QST

DEVOTED ENTIRELY TO AMATEUR RADIO

January 2011 WWW.ARRL.ORG

DIY

So Many Projects, So Little Time

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Official Journal of ARRL The national association for AMATEUR RADIO™

Send your voice to the world with a handheld radio.

Work a D-STAR repeater and you're tied in to worldwide communications, whether you're using a D-STAR mobile or handheld radio. Enjoy advanced digital communication with D-STAR transceivers.

Easy to use entry class digital handheld

VHF/UHF DUAL BAND TRANSCEIVER

IC-80AD

- D-STAR DV mode
- Analog FM
- Easy to use DR mode
- IPX4 Water-resistant
- Wideband receiver
- Optional GPS Mic HM-189GPS

Feature-rich handheld with dualwatch

VHF/UHF DUAL BAND TRANSCEIVER

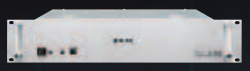
IC-92AD

- D-STAR DV mode
- Analog FM
- IPX7 Submersible
- Dualwatch receive
- Wideband receiver
- Optional GPS Mic HM-175GPS

*Frequency specs may vary. Refer to owner's manual for exact frequency specs. **IPX7: Tested to work after being under 1 meter of water for 30 minutes.

ID-RP2C
REPEATER CONTROLLER

The cornerstone of the D-STAR system. Handles up to four RF modules. Basic in-band or crossband operation. Linking capabilities through the internet.



ID-RP2D
1.2GHZ DATA MODULE

Access point with a data rate of up to 128kbps. Perfect for email, web applications and support via internet connection.

ID-RP2V
1.2GHZ DIGITAL VOICE MODULE

ID-RP2000V
2M DIGITAL VOICE MODULE

ID-RP4000V
70CM DIGITAL VOICE MODULE

D-STAR ready

ID-1
GO DIGITAL ON 23cm

- 50 Watt/VHF/UHF
- AM, FM, DV
- RX: 118–999.99MHz*
- 800 Alphanumeric Memory Channels
- Free Programming Software!†

†*For software details visit:*
www.icomamerica.com/Amateur/dstar

D-STAR optional

IC-2200H
D-STAR UPGRADEABLE FOR 2m

- 65 Watt Output
- RX: 118–174MHz*
- 207 Alphanumeric Memory Channels
- CTCSS & DTCS Encode/Decode with Tone Scan
- Built-in 10dB Squelch Attenuator
- Digital Voice & Data (Optional UT-118 Required)

D-STAR ready

ID-1
GO DIGITAL ON 23cm

- 10 Watt on 23cm (FM, DV, DD)
- RX: 1240–1300MHz*
- 100 Alphanumeric Memory Channels
- USB Rig Control, Ethernet Plug for DD
- Black Box Operation
- Remote Control Head, Remote Speaker and Cables Included
- PC Software Included

D-STAR optional

IC-2820H
D-STAR UPGRADEABLE 2m/70cm

- 50/15/5 Watt Output
- RX: 118–549.995, 118–173.995 375–549.999, 810–999.990MHz*
- 522 Alphanumeric Memory Channels
- One Touch Reply Function
- Digital Voice/GPS (Optional UT-123 Required)
- Low Speed Data (Optional OPC-1529R Required)

D-STAR optional

IC-91A
ANALOG & DIGITAL DUAL BANDER

- 5/0.5 Watt Output
- RX: 0.495–999.990, 118–174, 350–470MHz*
- 1304 Alphanumeric Memory Channels
- Li-ion Battery
- Digital Voice and Data (Opt. UT-121 Required)

D-STAR optional

IC-V82 & IC-U82
D-STAR UPGRADEABLE FOR 2m OR 70cm

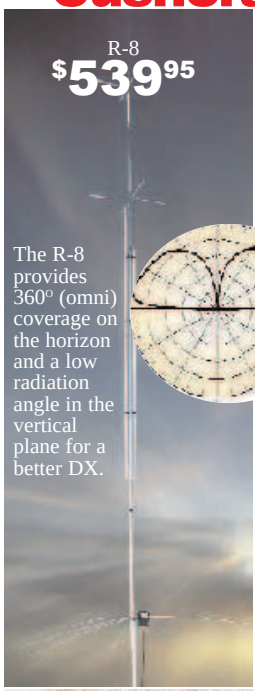
- 7/4/0.5W (V82), 5/2/0.5 (U82)
- RX: 136–174MHz* (V82), 400–479MHz* (U82)
- 207 Alphanumeric Memory Channels
- CTCSS & DTCS Encode/ Decode with Tone Scan
- Digital Voice & Data (Opt. UT-118 Required)

D-PRS™

ICOM®

Cushcraft R8 *8-Band Vertical*

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



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

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

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

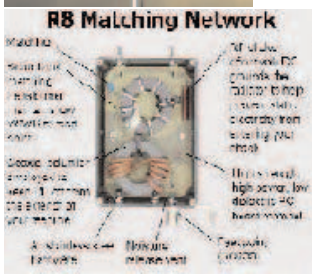
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

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

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

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

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



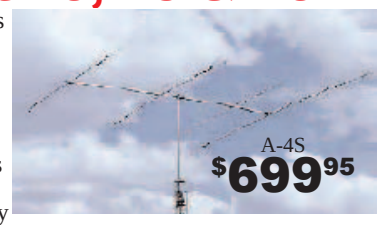
MA-5B *5-Band* Beam

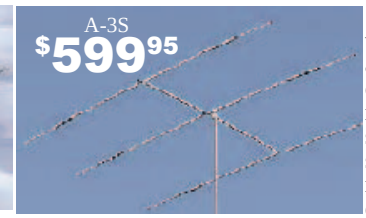
Small Footprint -- Big Signal

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

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

Cushcraft 10, 15 & 20 Meter Tribander Beams





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

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

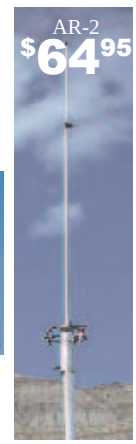
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS, $499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

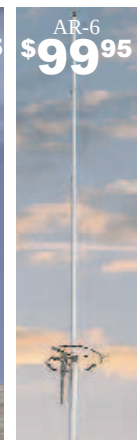
Cushcraft Dual Band Yagis

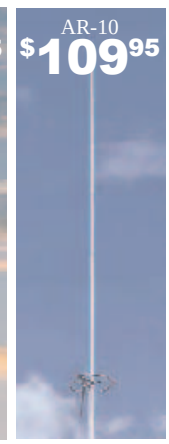
One Yagi for Dual-Band FM Radios

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

Cushcraft Famous *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!

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and Nearest Dealer . . . 662-323-5803
Call your dealer for your best price!

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308 Industrial Park Road, Starkville, MS 39759 USA
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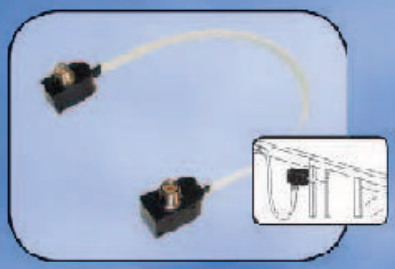
Life is a JOURNEY. Enjoy the ride!



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: 5 lbs 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

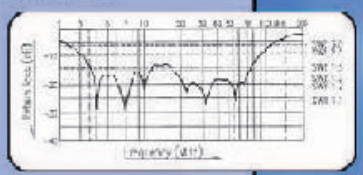
COMET CHA-250B
Broadband HF Vertical!

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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Interested in Writing for *QST*?
www.arrl.org/qst-author-guide
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Our Cover
Welcome to our Do-It-Yourself (DIY) issue! This issue is crammed with a variety of projects for your reading and/or building enjoyment. On our cover, ARRL Senior Lab Engineer Zack Lau, W1VT, constructs a small, 6 element 70 cm beam. Find out more about Zack's meticulously crafted project at **www.arrl.org/uhf-beams**.

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Choice of the World's top DX'ers

Loaded with Leading-edge Performance Capabilities. . .
The First Triumph in the 2nd Generation of the FT DX 9000 Lineage:
The Powerful FT-2000!

HF/50 MHz Transceiver
FT-2000
100 W Version (Internal Power Supply)

DMU-2000
Data Management Unit

Photograph shows 100-Watt version. Computer display and keyboard are after-market items, not supplied with the FT-2000.

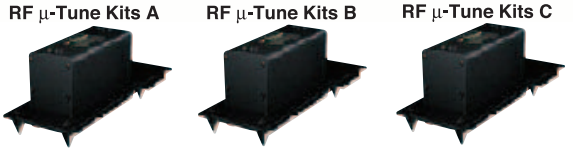
HF/50 MHz Transceiver
FT-2000D
200 W Version
(External Power Supply)

Options

SP-2000
External Speaker
with Audio filters

RF μ-Tune Kits

160m Band RF μ-Tune Kits A	80/40m Band RF μ-Tune Kits B	30/20m Band RF μ-Tune Kits C



- Up to three μ-Tune Kits may be connected.
- μ-Tune Kit is included in purchase price of μ-Tune Unit.

"The Best of the Best Just Got Better"

Introducing the new FT-2000 Series with PEP-2000 (Performance Enhancement Program)
Contact Dennis Motschenbacher K7BV at k7bv@vxstdusa.com for details

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http://www.vertexstandard.com

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

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

Vertex Standard
US Headquarters
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Cypress, CA 90630 (714)827-7600

Introducing the Yaesu FT-950 transceiver for DX enthusiasts
Superb receiver performance
Direct lineage from the legendary FT DX 9000 and FT-2000

HF/50 MHz 100 W Transceiver

FT-950

- Triple-conversion super-heterodyne receiver architecture, using 69.450 MHz 1st IF
- Eight narrow, band-pass filters in the RF stage eliminate out of band interference and protect the powerful 1st IF
- 1st IF 3 kHz Roofing filter included
- High-speed Direct Digital Synthesizer (DDS) and high-spec Digital PLL for outstanding Local Oscillator performance
- Original YAESU IF DSP advanced design, provides comfortable and effective reception. IF SHIFT / IF WIDTH / CONTOUR / NOTCH / DNR
- DSP enhancement of Transmit SSB/AM signal quality with Parametric Microphone Equalizer and Speech Processor
- Built-in high stability TCXO (±0.5 ppm after 1 minute@77 ° F)
- Built-in automatic antenna tuner ATU, with 100 memories
- Powerful CW operating capabilities for CW enthusiasts
- Five Voice Message memories, with the optional DVS-6 unit
- Large Multi-color VFD (Vacuum Fluorescent Display)
- Optional Data Management Unit (DMU-2000) permits display of various operating conditions, transceiver status and station logging.
- Optional RF μ -Tune Units for 160 m, 80/40 m and 30/20 m Bands

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Introducing the new FT-950 Series with PEP-950 (Performance Enhancement Program)

COMPACT HF/50 MHz TRANSCEIVER WITH IF DSP

A superb, compact HF/50 MHz radio with state-of-the-art IF DSP technology configured to provide YAESU World-Class Performance in an easy to operate package.
New licensees, casual operators, DX chasers, contesters, portable/field enthusiasts, and emergency service providers - *YAESU FT-450...This Radio is for YOU!*

HF/50 MHz 100 W All Mode Transceiver

FT-450 Automatic Antenna Tuner ATU-450 optional
FT-450AT With Built-in ATU-450 Automatic Antenna Tuner
Compact size : 9" X 3.3" x 8.5" and Light weight : 7.9 lb

HF/VHF/UHF Portable Operation
Just Got a Lot More Powerful!

FT-897D TCXO DSP 60 m Band
HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

HF/VHF/UHF Multimode Mobile Transceiver,
now Including Built-in DSP

FT-857D DSP 60 m Band
HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

Real Performance,
Really Portable

FT-817ND
HF/50/144/430 MHz
5 W All Mode
Transceiver
(AM 1.5 W)
60 m Band

Automatic Matching for FT-897/857 Series Transceivers

FC-40
Automatic-Matching 200-Memory Antenna Tuner (160 m ~ 6 m Band)
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Mobile Auto-Resonating 7~430 MHz for FT-897/857 Series Transceivers

ATAS-120A
Active Tuning Antenna System (no separate tuner required)

VHF/UHF Base RadialKit ATBK-100 for ATAS-120A.

ATAS MICRO
ATAS-25
Manually-Tuned Portable Antenna

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Experience 400 imposing Watts, and call with confidence!

Photograph depicts after-market keyboard, keyer paddle, and monitor, not supplied with transceiver. Display image simulated and may differ in actual use.

The FT DX 9000MP's Power Amplifier stage utilizes SD2931 MOS FET devices in a parallel, push-pull configuration, a conservative design that permits ultra-clean Class-A operation at a full 100 Watts of output, with continuous bias adjustment between Classes A and AB available on the front panel. If you have a professional microphone with a balanced "Cannon" (XLR) connector, you may connect it directly to the matching connector on the front panel, then use our exclusive three-band Parametric Microphone Equalizer to adjust the center frequency, bandwidth, and equalizer gain in the bass, mid-range, and treble frequency ranges.

YAESU engineers take signal quality seriously, because we know you do, too!

HF/50 MHz Transceiver

FT DX 9000MP

400 W Special Order Version

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 50 V/24 A Switching Regulator Power Supply and Speaker with Audio Filters

Display color (Umber or Light Blue) may be selected at the time of purchase. Modification from 400 to 200 W not possible.

HF/50 MHz Transceiver

FT DX 9000D 200 W Version

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

HF/50 MHz Transceiver

FT DX 9000 Contest 200 W Custom-Configurable Version

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

Display color (Umber or Light Blue) may be selected at the time of purchase. Modification from 200- to 400-Watt version not available.

"The Best of the Best Just Got Better"

Introducing the new FT DX 9000 Series with PEP-9000 (Performance Enhancement Program)

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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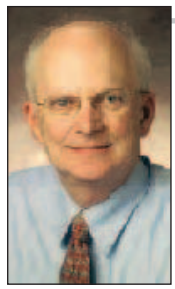

K1ZZ

The National Broadband Plan

"In one of its first acts, in February 2009 the 111th Congress directed the FCC to develop a National Broadband Plan (NBP) ensuring that every American has "access to broadband capability." A lot has happened since then."

Public Law 111-5 gave the FCC one year to deliver the NBP. That was little enough time given the magnitude of the task. To its credit, the Commission got right to work even though it was down to three members from its usual five and Julius Genachowski, the President's nominee for Chairman, had not been confirmed and sworn in. Under the leadership of Acting Chairman Michael Copps a Notice of Inquiry was adopted on April 8, 2009 as a medium for public participation, and in subsequent months the FCC solicited comments on numerous specific topics through public notices. Between August 2009 and January 2010 the Commission held 36 workshops and organized nine field hearings in different parts of the country. A dedicated Web site, **www.broadband.gov**, provided a wealth of resources for citizen monitoring and participation. While reasonable people may respectfully disagree about policies reflected in the NBP, the FCC's Omnibus Broadband Initiative was an impressive effort for an agency that was better known for sloth than for an interest in facts under its previous two chairmen.

As technology-oriented consumers and as licensed users of the radio spectrum, radio amateurs had several reasons to be interested in the development of the NBP — so, monitor it we did. Most of us would like faster, less expensive broadband service. We all would like that service to be delivered without polluting the radio spectrum. Finally, we would like to retain our access to the spectrum — access for which in return we serve the public interest through emergency and public service communications, technical advancement, self-training, and international goodwill.

The 376 page NBP was delivered to Congress in March 2010. To us it was as interesting for what it did not contain as for what it did. There is but one reference to broadband over power lines (BPL), and that is only a passing mention of its classification as an information service. There is *no* mention of BPL as a means of implementing the Plan's goals for broadband deployment. In short, the FCC now sees *no role* for BPL in providing broadband Internet connections to more consumers. This is not surprising given that the Plan's goals call for speeds that BPL cannot deliver, but it was still good news for all radiocommunication services.

As for what the NBP does contain, it recommends that the FCC should make 500 megahertz of spectrum available for broadband use within the next 10 years, including 300 megahertz between 225 and 3700 MHz for mobile use within five years. Among the 300 megahertz is 20 megahertz in the Wireless Communications Service (WCS) bands at 2305-2310, 2310-2320 and 2345-2360 MHz. We have already felt the impact of this in WT Docket 07-293, a proceeding in which, as reported on page 78 of November 2010 *QST*, we are seeking to protect the 2300-2305 MHz band where we remain the only allocated service.

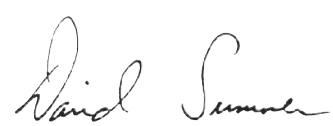
In June 2010 the President signed a Memorandum calling for the National Telecommunications and Information Administration (NTIA), in collaboration with the FCC, to make 500 megahertz of spectrum available for fixed and mobile wireless broadband in the next ten years. NTIA is part of the Department of Commerce and is responsible for management of Federal spectrum, much as the FCC is responsible for non-Federal spectrum. A lot of spectrum has both Federal and non-Federal users, including nearly all of the amateur bands in this frequency range. In most cases we are secondary to the Federal users, so our fortunes are tied closely to theirs.

NTIA responded with a plan dated October 2010 that was released to the public on November 15. NTIA has extended the upper frequency limit to 4400 MHz, a change that does not affect amateur allocations directly but that might relieve a bit of pressure on lower frequencies.

The NTIA plan concurs in 280 of the 300 megahertz tagged by the FCC for mobile use within five years (the FCC said the other 20 megahertz should come from Federal allocations "if possible") and offers an additional 115 megahertz of Federal spectrum, the result of a detailed "Fast Track Evaluation," as a "significant down payment" toward the 500 megahertz total. Another 65 megahertz is subject to further review. It will take more work by the two agencies to identify the remaining spectrum to reach the 500 megahertz target.

The two NTIA documents — the 34 page Ten-Year Plan and Timetable and the 262 page Fast Track Evaluation — are available on the NTIA Web site, **www.ntia.doc.gov**. They make interesting reading if you want to know more about Federal use of this part of the spectrum or about the spectrum allocation process generally. The NTIA notes that some of the actions being contemplated will require changes to the international Table of Frequency Allocations, which is a six to eight year process at best.

The good news for the Amateur Radio Service is that is that while 3100-3500 MHz — including our secondary band at 3300-3500 MHz — was an initial candidate, it was not selected for Fast Track Evaluation. It appears that the prevalence of high-power radars in this band is incompatible with broadband use below 3550 MHz. Of course, this could change. In 1994 an NTIA report said the Federal investment in radiolocation systems operating between 3100 and 3600 MHz was $24.3 billion. This led to the conclusion that additional non-Federal use of the band "is not considered to be a viable option." Some 17 years later, part of that band — 3550-3600 MHz — is on the Fast Track. When there is commercial interest in radio spectrum, never say never.



David Sumner, K1ZZ
ARRL Chief Executive Officer

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HAM-IV
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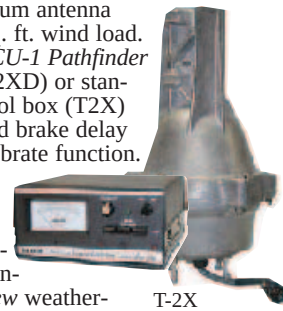
The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 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

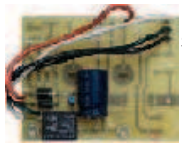
DCU-1
$749.95

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

50/144/(222)*/430 MHz
FM 5 W/AM 1W (50 MHz) Triple Band Handheld

VX-8DR * 222 MHz/1.5 W (USA version)

(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)

Actual Size

144/430 MHz
FM 5 W Dual Band Handheld

VX-8GR

(7.4V 1,100 mAh Lithium Ion battery/FNB-101LI and battery charger/NC-86A included)

Actual Size

VX-8DR NEW

All-in-one Prestigious Tri-band Transceiver
Bluetooth® for hands-free Operation with optional accessories
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Optional GPS and antenna unit for GPS/APRS® operation

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

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

Bluetooth®

VX-8GR NEW

144/430 MHz Dual Band Transceiver with GPS unit included
Built-in GPS Antenna - Waterproof
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The VX-8 series radios are compatible with the world wide standard APRS® (Automatic Packet reporting System) using the GPS system to locate and exchange position information.

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- Memories to list 50 stations
- Memories to store 30 APRS® messages
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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- The ARRL has filed a *Reply* to a Wireless Services *Opposition* filing, the latest in an ongoing series of exchanges regarding the FCC's proposal to allow mobile broadband services, in addition to fixed services, to operate in parts of the 2.3 GHz band.
- The FCC has issued a *Report and Order* that amended and clarified its rules with respect to vanity call signs. See Happenings, this issue, for details.
- The IARU member-society in Indonesia, ORARI, reports that amateurs supported communications to relief and government agencies following a devastating tsunami and a volcanic eruption.
- Following damaging monsoon rains in Thailand, that nation's IARU member-society, RAST, reported that amateurs have assisted with rescue and relief efforts in two provinces.
- Richard Jenson has been named the new Chief of Air Force MARS.
- Two US Attorneys have filed a *Complaint* in US District Court against Glenn Baxter, K1MAN, for not responding appropriately to an order that he pay a $21,000 fine for violating several sections of Part 97.
- ARRL President Kay Craigie, N3KN, took part in the final contact of the Wireless Institute of Australia's VK1ØØWIA centennial special event operation.
- The Dayton Hamvention® is accepting nominations for its four 2011 awards.

Media Hits

Allen Pitts, W1AGP
Media & Public Relations Manager

- Talk about a bad day! The *Mountain Democrat* (CA) reported on a new twist in disaster aid at their recent elections. First, they ran out of ballots. Then the electricity went out. Then the phones were all jammed up. Then too many voters chose that moment to all show up at the same time. Elections official Bill Schultz and Sheriff's Department Communication Manager Frank Yost, KA6GWY, "immediately got on the ham radio, putting out a call for help. Georgetown Fire Chief Greg Schwab picked up the call and jumped to work…"
- Another significant but unusual hit comes from *Patek Philippe* (yes, the watch people in Geneva) who have a beautiful magazine for special customers. The autumn 2010 issue has a very large article by David Rowan praising ham radio as life's counterpoise to today's impersonal digital/text communications. This same idea, which is showing up more and more in media, was a topic in "A Hobby Only An Engineer Would Appreciate" — *Forbes Magazine.* "When Tom Georgens [W2SC] isn't in Silicon Valley running data storage firm NetApp, which rakes in about $4.2 billion in annual revenue, he gets his mind off competing with giants including Oracle and Hewlett-Packard with a very unusual hobby. He competes in ham radio contests."
- "Radio club membership is good deal" was the headline of a Syracuse.com article by Lee Badman. In a digital age that was supposed to bring people together, we find individuals becoming more and more isolated. "Though the number of licensed amateur radio operators in the United States continues to climb, we are still very much a minority…finding other people who share your interests can be challenging, which is where local radio clubs come in."
- Full page articles were in the Roanoke Times (VA) — "Getting the word out" as three Roanoke County schools had amateur radio clubs participating in a contest thanks to the Roanoke Valley Amateur Radio Club, Instructor Bill Reed, W4PLS, and Principal Richard Turner, KZ4VT. Another was in the South Washington County Bulletin (MN) — "Ham operators to the rescue" with the Washington County ARES people. "Amateur Radio Operators Connect to Giant LORAN Tower" in the *Cape May County Herald* (NJ) told about the adventures of the Cape May County ARC hooking into a 625 foot antenna.
- The Lawrence (KS) *Journal-World* had a story "Weather balloon carries KU research project to lofty heights." Paul Verhage, KD4STH, a graduate student at Kansas University, and his team are part of the aerospace engineering department at KU. They launched a weather balloon that carried ham radio tracking gear, science experiments and cameras to an altitude of around 100,000 feet. The video (available on the Web) from the flight is impressive!
- Finally, one hit that offhand seemed very common (a special event station notice) was spotted in a very *un*common place (another major national association's magazine). "Amateur Radio Station Recognizes NRA's 139th Birthday" was in the November issue of *The American Rifleman*. The Yavapai ARC of Prescott, Arizona was at the Gunsite Academy in celebration of the NRA's 139th birthday.

Split Rock Lighthouse SpEv

On November 6, the Stillwater (MN) Amateur Radio Club operated a special event station on the shores of Lake Superior, near the Split Rock Lighthouse in Two Harbors, Minnesota. The event commemorated the sinking of the Great Lakes freighter SS *Edmund Fitzgerald* on November 10, 1975. Other special event stations were in Michigan, at Whitefish Point Lighthouse and Paradise, near where the ship rests on the lake bottom.

PAUL M. WALSH, NAØMI

Greg Patzman, KDØELF, of Burnsville, Minnesota (left), and Bob Jensen, WØGAF, of Oakdale, Minnesota, operate WØJH, the special event station on the shore of Lake Superior that made hundreds of contacts around the world in commemoration of the 1975 sinking of the SS *Edmund Fitzgerald*.

Virginia Hams Stage First Cruise-In

On May 1, the Albemarle Amateur Radio Club of Virginia staged the first statewide Ham Radio Cruise-In in Charlottesville. In vehicle-oriented cruise-ins, participants drive their cars, trucks, motorcycles, whatever, to display and compete for awards. Ham radio operators are likewise proud of the time, effort and more than a few dollars they have invested in their mobile Amateur Radio stations — hence the Ham Radio Cruise-In. Most are made available for public service communications, and the Cruise-In helped get that message out to the public. The event commanded the attention of the hundreds of visitors to Darden Towe Park.

Looking for a new club event and recognize mobile operators from your region or state? I recommend staging a cruise-in. Not only is it a great event for the participants, but it is also an enjoyable way to demonstrate how ham radio can operate in the field in emergencies. We would be glad to share a full how-to-do-it kit with any interested club. Just drop a request to **k4jec@arrl.net**.

The second annual Cruise-In has been scheduled for April 30, 2011. — *Jim Crosby, K4JEC*

DAYTON HAUGH, AA4DH

The lineup: **Hams from across Virginia and surrounding states cruised-in to Charlottesville for the first annual Virginia Ham Radio Cruise-In last May.**

CAMERON SMITH, N7NBB

Andrea Miller, a 6 year old from a Daisy Troop in Great Falls, Montana, part of the Council of Girl Scouts of Montana/ Wyoming, could only look on as her older sister made her first contacts during last year's Jamboree on the Air. This year it was her turn. Ken Wolfslau, W7WOF, is acting as control operator as she contacts other JOTA stations.

Inside HQ

Our Second DIY — Do It Yourself — Issue

Doing things ourselves has been an Amateur Radio tradition since our inception. My first DIY project was rewiring a WWII vintage BC455 receiver at my club when I was a teenager. I was clueless about soldering, but the experienced guys helped me and, when the project was completed, I was amazed when I first heard 40 meter signals crackle in the headphones. Whether it is an antenna or a QRP rig, we still enjoy building at least a part of our station with our own hands.

Here is what we have this month for us DIYers. The proper tools are needed for any DIY project, so we have published an article by "Dr" Joel Hallas, W1ZR, on basic tools and test equipment. It's on page 65. Have you been fearful of tackling a project using surface mount components? Read the article on page 32 about using modern surface mount soldering techniques. It is easier than you think! If those coils you have been saving are brimming over in your junk box and you'd like to know their inductance, check out the article on the Mystery Inductor Box on page 30. This straightforward test fixture enables you to easily verify an inductor's value.

You don't need expensive equipment and a massive antenna array anymore to participate in Earth-Moon-Earth Moonbounce (EME) activity. We've published an informative article called "Moonbounce on a Budget" on page 36. Author Bob Baker, KD3UY, shows you how to build and operate a fully functional EME station on a limited budget.

The most ambitious DIY project in this issue is a PIC processor controlled Directional Power/SWR meter that can accurately measure station power from milliwatts to the legal limit. This comprehensive project starts on page 39. If you are interested in PIC programming, we have introduced a kit to support our book *ARRL's PIC Programming for Beginners*. The kit (sold separately) includes a PIC programming device and all of the necessary components and boards to complete the book's exercises and tutorials. It also includes all of the components needed to build a microprocessor-controlled CW keyer, the book's culminating project.

If you would like to build a less complex (or first!) electronics project, we have introduced our own ARRL DIY project, a Morse Code Oscillator Kit. Instructors, teachers and clubs have asked us to create a simple DIY project for instructional purposes and this kit fulfills that requirement. The kit price is $24.95 (contact us for discounts on quantity orders). To enhance the educational value of the kit, we have supplied a detailed technical tutorial about the kit's circuit on our Web site, **www.arrl.org/shop/ARRL-Morse-Code-Oscillator-Kit**.

Also in this issue, we also have our regular *QST* Departments about DIY and technical topics. These include The Doctor is In, Hints and Kinks and Hands-On Radio. Whatever you decide to build or tinker with, have fun and know that your efforts are part of a great Amateur Radio tradition.

73,

Harold Kramer, WJ1B
ARRL Chief Operating Officer
wj1b@arrl.org

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- **Customized ARRL.org home page**
  Customize your home page to see local ham radio events, clubs and news.
- **ARRL Member Directory**
  Connect with other ARRL members via a searchable online Member Directory. Share profiles, photos and more with members who have similar interests.

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

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

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

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

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

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
  Insurance is available to protect you from loss or damage to your station, antennas and mobile equipment by lightning, theft, accident, fire, flood, tornado, and other natural disasters.
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QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
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The right meter is a multi-meter. Read antenna SWR, forward, reflected output power simultaneously (has adjustable PEP meter hold time) . . . amplifier balance . . . ALC between amplifier and transceiver . . . DC drain voltage of each power amplifier.

LEDs show which band is selected (manually bandswitched or automatically with optional ARI-500 Radio Interface) . . . ALC activity . . . when the amplifier is keyed . . . high SWR . . . power amplifier fault.

The desktop size amplifier is a compact 10½Wx6¾Hx19D in. Weighs just 23 lbs.

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Options

MOD-10MK $39.95, low-pass filter assembly gives you 12 and 10 Meter operation. Requires FCC ham license.

QSK-5, $359.95, pin-diode T/R switch gives lightning fast silent QSK operation.

