KC2UHB, a New York based fashion designer. She was combining her ham interests with her local maker group and we quickly recruited her for the ARRL Public Relations Committee. Through her, we learned a lot more about the community and its variations. It became clear that this was an area that had mutual interests and potential growth. We already had a major campaign focused on the technologies of Amateur Radio, so a minor tweaking of that WeDoThat-Radio campaign should do well as an introduction for the maker community.

Many DIY people are part of informal clubs. They meet to join forces in creating larger projects, show off what they have completed and share information — just like hams. And, like ham clubs, they are always in search of programs for club meetings. It was a simple deduction that a short video, targeted specifically at the Makers, would get viewers in club meetings and on YouTube. But the video needed to be different from anything we had done before. We needed to show Amateur Radio as a tool used in other projects and activities, not as an end in itself. We also needed to focus on interesting activities that could be done by a single person if needed.

The DIY Video Production Crew

Executive Producer: Allen Pitts, W1AGP
Producer: Bill Pasternak, WA6ITF
Director: Dave Bell, W6AQ
Writer: Henry R. Feinberg, K2SSQ
Principal Camera: Dave Booth, KC6WFS
Editor: Keith Glispie, WA6TFD

Video Brings it All to Life

With production money from the ARRL and supplemental funding from the ARRL Foundation, the proven team of Bill Pasternak, WA6ITF, and Dave Bell, W6AQ, were recruited to create the video. Dave and Bill agreed to work for free, charging only their direct expenses from the equipment, work and travel needed to cover such a broad topic. They recruited other volunteers and throughout 2011 went to many sites and shot over 65 hours of HD video. Other video clips were sent in by amateur and professional video volunteers.

But a video alone cannot accomplish the goal of linking the viewers with ham radio. They need something in their hand to take home that will bring them to our websites. So an auxiliary printed flier was crafted to go along with the video as a handout. In addition, we wanted to invite DIY people to speak with hams, so the "Ask me why I DIY with Ham Radio" buttons were made as a way to encourage non-hams to begin informal conversations about our hobby. It's easy to comment on an unusual button, even to a stranger in an elevator.

"What is Amateur Radio?"

So we also started a contest among Public Information Officers, asking them to send in the script of their own 30 second answer to the question, "What is Amateur Radio?" We believe every ham should be ready to give a good, creative and quick response to that question. PR people call it an "elevator speech." We made the best answers public on the website, **www.arrl.org/what-is-amateur-radio**.

The campaign was unveiled between Christmas and New Years — normally a dead time for media events, so it was a good time to get noticed. The video is available on DVD disks along with the printed handout from the ARRL's marketing department, or can be seen on the **WeDoThat-Radio.org** website and ARRL's own YouTube channel, **youtube.com/arrlhq**. High definition versions of the video are available for free download — but they are over 500 MB! The buttons will be made available to ARRL members for free at larger hamfests and conventions while supplies last.

2011 Elections: Delta Division Sees Leadership Change; Midwest, Atlantic Divisions Unchanged

On November 18, ballots were counted in the races for Director in the Atlantic, Delta and Midwest Divisions. This year, there were only three contested races for Director or Vice Director in the five Divisions holding elections. In the Delta Division, Vice Director David Norris, K5UZ, defeated Director Mickey Cox, K5MC, for the top slot in that Division. Bill Edgar, N3LLR, won re-election as the Director in the Atlantic Division. Cliff Ahrens, KØCA, was also re-elected in the Midwest Division. Terms for Directors and Vice Directors begin at noon on January 1, 2012 and run for three years.

The following incumbents ran unopposed and were earlier declared the winner of their elections by the League's Ethics and Elections Committee: Atlantic Division Vice Director Tom Abernethy, W3TOM; Dakota Division Director Greg Widin, KØGW, and Vice Director Kent Olson, KAØLDG; Great Lakes Division Director Jim Weaver, K8JE, and Midwest Division Vice Director Rod Blocksome, KØDAS. The rules state that if a candidate is running unopposed, he or she shall be declared the winner without balloting.

Atlantic Division

Atlantic Division Director Bill Edgar, N3LLR

Incumbent Atlantic Division Director Bill Edgar, N3LLR, of Bradford, Pennsylvania, faced two challengers for his position: John Mueller, K2BT, of Falconer, New York, and Philip Theis, K3TUF, of Ephrata, Pennsylvania. Edgar was declared the winner, with 1628 votes. Theis came in second with 1368 votes, and Mueller came in third with 755 votes. This will be Edgar's third term as Director. Before becoming Director in 2006, he served two terms as Vice Director.

Delta Division

Delta Division Director David Norris, K5UZ

Incumbent Director Mickey Cox, K5MC, of Monroe, Louisiana, faced incumbent Vice Director David Norris, K5UZ, in the election for Director. After all votes were tallied, Norris was declared the winner. He received 1313 votes to Cox's 1153. Both Norris and Cox just completed their first term; they were elected in 2008.

Midwest Division

Midwest Division Director Cliff Ahrens, KØCA

Current ARRL Midwest Division Director Cliff Ahrens, KØCA, of Hannibal, Missouri, faced Keith Kaiser, WAØTJT, of Kansas City, Missouri, in the race for Midwest Division Director. With 1276 votes, Ahrens was declared the winner; Kaiser received 802 votes. This will be Ahrens' first full term as Director. He was appointed Vice Director in 2006 after then-Midwest Division Vice Director Bruce Frahm, KØBJ, moved up to the Director position when Wade Walstrom, WØEJ, passed away. When Frahm was elected ARRL Second Vice President in 2010, Ahrens moved into the Director slot.

Vice Director Election Results

With Norris running for Director in the Delta Division, the Vice Director position was open. Tennessee Section Manager Glen Clayton, W4BDB, was the only person nominated for the position, and as such, was declared elected without balloting. In the Great Lakes Division, Vice Director Gary Johnston, KI4LA, decided not to seek re-election. As Michigan Section Manager Dale Williams, WA8EFK, was the only nominee for this position, he, too, was declared elected without balloting.

Delta Division Vice Director Glen Clayton, W4BDB

Great Lakes Vice Director Dale Williams, WA8EFK

"It is great to see such an interest on the part of members in this election," said ARRL New England Division Director Tom Frenaye, K1KI. "I would like to thank everyone for running and also thank the ARRL members in the Atlantic, Delta and Midwest Divisions who participated. The big turnout shows the high level of interest our members have in Amateur Radio and that they take the ARRL elections very seriously."

Along with Frenaye, Roanoke Division Director Dennis Bodson, W4PWF, and ARRL Chief Financial Officer Barry Shelley, N1VXY, served as election tellers; Frenaye and Bodson are members of the ARRL's Ethics and Elections Committee. Tiffany Williams from the accounting firm of J. H. Cohn LLP, served as the independent observer.

The next scheduled Division elections are next fall for the ARRL Central, Hudson, New England, Northwestern and Roanoke Divisions. In accordance with League's Bylaws, ballots will be counted on November 16, 2012.

S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

FCC TIGHTENS BPL INTERFERENCE RULES — BUT NOT BY ENOUGH

On October 24, 2011, the FCC released the *Second Report and Order* in its proceeding — now in its 9th year — to adopt rules for Access Broadband over Power Line (BPL) systems. The *Second Report and Order* is the final step in the Commission's effort to comply with the directives of the United States Court of Appeals for the District of Columbia Circuit, which in April 2008 ordered the FCC to correct errors it had committed in the course of adopting rules in 2004. The Court acted in response to a *Petition for Review* filed by the ARRL.

In July 2009, the FCC issued a *Request for Further Comment and Further Notice of Proposed Rule Making* in which it proposed slight modification of measurement standards for determining whether a BPL system is in compliance with the maximum allowable levels of radiated emissions. In response, the ARRL argued that coupled with a scientifically valid extrapolation factor for determining those levels, mandatory notching of the amateur bands to a level 35 dB below the general emission limit would reduce the likelihood of harmful interference to amateur stations to a level that would permit any remaining harmful interference to be remedied on a case-by-case basis. The ARRL noted that its request for mandatory notching simply reflected the best practices of the BPL industry.

In the *Second Report and Order*, the Commission decided not to adopt its own proposal and also declined to adopt the ARRL's request for mandatory notching. Instead, the Commission has increased the requirement for BPL systems to be able to notch frequency bands to at least 25 dB, an increase of 5 dB from the existing requirement of 20 dB. The Commission also made technical adjustments to its rules for determining the distance between a power line and a measurement antenna and for determining site-specific extrapolation factors.

"We were prepared to be disappointed, and we were," commented ARRL Chief Executive Officer David Sumner, K1ZZ, after reviewing the 76 page *Second Report and Order*. "The increase in notch depth is a step in the right direction, but the value of the change is greatly diminished by the notches not being mandatory. The FCC acknowledges that a compliant BPL system will increase the noise floor below 30 MHz at distances of up to 400 meters from a power line, but characterizes that as 'a relatively short distance.' How many amateur stations are located more than a quarter-mile from the nearest power line?"

More than 17 pages of the *Second Report and Order* are devoted to defending the Commission's choice of a 40 dB/decade extrapolation factor for measuring emissions at distances other than 30 meters from the power line. "It was particularly disappointing to read that '...ARRL asserts that there is only one scientifically correct and valid answer of an extrapolation factor of 20 dB...' Sumner said. "That is a gross mischaracterization of our position. Our argument was that the 40 dB/decade value chosen by the Commission was demonstrably inappropriate for BPL, which the FCC acknowledges does not behave as a point-source emitter. Lacking an unambiguous scientific basis for a single value that would be equally valid across the entire frequency range from 1.7 to 30 MHz, the Commission fell back on the single value that defies physics — while at the same time acknowledging that '...ARRL is correct with regard to the physics of this issue.'"

One FCC statement with which the ARRL is in strong agreement occurs toward the end of the extrapolation factor discussion: "Whether the extrapolation factor is 20 dB or 40 dB or somewhere in between is far less important than the fact that harmful interference must be corrected under any circumstances." Unfortunately, Sumner observed, the FCC's deeds do not back up these words: "The Commission notes that there are not many interference complaints about BPL systems that are currently in operation, but inaccurately attributes that to the adequacy of its rules. In fact, it is the marketplace failure of Access BPL — coupled with voluntary steps taken by the few system providers that are still in business — that is responsible for this fortunate result." The one interference complaint that the FCC acknowledges receiving was filed by the ARRL on December 29, 2010, and which the Commission says was "…submitted *recently* [emphasis added] and is under investigation at this time." "A well documented interference complaint languishing for months is a perfect illustration of why mandatory notching is needed," Sumner said.

The *Second Report and Order* states that "...the BPL system database shows that BPL systems are currently operating in 125 ZIP codes across the United States." In fact, once non-existent ZIP codes are eliminated, there are 200 ZIP codes listed in the BPL system database. The FCC offers no explanation for why it has discounted this figure to 125, but neither figure reflects reality. "The BPL system database is filled with listings for 'paper' systems that were never deployed, systems that have been taken out of service and systems that are at some planning stage or are only offering service to customers within a small pilot area," Sumner said. "The FCC's own report on the status of Internet access services as of December 31, 2010 shows no more than 6000 customers nationwide receiving service via 'power line and other' connections, and about half of those appear to be 'other.' There is no reasonable explanation for why the Commission cites a flawed industry source for data when it possesses better data itself.

"One of the most puzzling sections of the *Second Report and Order* is that devoted to a discussion of the noise floor," Sumner concluded. "The thrust of the Commission's argument is that while natural and manmade radio noise is extremely variable, there is no point in regulating BPL emissions down to a reasonable level because in some locations and at certain times, it will be obscured by other noise sources. Imagine if that sort of logic were applied to air and water pollution — and make no mistake, BPL emissions pollute an irreplaceable natural resource, the radio spectrum."

While a thorough technical analysis of the FCC's latest BPL document will take some time, Sumner predicted that the ARRL will file a *Petition for Reconsideration*. "While BPL has failed in the marketplace as a medium for delivering broadband connectivity to consumers, the technology is perceived to have some 'smart grid' applications," he said. "Now is the time to fix the rules, principally by mandatory notching, so that any new entrants will be competing on a level playing field with the existing BPL firms that have recognized the need for notching of the amateur bands."

PRESIDENT OBAMA NOMINATES TWO FOR FCC COMMISSIONER

President Barack Obama has nominated two new FCC Commissioners: Jessica Rosenworcel and Ajit Varadaraj Pai. Rosenworcel has been nominated to replace Commissioner Michael Copps, who retired in December 2011. President Obama selected Ajit Varadaraj Pai to fill the seat vacated by Meredith Attwell Baker, who left the FCC in June 2010. If Rosenworcel and Pai are confirmed by the Senate, the FCC would be at its full complement of five Commissioners.

The FCC has been down one commissioner since the departure of Baker and

Copps left the agency with only three commissioners: two Democrats and one Republican. Only three sitting Commissioners may be members of the same political party. At present, Chairman Julius Genachowski, Copps and Mignon Clyburn are Democrats. If confirmed, Pai will join Commissioner Robert McDowell as one of the two Republicans on the Commission.

Copps' Confidential Assistant Carolyn Conyers told the ARRL in November 2011 that Copps' term expired on June 30, 2010. "He is serving on what we call 'extended time,'" she explained. "He will leave office when Congress comes back from recess, whenever that may be, or when the nominee has completed her confirmation process, whichever comes first. But it is doubtful that Jessica's nomination process will be completed before the new year."

Copps has served as a Commissioner since May 2001. In January 2009, he took on the additional role of acting FCC Chairman, following the resignation of then-FCC Chairman Kevin J. Martin. Copps relinquished the chairmanship to Julius Genachowski after Genachowski was confirmed by the US Senate and sworn into office in June 2009.

In June 2011, Baker left the FCC to join Comcast as its Senior Vice President of Government Affairs, NBCUniversal. Baker was nominated by President Obama in June 2009 and sworn in five weeks later. She filled the unexpired term of fellow Republican and former FCC Chairman Kevin J. Martin, who resigned in January 2009; her term was to expire June 30, 2011.

"President Obama made two outstanding choices for the Commission and for the American people," Chairman Genachowski said in a statement. "Given their talent, leadership and expertise in our space, they would both play an invaluable role at the FCC."

Democrat Nominee Jessica Rosenworcel

Jessica Rosenworcel is the Senior Communications Counsel for the United States Senate Committee on Commerce, Science, and Transportation. Since 2009, she has worked for Senator Jay Rockefeller IV (D-WV). Before that, she worked in the office of Senator Daniel K. Inouye (D-HI).

Rosenworcel has a long history at the FCC. Before joining the Committee, she worked at the FCC from 1999-2007, serving as Legal Advisor, and then Senior Legal Advisor to Commissioner Copps, Legal Counsel to the Bureau Chief of the Wireline Competition Bureau and as an Attorney-Advisor in the Policy Division of the Common Carrier Bureau (which became the Wireline Competition Bureau in 2002). From 1997-1999, Rosenworcel was a communications associate at Drinker Biddle and Reath. She received a BA from Wesleyan University and a JD from New York University School of Law.

"I know first-hand what a gifted public servant Jessica Rosenworcel is because she worked in my office in a number of capacities, including Senior Legal Adviser," Copps said in a statement. "Her experiences here, combined with her current Congressional work, give her a perspective on telecom and media issues both wide and deep. Her dedication, intelligence and practical good judgment make her an ideal choice for Commissioner. As I look forward to completing my term here at the Commission, it is with great pride that I see a former colleague and member of my team nominated for this seat."

Republican Nominee Ajit Varadaraj Pai

Ajit Varadaraj Pai is currently a partner in the Litigation Department of Jenner & Block LLP. Immediately prior to joining Jenner & Block, Pai worked in the FCC's Office of the General Counsel, where he served as Deputy General Counsel, Associate General Counsel and Special Advisor to the General Counsel. Previously, he served as Chief Counsel to the US Senate Judiciary Committee's Subcommittee on the Constitution, Civil Rights and Property Rights, as well as Senior Counsel at the Office of Legal Policy at the US Department of Justice. Pai has also served as Deputy Chief Counsel to the US Senate Judiciary Committee's Subcommittee on Administrative Oversight and the Courts, and as Associate General Counsel at Verizon Communications Inc.

Pai began his career as a law clerk to Judge Martin L.C. Feldman of the US District Court for the Eastern District of Louisiana, and then as an Honors Program trial attorney in the Telecommunications Task Force at the US Department of Justice's Antitrust Division. He holds a BA from Harvard University and a JD from the University of Chicago.

"I have had the pleasure of working with Ajit Pai while he served in the Commission's Office of General Counsel," Copps said. "During that time, he provided valuable counsel on many of the complex matters coming before the Commission. Ajit's experience, both at the agency and on Capitol Hill, prepares him well for the many urgent telecom and media challenges confronting the Commission."

In Brief

● **Kirk Pickering, K4RO, Named 14th Editor of *NCJ***: Kirk Pickering, K4RO, of Pegram, Tennessee, has been named Editor of the *National Contest Journal* (*NCJ*). His appointment is effective with the January/February 2012 issue. Pickering takes over from Al Dewey, KØAD, of Plymouth, Minnesota, who has served as *NCJ* Editor since 2008. Pickering, who has been licensed since 1976, began writing the "Contesting 101" column in *NCJ* in 2008. "I've been chasing DX since 1986, and in 1994, I began entering contests. My current interests are mostly contesting and DXing. I tend to enjoy CW contesting the most, but I do RTTY and phone contests, too. I also like to tinker in the workshop and learn about how this magic medium of radio works." Dewey said that Pickering's "clear, easy-to-understand style has helped to make radiosport a little less intimidating for the new contester. Kirk and I had a long talk at Dayton this year and I am convinced that he is the person for the job." As *NCJ* Editor, Pickering will be responsible for soliciting and finding articles for each issue, determining content for each issue, pre-editing all submissions, writing an editorial, determining the content for each issue's cover, organizing and delivering content to ARRL Headquarters for each issue, managing the existing columnists and finding new ones when necessary, and proofreading each issue before it goes to print.

● **Former Midwest Division Vice Director C. Richard Dyas, WØJCP (SK)**: Former Midwest Division Vice Director C. Richard Dyas, WØJCP, of Oxford, Nebraska, passed away October 17. He was 90. Dyas — a Charter ARRL Life Member — was first elected Vice Director in 1975 and began his term on January 1, 1976. He resigned in 1985 to take care of his wife. In 1987, when then-ARRL Midwest Division Vice Director Richard Ridenour, KBØZL, resigned, then-ARRL President Larry Price, W4RA, appointed Dyas to serve Ridenour's unexpired term. Dyas was laid to rest on October 21 with military honors by Oxford American Legion Post 219 in conjunction with the US Army National Guard Military Honors Team.

RECORD NUMBER TAKE TECH EXAM AT CALIFORNIA UNIVERSITY

When 114 freshmen electrical engineering students at California Polytechnic State University in San Luis Obispo, California, gathered on November 4 to take their Technician exam, they made history. Not only was the session one of the largest exam sessions ever, it was the largest exam session sponsored by a college Amateur Radio club *and* the largest exam session ever held in San Luis Obispo County. After all the exams were graded, 96 of the 114 students were brand new licensed amateurs, joining the next generation of radio amateurs in the US.

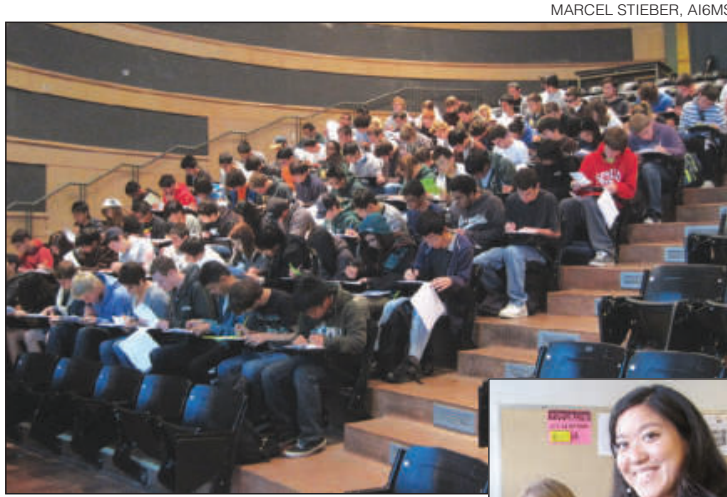
Hosted by the Cal Poly Amateur Radio Club (CPARC), this exam session broke its previous record of 62 new licensees, set earlier this year in October. CPARC members made special testing arrangements with the ARRL to accommodate this large group. These 96 new Amateur Radio operators will join more than 700,000 other hams in the US in providing volunteer and emergency communications support for everything from local bike rides and parades to global disaster relief.

Cal Poly Electrical Engineering Department Chair Dr Dennis Derickson, ACØP, conceived the Freshman Licensing Initiative, giving the 189 students in his Introduction to Electrical Engineering Course a chance to get their radio license. Eleven ARRL Volunteer Examiners administered the test session during the 50 minute class period; the Tech exam counted as one of the midterm exams for the class. The new licensees already had their call signs posted to the FCC website on November 7, thanks to the ARRL VEC office.

CPARC members hosted review sessions to help the students prepare to pass their exam and to get introductory knowledge on a wide variety of electrical engineering topics. Getting an Amateur Radio license is the first step toward many career opportunities in the communications industry, from engineering unmanned aerial vehicles (UAVs), integrating Wi-Fi technology for many wireless devices, creating 4G cell phone networks and designing communication subsystems on satellites. CPARC members are regularly learning about radios through retuning filters on radios and building directional antennas for transmitter hunts, as well as putting together an emergency vehicle tracking network for the Wildflower Triathlon, using two dozen radios and GPS units, digital repeaters and Internet gateways.

Founded in 1947, the Cal Poly Amateur Radio Club has a long tradition of communications service on campus and in the San Luis Obispo community. The club maintains Emergency Communications Station on the Cal Poly Campus for the San Luis Obispo Emergency Communications Council, which is equipped with emergency power and radio equipment to support various public safety agencies in the event of a disaster.

MARCEL STIEBER, AI6MS



Almost 120 freshmen electrical engineering students sat for the Technician exam; 96 students passed the test.

Students took the exam using Scantron sheets, which allowed for electronic — and fast — grading.

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Illinois, Indiana, Maine, Northern Florida, Oregon, Santa Clara Valley, Vermont and Wisconsin sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at **www.arrl.org/section-terms-nomination-information**. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Membership and Volunteer Programs Manager, the original documents are received by the Manager within seven days of the request.

We suggest the following format:

(Place and Date)

Membership and Volunteer Programs
Manager, ARRL
225 Main St
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager of this section for the next two-year term of office.

(Signature___ Call Sign____ City___ ZIP__)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 9, 2012. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters on or before April 2, 2012, to full members of record as of March 9, 2012, which is the closing date for nominations. Returns will be counted May 22, 2012. Section Managers elected as a result of the above procedure will take office July 1, 2012.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a two-year term beginning July 1, 2012. If no petitions are received from a section by the specified closing date, such Section will be resolicited in the July 2012 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager. — *David Patton, NN1N, Membership and Volunteer Programs Manager*

SM Resolicitation Notice: Since no nomination petitions were received for the Michigan Section Manager election by the September 9, 2011 deadline, nominations are hereby resolicited.

The EC: Where the Rubber Meets the Road

Rick Palm, K1CE

In "So You're the New EC — Now What?" in this column for November *QST*, veteran Oklahoma Section Emergency Coordinator Mark Conklin, N7XYO, provides a fine assessment of what faces a newly appointed Emergency Coordinator (EC). This month, we will look at an issue that is of paramount importance: How to pick a new EC in the first place. It is not easy, and frankly, all that Conklin has written is moot if the right person for the job isn't selected.

If you are entrusted with the responsibility for evaluating candidates and selecting an EC, first you must evaluate yourself to see if you have the requisite skills for judging who would be a good one. Honest self-appraisal is not easy: Like Hans Christian Andersen's Emperor, people seldom see themselves as others do. The problem with many people including myself is the natural tendency to see only the good qualities in people, to a fault. This is perhaps an admirable trait from some perspectives, but not when it comes to selecting a critically important appointee like the EC. You need to be able to take a hard look at the assets *and* perhaps especially the liabilities of the individual so that you can ultimately avoid a negative owner's equity.

Check for warning signs, and listen to the advice of local leaders in your county's ham community. First and foremost, what is it that motivates the candidate? Is it a genuine interest in leading others in service to the community altruistically? Or, is it a genuine interest in service to one's ego, and the consequent authoritarianism and autocracy that almost always go with it?

Assess the candidate's understanding of our relationship with served agencies, in most cases, the county emergency management office: We serve the agencies. They do not serve us. We are there to provide a seamless, almost transparent communications service (we are only one arrow of many in their quiver). We are not in the EOC to tell the professionals how to do their jobs. Nor are we there to demand things like flashing emergency lights and sirens for the roofs of our vehicles, nor to demand that we be deployed as we see fit. We do not bring our internecine rivalries to them to mediate.

What else makes a good EC? Perhaps heretical, but the official ARRL qualifications and job description do not define who will be effective. It's the intangibles that make or break an EC. A good EC is a uniter, not a divider. Inter-association rivalries are as old as when the second ham radio club was formed, are almost inevitable, and are part and parcel of human and organizational behavior. The EC is able to jump over these to enfranchise all radio amateurs in the county for ARES, regardless of affiliation. The effective EC is a careful listener, weighing all input, discussing it openly with the parties that will be affected by a decision, then making it and issuing an explanation for the reasons it was made. Not everybody will agree with the decision, but they will know that it was based on careful deliberation, with all opinions considered. The affected will feel more ownership of the decision.

The EC is intelligent, educated and experienced, and has a professional, friendly demeanor, always presenting himself or herself in clean khaki pants and ironed polo shirt like the pros and not like a typical hamfest flea market visitor. You know the type with the multiple radios hung around the belt like a bandolier, big belly hanging out, pants and shirts with vest festooned with patches and pins, and a cap with even more bling.

The EC should be physically fit for the rigors of the job: a candidate who is obese and/or smokes is a ticking time bomb loaded with risk factors for coronary artery disease, heart attacks, diabetes and strokes. Working a disaster scene is physically demanding in the extreme, and also mentally challenging. The EC will sooner or later witness in person the horrific carnage that the rest of us see only through the buffer of television and the Internet. The risk for post traumatic stress disorder is significant. Select a mentally stable individual as EC.

The good EC is cool, calm and collected under fire, never a hothead, a whiner, argumentative or demanding. He or she leads by example, and consequently earns the respect of all. A good EC candidate is not simply the one who has the most toys in town.

A good EC respects the chain of command from the District EC, up to the Section EC and finally to the Section Manager. A good EC may respectfully disagree with his senior officials, but gets behind their decisions and meets their requests, once they are made. A good EC understands the need for tolerance, understanding and acceptance of other points of view. As in all of life, the most important assets of an EC, or indeed any human being, are a sense of humility, a sense of humor, a sense of wonder and most of all, an open mind.

It is arguably best to have a selection committee, rather than one individual making recommendations, although committees as we all know can get bogged down and some members themselves may have baggage exceeding the weight limit they bring to the meeting table.

The EC position is the most critical position in the entire ARRL Field Organization in my opinion. The EC is where the rubber meets the road in the ARES program, and we need one that has a good deep tread.

Rick Palm, K1CE ♦ 31 Burning Ember Ln, Palm Coast, FL 32137 ♦ k1ce@arrl.net

OPINION: FORCE MULTIPLIER, NOT LAST DITCH FALL-BACK

As someone who has been both a provider and a consumer of Amateur Radio resources in disasters, I've never been fond of the catch phrase "when all else fails." It may alienate the public safety telecom professionals who should be our natural allies. Sure, some disaster scenarios are characterized by extensive telecommunications infrastructure damage. But modern public safety infrastructure is very robust in many jurisdictions. When failures occur, it has been my experience that they affect Amateur Radio infrastructure as well as commercial and public safety infrastructure — our repeaters tend to be located on the same towers and rooftops as our public safety counterparts! I've seen many instances in which Amateur Radio resources (including my own) failed miserably to perform when needed — and a few in which well-meaning amateurs who had intended to be a part of the solution became part of the problem instead. So why the focus on failure?