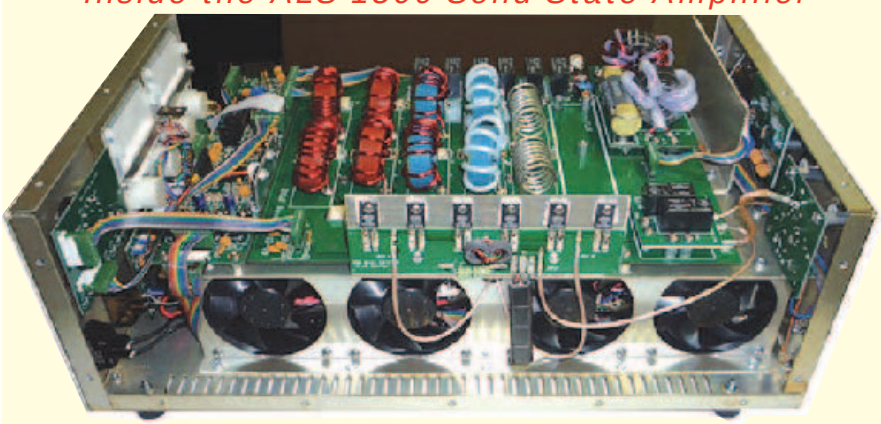
Here's what they say . . .

I have had my amp now for a few days and WOW! I picked the amp up at the factory and Mike was very helpful in showing me the ins & outs of the amp. Mine is S/N 8 and these amps are in high demand. It will truly talk 1200 watts all night long and never get warm. Thanks to Ameritron for the way they treat their customers and taking time that I was satisfied. N5SBZ

I've been using SN3 for about six weeks now. No processors or digital read-outs, but very easy to use and it puts out 1200 watts on most bands with no problem. I have been operating QSK as the internal relays are plenty fast enough. AD5X

I have had this fine amp now for a week and have made a number of QSO's (20). It can make the difference, and has in a number of occasions, getting thru the QRN and making a contact. Some of my QSO's have lasted up to 1 hour and there has not been a single problem...runs cool and gives me excellent results. KB4KKX

Inside the ALS-1300 Solid State Amplifier



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Up Front in QST

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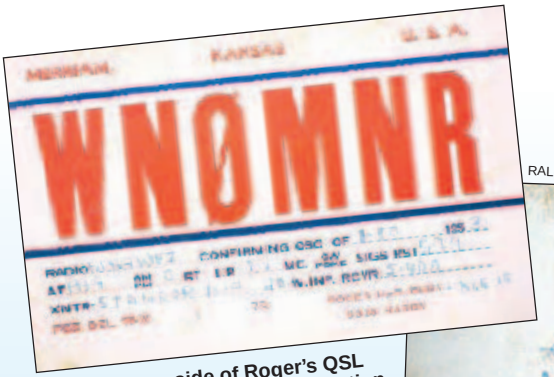
Old QSL Card Turns Neighbors into Friends

Ralph J. Crumrine, NØKC

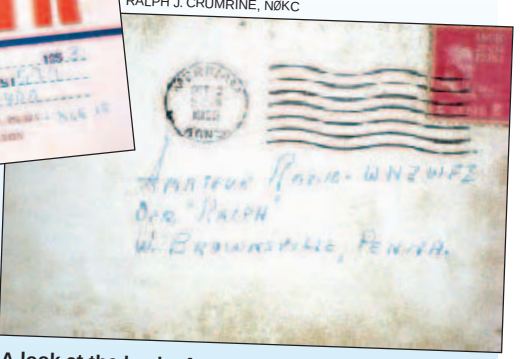
Ham radio is about people and friendships. In 1953, I was a young ham and high school student. My station was a WRL Globe Scout transmitter, an NC-125 receiver and a two element fixed array on 40 meters.

Pounding the brass as a newly minted Novice, I worked WNØMNR soon after getting on the air. Roger McClenny responded with his QSL card. What is so special about an old QSL card? Let me say here: Never throw them away — who knows what might be gained from them later.



The business side of Roger's QSL card with all the contact information.

RALPH J. CRUMRINE, NØKC



A look at the back of Roger's QSL card showing the "simple" address and 2 cent stamp. Notice that there isn't even a street address or last name.

In the years since, I have been in and out of the military, married, graduated from university, moved more times than I like to think about and completed a career in airborne radio communications design. The moves eventually brought me, with a family, to Olathe, Kansas and a settled life here. The address on Roger's card, Merriam, Kansas, is about 20 miles up the road from Olathe.

Last spring I decided to load all my old contacts into my computer log. I guess that comes from being married to a librarian. I looked up a lot of the old calls just for the fun of it, and ran across Roger's card, WNØMNR. Remember, he was living up the road in Merriam when I worked him in '53.

What a nice surprise! Roger was still listed in QRZ.com and his address was now also in Olathe.

It gets even better. His street address put him on the street directly behind me.

So, on a sunny Saturday morning, I took his card, walked around the corner, knocked on his door and presented him with his old QSL card. He looked at it for a long time, finally convinced that I wasn't some sort of confidence man. I learned later that Roger had spent a career in law enforcement.

Roger and I have had a lot to talk about. He let me in for coffee that morning, and I've had him over for coffee. We have a lot of catching up to do, for, you see, Roger grew up to be a pretty neat and interesting guy.

Our new friendship started with a radio contact 57 years ago.

Enter the First ARRL Video Contest!

Here's a chance to put that video cam to use: Shoot a ham radio-related video and send it our way for the **First ARRL Video Contest**. We will be posting the best entries on our Web site. We're looking for a few good videos (but only one per ARRL member) on any tasteful subject relating to Amateur Radio. This year's theme is **First On-Air Contact**. Extra points will be awarded for videos showing an actual first contact. (The person making it need not be licensed, of course.)

A Few Rules and Regs

Deadline: Entries must be postmarked by **February 28, 2011**. Burn your video to a CD or DVD using the appropriate software and mail it to ARRL Video Contest, 225 Main St, Newington, CT 06111.

Subject: Must be directly related to Amateur Radio and be in good taste. Extra points will be awarded for a video showing someone, young or old, licensed or not, making their first contact. Videos will be judged on overall quality and composition.

Specs

Maximum length: 5 minutes

Format: AVI, MPEG or WMV, 320 × 240 minimum resolution

STEVE FORD, WB8IMY

Shoot to win: **You can already find links to videos about Product Review gear (that's Lab Test Engineer Bob Allison, WB1GCM, in the frame capture) and ARRL events via the ARRL Web site. With the advent of the ARRL Video Contest, we're looking to expand the site's video offerings.**

Production equipment: We are looking for videos shot by amateur videographers using consumer-grade cameras and editing software/equipment. The use of professional-grade cameras, editing equipment or studios is not permitted.

Miscellanea

All entries must include the following information: where the video was recorded, a description of the subject of the video, and the names and call signs of any persons shown.

Rights: Those submitting a video retain the right to make use of it in any way they wish. The ARRL will retain non-exclusive rights; we can also make use of it in any lawful manner.

Videos will be judged on overall quality and creativity. The decisions of the judges, composed of HQ editorial and production staff, are final.

Oh yes: The winning entry will be awarded a $250 prize. Three runners-up will receive a $100 prize.

Check out the Video Contest Web site at **www.arrl.org/video-contest**.

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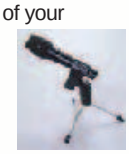
Microphone supplies are limited.

I would like to take advantage of your Eagle Early Bird Special. I am placing my order for the new Eagle Advanced Signal Reception transceiver and I would like to receive the free desk microphone and stand.



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CORRESPONDENCE

ELECTRIC EXCITEMENT

♦ Ever since my wife and I relocated from Florida to Georgia late in 2009, I have observed a somewhat high level of RFI at our home and the general area. A few weeks ago, I sent an e-mail to my local power company, alerting them to two noticeably bad spots for radio frequency interference from the utility lines here in the area. I let them know that I have observed both sites emitting great quantities of RFI; it was so bad in one of the locations that it desensed the AM receiver in my vehicle for at least a quarter-mile.

Within a couple of days, I received an e-mail and a phone call requesting additional information from Greg Proctor, the Manager of Member Services for Excelsior EMC. I then received several calls from them to let me know of their progress. They called today, asking me if I heard a difference. They told me that they had replaced a bunch of bad arrestors, and they were pleased to do so, since this could save them a 2 AM dispatch call if one went out unexpectedly.

It is pure joy to listen to the AM broadcast bands and amateur/shortwave bands now, whereas before it was horrible, both at home and in my van. So today I walked around with my handheld transceiver, listening on 1.9, 3.75, 7.185, 14.300, 21.300 and 28.400 MHz; in addition to not hearing any static, I could actually faintly hear signals on 14.300 using the internal ferrite bar antenna. Kudos to Excelsior EMC Power Company!

DAVID "DOC" COLBURN, KD4E
Nevils, Georgia

AN INTERNATIONAL PERSPECTIVE

♦ A few months ago, a colleague gave me several issues of your excellent *QST* magazine. I found these extremely informative and very well written. Living in the UK, it also gave me an insight into Amateur Radio "across the pond."

During the first week of October, I visited a nearby rally at Newark in the UK. To my amazement, there was an ARRL stall. At the time of my visit, this was manned by Bob Inderbitzen, NQ1R, and I had a lengthy chat with him. Bob gave me some excellent information on the ARRL and Amateur Radio in general in the USA. Needless to say, I ended up parting with about $60 by joining the ARRL and a subscription to *QEX*! To be perfectly honest, I have never felt so happy in parting with this amount of cash!

Within a week or so, I received my membership information and was able to log into the ARRL Web site, which I found loaded with enormous amounts of information. I have since joined Logbook of The World and uploaded my previous logs — a big mistake, because I have now gone from a casual operator to chasing every contact available (much to the annoyance of my wife).

Please pass on my sincere thanks to Bob, NQ1R, for being so helpful, and to the ARRL for running such an excellent service.

JIM BRYANT, MØJWB
Bristol, England

VIBRANTLY ALIVE

♦ Sitting in my room in a remote, undisclosed location in Southwest Asia, where I was deployed with the US Air Force, I found myself thinking that I really needed to call my father-in-law and let him know that I had gotten to my destination safely; however, as we had all just arrived, every phone would be tied up for hours. So I thought for a second and decided I did have another way to get the message to him: The National Traffic System. But having no MARS station on base, and no equipment available, I turned to the next best thing: EchoLink.

Now some might say that EchoLink is not radio, but in the absence of other options, I fired up my laptop (thankful that we did have Internet) and connected to the node in my hometown. I gave a call and back came the familiar voice of a good friend to help me out. He gladly took my message and passed it on. I thought nothing more of it at the time.

Two days later, I finally got to make my phone call home and talk with my family. I made the call to my father-in-law and he began to tell me how he got the message. He told me that the ham had tried to pass it the night before, but was not able to get him, so he waited and called again to make sure the traffic got through to him. I asked my father-in-law when he he received the message, and he told me it had traveled through the system, across the world and to him in only 8 hours.

This totally took me by surprise. I would also like to say to each operator who takes the time to handle traffic: Thank you. It might have only been 14 words, but it let my family know that I was alive, well and was thinking about them as much as they were thinking about me.

That one event also had a profound impact over here. That EchoLink message enabled me to change the minds of 20 people around me who thought Amateur Radio was for old men with lots of time, or even a dead hobby. In my experience, the hobby is not dead, and as for the old man part, Amateur Radio has proven itself to be a hobby for all ages.

SSgt CLIFFORD MOREY, W4CDM
Southeast Asia

SPECIAL DELVERY

♦ Today I received my copy of *QST*, but instead of my name and address printed in the white box, it was blank. Our mail carrier told me that they knew it was my magazine because I am "the radio guy." All the way from Newington to Weaubleau, Missouri, way out in the woods! The post office really can deliver!

ROBERT HOESLY, KØKME
Weaubleau, Missouri

ON FIRE

♦ I read with interest the interview with Will Butler of Arcade Fire ["Alt-Rock Meets Ham Radio," Nov 2010, pages 72-73]. As perhaps one their older fans (age-wise) — having discovered them watching Austin City Limits a few years ago — I had been intrigued by their use of a variant of the ARRL logo and their use of images of QSL cards during their current tour.

I was initially disappointed by some of the comments in Amateur Radio groups on the Internet that expressed concern that their use of the ARRL logo was somehow offensive or a copyright violation. It struck me that any positive reference to Amateur Radio should be welcome. I was impressed by the interviewer's questions on communications and music and Will Butler's responses. I also had not appreciated the Butler brothers' relation to Alvino Rey, W6UK (SK).

While the significance of the QSL cards fluttering by on the background screen during their tour may not be appreciated by many of their 20-something fans, I now better understand their relevance to their new album's theme and their song "We Used to Wait." It's nice to see *QST* move out of its comfort zone and explore an interesting contemporary reference to Amateur Radio.

RICHARD ECKMAN, KO4MR
Hampton, Virginia

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


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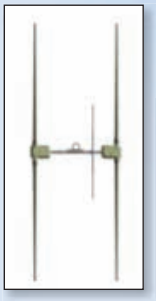
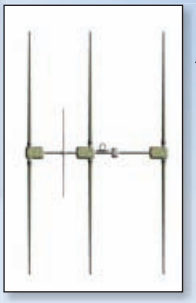
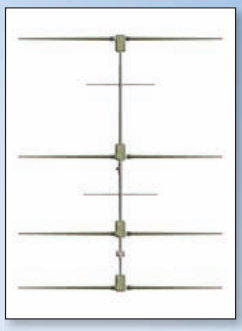


2 Element 20m-6m Yagi
2 element Yagi, 20m-6m continuous coverage; 57" boom, 36 ft longest element, 18.2 ft turning radius, 6 sq ft wind load, 30 lb; SDA 100 controller included.



3 Element Yagi 20m-6m
3 element Yagi, 20m-6m continuous coverage; 16 foot boom, 36 ft longest element, 19.7 ft turning radius, 6.1 sq ft wind load, 51 lb; SDA 100 controller included.



4 Element Yagi 20m-6m
4 element Yagi, 20m-6m continuous coverage; 36 ft longest element, 24.1 ft turning radius, 9.7 sq ft wind load, 99 lb; SDA 100 controller included.

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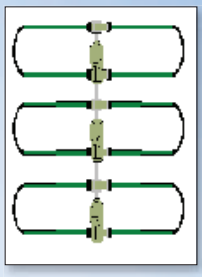
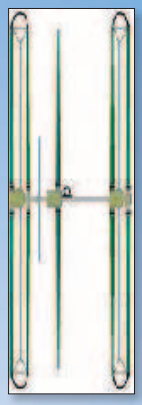
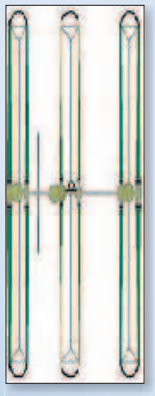
The Dream Beam series offers antennas for both space limited Hams as well as the "Big Guns" who have the space and want the very best.



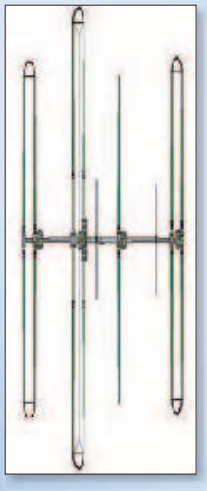
DB11 Yagi Antenna
DB11 Yagi, 18.5 ft element length, 11 ft boom, 10.8 ft turning radius, 61 lb, 5.9 sq ft wind load; 2 active elements on 20m; 3 active elements on 17, 15, 12, 10, 6m.

DB18 YAGI
Dreambeam DB18 yagi, 3 el on 20m-6m, 2 el on 40/30m, 18 ft boom; Does not include optional 6m passive element kit; Includes SDA100 controller.



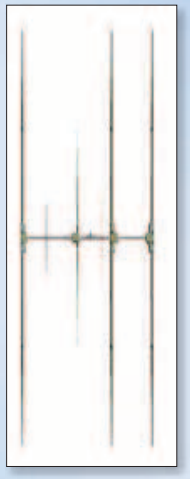


DB18E YAGI
Dreambeam DB18E, 3 el 30m-6m, 2 el 40m, three looped elements, does not include optional 6m passive element kit, 18 foot boom; Includes SDA 100 controller.



DB36 DreamBeam Yagi, 40m-6m
DreamBeam DB36 4 element Yagi, 40m-6m continuous coverage; 36ft boom, 48 ft longest element, 26 ft turning radius, 17.5 sq ft wind load, 160 lb; SDA 100 controller included.

MonstIR 4 Element Yagi 40m-6m
MonstIR 4 element Yagi, 40m-6m continuous coverage with full length elements; 34ft boom, 70 ft longest element, 39.7 ft turning radius, 23.9 sq ft wind load, 160 lb; SDA 100 controller included.



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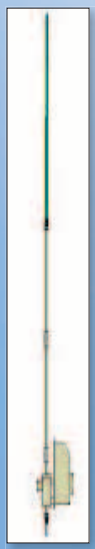
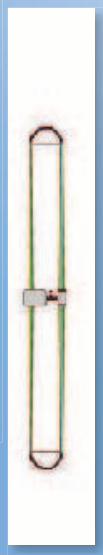


BigIR Vertical Antenna, 40m-6m
BigIR vertical antenna, 40m-6m continuous coverage, 32 ft length, 15 lb total weight, 2 sq ft wind load; EIA 222C wind rating when guyed; Comes with SDA 100 controller and 1.5"mounting pole ; Does not include optional 80m coil.

SmallIR Vertical Antenna 20m-6m
20m-6m continuous coverage, 18 ft total length, 12 lb weight, 1 sq ft wind load; EIA-222C wind rating without guys.

20m-6m Dipole
20m-6m continuous coverage dipole; 36 ft element length; Comes with SDA 100 controller.



40m-6m Loop Dipole
40m-6m continuous coverage, 39 ft total length; SDA 100 controller included.

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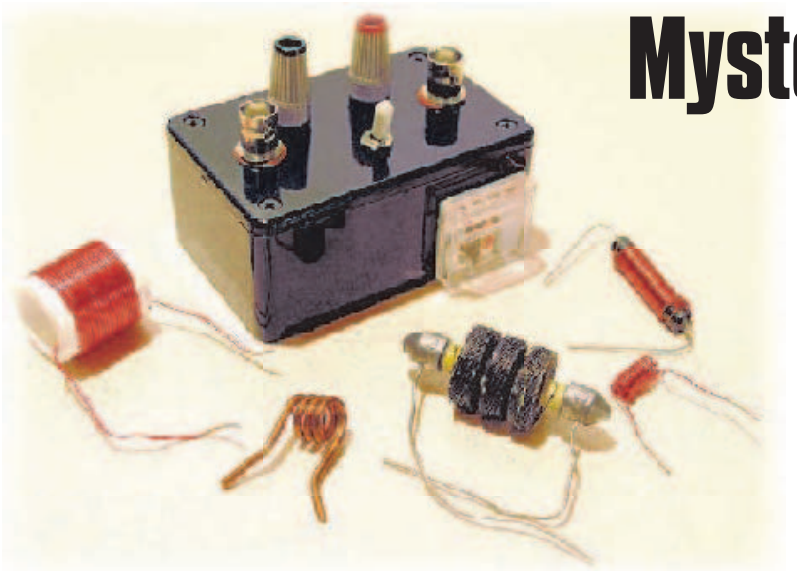


Mystery Inductor Box

With this test fixture, you can figure out what those coils in your junk box can do.

Robert J. Rogers, WA1PIO

There comes a time while building certain electronic equipment that it is important to use the correct inductor. If you have a box of unmarked and possibly mismarked inductors in your parts box, how do you choose the one to use? There also may be occasions that require winding your own inductor. In either case, this mystery inductor box will verify the inductor's value.

Measuring Inductance

One way to measure the value of an inductor is to connect it in parallel with a known capacitance and measure the resulting resonant frequency. In the past, grid-dip oscillators have been used to determine the resonant frequency of such parallel tuned circuits. You may have seen references to inserting a 100 pF mica capacitor in parallel with the unknown inductor and measuring the resonant frequency of the resulting combination. Using a dip oscillator, a dip, or drop in meter current was noted at the point of resonance.

There was always a problem with how tightly to couple the dip meter to the test circuit to accurately obtain the dip. Too little coupling would not provide a dip, while too much coupling would change the dip frequency. Having noted the frequency and capacitor value, you resorted to calculations to determine the value of inductance. Today, grid-dip meters are difficult to obtain, and even the more modern FET dip meters are no longer generally available.

Enter the Mystery Inductor Box

The mystery inductor box provides a convenient substitute for the dip meter method. A separate signal generator is used to provide the needed signal source, and switched internal capacitors provided are used to resonate the inductors. An internal meter is provided as is a port for an external detector to indicate resonance. The schematic with parts list is shown in Figure 1. It is a simple circuit to build.

Building the Box

Figure 2 shows the layout of the internal components. Construction is straightforward with no critical dimensions or layout requirements.

The 470 Ω resistor is used to provide a better Q or peak in the resonant voltage seen by the oscilloscope or meter movement. The voltage of the generator will be applied to this resistor until the point of resonance, at which time the highest fraction of the applied signal voltage will be across the parallel circuit. An oscilloscope is connected to the right BNC terminal, and its high input impedance, typically 1 MΩ or more, will not be a problem operating in these relatively low frequencies. Instead of the oscilloscope, the internal meter movement may be used to give a peak indication at resonance. The capacitor values were chosen to be larger than may have appeared in the past as to minimize the effects of lead length, a concern while operating a piece of test equipment at higher frequencies.

Using the Box

The mystery inductor box can be used to accurately determine the value of inductors in the mH and µH range. Placing the switch in the down position selects the 0.01 µF capacitor supporting measurement of inductors in the µH range using a signal generator with a 159 kHz to 5 MHz output. With the switch in the up position, a 0.22 µF capacitor is used to measure larger mH inductors, using signal generator frequencies in the 1 to 34 kHz region. [Note that the measurement accuracy depends on capacitor tolerance. — *Ed.*]

The signal generator is connected to the left BNC terminal. You will know if the switch is

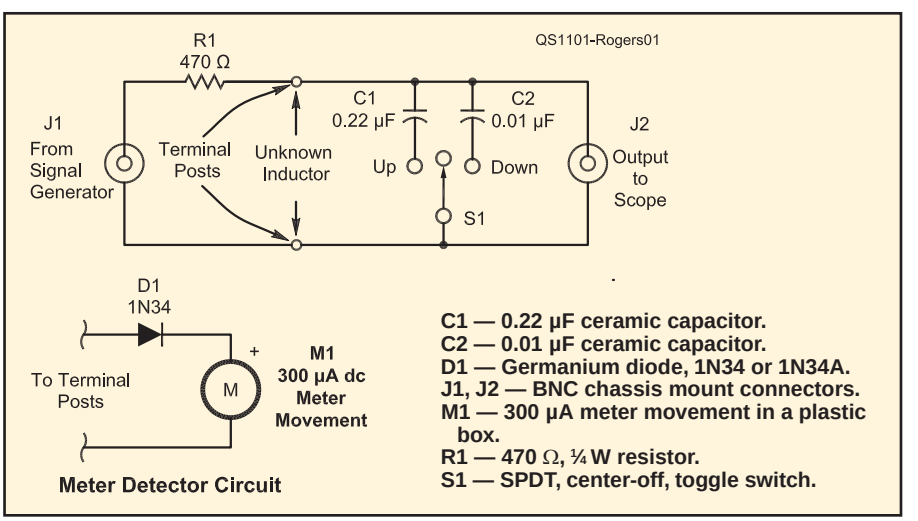


Figure 1 — Schematic diagram and parts list of the mystery inductor box. The switch center-off position is used to disconnect the internal capacitors and permit the placement of the desired value of capacitance in parallel with the reference inductor. A 1 mH inductor is used as the reference inductor.

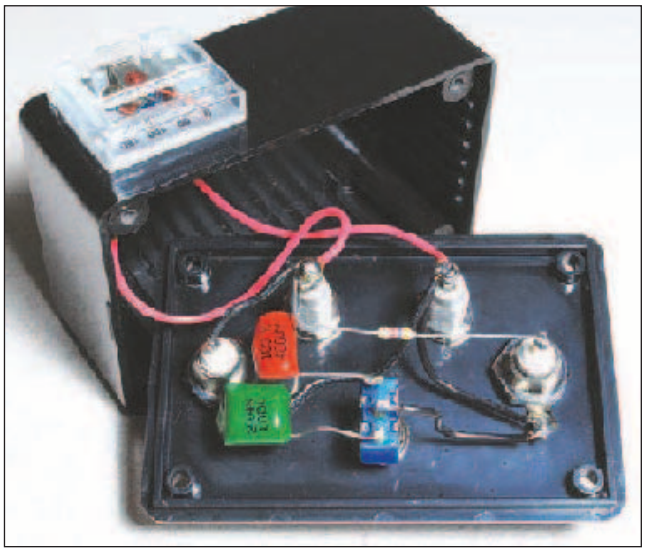


Figure 2 — Layout of the internal components.

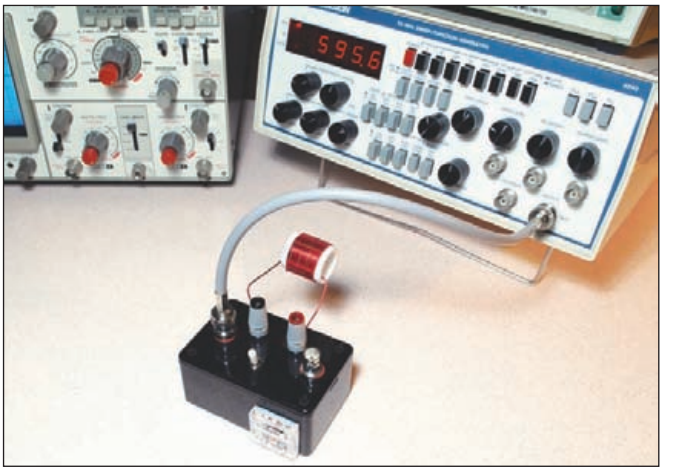


Figure 4 — The signal generator's output is 596 kHz (0.596 MHz) with the switch in the down (0.01 µF) position. Using the formulas shown results in an inductance calculated as 7.1 µH.

Figure 3 — Example of some hand wound inductors. From left to right 1.041, 0.39 and 0.163 µH.

in the wrong position, as there will not be a sharp peak in the voltage seen by the oscilloscope or built-in meter movement. Avoid the band edges of the particular generator output band, as their voltages tend to dip and are not as constant in output signal voltage as is the middle of their frequency ranges. A chart of frequency versus inductance for each of the two internal capacitors used to measure small and large inductors is shown in Table 1.

Once the circuit is completely hooked up, and the switch in the proper position, adjust the frequency of the signal generator until a very sharp peak is obtained on the oscilloscope or meter. It's that simple! Record the capacitor value used (switch position), the frequency observed on the signal generator, calculated from the oscilloscope waveform or indicated on an external frequency counter and plug these values into the following formula:

Resonant frequency in hertz:

$$F = \frac{1}{2\pi\sqrt{LC}}$$

Reworking the formula and solving for L:

$$L = \frac{1}{39.478F^2C}$$

where F is in hertz, C is in farads and the resulting L is in henrys.

The SPST switch has a center-off position, which removes the internal capacitors when the operator would like to test a particular capacitor-inductor combination using the terminal posts on the panel. The internal meter movement is always connected across the banana terminal posts.

Figure 3 shows some typical home wound coils, while Figure 4 shows the unit in operation.

How about winding your own coil? Refer to *The ARRL Handbook for Radio Communications* and make your own inductors.[1] Then verify the results with the mystery inductor box. An *Excel* spreadsheet that performs the calculation is on the QST-In-Depth Web site.[2]

[1]*The ARRL Handbook for Radio Communications,* 2011 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0953 (Hardcover 0960). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.
[2]**www.arrl.org/qst-in-depth**

Photos by the author.

Amateur Extra class operator Robert J. Rogers, WA1PIO, was licensed with this original call in 1971. Bob earned a BS in electronic engineering from Wentworth Institute of Technology in Boston and then an MBA in marketing and quantitative methods at Babson College. Bob also holds an FCC First Class GROL with radar endorsement. Bob now travels internationally and utilizes his IARP/CEPT permit to communicate with many hams back home.

Bob operates mostly on CW and likes designing and building antennas. He is currently an instructor in, and has published numerous papers on, infrared thermography applications. Bob conducts thermography course certification training in North, Central and South America, and is a VE and a member of ARRL, IEEE and ASNT.

You can reach Bob at PO Box 473, Frenchville, ME 04745-0473 or at **wa1pio@arrl.net**. QST

Table 1

Inductance Value at Null Frequency

Switch in Upper Position		*Switch in Lower Position*	
Inductance (mH)	*Frequency (kHz)*	*Inductance (µH)*	*Frequency (MHz)*
0.10	33.931	0.118	4.633
0.25	21.460	0.25	3.183
0.50	15.174	0.50	2.251
0.75	12.390	0.75	1.838
1.00	10.730	1.00	1.592
5.00	4.796	2.00	1.125
10.00	3.393	5.00	0.712
20.00	2.399	10.00	0.503
30.00	1.959	20.00	0.356
40.00	1.696	30.00	0.291
50.00	1.517	40.00	0.252
60.00	1.385	50.00	0.225
70.00	1.282	60.00	0.205
80.00	1.199	70.00	0.190
90.00	1.131	80.00	0.178
100.00	1.073	90.00	0.168
		100.00	0.159

Reflow Soldering for the Radio Amateur

How to use modern production soldering techniques at home.

Jim Koehler, VE5FP

I've always been interested in homebrewing equipment and I think I have probably tried every form of electronic assembly at one time or another. As a young lad, I built crystal sets on wooden planks using wood screws to hold down components; this is the classic *breadboard* form of construction. After I got my first license in 1952, and for many years afterward, I constructed vacuum tube equipment in what was then the standard way — components mounted on a metal chassis with punched holes for tube sockets. When transistors came along in the late 1950s and early 1960s, I gradually moved in using printed circuit (PC) boards. Later, in my career as an experimental physicist, I designed electronic equipment using PC boards and oversaw the construction of complex electronic devices using these boards, all using through-hole mounted components.

After I retired, I continued to design and build equipment using PC boards but, despite reading an excellent introduction to amateur use of surface mounted components, I resisted using them for several years because it just looked to be too difficult.[1] Nevertheless, it was becoming apparent that the latest devices were likely to be only available in surface mounted packages.

I decided to see if I really could assemble surface mount components to a PC board. To my great surprise, I found that it is easier and quicker to assemble a PC board using surface mount components than it is using through-hole parts. If you're designing boards, there is the additional advantage that surface mount boards can be smaller, lighter and cheaper to fabricate because when having them made, you pay at a rate depending on the surface area of the board. Now I wouldn't dream of going back to through-hole components on a PC board.

It really is not difficult to acquire the necessary skill in hand soldering surface mount components if they are not too small; I try to design boards for 0805 sized resistors and capacitors; these are 0.08 × 0.05 inches length × width. With a fine-tipped soldering iron, a low-power dissecting microscope and a little practice, even my somewhat shaky hands, combined with 72 year old hand-eye coordination can do it quickly and reliably.

There is nothing I can add to the excellent instructions given by Sam Ulbing, N4UAU, in the earlier referenced article, except to say that high magnification, in the form of a dissecting microscope, is an invaluable aid. I find that 7 power is about right. The large distance between the board and the objective lens of the microscope means that you can easily manipulate soldering iron, solder and tweezers in the field of view. It is not the aim of this article to proselytize surface mount usage, however, but rather to describe how to go to the next step.

While it is easy to hand solder a board, it becomes a bit tedious if you decide to make the same board several times over, perhaps for friends or as part of a club project. That is when you start thinking about mass production techniques.

Reflow Soldering

Reflow soldering is the most common method of producing surface mount PC boards in commercial quantities. It is the technique that is universally used to make computer equipment, radios, MP3 players and, indeed, virtually all modern electronic equipment. You can see an example of the results of this method by looking inside any

Figure 2 — Inexpensive multimeter with type-K thermocouple probe.

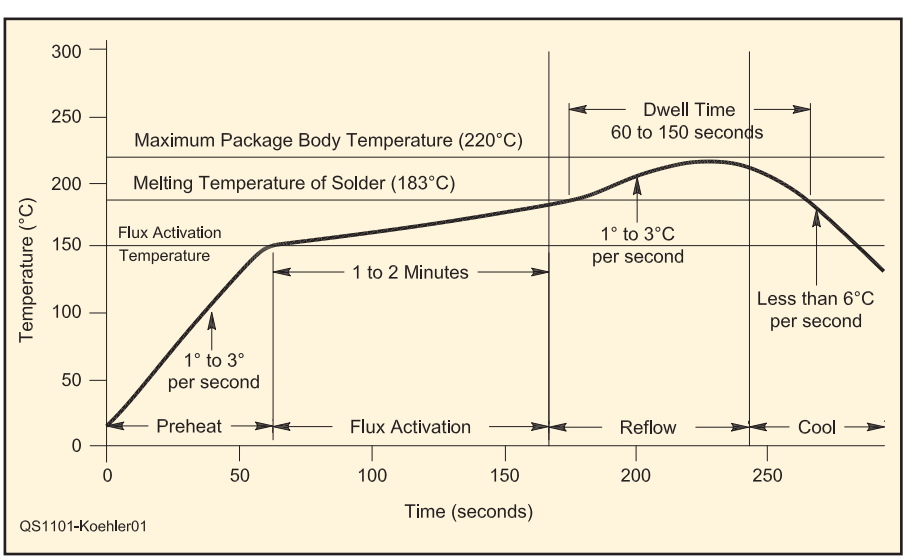


Figure 1 — Temperature profile redrawn from data in Altera Application Note AN081.

[1]Notes appear on page 35.

piece of mass-produced electronic hardware that has been built in the last 5 to 10 years.

Reflow soldering uses solder paste, a mixture of microscopic spheres of solder mixed with a semi liquid, viscous flux. A small dab of solder paste is placed on each pad of the PC board and then the components are all placed onto the pads. Finally, the board plus solder paste and components is placed into an oven. The oven heats the boards and components until the solder paste turns into liquid solder. The board is then allowed to cool and the solder solidifies again. Because all the soldering is done at the same time, the process can be very quick.

Of course, it is not quite that simple. The process of heating and cooling the board with its load of solder paste and components needs to be fairly closely controlled in order to get reliable results. Figure 1 shows the temperatures needed in a typical cycle of heating and cooling. As you can see, the board and its load are first heated quickly to a point close to the melting point of solder. It is then held at this temperature for a time to allow all the components to get to the same temperature — this is called the heat *soak* period. The oven is then raised to a temperature high enough to ensure that all the solder melts and, with the melted flux, forms a good bond. Then the whole assembly is cooled relatively quickly, but not so quickly that it will cause thermal stresses that could break some components. The whole process is over in just a few minutes.

The commercial ovens used for reflow soldering are large, complex devices costing tens of thousands of dollars. In them, the PC board travels on a conveyor belt through regions of different temperature in order to produce the temperature sequence shown in Figure 1. This is somewhat similar to the way pizzas are made in the big franchised pizza stores.

There are also smaller tabletop versions of reflow ovens, for amateur use or for small production lines, that go through a heating and cooling cycle with the PC board stationary.[2] I am going to describe how you can build an even simpler, but still usable, reflow oven in an afternoon and for little cost and trouble.

The Poor Man's Reflow Oven

One day, while shopping for groceries, I saw a pallet of Black and Decker toaster ovens (catalog number TR0964) in a local supermarket for $20 each. They appeared to be made of stainless steel, their power rating was 1.2 kW and the oven was not too large. It occurred to me that, with the aid of a simple electronic thermometer, one could easily approximate the type of heat cycle shown in Figure 1, without the complexity of a PID (proportional integral derivative) controller.

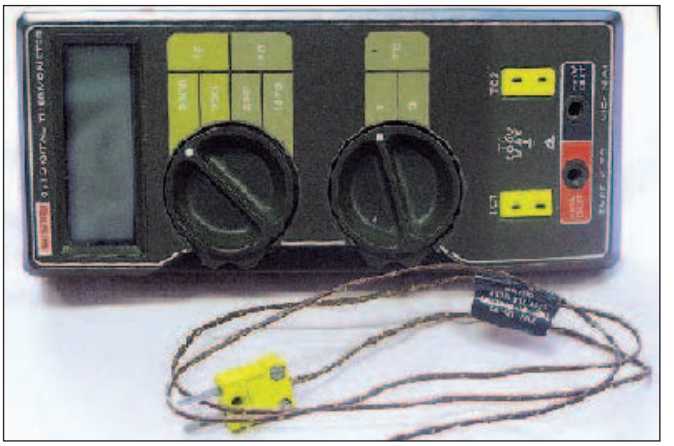


Figure 3 — Keithley electronic thermometer with type-K thermocouple probe.

Figure 4 — Tip of type K thermocouple from Keithley instrument with a pin for comparison.

Besides an electric toaster oven, you need an electronic thermometer. These are widely available at low cost. A few years ago, I bought a digital multimeter at a discount electronics warehouse in Phoenix that had a type K thermocouple temperature probe. It is shown in Figure 2. I have recently seen a similar one advertised online for about $25. On another occasion, I bought a used Keithley electronic thermometer, also with a type K thermocouple probe, on an Internet auction site for about $25 (see Figure 3).

The active part of these thermometers is a thermocouple, the tiny dissimilar metal junction at the tip of the probe as shown in Figure 4. As you can see, these probes are small and so require little heat to come to equilibrium with the temperature of the air. This means that the temperature of the probe tip is going to be close to the temperature of the air in its vicinity.

The idea I had was to drill a small hole in the back wall of the toaster oven and insert the thermocouple probe into it. Then, monitoring the temperature of the inside of the oven, I would just manually turn the oven on and off in order to approximate the heating profile needed to do the reflow soldering. I tried it, it worked wonderfully and it was simple to do.

Modifying the Toaster Oven

The toaster oven I bought was made by Black and Decker. It has two heating bars inside the oven, one at the top and one at the bottom. Both have a metal strip between them and the interior of the oven to provide some shade from the element so that things put inside the oven will not be heated directly by radiation but, instead, by convection of the air.

I made a small bushing from a piece of Teflon that I placed into a ¼ inch diameter hole I'd drilled in the back wall of the oven. This bushing is just to protect the insulated covering of the wire to the thermocouple probe from chafing at the edges of the hole. A small hole was drilled in the bushing to allow the probe to be inserted into the oven. The bushing is shown in Figure 5. Figure 6 shows the bushing inserted into the back wall of the oven. If you can't make a similar bushing, you could get the same result with a piece of sheet Teflon bolted to the rear panel and with a small hole in it going through a larger hole in the metal wall.

The oven door had a hook that connected to a sliding grill so that when the door was opened it would pull the grill forward slightly for easier access. I didn't want to have the grill move when the door was opened because I didn't want to shake the board while the solder was melted. I bent the hooks over so that they would not interfere with the grill. I did not use the metal pan that came with the oven.

The probe of the thermometer is inserted into the hole in the bushing and the wires are bent so that the junction at the tip of the probe is located about ½ inch above the surface of the grill and near the center. Circuit boards will be placed just under this probe tip. That completes the preparation of the oven.

Applying the Solder Paste

Solder paste can be bought in small quantities from suppliers such as Digikey, Mouser or Allied. If you order it, you will get a warning that it can only be shipped by courier because the usable lifetime of the paste is short unless it is refrigerated. My impression is that this warning is there because the viscosity and texture of the paste are important in the commercial methods used to put it on the pads of the PC boards. Also, if the temperature gets too warm, the little balls of solder tend to separate from the flux paste in which they are embedded. For an amateur, the exact viscosity is not

Figure 5 — Teflon bushing ready to be inserted in hole in rear of oven.

important. I have had the same 35 gram tube of solder paste in my refrigerator for several years and it seems to work just as well today as it did when I bought it. I probably have made several dozen boards and still have only used a fraction of the 35 grams.

In commercial houses, solder paste is placed on the board by using stencils with cutouts over all the pads that are to be soldered. Then solder paste is squeegeed over it in the same manner as silk screen printing is done. A method used in large scale production is to have a machine controlled head move over each pad on the PC board and dispense a fixed amount of solder paste through a nozzle. Neither of these methods is really suitable for an amateur who wants to make a few boards.

I bought a small hypodermic syringe at a drug store and ordered a few dispensing tips from Digikey (**www.digikey.com**). I found that a tip with a #18 AWG hole was suitable for putting solder paste onto the pads for 0805 sized components — this tip has Digikey part number KDS18TN25. I take the tube of solder paste from the refrigerator and place a small amount into the hypodermic syringe with the dispensing tip on it. I then place the tube back into the refrigerator for future use.

Then looking at the board with my dissecting microscope and using the hypodermic syringe with the dispensing tip, I place a little dab of solder paste onto each pad. I find that the pressure needed to dispense a tiny bit of solder paste onto a pad with the hypodermic syringe is quite a lot unless you let the solder paste warm up a bit. It doesn't have to be very hot; if you hold the syringe in your hand for a while so that the solder paste comes up to body temperature, it seems to work just fine.

Figure 7 shows a sequence of three photos of a small section of a PC board. In 7(A), you see the bare pads where surface mount components will be placed. In 7(B), you see a small blob of solder paste applied to the pads using a hypodermic syringe as described above. Figure 7(C) shows the resulting bond to the surface mounted components after the oven has been used as I will describe in the next section. The solder joints are quite nice, clean and electrically sound.

Figure 6 — Teflon bushing in the back of the oven.

Calibrating the Oven

Before you use the oven, it is necessary to make one calibration measurement. If the oven is turned on, the temperature will start to rise and will finally get to a relatively constant rate of increase of temperature; so many degrees per second. If it is then switched off, the temperature inside the oven will continue to rise because of the thermal inertia of the heating elements. It is necessary to measure how far the temperature *coasts* after turning off the oven. So, you need to do the following:

- Turn on the oven heating elements,
- Monitor the temperature and, when the temperature gets to 180°C,
- Turn off the heating elements and observe the maximum temperature that the oven reaches.

Make a note of the amount of this temperature overshoot. For example, if you turned the oven off at 180°C and it reached 195°C, then the overshoot was 15°C. This amount of overshoot will be approximately valid for the temperature region around 180°C.

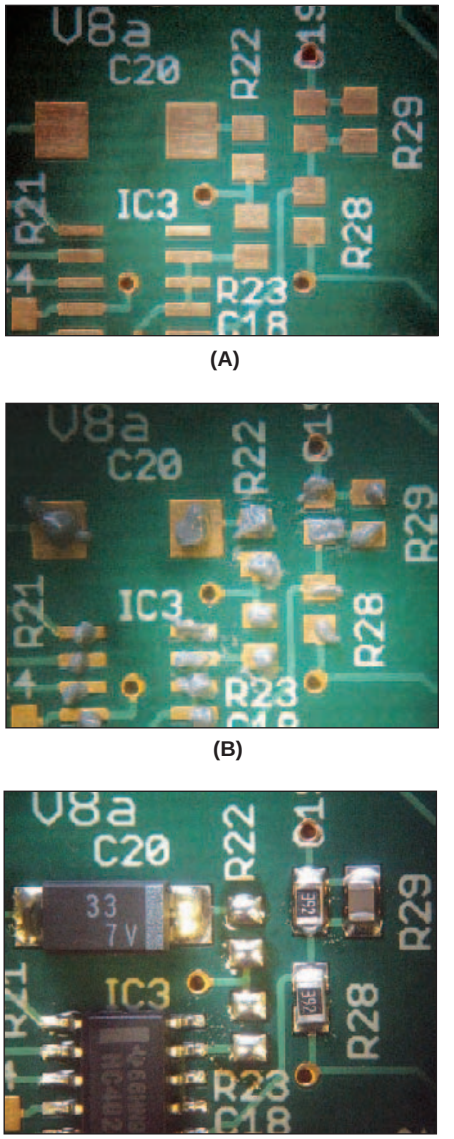


Figure 7 — Soldering the PC board in three stages. At (A) the bare board, at (B) the board with solder paste applied by hypodermic syringe, at (C) the board with the components in place after reflow soldering.

Making Your First Reflow Soldered Board

First, you need to prepare the PC board with solder paste, as described above, put

the components in their places and then put the board into the oven, being very careful not to jostle the components from their places on the board. Then carefully close the oven door and turn on the heating elements. Watch the temperature increase and turn the heating elements off when the temperature gets to 170°C minus the overshoot (for example, if the overshoot is 15°C, then turn off the elements at 155°C). As you now watch the temperature, it will coast up toward 170°C.

This pause in the heating will produce a plateau in temperature similar to the one in Figure 1 before the peak. As the temperature starts to slow down in its approach to 170° but a few degrees before it actually gets there, you can turn on the heating elements again and the temperature will start to rise again. Watch the temperature and when it gets to 220° minus the overshoot (in our example, this would be 205°C), turn off the heating elements again. Now, the temperature should coast up to 220°C and then start to fall. You will now have gone past the temperature peak shown in Figure 1. As it keeps cooling, when it gets down to 160°C, you can open the door to the oven to allow the board to cool off more quickly. You're done! When the board has cooled off enough to handle, take it out and inspect the solder joints to make sure they are all good — they should be.

The reflow soldering process takes just a few minutes so it is a good way to make a large number of boards in a batch. You do not have to wait till the oven cools down to room temperature between boards. As soon as it gets cool enough so you can put in another prepared board without burning yourself, you can start the process again.

Good luck and happy reflow soldering!

Notes

[1]Sam Ulbing, N4UAU, "Surface Mount Technology — You Can Work with It," *QST*, Apr 1999, p 33. This is part one of a four part article.

[2]Elektor SMT Reflow Oven, Elektor Shop, **www.elektor.com/shop**.

Photos by the author.A

ARRL International Member Jim Koehler, VE5FP, was first licensed in 1952 at age 15. He graduated from the Australian National University with a PhD in astronomy and went on to become a professor of physics and engineering physics at the University of Saskatchewan in Canada. He taught classes in instrumentation design and conducted research in upper atmospheric physics until he retired in 1996.

Jim now lives on Vancouver Island where he indulges in his hobbies of electronics, model aircraft and photography. You can reach Jim at 2258 June Rd, Courtenay, BC V9J 1X9, Canada or at **jark@shaw.ca**. QST

Going Once, Going Twice, GONE!

With almost 200 items up for bid — and almost 1000 bids placed — the Fifth Annual ARRL On-Line Auction closed on October 25 with winning bids on every auction item. ARRL Business Services Manager Deb Jahnke, K1DAJ, was happy with the responses the auction received during its run. The generosity of many donors, Jahnke says, made it possible for the auction to offer a diverse list of items that included transceivers, ARRL Lab-tested and reviewed equipment, vintage gear, one-of-a-kind treasures and mystery "junque" boxes.

Items that appeared in *QST*'s Product Review column included an RF Concepts Alpha 9500 HF Linear Amplifier, a Yaesu FTdx9000MP and an ICOM ID-880H Dual Band Transceiver with D-STAR. In all, 38 product review items were sold. The Yaesu FTdx9000MP attracted five bids and sold for the highest amount in the Auction — $7680. Among the items in this year's Auction was a rare First Edition *ARRL Handbook*. Originally listed for $40, this collectible book from 1926 sold for $775 after garnering 22 bids, the most in the auction!

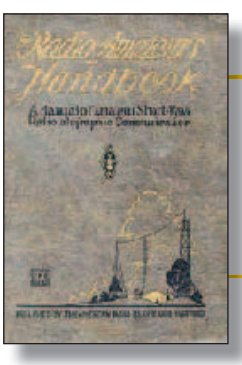
Among the most popular items in this year's auction were the three "junque boxes," donated by the ARRL Lab. Garnering 38 bids between them, these Amateur Radio treasure troves went for more than $200 each, raising almost $650. "We featured the 'junque boxes' in our first auction, and they proved to be extremely popular with our bidders," Jahnke said. "We've brought them back each year, and once again, we couldn't believe how they were all the rage. I can't even begin to describe how well received they were this year." The contents of each box are a mystery, Jahnke said, known only to the ARRL Lab staff. "And they won't tell!" she said.

Jahnke said that donors also added to the Auction excitement by donating gear and products and services. Thanks to our 2010 ARRL On-Line Auction donors: A&A Engineering, ASA Inc, Barker Specialty Company, Engraved Memories, Hotpress Ham Hats, K8RA Iambic & Single Lever CW Keys, KB3IFH QSL Cards and TNT Electrical Trades Gift Store. Special thanks to Hi-Q Antennas, the ARRL On-Line Auction Golden Gavel Sponsor.

Proceeds from the auction benefit various ARRL education programs, as well as fund efforts to license new hams, programs to strengthen Amateur Radio's emergency service training and the creation of new instructional materials. The proceeds also allow the League to offer continuing technical and operating education. QST

In its five year history, the ARRL On-Line Auction has raised almost $200,000 to promote educational activities.

S. Khrystyne Keane, K1SFA
ARRL News Editor



After 22 bids, this First Edition *ARRL Handbook* from 1926 went for $775.

Moonbounce on a Budget

Enjoy Earth-Moon-Earth communication without building another Arecibo.

Bob Baker, KD3UY

BOB BAKER, KD3UY

The below-the-noise receive software, from Joe Taylor, K1JT, *WSJT*, has made moonbounce possible and within financial reach for the ham with an average sized station.[1] Morse challenged? No problem. This article is intended to describe what you actually need, and don't need, to make that first Earth-Moon-Earth contact (EME QSO), and maybe a few more.

What's It Take?

When trying a new thing, not spending much money is a requirement for most of us. If you have an SSB VHF or UHF rig and a computer, you are almost there hardware-wise. You will also need to have a moderate sized antenna and a PC-to-radio keying interface, already in many stations. The days of giant antenna arrays and high power linear amplifiers for EME are past. You do not even need a back yard — EME QSOs have been completed with an antenna on an apartment balcony and even with an antenna lying in an attic.

WSJT has also been used to make HF contacts that would have been impossible using SSB or even CW. This is not to say EME is now easy. It is not. But the kW amplifiers, large antenna arrays and associated cash outlays are no longer necessary. The required software is all free.

But you ask: "Who will want to talk to me? I live in a big state, and I will just have a puny little station." Sure moonbouncers love to work that rare DX and bag that new state or new grid square, but they brag mostly about number of *initials*. An initial is a station you have not talked to before. You are a potential initial. But what moonbouncers really like to brag about is the *smallest* station they have worked. You will be very popular!

Minimum Station Requirements

Another reason very modest stations can make EME QSOs is the hard work of some hams who have created massive EME systems. In one case, a station is equipped with an array of 64 15-element Yagis for 2 meters. Another has a 15 meter diameter dish for 70 cm. These *big guns* have designed their stations to hear the smallest stations (like yours). Most run the maximum legal power, making it easy for you to hear them.

The *WSJT* software package allows the decoding of signals 10 dB below the level the human ear can detect. This facilitates the use of lower power levels and smaller antennas than CW. *WSJT* is the easiest starting point in EME. Using *WSJT*, 2 meter EME QSOs have been reported between big guns and stations as small as 35 W into a four element Yagi. On 70 cm a QSO has been reported using just 30 W at the transmitter end of the transmission line and a 22 element Yagi.

The *WSJT* package is also designed for use on meteor scatter as well as HF. While those modes are not the subject of this article, if you are interested in them, please check the QST-in-Depth Web site.[2]

Bands

I have completed EME QSOs on 6 and 2 meters as well as 70 cm. EME QSOs have been completed on higher bands, but these higher bands will not be specifically addressed here. If that is where your interest lies, hopefully this article will still be of some help.

Your decision regarding which band to pursue may depend on the equipment you have available. An old 70 cm brick (self contained amplifier) lying around the shack? A nice long Yagi for 2 meters?

Many transceivers have 6 meter SSB capability, but no 2 meter or 70 cm SSB capability. If that applies to you, you may be tempted to go for 6 meter EME. That may be the right choice for you, but be aware from the start — 6 meter EME is more difficult than the higher bands. If you do not have a good sized 6 meter amplifier you are probably better off going for 2 meters or 70 cm.

Huge super stations with large, very sensitive antennas designed to hear weak stations such as yours are on both the 2 meter and 70 cm bands. The biggest difference between the two bands is the activity level.

[1]Notes appear on page 38.

There is much more 2 meter EME activity than there is on 70 cm, perhaps by a factor of 10. There are simply more stations to work on 2 meters. This is particularly true with respect to digital mode EME. For whatever reason, a larger fraction of 2 meter stations have *WSJT* capability. More 70 cm stations prefer CW.

Bottom line — If you have some good equipment for one band but not the others, pick that band. If you like one band more, pick it. If you have no preference, I recommend starting your EME adventures on 2 meters.

Antenna Elevation

Whether or not to build adjustable elevation capability (tilting your antenna upward to track the Moon) into your initial EME antenna system is a fundamental decision you must make. Here are some factors to consider.

The biggest factor is ground gain. Depending on the quality of your ground, a horizontal antenna can provide as much as 6 dB of additional gain from ground reflection. This is like having four antennas versus one, for both transmit and receive. The question is: Do you actually have good ground gain? Salt water is perfect. Flat ground is usually pretty good, while hilly ground is bad. Moist soil is better than desert. Lots of structures are bad (urban or suburban neighborhoods). Your ground gain lobes will also be affected by antenna height. In general higher is better.

Another factor is interference. Horizons are noisy, particularly if you are pointing at a city. That 6 dB of additional gain will not do you much good if the noise and interference from that direction is at S-9. It will still help on transmit, but on receive it can be a real problem. Pointing up is a lot quieter. With respect to interference, a low antenna is actually better. It will be subjected to less noise. Of course if you have a low antenna surrounded by trees then you must elevate. Vegetation does attenuate signals. It's worse on 70 cm than 2 meters and even worse if the trees are wet.

Another option is to fix your antenna elevation upward at 15°. This will increase your moon time without adding significant loss for tropospheric contacts.

In summary, assess your situation. How is your ground? Flat or hilly? Urban or a cornfield? How close are you to a city? How bad is the interference? Do you really want to be able to make contacts anytime the Moon is up, or would you be content to run just around moonrise and moonset?

Planning your Station

Before deciding on the outline of the station you wish to build, there is one further consideration. The big gun is probably running at least a kilowatt. You are probably not. This means that it is very likely you will hear him. The critical question is whether or not he will be able to hear you. The big gun also has a sensitive preamp mounted at his antenna. You should not need a mast mounted preamp because of his high power. The question is — how good is the sensitivity of your receiver? Most newer rigs are pretty sensitive. There are other factors here as well, such as how quiet your neighborhood is. Coax loss, determined by the type, length and quality of your coax, is a major factor for both transmit and receive. Yagi antenna gain, for properly designed antennas, is a function of boom length as shown in Figure 1.

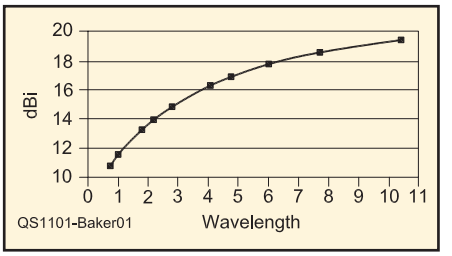


Figure 1 — Gain versus boom length for optimally designed Yagi antennas.

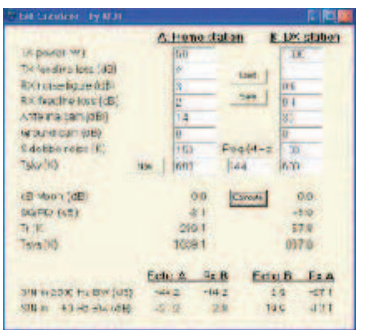


Figure 2 — *WSJT* EME Calculator data entry screen with column for station parameters at each end of the link.

EME Calculator

A very useful software tool to help you design your station is an EME calculator. The package will show you the effects of various changes to your station as well as the effect of varying EME conditions. While helpful, use of this tool is not vital. The bottom line is that for 2 meter EME a minimum station should have an effective isotropic radiated power (EIRP) of approximately 800 W (typically, 100 W and a small Yagi, for example) for working the giant stations. 2500 W EIRP will allow you to work most four Yagi stations. To work the super stations on 70 cm, 1000 W EIRP is required, and for 6 meters 4000 W EIRP.

The EME calculator is included in version 4.9.8 of *WSJT*. *WSJT* is very much a work in progress. New versions and new capabilities come out periodically. The latest release, currently version 7.07, does not include this utility. You will probably want to use the latest version when you are ready to listen for signals from the moon. Version 4.9.8 has some other useful features as well, such as an echo mode to listen to yourself. I recommend you download 4.9.8 and the latest version. The program is built for *Windows*, but there are also directions for *Linux* users. The data entry screen is shown in Figure 2. You can download the software at no cost from **physics.princeton.edu/pulsar/K1JT/**.

For a step-by-step guide to using the calculator, see the QST In-Depth Web site.

EME Conditions and Degradation

EME conditions vary dramatically from week to week and even from day to day. *The World Above 50 MHz* column in *QST* regularly publishes dates when EME conditions are good. But what does that mean? EME conditions are most commonly described by the term *degradation* expressed in dB.

There are two components to this degradation, the moon's distance from the Earth and the noisiness of sky (celestial) in the direction of the moon. The total degradation is just the sum of the two. At perigee (Moon is closest to the Earth) there is 0 dB degradation due to Moon distance. At apogee (Moon farthest from Earth) there is 2.2 dB of degradation due to lunar distance. The noisiness of the sky is even more variable. The quietest region is defined as 0 dB degradation. The noisiest area can contribute over 10 dB of celestial noise degradation. A total degradation of 0 dB would mean that the Moon is at perigee at the quietest point in the sky.

So it is easy to see that for a marginal station, the degradation can easily make the difference between success and failure. Total degradations below 1 dB are considered excellent. Lunar distance and sky noise are independent. It is rare for the Moon to simultaneously be at perigee and in the quietest part of the sky. More about EME conditions is on the QST-in-Depth Web site.

Get Ready to Listen

WSJT is a complicated program. There are a lot of buttons and a lot of user inputs. Running everything on defaults will produce some decodes and some QSOs. But knowing how to use the program well will be at least as beneficial as a second antenna. Read the tutorials that come with the software. You will

spend days building your system. Spend a couple of hours with the documentation and enter your setup information.

Time Synchronization

WSJT requires that your computer clock be accurate to within a second or two. Usually this is done through the Internet. *Windows XP* provides an easily changed default synchronization interval of once a week. Given the notorious inaccuracy of PC clocks, this is usually not sufficient. You can modify the *Internet Time Synchronization Schedule* registry to update more frequently using *Windows*. Newer versions of *Windows* provide more frequent time synchronization, but you should check your PC to be sure. More about this topic is on the QST-in-Depth Web site.

You are Now Ready to Listen

Connect your transceiver SPEAKER jack to your computer sound card INPUT jack. At this point it would be a good idea to see if the *WSJT* software, timekeeping and hardware are all working together for receive. One way to do this is to use *WSJT* on HF.

There are also Internet chat rooms that are used to arrange *JT65* QSOs. The most popular for 2 meter EME is NØUK. Different pages on the site are used for *JT65* EME, *JT65* Terrestrial, Meteor Scatter (*PingJockey*) and CW EME. For HF use the NØUK terrestrial page at **www.chris.org/cgi-bin/jt65talk**. More details about listening on HF and VHF are on the QST-in-Depth Web site. A waterfall display (see Figure 3) is very useful for detecting EME signals and distinguishing them from noise. Frequency is on the X axis, and time is on the Y axis, with the evenly spaced horizontal lines indicating minutes. The two approximately 1 minute duration vertical lines near the center of the waterfall show a strong EME signal. The other white traces are noise.

Get Ready to Transmit

You have now heard your first EME signals and can't wait to transmit? The *JT65* tones output from your sound card need to be routed to your MIC jack. Also, you need to have your computer activate your PTT line at the appropriate times.