A more sophisticated view of the matter is that at the same time that the community experiences infrastructure damage, the need for communications channels grows exponentially, both within and among organizations responding to the disaster. Amateur Radio can provide a surge capability to help disaster response professionals meet the exceptional communications demands of disasters, especially if Amateur Radio is included in the planning and training for such events. I'd like to see ARRL marketing us as a competent force multiplier rather than a last-ditch fallback.

Amateur Radio has a number of characteristics that are well-suited to this role as a provider of surge capacity. First, our assets are embedded in the served community, decentralized and geographically dispersed. In many cases, we don't need to respond. We're already there!

Second, most of our communications assets employ relatively simple technology that is less capable, but also inherently less dependent on infrastructure and more survivable, than complex interconnected networks that public safety agencies commonly employ nowadays. So while the public safety pros scramble to mobilize and reconfigure their surviving communications assets, we are doing the same with ours. And there are more of us than there are of them.

Our technology is heavily labor-dependent, but since we volunteer our services, the cost to served agencies is low. (Low, but not zero: Served agencies do typically need to invest in recruitment, training and credentialing of volunteers, as well as pre-positioning basic Amateur Radio equipment in key locations— especially antennas and feed lines.)

JAMES HASTINGS, K9AUC

During September 2011, the Red Cross closed its historic Arlington, Virginia Office. The Arlington County Amateur Radio Club had used this radio room to support the Arlington Red Cross Chapter since 1977. It was from this radio room that George Saunders, KR4MU, operating the Club radio station W4WVP, maintained the only contact between the Arlington Red Cross Chapter and the Red Cross response team at the Pentagon during the early hours of the 9/11 terrorist attack. Here is KR4MU in the Arlington County Virginia Red Cross radio room, recently, acting as net control station for the Eastern Regional Traffic Net. *— James Hastings, K9AUC, Alexandria, Virginia*

By default, our channels tend to be low-bandwidth, but our supply of such channels is almost limitless, and just one noisy channel serving a key location at a critical time can make an enormous difference in outcomes. With planning and the support of served agencies, there is no limit to the creativity and sophistication of the systems we can devise to augment their capabilities.

Last but not least, the Amateur Radio community includes many individuals with technical skills who can rapidly reconfigure basic communications equipment to improvise solutions to emergent needs. The public safety telecom pros also possess these technical skills, of course, but to the extent that we can provide interim solutions meeting the surge in demand, we free them to focus on restoration of their critical infrastructure.

In short, we should be offering to partner with our professional counterparts, instead of telling their bosses and the public that we'll be there to pick up the pieces when they fail. *— Al Taylor, KN3U, Rockville, Maryland*

LETTERS: AMATEUR RADIO IN DISASTERS: ONE STEP FORWARD, ONE STEP BACK

With recent events such as the Japan earthquake and Hurricane Irene still fresh on the mind, I was heartened to read David Sumner's (K1ZZ) astute opinion on the changing role of Amateur Radio in emergency communications in the September 2011 issue of *QST*. In a world of social media, real-time crisis mapping and pervasive smartphone use, the role of Amateur Radio is indeed changing, even as we remain a core tool in the communications toolbox. David's essential point assumes that a successful response to any significant emergency requires different agencies and organizations working together in a collaborative and trusting manner.

Unfortunately, just a few pages later Rick Palm's (K1CE) article about the Florida-based EMCOMM-1 vehicle does a fundamental disservice to that trust. No, it's not about the vehicle: from what I read and have seen online, it seems to be a fine vehicle and its builders are to be commended for their efforts. What I take exception to was the hyperbole and explicit attitude that said "Hams do it better than government — look how wasteful and incompetent they are." This "us versus them" attitude is exactly what is *not* needed in modern emergency response, and unfortunately only reinforces the negative stereotypes held in certain served agencies of the Amateur Radio service. The attitude is wasteful, and serves no useful purpose.

Whether we choose to acknowledge it or not, the technologies used in emergency response communications are changing radically right in front of our eyes. We also have to understand and accept the legitimate roles that other organizations have to contribute. After 9/11 and Hurricane Katrina, isn't it obvious that we either all sink or swim together? *— Rakesh Bharania, N6ILG, San Jose, California*

AMATEUR RADIO WORLD

Thai Hams Respond to Flooding

In mid-October, Thailand experienced some of the worst flooding in recent history, with almost 600 people reported dead. Hundreds of communities are reported to be uninhabitable, with flood water more than 10 feet high. Through it all, Thailand's radio amateurs have been providing communications support.

"Amateur Radio has been assisting with flood relief communications, helping victims in the affected areas," said Tony Waltham, HSØZDX, who serves as the Radio Amateur Society of Thailand's (RAST) International Liaison Officer.

Right after the flooding began, Waltham said that Thai hams used RAST's club station call sign HSØAC "and a special flood relief center with the call sign HSØAB was established at Bangkok's Don Mueang Airport. Please be formally advised that Thai radio amateurs are standing by on 144.900 MHz, 145.000 MHz and 144.9375 MHz, as well as on frequencies of 7.060-7.063 MHz in the 40 meter HF band." Waltham noted that RAST has posted a video (in Thai) to YouTube, showing the activities at the special flood relief Amateur Radio station at the airport. Watch the video at **www.youtube.com/watch?v=1m84ZW1xH8s**.

Ham radio has also seen its share of destruction due to the rains. The campus of the Asian Institute of Technology — where HSØAC, RAST's HF club and contest station is located — was inundated by more than a meter of water. According to Waltham, as of mid-November, all of HSØAC's gear was under water and may not be salvageable.

JARL WELCOMES NEW PRESIDENT

The Japan Amateur Radio League (JARL) named a new President and two new Vice Presidents, effective November 1, 2011. Akira Inage, JA5MG, will take over the presidency from Shozo Hara, JA1AN.

"Mr Hara led the JARL with great distinction for more than 35 years, including a period of phenomenal growth," remarked ARRL Chief Executive Officer David Sumner, K1ZZ. "It has been a great privilege to collaborate with him in protecting and promoting Amateur Radio worldwide."

Kazuo Niwa, JA1AYO, and Norimasa Nemoto, JH1UBU, will serve as the new JARL Vice Presidents.

COURTESY NORM FUSARO, W3IZ

JARL President Shozo Hara, JA1AN (left, seated), and ARRL Membership and Volunteer Programs Assistant Manager Norm Fusaro, W3IZ (right, seated), operate 8J1A at the Tokyo Ham Fair in August 2007.

USA BRINGS HOME GOLD AT 2011 HIGH SPEED TELEGRAPHY WORLD CHAMPIONSHIPS

Back in September 1936, Eugene A. Hubbell, W9ERU, took home the silver trophy at what the October 1936 issue of *QST* called the first official "Amateur Code Speed Contest." Only making one error, Hubbell won first prize with his winning speed of receiving 52.2 words per minute. Held at the ARRL Central Division Convention that year, the contest required operators to decipher plain language text at two minute intervals that ranged in speed from 25 to 52.7 words per minute.

But things have changed since Hubbell made history. Individuals all over the world compete in High Speed Telegraphy (HST) events where they are challenged to correctly receive and copy Morse code transmissions sent at very high speeds, upwards of 300 characters a minute. HST is very popular in Eastern Europe, but it is gaining ground in other parts of the world.

In October 2011, three Americans — Barry Kutner, W2UP, Kennan Low, KE3X, and Kody Low, K3ODY — participated in the Ninth High Speed Telegraphy IARU World Championship, held in Bielefeld, Germany. The competition, hosted by the Deutscher Amateur Radio Club (DARC), featured 22 nations competing for the title of Fastest Fist or Quickest Ear. Of the 22 nations represented, the US was the only country from the Western Hemisphere. This year, Team USA placed 10th in the competition. Kutner won a Gold Medal — the first in HST history to a non-European — in the pileup competition, and a Bronze Medal in the *RUFZ* competition.

COURTESY BARRY KUTNER, W2UP

In October 2011, Kody Low, K3ODY, Kennan Low, KE3X, and Barry Kutner, W2UP, represented the US at the Ninth High Speed Telegraphy IARU World Championship in Bielefeld, Germany. Kutner took the first-ever gold medal won by a non-European in the *RUFZ* competition.

International HST competitions are organized under the auspices of the International Amateur Radio Union (IARU). Since 1995, HST World Championships take place each odd-numbered year. According to Kutner, HST has long been considered a sport in Europe, especially Eastern Europe, similar to chess or an Olympic sport. Kutner was the sole US representative at the 2005 HST World Championship in Macedonia. In 2009, he led a team of seven to Bulgaria for the Eighth High Speed Telegraphy IARU World Championship. Kutner said there really isn't much of an interest in HST in the US, "so those who wish to participate in the World Championship must do so at their own expense."

Kutner said that most of the participating IARU Member-Societies hold a national competition in their country, seeking members to field and sponsor a team to the World Championship. "In some of the Eastern European countries, they take HST very seriously, and they have team and individual coaches," he said. Competitors must be licensed Amateur Radio operators, except that entrants in the younger categories may be SWLs. The IARU HST World Championships follow rules set forth by the IARU Region 1 High Speed Telegraphy Working Group.

With the 2011 competition in the books, it's not too early to think about 2013. If you are able to copy and/or send CW at dizzying speeds, why not think about attending the next IARU HST World Championship? "We are always looking for younger hams, especially young ladies, to join us," Kutner said. For more information on HST events, contact Kutner via e-mail at **w2up@arrl.net**.

S. Khrystyne Keane, K1SFA ♦ ARRL News Editor ♦ k1sfa@arrl.org

CONTEST CORRAL

in association with the *National Contest Journal*

JANUARY 2012

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Website or Contact
Jan 1, 0000Z - Jan 1, 2400Z	**3.5-28**	**50+**	**ARRL Straight Key Night**		✘		**General QSO information**	**www.arrl.org/straight-key-night**
Jan 1, 0000Z - Jan 1, 0100Z	3.5		New Years Snowball Contest	✘	✘		RST, serial, AGB number	**ev5agb.com/index.htm**
Jan 1, 0800Z - Jan 1, 1100Z	3.5-7		SARTG New Year RTTY Contest			✘	RST, serial, Happy New Year in your language	**www.sartg.com**
Jan 1, 0900Z - Jan 1, 1200Z	3.5-14		AGCW Happy New Year Contest		✘		RST, serial, AGCW number	**www.agcw.org**
Jan 7, 0000Z - Jan 7, 2400Z	3.5-28		070 PSKFest			✘	Call sign, RST, S/P/C	**www.podxs070.com**
Jan 7, 1300Z - See website	1.8-28		CWops Weekend Mini-CWT Test		✘		Name and member number or S/P/C	**www.cwops.org/onair.html**
Jan 7, 1500Z - Jan 8, 1500Z	3.5-14		Original QRP Contest		✘		RST, serial and category	**www.qrpcc.de**
Jan 7, 1500Z - Jan 7, 1800Z	3.5-28		QRP Pet Rock Sprint		✘		RST, S/P/C, QRP ARCI number or power	**www.qrparci.org/contests**
Jan 7, 1800Z - Jan 8, 2400Z	**3.5-28**		**ARRL RTTY Roundup**			✘	**RST, state/province/serial**	**www.arrl.org/contests**
Jan 8, 0900Z - Jan 8, 1059Z	28		DARC 10 Meter Contest	✘	✘		RS(T), serial, DOK code	**www.darc.de/referate/dx/contest**
Jan 8, 1000Z - Jan 8, 1400Z	3.5-28		Midwinter QSO Party	✘	✘		RS(T) and serial	**trafficbureau.veron.nl**
Jan 8, 1800Z - Jan 8, 2400Z	**3.5-28**		**Kid's Day**	✘			**Name, age, location, favorite color**	**www.arrl.org/kids-day**
Jan 10, 0200Z - Jan 10, 0400Z	3.5-28		ARS Spartan Sprint		✘		RST, S/P/C, and power	**www.arsqrp.blogspot.com**
Jan 11, 1300Z - See website	1.8-28		CWops Monthly Mini-CWT Test		✘		Name and member number or S/P/C	**www.cwops.org/onair.html**
Jan 13, 0200Z - Jan 13, 0300Z	1.8-14		SNS and NS Weekly Sprints		✘		Serial, name, and S/P/C	**www.ncccsprint.com/rules.html**
Jan 14, 0000Z - Jan 15, 2359Z	1.8-28		Hunting Lions In the Air	✘	✘	✘	RS(T), serial or name, club name, district	**lionshuntingintheair.lionwap.org**
Jan 14, 1200Z - Jan 15, 2359Z	1.8-28	50	MI QRP Club Jan QRP Contest		✘		RST, S/P/C, MI QRP number or power	**www.miqrp.org**
Jan 14, 1200Z - Jan 15, 1200Z	3.5-28		WW Peace Messenger Cities	✘	✘		RS(T) and PMC ref number or CQ zone	**www.s59dcd.si**
Jan 14, 1800Z - Jan 15, 0600Z	**1.8-28**		**North American QSO Party**		✘		**Name and S/P/C**	**www.ncjweb.com/naqprules.php**
Jan 14, 2000Z - See website	1.8		EUCW 160 Meter Contest		✘		RST, serial, club name, member nr or "NR"	**www.uft.net**
Jan 18, 2300Z - See website	1.8-7		Linc Cundall Memorial CW Contest		✘		See website	**www.antiquewireless.org**
Jan 19, 0130Z - Jan 19, 0330Z	3.5-14		NAQCC Monthly QRP Sprint		✘		RST, S/P/C, and NAQCC mbr nr or power	**naqcc.info**
Jan 21, 0000Z - Jan 21, 0400Z	3.5, 7		LZ Open Contest		✘		6-digit serial and serial from previous QSO	**www.lzopen.com**
Jan 21, 0000Z - Jan 22, 2359Z	1.8-28		YLISSB QSO Party	✘			Call sign, RS(T), ISSB number	**www.ylsystem.org**
Jan 21, 0200Z - Jan 21, 0300Z	3.5-7		Locust QSO Party		✘		Name, state or province or "DX"	**www.k6vva.com/lqp**
Jan 21, 1200Z - Jan 22, 1200Z	1.8-28		HA DX Contest	✘	✘		RS(T) and serial	**www.ha-dx.com**
Jan 21, 1200Z - Jan 22, 1200Z	3.5-28		UK DX RTTY Contest			✘	RST and serial	**www.ukdx.srars.org**
Jan 21, 1600Z - Jan 21, 1800Z	1.8-28		Feld-Hell Gridloc Sprint			✘	RST, S/P/C, Feld-Hell member nr	**www.feldhellclub.org**
Jan 21, 1800Z - Jan 22, 0600Z	**1.8-28**		**North American QSO Party**	✘			**Name and S/P/C**	**www.ncjweb.com/naqprules.php**
Jan 21, 1900Z - Jan 23, 0400Z		**50+**	**ARRL January VHF Sweepstakes**	✘	✘		**Grid square**	**www.arrl.org/contests**
Jan 22, 0900Z - Jan 22, 1500Z	3.5-28	144/ 432/1.2G	International United Teenager Contest	✘	✘		RS(T) and age or "RT"	**www.qrz.ru/contest/detail/140.html**
Jan 27, 2200Z - Jan 29, 2200Z	1.8		CQ WW 160 Meter Contest		✘		RST and S/P/C	**www.cq160.com**
Jan 28, 0600Z - Jan 29, 1800Z	3.5-28		REF French Contest		✘		RST and serial or department ID	**concours.ref-union.org/contest**
Jan 28, 1200Z - Jan 29, 1200Z	3.5-28		BARTG RTTY Sprint			✘	Serial	**www.bartg.org.uk**
Jan 28, 1300Z - Jan 29, 1300Z	3.5-28		UBA Contest	✘			RS, serial, and ON province	**www.uba.be/hf/contest-rules**
Jan 28, 1700Z - Jan 29, 1700Z	1.8-28	50+	Winter Field Day	✘	✘	✘	Call sign, RS(T), category, local temp	**www.spar-hams.org**
Jan 28, 1900Z - Jan 28, 2300Z	1.8		WAB Top Band Phone Contest	✘			See website	**www.worked-all-britain.co.uk/contest**
Jan 29, 1400Z - Jan 30, 0800Z	1.8-28	50,144	Classic Exchange		✘		RST, QTH, model of rcvr and xmtr	**www.classicexchange.org**
Jan 29, 2000Z - Jan 29, 2359Z	3.5-28		QRP Winter Fireside SSB Sprint	✘			RS, S/P/C, QRP ARCI number or power	**www.qrparci.org/contests**

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates.
Refer to the contest websites for full rules, scoring information, operating periods or time limits and log submission information.
No contest activity occurs on 60, 30, 17, 12 meters. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity.
Publication deadline for Contest Corral listings is the first day of the second month prior to publication.

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

2011 ARRL UHF Contest Results

250 logs — still to be reached!

John (JK) Kalenowsky, K9JK
hamk9jk@ameritech.net

Thanks to all who participated this year — August 6-7. While this year's log submission count of 142 was disappointing and moving *away* from my hope to see the "249s" of 1994 and 1999 finally eclipsed, I still believe it *can* be done. We need to *make* the activity happen as Lloyd, NE8I reminds us. The graph of Activity by Band compares the last five years of avtivity.

Activity was noted from quite a few stations that did not submit a log — almost 400 additional fixed stations and 20 call signs logged with an "/R" suffix (and showing activity *from* two or more grid squares) were among this year's 7000 reported QSOs. Just 15% of these stations submitting logs would have gotten the log total over 200 and 30% would have broken 250 with some margin and finally surpassed the log counts of 249 from 1994 and 1999 at last. *All* logs are appreciated and welcome, whether just a single QSO or several hundred. [Use WA7BNM's handy log submission web page at **b4h.net/cabforms** to submit your log. — *Ed.*]

Records and Leaders

Despite the lower activity level, there were still a few Division Category records for which the bar was raised in 2011. **Mike, WA6ZTY** (with **WD6CMU**) established a new best for Multioperator in the Pacific Division. The other two raised bars occurred in the newer Limited and Unlimited Rover categories; **Darryl, WW7D** set a new standard for Limited Rover in the Northwestern Division and **Rick, K1DS** accomplished the same feat for Unlimited Rover in the Atlantic Division.

Bruce, W9FZ claimed the highest QSO count of any entrant this year with 302. Aside from Bruce, 19 other entrants reported QSO counts of greater than 100. 91 entrants reported QSO counts between 10 and 99, leaving 31 with QSO counts in the single digits including 4 logs who reported only a single QSO.

One of those single-QSO logs was from **Mike, N4VBV** who was very excited to have completed his first 432 MHz QSO on SSB as well as his first QSO in a UHF contest. Mike noted that he was using an omnidirectional antenna and appreciated the heavy lifting that was performed by the other party, **Russ, K4QI** for them to be able to complete the QSO. We are reminded of Bill Seabreeze's comment: Listen for the weak ones!"

DARRYL HOLMAN, WW7D

WW7D's novel use of an airplane suggests new possibilities for an "aero-rover"! Do you think those radials at the base of the pole will provide any "lift" to his signals?

Call	Score
Single Operator, Low Power	
K2DRH	145,410
W3PAW	59,286
NØKP	45,828
KC9BQA	39,072
K2KIB	30,096
N9LB	29,820
W9SZ	27,531
WB2SIH	23,691
AF1T	23,232
NØTTW	9,108
Single Operator, High Power	
WA2FGK (K2LNS, op.)	142,230
K3TUF	61,746
WØUC	59,670
K1RZ	43,818
K2YAZ	40,014
WB2RVX	26,784
KØVXM	26,469
W4WA	21,420
N7EPD	17,220
K8TQK	16,284
Multioperator	
KBØHH	27,816
K2LIM	25,728
KO9A	8,277
WA6ZTY	7,350
W3SZ	7,161
K5QE	4,473
N2BJ	3,816
W5ROK	117
Rover	
WØZQ/R	139,200
W9FZ/R	90,870
W9SNR/R	60,786
N2CEI/R	26,400
KCØP/R	18,648
AA1I/R	8,091
WB8BZK/R	7,134
NØHZO/R	6,468
KAØKCI/R	6,420
VE3CRU/R	3,240
Limited Rover	
K9JK/R	10,800
WAØVPJ/R (+AIØZ)	6,216
WW7D/R	2,790
N6ZE/R	2,340
WA7KVC/R	180
KK6MC/R	105
N2YTF/R	45
Unlimited Rover	
K1DS/R	80,142

Where the Action Was

Contacts were reported with 176 different grid squares in 2011 which included **John, W3HMS** reporting a contact on 1.2 GHz with **Hannes, OE5JFL** in JN68 (presumably by EME) very likely the longest path travelled of any contact in this year's UHF Contest.

Among stations submitting logs, a total of 109 grid locators were represented. Fixed stations were active from 70 of those with 51 uniquely by fixed stations. FN31 and CN87 were most popular among the fixed stations with six logs being received from each of those, followed in popularity by: CM98 (5 logs), FN42 (5 logs), and four logs were received from each of EL98, FM19 and FN43.

The 85 grids activated by rovers were among 58 unique grid locators with 39 of those visited only by rovers. EN25, EN34, EN43, EN44 and EN52 were each visited by four different rovers. Forty-three grids were only visited by a single rover so that may have been the only way to make a contact with those multipliers.

When Did Contacts Happen?

With the UHF Contest spanning only 24 hours, the graph of QSOs by hour shows the QSOs reported during each hour. The first hour was the busiest by far with almost 850 QSOs logged — about 12% of the total QSOs reported in the contest. Unlike 2010, when activity dwindled significantly after the first hour, activity remained strong through Saturday evening with almost two-thirds of the total QSOs reported occurring on Saturday.

Top Scorers by Category

Log counts by category were 114 Single-Operator (71 Low Power and 43 High Power), 8 Multioperator and 13 classic Rovers. The 7 Limited Rovers and 1 Unlimited Rover actually matched 2010 for those categories. The 21 rovers activated 85 grids for an average of 4 grids activated by each rover.

Frequent top scorer **Bob, K2DRH** returns to his familiar top spot in Single-Op, Low Power from Illinois (also the top score

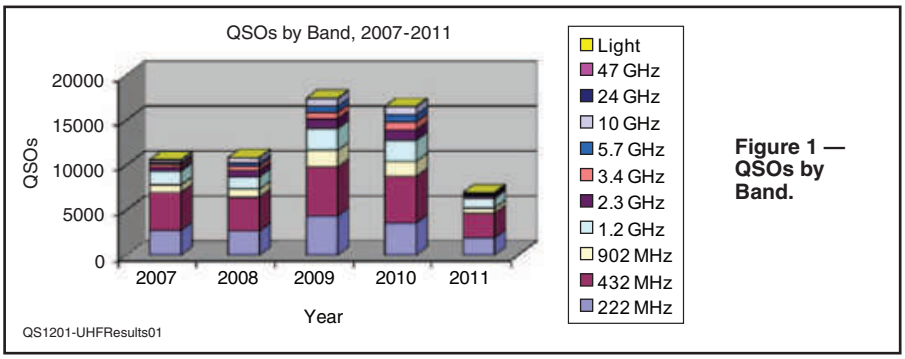


Figure 1 — QSOs by Band.

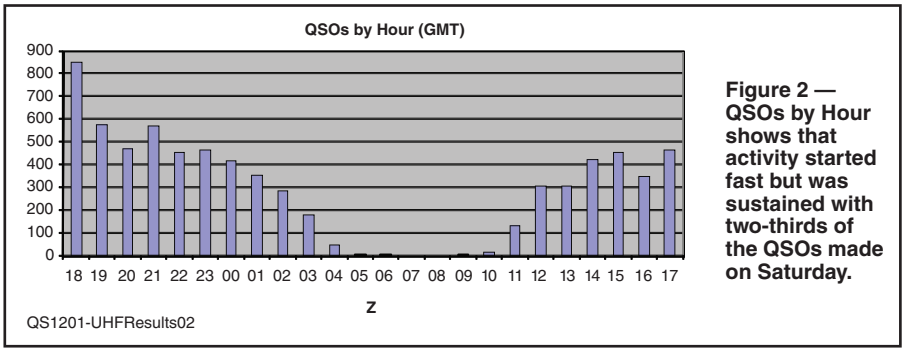


Figure 2 — QSOs by Hour shows that activity started fast but was sustained with two-thirds of the QSOs made on Saturday.

Division Leaders by Category

Division	*Call*	*Score*
Single Operator, Low Power		
Atlantic	W3PAW	59,286
Central	K2DRH	145,410
Dakota	NØKP	45,828
Delta	N4QWZ	8,658
Great Lakes	N8AIA	690
Hudson	K2KIB	30,096
Midwest	NØTTW	9,108
New England	AF1T	23,232
Northwestern	KD7UO	3,621
Pacific	AF6RR	3,876
Roanoke	K4FJW	1,632
Southeastern	W2BZY	6,348
Southwestern	K6TSK	3,540
West Gulf	WB5ZDP	8,787
Canada	VE7FYC	2,736
Single Operator, High Power		
Atlantic	WA2FGK (K2LNS, op.)	142,230
Central	WØUC	59,670
Dakota	KØAWU	11,514
Delta	AA4DD	1,392
Great Lakes	K2YAZ	40,014
Hudson	K2AMI	252
Midwest	WAØARM	60
New England	N1JEZ	6,417
Northwestern	N7EPD	17,220
Pacific	KC6ZWT	4,752
Roanoke	K4QI	5,742
Rocky Mountain	WA7KYM	792
Southeastern	KØVXM	26,469
West Gulf	W5VHF (K5SW, op.)	1,125
Canada	VA3ST	10,836
Multioperator		
Atlantic	K2LIM	25,728
Central	KO9A	8,277
Pacific	WA6ZTY	7,350
West Gulf	KBØHH	27,816
Rover		
Central	W9FZ/R	90,870
Dakota	WØZQ/R	139,200
Midwest	KAØKCI/R	6,420
New England	AA1I/R	8,091
Northwestern	K7HPT/R (+W7OE)	2,064
Rocky Mountain	KRØVER/R	1,476
Southeastern	N2CEI/R	26,400
Canada	VE3CRU/R	3,240
Limited Rover		
Central	K9JK/R	10,800
Dakota	WAØVPJ/R (+AIØZ)	6,216
Hudson	N2YTF/R	45
Northwestern	WW7D/R	2,790
Unlimited Rover		
Atlantic	K1DS/R	80,142

overall) followed by **Paul, W3PAW** from Western Pennsylvania. **Dave, NØKP** rounds out this year's SOLP scorers with a fine third place score from Minnesota.

After a seven-year "chain" of KMØT and K1TEO being among the top-three finishers in Single-Op High power, neither submitted a log in 2011. That allowed Eastern Pennsylvania's **WA2FGK** piloted by **Herb, K2LNS** to claim Top Spot honors in SOHP. Another EPA entrant, **Phil, K3TUF** stepped up to the second spot and **Paul, WØUC** claimed third place from Wisconsin.

In the Multioperator category, **Gary, KBØHH** (along with KC5DPT and KD5EKX) operated from Gary's Oklahoma bunk house station and finished in first place. The **K2LIM** "LIM Amateur Radio Group" (operated by KA2LIM, KB2YCC and W9KXI) took "The Limo" (and trailers) to their favorite Western New York location and stepped up a spot over 2010 to finish second. **Jim, KO9A** added "packet" as his second operator to claim third place for 2011 from his Illinois QTH.