The hardware required for the PTT circuit is no different than other sound card digital modes such as PSK. This requires a simple circuit with a single transistor.[3] There are also commercial products that will do the job; I use a RIGblaster from West Mountain Radio. The cheapest model, about $60, will work. After the interface is installed, you are ready for HF *JT65*, meteor scatter and EME. You may wish to test out the system first on HF. On VHF/UHF you will have a range

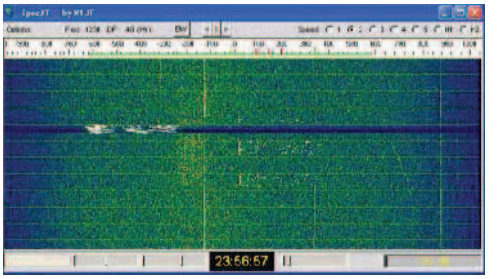


Figure 3 — One of the most useful *JT65* tools is the waterfall display (*SpecJT*).

of several hundred miles, via troposcatter, depending on conditions. You may find someone on the NØUK Web site in your home state or a neighboring state who would be willing to test with you prior to attempting EME. Or just go for it!

Your First QSO

Moonbouncers usually use a different system of signal reports than HF. It is actually pretty simple, but I remember being baffled by it. Go to the *WSJT7* MAIN screen and click on HELP, WHAT MESSAGE TO SEND?

You are ready. You are probably used to tuning the bands listening for stations, then calling them. That works on EME, and even with WSJT, but I would recommend that you learn to walk before you try to run.

Log on to the NØUK Web site, EME-1 page. Enter your user details including grid square. You can enter your antenna and power if you wish. Look to see if there are any big guns around, ask for a scheduled contact, admit you are a rookie (everyone wants to help newbies), and give them your antenna and power, if you haven't included it with your call. If you have already decoded a big gun off the moon, tell them that. If there are no big guns chatting, they may be lurking in the background, so just ask.

You may see a big gun calling CQ and be tempted to just respond to his call without announcing yourself on the Web site. By all means, try that. But do not be surprised if you fail.

The reason is the *JT65* deep search decoder. If your signal is not strong enough for a direct decode, the deep search decoder is used. See *WSJT7* main screen, DECODE tab at top, *JT65* (I recommend selecting NO SHORTHANDS IF TX 1, INCLUDE AVERAGE IN AGGRESSIVE DEEP SEARCH). What the deep search decoder does is search a database of call signs for the best match to the received signal. The database has approximately 5000 EME station call signs in it. You are probably not in it yet. If you are in a schedule, the chance of getting a correct decode through random chance is therefore negligible. However, beware if you are calling CQ and the DS decoder comes up with a call sign. You want to wait to see if you get the same decode twice.

By announcing yourself on NØUK, the big gun will be able to enter your call sign and grid square into his personal call sign database. This is worth about 3 dB. You needn't worry — the big guns are all in the database. Start transmitting.

In Summary

For *WSJT* EME, the hardware required is a VHF/UHF SSB transceiver, a PTT keying circuit, a moderate gain VHF/UHF antenna and a computer. An Internet connection is not strictly required, but it makes the process easier. The software required is the WSJT package and usually a computer time synchronization program. Read the *WSJT Users Manual*. Hook it all together. Listen first, and then start bouncing signals off the moon.

I would like to thank Joe Taylor, K1JT, for his paradigm changing software, and my Elmer, DF2ZC, for all his help and his review of this article. Any errors are mine, not his.

Notes

[1]J. Taylor, K1JT, "WSJT: New Software for VHF Meteor-Scatter Communication," *QST*, Dec 2001, pp 36-39.
[2]**www.arrl.org/qst-in-depth**
[3]**www.qsl.net/wb5apd/wsjt-fsk441.html**

ARRL member and Amateur Extra class operator Robert F. Baker, KD3UY, has been licensed since 1989. Robert received a BS in mechanical engineering from Lehigh University in 1978 and works in space operations at the Applied Physics Laboratory of Johns Hopkins University. You can reach him at 14565 MacClintock Dr, Glenwood, MD 21738 or at **kd3uy@comcast.net**.

Hamspeak

Effective isotropic radiated power (EIRP) — Transmit power standard based on comparison to the power that would be transmitted from an antenna that transmits equally in all directions.

Yagi — Multielement directive antenna in which many of the elements are not directly connected to the driven element(s). The other elements are parasitic and receive and reradiate energy due to electromagnetic coupling. Often used as a rotatable antenna system in the upper HF through UHF regions.

A Modern Directional Power/SWR Meter

Every ham needs an RF power meter.
Here's a high performance unit to build at home.

Bill Kaune, W7IEQ

I first got the idea of designing and building a power meter from a construction article in *The 1997 ARRL Handbook* entitled "The Tandem Match — An Accurate Directional Wattmeter" by John Grebenkemper, KI6WX. John described the difficulties of building an accurate power meter using diodes to convert RF to dc because of the diode's inherent nonlinearity. He describes a fairly complicated (at least it looked complicated to me) analog circuit that corrects for this nonlinear behavior and that also calculates and displays SWR.

Shortly after reading this article, I noticed several articles in *QST* that described a new integrated circuit, the Analog Devices AD8307, that converts a low level RF signal into a voltage proportional to the logarithm of the signal's power. I became intrigued with this device because it eliminated the difficulties associated with the use of diodes and would work over a wide range of powers, from milliwatts to the legal limit.

In addition, I was interested in learning more about microprocessors. Thus, I developed the idea of using AD8307s in the front end of a power meter to convert from RF watts to dBm, then a microprocessor with a built-in analog-to-digital converter (ADC) to process the dBm signals and display power and SWR on a liquid crystal display panel and, perhaps, a panel meter.

The primary use I had in mind for this unit was to monitor the output power and tuning of my rig. I live in an area with antenna restrictions so must operate with a wire antenna whose configuration is more determined by my lot size and configuration than by electrical considerations. Thus, my antenna does not present a good match to 50 Ω on any amateur band. As a consequence, I always use a manual antenna tuner. My setup, including the power meter described here, is shown in Figure 1.

RF power generated by my transmitter is routed via RG-8 coaxial cable through a directional coupler to my antenna tuner, which is connected to my antenna with about 60 additional feet of RG-8. The directional coupler contains circuits that sample the RF power flowing from the transmitter to the tuner (the *forward power*) and the RF power reflected back from the tuner to the transmitter (the *reflected power*). These samples are sent via RG-58 cable to the two input channels of the power meter. This article describes the directional coupler and the power meter in enough detail so that an interested ham can duplicate the device or, perhaps, improve on my design.

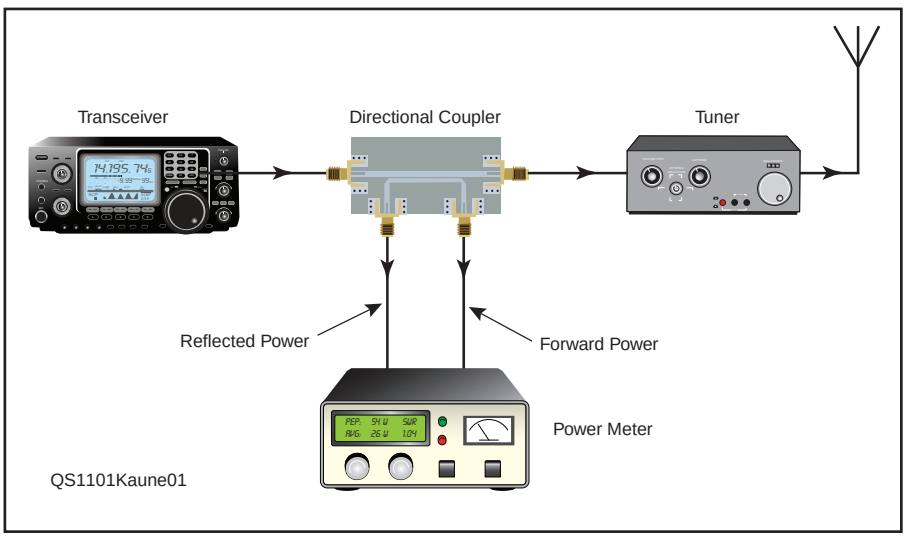


Figure 1 — W7IEQ station setup, including the power meter being described here.

Directional Coupler

The directional coupler I built is based on the unit described in the article by John Grebenkemper mentioned earlier. Coaxial (SO-239) UHF sockets were mounted on opposite faces of an aluminum box (Radio Shack 270-238). A cable from the transceiver was connected to one of these sockets and the other was connected to my antenna tuner. Two BNC sockets were mounted 2 inches away from these coax sockets. Two short lengths of RG-8 coaxial cable were prepared by exposing about ¼ inch of the shield on one end of each. I wound 31 turns of #26 AWG magnet wire on each of two Amidon FT-82-67 ferrite toroids so that the windings occupied about 75% of the circumferences of the cores. These toroids were then slipped over the two sections of RG-8 until they were about ½ inch from the end of the exposed shield. One section of RG-8 was soldered between the two UHF sockets and the other between the two BNC sockets. Holes were drilled in the PC board shields to accommodate these two lengths of cable.

The exposed braid at one end of each section of RG-8 was soldered to a nearby solder lug, as shown in Figure 2. (Do not solder the other end of the braid to ground.) This braid forms a shield that prevents capacitive coupling between the transmission line and the wire wound on the toroids. In addition, one lead from each of the toroids was soldered to these lugs. The other lead from each toroid was passed through the center shield and soldered to the center terminal of the nearby connector. Small rubber grommets were used to insulate the points that these leads passed through the center shields.

The forward and reflected power samples coupled from the main line are reduced by a factor of $1/N^2$, where N = 31 is the number of turns of wire on each toroid. Thus the forward and reflected power samples are reduced by about 30 dB. For example, if a transceiver were delivering a power of 100 W to a pure 50 Ω load, the forward power sample from

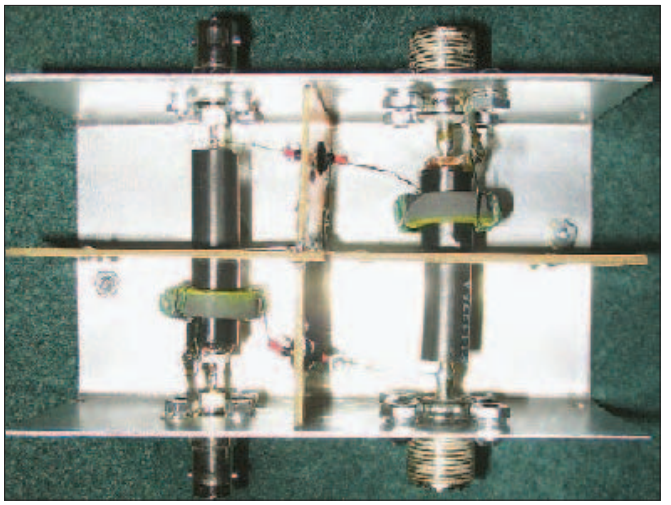


Figure 2 — Compled directional coupler.

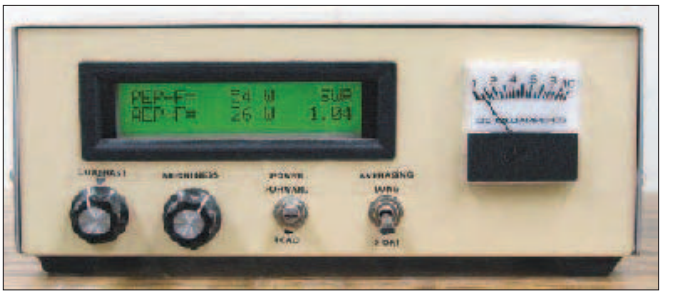


Figure 3 — Front panel of power meter. The LCD shows the peak envelope power (PEP), the average envelope power (AEP) and the SWR. The two knobs control the contrast and back lighting of the LCD. One toggle switch determines whether forward or load powers are displayed. A second switch sets the averaging time for the AEP calculation. The meter shows the SWR and is used for tuning purposes.

the directional coupler would be about 0.1 W (20 dBm) and the reflected power sample, in theory at least, would be exactly 0 because there would be no reflections from the 50 Ω load. Of course, in a real device, the reflected power sample will never be exactly 0. The *directivity* of a directional coupler is defined as the ratio of the forward power sample divided by the reflected power sample when the coupler is terminated in 50 Ω. In my coupler, the directivity, measured using an inexpensive network analyzer, is at least 35 dB at 3.5 MHz and 28 dB at 30 MHz.

Power/SWR Meter — Circuit Description

Figure 3 shows a front panel view of the power meter. I used a two line, 20 characters per line, liquid crystal display (LCD) to display the measured peak (PEP) and average (AEP) envelope powers as well as the standing wave ratio (SWR). Depending on the position of a front panel switch, the power meter calculates either the peak and average envelope power traveling from the transceiver to load (the forward power) or the peak and average envelope powers actually delivered to the load (the forward power minus reflected power). The average envelope power (AEP) represents an average of the forward or load powers over an averaging period, depending on the position of a second front-panel switch, of either 1.6 or 4.8 seconds. I generally use the shorter period, but sometimes use the longer when I am operating SSB.

I included a 1 mA-movement analog meter on the front panel to facilitate antenna tuning. This meter continuously displays the quantity 1 – 1/SWR, where SWR is the standing wave ratio on the line. Thus, an SWR of 1.0 corresponds to a meter reading of 0, that is no deflection of the meter. An SWR of 2 results in a 50% deflection of the meter, while an SWR of 5 produces an 80% deflection of the meter. I have found this method of displaying SWR to be effective for antenna tuning.

Figure 4 shows the schematic diagram and parts list of the power meter. The forward and reflected power samples from the directional coupler enter at the left through two identical channels. Since the logarithmic detectors, U1 and U2 in Figure 4, can only handle a maximum input power of about 15 dBm, I placed two external 20 dB attenuators (Mini-Circuits HAT-20) in cables from the directional coupler. As noted earlier, the directional coupler has an internal attenuation of about 30 dB, so the total attenuation in each channel is about 50 dB. Thus, a rig operating at a power level of 1 kW (60 dBm) will result in an input to the forward power channel of about 10 dBm.

The internal input impedances of the logarithmic detector chips, U1 and U2, are about 1100 Ω in parallel with 1.4 pF. These impedances are in parallel with R1 and R2, respectively, both 52.3 Ω, yielding net input impedances of 49.9 Ω. Capacitors C7 and C8 set the time constants of the output networks of U1 and U2 to filter out RF components in the signal while retaining the modulation components with frequencies up to about 20 kHz. In other words, the outputs of U1 and U2 follow the modulation envelope of the RF signal.

The output signals from U1 and U2 enter U3 and U4, sample-and-hold (S/H) integrated circuits. These circuits operate as follows: As long as the voltages on pins 8 are held high (+5.0 V), the outputs on pins 5 are the same as the inputs (pins 3). However, if the voltages on pins 8 are set low (≈ 0 V), the outputs become *frozen* at the values at the inputs at the moment when the voltages on pins 8 were changed. In this way, input voltages from the forward and reflected power logarithmic detectors can be sampled at the exact same time and held for subsequent serial reading into the microprocessor.

I used a PIC microprocessor in the power meter for several reasons. PIC processors seem to be used in a many types of amateur equipment, so it seemed sensible to become familiar with them. They are remarkably inexpensive. Being RISC (reduced instruction set computers), they have a relatively small number of instructions to learn. Also, you can purchase units that contain a variety of on-chip peripherals, such as analog-to-digital converters (ADC). And, finally, there are software and a large number of helpful documents available for no charge from the producer of these devices (**www.microchip.com**).

Because I needed a device with at least two channels of ADC and a way of outputting a voltage that would drive an analog panel meter, I selected the PIC16F876A, which includes five input analog channels and a pulsewidth modulated output. The two analog signals from the S/H chips were input on pins 2 and 3 of U5, the system processor. In this processor, the ADC is a 10 bit device and conversion can be done relative to a reference voltage. While you can use the 5.0 V supply voltage for this purpose, I elected to improve the accuracy and stability of the unit by using a separate voltage reference chip (U7) that delivers a precise 2.50 V from its pin 6. This choice was also appropriate because the maximum output voltage from the logarithmic converters is close to 2.5 V.

I operated the processor with a 20 MHz clock, which corresponds internally to an instruction execution time of 200 ns (four clock cycles per one instruction cycle). As noted earlier I selected a two line, 20 character per line, LCD to display digital values of the peak envelope power (PEP), average envelope power (AEP), and SWR. R4 adjusts the contrast of the display and R8 its

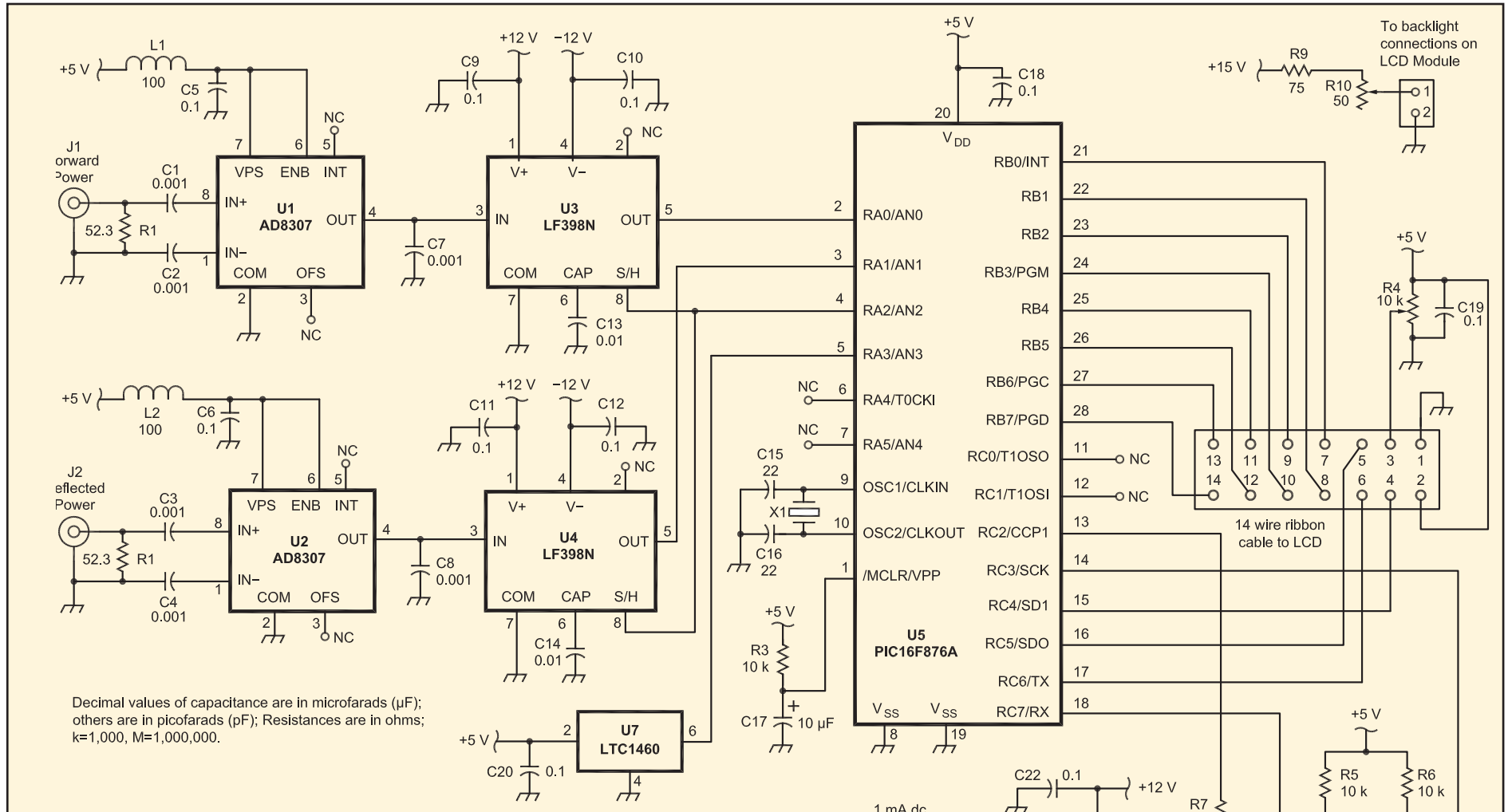


Figure 4 — Schematic diagram and parts list for power meter.

C1-C4, C7, C8 — 0.001 µF ceramic capacitor.
C5, C6, C9-C12, C18, C19, C20-C23 — 0.1 µF tantalum capacitor.
C13, C14 — 0.01 µF polypropylene capacitor.
C15, C16 — 22 pF silver mica capacitor.
C17 — 10 µF, 15 V electrolytic capacitor.
J1, J2 — Female panel mount BNC connectors.
L1, L2 — 100 µH RF choke.
LCD — 2 line × 20 character display (Digi-Key 73-1063-ND).
M1 — 1 mA meter.
R1, R2 — 52.3 Ω, ¼ W resistor.
R3, R5, R6 — 10 kΩ, ¼ W resistor.
R4 — 10 kΩ potentiometer.
R7 — 100 kΩ, ¼ W resistor.
R8 — 5 kΩ trimmer.
R9 — 75 Ω, 4 W resistor.
R10 — 50 Ω, 2 W potentiometer.
S1, S2 — SPST miniature switch.
U1, U2 — AD8307 integrated circuit.
U3, U4 — LF398N integrated circuit.
U5 — PIC16F876A programmable integrated circuit.
U6 — TL082 operational amplifier integrated circuit.
U7 — LTC1460, 2.5 V reference.
X1 — 20 MHz microprocessor crystal.

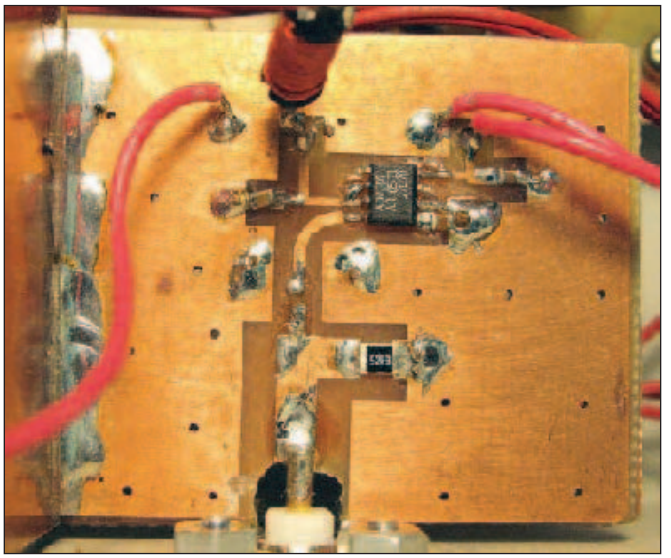


Figure 5 — One of the two RF logarithmic converters.

brightness. In practice, I never change these settings, so if I were building this unit again, I would place them on the back panel.

The PIC processor includes a pulsewidth-modulated output that I use to control the analog SWR meter on the front panel. Essentially, this peripheral produces an output train of rectangular pulses with a frequency of about 4.9 kHz. The pulse height is 5.0 V, the operating voltage of the processor. The spacing in time between two consecutive pulses is about 200 µs. In software, the width of the pulses can be adjusted in 256 increments from 0 µs (the output voltage is always 0) to 100 µs (output is 50% high and 50% low) to 200 µs (output is always high). R7 and C21 comprise a low-pass filter that removes the 4.9 kHz component and leaves only the dc component of this pulse train. In other words, this filter essentially "calculates" the average voltage from the pulsewidth modulated stream, which ranges from 0 V when the pulsewidth is 0 µs to 5.0 V when it is 200 µs.

Construction Notes

The power meter was built in a 8 × 3 × 6 inch deep aluminum cabinet purchased from our local RadioShack; unfortunately this cabinet is no longer available. The RF circuits associated with U1 and U2 were constructed on a small piece of PC board. Figure 5 is a close-up photograph of one of these circuits. I actually built two versions. The first used the *dead bug* construction method and included about 20 dB of on-board attenuation. Unfortunately, the result was somewhat frequency sensitive. The second version used surface mount parts and did not include any internal attenuation.

Eight data lines and three control lines connect between the microprocessor and the LCD. These connections, as well as the connections associated with power, ground and the contrast circuits for the display, were accomplished using a 16 wire ribbon cable. This cable can be seen in Figure 6.

The following components were mounted on the front panel: The brightness and contrast potentiometers (R9 and R4, respectively), the FORWARD/LOAD POWER and AVERAGING TIME switches (S1 and S2, respectively), the LCD display and the SWR analog meter (M1). Connections between these components and the main PC board were made using Molex connectors. I purchased a number of 12 pin male and female headers (Digi-Key WM4010-ND and WM2021-ND) and associated crimp terminals (WM2200-ND). I then cut the headers into smaller pieces (fewer pins) as needed, and soldered the terminals onto the wires in each cable harness. As Figure 6 shows, I used these connectors liberally so that the PC board could be removed without having to unsolder any connections. Finally, I mounted a male DB-9 connector on the rear panel for connection to the remote power supply.

Power Supply

The power supply needs to supply the following voltages: an unregulated 15 V for the back-lighting of the LCD display; a regulated ±12 V for the sample and hold chips (U3 and U4) and U6, the meter driver; and a regulated +5.0 V for the RF deck, system microprocessor and the voltage reference chip (U7). Since the power requirements are small, I constructed a simple power supply using only a single transformer. The schematic and parts list are given in Figure 7. I built the power supply in a separate aluminum box (RadioShack 170-238) and all the parts for it were obtained from Radio Shack. I used a 9 pin serial cable from my junk box to carry power from this supply to the power meter.

Software

As in many modern pieces of electronic equipment, a microprocessor plays a key role in my power meter. As noted earlier, I selected the PIC16F876A for my power meter. While I found the PIC relatively easy to program, learning how to use the various peripherals was more of a challenge. The data sheets from the manufacturer were difficult to follow, and I only began to make progress after purchasing a third-party book describing these units.[1]

When power is supplied to the power meter, the microprocessor will not start until the voltage at pin 1 rises to a threshold value. R3 and C17 establish a time constant of 0.1 seconds, enforcing a delay of about ¼ second. This allows the supply voltages time to stabilize before the processor starts. Once running, the processor samples the forward and reflected power signals every 90 µs, that is, at a rate of 11.1 kHz. Between each sample, the processor converts the power signals, in dBm, to watts. Each measured dBm value is a 10 bit number. This number is used as an index into lookup tables held in program memory. After lookup, each forward and reflected power becomes a 16 bit floating-point number in units of watts. Each forward power value is added to an accumulator, later used to calculate the average envelope power (AEP). In addition, the processor keeps track of the maximum forward power and the respective reflected power.

After 1111 samples, taken during a period of 0.10 seconds, the processor pauses to calculate the SWR, using the maximum forward and corresponding reflected powers measured during this period, updates the front panel tuning indicator, and updates the LCD display if the maximum forward power measured during the period exceeds the PEP value being displayed at that moment. Depending on the setting of the front-panel averaging switch, either 16 or 48 cycles of 1111 samples each are taken, at which point a new value of the AEP and SWR are calculated and displayed on the LCD.

The lookup tables for the forward and reflected powers occupy 4098 bytes (50%) of the available program memory. The remainder of the program uses 2753 bytes, of which 885 bytes are consumed by a 24

[1]M. Predko, *Programming and Customizing PIC Microcontrollers*. McGraw-Hill, New York (2001). Available from Amazon (**www.amazon.com**) or Barnes & Noble (**www.barnesandnoble.com**).

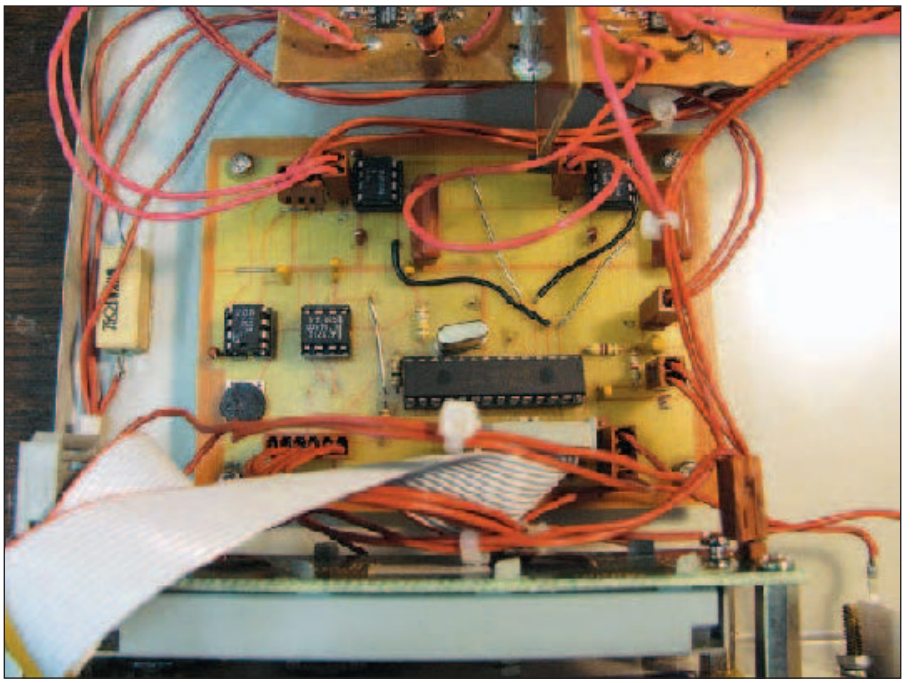


Figure 6 — Interior of power meter. The front panel of the unit is below the bottom of the photograph. The edge of the RF board shows at the top of the photograph. The larger integrated circuit in the middle of the photograph is the 16F876A processor. The two sample-and-hold integrated circuits are located above the processor. The two chips to the left of the processor are a 2.50 V precision voltage reference and a TL082 operational amplifier.