Without the concentrated, high-scoring rover participation from Southern California that has been present in recent years, the top three scorers of the 13 classic Rover entrants were back in the middle of the country. **Jon, WØZQ** led the way, visiting seven grids around Minnesota with eight bands. **Bruce, W9FZ** visited eight grids around Wisconsin with six bands for second place and **Jim, W9SNR** rounded out the top three, travelling among four Illinois grids with his eight-band rover. While the author wrote in last year's results article that he planned to not be "limited" in 2011, **John, K9JK** *was* again Limited and claimed the top spot in Limited Rover this year, visiting four grids in Illinois with three bands. Second and third places in Limited Rover were **John, WAØVPJ (+Mark, AIØZ)** visiting four grids around Minnesota with three bands and **Darryl, WW7D** visiting six grids around Western Washington with two bands, including travel by air and hiking on foot (see Darryl's description and photos at **tinyurl.com/ww7dUHF2011**). **Rick, K1DS** was the sole entry in Unlimited Rover in 2011 visiting three grids around Eastern Pennsylvania with his eight-band rover.

Affiliated Club Competition

Medium Club

Club Name	*Logs*	*Total Score*
Badger Contesters	8	294,396
Northern Lights Radio Society	10	289,146
Mt Airy VHF Radio Club	7	189,507
Society of Midwest Contesters	4	185,034
Florida Weak Signal Society	7	62,163
Pacific Northwest VHF Society	15	43,173
North East Weak Signal Group	8	24,315
Contest Club Ontario	3	14,841

What About the Clubs?

Clubs were definitely present in 2011, with 84 of the 142 logs giving a club name in their Cabrillo log file. That is consistent with the 60% of logs that have listed a club name since Club Competition started in the UHF Contest. With that lower log count, though, not as many clubs were listed. Twenty-five different club names were found compared to 33 in 2010. Only *eight* clubs met the minimum of three logs submitted to be eligible for the Club competition and all were in the Medium Club category so there is no Local Club gavel for 2011.

The battle for the 2011 Medium Club gavel turned out to be very close, with 8 logs from the Badger Contesters aggregating a total score of 294,396 and narrowly edging ahead of Northern Lights Radio Society's 10 logs and 289,146 aggregate point total.

Still Hoping for 250 in 2012!

Winter is upon us as this *QST* is being delivered into your hands (or extended web version being posted). January's VHF Sweepstakes will happen soon, followed by Spring VHF & Up Sprints in April and May, then June's VHF QSO Party (or will it be another June Six Meter QSO Party in 2012?). Before we know it, that first full weekend of August 2012 will be here, offering the opportunity for another 24 hours of radiosport on the bands 222 MHz and Up starting at 1800 UTC on August 4, 2012.

Looking for More?

The "ultra-high" version of this article at **www.arrl.org/contests** provides additional discussion, tables and charts for more in-depth contest reporting.

The 2012 School Club Roundup

Monday, February 13 – Friday, February 17, 2012
Operate from 1300 UTC through 2359 UTC each day.

- Make your school "radio-active"! Get involved with the School Club Roundup! This week-long event combines promotion of Amateur Radio in the classroom with a fun, competitive atmosphere. SSB and CW operation is strongly encouraged! School Club Roundup is designed for the schedules of students and teachers...Young operators welcome!
- Separate categories for Elementary, Middle, High School and College clubs.
- Send logs to **scr@limarc.org**. All logs must be received by March 16, 2012.

Complete rules, logging sheets and other info can be found at
www.arrl.org/school-club-roundup

RONNY RISINGER, KC5EES

From the left, Liberal Arts & Science Academy (LASA) Junior David McNeil operates K5LBJ during the October 2010 SCR from LBJ High School in Austin, Texas. Joe Fisher, K5EJL, assists with a logging issue as senior Sam Fairies logs contacts.

Sean's Picks

Contest Manager Sean Kutzko, KX9X

All dates/times are in UTC.
State QSO Parties this month: none

- **QRP contests this month:** QRPCC's Original QRP Contest (Jan 7-8), QRP-ARCI Pet Rock Sprint (Jan 7), ARS Spartan Sprint (Jan 10), MI QRP Club January QRP Contest (Jan 14-15), Flying Pigs Run For The Bacon (Jan 16), NAQCC Monthly QRP Sprint (Jan 19), QRP-ARCI Winter Fireside SSB Sprint (Jan 29)
- **ARRL Straight Key Night (Jan 1):** No, SKN isn't really a contest, but it's a heck of a lot of fun to send CW by hand. Join us — you'll have a blast!
- **ARRL RTTY Roundup (Jan 7-8):** Digital modes are where the biggest contest growth has been for the past few years. Are you on the bus or off? Everybody works everybody in the RTTY RU!
- **North American QSO Party, CW (Jan 14-15):** Twelve hours of CW fun! Exchange is simply your name and state. A great event that doesn't take up the entire weekend. Great fun for newer CW ops, too!
- **LZ Open (Jan 21):** A 4 hour contest on 40/80 meters, centered on our Bulgarian friends. Exchange includes a sequential serial number, plus the serial number you received from your previous QSO.
- **North American QSO Party, Phone (Jan 21-22):** The SSB version of the NAQP. With the simple exchange of your name and state, this is an excellent event for the newer contester.
- **ARRL January VHF Sweepstakes (Jan 21-23):** Activity on 6 meters and up shoots through the roof during the third weekend in January. A challenging event for the VHF+ operator.
- **CQ WW 160 Meter Contest, CW (Jan 27-29):** Winter means excellent low-band conditions, even during an increase of sunspot activity. Don't miss this great opportunity to work some excellent DX on Top Band.
- **SPAR Winter Field Day (Jan 28-29):** Sponsored by the Society for the Preservation of Amateur Radio, Winter Field Day includes the temperature at the operating position as part of the exchange. The more bands you operate, the bigger your multiplier.

January 2012 W1AW Qualifying Runs

W1AW Qualifying Runs are 10 PM EST Friday, January 6 (0300Z January 7) (35-10 WPM) and 9 AM EST (1400Z) Thursday, January 19. The West Coast Qualifying Run will be transmitted by station K6YR on 3590 kHz at 9 PM PST Wednesday, January 11 (0500Z) January 12) (40-10 WPM).

Strays

HORKHEIMER PRIZE 2012

◊Rudolf Horkheimer was one of the first radio amateurs in Germany. His name stands as a synonym for the active amateur who promotes Amateur Radio in a selfless manner. The prize bearing his name is awarded by DARC (Deutscher Amateur Radio Club) for Amateur Radio accomplishments, its further development and the goals of the DARC. The prize can be awarded to one or more persons or institutions and is not restricted to DARC members. Any member of an Amateur Radio society in the IARU is entitled to submit a proposal. Self proposals are permitted. The prize consists of an etched glass-sheet and a monetary prize for non-personal use. This money may be spent for the promotion of Amateur Radio in any way the recipient chooses.

The prize is awarded during the opening of HAM RADIO 2012 in Friedrichshafen, Germany. The proposals must be submitted by March, 30 2012, to DARC, Lindenallee 4, 34225 Baunatal, Germany or via e-mail to **darc@darc.de**. Proposals should list name and address of the amateur, a short substantiation and possibly further information. The decision of the jury is final.

W3UR

HOW'S DX?

QSLing in the New World of LoTW

As of October 2011 about 45,000 individual users are signed up for the ARRL's Logbook of The World (LoTW) and over 371 million contacts have been added with more than 45 million confirmed. This month former ARRL Membership Services Manager Wayne Mills, N7NG, who was a major player in the implementation of LoTW, discusses its impact on QSLing and funding DXpeditions.

Wayne A. Mills, N7NG

The introduction of ARRL's LoTW in 2003 began a series of significant changes in ham radio QSLing. Logbook of the World (LoTW) is a form of electronic QSLing that is low cost and can be nearly instantaneous. In one particular case, the introduction of LoTW began to change the way DXers request QSLs — and the way DXpedition organizers respond.

For many decades, QSLing has been done either through the use of direct mail or via the IARU QSL Bureau system. Exchanges of cards through the bureau system has always required considerably more time than direct mail. Originally, the consolidation of cards and economical bulk shipping methods saved money — not so much now. Using the bureau system, cards are consolidated and mailed between bureaus in most countries around the world. For various reasons, end-to-end delivery times of several years are common. If a DXer wants or needs a QSL quickly — for his or her "last" state or country for an award — he will usually send a direct QSL request via international post. Sometimes, even a registered request is sent for the last few confirmations required for a place on the DXCC Honor Roll.

While the bureaus handle cards only, direct QSL requests in an envelope with the card present an *opportunity* to make a contribution toward the expenses of a DXpedition. With only the bureau as an alternative, most DXers needing a quick response will submit a direct request and many times they will also take the opportunity to make an unsolicited donation to a DXpedition. Doing so is relatively convenient. In some cases, just the one or two "green stamps" required for postage will leave enough left over to add something to the DXpedition fund. In other cases, DXers will use this method to make a substantial contribution.

Electronic QSLing and DXpedition Funding

With the advent of LoTW, DXpeditions must deal with another method of QSLing. Because of its inherent delays, the bureau can still be relegated to last place on the list for DXpedition members. Direct QSLing can be done as it has been in the past. But, LoTW is different. It can provide very rapid QSLing, even more quickly than direct mail requests. DXpeditions could also do real-time QSLing if desired. At the very least, it is entirely practical to submit a DXpedition's log to LoTW immediately after completing the trip.

The low-cost, short-turnaround scenario can cause joy as well as angst for DXers and DXpeditioners alike. It brings into focus certain aspects of the funding of DXpeditions. If a DX log is uploaded to LoTW immediately following an expedition, it is likely that fewer DXers will take advantage of the direct QSL opportunity to make a donation. For this reason, a number of expedition organizers have opted not to upload their LoTW logs for an extended period of time.

HAMAD ALNUSIF, 9K2HN

When Hamad, 9K2HN, in Kuwait, first heard about LoTW he never thought it would work for DX stations, but a few years ago he started to receive many requests from hams around the world asking him to upload his log to LoTW. After 2 years, he has uploaded more than 300,000 contacts to LoTW. Hamad says it's a great tool and has made life much easier. He hopes DXers across the world are happier as a result.

Here are some things to think about. In recent years, QSLing has evolved with the use of online money-transfer systems. PayPal comes to mind. These systems allow an alternative to the direct mail QSL model regarding donations. The use of the Online QSL Request System (OQRS) along with PayPal, cuts postage costs and shortens turnaround time — all good. We do expect at least to pay the costs for postage, cards, etc. The use of OQRS along with PayPal might become a popular alternative to the direct QSL and donation model, where a donation is easy to do, *but not required*.

Unfortunately, these systems can also be used in ways that take advantage of DXers' desires for a quick QSL. One has always had to ask: Should DXers be *required* to make a *contribution* in order to receive a QSL

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quickly? If a donation is *not* required, what is a reasonable response time? If a donation *is* required for preferential treatment, should DXers, who have contributed to a DXpedition through a club or foundation, be required to make *another contribution* in order to receive a QSL? Or should they somehow receive "credit" for their club donation? These are not new issues. Questions about funding related to QSLing have been heard for many years. As the use of OQRS and LoTW has increased, these questions have taken on more significance. DXers and DXpeditioners are beginning a process of sorting out these questions.

POOYAN KH, EP3PK

LoTW is a superb tool to confirm contacts, plus by not wasting paper it helps save trees says Pooyan, EP3PK, from Iran. It is fast, reliable and especially useful for those in countries with lower postal standards.

"Encouraging" Donations

The bureau system is an important avenue for exchanging DX QSL cards. One recent DXpedition QSL policy stated that *no* bureau cards would be accepted at all. Further, LoTW logs would only be uploaded 1 year after the operation. Such a procedure leaves only direct contributions. In this case, the only way to receive a QSL in a reasonable time would be in making a direct request. It seems clear in this case that withholding bureau and LoTW replies is directly intended to promote donations. A DXpedition might not require a donation, but it certainly would be "encouraging" such contributions and the encouragement might be even stronger if responses for contributing DXers were given preference.

Experience has shown that without LoTW in the picture, most direct QSL requests are received within 3-4 months. All things being equal, one might then expect that a LoTW upload could be done shortly thereafter. In fact, though, all things are not equal. Given only 3-4 months to wait, many DXers will wait and not send a direct request. If LoTW uploads are withheld for a year, more people will send direct requests, while not uploading within a year is seen as an attempt to increase donations.

WALDEMAR RÜTTIMANN, HBØYWR

The main reason Waldemar, HBØYWR, from Liechtenstein, has for using LoTW is that he is working on his Worked All States award. He uploads his log about every month.

Of course, as always, there are other considerations. There is no requirement that LoTW be used at all. If an expedition were to state that there would be no upload ever, we would be back to the pre-LoTW era. This was the case in the first few years after LoTW was introduced. But the genie is out of the bottle and DXers will increasingly demand its use.

Another consideration is the case where the QSLs are for a new DXCC country. In this case, while many DXers would prefer a rapid LoTW upload, they will probably respond with a direct request — and a contribution, if necessary — in order to keep up their DXCC award total. The demand in this case is very large. There is really no need for DXpedition organizers to delay cards being sent via the bureau, since that system is naturally slow — usually more than a year. But, LoTW offers a rapid reply with no mechanism for a concurrent contribution. As a result, delaying LoTW uploads becomes a means of "encouraging" DXers to make a contribution. This situation has caused considerable consternation, particularly in Europe. We would all prefer that sufficient donations are made without excessive encouragement.

Yet another consideration is that some expeditions require more funding than others. DXpeditions to the Antarctic often require large amounts of cash. These are usually justified by the demand. Perhaps additional "encouragement" is justified for high-cost expeditions.

Delaying Uploads

When LoTW was first introduced, ARRL's Colvin Award guidelines *required* that the recipient make the log available for LoTW submission no later than 1 year following the operation. This 1 year requirement was entirely arbitrary. No one knew how LoTW would be received and how its use would expand in subsequent years. LoTW is now a significant alternative to direct and bureau cards.

Other funding organizations have established their own uploading rules. Big foundations — which make significant contributions to large DXpeditions — play an important role in setting QSLing policy. It seems reasonable that they would be advocates for their members and contributors. Most *require QSL responses in the same manner as QSLs are received*. When it comes to LoTW, most organizations do require an LoTW upload. But, some of these organizations require only that the expedition upload the log within 1 year, rather than *responding in a timely manner via the same method by which the QSL was received*. This situation could be improved by requiring an LoTW upload in 3-6 months.

In fact, as DXers have suffered long delays — and complained about it — some organizations have echoed their contributors wishes and changed their requirements for LoTW uploads from 1 year to 6 months — some less than 6 months. Experience now shows that 6 months should be more than enough time to "encourage" direct requests, while minimizing complaints. But, the perception still exists that if LoTW is not an early option, more DXers will contribute. At the end of the day, DXers should — and generally will — help fund legitimate DXpedition costs, but they don't want to be pushed and they will "vote with their pocket books" to say how best to do it.

Wayne Mills, N7NG, can be contacted at **n7ng@arrl.net**.

NØJK

THE WORLD ABOVE 50 MHz

Transequatorial VHF Propagation

Many of the propagation reports on 6 meters this fall involve transequatorial propagation (TEP). What is this and how may it help you work DX?

Transequatorial ionospheric propagation involves the propagation of HF, VHF and even UHF signals across the geomagnetic equator over very long paths. It typically occurs in the late afternoon and evening, much later than predicted by conventional F-layer propagation, between stations located in a zone 20-40° north of the geomagnetic equator to stations located in a zone 20-40° south. It was as if TEP disobeyed the laws of physics and the existing simple midlatitude model of the ionosphere, which predicted the MUF would be much too low. Note that the geomagnetic equator is south of the geographical equator for North and South America. Low power 50 MHz signals can propagate with little loss over thousands of miles via TEP. At solar cycle peaks 144 and even 432 MHz signals have been propagated by this mode.

The discovery of TEP by radio amateurs is one of the greatest contributions by Amateur Radio to science. TEP was first observed on 50 MHz in August, 1947 when W7ACS/KH6 worked VK5KL on the 25th followed on the 27th by Benjamin Kroger, XE1KE, working LU6DO.[1]

The ARRL participated in the International Geophysical Year (July 1, 1957 to December 31, 1958) by setting up the Propagation Research Project. Reports of 50 MHz activity were analyzed at Stanford University and Mason Southworth presented the first summary of the results in *QST*.[2] Also of interest are R. G. Cracknell's, ZE2JV, article "Transequatorial Propagation of V.H.F. Signals" and R. A. Whiting's, 5B4WR, definitive article on TEP entitled "How does TE work?"[3,4]

TEP occurs due to two related mechanisms. The afternoon TEP mechanism is caused by two bands of high electron densities that form in the F-layer in the afternoon centered about 15° north and south of the geomagnetic equator. This is in part due to the "fountain effect." Electrons formed by ultraviolet light photoionization in the F-layer in the morning rise upwards due to the effect of the electrical and magnetic field in the equatorial region. The electrons then move down magnetic field lines on each side of the geomagnetic equator to produce regions of high electron density. The process looks like a fountain of electrons rising up from the equator and raining down on each side. The electrons accumulate as the day progresses and the ionization becomes more intense. This process stops at sunset, when ionization by the sunlight ceases.

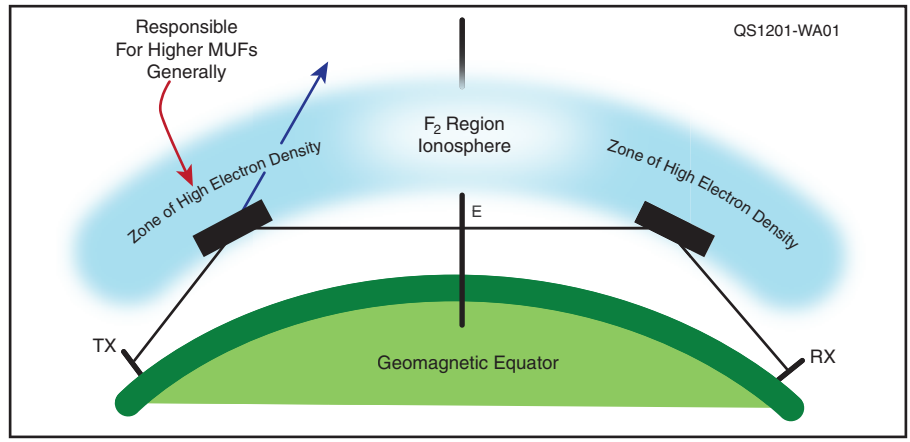

Figure 1 — The fountain effect causes two areas of high electron density to form on either side of the geomagnetic equator. The signal from the transmitter strikes one area and is reflected parallel to the Earth until it strikes the second area, which reflects it down to the receiver.

The evening TEP mechanism takes over after sunset. At that time ionospheric winds create instabilities with bubbles, pockets and plumes of ionization spreading out the F_2 layer. They are aligned with the geomagnetic field and can also propagate radio signals.

Afternoon TEP

During Afternoon TEP the signal from one station is refracted from the first crest on to the second, then back to the earth (see Figure 1). Thus it is "chordal" propagation. Signal loss is low as there is no ground reflection and there are only two passes through the D-layer. Because the grazing angle of the first crest is significantly smaller than a ray refracted completely back to the earth, the MUF is higher. The "regular" F_2 MUF of the first crest may be 25 MHz, but due to the geometry of the path with the second crest, the overall MUF of the entire circuit may be over 50 MHz.

Some characteristics of Afternoon TEP are:

- MUF up to 60 MHz
- Best times are 1500-1900 local time, best months those around the equinox
- Afternoon TEP occurs primarily at solar cycle peaks but has been reported at the minimum
- Path lengths are usually 5000-7000 km.
- Signals are usually clear with no Doppler or distortion

This Month

January 1-10	Quadrantids Meteor Shower
January 10-13	EME days with lowest degradation loss*
January 14-15	Moderate to good EME conditions*

*Moon data from W5LUU

[1]E. P. Tilton, W1HDQ, "The World Above 50 Mc.," *QST*, Oct 1947, p 56.
[2]M. Southworth, W1VLH, "A Look Back and Ahead at PRP," *QST*, Jun 1959, pp 48-49.
[3]R. G. Cracknell, ZE2JV, "Transequatorial Propagation of V.H.F. Signals," *QST*, Dec 1959, pp 1-17.
[4]R. A. Whiting, 5B4WR, "How Does TE Work?" *QST*, Apr 1963, pp 13-14.

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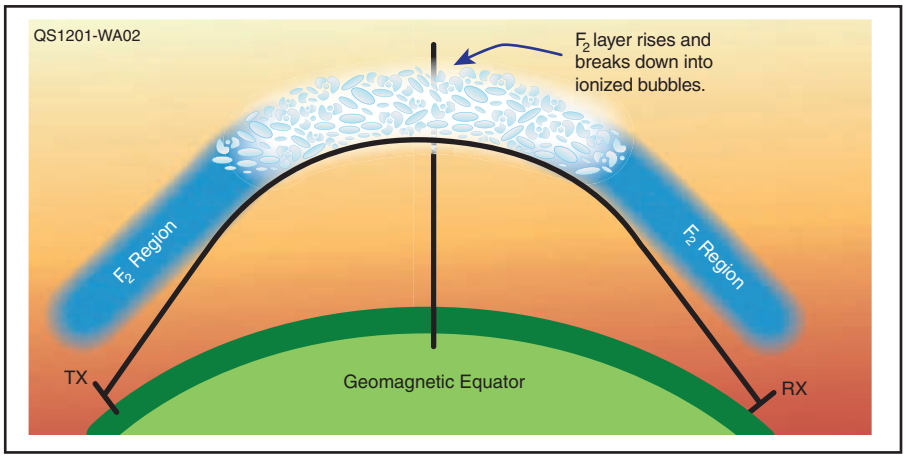

Figure 2 — After sunset the F_2 layer rises and begins to change from a consistent layer of ionization to a collection of ionized bubbles. A signal striking these bubbles is refracted pinball-like along the curve of the F_2 layer and eventually returns to earth.

■ Afternoon TEP can occur over very long paths, that is, Europe to Brazil, Argentina to Japan, etc. These may involve multiple hops from crest to crest.

Evening TEP

After sunset, Evening TEP begins to appear. It is thought to be due to ionospheric bubbles and plumes rising over the geomagnetic equator (see Figure 2). These plasma bubbles cause multiple refractive surfaces, similar to a giant ionospheric pinball machine. Signals via evening TEP often have a rapid flutter. At other times they are hollow sounding or resemble auroral signals. Doppler shift can be up to several kilohertz. Evening TEP can support much higher frequencies than afternoon TEP. This fall many 144 MHz contacts were reported between the Caribbean and Uruguay and between Argentina and Brazil.

In November, 2000 I worked Peter, PY5CC, on 144.200 MHz from Guadeloupe via Evening TEP. I was running only 10 W and a 2 element quad. Occasionally even 432 MHz contacts are made. The characteristics of Evening TEP are:

■ Occurs most frequently between 2000-2300 local time

■ Equinox months are the best

■ Signals are distorted with Doppler shift and multipath "TEP flutter."

■ Path lengths of 3000-9000 km.

■ MUF is much higher than Afternoon TEP, up to UHF at times.

Tips to Using TEP

For stations in the United States, the northern zone of TEP is usually limited to 40° magnetic North. So those south of this boundary — KP2, KP4, Florida, the Gulf Coast, Texas, Arizona, Hawaii and California — are able to work Afternoon TEP. During periods of high solar flux and geomagnetic activity, the TEP northern zone boundary may extend farther north.

Evening TEP is most stable during periods of low geomagnetic activity; high geomagnetic activity may disrupt it. Typical paths from the contiguous states are to CE, CX, LU and PY, but it may also occur to the South Pacific. E_s may "link" to TEP, allowing stations farther north of the TEP zone to make contacts. Unfortunately the best months for TEP — the equinoxes — have the lowest occurrence of midlatitude E_s. But TEP can be worked via E_s links during months of high E_s activity. This can occur in the months of May, September and December (minor E_s season peak).

Even in the northern hemisphere summer (worst time for TEP) I worked LW3EX in July, 2001 via E_s link to TEP on 50 MHz. E_s links occurred in September and again in October, 2011 for some fortunate stations. Close monitoring in the late afternoon and evening, plotting E_s paths and a little luck can help detect an E_s link to TEP. This is just a brief summary of TEP, there are many nuances to working it. I suggest reading the articles previously mentioned in the *QST* archives as well as the articles by Roger Harrison, VK2ZRH (**home.iprimus.com.au/toddemslie/aTEP-Harrison.htm**), Carl Luetzelschwab, K9LA (**myplace.frontier.com/~k9la/Trans-Equatorial_Propagation.pdf**) and Jim Kennedy's, K6MIO/KH6 (**www.bobcooper.tv/kh6-k6mio.htm**). My summary of TEP used their fine articles as references and one by John Kennewell and Phil Wilkinson, "Transequatorial Radio Propagation," at **www.ips.gov.au/Educational/5/1**.

ON THE BANDS

50 MHz. TEP was outstanding in October. From Hawaii, Fred, KH7Y, noted great conditions to South and Central America on October 1 working TI, CE, LU, PY. He worked CX9AU who had just purchased an FT-100 from a local and put up a 3 element Yagi on 6 meters that evening. The first 6 meter signal he heard when he turned his radio on was KH7Y calling CQ!

The 3rd had the South Pacific in for Fred, with FO4BM, FK8CP, VK4s and VK8s. He heard K6QXY work FK8CP. On the 4th he worked 3D2R just 7 hours before the DXpedition to Rotuma shut down. He found them first on 12 meter CW after hearing their 6 meter beacon 599. After a "long 30 minutes" 3D2R came up on 6 meter SSB and Fred worked them though a big JA pileup even with their antenna "fixed on Japan." 3D2R reported 186 contacts on 6 meters.

October 7 Chip, K7JA, reports working Remi, FK8CP, at 0150Z. The E_s that appeared over Mexico October 9-11 supported E_s links to TEP to the South Pacific. N5ORT (EM50) worked FK8CP on SSB running 100 W at 2341Z October 9. Orlin said "It was quite a thrill for me!" On the 10th, Terry, K4RX (EM70) worked FK8CP at 0011Z on CW. He says "Cycle 24 lives!"

N7KA (DM65) heard FK8CP at 0238Z. N5JEH, also in NM, logged Remi about the same time on both SSB and CW. FK8CP was spotted by many stations in Texas and was worked by WUØR Dallas and KØGU (DN70) Colorado at 0246Z. Jay, KØGU, reports he listened for FK8CP for 2 hours, heard him for only about 4 minutes. Jay received a "419" report from FK8CP. An interesting TEP/F_2 contact was reported on October 15 between PY7RP and A92IO at 2037Z.

Direct F_2 appeared on the morning of October 10 between New England and Africa. Lefty, K1TOL, worked 5N7M, a DXpedition to Nigeria at 1614Z! Lefty was spotted by EA7KW and CT1HZE who heard him via "skew path scatter." He heard 5N7M for almost 1½ hours, but the footprint was very small in New England. K1SIX, K1CP and K1AC also worked 5N7M.

T32C. Between October 1-24, 2011, 38 hams from 11 countries activated the Island of Kiritimati (Christmas Island), a part of the Republic of Kiribati using the call sign T32C in BJ12ha. They made over 200,000 contacts including 110 on 50 MHz. The group operated 6 meter EME using JT-65a and also terrestrial SSB/CW with a 50 W beacon. Their antenna was a 6M8GJ Yagi. Lance, W7GJ, worked T32C on 6 meter EME on October 16 at 0759Z (see Figure 3). This was Lance's 174th country on 6 meters, with 120 via EME.

On October 10 UTC T32C worked many stations in California then east as far as Arkansas via a presumptive E_s link. Phil, AF6A, worked T32C and FO4BM from San Diego around 0100Z as did many others. The footprint extended east and around 0220Z XE2OR (DL98), AG4V (EM55), K5UR (EM35) and N5ZM (EM34) worked T32C! The footprint to Arkansas and Tennessee was very small. This occurs often with an E_s link. K5SW (EM25) reported no signals from T32C when he heard AG4V and K5UR work them. Don, G3XTT, one of the T32C "pilot stations" commented "Wow, we certainly weren't expecting that!" T32C continued with 6 meter operation despite the amplifier "blowing up" the

COURTESY MIKE CHAMBERLAIN, G3WPH

Figure 3 — Michael, DG1CMZ (left) and Mike, G3WPH, the two team members who made the first EME contact with Lance, W7GJ, are shown here congratulating each other. Not shown is Bob, MDØCCE, the third member of the EME team.

DXSHERLOCK

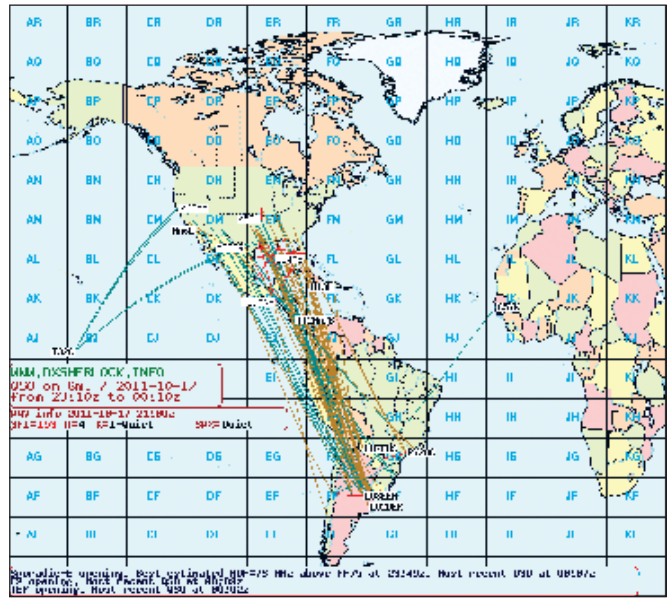

Figure 4 — More TEP with E_s links appeared the afternoon of October 17. LU8EEM (FF95) made many contacts with stations in Arizona, Florida, Texas and as far north as EM04. The good TEP and E_s persisted into the evening and helped the T32C contacts to AR and TN occur.

next day. On October 18, a number of stations in the Pacific Northwest worked them including Mike, KB7ME, at 0211Z. He reports that T32C was an honest 599 for 10 minutes.

More TEP with E_s links appeared the afternoon of October 17 (see Figure 4). LU8EEM (FF95) made many contacts with stations in Arizona, Florida, Texas and as far north as EM04 (KD5PBR), EM06 (KBØHH), EM25 (K5SW, K5CM), EM28 (NØJK), EM40 (KN5O), EM47 (NWØW) and DM52 (N2IC).

Another E_s-TEP opening occurred on October 20/21. K7TNT (DN74) worked ZL1RS at 0001Z. W7GJ and W7LR in Montana also worked ZL1RS a few minutes earlier. There were E_s from MT and WY to CA at this time. Phil, NØKE (DM69) had E_s for over 3 hours to CA while the ZL opening was in progress, but he was in the wrong place for it to form a link.

Aurora. A surprise aurora occurred the evening of October 24. A CME left the sun October 22 at 0100Z. The CME reached earth around 1800Z on the 24th. It was very geoeffective as it contained a "knot" of south pointing magnetic fields. "These fields partially cancelled Earth's north-pointing magnetic field at the equator, allowing solar wind plasma to penetrate deeply into Earth's magnetosphere."

Strong aurora was reported on 50 MHz starting around 2200Z. Radio aurora was worked as far south as Oklahoma, Arkansas and Alabama. Many saw the aurora as well. I set up portable in EM28 at 0100Z and logged W5KI (EM36), KA9FOX (EN43), KIØF (EN34), KØSIX (EN35), KØGU (DN70) and KF6A (EN73) on 6 meters. KF6A in Michigan reported working 56 stations on 6 meters during the aurora.

Two meter aurora reports were few. NØLL (EM09) said he worked W9RM (EN52) and K8TQK (EM89). NØDQS (EN22) also worked W9RM. Larry had only 8 contacts on 6 meter aurora. Tim, NWØW (EM47) reported VE3FGU (FN04) peaked "40 over S9" on 6 meters during the aurora. VE3FGU was strong in EM28 as well, working a large pileup.

After the aurora began fading, some unusual TEP appeared to South America from the central USA. K5CM Oklahoma worked PY2XB on 6 meters at 0300Z. PY2XB heard the W9DR/b (EM75) at 0358Z. It pays to watch for DX carefully after the breakup of an aurora and be alert the day after as well.

The following morning October 25 there was E_s from Oklahoma to Florida. Later F_2 with TEP opened from Florida, the Gulf Coast and Texas to South America. W5UWB (EL17) logged OA4TT and LU8YD. Jack, OA4TT, worked as far north at Dallas, Texas and was very loud into Florida. K6QXY worked OA4TT at 1718Z. That afternoon TX7M (DXpedition to the Marquesas Islands) showed up on 6 meters. They worked stations in Arizona, California, Colorado, Montana, New Mexico and Texas. TX7M made a total of 81 contacts on 6 meters. Chip, K7JA, logged TX7M at 1945Z. W5OZI spotted TX7M strong at 2247Z.

That evening TEP from the South Pacific to the southern states continued along with E_s links. W5KI (EM36) and K5YY (EM26) worked A35CT at 0214Z! Steve said A35CT was about 52, reportedly A35CT has only 10 W to a M^2 loop! W5KI also worked FK8CP. K7JA noted strong E_s to W5 from Southern California during the time frame the Arkansas stations made their contacts with the South Pacific, confirming an E_s link being present.

South Pacific DX continued October 26, with K7JA noting contacts with E51CG, VK4FNQ and VK4BKP around 0150Z. To wrap up October, Bob, K6QXY, worked ZL1RS on the 27th at 2244Z. He notes ZL1RS and FK8CP were in almost every day.

E_s. Paul, WBØBBC (EL96) logged YN2N on October 9 via E_s at 2351Z with a 54 report. Octavio was Paul's first YN on 6! Paul runs a modest station with 100 W to a Squalo up 20 feet. E_s also reported from Montana to California October 20 and Oklahoma to Florida October 25. On the 25th the E_s was widespread at times, with N7JW/b (DM37) heard in eastern Kansas for nearly an hour at 2215Z.

144 MHz. Few 144 MHz and up reports. Those I received are included in the propagation mode sections. One interesting report is from Jose, KP4EIT, who has made many 144 MHz TEP contacts to South America. On October 10, he worked CX2TQ. His best day was October 28, with many contacts in Argentina, Brazil, CX1DDO and CX6DH. NP2X also worked Brazil on October 17. NP2X has a 2 meter beacon beaming to South America for TEP on 144.291 MHz. It runs 25 W to a 15 element Yagi.

Tropo. Few reports of any widespread tropo for October. KA1ZE/3 (FN01) reported the WD4GSM/b (EM86) S-9 at 665 km on October 5 on 144 MHz on tropo.

HERE AND THERE

Central States VHF Society Conference. Jim Kennedy, K6MIO/KH6, presented a paper on solar cycle 24 detailing how the Stanford University's polar magnetic field measurements suggest strongly that the northern solar hemisphere (the source of most of the current sunspot activity) will reach its solar maximum in December 2011 or January 2012. This is about 11½ years since its last maximum (that is, a more or less normal cycle length, for the north, at least).

The same measurements suggest that the southern hemisphere will not reach its maximum for at least another year or two. This suggests a double peak, possibly with a gap in the middle. Then perhaps a second peak in 2013, similar to cycle 23's two peaks. Thus, I wonder if this fall and next spring may be "as good as it gets" for F_2 and TEP on 50 MHz. Other predictions are for a single peak between February and July 2013.

Quadrantids Meteor Shower. The Quadrantids meteor shower is predicted to have a visual and radio peak the evening of January 3. The peak is narrow, lasting only a couple of hours with up to 60 meteors per hour ZHR. The radiant is in the constellation Boötes.

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Nov 1-Jan 1, 0000Z-0000Z, HB9STEVE, Lugano, Switzerland. HB9ON Radio Group. Remembering Steve Jobs. All HF frequencies. QSL. HB9STEVE, c/o Fulvio Galli, In Piancamara, Origlio 6945, Switzerland. **www.qrz.com/db/hb9steve**

Dec 8-Dec 16, 0000Z-0000Z, BA1TX/K1NIU and BA1RX/K1NIU, Beijing, China. 2011 Beijing DXpedition. All HF bands. QSL. X. Rick Niu, 10 Whispering Hollow Ct, Cheshire, CT 06410. *Primary mode is SSB.* **www.qrz.com/db/BA1TX**

Jan 1, 1400Z-2000Z, WA5DTK, Llano County, TX. CenTex Contest Group. Lake Buchanan Lighthouse. 14.270 center of General Class Subbands. QSL. Barry Brewer, 601 Wagon Wheel Tr, Pflugerville, TX 78660. *Operating from the Lake Buchanan Lighthouse (USA-1408) in Llano County, Texas as part of the ARLHS Christmas Lights QSO Party.* **wa5dtk@arrl.net**

Jan 1-Jan 31, 0000Z-2359Z, K3Y, All cities, states and call areas. Straight Key Century Club. 6th Anniversary. 14.050 10.120 7.055 3.550. QSL. Dan Rhodes, KA3CTQ, 618 Seminole Dr, Erie, PA 16505. *Celebrating six years of steady growth to over 8500 members on CW.* **www.skccgroup.com**

Jan 2-Jan 8, 0000Z-2359Z, W2V, Bethpage, NY. New York City/Long Island Section. Ham Radio University/NLI Section Convention. 14.260 14.070 7.250 7.035. QSL. Philip Lewis, N2MUN, 22 Belle Terre W, Lindenhurst, NY 11757. *Special Event Station W2V will be operated by the Ham Radio University committee and moderators all week using all modes and bands, including ARRL RTTY Roundup. QSL to Phil Lewis, N2MUN with SASE, LOTW and eQSL. DX stations can use W2 Bureau to N2MUN.* **www.qrz.com/db/w2v** *or* **www.hamradiouniversity.org**

Jan 7, 1600Z-2000Z, WØCS, Clinton, IA. Clinton Amateur Radio Club. Eagle Watch on the Mississippi Lock and Dam #13. 14.265 14.055 7.265 7.055. QSL. WØCS, PO Box 1501, Clinton, IA 52733-1501. *Eagle Watch sponsored by US Corps of Engineers.*

Jan 14, 1400Z-2200Z, KE4HAM, Bluffton, SC. Sun City Hilton Head Amateur Radio Club. 224th Anniversary of South Carolina Statehood. 28.485 21.285 14.285. Certificate. KE4HAM, 19 Rose Bush Ln, Bluffton, SC 29909.

Jan 14, 1600Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. US Navy Seal Teams Established 1962; USS *Nautilus* First Ship Underway on Nuclear Power 1954. SSB 14.320 7.250 PSK31 14.070 D-STAR 012C 2 m 70 cm SOCAL rptrs. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101-5811. **kk6fz@arrl.net**

Jan 16-Jan 29, 0000Z-2300Z, W7Q, Quartzsite, AZ. Quartzfest 2012. 14.250 7.250. QSL. K7PO, PO Box 277, Tonopah, AZ 85354. *Quartzfest is a gathering of Amateur Radio Operators in RVs near Quartzsite, AZ.* **www.quartzfest.org**

Jan 18-Jan 19, 1700Z-0500Z, NA1CC, Cape Cod, MA. Area amateurs. Commemorating the Anniversary of the First US-EU Radio Communication. CW only, 28.025 24.905 21.025 18.083 14.025 10.115 7.025 3.525 especially when open to EU. QSL. Wes Baden, PO Box 499, South Orleans, MA 02662. *Marconi wireless station CC, Cape Cod, MA, completed the first US-EU radio communication on the night of January 18, 1903. Skeds, particularly EU, welcome.*

Jan 28, 0300Z-1200Z, WD6RAT, Palm Springs, CA. Desert RATS Club. Palm Springs Hamfest 2012. 14.251 7.251. QSL. Desert RATS Club, PO Box 1167, Palm Springs, CA 92264-1167. **desertrats.am**

Jan 28-Jan 29, 1600Z-2300Z, AG6AU, Coloma, CA. El Dorado County Amateur Radio Club. 164th Anniversary of the Discovery of Gold in California. 21.348 14.248 7.248 AG6AU repeater. QSL. EDCARC, PO Box 451, Placerville, CA 95667. *From the Marshall Gold Discovery Site in Coloma.* **www.edcarc.net**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is available at that site. You may also request a copy by mail or e-mail. Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Mar** *QST* would have to be received by **Jan 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through Nov 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Strays

US ADVENTURE RACE ASSOCIATION PUBLIC SERVICE EVENT

♢The USARA National Championship Extreme Racing event was held October 7-8, 2011 in McCreary County, Kentucky. This race is a cross country extreme Ironman type of event consisting of three person coed teams from across the US who compete in Hiking, Biking, Canoeing and Orienteering.

Communications support consisted of several members of Region 5 ARES® members from McCreary, Pulaski and Whitley County. A number of members met at Whitley City prior to moving into position at one of six different Transition Areas. NCS operations were established by members of the Lake Cumberland ARA and several ARES groups. After moving into position the operators started reporting arrival and departures of each team at each of the Transition Areas. — *Randall E. Gilreath, AD4WB, DEC, District 11 ARES Kentucky Section*

RANDALL GILREATH, AD4WB

Don Munsey, AC4DM, and Robert Miller, KY4KAT, at Net Control during the Extreme Racing event in Kentucky in October.

QST congratulates…

♢Dr Vincent A. Barr, WK4G, of Denver, Colorado, who turned 100 on November 4, 2011. Dr Barr earned his Amateur Radio license after retiring from a 40 year dental practice in Kentucky. — *Betty Barr*

♢Kevin Baxter, KD8OPX, of Middlefield, Ohio, who has been appointed Tenth District Youth Corps Coordinator. The ARES® Tenth District Youth Corps is a team of volunteers with the mission to educate young people about not only ham radio but specifically the Amateur Radio Emergency Service. — *Matt Welch, W8DE*

AB1FM

EXAM INFO

Extra Question Pool Update, Web Resources for VEs

New Extra Question Pool to Take Effect July 1

Effective **July 1, 2012** a new Element 4 Extra class question pool takes effect for examinations. VECs and VEs will have new test designs available for use at exam sessions effective that date.

The newly revised pool released in December 2011 by the Question Pool Committee (QPC) of the National Conference of Volunteer Examiner Coordinators (NCVEC) must be in use starting July 1. There are 12 graphics required for this pool. The new pool has been updated for content; any content that has become less relevant over time or technically inaccurate has been deleted. The QPC can be reached by e-mail at **qpcinput@ncvec.org**.

With the Extra class exam questions changing **July 1**, new test designs must be used effective that day. ARRL VEC will be supplying all its (over 1000) Field Stocked VE teams with new test booklet designs about the 3rd week in June. ARRL VEC VE Exam Maker Software will also be updated and be available about mid-June 2012. Previous ARRL VEC supplied Extra class test booklets versions (2008 series) and computer generated Extra class tests created from the 2008 question pool are only valid until midnight June 30, 2012. At that time VE Team leaders may destroy the old versions of the Extra exams.

All current question pools can be found on our web page, **www.arrl.org/question-pools**.

2012 Test Fee Remains at $15

The ARRL VEC Test Fee for 2012 will remain at $15. Remember that a $15 fee is charged to every person seeking a new license or upgrade as listed on your ARRL VEC Candidate Roster form. That one fee pays for one attempt at each of the three exam elements. If an applicant retests an exam element that was failed moments earlier, another $15 fee is charged (and another roster entry is created).

Register Your Exam Session and Order Supplies via the Web

ARRL VEs can register Amateur Radio exam sessions and order exam supplies via our interactive web forms.

Register an ARRL VEC Amateur Radio License Exam Session at **www.arrl.org/register-an-amateur-radio-license-exam-session**. ARRL VE Teams that have been formally Field-Stocked with exams by ARRL VEC may restock their exam supplies via the online VE team restock form at **www.arrl.org/field-stocked-ve-teams**.

ARRL VEs simply complete the required form fields and click on the submit button. If the form is incomplete, "red" highlights will appear with a note that says "This field is required" to show the user where the form requires additional information. Otherwise, a confirmation message appears on screen to verify the registration or restock order has been received by the ARRL VEC.

Completed online exam registration forms will automatically be sent to the VEC Department for review and release to the exam search web page, **www.arrl.org/find-an-amateur-radio-license-exam-session**. It normally takes a couple of business days for us to upload the approved listing.

Question Pool Schedule

- Technician class (Element 2) Pool effective July 1, 2010 is valid until June 30, 2014.
- General class (Element 3) Pool effective July 1, 2011 is valid until June 30, 2015.
- *Current* Extra class (Element 4) Pool effective July 1, 2008 will expire June 30, 2012.
- **New** Extra class (Element 4) Pool released December 2011 will become effective July 1, 2012 and will be valid until June 30, 2016.

2012 ARRL National Exam Day Weekends

ARRL sponsored national exam day weekends are held annually on the last full weekends of April and September.

- April national exam day weekend is April 28-29, 2012.
- Fall national exam day weekend is September 29-30, 2012.

We thank you for your support of these events!

ARRL VEC Staff is Ready to Serve You

Maria Somma, AB1FM
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Web Resources for ARRL VEs

The ARRL VEC VE support page, **www.arrl.org/resources-for-ves** offers useful resources for ARRL VEs. The information you will need to help conduct exam session business has been compiled in this one location for your convenience.

- Link to the Amateur Radio Question Pools and keep up to date on the current pools as well as questions formally withdrawn from use by the National Conference of VECs QPC.
- View the List of Current ARRL VEC Exam Booklets. VE Teams officially Field-Stocked by the ARRL VEC with a bulk quantity of our exam materials should check our VEC Exam Booklets page periodically to ensure your VEC printed exam booklets are up-to-date.
- Generate and print exams using the ARRL VE Exam Maker Software program.
- Download and print all ARRL VEC exam session forms or print individual exam forms. All ARRL VEC forms, except for the CSCE (Certificate of Successful Completion of Examination) form, may be duplicated. Contact the ARRL VEC for a supply of CSCE forms.
- Access FCC Amateur Radio Service Rules and Regulations, particularly Subpart F, which pertains to the rules governing the VEC program.
- Candidate information, which includes a detailed list describing the items candidates are required to bring to the exam session and the items they are prohibited from using during the test, FCC rules and VE instructions related to exam element credit, resources for the disabled and Amateur Radio practice exams.

We hope you find these pages and features straightforward and effortless to use.

Maria Somma, AB1FM ♦ ARRL VEC Manager ♦ msomma@arrl.org

K2TQN

VINTAGE RADIO

AWA's Founding Members

Bruce Kelley, W2ICE, was a visionary who recognized others had good ideas and implemented them to found the Antique Wireless Association (Jul 2007 *QST*), He was a natural leader and his enthusiasm was infectious. He was able to recruit friends and strangers alike who shared his love for radio history to work with him. The AWA is 60 years old this year and has amassed one of the world's largest radio collections. Most were donations, and are from members who wanted to share their collections with future generations.

What began six decades ago will evolve into the world's premier and most important radio and electronic communications history museum, opening summer 2013. The new AWA Museum and Research Campus will be located in Bloomfield, New York, just two miles east of the present AWA Museum on Routes 5 and 20 in upstate New York.

During this year I will present the history of some of the AWA's founding members. Here is the first one: In July 1976 I attended a hamfest in Philadelphia, associated with the bicentennial. If I remember correctly it was located in the Ben Franklin Hotel. While there I met Ed Raser, W2ZI. He had a display of early ham radios and I stopped and listened to him for a while. He invited me to visit his early radio museum in his home after the hamfest, an invitation I have regretted turning down for many years. At that time I was all consumed with the new personal computers and running the PC76 show that August and I told myself I didn't have time. Ed had a world-class radio museum, one of only a very few in the US.

After a few years I had had my fill of PCs and I came back to ham radio and started collecting. By then, however, I had missed the good early years of collecting, a time when vintage radios were unwanted and cheap. Later on, I got to know Ed quite well through his letters and friends. What follows is a collection of stories and photos of his life and radio career. Ed was also an early-radio historian, gathering all the information he could. And he gathered it from the pioneers who developed radio and from the early hams who participated in its development.

Ed also documented his radio hobby and career with a large collection of photographs. The story following has some of his photos added. This month's installment shows his early ham stations. Next month we will continue with his seagoing career as a wireless operator, starting in 1919.

The following is taken from the *OOTC Spark-Gap Times*, Aug-Sep 1969, Vol 8, No. 10. I am deeply indebted to the Old Old Timers Club for documenting this story. Visit them at **www.ootc.us/**.

Edward G. Raser, W2ZI, Wireless Pioneer (SK)

One of the really great wireless pioneers and long active member in the Old Old Timers Club is Ed Raser. Here for the edification of the OOTC membership is the story of his illustrious radio life. (Written while Ed was a director of the OOTC, by Fred C. Crowell, Jr, W9MIB, Editor.) [lightly edited]

This is the story of one amateur radio operator who has really lived over a half century of wireless and radio. His early interest in wireless soon developed into a lifetime of activity which has dominated most of his waking hours, providing a satisfying career as well as rewarding friendships among the amateur fraternity.

Experimenting with coherer detecting devices as early as 1908 at the age of nine, Ed joined up the next year with Hugo Gernsback's Wireless Association of America, one of the earliest wireless clubs in the world. By 1910 he had worked a distance of ten miles with a quarter-inch spark coil, homemade tuner, a piece of silicon mineral, and a 75-ohm telephone receiver. The call letters were then "RE", his initials in reverse.

After the Radio Law of 1912, he made

Ed Raser's 1914 wireless shack at his mother's home.

Ed's first ½ kW spark rig at his mother's home, gear all hand made, Leyden jars were mothers fruit jars filled with salt water, worked FB!

Half-kilowatt spark transmitter "3CS" from 1919 to 1922, equipment is all home built, called it "Big Bertha," receiver is regenerative 150-700 meters with Moorhead Audion Detector and 2 stage amplifier. Commercial marble base key and Baldwin phones.

Mrs Paulie Raser, XYL, operating "3CS" 1 kW spark set, remote controlled in cellar, 1923. Receivers from left, long wave, and Paragon RA-6 short wave.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

1928 — 50 W "Hartley" transmitter in the attic, remotely controlled from the shack. Antenna used — semi vertical cage with "V" type counterpoise.➢

➢1928 shack receivers and controls for remote transmitter in attic.

1940 shack used for Second Corps Area Army-Amateur Radio System.

1947 — Ed's last 1 kW rig, on the right, and 75 W phone set behind the typewriter.➢

1961 — National NC-100, Collins 75A4 receivers, Viking Ranger and Collins 32V3 transmitters and Johnson Match Box tuner.

his appearance at the Philadelphia Navy Yard and took the examination for a First Grade license. He recalls that the license was signed by a Lt. S. S. Payne, USN, as the Navy was the only government agency authorized to conduct examinations at that time. His brand new call letters were then 3NG. By 1915 he was working stations 400 miles away with a ½ KW Packard transformer and homemade rotary gap, using only a galena mineral detector, loose coupler and Brandies phones for receiving.

The impending war in Europe put an end to his experimenting. So not to be completely frustrated, he enlisted in the Navy as a wireless operator, and served a three-year hitch aboard various ships and at shore stations. During this period, while serving on detached duty at the Cape May Naval Air Station, he installed and test hopped the first E. J. Simon ¼ KW, 500 cycle spark sets ever to go aloft in an airplane, and using long trailing wire antenna. Other duty stations were on sub-patrol boats, and after hostilities ceased, at coast stations NAH, NAI and NSD.

In April 1915 Ed had joined up with the then newly organized American Radio Relay League. He became the 381st member of this organization, which now has over 100,000 members throughout the U.S. and Canada. He immediately became active in long distance relay and traffic handling, and was assigned in May 1916 to old Trunk Line C, the then very busy line operating between Boston and Washington, D.C. He also was one of the first ORS (Official Relay Station) appointees in 1922, the year when this appointment was created. During his some 47 years of traffic work, dedicated to serving the public and amateur radio, Ed has held all ARRL field positions and appointments, as well as that of elected Director of the League for a two-year term.

In 1922 he received Special Amateur Station License number 9, and with it the call letters 3ZI. This allowed him special wavelengths out of the 200-meter amateur band for long distance relaying of messages. He and Irving Vermilya, WIZE, are the only two original east coast "z calls" left on the air today as far as it is known-all others are reassignments. Other early two-letter calls were: 3NG and 3CS, both well known sparks until 1924.

Amateur radio-wise, having passed through all the various stages of spark transmission from ¼ inch spark coil to the booming 1 KW sync-spark set in the middle 20's, Ed finally saw the light when a little 7½ watt tube began to run rings around his "Big Bertha." In late 1924 he gave in to the less noisy tweet of the CW signal. Then came the 5 watt "Colpitts" and "TNT" circuits, with basketweave coils and honey-comb tuners, all of which led up to the present pretty desk-top gear of today.

Continued next month. — *K2TQN*

All photos by W2ZI

WB8IMY

ECLECTIC TECHNOLOGY

AMSAT-UK App to Fly on STRaND-1

You may recall the story in this column last year about the pending launch of the STRaND-1 satellite in 2012. To refresh your memory, this unique satellite will carry an unmodified Android smartphone to test whether it is possible to use ordinary smartphones as the "brains" of small satellites for scientific research and Amateur Radio purposes.

A few months ago the space technology experts from Surrey Satellite Technology (SSTL) and the Surrey Space Centre (SSC) at the University of Surrey in the United Kingdom announced the winners of a competition to design Android apps for use on the STRaND-1 smartphone. Four winners were chosen for their app's scientific benefits, creativity or ability to get young people enthusiastic about science and technology.

The winners included the AMSAT-UK team behind the FUNcube Amateur Radio educational satellite. Their *STRaND Data* app will display satellite telemetry on the smartphone screen, which will then be captured and relayed to Earth by an on-board camera.

To find out more about the progress of the STRaND-1 mission, follow **@Surrey Nanosats** on Twitter. Or visit the STRaND Facebook page, **www.facebook.com/nanosats**.

A "FANLESS" PC POWER SUPPLY?

If you have a computer in your station you probably know that one of its noisiest components is the fan within the switching power supply. Cooler Master claims to have calmed the roaring beast with their new Silent Pro Hybrid fanless power supplies.

Calling these power supplies "fanless" is a stretch. They do indeed sport fans, but the blades only spin up when the load exceeds a 200 W threshold; otherwise they are utterly silent and immobile.

It is difficult to say whether the average Amateur Radio software package would place enough of a load on a computer to trigger a Silent Pro fan. Much depends on whatever else you have going on at the time. Unless you are simultaneously running every possible application and throwing in a USB coffee warmer for good measure, the fan would probably remain inactive.

When you factor in the modular cables and a control panel that lets you manually adjust the speed of your system fans, you're looking at an interesting product for the ham who likes to build his station computer. Of course, all this comes with a price tag substantially higher than your ordinary PC power supply. Cooler Master is offering three different models: 850 W, 1050 W and 1300 W, which range in price from $200 to $300. You'll find more information online at **www.coolermaster-usa.com**.

The Cooler Master "fanless" computer power supply.

UHF CLOTH ANTENNAS

Last year I mentioned that the Finnish company Patria was exploring wearable antennas that could be sewn into various fabrics. Now the first of these antennas appear to be coming to market, initially in the form of an antenna incorporated within a marine life vest. The antenna is designed to be coupled to a Cospas-Sarsat search-and-rescue beacon transmitter operating at about 406 MHz. When activated, the beacon signal is picked up by a Cospas-Sarsat satellite and the location of the transmitter is determined almost immediately.