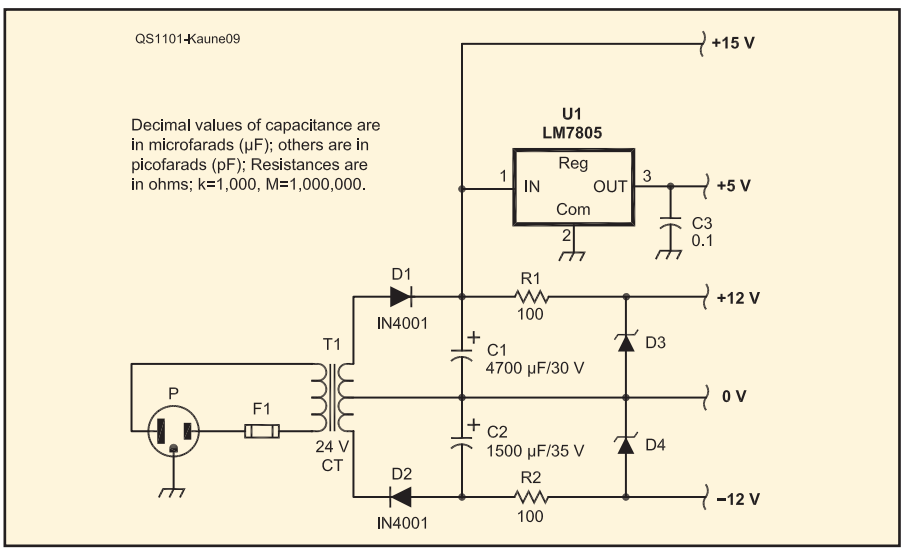


Figure 7 — Schematic diagram and parts list of the power supply.

C1 — 4700 μF, 35 V electrolytic capacitor.
C2 — 1000 μF, 35 V electrolytic capacitor.
D1, D2 — 1N4001 diode.
D3, D4 — 1N4742A 12 V Zener diode.
F1 — Fuse, 1A.
R1, R2 — 100 Ω, 1 W resistor.
T1 — Power transformer, 24 V CT.
U1 — LM7805 voltage regulator.

bit floating point package that I downloaded from the Microchip Web site.

Calibration

The output of a logarithmic converter is a voltage linearly proportional to the input RF power measured in units of dBm. Furthermore, the digitized value, D_{ADC}, of the voltage measured by the ADC is a linear function of the input voltage. Putting these together, dBm = $\alpha D_{ADC} + \beta$, where α and β are constant. Calibration consists of determining these two constants. I did this by writing a special calibration program for the PIC processor that constantly displayed the digitized ADC values for both the forward and reflected power channels as I inputted various power levels to each channel. In this way, I determined that $\alpha = 0.10063$ and $\beta = -70.83$ for the forward power channel and $\alpha = 0.09965$ and $\beta = -71.50$ for the reflected power channel. Unfortunately, I have no way to accurately measure absolute power, so these values are somewhat uncertain by perhaps ±10% or so.

Once I had determined the calibrations of the two channels, I constructed the look-up tables used by the processor to quickly determine the power in watts corresponding to a measured ADC number.

Conclusions

In contrast to a number of my projects, the power meter described here seems to work well and has proved to be a useful instrument. I use it whenever I operate. My transceiver has a maximum output of a little more than 200 W, and I have a linear amplifier that can run an output power of 1000 W. The power meter works well with both levels of power. What I did not anticipate when I built it is how well it works at low power levels. When I transmit SSB, but am not speaking into the microphone, the background noise in my shack is sufficient to produce an output power of about 0.1 W or so. I find that this power level is sufficient for me to adjust my antenna tuner using the tuning meter on the front panel of the power meter. In this way, I can tune up without disturbing other stations operating on nearby frequencies.

A version of this article with additional construction details, a discussion of how the coupler works and related Hamspeak items is provided on the QST-In-Depth Web site (**www.arrl.org/qst-in-depth**). Also there are the required firmware and PC board artwork.

Bill Kaune, W7IEQ, was first licensed in 1956 as a Novice and was licensed again in 1998. He upgraded to Amateur Extra class in 2000. Bill earned BS and PhD degrees in physics. He spent most of his career collaborating with biologists and epidemiologists researching the biological effects of power-frequency electric and magnetic fields. He is now retired.

Bill is married, has two grown daughters, four grandchildren and a standard poodle. In addition to Amateur Radio, he spends his time hiking and backpacking, including two recent trips to Alaska. Bill is currently the treasurer of the Jefferson County Amateur Radio Club, a member of the ARRL and a member of the ARRL's RF Safety Committee. You can reach him at 160 Cedarview Dr, Port Townsend, WA 98368 or at **w7ieq@arrl.net**.

A Coax Entrance Facility

This arrangement provides a dry and pest proof route for your antenna connections.

David Waits, K4VMV

When I had to move the antenna tower from the rear of the house to the end of the house, I quickly decided to use the gable vent for the coax entrance. Doing this opened the screen on the inside of the gable vent. This allowed a small creature to enter the attic along with the coax. This creature evidently became hungry and decided RG-8X and RG-213 were good to eat. Finally the pest removal was accomplished and the gable pest proofed with ¼ inch hardware cloth on the outside as shown in Figure 1. As this adventure had cost two runs of coax and did not look very nice, I knew there had to be a better way.

[This arrangement makes use of the tower as the primary ground for lightning induced currents. Having the feed lines branch off above ground results in a fraction of any lightning currents following the coax and other tower wiring to the station. If lightning is a concern, it is better if the cables follow the tower to the base and get bonded to ground there before entering the station. — *Ed.*]

A Solution Appears

While visiting our local home improvement store electrical department, I saw a PVC junction box, measuring 12 × 12 × 6 inches. Since antenna building, testing and changing is my favorite part of Amateur Radio, I needed a box this big to support future projects. You may use a smaller box if you don't need as many entrance points. Figure 2 shows the box drilled and six 1½ inch plastic pipe male adapters mounted with their supplied nuts. Also the bottom of the box has twelve ¾ inch plastic pipe male adapters mounted with ¾ inch steel conduit lock nuts.

Making it Happen

Drill or saw out a hole in the wall for the box and the adapters to mate with the wall. Next mount the box to the outside of the building as shown in Figure 3 using silicone caulking and at least four good screws for this size box. I used corks to seal the bottom adapters. I then put the box front on until I was ready to install the coax.

Figure 2 — The box with all adapters mounted.

With the box mounted you insert as many runs of coax, rotor control cable and antenna switch control cable as you want. Figure 4 shows the box as cables were being fed into the attic. These cables in the attic go over and into an interior wall behind the desk in the ham shack. The holes in the top plate of the wall are ⅝ inch and are placed to put all the wires in between two of the wall studs. The bottom adapters are not large enough to pass PL-259 or type N coax connectors, so the coax must be run into the operating position prior to adding the connectors. Figure 5 shows the box cover in place and the corks in the unused adapters on the bottom. Add silicone caulk around the wires as they come out of the bottom of the box to prevent small insects from getting into the box.

Figure 6 shows the panel I made of aluminum and wood frame mounted on the wall behind the operating desk with several wires coming into the room. The same ¾ inch adapters are used in this panel as in the bottom of the box. You may also use the corks and silicone to prevent air leakage into the room from the wall. Previously there were

Figure 1 — The gable vent prior to mounting the box.

Figure 3 — The box mounted on the end of the house.

Figure 4 — The wires going through the box into the attic.

Figure 5 — Box closed prior to wires being dressed to the tower.

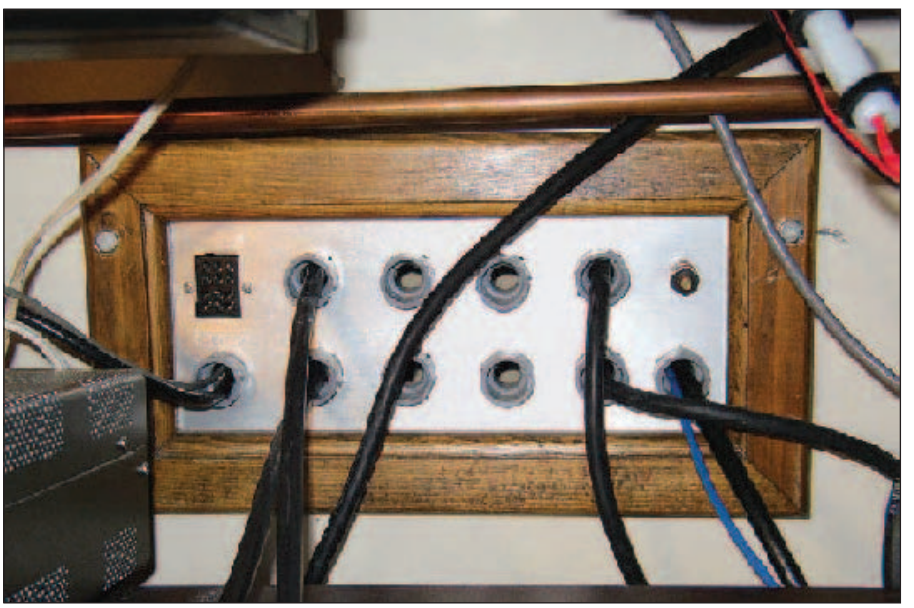


Figure 6 — Interior panel on wall behind the operating desk.

SO-239 connectors mounted in this panel, but running the coax straight through eliminates the chance of loss due to connectors.

The odd pieces of coax on the tower have been removed and the interior screen on the gable vent has been replaced. My wife is pleased with the new look and antennas are performing well. This project is easy to fabricate and cost well under $100. The hardest part is crawling around in the attic to get the wires into the wall. If you need a safe, dry way to get coax into the shack, this one works well.

David Waits, K4VMV, was first licensed in 1957 as KN4VMV and soon thereafter became a Technician class with his current call. After letting his license expire, he regained interest in the 1960s and got the call WB4JXE. He later obtained his old call and his Amateur Extra class license.

David loves working with antennas and operates on 160, 75, 40, 6 meters as well as on the 146 and 440 MHz bands. He is a member of ARRL, Gadsden Amateur Radio Club, West Carolina Volunteer Examiner Group and NAQCC #3683.

David retired from the Federal Civil Service as Fire Chief at Fort McClellan, Alabama in 1996. He then went to work for the City of Gadsden and retired again from the Gadsden/Etowah County Emergency Management Agency in 2008. You can reach Dave at 2169 Cove Circle E, Gadsden, AL 35903 or at **k4vmv1@charter.net**. QST

New Products

LUSO 90 FOOT CRANK-UP TOWER

◊LUSO has installed its first tower in the US at the station of Ken Moak, KM8AM, of Urbana, Ohio. Shown at the 2010 Dayton Hamvention, the LUSO90US is a motorized crank-up tower that rises to 90 feet by means of a motorized winch controlled from inside the station. Nested height is 30 feet. The LUSO90US is made from four sections ranging from 47 inches wide at the base to 17 inches at the top weighs more than 9000 pounds. Price: $20,000. Other models are available, ranging from 70 to 170 feet. For more information, specifications and photos, visit **www.luso.us**.

Yaesu FTM-350R Dual Band FM Transceiver

Reviewed by Howard Robins, W1HSR
Contributing Editor

The FTM-350R is one of the more feature rich dual band radios I have had the occasion to use. I will elaborate on the features in this review. However, it is worth mentioning up front that this dual band rig also operates in the amateur 222 MHz band with 1 W of output power. It has APRS — Automatic Packet Reporting System — built-in, too.[1]

Separated Front Panel and Main Radio Unit

The FTM-350R has a separated front panel (control head) that is connected by umbilical to the main radio unit. RJ-11 and RJ-45 connectors are used for mic and umbilical connections. Note that the front panel cannot be attached to the main unit. The included mounting bracket for the front panel is an L bracket with a suction cup on the bottom. This leaves much room for improvisation.

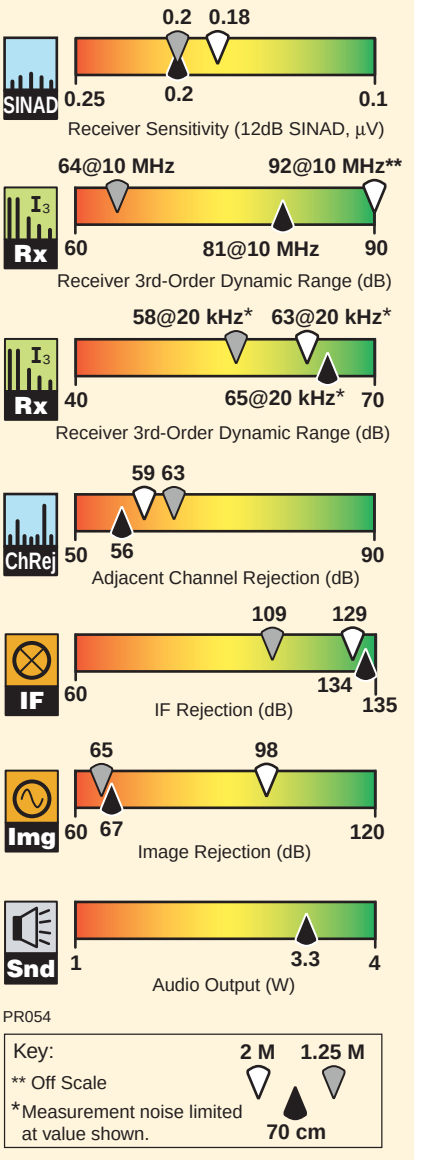
[1]APRS is a program developed by Bob Bruninga, WB4APR. For more information, see **www.aprs.org**.

The front panel has a larger than usual display with brightness, color (eight choices) and contrast adjustable in the menu system. The panel is split into left and right half radios with mirrored controls on each half. Each half has a VOLUME control and a TUNING knob. The left side is dominant in that its tuning knob doubles as selector dial while working with the menus.

There are three buttons on each side of the display and five more under the display. The functions of many of these buttons change depending upon Smart Function mode. The eleventh button is the POWER/LOCK button. While a mic is included in the box and the rig is optionally Bluetooth capable, there is also a mic built into the front panel and the top button on the right serves as PTT. There are two built-in speakers, so external speakers are optional.

The main radio unit weighs in at just over 3.5 pounds. There are connectors for the umbilical and mic (yes, a second mic connector) on one side panel, and RF, data, line-in, and external speakers on the opposite side panel. Of course the fused power cord is also on this end of the main unit. There is a third speaker built into the main radio unit. From

Key Measurements Summary



Bottom Line

The FTM-350R is a top-of-the-line mobile FM transceiver with well thought out controls. It offers some unusual features such as 222 MHz transmit and a stereo FM broadcast receiver, as well as options such as APRS and Bluetooth connectivity.

Mark J. Wilson, K1RO ♦ Product Review Editor ♦ k1ro@arrl.org

a menu, you can enable the control head speakers, main unit speaker, all speakers or no speakers. Another menu allows you to tailor the audio a bit by enhancing the high or low tones in several steps.

Three helpful documents are included in the package: *Operating Manual* (52 pages), *APRS Manual* (35 pages), and two pages of diagrams depicting the installation of optional accessories, connections, and settings. Installation instructions for the optional accessories were weak or nonexistent — the diagrams were a lifesaver.

System Organization

This rig has so many features that I really did not get too far on my own before cracking open the manual. There are Set Mode menus, Smart Function keys, and Special Function Mode to configure the various installed features. It takes a little experience to know where to go to adjust settings. However, I must say that given the considerable suite of features, the keys and menus are very well thought out. After only a few minutes to get acquainted with them, making adjustments becomes fairly intuitive. A lot of consideration had to go into designing a system with so many features and options to make them reasonably manageable.

Too often I find that ergonomics and user-friendliness are left out of the equation. What good is a feature-rich radio if you can never figure out how to program it? I have a "simple" 2 meter radio that has such cryptic stenciling on the buttons that I need to refer to the manual to make simple changes, such as switching from memory to VFO or changing power level. Yaesu did a great job with this radio.

The three buttons to the left of the display are FWD, BCK and SET. Pressing the FWD or BCK buttons scrolls through several page displays: Main radio — Navigation — Clock — Barometer/Altitude — GPS. Which pages are included in this scheme is user settable.

Pressing the SET button brings you to the menu groups. Once there, turning the left TUNING knob indexes or scrolls from one group to the next; pressing the knob selects and opens the group. Turning the knob indexes into the list of options within the group; pressing the knob selects the option for setting. Rotating the knob scrolls through the available choices for setting the option. The groups are: Audio, TX/RX, Display, Memory, APRS/PKT, Scan, System, Navi, Timer/Clock, Signaling and Option. So, most of the settings for this rig are implemented using the same buttons and procedures.

The five buttons below the display are called Smart Function Keys. Their functions change with the push of the F key, which is

Table 1

Yaesu FTM-350R, serial number 9M010140

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.5-1.8 MHz (AM), 76-108 MHz (WFM), 108-137 MHz (AM), 137-174 MHz (FM), 174-222 MHz (WFM), 222-250 MHz, (FM), 300-336 MHz (AM), 336-470 MHz (FM), 470-800 MHz (WFM), 800-999.99 MHz (FM, USA version cellular blocked); transmit, 144-148, 223-225 (USA only), 430-450 MHz.	Receive, As specified, except 0.5-1.71 MHz (AM). 800 MHz and up, 800-868.990, 894.010-911.990, 943.510-956.990, 988.510-988.510-999.990 MHz (FM); transmit, as specified.
Modes: FM, AM receive (specified frequencies).	As specified.
Power requirements: Receive, 500 mA; transmit, 10 A on 144 and 430 MHz (50 W output) at 13.8 V dc.	At 13.8 V dc: Receive, 960 mA (max vol, max lights, no signal, both receivers), 300 mA standby, min lights). Transmit, 146 MHz, 9.1, 5.8, 3.1 A (hi, med, low), 440 MHz, 10.5, 6.2, 3.4 A (hi, med, low).
Minimum operating voltage: Not specified.	9 V dc (5, 17, 30 W output typical).
Receiver	**Receiver Dynamic Testing†**
Sensitivity: (10 dB S+N/N) 0.5-1.7 MHz, 5 µV; 108-137 MHz, 0.8 µV; 300-336 MHz, 0.8 µV (12 dB SINAD) 76-108 MHz, 2 µV; 137-150 MHz, 0.2 µV; 150-174 MHz, 0.25 µV; 174-222 MHz, 1 µV; 336-420 MHz, 0.25 µV; 420-470 MHz, 0.2 µV; 470-800 MHz, 5 µV; 800-900 MHz, 0.4 µV; 900-1000 MHz, 0.8 µV.	For 12 dB SINAD, 146 MHz, 0.18 µV; 223 MHz, 0.2 µV; 440 MHz, 0.2 µV; 902 MHz, 0.38 µV; 100 MHz, 0.7 µV. For 10 dB S+N/N, 1 MHz, 0.47 µV; 120 MHz, 0.7 µV; 340 MHz, 0.7 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset*: 146 MHz, 63 dB; 223 MHz 58 dB; 440 MHz, 65 dB, 902 MHz, 64 dB. 10 MHz offset: 146 MHz, 92 dB; 223 MHz, 64 dB, 440 MHz, 81 dB, 902 MHz, 70 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 91 dB; 223 MHz, 93 dB; 440 MHz, 108 dB; 902 MHz, 76 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset, 146 MHz, 59 dB; 223 MHz, 63 dB; 440 MHz, 56 dB; 902 MHz, 48 dB.
Spurious response: Not specified.	IF rejection, 146 MHz, 129 dB; 223 MHz, 109 dB; 440 MHz, >134 dB; 902 MHz, 125 dB. Image rejection, 146 MHz, 98 dB; 223 MHz, 65 dB, 440 MHz 67 dB; 902 MHz, –3 dB.
Squelch sensitivity: 0.16 µV (144/430 MHz).	At threshold, 146 MHz, 0.1 µV, 0.25 µV (max); 223 MHz, 0.1 µV, 0.27 µV (max); 440 MHz, 0.12 µV, 0.29 µV (max).
S meter sensitivity: not specified.	At full scale, 146 MHz, 5.3 µV; 223 MHz, 3.8 µV; 440 MHz, 6.1 µV.
Audio output: 4 W at 10% THD into 4 Ω (external speaker).	3.3 W at 10% THD into 4 Ω. THD at 1 V RMS, 1.5%.
Transmitter	**Transmitter Dynamic Testing**
Power output: 50, 20, 5 W (hi, med, low) at 13.8 V dc ±15%.	146 MHz, 53, 20, 5 W (hi/med/low); 223 MHz, 1 W (fixed); 440 MHz, as specified.
Spurious signal and harmonic suppression: >60 dB.	>70 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal: 70 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	146 MHz, 134 ms; 223 MHz, 130 ms; 440 MHz, 115 ms.

Size (height, width, depth): Control panel, 2.6 × 6.2 × 1.3" (not including knobs and connectors); rear chassis, 1.8 × 5.5 × 5.9". Weight, 4.6 lbs (panel, chassis and connection cable).

Price: FTM-350R, $550; FGPS-2 GPS unit, $80; CT-133 GPS cable, $70; CT-136 GPS adapter, $30; BH-1A Bluetooth stereo headset, $90; BU-1 Bluetooth adapter, $70; FEP-4 earphone for BH-1A, $20; CAB-1 charger sleeve for BH-1A, $10; FVS-2 voice guide unit, $35; CT-140 packet cable, $55; ADMS-350 *Windows* programming software and cable, $50.

†"Left Side" and "Right Side" receivers measured identically.
*20 kHz offset measurements were noise limited at the values indicated.

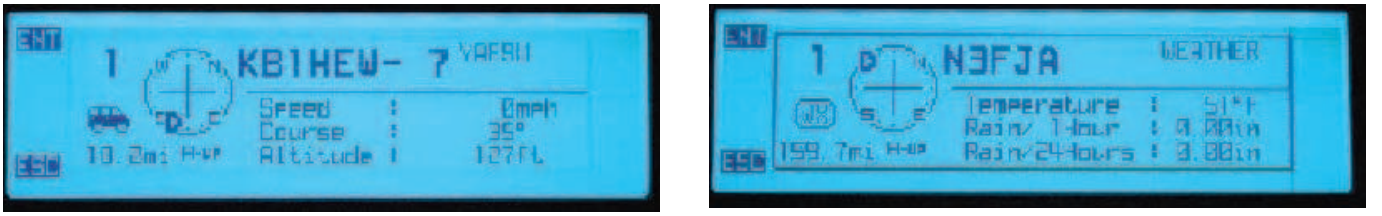


Figure 1 — Two examples of the FTM-350R display during APRS operation. (Left) Received positions include an icon, distance, relative location (D), speed and coordinates. (Right) Received weather beacon information can include temperature, precipitation and wind speed.

the lowest of the three buttons to the right of the display. There are four sets of functions with the optional Voice Guide Unit installed and APRS activated. Pressing and holding the F key brings up a fifth set of functions that control squelch type and tones.

A Special Function Mode is accessed by powering up while pressing the key to the left of the power key. In this mode you can reset the radio, reset APRS settings, setup cross-band repeat, control cloning, turn on Bluetooth pairing and so on.

Channel programming is equally simple. Each memory channel can store frequency, split/offset, tone, power level and alphanumeric label. I like the fact that the power level is included — it avoids accidentally using too much or too little power when changing channels, and results in less fumbling around while on the road. There are eight character positions for each alphanumeric entry. The large alphanumeric display is crisp and readable from several feet away. The frequency is also displayed in a smaller font. Each half of the radio has its own set of 500 programmable channels.

Yaesu's MH-48 microphone, which has four programmable P buttons, is included. These buttons can be set to most common functions such as TX power, repeater shift, reverse, scan or tone. There are also UP and DWN buttons that can be used to change channels or frequency in VFO mode. The alphanumeric keypad can be used for direct entry of numerical information, such as frequencies or pairing codes, and text for APRS text messages. The A, B and C buttons on the mic can be used to navigate the text message entry fields.

Built-in Features

Packet Radio and Automatic Packet Reporting System (APRS)

Yaesu, with the FTM-350R joins Kenwood in providing mobile APRS. The Set Mode, APRS group, provides one-stop shopping for all APRS parameters such as MYCALL, SSID, icon, Beacon rate, SmartBeaconing Path, and so on.[2] There are a number of interesting ways that beacons can be managed in this radio. In addition to manual, auto and SmartBeaconing, there are Interval, Proportional, Decay, Slow Speed and Rate Limit controls available. *Proportional* cycles through a series of Path routes over a period of time. *Decay* extends the preset beacon interval when your vehicle is stopped for a period of time. Your beaconed position can be fixed or based on actual coordinates with the optional GPS receiver attached.

Received positions are displayed on the full screen and include icon, distance, a graphic display of relative location, speed and coordinates. Received weather beacon information is decoded and displayed quite clearly. See Figure 1 for some examples. With the Smart Function keys set for the APRS functions, pressing the S LIST button brings up a list of received beacons; turning the left tuning knob indexes through the list. Pressing that knob selects and opens the beacon info for reading.

Text messaging works in similar fashion. After I received a message that was sent as a bulletin, a little message icon appeared on the main screen. Pressing the MSG button brings up a list of messages and turning the left tuning knob scrolls through the list. Pressing that knob selects and opens the message for reading and reply.

Muting the APRS side of the radio (the side you select) is an option that makes it possible to not have to turn down the volume to avoid listening to packet clatter. You can also select options for alerting you when various types of beacons are received.

Alerting has been taken to another level with this radio. Some of us manually set up a 100 Hz tone to be transmitted with position beacons. Receivers are set up to open squelch when they are close enough to the transmitter to decode the tone. Hearing packet clatter alerts you to the fact that you are within simplex range of another station (digipeaters do not repeat the tone), which means you could make voice contact on the APRS frequency and move to a different frequency to have a conversation if desired. Kenwood made this a feature in the TM-D710 that could simply be turned on and off.[3]

Needless to say, this conventional 100 Hz tone arrangement could also be implemented on the FTM-350R. However, it seems Yaesu has adapted its proprietary alerting features (Enhanced Paging and Coded Squelch, EPCS — more on this later) to work with APRS. You can set up alerts when beacons and messages from specific stations are received, or for those received from any station meeting range criteria that you can set. With the Voice Guide Unit installed and MSG VOICE turned on (in the APRS/PKT Set group), call sign and message will be announced. There are filters that can be used to limit which beacons and messages will be announced. For example, it is possible to set up a filter so that only participants in a public service event are displayed.

We bought the CT-140 data cable to see how this radio would work with a PC. This cable has an 8 pin mini-DIN plug that goes into the data port on the main radio unit. On the other end of this cable are a 9 pin female D connector for a PC serial port, and a 6 pin mini-DIN connector for an external TNC. There is no information in either manual on using the built-in TNC for anything other than APRS. You can select either GPS or packet to be outputted on the data port. There are TXD and RXD pins on the serial PC connector diagram, but no PTT.

I tested the packet cable using *HyperTerminal* and mapping software. The GPS GPRMC and GPGGA sentences are sent, and they did spill into *HyperTerminal* with their coordinates reflected on the mapping software. (GPRMC and GPGGA sentences are standard strings of data that contain latitude and longitude, speed, bearing, time and other information used by GPS systems.) I switched the data output to the packet mode and saw raw APRS data spill out. I tuned to a local packet node frequency and saw its ID beacon and some other packet data. I could not get a command prompt, so could

[2]SmartBeaconing is an algorithm created by Tony Arnerich, KD7TA, and Steve Bragg, KA9MVA, of HamHUD for adjusting transmit rate based on speed and heading changes of the vehicle. See **www.hamhud.net** for more details on this algorithm.

[3]See *QST* Product Review, February 2008. Past *QST* reviews are available to ARRL members at **www.arrl.org/product-review**.

not exercise the internal TNC any further.

I am a bit surprised that the built-in TNC is set up for APRS only. While APRS is the dominant packet application these days, there are still some conventional packet nodes, BBS and Winlink 2K in use for emergency communications. If you want to use this radio for those purposes, you will have to add a fully functional external TNC to do so.

While I am mobile, I like to keep APRS running; which ties up one side of the radio. I wish APRS could be implemented to run in the background, perhaps as a third channel, so that both halves of a dual band radio could run in the foreground. Too much of the radio becomes dedicated to APRS the way it is implemented on *any* radio available today.

Figure 2 — We ordered several of the many available accessories for our FTM-350R, including GPS, Bluetooth and Voice Guide. See text for details.

AF Dual

This feature lets you monitor an Amateur Radio frequency on the right side of the radio while listening to the *built-in* AM/FM broadcast radio on the left side. (The FM receiver is stereo and makes use of the two speakers in the control head.) There is also a LINE-IN connector that lets you attach your own MP3 player or other audio source. If a signal is received on the amateur frequency, audio switches to it and the other audio source will not be heard. I tested this with *muted* APRS operating on the right side. The FM broadcast station came in, uninterrupted except when beacons were transmitted. APRS functioned — received positions were displayed and periodic beacons were transmitted (right side set to main or active transmit side). The interruption only lasted for the short time it takes to transmit a beacon.

Band Scope

In VFO mode you are able to observe activity on ±22 or ±50 channels from your frequency. There is even a 10 dB attenuator that can be switched in or out if strong local signals are a problem.

Clock/Timer

One of the FWD/BCK pages displays the clock functions. The current date and time, count up, and count down timers are mode choices. Lap functions are optional selections. Average and maximum speed can be displayed instead of lap when the GPS is connected. One neat feature is that it plays a unique note on the hour, every hour. You can leave the clock page up if you want a large digital clock to look at, and it won't interfere with other radio functions. There are areas on the clock display that indicate what channels/frequencies the left and right sides are on.

Scan Modes

The FTM-350R has four scan modes: VFO, Memory, Programmable Memory Scan (PMS) and Priority Channel Scan (Dual Watch). VFO and Memory scan are just that. PMS — there are nine pairs of band limits (upper and lower frequencies) that can be programmed for scanning. Dual Watch — Priority memory channel 000 can be programmed to be checked for activity while operating in VFO or memory mode.

WX Alert Scan has become so commonplace that it does not warrant explanation, and there is none in the Operating Manual. This feature can be turned on and off in the Set Mode, TX/RX Group. In memory scan mode with just a few channels programmed, I observed that the 10 weather band frequencies were also being scanned. I noticed a brief stop in the scan and a full scale S-meter reading on one of the frequencies, but heard no audio. I assume that with this feature on, if the National Weather Service transmits the 1050 Hz alert tone, the FTM-350R will stop on that WX frequency and open squelch. There is no WX indication on the main radio display.

Tones

In addition to the usual CTCSS and DCS, Enhanced Paging and Code Squelch (a Yaesu proprietary system) is also incorporated into this radio. EPCS uses paging memory and tone pairs to accomplish selective calling. The receiver remains quiet until the stored tone pair is received with paging activated. A bell ringer can be assigned to sound when the tones are received.

Barometer/Altimeter

One of the available page displays is the barometer/altimeter, which uses the built-in sensor to determine barometric pressure. This pressure is shown numerically in the upper right side of the display and graphically on the left side. The graphical display is over a user changeable time scale from 2 to 24 hours. Altitude and position coordinates are also displayed on the right side when the optional GPS receiver is attached.

Cloning

With the Yaesu CT-135 or equivalent cable plugged into the data ports, memory contents and configuration data can be transferred from radio to radio. This feature is implemented in the Special Function Mode (accessed by powering up with the button to the left of the power button pushed). The data port is a standard 8 pin mini-DIN, so I suspect that fabricating a cable for this purpose should be fairly simple.

Optional Hardware Installation

We added most of the optional features (Figure 2), including the Bluetooth Adapter Unit (BU-1), Bluetooth Headset Charging Sleeve (CAB-1), GPS Antenna Unit (FGPS-2), GPS Adapter (CT-136), GPS Connection Cable (CT-133), and the Voice Guide Unit (FVS-2).

Installation of the Voice Guide Unit requires removing the lid from the main radio unit. Mating surface mounted connectors on the PC boards (PCB) made this a very simple installation. One word of caution, however; the speaker mounted on the lid has very short connecting wires that broke when the weight of the lid stressed the soldered connections. The other end of that wire has a pin connector that I could have pulled off the PCB, but I did not get the chance to do that.

The other devices are installed in or onto the front panel following an order of process. There are six screws on the back of the panel that must be removed. The panel has circuit boards on both halves, but the flat ribbon cable that ties them together is long enough to let you work. The Bluetooth BU-1 has a surface mount connector that mates with the panel's PCB (Figure 3). Once that is installed, the panel can be reassembled.

Two of the screws previously removed held a cover plate in place. The access port that was covered by this plate has a connectorless flat ribbon cable pigtail. That pigtail must be inserted into a connector on the

GPS connection cable. There was just enough room to manipulate the flat pigtail into the cable connector. This required care, as it was important to get the flat cable properly inserted without breaking it. The two screws from the cover plate are used to attach the GPS cable to the panel.

The Bluetooth headset charging sleeve is installed last, to avoid interference with the GPS cable. Removing an adhesive patch that covers the mounting spot for the charging sleeve reveals two tiny screw holes. The charging sleeve screws provide electrical and mounting connections for charging the headset battery. The good news is that everything worked when I reassembled the radio!

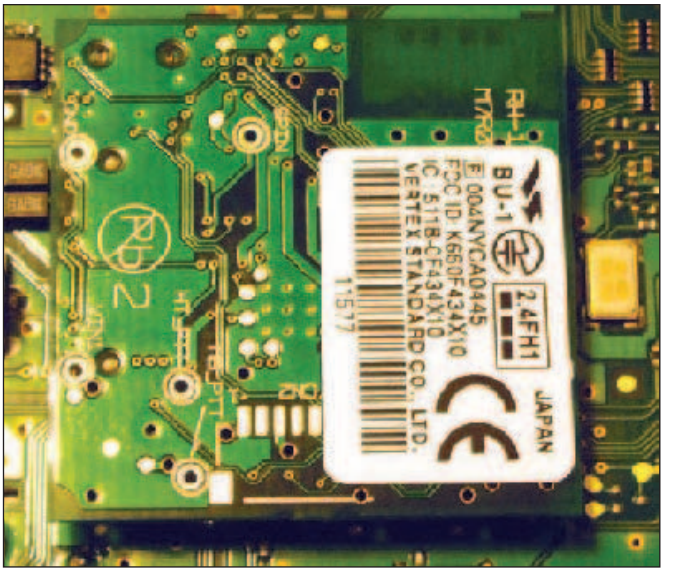


Figure 3 — The BU-1 Bluetooth adapter is a small PC board that piggybacks on the control head. Accessory installation required attention to detail but wasn't difficult.

Optional Features

Bluetooth

After charging the Bluetooth headset, I tried to pair it with the radio, but failed. The headset was positioned behind the front panel. After several retries, I moved the headset to the front of the panel and pairing succeeded immediately. My assumption is that either the rear of the panel is shielded or the Bluetooth antenna in the front panel is focused forward.

I tested the Yaesu BH-1A Bluetooth headset over the air and got good audio reports. In fact if I did not mention that I was using Bluetooth, nobody would have known. You have the option of using a PTT button that is located on the earphone or using VOX. VOX sensitivity adjustment, an Option menu item, is either high or low, and with the flexible boom mic, it is possible to make it just right. I personally do not like to use VOX, but if you want totally hands free operating, this will give it to you. In Connecticut, and in many other states, hands free operation is required for driver cell phone use in a moving motor vehicle, so this could help avoid having to try to explain to police that this isn't a cell phone.

I prefer hands free speaker phones and in-ear devices to something that hangs on my ear. I tested and found that standard Bluetooth devices will pair and work with the FTM-350R. My JVC HA-W700BT clip-on Bluetooth device, with Bose in-ear phones, paired with no problems. The phone button on the JVC clip worked as PTT. The received audio had great fidelity.

In a comparison test my transmit audio sounded better with the boom mic on the Yaesu BT headset. Surprisingly, the best transmit audio report came from the mic built into the front panel. While mic characteristics vary, this was a subjective test, and gain and position adjustments could modify perceived audio quality from any of the mics.

Navigation

Most typical GPS receivers are used for navigation and have detailed maps and much useful information for the traveler. This is a radio with an optional GPS receiver attached. When Navi is enabled as one of your display pages, pressing the FWD or BCK buttons will scroll to it. There are a total of 16 *point memories* in 4 four point groups. Latitude and longitude can be manually entered or stored in point memory from GPS positions. There is a graphical compass on the left side of the display. A D is located on the compass that represents the destination relative to your position. The object is to drive in the direction of the D to get to your destination. The right side of the display reflects the destination point information and distance to it.

If you could use this feature to navigate to received APRS position beacons it could be useful in certain public service operations. Unfortunately, I could not find any connection between the APRS and Navi features to make this happen.

Audio Playback

The optional Voice Guide Unit provides memory to record the last 30 seconds of received audio — *Last* mode — or up to five minutes total in eight variable length memories — *Free* mode. The VGU also provides for the announcement of main band operating frequency when the operating band changes.

Closing Thoughts

I am pleased that Yaesu has added APRS to their suite of features. I am a bit disappointed that the GPS functionality is so integrated that it seems to require the use of a Yaesu proprietary GPS receiver, which precludes working with external map-based navigation systems. This could be considered an attribute, if you like this integrated approach, as it does not require an external system to be fully APRS functional. Everything is there, but users might wish for the map, graphics and other features such as turn-by-turn routing of navigation systems commonly available today. Of course the GPS position data could be outputted for manipulation by a laptop computer running mapping software.

The FTM-350R is a significant departure from typical dual band radios. It incorporates all the features hams expect and then some, yet ease of use could hardly be made better. Low power 222 MHz operation is a bonus. Mobile installation should be a snap given that the main radio unit can be hidden almost anywhere, even in the smallest of vehicles. Front panel mounting could require some creativity, but I find that always to be the case when they are detached. Having mic connectors and speakers on both the main unit and front panel is a big help. The optional Bluetooth features work well, allowing effortless hands-free operation.

As this review went to press, Yaesu announced an updated model — the FTM-350AR. Scheduled for shipping at the end of 2010, the new model features a redesigned, adjustable angle suction mount for the control head and new firmware. According to Yaesu, new features include GPS and waypoint data output in standard NMEA format, APRS operation in the background on a single band, additional voice alert functionality, reallocated button functions and use of the programmable button on the microphone for APRS functions. Current FTM-350R owners can get the new features via a firmware update (data cable required). Updated firmware and revised manuals are available on Yaesu's Web site.

Manufacturer: Vertex Standard, 10900 Walker St, Cypress, CA 90630; tel 714-827-7600; **www.yaesu.com**.

Begali CW Machine

Reviewed by Bruce Prior, N7RR
ARRL Technical Advisor

After many years' wait, the classic AEA MM-3 MorseMachine has finally met its match. The Begali CW Machine is more than just a sophisticated keyer. It's a code reader that disciplines sending quality, a Morse trainer for anyone from rank beginners to experts, a logger for CW or phone and for routine or contest contacts, a transmitter for contacts with other CW Machines via the Internet, and a facility for controlling a transceiver at a remote site via the Internet. The CW Machine can be governed by its supplied keypad or a keyboard, plus any style of key or paddle. In a pinch, the joystick could be used as a keyer paddle, but its handle is not long enough to do so conveniently. Although many functions work without a computer, operation is enhanced by connecting a companion PC to the unit.

The CW Machine is actually a series of American hardware and software products created by Ulrich Steinberg, N2DE, and marketed through the Italian key manufacturer Begali. The CW Machine is supported by N2DE from his home in Pleasant Valley, New York. Ulrich's customer support is excellent. I caught him on the phone away from home with some questions about the CW Machine software and he happily talked me through the situation without his accessing a computer.

Features and Functions

Here's a quick summary of a few of the tasks the CW Machine product line performs:

- Software and firmware enhancements via free downloads.
- Memory keyer with modes A, B with dot and dash memory enabled or disabled. (The old ultimatic keyer mode is not currently included. See **wb9kzy.com/ultimat.txt** for a discussion of ultimatic keying with reference to a series of *QST* articles on the subject. Since the CW Machine is governed by software and firmware, ultimatic keying could be added in response to owner requests.)
- Bug mode for right hand or left hand bug emulation operation with a single-lever or dual-lever paddle.
- Hand mode for sideswiper, bug or straight key.
- COMKEY mode to turn the CW Machine into an ASCII-to-CW converter for use with other logging programs.
- SSB mode for logging non CW contacts.
- Variable font size on text in keyer and trainer modes, making this product usable by visually impaired operators.
- Toggled sidetone with variable pitch and volume.
- Reversible paddle orientation.
- Toggled automatic character and word spacing.
- Toggled contest option.
- Contest serial number manipulation.
- Transmitter key down and pulse tuning modes.
- Prosigns and embedded commands.
- Memories for up to 30 message of any length up to a grand total of 12.6 kB for all memories in regular keyer mode, and 100 messages totaling 512 kB from an accompanying computer in trainer mode.
- Message interruption and resumption.
- Multiple beacons with programmable pauses.
- Clock and calendar coupled to a logger with many features including log searching, turning automatic logging on or off, uploading to PC in ADIF format or loading log information from PC to the CW Machine and band differentiation.
- Automatic logging using hand mode keys as well as electronic mode keying devices.
- Duplicate contest call sign detection in real time to prevent duplicate contacts before they occur.
- Timer with 10 minute ID alert for SSB mode.
- Interface with the supplied numeric keypad or an independent PS/2 keyboard or a computer via a serial port or serial to USB converter.
- Morse decoder coupled with the CW Trainer for disciplined sending, including interface with any hand key.
- Optional receive Morse Code trainer.
- Program adjustable potentiometer speed range within the extremes of 5 to 75 WPM.
- Extremely slow CW (QRSS), using coded commands.
- Error codes.
- Completely different parameters for two users or two different kinds of operation, such as contests versus normal QSOs.

Bottom Line

More than just a keyer, the Begali CW Machine developed by N2DE offers a wide range of features for on air CW operation and off air Morse training.

An important design philosophy of the CW Machine developer is to transmit Morse with strictly standard timing, except for adjustments necessary to correct for transmitter Morse character truncation. Farnsworth speed, for instance, is not supported except for code training that is not transmitted. Staccato or elongated dits and dahs are not allowed. An operator who wishes to transmit from memories in nonstandard Morse needs to use another keyer.

There are two cases in which the CW Machine uses nonstandard Morse characters — the exclamation mark and the ampersand. Official ITU Morse code does not include ! and &. The CW Machine uses – · – · – – (think kW) for an exclamation mark and · – · · · for an ampersand, which is the same as the code for the wait prosign. Both combinations are mentioned in the Wikipedia Morse code article at **en.wikipedia.org/wiki/Morse_code**. Those two Morse characters are badly needed. Maybe their implementation on the CW Machine will pave the way for their official ITU recognition.

If sending via a separate keyboard or via the computer keyboard, text may be stored ahead of time in a buffer that is displayed in the lower portion of the screen and then sent and displayed in real time in the upper portion of the screen, or it can simply be typed in while sending. See Figure 4.

The optional USB-serial adapter is very short, requiring a user-supplied female-to-male USB extension cable in order to conveniently connect to a standard computer. I found one in a parts store for $6. With a laptop computer, the CW Machine could be operated just with the short adapter.

An earlier version of the CW Machine

was mounted in a larger enclosure in which the operating interface was tilted toward the user. The current CW Machine version is housed in a substantially smaller enclosure that takes up less space in the operating position. The accompanying numeric keypad has a slightly larger footprint than the CW Machine itself.

The new box includes three circuit improvements: It can be powered through the serial port; its audio socket is the mini-stereo style used by most earphones, as well as the small speaker pair that is now included with the CW Trainer firmware and it now can key the negative voltages used in some tube transmitters.

Reading the LCD display on the smaller version may be easier if the box is tilted up in some fashion. I tried propping the box on a dowel, which worked just fine. After a while, I found a better alternative was to leave the blue box flat on the operating surface and turn the LCD contrast down so it could be read without strain from various angles.

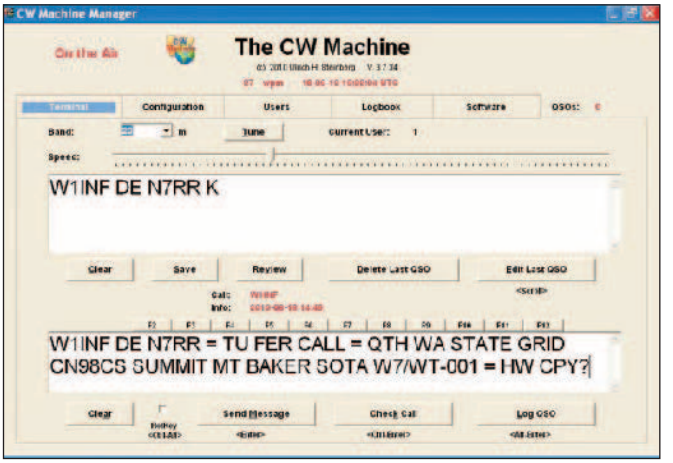


Figure 4 — If the CW Machine is used with a computer, text can be stored ahead of time in a buffer.

Training

The optional training software module is an implementation of the online book by Carlo Consoli, IKØYGJ, called *Zen and the Art of Radiotelegraphy* (**www.qsl.net/ik0ygj/enu/index.html**), a successor to the 2002 online book by William G. Pierpont, NØHFF (SK), *The Art and Skill of Radio-Telegraphy* (**www.qsl.net/n9bor/n0hff.htm**). Carlo Consoli has also written a special primer for the beginner called *Learning CW with the Begali CW Machine* (**www.i2rtf.com/docs/LearningCW.pdf**).

Getting the CW Trainer operating is not trivial. Neither is driving a fancy sports car for somebody who normally drives a regular sedan. The CW Trainer firmware needs to be loaded from the operator's computer into the CW Machine box if it has been used as a regular keyer. Similarly, returning to normal keyer-logger operation from training mode requires another firmware reload. The operation in either direction involves several steps and takes about a minute.

The CW Trainer can be geared for a complete Morse beginner who is learning the characters. There are no charts of dots and dashes to memorize. That poor method is discouraged. Character groups and words are presented as sounds to the student. Somebody who is already skilled in Morse can continue to improve by asking the CW Trainer to push those skills to a higher level. For example, a long message can be programmed to increase speed gradually, say, from 15 WPM to 40 WPM.

A flash-card mode sends a word followed by a pause before the word is displayed. I prefer to use a very large font size for flash-card practice. This facility helps a person learn to understand a whole word by ear without writing it down letter-by-letter.

Table 2
Begali CW Machine
Measured in the ARRL Lab

Code speed range: 5 to 74 WPM.
The code speed indicator is right on the button.
Current drain (13.8 V dc): 13 mA idle, 14 mA while keying.
Minimum operating voltage: 8 V dc.
Size: 4.5 × 3 × 1.5 inches (height, width, depth).
Price: CW Machine including a numeric keypad, $295;
CW Trainer including a small dual speaker, $30;
USB-serial adapter, $25; remote control option, $25.

CW Over the Internet

There is a facility accessible by clicking the program icon on the CW Trainer screen that allows one CW Machine owner to talk on Morse with another owner by entering the other operator's Internet IP address. The code-reader quality discipline applies both ways, since text both coming and going is displayed on the monitor.

Logging

The basic CW Machine without any add-ons includes logging firmware that can be used for routine operating as well as for contesting. All contacts are stamped with date and time. I keep my computer operating on UTC time and date. The CW Machine picks that up automatically. Log records of up to 12,000 contacts can be stored within the blue box before they have to be saved to a computer and erased from the keyer. Within the keyer firmware — not just in the accompanying computer-based CW Machine *Manager* software — is the ability to convert logging data from the native format the keyer itself uses to ADIF format (a popular file format used by many logging programs), which makes the log easily readable by the operator or useful with other software. The contest logger checks for duplicates and handles serial numbers automatically. In CW mode, it detects and records standard exchanges and call signs sent through the CW Machine for automatic entry into the time-stamped log.

As a contest logger, however, this product currently requires operators to become, in effect, programmers during the preparation of messages to automate the exchange. This requires a substantial learning curve. Since the CW Machine is software defined, its contesting facilities will doubtless improve over time, but that day has not yet arrived. At the moment, some contesters may prefer to use the CW Machine as a keying supplement to computer-resident contest software.

Terminal Screen

Although the CW Machine will operate without being connected to a computer, an operator can best take full advantage of the many capabilities of the keyer by using it in conjunction with a computer. In normal operation, the Terminal Screen will be used. Both current and pending outgoing Morse texts are displayed on the screen.

Bottom Line

The N2DE/Begali CW Machine already works very well as both an on-the-air keyer and as a Morse trainer. It is software and firmware defined, so it will doubtless become even more capable and operator-friendly. I cannot recommend the current rendition of its contest logger, though.

Seldom does a training product appear that can give a fine boost to an operator who is just beginning to acquire operator skills, and also can serve admirably the continuing self-improvement needs of the finest expert operators. It is fitting that it bears the Begali name, whose machined key products are synonymous with quality.

Manufacturer: Officina Meccanica Pietro Begali, Via Badia 22, I-25060 Cellatica, Italy; **www.i2rtf.com**; e-mail **pibegali@tin.it**.

TECHNICAL CORRESPONDENCE

BONDING OF GROUNDING CONDUCTORS

◊Figure 1 of the April 2009 "Doctor is In" column depicts the antenna installation at W4EDX. I would like to offer some comments regarding the bonding of our antenna system ground to the electrical service grounding electrode system and of experiences regarding precipitation static.

Safety Ground Issues and Requirements

I frequently see illustrations that do not show the requirements to bond the antenna and station grounds to the electrical service grounding electrode system.

I believe that we need to do all we can to educate our fellow amateurs that bonding of all of our ground systems to the electrical service grounding electrode system is a safety issue, not only for ourselves as operators of the station, but for protection of others who might come in contact with our tower or perhaps a fallen antenna.

Our antenna systems could become energized with unsafe voltages due to faults in our equipment or perhaps an unintentional contact with a power line. We generally say well, the tower is grounded or the antenna coax is grounded at the tower, so we need not be concerned. What we forget is that the earth is not a bonding jumper. The resistance of the earth between our tower or antenna ground system is not low enough to permit enough current to flow in the circuit to trip a 15 or 20 A circuit breaker or blow a fuse. This may, and sometimes has, resulted in the antenna system being energized at 120 V ac due to an equipment fault. The return path through the earth cannot support enough current to trip a breaker. This fault causes the antenna system to remain energized until someone discovers this, typically by receiving an electrical shock.

I have seen many installations in which a two wire line cord or three wire line cord using an adapter to an older non-grounding receptacle are used. Yes, the operator says their station is grounded and in fact it is connected to a ground rod outside the house and at the tower. Those ground rods, however, are not bonded to the electrical service grounding electrode and as mentioned above, the earth is not a bonding jumper. The equipment chassis may be hot at all times due to energy coupled through an ac power bypass cap in the equipment but not to the point of causing a problem unless you were to touch the equipment and some other item that is properly bonded to the electrical service grounding electrode at the same time.

Under normal operation some leakage through the bypass cap on the ac line cord in the equipment energizes the chassis but not to the point of becoming harmful. It is just a nuisance when you are touching some other grounded object or standing on the earth outside while working on the antenna. This filter/bypass cap may fail at some point, however, placing full line voltage on the chassis and the complete antenna system. Now we have a serious problem that may not be uncovered for some time depending on the equipment location and many other factors.

By properly bonding the station ground system, antenna ground system and coax shield at the point of entry into the structure to the electrical service grounding electrode system as required by the National Electrical Code, the equipment and antenna system could not remain energized as the circuit breaker would trip due to the fault current. I suggest that when diagrams of antenna systems or station equipment are drawn, every one show a grounding conductor bonding the antenna system and station ground to the electrical service grounding electrode conductor.

National Electrical Code Grounding and Bonding Requirements

I have pasted some excerpts from NFPA-70 (2008), below. I suggest you review Article 810 for an overview on how the National Electrical Code (NEC) applies to "Receiving and Transmitting Stations."[1] I have made many presentations to amateur clubs regarding proper bonding and grounding of the amateur station. I find many folks have no clue about the requirements of the NEC and how these requirements relate to the radio amateur or short wave listener.

Unfortunately some have learned following a personal experience or an insurance claim that has been denied because the station installation did not meet the requirements of the NEC. We periodically read in the press about people receiving an electrical shock or being electrocuted by having touched light poles and fences. This could just as well be an amateur's tower or fallen antenna. Let's remember safety first, to follow good engineering practices and the requirements of the NEC.

Section 810.20 Antenna Discharge Units — Receiving Stations. (A) Where Required. Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit… (C) Grounding. The antenna discharge unit shall be grounded in accordance with 810.21. 810.21 Grounding Conductors — Receiving Stations... (J) Bonding of Electrodes

Extension to Precipitation Static

◊In response to VE3CQH, also in the April 2009 "Doctor is In" column, you reference static electricity from charged snowflakes. This is commonly called precipitation static and can result from rain or snow. And, it does not have to be raining or snowing at the specific point for this to be introduced into the antenna system. Since licensed in 1954 I have almost always used wire antennas rather than a Yagi on HF. I place them high and in the clear. Generally from the top of a 100 foot or so tower to a tall tree. Many have been greater than 300 feet in length for 80 and 160 meter operation. I generally use window or open wire line to feed the antenna from a balun or tuner located outside of the home. When not being used all of my HF antennas are grounded to a ground rod some distance from the house.

When I desire to operate, generally every evening, I unclip the alligator clips from a ground bus out in the yard and bring one or more ladder lines to the end of the house where I attach them to a balun or tuner. Many times as I have connected the alligator clips with insulated covers (I learned a long time ago that they had to be well insulated) to the ground rod, balun or tuner, and have noted significant arcs of as much as ½ inch. I just experienced this a couple of weeks ago when rain and snow were in the area but nothing was reaching the ground at that

[1]The National Electrical Code as a document is protected by copyright law and can be purchased from various publishers found via an Internet search. Once it has been incorporated into building codes, as generally happens, the building codes are in the public domain. For example, see the electrical section of the California building code, based on the NEC at **bulk.resource.org/codes.gov/ca_2010_title24_03.pdf**.

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

time. My first exposure to precipitation static was back in 1960 while working as a dispatcher using a communications system operating around 40 MHz. I was unable to receive signals from another fixed station about 30 miles distant or from a mobile unit 5 miles away when another mobile unit nearby could receive both of them clearly. It was snowing hard at the time and I learned that the static level generated by the snow on the coaxial antenna on the tower top at 200 feet AGL was masking the received signal.

During another occurrence one of the technicians took me to the receiver location and showed me the saturated limiter current meter reading resulting from the precipitation static. You might ask some professional tower climbers about their experiences with static discharge from the top of a tower or tip of an antenna during a rain shower or when a thunderstorm is off in the distance.

I have also noted an increased noise level on my HF receivers during times of precipitation static. So, you are correct in suggesting that the condition may be precipitation static. The Doctor correctly suggested that a lightning arrestor might be a good idea but stops short of mentioning the grounding and bonding requirements that would eliminate this condition, at least on the shield.[2]

Another thing that many folks don't consider in the selection and installation of a transmission line surge protection device (SPD) is that our receiving equipment typically has a coil to the chassis essentially connecting the center of the coaxial cable to the shield and chassis of the equipment. We install an SPD that may have a spark gap or gas tube device between the center conductor and the shield. We need to remember that the coil is essentially shorting out the spark gap or gas tube keeping it from conducting (the voltage does not rise to the firing point) and protecting the equipment. Of course this depends on where the SPD is located with respect to the equipment coil and the level of the surge energy. For this reason some SPD manufacturers insert a capacitor between the antenna connector and the equipment connector while keeping the gas tube on the antenna side of the cap. This lets the spark gap or gas tube do what it is intended to do without subjecting the equipment to the surge energy. This results in a much lower let-through voltage to the equipment and greater equipment survivability.

We also must realize that the SPD tends to equalize the voltage on the center conductor to that on the shield at the location of the SPD. If the SPD is some distance from the equipment and the two are not well bonded together there could be a significant difference in voltage on the center conductor at the equipment end of the cable. We must remember that a high impedance may result if the coax cable length and the bonding conductor length are the same and they both just happen to be a ¼ wavelength (or odd multiple). This high impedance may result in a high voltage at the equipment on the center conductor of the coaxial cable when the SPD is at a distant location.

You mention in your response to VE3CQH in the last sentence that the "ground connection need not be a terribly low impedance one to work." Well, this depends on how we define work. If it is intended to drain off the static charge, I agree. However, we must be careful in making statements of this type as it can mislead one to believe that a high impedance ground is suitable in clearing fault currents. This is all dependent on the readers' definition of the word "work" and how we choose to define a high impedance ground. Remember that the ground is required to be bonded to the electrical service grounding electrode with the intent of clearing fault current. Therefore it typically would not be a high impedance ground.

I hope my comments have offered some food for thought. Generally we tend to gloss over many of the relevant details until we are focused on the topic by a recent event or discussion. Having been licensed for 55 years, being retired from Motorola and having written portions of the Motorola publication "Standards and Guidelines for Communications Sites," I have seen first hand why all of what we are discussing here is so important. — *73, Bruce Carpenter, W3YVV, PO Box 84, Dayton, MD 21036 or* **w3yvv@arrl.net**

DUMMY LOAD FOR A Q-SECTION

◊Several antenna designs have nonreactive feed point impedances at resonance of slightly more than 100 Ω. These include loops and 1½ wavelength dipoles. A ¼ wave transmission line matching section (Q-section) will approximately match their impedances to a 50 Ω feed line. A dummy load of about 100 Ω can be a useful diagnostic tool while you are looking for antenna system faults.

The required impedance of a Q-section can be determined using the following formula:

$$Z_0 = \sqrt{(Z_1 \times Z_2)} \qquad \text{[Eq 1]}$$

where

Z_0 is the characteristic impedance of Q-section transmission line,

Z_1 is the characteristic impedance of feed line and

Z_2 is the resonant feed-point impedance of antenna.

The physical length of ¼ wavelength is found by using the formula:

$$\lambda/4 \text{ (in feet)} = 246 \times V_R/f \qquad \text{[Eq 2]}$$

where

f is the frequency in MHz and

V_R is relative velocity factor of transmission line used for the Q-section, about 0.66 for cable with polyethylene dielectric and about 0.85 for cable with polyethylene foam dielectric

Typically, the feed line is 50 Ω coax and the Q-section is 75 Ω coax, so solving Equation 1 yields a 112.5 Ω antenna as the matched load. Properly adjusted, and in an appropriate environment, a square full wave loop or a ½ λ dipole will provide a fairly good match — 112.5 Ω is what the Q-section must see in order for the radio to drive a load with a 1:1 SWR.

What can go wrong with this magical section of feed line? Aging coax might have a different impedance or the coax connectors might become corroded. Once fabricated, however, a Q-section is not likely to malfunction. The cause for improper operation is probably that an incorrect parameter is being used. Using the correct length means knowing the correct velocity factor and then cutting the cable without error. Also, you may wonder whether the unmarked cable a friend gave you is really RG-59. Perhaps it's RG-8X (or it's RG-8 and not RG-6). It's easy to make a quantitative check on the matching section: use a Q-section dummy load! That would eliminate the antenna itself as a source of your tuning problem.

A Q-section dummy load should have a resistance of 112.5 Ω. My junk box yielded three nonreactive 25 W resistors, which I wired as shown in Figure 1 to constitute a 116.5 Ω resistive load.

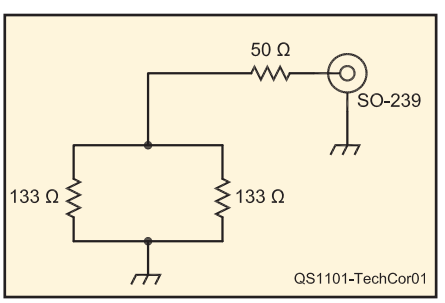


Figure 1 — Wiring diagram for dummy load used by the author. Its resistance is 116.5 Ω rather than the ideal 112.5 Ω.

[2]Recent standards changes specify a *lightning arrestor or surge arrestor* as a product that is used on HV power utility lines. *Surge suppression devices* are used on all low voltage (<1 kV) applications. See NEC Article 280.