This wearable antenna is able to send a UHF signal to satellites using the Cospas-Sarsat worldwide search and rescue satellite system. It is made from highly flexible, lightweight material that is robust against water exposure and moist conditions and resistant to wear and tear.

The beacon antenna is made from highly flexible, lightweight material with embedded metallic fibers. It's waterproof and highly resistant to wear and tear. Field trials this year demonstrated that the location of someone lost at sea could be pinpointed within minutes. The life vests are designed and sold by Viking Life Saving Equipment, based in Demark.

A NEW APPROACH TO LONG RANGE WIFI?

Curious amateurs have been connecting high-gain antennas to consumer-grade 2.4 GHz wireless network routers to see just how far they can swap data. When this column went to press, the unofficial record was about 90 miles.

But Mike Morris, WA6ILQ, tipped me to a company that claims to have created a method for doing long-range WiFi *without* gain antennas. A San Diego company called On-Ramp Wireless has unveiled a 2.4 GHz transceiver that uses a form of highly sophisticated signal encoding/decoding known as *Ultra-Link Processing*. This processing scheme allegedly makes it possible to exchange data over paths measuring 10s of miles using milliwatt power levels and omnidirectional antennas. The catch, however, is that the data rate is quite low. As digitally active hams will tell you, if you can't use RF power and gain antennas to break through, the alternative is to reduce the data rate and toss in redundancy to boot. JT65, for example, uses this approach.

The On-Ramp Wireless system uses Direct Sequence Spread Spectrum, trading a low bit rate for maximum coverage. Their customers are public utilities building, so-called SmartGrid networks, but there may be something worthwhile here for Amateur Radio as well. More information is available on the Web at **http://onrampwireless.com/technology/**.

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

W1GHZ

MICROWAVELENGTHS

Rain — Friend and Foe

For most portable ham operation, rain is an unpleasant problem, but for 10 GHz portable operation, it is a mixed blessing. Rain scatter can provide enhanced propagation and the possibility of contacts over obstructed paths, but rain can bring lessons in preparation and design as well.

Microwave signals are best scattered by rain drops whose size is at least a tenth of a wavelength. A wavelength at 10 GHz is 30 mm, a bit over an inch, so the large drops found in heavy rain can scatter 10 GHz signals effectively. The falling rain adds Doppler shift to the signals, distorting them with an aurora-like sound, but easily copyable on CW and sometimes SSB. The signal is scattered in many directions, enabling propagation over paths that are normally obstructed. Commercial microwave links carrying data are often disrupted by heavy rain — they can't handle the distortion as well as our ears can. A good description of rainscatter by WA1MBA may be found at **www.wa1mba.org/10grain.htm**.

This past August, I was operating the ARRL 10 GHz and Up contest from the top of Mt Mansfield in Vermont with Mike, N1JEZ and Chip, W1AIM. We were doing pretty well, and keeping an eye on an approaching storm. N1JEZ moved his dish under cover and I got a clear plastic garbage bag over mine before a squall hit, but W1AIM didn't have time. Figure 1 shows the ¼ inch hail pelting the area.

After the squall passed, we could hear rain scatter on some signals. We called Ray, VE3FN, on Mont Tremblant in Quebec, FN26rf — earlier attempts had been unsuccessful since the mountain obstructs the path — and asked him to start sending CW while we searched for his signal. Mike quickly found the signal (see Figure 2) on his Funcube Dongle Pro (**www.funcubedongle.com**) panadaptor and peaked it, while I found a stronger peak at a different heading — obviously multiple rain showers were present. We both quickly made a contact, then alerted other New England stations. Ray started calling CQ and made a number of contacts as the rain showers moved through New England. It is possible to call CQ on 10 GHz and get an answer!

Meanwhile, Chip had heard nothing. He emptied some rain water out of his feedhorn, Figure 3, then borrowed a hair dryer from the TV transmitter engineer to dry out the horn, Figure 4. We have successfully rejuvenated wet microwave equipment in the past with a hair dryer, but no luck this time. Rain had gotten into the electronics as well as the feed horn.

Mike and I were able to make some additional rain scatter contacts using internet weather radar plots to locate storm cells. Then we used 2-meter liaison to get other stations aimed at them as well. We used smartphones for internet access, but this may be difficult in remote locations with poor cellphone coverage. In the past, we have relied on the cooperation of home stations with internet access for storm location. (Please note that some other contests may not allow various assistance to make contacts.)

A more sophisticated approach is the RainScatter program by Andrew Flowers, KØSM, (**www.frontiernet.net/~aflowers/rainscatter/**), which uses National Weather Service radar data directly from the internet to identify and map potential rainscatter propagation.

Figure 1 — Rain and hail on Mt Mansfield, Vermont during the 2011 10 GHz and Up Contest.

MIKE SEGUIN, N1JEZ

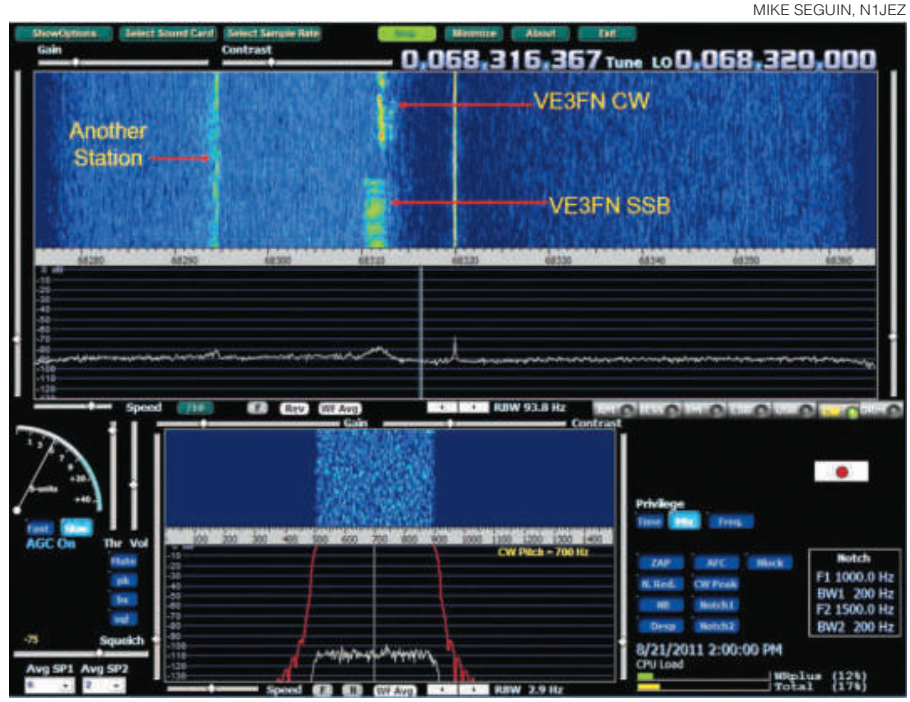

Figure 2 — 10 GHz rainscatter signals seen on a panadaptor.

Paul Wade, W1GHZ ♦ 161 Center Rd, Shirley, MA 01464 ♦ w1ghz@arrl.org

Figure 3 — Water in feedhorn.

Figure 4 — Chip, W1AIM, drying out feedhorn with hair dryer.

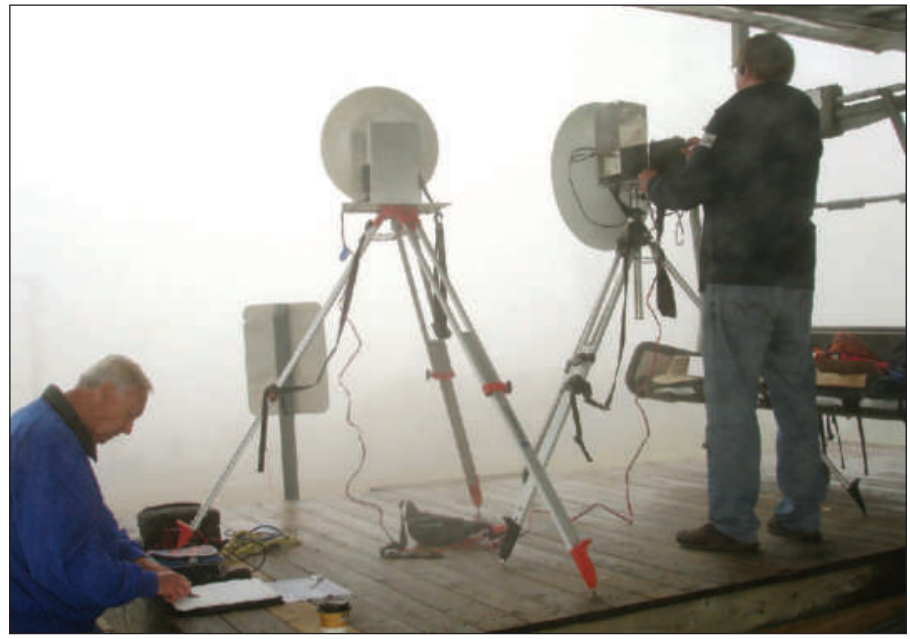

Figure 5 — Ray, VE3FN, operating 10 GHz in the clouds with Doug, VE3XK, manning 2 meter liaison.

Troubleshooting

W1AIM did not get his rig going again that day, but was able to repair it later. He found some soldering flux had been left on a three-terminal regulator which was apparently conductive when wet. Scraping off the flux cured the problem. I remove excess flux from microwave circuits, but usually leave it on dc circuits — it seems to have no effect, but I've never tested it wet. Solder with low-residue flux like Kester 245 or Multicore X39B is preferable anyway.

Normally, I have a spare 10 GHz transverter which I could have lent to Chip, but it had failed earlier in the day. It had exhibited intermittent behavior on previous portable operations, so I ran it for a week before the contest with no problems. Naturally, it failed after less than an hour in the field.

After the contest, I was determined to fix the intermittent problem. I ran it in the basement listening to a weak-signal source for several days with no problem, so I thought it might be related to temperature variations outdoors. I first applied a hot air gun to the case until it was too hot to touch — this only produced some drift. Since it was a cool day, I took it outdoors. It ran fine for a while, and I was about to head back inside to try some freeze spray when it failed — the signal disappeared.

I carefully moved the rig back inside, keeping it powered up to keep it in the failed state. I opened the cover and wiggled all the wired and cables with no change. Then I started disassembly. When I loosened the clamps holding the DB6NT transverter module in place, I heard some intermittent noise bursts — now I was on the right track.

I took the cover off the module and starting poking components with the wooden end of a Q-tip, to no avail. Mike had mentioned once having trouble with a broken chip capacitor in a similar module, so I put the module under a microscope and went over it a millimeter at a time. I finally found a cracked solder joint on the chip capacitor near the 10 GHz receive SMA connector — a location that might be stressed when installing cables and tightening connectors. The crack was difficult to see even with magnification, but it was enough to keep from hearing anything. Touching up the solder joint cured the problem — the rig operated flawlessly for the second weekend of the 10 GHz contest in September. Fortunately, we didn't have any rain. Unfortunately, we didn't have any rain scatter.

Lessons

Heating and cooling is an old trick for troubleshooting electronics. Many problems can be localized by heating or cooling — a hot air gun or even a soldering iron held close to a component for heating, and a can of freeze spray or an ice cube in a plastic bag for cooling.

Before taking equipment out for portable operation, it's a good idea to make sure it will operate over a reasonable temperature range. Oscillators in particular can be fussy about temperature. A reasonable temperature range might be a little more extreme than you expect to experience — a New England mountaintop can dip below freezing, while a Texas summer day can be well over 100 degrees.

Be sure to keep rain out of the equipment, or you might miss the rain scatter. Attempts to seal the box are not always successful. I find the clear plastic garbage bags to be quite effective — bungee cords help to hold them in place, and spares are cheap if wind does take one away. And they seem to be transparent to microwaves as well, so we can operate in the rain.

Operating in the rain can be unpleasant if you are not prepared. My equipment is set up for remote operation with long cables, as seen in Figure 1. In some locations, you can operate under cover, like VE3FN in Figure 5. Or you can just stand out in the rain in your foul weather gear — and get soaked if it isn't adequate. I've been there and don't recommend it.

AT THE FOUNDATION

ARRL Foundation Scholarship Application Period Closes February 1!

The application period for the ARRL Foundation Scholarship awards closes February 1.

More than 80 scholarships for the 2012-2013 academic year will be awarded in the spring of 2012. If you are a young radio amateur pursuing higher education, this is your opportunity to apply for a scholarship to help pay for your education. Information about all of the awards, including selection criteria, application instructions and application forms, can be found on the web at **www.arrl.org/scholarship-program**. Applicants are urged to review the scholarship descriptions and apply *only* for those awards for which they qualify.

The application process is now completely electronic. Paper applications are not accepted. In addition, applicants must submit a complete and current electronic transcript, which can be attached to the application.

The prestigious William R. Goldfarb Memorial Scholarship is open only to high school seniors. Applicants for the Goldfarb Scholarship must submit a transcript and a FAFSA (Free Application for Federal Student Aid) is required, based on the most recent available federal tax information. This family financial statement must also be attached electronically to the student's application.

A special note for Amateur Radio Clubs: You can help young hams in your area by including this scholarship information in your next club newsletter or on your club website. Please also share it with members, especially students and their parents, at your next club meeting.

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

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 BULLITEN				
7 PM	8 PM	9 PM	10 PM	0300	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0400	CODE BULLETIN				

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 WPM.

Code bulletins are sent at 18 WPM.

♦ W1AW Qualifying Runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted by K6YR and other West Coast stations on 3590 kHz and other frequencies. See "Contest Corral" in this issue. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ Digital transmissions: Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent using 45.45-baud Baudot, PSK31 in BPSK mode and MFSK16 on a daily revolving schedule.

Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern Time using Baudot and PSK31.

♦ Voice transmissions: Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour and CW on the half hour.

W1AW code practice and CW/digital bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions.

During 2012, Headquarters and W1AW are closed on New Year's Day (observed January 2), Presidents' Day (February 20), Good Friday (April 6), Memorial Day (May 28), Independence Day (July 4), Labor Day (September 3), Thanksgiving and the following day (November 22 and 23) and Christmas (December 25). For more information, visit us at **www.arrl.org/w1aw**.

Strays

SAN DIEGO CLUB DONATES ARRL LICENSE MANUALS TO AREA LIBRARIES

◊The San Diego Amateur Radio Council (SANDARC) has donated 77 *ARRL General Class License Manuals* to be placed in each of the City and County Libraries. This is the fourth time that SANDARC has purchased these books to be donated to local area libraries. In recent years, every time the question pool has been updated for the Technician, General and Amateur Extra class, SANDARC has donated the latest study guide. — *Paul Rios, KC6QLS*

PAUL RIOS, KC6QLS

Mike Maston, N6OPH, the SANDARC Chair, is pictured delivering the books to Jessie Goodwin, the Librarian at the New La Mesa Library. A few days earlier Mike had delivered the *License Manuals* to the City of San Diego Libraries.

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

QUARTZFEST CONVENTION

January 21-28, Quartzsite, AZ

F H S V

The Quartzfest Convention (Annual Amateur Radio "get-together" and RV'ers Boondocking Event), sponsored by the Quartzfest Organizers, will be held at the Road Runner BLM Campground, US 95 at La Paz Valley Rd. Doors are open 9 AM to evening. Features include an entire week packed full of scheduled seminars and activities, technical information, "Get on the Air Workshop," Antenna Shootout, hidden transmitter hunting, VE sessions, Special Event Station W7Q, RV camping, and much more. Talk-in on 146.55. Admission is free. Contact Steve Weed, KO4QT, 27452 Pass Rd, Hot Springs, SD 57747; 619-733-2320; **quartzfest2012@yahoo.com** or **organizer@quartzfest.org**; **www.quartzfest.org**.

California (Palm Springs) — Jan 28
D F H R S T

9:30 AM-5 PM. *Spr:* Desert Radio Amateur Transmitting Society of Palm Springs. The Boskovich Estate, 4193 Matthew Dr. 3rd Annual Event. *Tl:* 146.94 (107.2 Hz). *Adm:* $1. Tables: Free. Peter Reinzuch, VE7REZ, 11445 Western Ave, Desert Hot Springs, CA 92240; 760-318-0186; **ve7rez@desertrats.am**; **desertrats.am**.

Colorado (Loveland) — Jan 21
D F H R S T V

8:30 AM-2 PM. *Spr:* Northern Colorado ARC. The Ranch - Larimer County Fairgrounds, 5280 Arena Cir. *Tl:* 145.115 (100 Hz), 146.52. *Adm:* $5. Tables: advance $12, door $17. Charles Hess, KDØGMW, 5502 Tripp Ct, Fort Collins, CO 80525; 970-667-4357; **sales@667help.com**; **www.ncarc.net**.

Florida (Arcadia) — Jan 28 D F H R T V

6 AM-1 PM. *Spr:* DeSoto ARC. Turner Civic Center Exhibit Hall, 2260 NE Roan St. *Tl:* 147.075 (100 Hz). *Adm:* $5. Tables: $10. Doug Christ, KN4YT, 2200 NE Roan St, Arcadia, FL 34266; 863-266-4206; fax 863-993-4840; **kn4yt@yahoo.com**; **desotoarc.org**.

Florida (Fort Myers) — Jan 21 D F H R S T

8 AM-3 PM. *Spr:* Fort Myers ARC. Araba Shrine Auditorium, 2010 Hanson St. *Tl:* 147.345 (136.5 Hz). *Adm:* $5. Tables: $15. Laing Batchler, NT4TS, 2602 NW 15th St, Cape Coral, FL 33993; 239-214-0005; **kb3tshl9ts@hotmail.com**; **fmarc.net**.

NORTHERN FLORIDA SECTION CONVENTION

February 10-12, Orlando

D F H Q R S T V

The Northern Florida Section Convention (66th Orlando HamCation® and Computer Show), sponsored by the Orlando ARC, will be held at the Central Florida Fairgrounds, 4603 W Colonial Dr (SR 50). Doors are open Friday noon-6 PM; Saturday 9 AM-5 PM; Sunday 9 AM-2 PM. The theme for the 2012 Orlando HamCation® is "Ham Radio - Always An Exciting Experience." Features include swap tables, commercial booths ($300), major vendors, tailgating ($35 for the weekend, plus admission), RV camping with water and limited electricity ($25 per night, no reserved spaces), VE sessions (two sessions on Saturday, 9 AM and 1 PM, pre-registered only; Joe, N4UMB, **hamcationtesting@cfl.rr.com**), forums on various subjects of interest, foxhunt, Special Event Station, QSL card checking, handicapped parking, free parking. Talk-in on 146.76, 147.015. Admission is $10 in advance (by Jan 22), $12 at the door (good for the entire 3 days); under 12 free with paid adult. Swap tables are $45 (per 8-ft table for the entire weekend, plus admission). Contact Orlando HamCation®, Box 547811, Orlando, FL 32854-7811; 407-841-0874 or 800-214-7541; **info@hamcation.com**; **www.hamcation.com**.

Florida (Tampa) — Jan 14 D F H Q R T V

8 AM-1 PM. *Spr:* Tampa ARC. TARC Clubhouse, 7801 N 22nd St. TARCFest XXVI.V. *Tl:* 147.105 (146.2 Hz). *Adm:* $2. Tables: $15. William Bode, N4WEB, 14302 Capitol Dr, Tampa, FL 33613; 813-382-9262; **n4web@hamclub.org**; **www.hamclub.org**.

GEORGIA ARES CONVENTION

January 21, Forsyth

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The Georgia ARES Convention, sponsored by the Georgia ARES, will be held at the Georgia State Public Service Training Center, 1000 Indian Springs Dr. Doors are open 9 AM to 4 PM. Features include technical demonstrations, ARRL booth. Talk-in on 146.58. Admission is free. Contact Mike Brown, KE4FGF, 927 Enon Rd, Coolidge, GA 31738; 229-226-5060; **ke4fgf@arrl.net**; **www.gaares.org**.

Georgia (Lawrenceville) — Jan 14
F H Q R S T V

10 AM-2 PM. *Spr:* Gwinnett ARS. Gwinnett Medical Center Resource Center, 665 Duluth Hwy (GA 120). 14th Annual TechFest, several Amateur Mode How To's and Demos. *Tl:* 147.075. *Adm:* Free. Tables: Free with reservation. Norm Schklar, WA4ZXV, 480 N Peachtree St, Norcross, GA 30071; 770-313-9410; **wa4zxv@arrl.net**; **gars.org**.

Illinois (Collinsville) — Jan 28 D F H R V

8 AM-1 PM. *Spr:* St Louis & Suburban RC. Gateway Convention Center, 1 Gateway Dr. Winterfest 2012. *Tl:* 146.76, 146.94. *Adm:* advance $6, door $7. Tables: $22 (6-ft). Bill Coby, KBØMWG, c/o St Louis & Suburban RC, Box 2233, St Louis, MO 63139; 314-504-1104; **bcoby@sbcglobal.net**; **slsrc.org**.

Illinois (St Charles) — Jan 22 D F H R S V

8 AM-1 PM. *Spr:* Wheaton Community Radio Amateurs. Kane County Fairgrounds, 525 S Randall Rd. *Tl:* 145.31 (107.2 Hz), 146.52. *Adm:* advance $8, door $10. Tables: $25. John Faber, WT9Y, 1586 Scottdale Cir, Wheaton, IL 60189; 630-605-8027; **wt9y@arrl.net**; **www.w9ccu.org**.

Kansas (LaCygne) — Feb 4 D F H R

9 AM-1 PM. *Spr:* Mine Creek ARC. Community Building, 204 Commercial St. Winterfest, small town atmosphere conducive to eyeball QSOs. *Tl:* 147.285. *Adm:* Free. Tables: $10. Ron Cowan, KBØDTI, Box 36, LaCygne, KS 66040; 913-757-3758; **kb0dti@arrl.org**.

Louisana (Hammond) — Jan 21 D H R S V

8 AM-1:30 PM. *Spr:* Southeast Louisiana ARC. University Center, 800 W University Ave. *Tl:* 147.0 (107.2 Hz). *Adm:* Free. Tables: $15. Carol Redmond, KE5GOC, 11097 Martin Ln, Tickfaw, LA 70466; 225-567-2100; **redmondqnt@charter.net**; **www.selarc.org/selarchamfest.htm**.

Maine (Augusta) — Feb 4 D F H Q R V

8 AM-noon. *Spr:* Augusta ARA. Le Club Calumet, 334 W River Rd. *Tl:* 146.88 (100 Hz). *Adm:* $5. Tables: Free. Bill Crowley, K1NIT, 150 Maple St, Farmingdale, ME 04344; 207-623-9075; **k1nit@arrl.net**; **www.w1tlc.com**.

Maryland (Odenton) — Jan 29 D F H R V

7:30 AM-noon. *Spr:* Maryland Mobileers ARC. Odenton Volunteer Fire Department Hall, 1425 Annapolis Rd (Rte 175). 18th Annual Post Holiday Hamfest. *Tl:* 146.805. *Adm:* $5. Tables: $13. Frank Winner, N3SEO, 283 Oak Ct, Severna Park, MD 21146; 410-647-3335; **n3seo@aol.com**; **sites.google.com/site/marylandmobileers/hamfest-2**.

Coming ARRL Conventions

January 8
New York City/Long Island Section, Bethpage*

January 20-21
North Texas Section, Fort Worth

January 21
Georgia ARES, Forsyth

January 21-28
Quartzfest, Quartzsite, AZ

January 27-28
Mississippi State, Jackson

February 4
South Carolina State, Ladson
Virginia State, Richmond

February 10-12
Northern Florida Section, Orlando

February 17-18
Southwestern Division, Yuma, AZ

February 18
Arkansas Section, Hoxie

February 25
Vermont State, South Burlington

March 3
South Texas Section, Rosenberg

March 3-4
Alabama Section, Birmingham

March 9-10
Louisiana State, Rayne
Oklahoma State, Claremore

March 10-11
Roanoke Division, Concord, NC

*See December *QST* for details.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

Michigan (Hazel Park) — Jan 15 D F H R
8 AM-noon. *Spr:* Hazel Park ARC. Hazel Park High School, 23400 Hughes Ave. 46th Annual Hamfest. *Tl:* 146.64 (100 Hz). *Adm:* $5. Tables: $15. Walt Carter, KD8LWC, 27333 Brush St, Madison Heights, MI 48071; 248-548-4645; **kd8lwc@yahoo.com**; **hparc.org**.

Michigan (Negaunee) — Feb 4 D F H R
9 AM-2 PM. *Spr:* Hiawatha ARA. Negaunee Township Hall, 42 Highway M-35. *Tl:* 147.27 (100 Hz). *Adm:* $4. Tables: $6. John Veiht, N8RSE, 1609 Altamont St, Marquette, MI 49855; 906-228-9417; **carczar52@gmail.com**.

MISSISSIPPI STATE CONVENTION

January 27-28, Jackson
D F H R S V

The Mississippi State Convention (Capital City Hamfest), sponsored by the Jackson ARC, will be held at the Mississippi State Fairgrounds Trade Mart Building, 1200 Mississippi St. Doors are open Friday 5-8 PM, Saturday 8 AM-4 PM. Features include flea market, dealers, forums, VE sessions, handicapped accessible, refreshments. Talk-in on 146.76 (77 Hz). Admission is $6, under 13 free with paying adult (good both days). Tables are $15 (flea market), $25 (dealers/vendors). Contact Gary Young, K5GCY, 5354 Brookhollow Dr, Jackson, MS 39212; 601-373-0233; **k5gcy@att.net** or **hamfest@msham.org**; **msham.org**.

Missouri (Kansas City) — Jan 21 D F H R S V
8 AM-2 PM. *Spr:* Northland Emergency Response. Hillside Christian Church, 900 NE Vivian Rd. *Tl:* 147.045. *Adm:* advance $5, door $7. Tables: $20. Alan Altis, KCØSCT, Box 921, Kearney, MO 64060; 816-204-5962; **alan@patriotpublicsafety.com**; **www.northkchamfest.com**.

New Mexico (Albuquerque) — Jan 28
D F H R T
Sunrise-1 PM. *Spr:* 146.580 Simplex Group. Transcore Amtech Technology Center, 8600 Jefferson St. *Tl:* 145.33 (100 Hz). *Adm:* Free. Tom Ellis, K5TEE, 912 Lomas Ct NE, Albuquerque, NM 87112; 505-291-8122; **k5tee@arrl.net**.

New York (Lockport) — Jan 28 F H R
8 AM. *Spr:* Lockport ARA. South Lockport Fire Company, Transit and Ruhlman Rds (Rte 78). *Tl:* 146.82 (107.2 Hz). *Adm:* $5. Tables: $5. Duane Robinson, W2DLR, Box 142, Ransomville, NY 14131; 716-791-4096; **w2dlrham@aol.com**; **lara.hamgate.net**.

New York (Marathon) — Jan 14 D F H R V
7 AM-1 PM. *Spr:* Skyline ARC. Marathon Civic Center, corner of Peck Ave and Brink St. *Tl:* 147.18 (71.9 Hz). *Adm:* $3. Tables: $5. Eamon O'Shea, N2RQS, Box 5241, Cortland, NY 13045; 607-543-0061; **eamonoshea@gmail.com**; **www.skylineradioclub.org**.

North Carolina (Winston-Salem) — Jan 14
D F H R T
7 AM-noon. *Spr:* Forsyth ARC. Summit School Eagles Nest, 2100 Reynolda Rd. "Winston-Salem FirstFest 2012." *Tl:* 146.64 (100 Hz). *Adm:* advance $4 with coupon from **hamfest.w4nc.org**, door $5. Tables: $15. Henry Heidtmann, W2DZO, Box 11361, Winston-Salem, NC 27106; 336-245-5740; **FirstFest2012@w4nc.org**; **FirstFest2012.w4nc.org**.