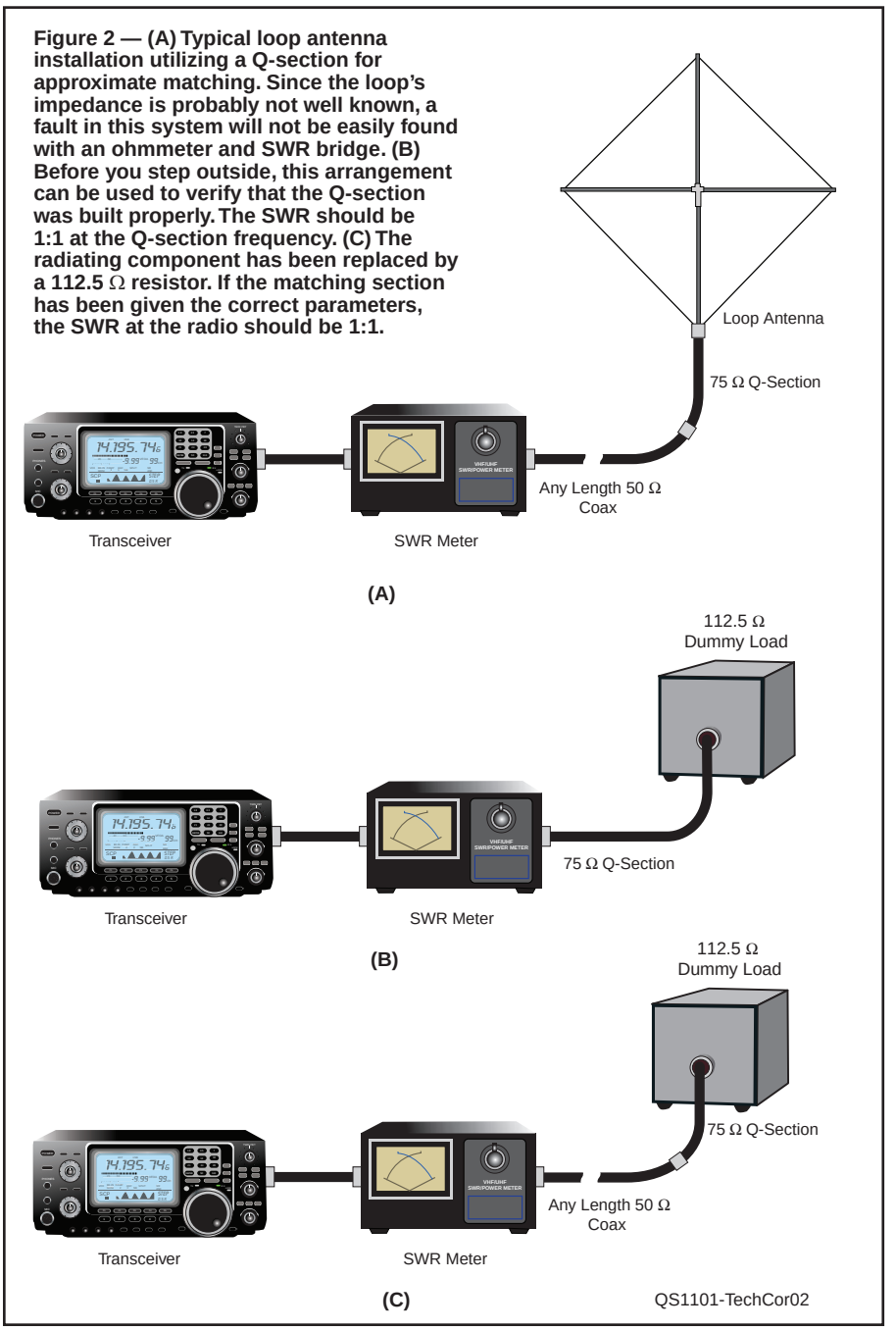


Figure 2 — (A) Typical loop antenna installation utilizing a Q-section for approximate matching. Since the loop's impedance is probably not well known, a fault in this system will not be easily found with an ohmmeter and SWR bridge. (B) Before you step outside, this arrangement can be used to verify that the Q-section was built properly. The SWR should be 1:1 at the Q-section frequency. (C) The radiating component has been replaced by a 112.5 Ω resistor. If the matching section has been given the correct parameters, the SWR at the radio should be 1:1.

As power to my circuit is increased, the first resistor to have to dissipate 25 W is the 50 Ω one. When it is at 25 W, the entire circuit is handling almost 60 W. It can do so indefinitely; for short periods you are safe running much more power. The 75 Ω matching section and the 116.5 Ω dummy load result in an SWR of less than 1.04:1 on the 50 Ω feed line. That's fine for me.

Figure 2 and its caption illustrate practical use of a Q-section dummy load. Notice that the length of the quarter-wave matching section is frequency dependent, but the length of the feed line, the impedances of the feed line and the matching section, and the resistance of the dummy load do *not* depend on the operating frequency. — *73, Bob Raffaele, W2XM, 5 Gadsen Ct, Albany, NY 12205 or* **w2xm@arrl.net**

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.

Feedback

♢In "Product Review — Wouxun KG-UVD2 and KG-UVD1P Dual Band Handheld Transceivers" [Nov 2010, pp 52-57] we listed Wouxun.US as the US distributor. Wouxun does not use a US distributor, but works directly with retailers. Wouxun radios are available directly from several *QST* advertisers, including Associated Radio (**www.associatedradio.com**), Austin Amateur Radio Supply (**www.aaradio.com**), Lentini Communications (**www.lentinicomm.com**), Powerwerx (**www.powerwerx.com**), Radio City (**www.radioinc.com**), Total Radio Service (**www.totalradioservice.com**) and Universal Radio (**www.universal-radio.com**).

♢In "Revisiting a 10 and 6 Meter Mobile Antenna" [Nov 2010, pp 45-46] Figure 3 omitted the depth of the holes in the coil for the whip sections. They should have been shown as 2 inches.

♢In "An Expanded Scale Voltmeter for 120 or 240 V ac — With a Bonus" [Nov 2010, pp 43-44] the caption of Figure 1 has the wrong information on the board fabricator. The boards are available from FAR Circuits at **www.farcircuits.net**. The author notes that following additional development, he has found that for the 120 V version only, R1 should be removed and replaced with a jumper, while R3 should be changed to 1 kΩ.

♢In "Product Review—Yaesu FTDX5000D HF and 6 Meter Transceiver" [Dec 2010, pp 42-47] our review said: "The two discrete and comparable receivers make it possible to transmit and/or receive on separate bands — SO2R in a box." Later we explained: "The FTDX5000 opens the door to SO2R with a single box and, if desired, just *one* antenna. This is true as far as it goes, but because *you cannot listen on one receiver/VFO while transmitting on the other* with the FTDX5000, it's not "true SO2R." So, we stand corrected in that regard and apologize for any confusion.

♢In "Gimme an X, Gimme an O! What's that Spell? — Radio" [Dec 2010, pp 33-37] the correct Mini-Circuits part number for the SPDT PIN diode switch in Figure B is ZMSW-1211.

♢In "Hamspeak" [Dec 2010, p 101] Sheldon, K4MAS, wrote to say the frequencies listed for WWV are slightly incorrect. The list should start with 2.5 MHz and 25 MHz should be eliminated.

Strays

I would like to get in touch with…

♢anyone with a copy (DVD or VHS) of the 1946 film *So Goes My Love*, starring Don Ameche. The film is based on Hiram Percy Maxim's book, *A Genius in the Family: Sir Hiram Stevens Maxim through a Small Son's Eyes*. — *Scott Verity, KC2FBV,* **kc2fbv@gmail.com**

♢plankowners of the USS *Haddock* SSN-621, especially Chief Radioman Charles Kovacs and Marcus R. Johnson. — *Stephen Hawkins, NGØG,* **ng0g@arrl.net**

W1ZR

THE DOCTOR IS IN

Q Roger, W5RDN, asks: I know they make lightning arrestors for multiwire rotator cables. I do not have one, however. The control cable from my rotator terminates into a socket mounted in the metal plate at the bottom of the window in my shack. If I make a second socket on the plate with all wires grounded and plug the rotator into that when not in use, would this protect the rotator motor windings from lightning as well as an arrestor would?

A The point of the arrestor (or your ground connection) on the bottom of the rotator cable is to protect the station equipment from lightning induced current coming down the cable toward your station. It is not designed to protect the rotator. In that regard, if you have a solid low impedance ground, your grounding plug should be at least as protective as an arrestor, and likely better, but only whenever the cable is actually moved to the ground connection.

The advantage of the arrestor is that it does what it does even if you don't remember to move the connection, or even while you are on the air. Having both is even better — move the cable during threats of (but not during) lightning storms for the most protection.

I haven't heard of many rotator motors being damaged in storms. I suspect that with a metal housing and a ground connection, little current will have a reason to flow within the rotator as long as there is a continuous connection from the mast through the housing to the grounded tower. Lightning current can indeed come into the station on rotator control cables, as well as power and telephone lines.

Q Doug, WA2NPD, wants to attach two Yagi antennas, one a tribander (20, 15 and 10 meters) and one covering 17 and 12 meters, to an 8 foot mast extending from the top of a 55 foot tower. He asks: How far above the tribander, which will be mounted at the bottom of the mast, should I position the two band Yagi to minimize any mutual interference between the antennas?

A Interaction is usually a problem if antennas are both resonant on the operating frequency. If it were a problem, 8 feet would likely not be far enough away to avoid it in any case. I didn't check every combination, but did confirm that a shorter antenna slightly above a modeled Yagi didn't affect its pattern, although there was a slight change in the impedance.

Check out some types of commercial multiband — particularly five band — Yagi antennas. They often have their elements on the same boom. Of course, there may be some tuning effects that the designers take into account, and the farther apart the better on that score.

One potential problem to watch for is that you don't end up with an unintended resonance from the unused antenna. Typically, the unused antenna is switched off and the coax left open. That open circuit will be transformed by the coax into a reactance at the center of the unused antenna that will shift its resonance — possibly to one of the bands of the other antenna. This is especially the case here since some (10 and 12 meters, for example) are fairly close in frequency.

One way to check for this is to see if there is a change in F/B (probably the easiest change to observe) on each band of one antenna while you switch the feed of the unused antenna from an open to a short. That should move any resonance around. If it is worse with the open circuit, you should either terminate it in 50 Ω or change the length of coax, which will change the impedance — be sure to recheck on all bands to make sure you didn't make it worse elsewhere.

Q Gary, W7SMA, asks: In a recent *QST* article, you wrote about installing HF and VHF amateur gear in your sail boat.[1] Could you share with us what antenna and RF ground system you used?

A For an HF antenna, I had a rigger install special inline insulators at the top and bottom of my backstay.[2] The backstay splits (for tension adjustment) about 6 feet above the deck, so the lower insulator is above that point (just above the cockpit Bimini cover in the photo) to avoid potential intermittent connections through the fittings there. The resulting length is about 30 feet and that is extended via a lead-in wire about 8 feet to an autotuner mounted directly below in the lazerette compartment at the stern.

For a ground system, I have a short run of coax shield from the tuner ground post to a lug under an engine head bolt, in common with the heavy battery negative lead. In addition to the engine, shaft and propeller, this also picks up the power leads as they

Rear view of the auxiliary sloop *Windfall*. The HF antenna is the stainless steel wire from the stern of the craft to the top of the mast. In addition to helping hold up the mast, it also puts out a good signal if fed against and reflected from a seawater ground.

[1] J. Hallas, W1ZR, "Getting on the Air — It's Time to Take to the Water," *QST*, Jul 2009, pp 51-52.

[2] Mine were made by Ronstan, designed for the purpose and are available at Defender Marine Supply, **www.defender.com**.

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

run around the boat, serving as capacitance coupling to the sea water.

I had planned to augment the ground system by drilling and tapping into a keel bolt for an additional ground connection, and also gluing aluminum sheet beneath the cabin bins right against the outer hull to add more capacitance to ground. After I made successful 25 W AM, 75 meter contact with the Antique Wireless Association AM net centered in Rochester, New York, about 300 miles away on a summer afternoon, I decided it was working well enough, since it should be even less critical on higher bands. No doubt, more could be done, but I can usually work anyone I can hear.

For 2 meters, I just use the masthead VHF marine antenna that I can switch between the two radios. Although it isn't well matched on 2 meters, the loss in the transmission line makes the SWR at the radio low enough so that the transmitter can operate. I can reach any local repeater with ease. Do remember to keep it switched to the marine radio so you're ready for an emergency.

Q Jim, NX9F, asks: Since the registration or *tail* numbers of US aircraft begin with an N, and some ham calls do as well, is it possible to have a ham call sign on an aircraft tail?

A The similarity between radio call signs and aircraft tail numbers is not a coincidence. "The first use of aircraft registrations was based on the radio call signs allocated at the London International Radiotelegraphic Conference in 1913."[3] This is not a US, but an international phenomenon. As with the US, there are multiple prefixes assigned to many countries. For example, while N was assigned to the US, and was used for many years as an aircraft tail number prefix, it only became an amateur prefix relatively recently, after the FCC ran out of the W and K series of call signs.

The administration of the two registration systems is handled by two different agencies in the US, the FAA and FCC. They assign and maintain their own series, and each has provision for what is termed vanity licensing, or requesting a specific available number. Someone could thus request matching numbers, within the constraints of each system. For example, while the aircraft series includes what we would call a "one by two" (N1AB), the aircraft series do not follow a number with more than two letters. Tail numbers also cannot include the letters I or O to avoid confusion with the numerals 1 and 0. In addition to having a single digit following a prefix, as do amateur calls, aircraft may have up to five digits after the prefix, so the range of possible common call signs is limited (see the photo). In summary, yes, a tail number could be both a ham call and a tail number, either by accident or design, as long as it met the requirements of both.

K1STO

Tail number on WD6BOR's 1948 Stinson at the 2002 Air Adventure in Oshkosh, Wisconsin.[4]

Note that this is not just a US situation, but other countries also share the same prefixes.

Q Jerry, W2JCNI, asks: I have looked in vain for info on stacking Moxon beams and have found nothing. I have successfully stacked other types of directional antennas and wonder why Moxons are not routinely stacked. If it is feasible, how would you properly feed such an arrangement?

A The Moxon rectangle is a great compact antenna invented by Les Moxon, G6XN (SK). It is essentially a two element reflector Yagi with the ends bent inward, resulting in an antenna with about ⅔ the width of the typical Yagi. One bonus feature is the very clean azimuth pattern with a smooth rearward null. Another Moxon plus is that the driven element feed impedance is very close to 50 Ω, and thus is usable with a split or dipole feed and no fancy matching networks required. A common mode choke should be used at the feed to avoid messing up the nice pattern with coax radiation.

I am not surprised that there hasn't been a lot about stacking them, since that tends to move them out of the compact realm, and then why not just stack a pair of three or four element Yagis. But yes, they can be stacked. Just as with other small antennas, the gain increases to somewhat more than 3 dB at ⅝ wave spacing and then falls off as energy goes off at high angles. I would observe that the physical scale of the stacked Moxons is such that a stacked array of three or even four element Yagis is similar in overall size, and will provide 2 or 3 dB additional gain. While the *EZNEC* analysis was conducted at 14.15 MHz with the single or bottom antenna ½ wave above ground, the results should be similar at other bands and heights.[5]

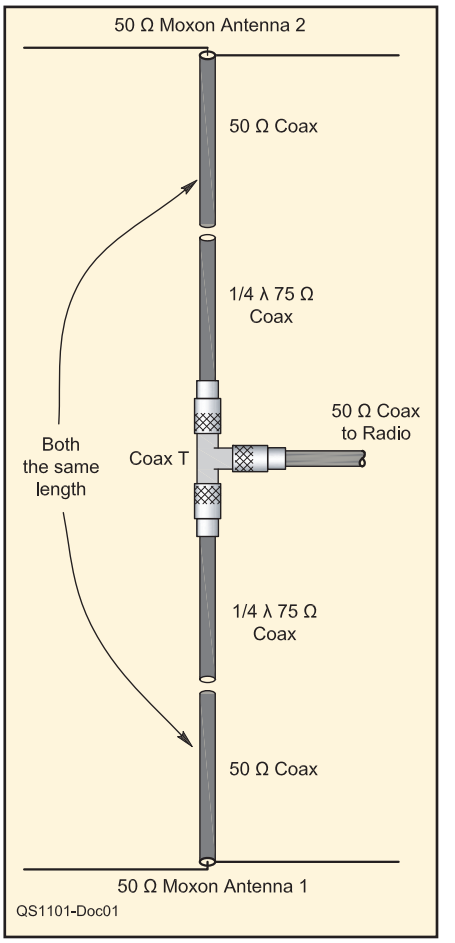


Figure 1 — Feed harness arrangement usable with two Moxons, or any pair of 50 Ω antennas fed in phase. The transition between 50 and 75 Ω coax should be made with a PL-258 barrel connector and two PL-259 plugs.

Regarding matching, *EZNEC* indicates that the 50 Ω feed is maintained closely for each antenna in the stack, so any of the usual arrangements for feeding pairs of 50 Ω antennas in phase should work. One is shown in Figure 1.

[3] **en.wikipedia.org/wiki/Aircraft_registration#International_standards**

[4] R. White, K1STO, "Hams Fly High at Oshkosh," *QST*, Nov 2002, pp 55-57.

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

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.

MFJ-1703 Transmitter Antenna Crossover

By Joel Hallas, W1ZR
QST Technical Editor, **w1zr@arrl.org**

Many amateurs have more than one HF transceiver, either by design, or because it just happened as they grew into a new one. The MFJ-1703, essentially a DPDT coax switch, is intended to connect the two transceivers to two antennas, or even better, one antenna and a dummy load. The arrangement is such that each transceiver is connected to a load — either antenna or dummy load, at all times. This avoids inadvertently transmitting with a transceiver driving into an open coax jack.

Problem Solved?

It used to be that transmitting into an open circuit was certain death to final amplifier transistors. Perhaps because manufacturers have observed that amateurs are not infallible, modern transceivers usually provide a *fold back* circuit that reduces power output if the transmitter tries to drive a mismatched load. This should keep the transmitter from destroying itself, but it's so much safer [just ask any shooter about trusting firearm safeties — *Ed.*] to not give it an excuse — enter the '1703.

Table 1

Measured Worst Case Port-to-Port Isolation and Computed Signal Level and Voltage at Rated 150 W (51.8 dBm) CW Input

Band	*Isolation (dB)*	*Signal Level (dBm)*	*Signal Level (V)*
160	>50*	1.8	0.3
80	>50*	1.8	0.3
40	47.9	3.9	0.3
15	39	12.8	1.0
10	36.2	15.6	1.3
6	31.8	20.0	2.2

*50 dB isolation is instrumentation measurement limit.

The Other Side of the Coin

The switch is designed to have two transceivers connected to it — typically, but not necessarily, with one active at a time. While the majority of the transmit power is routed to one or the other of the antenna/dummy load ports, a small fraction gets coupled to the other transceiver port. We thought it would be good to find out how much ended up there, and ARRL Lab Test Engineer Bob Allison, WB1GCM, was ready to measure the crosstalk. The results are shown in Table 1.

Note that while the switch is rated for operation only through 30, MHz, we tested it at 6 meters as well. Many current transceivers operate up to 6 meters, and it seems likely that if you have one of these, it will still be connected to the switch while operated there.

How Much Isolation is Enough?

I polled the major transceiver manufacturers to try to get a sense of how much RF is allowed at their transceiver receiver inputs before there are problems. Interestingly, none admitted to having a specification, nor a design standard, that specified the safe level. Some suggested that 20 dBm (1/10 W) into a receiver should not be a problem. One noted that the HF equipment they built for the US military was required to meet MIL-STD 188-141B. This requires equipment to survive up to +43 dBm (20 W) for 5 minutes. It seems unlikely that most amateur gear should be expected to do that.

The ARRL Lab protocol avoids putting more than 10 dBm into a receiver, and we haven't yet destroyed one, although that is likely a conservative level. The last receiver that I saw with an explicit spec was the 1957 Collins 75A-4, which had a sticker saying "Do Not Exceed 50 V" next to the antenna input. That's 50 W or 47 dBm at 50 Ω. That was the vacuum tube era, perhaps a day when receivers were able to take more abuse, although they were also a lot heavier!

We measured some coupled signals at W1AW, our local multitransmitter station, perhaps typical of a serious multiop contesting station. Those stations, as well as your local ARRL Field Day group, have equipment survive with fairly tightly coupled antennas, sometimes on the same band. The highest we could obtain was about +20 dBm — this from a 1.2 kW PEP SSB transmitter into a Yagi received by a nearby 160 meter dipole. At W1AW, as well as at most multitransmitter stations, the maximum into a receiver is usually reduced by the use of narrow band pass filters, not to avoid damage as much as to avoid intermodulation products from nearby transmitters.

Thus, it appears that if it is operated within its ratings the isolation should result in coupled signals safely below anticipated survivable levels on all bands. Extending operation to 6 meters at 150 W may result in signals close to what we were able to confirm as safe at W1AW, so the MFJ limit of 30 MHz may be good advice to follow.

Manufacturer: MFJ Enterprises, 300 Industrial Park Rd, Starkville, MS 39759; tel 662-323-5869, fax 662-323-6551; **www.mfjenterprises.com**. *Price*: $29.95. QST

NØAX

HANDS-ON RADIO

Experiment 96

Open Wire Transmission Lines

Over the past few years, the open wire transmission line has enjoyed something of a rebirth in ham radio. Before coaxial feed lines were still impractical for the ordinary ham, open wire line was often homebrewed. Insulators, ceramic or waterproofed wood, separated solid copper wire by up to 6 inches. Link or transformer coupling was used to connect the transmitter output circuits to the balanced feed line. The science of open wire lines was a hot topic as in an excellent January 1934 *QST* article.[1] The back of *QST* contained numerous ads for insulators and feed-through insulators and other necessary parts for "rolling your own."

Figure 1 shows a familiar transmission line configurations (two wire) and three not so familiar configurations (single wire, four wire and five wire). The balanced four wire and unbalanced five wire lines were widely used for high power HF applications long after World War II and are still found at some shortwave broadcast stations. The five wire configuration is a sort of "skeleton coax."

While coaxial cable is far more convenient to use, there are applications in which it is not a good choice for an antenna system. The lower loss of open wire line compared to coaxial cable makes it an effective choice with high SWR, such as from non-resonant antennas or those with a high feed point impedance. For very long feed lines, such as to a distant tower or to antennas in the upper HF/lower VHF spectrum, open wire line may be a very cost effective solution compared to hardline. Open wire line can also be used to make two wire switched direction Beverage antennas.[2]

Why Don't Open Wire Lines Radiate?

With properly terminated coaxial cable, the field of a high frequency signal is completely contained between the inner surface of the outer shield and the outer surface of the center conductor. If there are no breaks in the shield, the field cannot escape. Neither can a high frequency signal from outside the cable cause current to flow inside the cable. This is fairly intuitive. Open wire lines, however, have both (or all) conductors exposed. Why don't they radiate?

Well, actually, they *do* radiate a little bit as given in the following formula for two wire lines with a wire to wire spacing S of less than ⅒ of a wavelength:

$$\text{Radiated power} = 160 \times I^2 \times (\pi \times S/\lambda)^2$$

where I is the line current and S/λ is the *electrical line spacing*.[3] (This equation also requires the line to be non-resonant, meaning not an integral number of ¼ wavelengths long.) For example, if a 600 Ω line with wire to wire separation of 2 inches is carrying 1 kW at a frequency of 14 MHz, the line current, $I = \sqrt{(1000 / 600)} = 1.29$ A and the line spacing is 0.0024 λ. The radiated power is then 160 $(1.29)^2$ $(3.14 \times 0.0024)^2$ = 0.015 W, which is 48 dB below the power being carried in the line.

The real question is why don't they radiate *more*? Each individual conductor in the line does radiate an electromagnetic field as would a single, isolated wire. In a symmetric, balanced line, such as our two wire example, however, the currents in the two wires have opposite polarities and radiate fields that cancel almost completely at distances more than a few line spacings away. As the electrical line spacing, S/λ, increases you can see from the formula that radiated power also increases, either because physical distance between wires increases or as the frequency of the signal in the line increases — or both! A good rule of thumb is not to use open wire lines with line spacings greater than ⅒ of a

[1]R. Glover, "A Practical Transmission-Line System for the Doublet Antenna," *QST,* Jan 1934, pp 17-22. *QST* articles more than four years old can be viewed by ARRL members by using the ARRL Periodicals Archive and Search, **www.arrl.org/arrl-periodicals-archive-search**.

[2]W. Silver, NØAX, "A Cool Beverage Four-Pack," *QST,* Apr 2006, pp 33-36.

[3]F. Terman, *Radio Engineer's Handbook,* First Edition, 1943, McGraw-Hill.

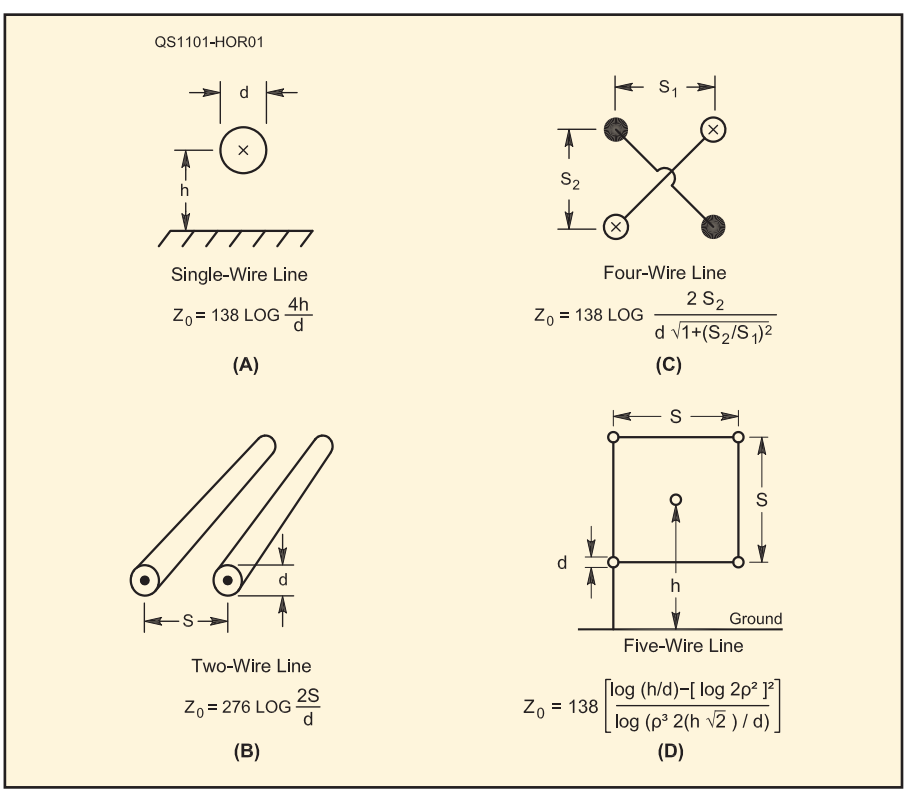


Figure 1 — Several types of transmission lines and the formulas that determine their characteristic impedance. Note in (D) ρ = zh/s.

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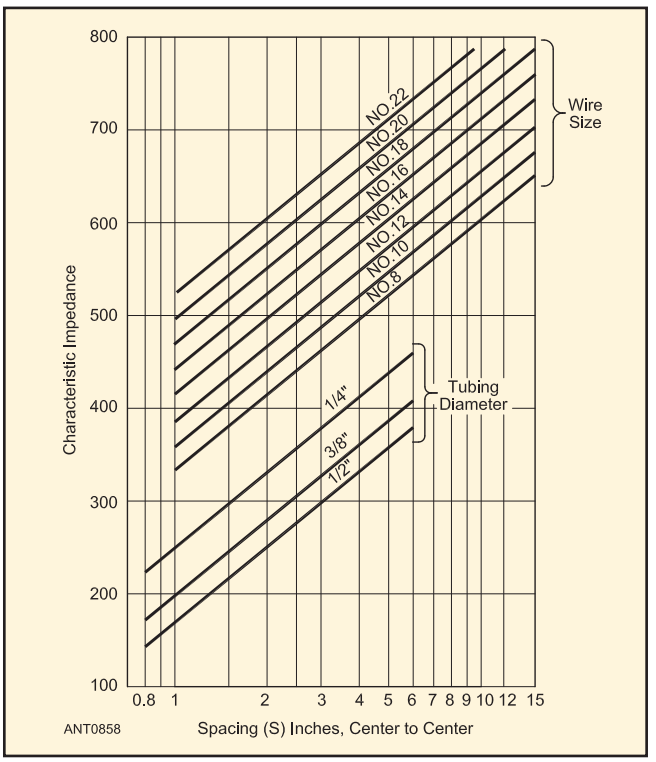

Figure 2 — Characteristic impedance as a function of conductor spacing and size for two wire lines.

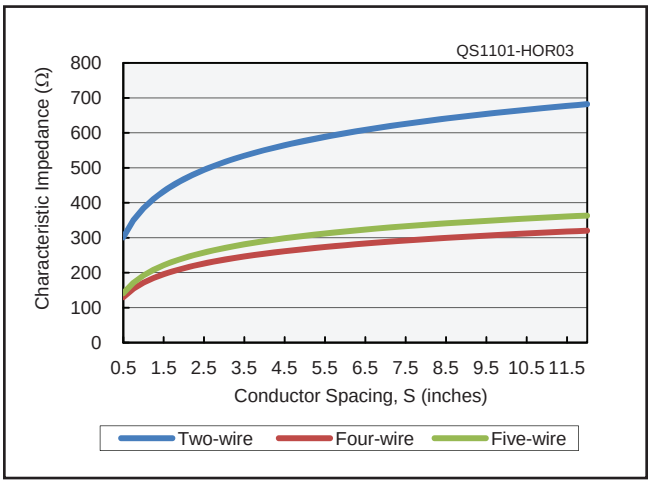

Figure 3 — Characteristic impedance for two, four and five wire lines made from #12 AWG wire 60 inches above ground. Height above ground affects the unbalanced five wire configuration. The spreadsheet is available for download from the Hands-On Radio Web page.

wavelength (0.1 λ), at which point radiation from the line approaches 20 dB below the carried signal.