Ohio (Lorain) — Feb 5 D F H R
8 AM-noon. *Spr:* Northern Ohio ARS. Gargus Hall, 1965 N Ridge Rd. Annual Winter Hamfest. *Tl:* 146.7. *Adm:* $6. Tables: $10. Darlene Ohman, KA8VTS, 4122 Bush Ave, Cleveland, OH 44109; 216-398-8858; **dohman@roadrunner.com**; **www.noars.net**.

Ohio (Nelsonville) — Jan 15 D F H R T V
8 AM-3 PM. *Spr:* Sunday Creek AR Federation. Tri-County Vocational School, 15676 State Rte 691. 16th Annual Hamfest. *Tl:* 147.225. *Adm:* $6. Tables: $6. Jeramy Duncan, KC8QDQ, 10847 Walnut St, Glouster, OH 45732; 740-767-2554; **duncan10847@embarqmail.com**.

Ohio (Strasburg) — Jan 29 D H R
Set up 6:30 AM; public 8 AM. *Spr:* Tusco ARC. Wallick Auction Center, 965 N Wooster Ave. 22nd Annual Hamfest. *Tl:* 146.73 (71.9 Hz). *Adm:* $5. Tables: $10. Gary Green, K8WFN, 32210 Norris Rd, Tippecanoe, OH 44699; 740-922-4454; **k8wfn@tusco.net**; **www.tuscoarc.org**.

Pennsylvania (Harrisburg) — Jan 14
F H R V
8 AM-noon. *Spr:* Harrisburg RAC. Paxtang Firehouse (rear), 3423 Derry St. *Tl:* 146.76 (100 Hz). *Adm:* $3. Tables: $3. Terry Snyder, WB3BKN, Box 355, Halifax, PA 17032-0355; 717-896-0256; **HRACw3uu@gmail.com**; **www.w3uu.org**.

Puerto Rico (Hatillo) — Feb 5
D F H Q R S T V
8 AM-3 PM. *Spr:* Caribbean AR Group. Pancho Deida Hatillo Municipal Coliseum, Hwy 2. *Tl:* 147.21 (127.3 Hz), 146.52. *Adm:* Free. Tables: $10 donation. Serafin Martinez, KP4FIE, HC 4, Box 43014, Hatillo, PR 00659; 787-221-5016; **wavilesjr@yahoo.com**.

South Carolina (Greenwood) — Jan 14
D F H R S T V
9 AM. *Spr:* Greenwood ARS. Piedmont Technical College, 620 N Emerald Rd. *Tl:* 147.165 (107.2 Hz). *Adm:* $6. Tables: $8 (6-ft). Tedd Davison, AI4WN, 116 Mountain Shore Dr, Greenwood, SC 29649; 864-377-1872; **ai4wn@arrl.net**; **www.w4gwd.org**.

SOUTH CAROLINA STATE CONVENTION

February 4, Ladson
D F H R S T V

The South Carolina State Convention (39th Annual and Original Charleston Hamfest and Computer Show), sponsored by the Charleston ARS, will be held at the Exchange Park Fairgrounds, 9850 Hwy 78. Doors are open for setup Friday 5-9 PM, Saturday 6:30 AM; public 8 AM-3 PM. Features include flea market, new equipment dealers, vendors, tailgating, forums (ARRL, APRS, Weather, and more), VE sessions, campsites available with full hookups (843-572-3161 to reserve), handicapped accessible, refreshments. Talk-in on 146.79, 145.25, 147.045, 145.41. Admission is $5, 12 and under free. Tables are $10 in advance, $12 at the door (if available); chairs $2 each. Contact Jenny Myers, WA4NGV, 2630 Dellwood Ave, Charleston, SC 29405; 843-747-2324; **brycemyers@aol.com**; **www.wa4usn.org**.

NORTH TEXAS SECTION CONVENTION

January 20-21, Fort Worth
D F H R S T V

The North Texas Section Convention (Cowtown Hamfest), sponsored by the Lockheed Martin ARC, will be held at the Lockheed Martin Recreation Area, 3400 Bryant Irvin Rd. Doors are open Friday 3-8 PM, Saturday 8 AM-3 PM. Features include dealers, commercial vendors, flea market, tailgating ($5 per space), exhibiting clubs and organizations, seminars, educational programs, VE sessions (both days), refreshments, handicapped accessible. Talk-in on 147.28 (110.9 Hz). Admission is $8 in advance, $9 at the door. Tables are $35. Contact David Forbes, KC5UYR, 2721 Marigold Ave, Fort Worth, TX 76111; 817-925-5126; **kc5uyr@compuserve.com**; **www.cowtownhamfest.com**.

Texas (Schertz) — Jan 14 D F H Q R S T V
8 AM-2 PM. *Spr:* San Antonio RC. Schertz Civic Center, 1400 Schertz Pkwy. 2012 Amateur Radio Fiesta. *Tl:* 146.94 (179.9 Hz). *Adm:* advance $8, door $10. Tables: $10. Lewis Archer, WØYVY, Box 34263, San Antonio, TX 78265; 210-415-5733; fax 210-256-6840; **usxpop@yahoo.com**; **w5sc.org**.

VIRGINIA STATE CONVENTION

February 4, Richmond
D F H Q R S V

The Virginia State Convention (Frostfest 2012), sponsored by the Richmond Amateur Telecommunications Society (RATS), will be held at the Richmond Raceway Complex, 600 E Laburnum Ave. Doors are open for setup Friday 10 AM-9:30 PM, Saturday 6:30-8 AM; public 8:30 AM-3:30 PM. Features include over 300 flea market tables, commercial vendor booths (see website for more information), new equipment dealers, major manufacturers, forums and meetings, VE sessions (10 AM-1 PM, walk-ins only, all license classes), QSL card checking, RV camping ($45 per night), handicapped accessible, refreshments. Talk-in on 146.88 (74.4 Hz). Admission is $8 in advance (online tickets - see web site; special "Early Bird" tickets for early admission into the event); $9 at the door. Tables are $30 (8-ft, plus admission; electrical hookups $40 extra). Contact Rob Marshall, KI4MCW, Box 14828, Richmond, VA 23221; 804-657-7038; **info@frostfest.com**; **www.frostfest.com**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **January 1** to be listed in the **March** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL Web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

75, 50 AND 25 YEARS AGO

January 1937

- The cover photo shows a newspaper opened to the real estate section, lying on top of a copy of *QST* that is opened to an article on rhombic antennas.
- The editorial looks back at the good and bad ham radio news of the year 1936, just passed. Lots of good news was noted, but the passing of Hiram Percy Maxim, League President and Co-Founder, was sadly remembered
- H. Selvidge, W9BOE, spins the tale of "Amateur Radio on the Harvard–M.I.T. Eclipse Expedition to Siberia."
- Vern Chambers, W1JEQ, adds a T55 final stage to the popular type 10 rig, thereby "Boosting the Output of the Low-Power Transmitter."
- John Stiles, W8PNL, tells about using "The 807 as a Crystal Oscillator."
- "A 913 Oscilloscope with Linear Sweep," by J. B. Carter, puts the new miniature cathode-ray tube to work in the ham radio shack.
- "August '36 Field Day" reports on the year's second Field Day exercise, in reply to the popular demand of our FD hams!
- R. E. Herbert, W8NMY, and Steve Tunder, W8QCF, describe their new baby, "A 50-Watt Rack-Mounted 'Phone Using Beam-Type Tubes."
- "An Inexpensive 160-Meter 'Phone for Local Rag Chews," by Walter Roberts, W3CHO, uses only four tubes in its simple crystal-controlled circuit.
- The "Amateur Radio Stations" column looks at the stations of W2EVV and W6NZ, which were built into normal-looking furniture cabinetry. Close the doors and no one would know there's a ham station in the home!

January 1962

- The cover photo shows the first Amateur Radio satellite — OSCAR — with the announcement, "It's Up!!!"
- The editorial looks at the many accomplishments of our fellow hams, leading off with a tip of the hat to OSCAR.
- In "Six-Meter S.S.B., the Simple Way," Roger Ries, KØIAX, describes his transmitting converter that converts the output of a 14-Mc. exciter to 50 Mc.
- Harry Gensler, K8OCO, presents "The OCO Audio Filter," a very small filter that provides good skirt selectivity for C.W. reception.
- Lew McCoy, W1ICP, presents information to help the new ham who is "Choosing an Antenna."
- Alan Margot, W6FZA, tells about "A High-Performance Tuner for V.H.F. Converters" that provides improved stability and a tuning rate that is slower than normal.
- Irvin Kridler, W7BTB, tells about his work on "Close-Spacing the W3QEF Quad." Compared to the original, Irvin's redesign results in a smaller tuning radius and a more rugged mechanical design, without sacrificing gain.
- Ever forward-looking Raphael Soifer, K2QBW, uses his crystal ball to examine "The Feasibility of Amateur Space Communication."
- "More on the Electromonimuter," by Ernest Adolph, K8WYU, presents modifications for greater versatility of his earlier design of a device to key the transmitter, mute the receiver, and give a sidetone for monitoring.

January 1987

- The cover photo looks up through WD8RXP's very tall triangular tower (described in this issue), and cautions "Don't look down!"
- The editorial discusses the spectrum challenges facing ham radio today.
- "Mid-Michigan Skyhook," by Norman Keon, WA8AEG, tells about the construction of WD8RXP's monster 180-foot tower, which supports a number of HF beams.
- John Grebenkemper, KA3BLO, describes "The Tandem Match — An Accurate Directional Wattmeter." The unit measures power levels from 1.5 to 1500 W and SWR from 1:1 to 50:1 — accurately.
- Doug DeMaw, W1FB, presents Part 15 of the "Under Construction" series, "Some Power-Supply Design Basics."
- Jan King, W3GEY, writes about "OSCAR at 25: Beginning of a New Era."
- Rick Palm, K1CE, urges us all to "Join Amateur Radio's Action Team," so we can help with emergency organization and communication services.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

OCTOBER 2011

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program are at this web page: **www.arrl.org/public-service-honor-roll**.

665
AC6C
538
W5KAV
536
N4HUB
508
W4LHQ
472
KØIBS
465
KT2D
447
KT5SR
393
K8OLY
340
K7BFL
320
KT4YA
304
KA2ZNZ
286
W2MTA
276
KI4KWR
WB9YBI
265
WB9JSR
262
WB9FHP
260
KK5NU
K8RDN
250
N9VC
242
KB2ETO
240
W7FQQ
K2HAT
232
N8OSL
230
NX9K
225
WA9LFO
220
WA4UJC
210
W5DY
WA3EZN
209
W4CAC
200
KB2KOJ
KC5ZGG
201
KØLQB
193
WA2BSS
192
KA8ZGY
185
WD8USA

182
WB8RCR
180
K9LGU
K4GK
176
KC2SFU
175
K6HTN
K4JGA
174
K2ABX
170
N2WKT
165
N8FVM
160
WS6P
AE5VY
KB5SDU
KB2RTZ
KGØGG
WB6UZX
WE2G
N5ASU
KD1LE
158
KA4IZN
157
KD8QPF
155
KB8RCR
KE5HYW
N4ELI
150
N8IO
KK3F
K7OAH
KO4OL
149
W3CB
K6FRG
148
K4BEH
147
KB5PGY
145
AG9G
WK4P
140
WD9FLJ
N2GJ
N7CM
W4DNA
WB8WKQ
NW8E
135
KØVTT
K5CRX
W8DJG
KC8WH
W3YVQ
N2RDB
K2TV
133
WM2C
130
K6JT

KA8IAF
WB8SIQ
WB2FTX
N5EEO
K7EAJ
K4IWW
KW1U
N1IQI
129
W9WXN
W2LIE
126
W2KFV
125
N7EIE
KD8KWG
121
KD7OED
120
NN7H
WA5LOU
WB8HHZ
W8UL
W2CC
N3RB
KA4FZI
K4JUU
WI2G
N2JBA
118
WX4RQN
KC2YDT
115
KF5IOU
KC5OZT
N8CJS
WØLAW
111
KJ6IJJ
110
W7QM
W7GB
K7BDU
K3RC
K4BG
N7XG
N7YSS
N9MN
WA2NDA
KE4CB
W2EAG
KD8CYK
K8VFZ
109
KK7DEB
KJ4KZ
107
W2DWR
KD2AEX
105
KO6V
W8MAL
103
WB8WJV
101
KC5MMH
N9WLW
W9YQ
100
W5GKH

N5OUJ
W4OTN
K5MC
K4SCL
N3SW
W3TWV
WG8Z
N1JX
KI4AAN
NR2F
KA1G
NU8K
AA3SB
WB4FDT
WØCLS
NØMEA
KD7ZUP
KJ4JPE
W4TTO
W8CPG
KF7GC
WB6OTS
W8QZ
99
NC4VA
N2VC
98
KJ6HRJ
W7JSW
97
N7IE
KC4PZA
96
K7FLI
95
KC0M
W6RJA
WD8Q
N8SY
K1YCQ
93
N2GS
91
WD8JAW
90
N3KB
W9MBT
N2DW
KB8HJJ
N8DD
W2CC
WB4BIK
W3GQJ
KJ4HGH
W8IM
KZ8Q
N3ZOC
K3IN
KB3LNM
AA2SV
N2YHQ
KD8LZB
89
KD7THV
NC3F
88
KB9KEG
NC8V
N2VQA
87
NA9L

W5CU
W4AVD
KC4BQK
86
KC2UMX
KJ7NO
K2RRM
85
N5NVP
KJ4DRW
84
W9LW
83
KC2SYM
82
AL7N
K2GW
81
KE8BP
80
K7MQF
K5AXW
KV4AN
N9VT
WDØGUF
K8KV
KØDEU
NI0I
NØMHJ
NØUKO
KFØXO
NA7G
KB7RVF
N2YJZ
KC8BW
79
N2RTF
78
KK7TN
W2OSR
77
KK1X
76
W5ESE
K4MSG
75
WB8YYS
N8OD
74
KC2EMW
W1PLK
73
W4BKG
71
W9RSX
W5XX
70
KE5YTA
WØAYN
KØDLK
NØDUW
NØDUX
W0FUJ
N3NTV
KØPTK
KØRXC
WAØVKC
KCØZDA

The following stations qualified for PSHR in previous months, but were not recognized in this column: (Sept) W5KAV 530, W4CAC 428, KØIBS 440, KØKKV 384, KI4KWR 337, KØLQB 146, K7OAH 145, KC5ZGG 142, KD7OED 129, KJ4IT 110, KO4OL 110, W4OTN 100, WB6OTS 100, KF7GC 100, W5CU 90, K7FLI 90, W7JSW 84, KA3NZR 80, KB7RVF 80, N9VT 74, WD8JAW 72, K4MSG 70. (Aug) KO4OL 110, WD8JAW 65. (Jul) KO4OL 110, WD8JAW 71, K4BQK 70. (Jun) WD8JAW 145, KO4OL 110, KC8BQK 98. (May) KO4OL 130, WD8JAW 111, KC4BQK 107. (Apr) WD8JAW 106, KO4OL 110, KC4BQK 72.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, EB, EMA, ENY, EPA, EWA, GA, IL, IN, KY, LA, LAX, MDC, ME, MI, MN, MS, MT, NC, NFL, NLI, NNJ, NNY, NTX, OH, OK, OR, SD, SFL, SJV, SNJ, TN, UT, VA, WCF, WI, WNY,WPA, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: ENY, EWA, GA, IA, IN, KS, MI, MN, MO, ND, NLI, NM, NNJ, NTX, OH, ORG, SFL, STX, VA, WTX, WV, WWA.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W5KAV 4112, KK3F 3904, WB9FHP 2775, W6WW 1871, KW1U 1280, WB5NKD 1123, W8UL 1124, W9WXN 1000, WB5NKC 941, K7BDU 932, NX9K 732, N9VC 720, WB9JSR 678, K6HTN 666, KA4FZI 619, WB8WKQ 526, W7QM 525.

The following stations qualified for BPL in September, but were not recognized in this column: W5KAV 3763, WB6OTS 587.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

♦K1DH **Huntington**, Donald E., East Hartland, CT
AC1G **Christiansen**, John A., Yarmouth, ME
KA1LPW **Smith**, Arnold "Skeet" P. Sr, Vassalboro, ME
KK1P **Anderson**, Oscar W., Mayer, AZ
W1QBA **Abbadessa**, Salvatore J., Lexington, MA
N1RRW **Crego**, Howard "Skip" L., Shaftsbury, VT
W1SIK **Wattman**, Edwin Z., Providence, RI
K1TQ **Brown**, H. Walcott Jr, Falmouth, MA
KD1TQ **Locher**, Richard B., Southbury, CT
N1WKT **Linn**, Edward A., Kensington, CT
♦WA2EAW **Morgenstern**, Robert L., Delray Beach, FL
W2EBM **Gonzalez**, Jesse, Whiting, NJ
K2HA **Cross**, Charles "Bob" R., Marlborough, MA
KB2IPJ **Downs**, Susan L., Hamilton Township, NJ
W2KE **Schick**, Walter H., Schenectady, NY
W2KEL **Kelley**, Robert G., Nokesville, VA
KA2VAE **Duffey**, Paul T., Watervliet, NY
K2VBS **Ducroiset**, Paul J., Glendale, NY
KC2YRV **Fogle**, James, Absecon, NJ
K2YYM **Dupre**, Gerald Sr, Lawrenceville, NY
N3AHP **Evans**, D. R. "Bob," Boothwyn, PA
KB3APA **Dilks**, Edgar A., Mechanicsburg, PA
AD3C **Banyasz**, Bela A., Kensington, MD
WA3DCG **Bishel**, Thomas E., Elkton, MD
KB3FLI **Smith**, Arthur J., Shohola, PA
♦W3FP **Palladino**, Francis J., King of Prussia, PA
ex-W3HSS **Demeules**, Margaret "Peg" M., Port St Lucie, FL
♦WW3JC **Robinson**, Wayne Lee Jr, Corry, PA
K3JEH **Holloway**, John "Jack" E., Washington, DC
W3LJS **Sparks**, Leah J., Hanover, MD
KB3LSK **Lenhart**, Jay J., Shadyside, PA
W3QFF **Gatton**, William M. Sr, Glen Burnie, MD
WA3USH **Bomboy**, Richard L., Albion, PA
KF4BFZ **Jones**, Everett W., Wallins Creek, KY
W4BIN **Harrell**, Orbra W., Fort White, FL
KI4BSB **Carpenter**, Steven L., Tifton, GA
W4CKD **Ekleberry**, Robert H., Greenville, OH
KC4DKO **Crutchfield**, Charles C., Knoxville, TN
K4DRE **Cockman**, Charles "Jack" L. Jr, Gibsonville, NC
KG4EAE **Miller**, A. J. Erwin, Milledgeville, GA
KF4FRS **Shultz**, Marjorie M., Palmyra, VA
KF4FWQ **Paschall**, Hugh C., Ruther Glen, VA
KN4G **Plaks**, Norman, Raleigh, NC
♦W4HON **Piper**, Jimmy G., West Point, GA
W4IB **Bledsoe**, Ira I., Richmond, VA
N4KAJ **Street**, John C., Williamsburg, VA
♦WB4MMI **Bartlett**, George P., Ramer, TN
WD4OVN **Scott**, Jackie K., Dallas, GA
AE4OW **Sola**, Frank C., Palmyra, VA
KJ4QCL **Huffman**, Jack, Ridgeville, SC
W4RRY **Lehner**, Leo L., Sun City West, CA
KE4RSS **Pate**, Thomas D., Douglasville, GA
WD4RTG **Castleberry**, Michael W., Cordele, GA
K4SR **Bishop**, Richard F., Richmond, VA
♦W4SSU **George**, Curt, Gainesville, GA
KY4TT **Frank**, Delbert "Ray" Jr, Cadiz, KY
W4TTJ **Marrow**, George B., Oak Ridge, TN
KE4UFS **Henry**, Martin, Rotonda West, FL
KF4WMT **Dunnum**, Harold E., Lexington, KY
KU4WT **Webb**, Darlton D., Richmond, IN
WA4WTK **Doughty**, Margaret C., Young Harris, GA
W4YXI **Graham**, J. Burell, Hanceville, AL
KD4ZMP **McMillan**, Jack A., Conyers, GA
KC4ZY **Smith**, Samuel, Lexington, KY
W5BCL **Hartley**, James M., Richardson, TX
WV5C **James**, Donald M., Ellisville, MS
KD5CPL **Carson**, Gary L., Oklahoma City, OK
WB5EKP **King**, Kenneth, Grants, NM
KD5IOY **Harris**, Thomas E., Oklahoma City, OK
♦W5JAH **Laurents**, Benoiest W., Shreveport, LA
W5KRL **Hewlett**, Thomas N., Hendersonville, NC
W5MVR **Lightfoot**, Charles C., Willis, TX
N5PWG **Sicard**, John W. Jr, Pasadena, TX
♦N5TX **Kennedy**, Craig "Tex" B., San Antonio, TX
W5VNY **Gordon**, Herbert L., Olympia, WA
WB5YQY **Skinner**, Emmett E., Batesville, AR
WA5ZTV **Steele**, Chester M. Jr, San Antonio, TX
N6DAC **Caouette**, David A., Seal Beach, CA
AC6EX **Lippman**, Robert I., Riverside, CA
WB6EYC **Smith**, Harvey L., Fresno, CA
KB6FHE **Whitten**, Diana, Garden Grove, CA
KE6HSH **Crosier**, Marilyn L., Newhall, CA
KC6LPL **Cutler**, Edward J. Sr, Fresno, CA
WA6MZV **Pitman**, Jim, Torrance, CA
W6ORD **Friedman**, Norman E., Palm Desert, CA
W6PBF **Flusser**, Peter, Culver City, CA
KF6POL **Tyler**, Douglas G., Lucerne Valley, CA
KE6RMH **Coleman**, Burrell R. Jr, Sunnyvale, CA
K6TQ **Taylor**, William H. Jr, Vista, CA
KH6UO **Chinen**, Masaichi, Hakalau, HI
KD6UP **Richards**, Russell F., Sevierville, TN
W6WOH **Johnson**, Wayne B., Los Altos Hills, CA
N6WXI **McConnell**, Keith H., Wofford Heights, CA
W6WXZ **Boghosian**, Jack H., Fresno, CA
K7AUF **Hartman**, Henry W., Longview, WA
ex-KC7AW **Dinkelman**, John H., Salt Lake City, UT
K7COC **Whiting**, David R., Hansville, WA
KA7DPB **Robinson**, Earl F., Great Falls, MT
W7MEH **Gorham**, John R., Pullman, WA
KL7NI **McLaren**, Gene L., Burleson, TX
♦KE7PB **Rode**, Herbert H., Casa Grande, AZ
W7RME **Collins**, William C., Bremerton, WA
W7RWB **Budd**, Richard W., Minden, NV
W7SFF **Score**, Dean A., Deming, WA
W7TFZ **Kidd**, Allen I., Salt Lake City, UT
N7UYZ **Burke**, David F., Globe, AZ
♦W7VAZ **Deines**, Albert, Crescent City, CA
W7YOF **Crain**, Melvin H., Payson, AZ
N8AJN **Close**, John "Jack" C., Nathrop, CO
KC8ASD **Nichols**, Crawford L., Hilliard, OH
WB8DRM **Hund**, William O., Manistee, MI
W8NYP **Caulkins**, Frank A., Apollo Beach, FL
WB8RXI **Newland**, Jeem E., Miamisburg, OH
WA8SLN **Shields**, Lawson "Scotty" A., Seven Hills, OH
KB8YEE **Cech**, George, South Lyon, MI
KB9DZG **Neubauer**, Phillip G., Merrill, WI
K9EWK **Kost**, O. D., Vermont, IL
AK9F **Dybedock**, Howard S., South Bend, IN
K9FIV **Lightner**, Donald A., South Bend, IN
W9GLH **White**, James J. Jr, Franklin, WI
K9JKH **Judkins**, Jewel E., Indianapolis, IN
♦KB9LQO **Grosko**, Stephen J. Jr, Vernon Hills, IL
KC9QYO **Pesek**, James Sr, Cary, IL
WA9RRY **Whitesel**, Melvin D., Fort Wayne, IN
♦KC9UU **Harker**, Robert J., Terre Haute, IN
N9ZFW **Hawkins**, Ruth M., Thorntown, IN
WØHIK **Fisher**, Carl A., Augusta, KS
WØJCB **Rice**, William A., Cozad, NE
♦WØJCP **Dyas**, Claire "Dick" R., Oxford, NE
KEØKI **Johnson**, Gerald L., Nixa, MO
KØLYP **Sevcik**, John J., Cedar Rapids, IA
WBØOKR **Worster**, Donald E., Keokuk, IA
WOØP **Vales**, Hugh M., Hamlet, IN
KCØQB **Keith**, Alden L., El Dorado Springs, MO
WØSIK **Carriger**, James R., Topeka, KS
KØTMU **Tyler**, Warren D., Mason City, IA
♦VE5RU **Frederickson**, Russell A., Wadena, SK, Canada
♦VA6IK **Juranek**, Vladimir, Calgary, AB, Canada
Z22JE **Kaye-Eddie**, Dudley Norman, Chisipite, Zimbabwe

♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Silent Keys Administrator ♦ sk@arrl.org

Strays

GRANT TO TEXAS CLUB SUPPORTS VOLUNTEER EFFORTS

◊InTouch Credit Union, the title sponsor of the Plano Balloon Festival, Plano, Texas honored the Plano Amateur Radio Klub (PARK) at the 2011 festival with a $500 grant for its many years of working behind the scenes handling communications for the festival. Along with other North Texas Amateur Radio clubs, PARK coordinated more than 63 ham volunteers who contributed more than 1000 hours to support the event. The amateurs coordinated communication on the field and at refueling, and assisted in balloon recovery.

PARK President Kipton Moravec, AE5IB, said, "PARK is honored to be recognized by InTouch Credit Union. I am especially proud of the North Texas radio operators who donate their time and talent to the annual event. Operators from 10 area clubs came together to support this event."

The Plano Amateur Radio Klub has voted to use the grant to invest in radio tracking devices (APRS) for the club and other radio clubs to use to support the festival and many other future public services events and emergencies. — *Ted Gurley, KD5VFB*

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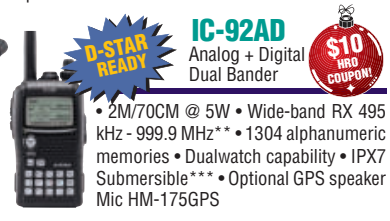

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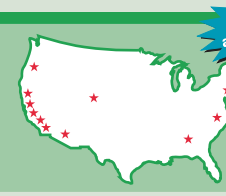

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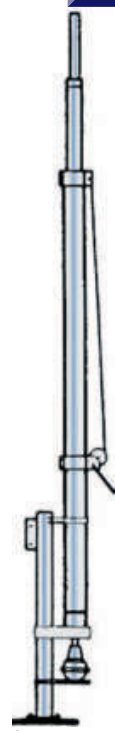

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SALEM, NH
(Near Boston)
224 N. Broadway, 03079
(603) 898-3750
(800) 444-0047
Peter, KI1M, Mgr.
sales@hamradio.com
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DX ENGINEERING

#1 Rated Cable Assemblies Made in USA!

DXE-8X

New!

- 96% Bare Copper Braid Shield
- 0.9 dB loss/100 ft. @10 MHz
- Foam Polyethylene Dielectric .155" O.D.
- Black Vinyl Jacket .242" O.D.
- Center Conductor 16 AWG
- UV Resistant—Direct Burial

DXE-8U

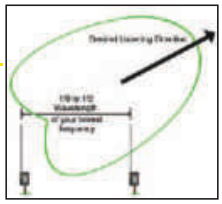
New!

- 95% Bare Copper Braid Shield
- 0.9 dB loss/100 ft. @50 MHz
- Foam Polyethylene Dielectric .285" O.D.
- Black Vinyl Jacket .405" O.D.
- Center Conductor 11 AWG 7 Strands Bare Copper

ARE YOU HEARING THEM ALL?

DX Engineering Receiving Antenna Systems allow you to hear them first and best! From Beverage antenna components to arrays of active receive antennas, DX Engineering is your source for world-beating receiving equipment.

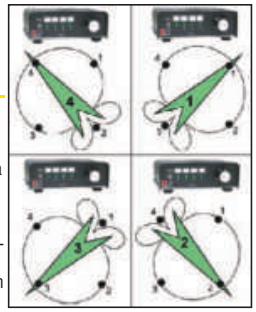
Receive Antenna Phasing Controller System



The NCC-1 is a two-channel receiving phasing system. This sophisticated controller allows the user to combine and independently adjust the phase and level of two antenna inputs, creating a fully adjustable phased array from any two antennas.

DXE-NCC-1	Receive Antenna Phasing Controller	**$599.95**
DXE-AAPS3-1P	Two Antenna System, electronically rotatable	**$1,099.95**

Receive Four Square Arrays

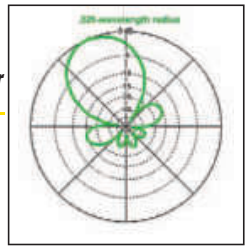


The patented* DXE-RFS-SYS-2P uses time delay phasing to produce wider and deeper rear nulls and a narrower main lobe in four selectable directions. The result is greatly reduced levels of noise and undesirable signals for a superior front-to-rear ratio. Use with DX Engineering Active Vertical Antennas for great F/R response over octaves of bandwidth from 100 kHz to 30 MHz with just a 102" whip as the antenna element.

**US Patent Number 7,423,588*

DXE-RFS-SYS-2P	Four Square Controller/ Switch Package	**$389.95**
DXE-RFS-SYS-3P	160/80/40m Electronics Package	**$799.00**
DXE-RFS-SYS-4P	Complete System Package	**$1,650.00**

Receive Eight Circle Switch and Controller Packages



This switchable 8-direction array allows the user to pinpoint the exact direction for maximum receive signal performance. It uses the same time delay phasing technique as the Receive Four Square system to provide excellent bandwidth and pattern control with 102" long active antenna elements.

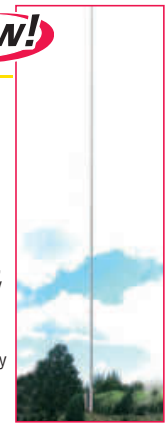
DXE-RCA8B-SYS-2P	Receive Eight Controller/ Switch Package	**$449.95**
DXE-RCA8B-SYS-3P	Electronics Package	**$1,375.00**
DXE-RCA8B-SYS-4P	Complete System Package	**$2,575.00**
Beverage Antenna Components		
DXE-BFS-1	Beverage Antenna System, single direction	**$49.95**
DXE-RBSA-1P	Reversible Beverage System, two direction	**$199.95**
Active Receive Antennas w/Internal Disconnect Relay		
DXE-ARAV3-1P	Vertical Antenna	**$289.95**
DXE-ARAH3-1P	Horizontal Antenna	**$349.95**
Preamplifier		
DXE-RPA-1	Receiver Preamplifier, 0.3-35 MHz	**$119.95**
Time Variable Sequencer Unit		
DXE-TVSU-1A		**$199.95**

Visit DXEngineering.com to see additional Receive Antenna products

We Have First Rate Products, Reliable Performance, & Great Prices—

Full Size 75/80 Meter Quarter-Wave Vertical Antennas!

New!



DX Engineering's FULL SIZE quarter-wave vertical antennas provide the highest possible performance. Now you can achieve the strongest possible presence at your power level and be competitive!

The 68-foot tall antennas have rugged base sections starting from 2, 3 and 4-inch diameter aircraft-grade aluminum tubing. The VA-1 requires simple guying, while the VA-2 and VA-3 models are very stout antennas that can stay up with no guying necessary and no worry on your part. The VA-2 and VA-3 antennas can easily be lowered with the supplied Heavy Duty Plus Stainless Pivot Base and the optional hand winch.

- Ultra-WIDE SWR bandwidth
- Highest Wind Ratings—high strength 6063/6061 tubing manufactured to DX Engineering specifications
- High Power Handling Capacity—BIG high strength, UV-protected Extren® insulator
- Reliability Second to None—specially manufactured stainless steel and aluminum saddle clamps, stainless steel bolts, and precision machining
- Easy Tilt Up and Down—specially manufactured heavy duty stainless steel Pivot Base supplied with VA-2 and VA-3 antennas

DXE-7580FS-VA-1	Vertical Antenna, standard HD	**$379.50**
DXE-7580FS-VA-2	Vertical Antenna, Heavy Duty	**$675.50**
DXE-7580FS-VA-3	Vertical Antenna, Ultra Duty	**$1,675.50**

DXE-VRW-1 Manual Winch

This optional winch for the VA-2 and VA-3 Vertical Antennas allows easy one-man raising and lowering. You can use the DXE-VRW-1 winch on similar DX Engineering antennas in a multi-antenna installation.

DXE-VRW-1 Manual Winch Add-on Raising Kit **$169.99**

NEW - UNSLIT TUBING— OR SLIT ONE END EXACT TELESCOPING SIZES!

6063-T832 Aluminum Tubing

- Smoothly telescoping sections
- Drawn—not extruded tubing
- Better than the other guys—guaranteed lowest price
- Custom made just for DX Engineering
- Use DXE Stainless Steel Element Clamps to assemble slit lengths

See DXEngineering.com for details.

65 Ft. Telescoping Antenna Kit

- Eleven telescoping sections from 2" to 7/8" O.D.
- Stainless steel element clamps

DXE-ATK65	Telescoping Antenna Kit	**$194.50**
DXE-VE-BASE	Fixed Vertical Insulated Base Kit	**$99.50**
DXE-VA-BASE	HD Vertical Insulated Tilt Base Kit	**$159.50**

GUARANTEED LOWER PRICES!

High Quality Performance Grade Cables

- Heat shrink weatherproofing/strain relief
- All assemblies Hi-Pot high voltage tested
- Silver/Teflon® crimped and soldered connectors

RG-213/U DXE-213U Cable Assemblies with PL-259 Connectors		
DXE-213DU003	3 ft.	**$12.88**
DXE-213DU006	6 ft.	**$14.88**
DXE-213DU012	12 ft.	**$21.88**
DXE-213DU018	18 ft.	**$24.88**
DXE-213DU025	25 ft.	**$34.88**
DXE-213DU050	50 ft.	**$58.88**
DXE-213DU075	75 ft.	**$82.88**
DXE-213DU100	100 ft.	**$104.88**
DXE-213DU125	125 ft.	**$131.88**
DXE-213DU150	150 ft.	**$157.88**
DXE-213DU175	175 ft.	**$182.88**
DXE-213DU200	200 ft.	**$210.88**
RG-8/U DXE-8U Cable Assemblies with PL-259 Connectors		
DXE-8UDU002	2 ft.	**$12.88**
DXE-8UDU003	3 ft.	**$13.88**
DXE-8UDU006	6 ft.	**$16.88**
DXE-8UDU009	9 ft.	**$20.88**
DXE-8UDU012	12 ft.	**$24.88**
DXE-8UDU018	18 ft.	**$31.88**
DXE-8UDU025	25 ft.	**$39.88**
DXE-8UDU050	50 ft.	**$61.88**
DXE-8UDU075	75 ft.	**$85.88**
DXE-8UDU100	100 ft.	**$108.88**
DXE-8UDU125	125 ft.	**$139.88**
DXE-8UDU150	150 ft.	**$159.88**
DXE-8UDU175	175 ft.	**$179.88**
DXE-8UDU200	200 ft.	**$199.88**
RG-8X DXE-8X Cable Assemblies with PL-259 Connectors		
DXE-8XDU1.5	1.5 ft.	**$9.88**
DXE-8XDU002	2 ft.	**$10.88**
DXE-8XDU003	3 ft.	**$11.88**
DXE-8XDU006	6 ft.	**$13.88**
DXE-8XDU012	12 ft.	**$16.88**
DXE-8XDU025	25 ft.	**$23.88**
DXE-8XDU050	50 ft.	**$32.88**
DXE-8XDU075	75 ft.	**$40.88**
DXE-8XDU100	100 ft.	**$47.88**
DXE-8XDU150	150 ft.	**$69.88**
DXE-400MAX Cable Assemblies with PL-259 Connectors		
DXE-400MAXDU003	3 ft.	**$13.88**
DXE-400MAXDU006	6 ft.	**$15.88**
DXE-400MAXDU009	9 ft.	**$19.88**
DXE-400MAXDU012	12 ft.	**$24.88**
DXE-400MAXDU018	18 ft.	**$31.88**
DXE-400MAXDU025	25 ft.	**$39.88**
DXE-400MAXDU050	50 ft.	**$61.88**
DXE-400MAXDU075	75 ft.	**$85.88**
DXE-400MAXDU100	100 ft.	**$104.88**
DXE-400MAXDU150	150 ft.	**$159.88**
DXE-400MAXDU175	175 ft.	**$179.88**
DXE-400MAXDU200	200 ft.	**$199.88**

FREE SHIPPING on $50.00 or more Coax order!

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	**$39.95**
DXE-UT-808X	Cable Stripper for RG-8X, 9258, etc	**$39.95**
DXE-UT-80P	PL-259 Assembly Tool	**$22.95**
DXE-UT-80N	2-Piece N Connector Tool	**$22.95**
DXE-CNL-911	Coax Cable Cutters	**$23.75**
DXE-170M	Precision Shear Side Cutters	**$7.95**
Now available in cost-saving tool kits with carrying case		
DXE-UT-CASE	Molded carrying case only	**$22.95**
DXE-UT-KIT1	Basic Coax Cable Prep Kit	**$99.95**
DXE-UT-KIT2	Complete Coax Cable Prep Kit	**$174.95**

We Will Beat Any Competitor's Prices—Call Us For Details!

FREE SHIPPING on $50.00 or more Coax Order!

DXE-213U

New!

- 96% Bare Copper Braid Shield
- 1.3 dB loss/100 ft. @50 MHz
- Polyethylene Dielectric .285" O.D.
- .405" O.D. Non-Contaminating Black Vinyl Jacket
- Center Conductor 12.5 AWG
- UV Resistant—Direct Burial

DXE-400MAX

New!

- Bonded Aluminum Tape plus Tinned Copper Braid Shield, 95% coverage
- 1.8 dB loss/100 ft. @150 MHz
- Gas Injected Foam Polyethylene Dielectric,.285" O.D.
- .405" O.D. Black Low Density Polyethylene Jacket
- Center Conductor 10 AWG
- UV Resistant—Direct Burial

Plus Great Customer Service and Fast and Inexpensive Shipping!

Rotor Control Cable

Heavy Duty, Highest Quality—Cut to Your Length

DXE-CW8-HD 2 #16, 6 #18 AWG ..per ft. **$0.89**
per 100 ft. **$89.00**

Genuine Synthetic Textiles Brand Antenna Rope

STI

- Black Double Braid Dacron/Polyester

STI-DBR-94-100	3/32" x 100 ft., 260 lb. rating	**$9.95**
STI-DBR-94-1000	3/32" x 1,000 ft., 260 lb. rating	**$69.95**
STI-DBR-125-100	1/8" x 100 ft., 420 lb. rating	**$11.95**
STI-DBR-125-1000	1/8" x 1,000 ft., 420 lb. rating	**$99.95**
STI-DBR-187-100	3/16" x 100 ft., 770 lb. rating	**$12.95**
STI-DBR-187-350	3/16" x 350 ft., 770 lb. rating	**$41.95**
STI-DBR-187-500	3/16" x 500 ft., 770 lb. rating	**$58.95**
STI-DBR-312-100	5/16" x 100 ft., 1,790 lb. rating	**$20.95**
STI-DBR-312-500	5/16" x 500 ft., 1,790 lb. rating	**$94.95**
STI-DBR-437-500	7/16" x 500 ft., 2,150 lb. rating	**$199.95**

Grounding Braid

- Flat tinned copper with ring terminals and heat shrink tubing

1/2" Wide, #10 Terminals

DXE-TCB05-RT01	1 ft.	**$4.95**
DXE-TCB05-RT03	3 ft.	**$5.95**
DXE-TCB05-RT05	5 ft.	**$6.95**
DXE-TCB05-RT10	10 ft.	**$9.95**

1" Wide, 1/4" Terminals

DXE-TCB10-RT01	1 ft.	**$5.95**
DXE-TCB10-RT03	3 ft.	**$8.95**
DXE-TCB10-RT05	5 ft.	**$12.95**
DXE-TCB10-RT10	10 ft.	**$18.95**

See DXEngineering.com for other sizes.

DIGITAL MODES + RIG CONTROL INTERFACE!

West Mountain RADIO

West Mountain Radio RIGblaster

Connect the RIGblaster Advantage to your radio's microphone connector and a computer USB connector and you'll have access to over 100 existing and future ham radio sound card software programs! You'll also get over 20 exciting modes that your radio could not otherwise operate. The Advantage also links your computer software and radio using CAT, CI-V or DB9 interfaces cables.

WES-RB/AD/CUSB	RIGblaster Advantage	**$199.00**
WES-CIV/CBL	RIG Control Cable for CI-V (Icom & TenTec) Radios	**$9.95**
WES-CAT/6D/CBL	CAT Cable for Yaesu FT-736/747/767/990/1000	**$13.95**
WES-CATMINI/CBL	CAT Cable for Yaesu FT-100/100D/817/857/897	**$13.95**
WES-58214-1295	Rigblaster DB9F to DB9F Serial Cable	**$9.95**

Limited Time Offer—FREE Shipping on Comtek Baluns!

COM-BAL-11130T

New!

COM-BAL-11130E

Better Performance, Lower Prices—from just $49.95

COMTEK W2FMI Series Baluns

Design inspired by Jerry Sevick W2FMI and perfected by DX Engineering's balun R&D department.

- High voltage compensating capacitors for unequalled low SWR—a DX Engineering innovation!
- Large fender washers distribute fastener loading to prevent case `
- Special coated toroid core handles close coupling without extra stress
- High, consistent common mode impedance across specified bandwidth—provides isolation where most needed
- Special wire sizing and Teflon-insulated wire sleeves for exact impedance matching and better isolation than Thermaleze wire
- Typical insertion loss: less than 0.2 dB
- Power handling: 3 kW continuous to 5 kW+ intermittent depending on model
- Silver-plated gasketed SO-239 connectors, stainless hardware, weatherproof NEMA box

1:1 Dual Wire/Single Core, 1.8 to 54 MHz		
COM-BAL-11130E	3 kW, side eyebolts	**$49.95**
COM-BAL-11130ET	3 kW, side and top eyebolts	**$49.95**
COM-BAL-11130S	3 kW, side studs/wingnuts	**$49.95**
COM-BAL-11130T	3 kW, top studs/wingnuts	**$49.95**
1:1 Coax/Single Core		
COM-BAL-11150E	5 kW, side eyebolts	**$49.95**
COM-BAL-11150ET	5 kW, side and top eyebolts	**$49.95**
COM-BAL-11150S	5 kW, side studs/wingnuts	**$49.95**
COM-BAL-11150T	5 kW, top studs/wingnuts	**$49.95**
1:1 Dual Wire/Dual Core		
COM-BAL-11140T	5 kW, top studs/wingnuts	**$69.95**
COM-BAL-11140S	5 kW, side studs/wingnuts	**$69.95**
1:1 Coax/Dual Core		
COM-BAL-11150DS	5 kW, side studs/wingnuts	**$69.95**
COM-BAL-11150DT	5 kW, top studs/wingnuts	**$69.95**
4:1 Dual Wire/Single Core		
COM-BAL-41130E	3 kW, side eyebolts	**$59.95**
COM-BAL-41130ET	3 kW, side and top eyebolts	**$59.95**
COM-BAL-41130T	3 kW, top studs/wingnuts	**$59.95**
COM-BAL-41130S	3 kW, side studs/wingnuts	**$59.95**
4:1 Dual Wire/Dual Core		
COM-BAL-41150T	5 kW, top studs/wingnuts	**$89.95**
COM-BAL-41150S	5 kW, side studs/wingnuts	**$89.95**
COM-BAL-41150E	5 kW, side eyebolts	**$89.95**

Contact DX Engineering Customer Support for recommendations for your application.

DX ENGINEERING IS NOW AN AUTHORIZED DISTRIBUTOR!

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Rohn Commercial Towers

FIBERGLASS TUBING TELESCOPING SIZES HIGH STRENGTH

Great for wire antenna spreaders or insulated stacking frames! Build your favorite antenna design!

50 Ft. Telescoping Fiberglass Tubing Mast Kit

- Tubing custom made just for DX Engineering
- Smoothly telescoping sections
- Neutral light gray color
- Uses DX Engineering Stainless Steel Element Clamps to assemble slit lengths

DXE-FTK50 Telescoping Tubing Kit..... **$138.00**

Telescoping Fiberglass Tubing

- 1/8" nominal wall x 8 feet long

Unslit Tubing

DXE-FT0500-8	0.500" O.D.	**$6.45**
DXE-FT0750-8	0.750" O.D.	**$8.95**
DXE-FT1000-8	1.000" O.D.	**$9.95**
DXE-FT1250-8	1.250" O.D.	**$11.95**
DXE-FT1500-8	1.500" O.D.	**$18.95**
DXE-FT1750-8	1.750" O.D.	**$20.95**
DXE-FT2000-8	2.000" O.D.	**$25.95**

Tubing with One End Slit

DXE-FT0750-8S	0.750" O.D.	**$13.95**
DXE-FT1000-8S	1.000" O.D.	**$14.95**
DXE-FT1250-8S	1.250" O.D.	**$16.95**
DXE-FT1500-8S	1.500" O.D.	**$23.95**
DXE-FT1750-8S	1.750" O.D.	**$25.95**
DXE-FT2000-8S	2.000" O.D.	**$30.95**

PSK-31 SSTV WSJT

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SignaLink™ From Tigertronics

TIG-SL-USB..... $86.95

Then choose a cable for each radio!

Any Radio Interface Cable*, only **$12.95** when purchased with SignaLink™ unit

.....YOUR TOTAL $99.90

For your complete digital solution!

**except the special Elecraft K3 cable*

- Easiest installation and setup—Macintosh or PC
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- Built-in low noise sound card
- Requires radio interface cable
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- Works with ALL radios
- Supports all sound card digital and voice modes

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We Will Beat Any Competitors' Prices! Call us for complete details.

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LDG ELECTRONICS

FREE Balun

with any new LDG tuner or S9V antenna!

Purchase any new LDG Tuner or S9V Antenna between 9/1/11 and 4/15/12 and receive a FREE balun! Log-on to www.ldgelectronics.com for more information!

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

NEW! AT-200Pro II

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

Z-11Pro II

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.

We have a tuner that will work for you!

*We make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the **Tuner Comparison Chart** on our web site for more selection help!*

radio not included

AT-897Plus

for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment 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-600Pro

The AT-600Pro handles up to 600 watts SSB and CW, 300 on RTTY (1.8 – 30 MHz), and 250 watts on 54 MHz. Matches virtually any kind of coax-fed antenna and will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use it with longwires, random wires and antennas fed with ladder line just by adding a balun. Two antenna ports with a front-panel indicator, and separate memory banks for each antenna. LED bar-graph meters shows RF power, SWR and tuner status, tactile feedback control buttons and an LED bypass indicator. Operates from 11 – 16 volts DC at 750 mA. Includes six foot DC power cable.

Suggested Price $359.99

Z-100Plus

Small and simple to use, the Z-100Plus sports 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***

LDG Electronics, Inc. 1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

The #1 Line of Autotuners!

Designed to handle the higher power of the Tokyo Hi Power HL-45B.

NEW! Z-817H

The ultimate autotuner for QRP radios including the Yaesu FT-817(D) with addition of the Tokyo High Power HL-45B. Interfaces to the CAT port (ACC) on the back of the radio with the provided cable. One button push on the tuner and the Z-817H takes care of the rest. Will also function as a general purpose antenna tuner with other QRP radios or QRP radios with up to 75 watt HF amps. Powered by four AA internal Alkaline batteries (not included). 2000 memories cover 160 through 6 meters.

Suggested Price $159.99

- *RF Sensing*
- *Tunes Automatically*
- *No Interface Cables Needed*

AT-100Pro II

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

AT-1000Pro

The AT-1000Pro has an Automode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Operates at any power level between 5 and 1,000 watts peak. RF Relay protection software prevents tuning at greater than 125 watts. Tunes from 1.8 to 54.0 MHz (inc. 6 meters), with tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. 2000 memories. 2 Antenna connections. Includes six foot DC power cable.

Suggested Price $599

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

FREE!

RBA-1:1 Balun or RU-4:1 Unun

When You Buy A S9V 43', 31' or 18' Multiband Antenna

Purchase an S9V 43', 31' or 18' antenna and fill out the included form. Mail it to LDG Electronics, and we will send you either a 200 watt balun or unun, your choice!

Antennas!

S9V 43' $199.99

80-6 meters *Fixed Operation*

The S9V 43' is a high-performance lightweight telescoping fiberglass vertical. The best value in high-performance 'tall' verticals!

S9V 31' $99.99

40-6 meters *Fixed or Portable Operation*

S9V 18' $49.99

20-6 meters *Fixed or Portable Operation*

The S9V 31' and 18' are tapered, ultra-lightweight fiberglass vertical antennas. Friction-locking sections and high-tech polymer tube rings allow the antenna to be quickly and safely deployed in practically any environment without tools!

S9RP $39.99

Aluminum Radial Plate

Includes 20 sets of stainless steel nuts & bolts

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LDG

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. . . the first choice of hams around the world!

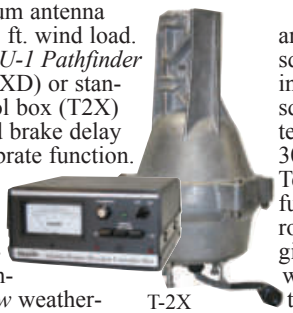
HAM-IV

HAM-IV **$649.95**

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II



For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X **$799.95**

T-2XD **$1229.95** with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II **$449.95**

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V **$1099.95** with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

AR-40

AR-40 **$349.95**

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A **$1499.95**

King-sized antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

ROTATOR OPTIONS

MSHD, $109.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $49.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

Digital Automatic Controller

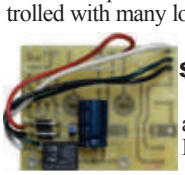
DCU-1 **$749.95**

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35 **$89.95**

For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.



RBD-5 **$29.95**

NEW! Automatic Rotator Brake Delay

Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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TH-F6A Triband FM HT

- TX: 144-148, 222-225, 430-450 MHz
- RX: 0.1-1300 MHz (cell blkd) • Dual band RX
- FM Wide/Narrow, AM, SSB and CW receive modes
- Power: 5/0.5/0.05W • Memories: 435

TH-D72A 2M/440 FM HT Built-in GPS

- TX: 144-148, 430-450 • RX: 118-174, 320-524 MHz
- Power: 5/0.5/0.05W • Memories: 1000 • USB Port
- 1200/9600 bps packet TNC • SkyCommand and APRS
- Stand-alone Digipeater • Built-in High Performance GPS
- GPS logging - stores up to 5,000 points of track data
- Echolink® ready • KISS mode protocol

TM-V71A Dualband FM Mobile

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Cross-band repeat • EchoLink® ready
- The optional RC-D710 can replace the TM-V71A control panel to enable all the features of the TM-D710A.

TS-480HX 200W HF/6M Mobile

- TX: HF/6M • RX: 0.5-60 MHz • Power: 10-200W (with two optional 22A PS's) • Memories: 99
- IF/stage DSP on main band, AF/stage DSP on sub-band 100W with auto antenna tuner.

TM-281A 2M FM Mobile

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 65W • Memories: 200

TS-2000 HF/6/2M/440 MHz All Mode

- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

The Perfect APRS Pair!

AvMap G6 APRS

TM-D710A Dualband FM Mobile w/TNC

- TX: 144-148, 430-450 MHz
- RX: 118-524, 800-1300 MHz (cell blkd)
- Power: 50/10/5W • Dual receive (V+V) (U+U)
- Built-in TNC for APRS (needs GPS)
- Cross-band repeat • AvMap G6 & EchoLink® ready

AvMap G6 APRS GPS Navigator

- Intergrates best with the TM-D710A and TH-D72A but also works well with the TM-D700A and TH-D7A
- Bright non-glare 4.8 inch color touchscreen
- Preloaded NAVTEQ street maps of N. America
- Text to Speech instructions • Lane Assistant
- Full bi-directional RS-232 APRS communication

TS-590S 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz
- Power: 5-100W (5-25W on AM)
- Memories: 110 + 10 Quick Channels
- HF/6M Auto Antenna Tuner
- Full/semi break-in CW • 10 Hz Dual VFO Display
- USB connectivity for PC and remote control
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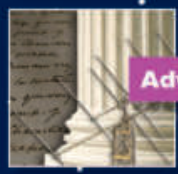

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Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
Intl CD	$39	$76	$111	Annual CD-ROM (*QST*, *NCJ* and *QEX*) for international members
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Source Code: QST 12/2011

FT-270R 2M FM HT

• TX: 144-148 • RX: 136-174 • Power: 5/2/0.5W
• Memories: 200 • Extra large LCD display & speaker

VX-6R 2M/440 FM Dual Band HT

• TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
• Power: 5/2.5/1/0.3W (1.5W on 220) • Memories: 900
• Submersible 3 feet for 30 minutes

VX-8DR Quad-band FM HT

• TX: 50-54, 144-148, 222-225, 430-450 MHz
• RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
• Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
• Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand mic provides you with APRS® data

FT-1900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 55/25/10/5W • Memories: 221

FT-7900R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blocked)
• Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
• Memories: 1055 • YSK-7800 included!

FT-8800R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
• Crossband repeat • YSK-8900 included!

FT-8900R Quad-Band FM Mobile

• Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 included!

FT-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-450D HF/6M Compact Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 500 • Auto Tuner • Same as the FT-450AT with new features: Key illumination, Foot stand, Selectable 300 Hz/500 Hz/2.4 kHz CW IF Filters and more!

FT-950 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 100 • Auto Antenna Tuner
• 32-bit Floating Point DSP • Built-in high stability TCXO

FT-2000 HF/6M Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
• Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive • Internal Power Supply
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000D RF output is 200W, PS is external

FTDX-5000MP

FTDX-5000 Series – Covers HF and 6M;

Three different configurations all running 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" also comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000 - Basic Model & ±0.5ppm TCXO
FTDX-5000D - With Station Monitor & ±0.5ppm TCXO
FTDX-5000MP - With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

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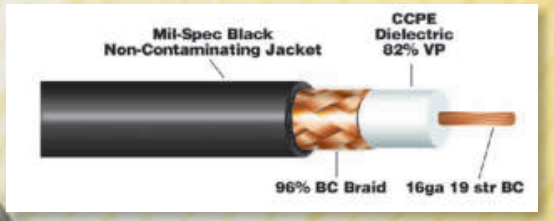
2213A RG213/U MIL-SPEC
Non-contaminating Direct-Burial Ultra-Violet Resistant Jacket.
W/SILVER-TEFLON PL259 & WEATHERPROOF HST each end.

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

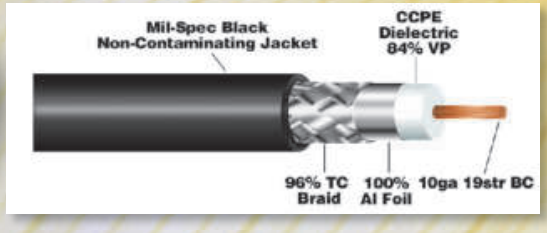
Part #	Length/Ft	Price/ea
2213A-PL-3	3	$11.95
2213A-PL-6	6	$14.95
2213A-PL-50	50	$57.95
2213A-PL-75	75	$80.95
2213A-PL-100	100	$99.95
2213A-PL-150	150	$144.95



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

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

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



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

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

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

Prices subject to change without notice or obligation.

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IC-80AD 2M/440 D-Star & FM HT
- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/2.5/0.5/0.1W • Improved User Interface
- Optional HM-189GPS Speaker Mic adds GPS capabilities

IC-92AD 2M/440 D-Star & FM HT
- TX: 144-148, 420-450 MHz • RX: 0.495-999 MHz (cell blkd)
- Power: 5/2.5/0.5/0.1W • Duel RX
- Optional HM-175GPS Speaker Mic adds GPS capabilities

GPS Speaker Microphones
- Shows your position data on the display and offers a position reporting function in DV mode
- HM-189GPS for IC-80AD and HM-175GPS for IC-92AD

IC-2200H 2M FM Mobile
- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207
- D-Star upgradable with optional UT-118

IC-208H 2M/440 FM Mobile
- TX: 144-148, 430-450 MHz • Memories: 512
- RX: 118-173, 230-549, 810-999 MHz (cell blkd)
- Power: 55/15/5W (2M), 50/15/5W (440 MHz)

IC-7000 HF/6/2M/440 MHz Mobile
- TX: HF/6/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
- Memories: 503 • 41 band-widths with sharp or soft filter shape • RMK-7000 included!

IC-7200 HF/6M Portable
- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 201 • Rugged design for outdoor use
- 32-bit IF-DSPs + 24-bit AD/DA Converters
- USB Port for CI-V Format PC Control & Audio In/Out

IC-7410 HF/6M Transceiver
- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- 15kHz 1st IF filter and optional 3kHz & 6kHz filters to protect against strong unwanted adjacent signals
- Much faster DSP unit compared to the IC-746PRO
- Automatic antenna tuner • USB connector for PC control

IC-7600 HF/6M Transceiver
- TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W
- Memories: 101 • 5.8 inch color screen
- High-resolution real time spectrum scope using a dedicated DSP unit • Automatic antenna tuner

IC-7700 HF/6M Transceiver
- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen
- Two 32-bit floating DSPs • Power supply built-in
- Three roofing filters • External VGA connector
- Automatic antenna tuner • USB memory drive socket
- Real time spectrum scope

IC-9100 HF/6/2M/440 MHz All Mode
- TX: HF/6/2M/440 MHz • RX: 0.03-60, 136-174, 420-480 MHz • Optional 1.2 GHz, 1-10W Operation
- Power: 2-100W HF/6/2M & 2-75W 440 MHz
- Memories: 297 • Optional D-Star Board • Auto Tuner
- Optional 3 kHz & 6 kHz Roofing Filters (first IF)
- USB Port for CI-V Format PC Control & Audio In/Out

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Radios by ICOM

MFJ-259B *World's* most popular Antenna Analyzer is super easy-to-use!

MFJ-259B
$289.95

The MFJ-259B is the world's most popular Antenna Analyzer and the easiest to use! Just select a band and mode. Set frequency. Your measurements are instantly displayed!

Handheld Antenna Lab

Owning the MFJ-259B is like having an entire antenna lab in the palm of your hand!

Measure SWR quickly or make sophisticated measurements such as Return Loss, Reflection Coefficient, Resonance, Complex Impedance (R+jX), Impedance Magnitude (Z) plus Phase in degrees. Covers 1.8 to 170 MHz -- no gaps.

Coax Analyzer

Determine coax cable velocity factor (Vf), loss in dB, coax length, distance to open or short plus detect wrong coax impedance.

Frequency Counter

Measure frequency of external signals using the separate BNC counter input.

Signal Generator

Use as a signal source 1.8-170 MHz with digital dial accuracy for testing and alignment.

Inductance and Capacitance

Measure Inductance (uH) and Capacitance (pF) at RF frequencies not at audio frequencies used by most L/C meters.

Digital and *Analog* Meters

A high-contrast backlit LCD gives precision readings and *two* side-by-side *analog meters* make antenna adjustments intuitive.

Smooth, Stable Tuning

Velvet-smooth reduction drive tuning and precision *air-variable capacitor* makes setting frequency easy and stable.

Battery Saver & More

Battery-saver, low-battery warning, battery voltage meter and charger are all built in. Use ten Alkaline, NiCad or NiMH AA batteries (not included) or 110 VAC with MFJ-1312D, $15.95. 4Wx6¾Hx2D inches.

Here's What You Can Do

Find true antenna resonant frequency
Tune *antenna quickly for minimum SWR*
Match complex loads to your feedline
Adjust *mobile whips without stressing finals*
Determine safe 2:1-SWR operating windows
Adjust *tuners without generating QRM*
Find exact location of shorts and opens
Cut *stubs and phasing lines accurately*
Check cable for loss and contamination
Find *value of unknown coils and caps*
Test RF transformers and baluns
Troubleshoot *filters and networks*
Find self-resonance and relative Q
Check *patterns and compare gain*
MFJ-259B does all this and more!

MFJ Analyzer Accessories

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this *genuine* MFJ custom carrying case. Special foam-filled fabric cushions blows, deflects scrapes and protects knobs and meters from harm. **MFJ-39C, $24.95.** Like MFJ-29C, but for MFJ-269.

MFJ-66, $24.95. Plug-in coils turns any MFJ Antenna Analyzer into a sensitive and accurate *band switched* dip meter. 2 coils.

MFJ-92AA10, $29.95. Ten MFJ *SuperCell*™ Ni-MH AA rechargeable batteries.

MFJ-99B, $88.90. ***Save $7!*** MFJ-259B Deluxe Accessory Pack: MFJ-29C Pouch, 10 Ni-MH batteries, dip coils, AC adapter. **MFJ-98B, $88.90.** Like MFJ-99B but for MFJ-269.

MFJ-99, $60.85. ***Save $5!*** Like MFJ-99B, less batteries, for MFJ-259B. **MFJ-98, $60.85.** Like MFJ-99 but for MFJ-269.

MFJ-99C, $40.90. ***Save $5!*** AC Adapter and 10 Ni-MH batteries for MFJ-259B/269.

MFJ-917, $29.95. Current balun lets you make balanced line antenna measurements on HF with your MFJ Analyzer. **MFJ-7702, $3.95.** MFJ-917 to MFJ Analyzer adapter.

MFJ-731, $99.95. Tunable RF filter allows accurate Antenna Analyzer measurements in presence of strong RF fields. 1.8-30 MHz.

MFJ-5510, $9.95. Cigarette lighter cord.

MFJ-269 ...1.8-170 MHz and 415-470 MHz plus 12-bit A/D!

The MFJ-269 does everything the MFJ-259B does - and much more!

Expanded Frequency Coverage

MFJ-269 adds UHF coverage from 415 to 470 MHz -- right up into the commercial band. With it, you can adjust UHF dipoles, verticals, Yagis, quads and repeater collinear arrays with ease -- plus construct accurate phasing harnesses and timed cables. Also use it as a signal source to check UHF duplexers, diplexers, IMD filters and antenna patterns.

Much Better Accuracy

New *12-bit* A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads *parallel* equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

MFJ-269
$389.95

CoaxCalculator™

Lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and coax loss with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Logarithmic Bar Graph

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Uses instrumentation grade N-connector to ensure minimum mismatch on all frequencies. Includes N to SO-239 adapter.

MFJ-269*PRO*™ Analyzer

Like MFJ-269, but has extended commercial frequency coverage in UHF range ***(430 to 520 MHz)*** and *ruggedized* cabinet that protects LCD display, knobs, meters and connectors from damage in the field/lab.

MFJ-269PRO
$419.95

MFJ-266 ...Wide range 1.5-185 MHz and 300-490 MHz!

New!

MFJ-266
$349.95

The compact MFJ-266 covers HF (1.5-65 MHz) in 6 bands, plus VHF (85-185 MHz) and UHF (300-490 MHz).

In *Antenna Analyzer* mode, you get Frequency, SWR, Complex Impedance (R+jX), and Impedance Magnitude (Z) *all displayed simultaneously* on a high-contrast backlighted LCD (SWR only on UHF).

In *Frequency-Counter* mode, the MFJ-266 functions as a 500-MHz counter with up to 100 Hz resolution and measures relative field strength of a signal and its frequency and can be used for tracking measurement interference.

MFJ-266 also functions as a 10 dBm signal source with digital-frequency readout. It can also measure inductance and capacitance at RF frequencies.

Features include solid-state band switching and electronic varicap tuning with a smooth 10:1 lockable vernier tuning drive.

Use eight AA *alkaline* batteries or 110 VAC with MFJ-1312D, $15.95. Includes N-to-SO-239 adapter. 3¾Wx6½Hx2¾D inches. 1.3 lbs.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

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MFJ . . . The World Leader in Amateur Radio!

MFJ TUNERS

Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

***Full* 1.8-30 MHz Operation**

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

***Custom* inductor switch**

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*® insulating washers and proper L/C ratio gives you *arc-free* no worries operation up to 300 Watts PEP transceiver input power.

MFJ-949E **$179.95**

The MFJ-949E inductor switch was *custom* designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

***8-Position Antenna* switch**

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

***Lighted* Cross-Needle Meter**

***Full* size** 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, *peak* or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

***QRM-Free PreTune*™**

MFJ's *QRM-Free PreTune*™ lets you pre-tune your MFJ-949E *off-the-air* into its built-in dummy load! Makes tuning your actual antenna faster and easier.

Plus Much More!

***Full* size** built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^{5}/_{8}$x$3^{1}/_{2}$x7 inches. Superior cabinet construction and more!

MFJ-948, $159.95. Econo version MFJ-949E. Has all features except for dummy load.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D *Legal Limit* Tuner

MFJ-989D **$389.95**

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. Easily handles *full* 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. *New* 500 pF air variable capacitors. *New* improved *AirCore*™ Roller Inductor. *New* high voltage current balun. *New* crank knob. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D".

MFJ-986 Two knob *Differential-T*™

MFJ-986 **$349.95**

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D *compact* kW Tuner

MFJ-962D **$299.95**

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$x$10^{7}/_{8}$ in.

MFJ-969 300W *Roller Inductor* Tuner

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-969 **$219.95**

MFJ-941E *super value* Tuner

The most for your money! Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-941E **$139.95**

MFJ-945E HF/6M *mobile* Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-945E **$129.95**

MFJ-971 *portable/QRP* Tuner

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-971 **$119.95**

MFJ-901B *smallest* Versa Tuner

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-901B **$99.95**

MFJ-902 *Tiny Travel* Tuner

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902 **$99.95**

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 *random wire* Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-16010 **$69.95**

MFJ-906/903 *6 Meter* Tuners

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB.

MFJ-906 **$99.95**

MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 *VHF/UHF* Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-921/924 **$89.95**

MFJ-931 *artificial* RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 **$109.95**

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MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B **$259.95**

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 **$699.95**

300 Watt *Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

***Extra** wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

***No** extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

G5RV Antenna

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778 **$44.95**

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

***Fully** weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926B **$279.95**

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 **$259.95**

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MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

The famous G5RV antenna is the most popular ham radio antenna in the world! You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

MFJ-17754, $59.95. Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A **$69.95** 160M, 265 ft.
MFJ-1779B **$49.95** 80-40M, 135 ft.
MFJ-1779C **$29.95** 20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*® 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
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators.
MFJ-16B01, $19.95. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.
MFJ-18G100, $24.95. 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.
MFJ-58100X, $49.95. 100 ft. 50-Ohm RG-8X with PL-259s on each end.
MFJ-18H100, $34.95. 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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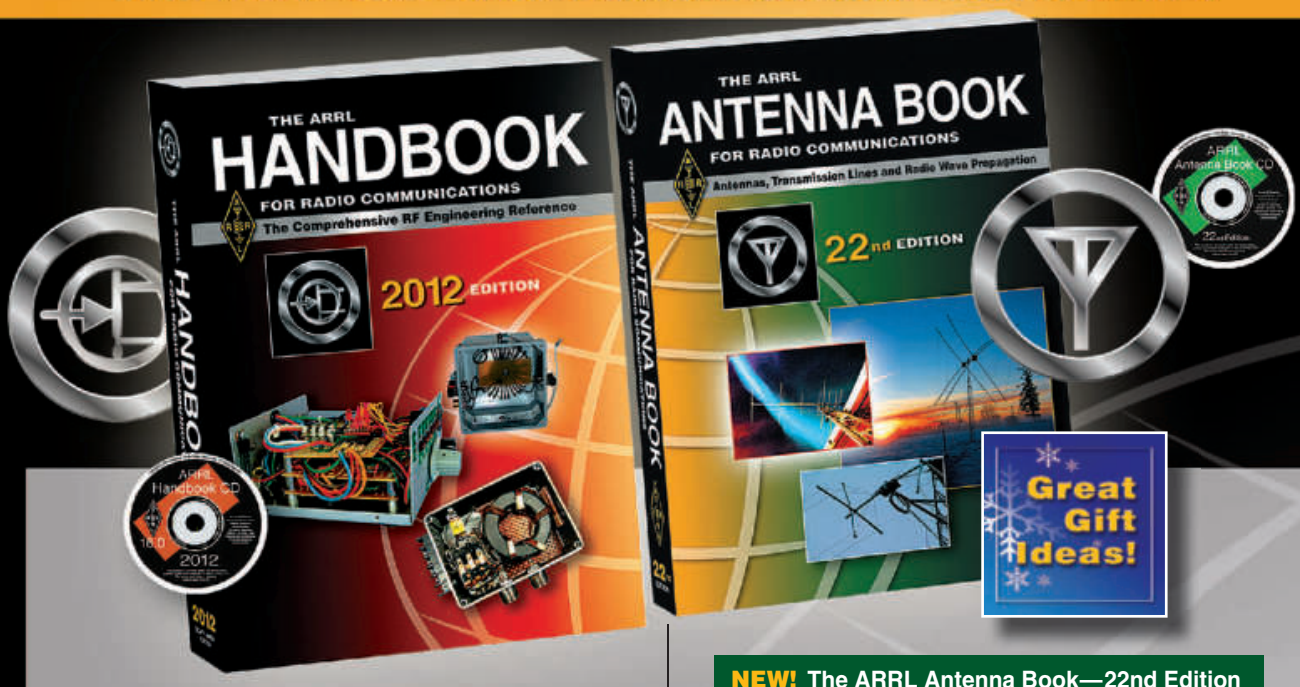

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10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

MFJ-1798
$349.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters *Rotatable* Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .

MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter *Rotatable* Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency.*

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 M as Marconi. 1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

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MFJ . . . the world leader in ham radio accessories!

MFJ *giant* 6.5 inch SWR/Wattmeter

World's *largest HF* SWR/Wattmeter has *giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868 **$149.95**

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5½Hx5D in. SO-239 connectors.

Giant 144/220/440 MHz SWR/Wattmeter

MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

MFJ peak-reading *giant* 4.5 inch *Cross-Needle* SWR/Wattmeter

New!

See it all at once on giant Cross-Needle SWR/Wattmeter! MFJ-891 simultaneously displays forward/reflected power and SWR on easy-to-read three-color scale. 20, 200, 2000 Watt ranges have individual scales. *True*™*Active peak-reading circuit* reads forward and reverse *true peak* power in all modes. New directional coupler gives increased accuracy over entire 1.6 to 60 MHz frequency range. Low bias Schottky diode detectors increase linearity at low power -- great for QRP. Super-bright LED backlight with on/off switch provides smooth even illumination. DC grounded antenna connections prevent electrostatic build up. Quality SO-239 connectors. Designer-styled molded front panel and rugged metal housing looks great. 7¼Wx4½Hx4½D in.

MFJ-891 **$109.95**

MFJ *high-accuracy* Digital SWR/Wattmeter

MFJ-826B has a large high-contrast, high-accuracy *backlit* LCD display. Auto-ranging selects optimum full-scale range from 25W, 250W and 1500W ranges with full 10-bit resolution on each range. Covers entire amateur power spectrum. Built-in frequency counter selects frequency compensated data set to insure highest accuracy for each band. Displays frequency, provides digital read-out for older rigs and QRP rigs. *True* peak/average and forward/reflected power, SWR and frequency are *simultaneously* displayed. Select bargraphs to display forward/reflected power *or* forward /SWR *or* SWR only. MFJ's *PeakHold*™ freezes highest forward power displayed 1, 2 or 3 seconds. When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds. Use 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½Wx2⅝Hx6D inches.

MFJ-826B **$179.95**

www.mfjenterprises.com . . . World's largest selection of HF/VHF/UHF SWR Wattmeters!

MFJ-822 **$59.95**

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862 **$69.95**

Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864 **$99.95**

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C **$89.95**

Lighted 3" C/N Meter, SWR/Watts, 1.8-30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B **$39.95**

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B **$149.95**

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403 **$119.95**

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

MFJ-1164B **$79.95**

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

MFJ-655B **$219.95**

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MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" ***Can you hear but . . . just can't always understand everything people are saying?***

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack*. Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null *wipes out* noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network*. You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like

MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ *tunable* Super DSP filter

MFJ-784B
$279.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

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MIRAGE. . .160 Watts on 2 Meters!

Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer. . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

Ideal for 25-50 Watt 2 Meter mobile or base. Weak signals pop out with its low noise *GaAsFET* preamp and its excellent 0.6 dB noise figure. Selectable 5, 8 or 14 dB preamp gain.

Exclusive MIRAGE *ActiveBias*™ circuit gives *crystal clear SSB* without splatter or distortion.

B-5018-G is legendary for its ruggedness and is fully protected -- high SWR or excessive input power automatically bypasses the B-5018-G to prevent damage.

Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ inches.

B-5018-G **$329.95**

B-1018-G, $409.95. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.25-10 Watt rigs.

B-2518-G, $329.95. Same as B-5018-G but for 10 to 25 Watt mobile or base. 160 Watts out for 25 Watts in.

RC-2, $49.95. Remote Control. On/Off,pre-amp On/Off, selects SSB/FM. With 25 foot cable.

Power Curve -- typical output power in Watts

B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	--	--
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

35 Watts for 2 Meter HT

For handhelds up to 8 Watts. 35 Watts out for 3-8 Watts in (18 W out/1W in)! 18 dB *GaAsFET* preamp. All modes: FM, SSB, CW. RF sense T/R switch. Reverse polarity protection. Includes mobile bracket, 1 year warranty. 5¼Wx1¾Hx4¾D in.

B-34-G **$129.95**

35 Watts, $109.95, FM only

B-34, $109.95. 35 Watts out for 2 Watts in. Like B-34-G, FM only, less pre-amp, mobile bracket. 3⅛Wx1¾Hx4¼D in.

MIRAGE Dual Band 144/440 MHz Amp

Boost your *dual band* 144/440 MHz handheld to a powerful mobile/base -- 45 Watts on 2 Meters/ 35 Watts on 440 MHz! Works with all FM handhelds to 7 Watts. Includes *full duplex* operation -- lets you talk on one band, listen on other at same time. Auto band selection, RF sense T/R switch, single connector, reverse polarity protection, 5Wx1¾Hx5D in. Mobile bracket. One year warranty.

BD-35 **$199.95**

100 Watts for 2M HT

100 Watts out for 2-8 Watts in! Great for HTs up to 8W. FM, SSB, CW. 15 dB *GaAs-FET* preamp, RF sense T/R, high-SWR protected.

B-310-G **$249.95**

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the *finest* antenna tuner made!

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- ***SSB*Analyzer Bargraph™***
- ***Cross-Needle Meter***
- ***6 Position Antenna Switch***
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FM Radio? Ham radio legend Edwin Howard Armstrong commenced VHF high fidelity FM broadcasts in 1937; *"You could hear a pin drop!"*

Cable TV? Ham Ed Parsons in Astoria, Oregon conceptualized and hand built on his work bench the world's first CATV system; 1948. Parsons actually *asked* the FCC for *approval* first. They put it in the *'too hard'* basket.

Translator TV? TV deprived Emporium, Pa sent a group of hams (1949) to workshops creating first 'TV booster/translator' facility (TV ch13 in/7 out). *A license?? No, the FCC was not amused.*

Commercial TV? San Francisco's first public TV was KPIX (on air 24 December 1948). A close second was Bob Melvin (W6VSV) operating 8-10PM nightly (March 1949) on 423 Mc/s. The FCC told him: *"your callsign is W6VSV, NOT W6VSV-TV".*

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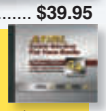

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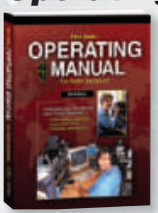

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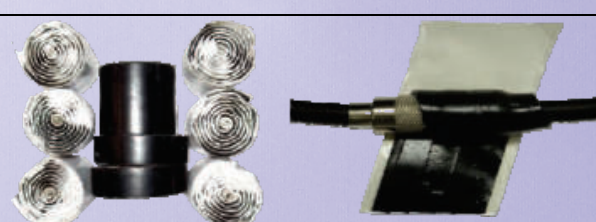

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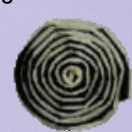

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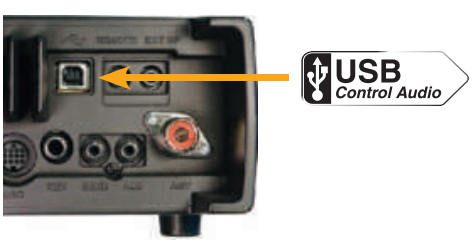

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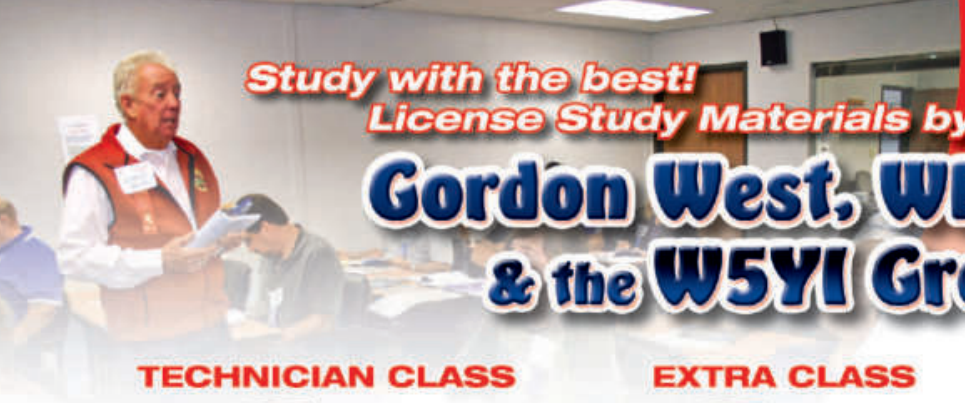

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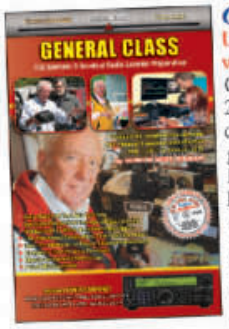

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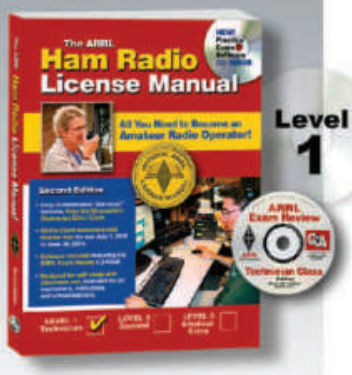

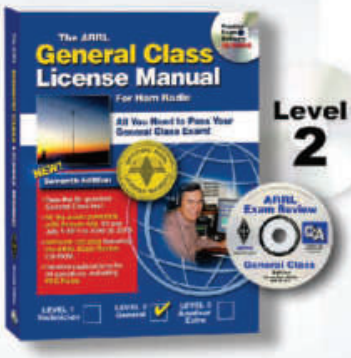

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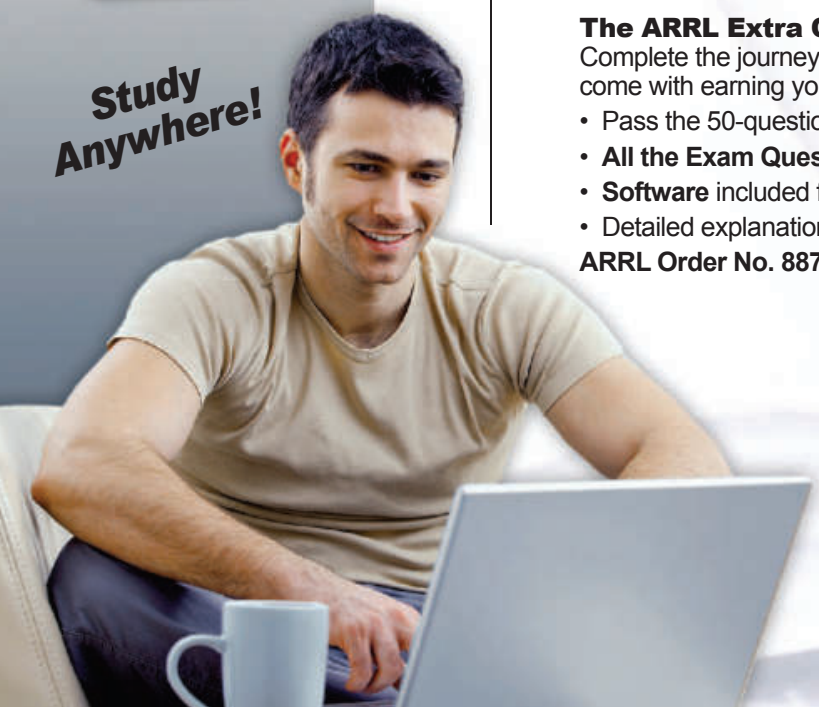

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sta·tis·tics (st-tstks) n.
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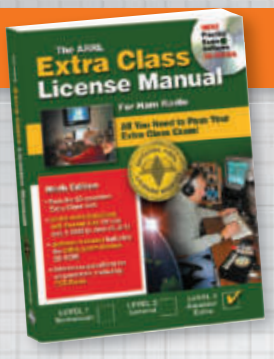

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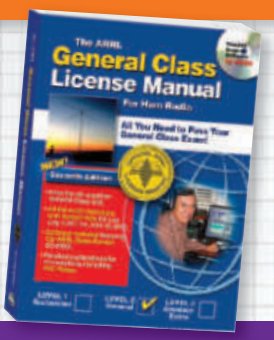

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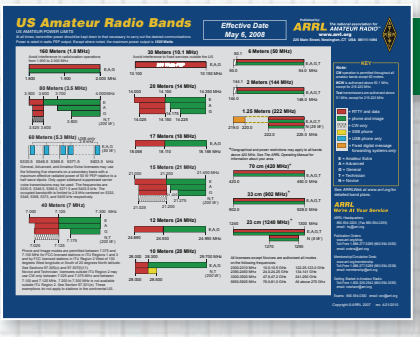

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Yes, in the car: 17%
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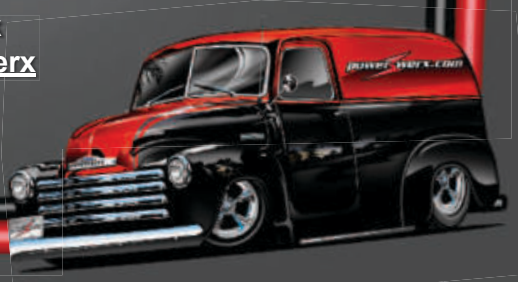

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