Characteristic Impedances

Figure 1 also gives the formulas for the characteristic impedance, Z_0, for each configuration of transmission line. Figure 2 shows Z_0 for a variety of the common two wire configurations. Figure 3 is the output from a spreadsheet on the Hands-On Radio Web page that specifies exact values for two, four and five wire lines.[4] The most common impedances of two wire lines used by hams are from 300 to 600 Ω because those lines have practical spacing and power handling capability and impedance transformers are easily made for 50 and 75 Ω systems.

Unrolling Your Own

You, too, can make your own transmission line. It's an interesting exercise and not many of today's hams can say they are using a homebrew feed line. The biggest decision after selecting a characteristic impedance is obtaining the line spacers. The construction process is summarized nicely in a December 2006 *QST* "Hints and Kinks" item by ACØAX, "Make Your Own 600 Ω Ladder Line."

Before running off to the hardware store for a reel of wire and insulator material, start by practicing with a short section of your two wire line. Constructing the line on the workbench is not particularly difficult — strip some wire and appropriate some paper or plastic drinking straws from the kitchen for insulators. Make two cuts halfway through the straw at the desired spacing, stretch the wire out straight, and press it into the cuts. Voila — transmission line!

How can you measure Z_0 to confirm your calculations? Rather than go to the trouble of making an impedance transformer for each different impedance, you can use your 50 Ω SWR analyzer to do the job by using a special property of ¼ wavelength lines — *impedance inversion*.

When a ¼ wavelength line with a characteristic impedance of Z_0 is terminated in a different impedance, Z_L, the input impedance at the other end of the line, Z_{IN}, is inverted about Z_0. Stated as an equation:

$$Z_{IN} / Z_0 = Z_0 / Z_L \text{ or } Z_{IN} = Z_0^2 / Z_L$$

By varying Z_L until the SWR analyzer shows an SWR of 1:1, you can then use the equation $Z_0 = \sqrt{(50\ Z_L)}$ to determine the Z_0 of your line. (If this looks familiar, it is the same equation used to determine the required impedance for a synchronous transformer as described in Experiment #81.)

Start by choosing a characteristic impedance and a convenient spacing. A 3 inch spacing and #12 AWG wire from a piece of house ac wiring cable result in a predicted Z_0 of 516 Ω. Make the line ¼ wavelength long at some convenient frequency for measurement. For example, at 29 MHz, ¼ wavelength of open wire line is about 7.7 feet. Hold the line above a nonmetallic work surface on nonconductive supports so that it is as straight as possible and with no kinks or abrupt bends. Use a binding post adapter such as a Pomona 1699 (UHF) to connect the one end of the line to the SWR analyzer or homebrew an adapter, keeping all connections short and direct. This is the input end. Leave the other end open with nothing contacting the unconnected wires.

Determine the frequency at which the line is exactly ¼ wavelength long by adjusting the analyzer frequency and watching the resistance value. SWR will remain infinite, but when R reaches a minimum, the line is ¼ wavelength long.

Without changing frequency, tack solder a noninductive resistor (carbon composition or carbon film will do) with a value approximately $Z_L = Z_0^2 / Z_{IN}$ across the open end of the line, In our example with a 516 Ω characteristic impedance, Z_L should be 5325 Ω. Using the closest standard value of 5.1 kΩ, the input impedance should be approximately $Z_0^2 / Z_L = 52$ Ω. If the analyzer reads a higher value, Z_0 is lower than 516 Ω and vice versa.

You can also use this technique to determine Z_0 of an unknown piece of open wire line. Start by shorting the load end of the line and finding the *lowest* frequency at which the value of R reaches a minimum value. The line is ½ wavelength long at this frequency, so it will be ¼ wavelength long at ½ that frequency. Now terminate the line in varying values of Z_L until you get an input impedance close to 50 Ω and the characteristic impedance of the line is $Z_0 = \sqrt{(50\ Z_L)}$.

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

W1ZR

GETTING ON THE AIR

Feeding a Balanced Antenna with Coax Cable

In an earlier era of Amateur Radio, coaxial cable wasn't available. Amateurs fed their balanced antennas with usually home made open wire line to balanced tuners and then to the usual balanced output circuits of transmitters. This arrangement almost always worked well, losses were low and almost no one had heard of standing waves or SWR.

The coming of the TV age after WW2, TV interference and cheap surplus coaxial cable came together at about the same time. Transmitters were now shielded and their outputs had coaxial connectors designed to feed coax cable, not balanced line. All was well, except:

- We still mostly had the same balanced antennas,
- The coax line had high loss if it wasn't matched (SWR wasn't low), and
- If signals weren't kept on the inside of the coax, the coax radiated, eliminating the benefits of shielding.

So What's Wrong with Hooking Up a Dipole With Coax?

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

How Much Current are We Talking About?

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

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

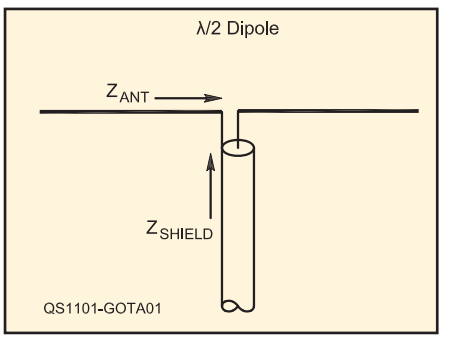

Figure 1 — Diagram of a center fed dipole with a transition to coax. Note that the current on the shield side will split between the dipole and the outside of the coax shield.

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

What's Wrong with Current on the Outside of the Shield?

Current on the outside of the shield acts just like current on an antenna conductor — it radiates. This has a number of effects:

- If the radiation is in a useful direction, this can be beneficial and is a part of some designs.
- In most cases, the transmission line is not in an optimum location for radiation. Power in these locations is wasted, reducing the power available to go where you wanted it. Your antenna pattern won't be as expected.
- If the transmission line enters or goes near a building, RF can be coupled into power lines, alarm or communication wiring or other locations, resulting in RFI problems.
- In addition to acting as part of your transmitting antenna, the coax shield will also be part of your receiving antenna. Any signals from those household devices that you interfered with will also come into your receiver interfering with your reception.
- If the current ends up as RF voltage on equipment cabinets, it can result in RF tingles or burns. In some cases the signals will couple to mic and speaker wiring causing transmitter lockup or other operating problems.

Enter the *Balun* or Balanced to Unbalanced Transformer

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

- Insert a device between the coax and the antenna that causes the coax current to flow only to the antenna. This is called either a *balun* or a *common mode choke*.
- Ensure that the coax is perpendicular to the antenna for at least ¼ to ½ wavelength. Efforts to avoid shield current with a choke or balun at the antenna may be nullified if the coax is closer to one side than the other. The antenna can then couple to the coax, picking up a signal on the outside from the antenna's field.

The Balun

The classic balun is an actual transformer design, generally constructed of wire wound in parallel windings on a ferrite rod or toroid and connected to cancel currents on the outside of the coax. This kind of balun has the advantage that it can also be used to transform the impedance of the coax to a different value. Some typical transformation values besides the 1:1 appropriate for a dipole are 4:1, useful for folded dipoles or T matched elements; 9:1, good for matched 450 Ω transmission lines and 12:1 to match coax to a 600 Ω terminated rhombic.

The typical ferrite core balun offers operation over a wide range of frequencies, often the whole HF spectrum or beyond, making it a good choice for multiband antennas. There are a number of other balun types, often useful on a single narrow range of frequencies and constructed of coax in various configu-

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rations. These are described in detail in *The ARRL Antenna Book*.[2]

Common Mode Chokes

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

That same coil has inductance that just affects the common mode, and that is the basis of our common mode choke. In fact many amateurs just use a small coil of coax at the antenna feed point to serve that function. It actually makes sense to be somewhat more scientific about the coil design. The inductance of a coil goes up with the square of the number of turns and the higher the inductance, the higher the choking impedance. Unfortunately, too many turns adds shunt capacitance, which tends to cancel the inductive effects. The capacitance is higher on a jumbled coil than on one carefully wound on a cylinder.

The ARRL Antenna Book has a section describing the optimum coil wound on PVC tubing for different bands.[3] A single turn coil of eight turns of coax wound on PVC pipe 6.625 inches in diameter will give useful performance over the HF range, while four turns is better if operation will mainly be above 7 MHz. Jumble wound coils can also be used, but will be most useful over a narrower range of frequencies — these are also described in the reference.

A simpler, if slightly more expensive approach is to wind coax through a ferrite toroid. These donut shaped cores increase the inductance without increasing the capacitance very much, are lighter weight and use less coax — a consideration described below. They can be as effective as the much larger air wound type, and cover a wider frequency range.

My favorite common mode choke arrangement is to use a 2.4 inch diameter K mix ferrite core (**www.amidoncorp.com/items/23** or **www.fair-rite.com**, for example). Wrap as many turns of thin size coax as you can, just before it connects to the antenna as shown in Figure 2. Some nylon tie wraps can be used to secure the coax neatly. One advantage of this configuration is that there are no extra connections exposed to the weather and any extra loss is just that associated with a few feet of the same coax you would use anyway.

Figure 2 — Common mode choke made by winding the antenna feed coax through a ferrite toroid. The coax can be neatly secured with nylon tie wraps.

Connecting to Multiband Antennas with Balanced Feed

A popular multiband antenna is a dipole cut for the lowest band and fed with low loss window or open wire line and an antenna tuner. In many cases, the antenna tuner is really designed for unbalanced coax connectivity. A frequent question is: "What ratio balun is best between the tuner and the feed line?" A similar question often is asked by those who want to extend transition to coax outside the house to feed it into the shack.

My usual answer is that the impedance will vary from the single units of ohms to the thousands, depending on the band, antenna and transmission line length. Thus, no single balun will come close to providing a match on each band. The real question then is which, if any, will result in an impedance that your tuner can match on all (or most) bands. Of course the best approach is to measure the impedance at the bottom of your feed line with an antenna analyzer, or analyze the antenna system with modeling software and select a balun that comes closest to the needed ratio on as many bands as possible. Then try it and see what happens. Since you won't be able to come close, starting with a common mode choke as above — in the absence of other information — may be as good a guess as any.

Keep in mind that in this scenario, any coax between the balun or choke and tuner will be at a very high SWR on at least some bands. It can easily be 100:1, and even 10 feet of RG-8X coax, for example, will have a loss of about 6 dB at 14 MHz. The answer is to keep that coax as short as you possibly can — perhaps a reason for using a weatherproof remote autotuner at or as close to the transition point and running back to the station with matched coax.

[2]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition, Chapter 26. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9876. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

[3]See Note 2, pp 26-22, 23.

Hamspeak

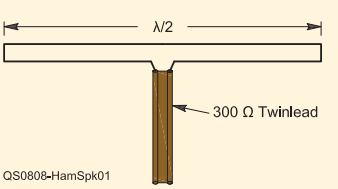
Balun — *BAL*anced to *UN*balanced transformer. Provides a transition between balanced transmission lines such as ladder line or open wire line and unbalanced transmission lines such as coaxial cable.

Coaxial cable — An unbalanced transmission line in which one conductor is a wire in the center of a dielectric with a circular cross section. The dielectric is surrounded by a tubular conductor, often made of flexible braid. In some cable types, the outer conductor is covered by a protective insulating jacket.

Dipole — Antenna often, but not always, center fed with two halves along the same line. Often refers to an antenna with a length equal to half an electrical wavelength. Often a reference antenna and also used as an element of multielement arrays.

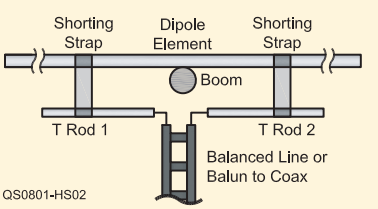
Ferrite core — Ceramic material made from compounds of iron oxide often used as a core in an electromagnetic structure. Commonly found in the shape of rods, toroids or beads than can surround wires to increase inductance to common mode currents. Inductors formed on ferrite donut shaped toroids have the useful property that the magnetic fields stay within the core material making them self shielding.

Folded dipole — Multiple wire antenna in which the transmission line is connected to the center of one wire and the other wires are interconnected at the ends. The input impedance of the antenna goes up with the square of the number of wires. Thus a two-wire folded dipole in free space (see Figure) would have an impedance of $72 \times 2^2 = 288\ \Omega$.



SWR — Standing wave ratio. This is a measure of how well a load, such as an antenna, is matched to the design impedance of a transmission line. An SWR of 1:1 indicates a perfect match. Coaxial cables, depending on length, type and frequency can often work efficiently with an SWR of up to 3:1, sometimes higher.

T match — Kind of double gamma match that provides a balanced connection to a dipole.



AG1YK

HINTS & KINKS

FLEXIBLE MOBILE MOUNT

◊A great deal of my Amateur Radio work takes place in my vehicle. My 2001 Chevy Tracker has a gearshift console between the two front seats that meets the dash right in the center where radio gear would normally be mounted. I needed another solution for mounting a radio.

Being a non-smoker, I removed the ash tray and found it opened to the area behind the dashboard. The cavity was too small for my ICOM IC-706 transceiver, but it has a removable control head. I could mount the radio body behind the dash and feed the control cable through to the control head. I wanted something adjustable and the idea of an arm on which the control head could be mounted came to mind (see Figure 1). The arm shown in the photo and the accompanying diagram works very well.

While examining the ash tray cavity, I noticed two ⅛ inch grooves for the ash tray runners. In these grooves I positioned a ⅛ inch aluminum plate just long enough to extend from the dash without interfering with the gearshift lever. This provided the mounting point for my device.

The construction is very simple (see Figure 2). A bench top drill press is the only power tool necessary. Otherwise, a hacksaw, file, screwdriver and combination wrench are all that are required. The materials are all stock parts found at any hardware store except the ⅛ × 4 × 8 inch plate, which was purchased at a local metal supplier for $3. The total cost was under $20 and took about 2 hours to complete.

KAYCEE JOHNSON

Figure 1 — A view of the completed mount in the raised operating position.

Things to Think About

Before building the mount, here are two things to consider. First, different vehicles have ash trays that operate differently. A modification of the base plate might be necessary. Once mounted, the rest of the design should be the same. Second, this mount allows a great deal of motion both horizontally and vertically. The display also pivots toward the driver, the passenger or any position in between. Care must be taken during construction to insure that the range of motion in any direction doesn't interfere with the operation of the vehicle. The bottom

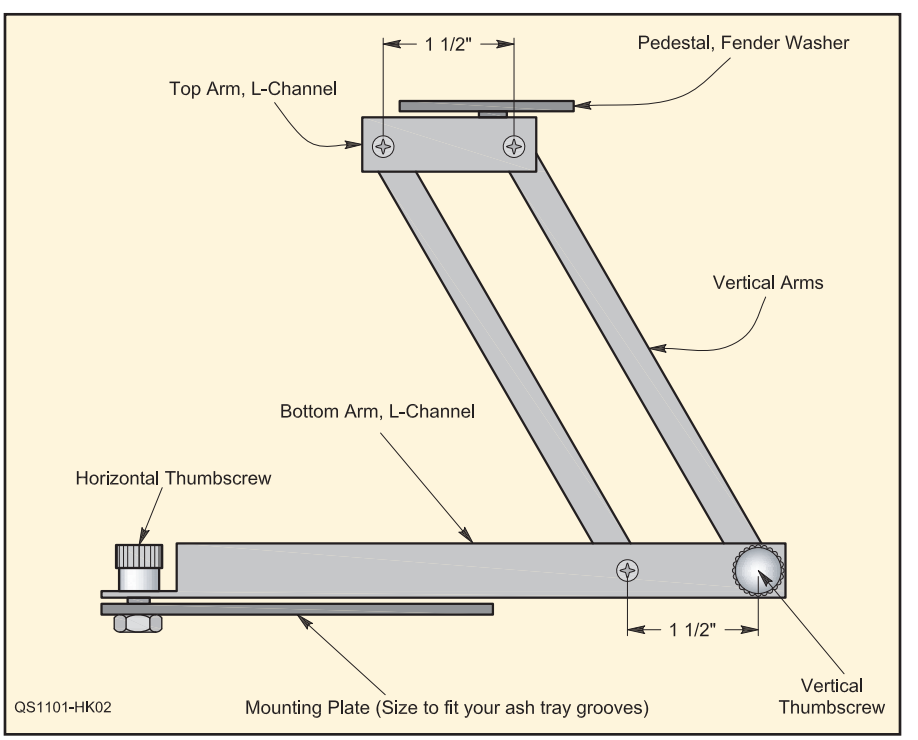


Figure 2 — Construction details for building the flexible mobile mount.

Parts List

Quantity	*Part*	*Size*
1	Base	4 × 8 × ¼ inch aluminum plate
1	Bottom arm	⅝ × ½ × 7 inch aluminum "L" channel
2	Vertical arms	⅜ × ⅜ × 6 inch aluminum bar stock
1	Top arm	⅝ × ½ × 2 inch aluminum "L" channel
1	Pedestal	2 inch fender washer
2	Thumbscrews	⅛ inch
4	Phillips bolts	⅛ × ¾ inch
6	Nuts	⅛ inch (nuts on the thumbscrews can be wing nuts)
10	Washers	⅛ inch

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or top arms can be shortened or lengthened to fit your vehicle's controls and available space. Test the fit as you build.

Getting Started

Cut the mounting plate to a length that, when inserted into the ash tray cavity, will not interfere with the gear shift. Using the full depth of the cavity provides the best support for the device. Next, cut a piece of aluminum L channel an inch or two longer than the plate's width. This will be the bottom arm. In my truck, a piece about 6 inches long gave the best range of motion without interfering with the gear shift or my passenger.

Place the bottom arm on the mounting plate with the widest side down and the other side facing the rear. Cut away about an inch of the vertical side nearest the driver for the horizontal thumbscrew. Place the arm on the plate with the tab nearest to the driver and pivot the arm on the plate to determine the range of motion and length of arm necessary. Outline the arm on the base plate. Drill a hole at the center of the tab and through the base plate. Using a thumbscrew, two washers and a nut, install the arm and check for range of motion.

The vertical arms are two identical pieces of ⅜ inch aluminum key stock. Round the corners of each end of the key stock so the corners don't bind when moved. Drill a hole in each end of both pieces of key stock. These holes must be positioned identically so the arms travel parallel to each other keeping the top of the control head mount level throughout the arm's range of movement. The vertical arms must be identical; otherwise, the mounted object will tilt.

Cut a 2 inch piece of L channel; this will be the top arm. In the narrow face, drill two holes, 1½ inches apart. Drill two corresponding holes in the vertical side of the passenger end of the bottom arm. Attach the two vertical arms to the top and bottom arms. Use three bolts, nuts and washers, and one thumbscrew, wing nut and washer. The thumbscrew will allow the upper arm to be moved and locked into position and the wing nut will rest against the channel, making a self-locking nut.

Finally, the pedestal. To allow it to rotate I bolted a 2 inch fender washer to the top arm using a bolt and two nuts. The two nuts are tightened against each other, fixing the bolt to the top arm. The nuts can also be adjusted so the fender washer can rotate with slight finger pressure, but can't turn on its own. This step, like the base plate, might require a little ham ingenuity depending on the mounting needs of your device. These directions should provide an adequate starting point to build your own mobile mount. — *73, Michael K. Johnson, NØVX, 19215 NE 129th St, Kearney, MO 64060-7945*, **n0vx@arrl.net**

ALIGNING DRILL HOLES

◊I had the idea to use a two-section telescoping TV pole to increase the height of my 6 meter beam. To bond the pipes mechanically I had to drill a pass-through hole for a 4 inch bolt. In the past when I drilled a hole on the side of a pipe, the adjoining hole on the other side was always misaligned.

My solution was to drill the first hole in the pipe, but stop short of drilling through the other side. Next, take a short piece of string and cellophane tape it to the center of the hole, then run the string around the pipe until it meets the end you just taped. Cut the string to match the diameter of the pipe. Then untape the string, cut it in half, then retape one end to the first hole again and wrap it back around the pipe. It will end exactly one half way around and the end will be at the second drill hole. This method worked perfectly the first time I tried it. — *73, Randy Miller, AA5OZ, 4122 Mary Ann St, Lake Charles, LA 70605-4102*, **ka5flm@aol.com**

LIGHTING FRONT PANELS

◊Although all rigs have dial backlighting, the front panel leaves a lot to be desired. Operate at night? Of course, we all do but the front panel of the rig is not lit. Visit your local hobby store and peruse the model train area. There will be a number of small lights available, from "grain of wheat" bulbs to LEDs. I found a package of six adhesive backed 12 V dc lights for just a couple of dollars. These can be easily mounted at the ham operating position to light up the front of the rig, an easy solution to a problem with most operating positions. — *73, Susan Meckley, W7KFI/MM, PO Box 1210, Pahrump, NV 89041*, **ussvdharma@yahoo.com**

MOLEX PIN REMOVAL

◊For Molex connectors, in order to remove a pin for repair you need a special pin removal tool to compress the fingers that retain the pin in the connector. When I recently could not find my pin tool, I came up with an alternative from my junk box. A broken telescoping antenna from a portable AM/FM radio can be a source of various sizes of pin tools. They can be easily cut and will fit over the pin allowing compression of the locking fingers so that the pin can be removed. Telescoping tubing sold in hobby shops can also be used. — *73, Art Carlson, WAØNJR, 2707 15th St N, St Cloud, MN 56303-1656*, **wa0njr@arrl.net**

POWERPOLE TOOL

◊Sliding Anderson PowerPole connector housings together or apart can be difficult. To simplify this task, I used a bench grinder to offset the jaws of two pairs of inexpensive slip-joint pliers (see Figure 3). The jaws are mirror images — one set is for joining the connectors and the other is to disassemble them (see Figure 4). Be sure to work from the bottom of the connectors as shown in the illustration — this positions the jaws of the pliers against the strongest part of the housing. — *73, Lynn Burlingame, N7CFO, 15621 SE 26th St, Bellevue, WA 98008*, **n7cfo@n7cfo.com**

LYNN BURLINGAME, N7CFO

Figure 3 — Using the modified pliers simplifies the task of joining a pair of PowerPole connectors.

LYNN BURLINGAME, N7CFO

Figure 4 — Joining and separating PowerPole connectors requires that two pliers be modified in a mirror image of each other.

CHECKING INFRARED LEDs

◊A trick to verify if an IR LED is working is to point your cell phone or digital camera at the LED output. You should be able to see it glowing in your camera's display if the LED is working and connected properly. Use a TV remote to verify that your camera will work this way. — *73, Stanley Slaughter, N3LU, 213 Berwick Rd, Columbia, SC 29212-1902*, **n3lu@arrl.net**

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

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Kinks" at ARRL Headquarters, 225 Main St, Newington, CT 06111, or via e-mail to **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. QST

Tools for Doing it Yourself

Hams have a long tradition of making their own antennas, accessories and equipment — but you need the right tools for the job.

Joel R. Hallas, W1ZR

To me, the right tool for the job means a tool designed to do the job at hand that is the right size to grasp or fit snugly onto the work. For the Amateur Radio homebrewer, having tools that match microelectronic construction projects up to major tower work requires quite a collection. Although the "Construction" chapter of *The ARRL Handbook for Radio Communications* offers a list of suggested tools that covers most projects, it is quite a lot to take in one bite.[1] In fact, I suspect many amateurs would decide to just go and buy a new transceiver instead.

Start Small and Work Up

Many electronic assembly and repair tasks can be handled with a few basic hand tools that we all will need sooner or later. The first to get include a pair of small (4 inch) needle nose pliers and diagonal wire cutters and a set of slotted (1/16 through 5/16 inch) and Phillips head screwdrivers (size #0 through #2).

You will soon wish you had a set of *nut drivers* or *socket drivers*. These look like screwdrivers, but have socket heads on the end. They can reach into tight corners to hold nuts and other hex items. It might be temping to buy a single handle with changeable sockets. This can work, but causes frustration if you are trying to use two sizes together. A compromise might be to have a set of removable sockets in both metric and English (inch) sizes that also work with a 1/4 inch drive ratchet wrench, plus dedicated nut drivers in the most popular sizes: 1/4, 5/16 and 11/32 inches. Sets of *ignition* wrenches in metric and English sizes will often come in handy and aren't very expensive.

The preceding tools work fine for circuit board work, but won't hold up for power or antenna connections. Moving up a size to 6 inch long nose and side cutters will be a better match, and you'll want to add lineman's pliers with heavy cutters. If working with tubing type antennas and associated fasteners, it will be good to have a set of combination wrenches in at least 3/8, 7/16, 1/2 and 9/16 inch sizes. If you encounter antennas with metric size fasteners, be prepared to add in some metric sizes as well. A 6 inch adjustable end wrench can help if you encounter an odd size or need two of the same — they fit metric sizes, too. Adding in a 3/8 inch drive socket set will also be handy and can help in the garage as well.

[1]*The ARRL Handbook for Radio Communications*, Chapter 23, 2011 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 0953 (Hardcover 0960). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

Soldering Tools

Once you are ready to move the small parts around, you will quickly have a need to solder and unsolder the pieces to each other or to circuit boards. In the vacuum tube days, an instant heat 100 and 140 W soldering gun did almost everything. The soldering gun is still great for working with wire antennas and coax connectors, but will quickly char today's small and sensitive parts, as well as the circuit boards.

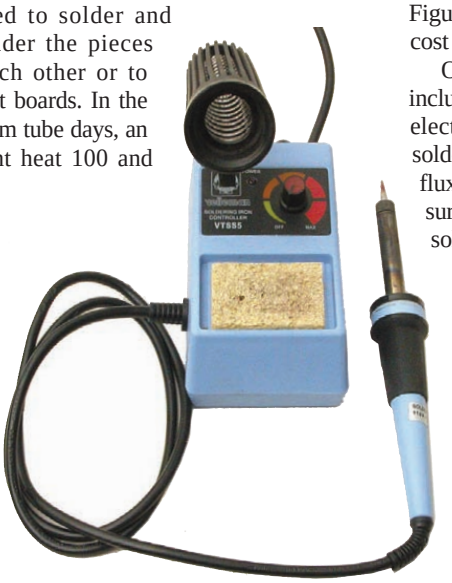


Figure 1 — An inexpensive temperature controlled soldering station.

The modern electronic hobbyist or technician uses a fine tip soldering iron that is part of a temperature controllable soldering station. The best are thermostatically controlled, with a digital temperature readout. Others have an analog controlled variable temperate adjustment. I purchased one of the latter for around $30, and found it satisfactory (see Figure 1), while more exotic units can easily cost more than three times as much.

Of course you will need a few other items, including solder. Most home construction of electronic equipment is done with tin/lead solder at a 40/60% ratio with an integral rosin flux core. This mix will melt at 370°F. Make sure you never use an acid flu or acid core solder around electronic equipment.

New commercial equipment, especially if also sold outside the US, is generally made with lead-free solder to meet environmental requirements. This requires a higher temperature to melt, or to fuse with tin/lead solder, typically 450°F, so make sure the station you select can achieve a higher temperature than needed for just tin/lead solder. You will also need some *solder wick*, a thin metallic woven braid that can be used to remove molten solder from a connection.

Test Equipment

The serious amateur shop can include test equipment with a value higher than that of the radio equipment. Again, starting small will help avoid sticker shock! The first piece of test equipment an amateur is likely to need is a volt-ohm-milliammeter (VOM). The current incarnation of a VOM is also known as a digital voltmeter (DVM), or digital multimeter (DMM). See Figure 2. The modern digital models can run rings around my old analog unit in most ways, especially in terms of functionality and precision. Analog and digital multimeters are both available starting at less than $20, with the professionally oriented DVM including extra features running into hundreds of dollars.

Figure 2 — A modern digital voltmeter next to the author's venerable Simpson 260 series analog VOM.

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

3W6C DXpedition to Côn Có Island, Vietnam

Hans-Peter Blaettler, HB9BXE, and Paul Schreier, AA1MI/HB9DST

An island military outpost proves to be a challenging DX location.

In a legal document, the French phrase *force majeure* (superior force) refers to extraordinary circumstances (strikes, riots or natural disasters) that prevent one or both parties from fulfilling the contract. And while the April 2010 3W6C DXpedition to Côn Có Island in Vietnam didn't encounter any of those, we faced another set of circumstances we could perhaps call *force militaire*. Shortly after we had erected many of our antennas and begun operating, the Vietnamese military instructed us to abandon two remote sites and consolidate all of our activities in a cottage adjacent to their training grounds where they could keep a close eye on us.

But even given these sudden severe restrictions, we were able to operate for almost the entire planned time and made almost 18,000 contacts — a number we are proud of given the circumstances. In addition, we should add that it was only with the military's permission that we were able to conduct a DXpedition on this island at all. It is still considered a strategically important outpost and it is devoted almost entirely to military facilities.

Detailed Preparations

To smooth the way for a successful DXpedition, in late September and October of 2009 team leader Hans-Peter, HB9BXE, conducted a scouting trip along with Vietnamese Amateur Radio Society President Bac Ai, XV2A. They met with a delegation of officials on Côn Có Island including representatives of the military, Peoples' Committee and telecom authorities. At that time, Hans-Peter described the structure and goals of the DXpedition and outlined our intended operations. Three operating sites (HQ/RTTY, CW and SSB) were selected and approved, the financial terms were worked out and a contract covering these activities was signed.

With this information, Bac Ai applied for the 3W6C license. In December 2009, the Vietnamese telecom authorities issued a license for operation from the three requested locations. We then assumed that with the contract and 3W6C license we had fulfilled all the requirements for the operation.

The 3W6C Team

The team members for the operation were Hans-Peter Blaettler, HB9BXE, Team Leader; Rene Schmitt, HB9BQI, Deputy Team Leader; Hans-Ruedi Buerki, HB9BHW; Christina Toporitschnig, HB9BQW; Thomas Parthier, HB9BSH; Hans-Juerg Voegeli, HB9DKZ; Paul Schreier, AA1MI/HB9DST; Friedhelm Hoffmann, HB9JBI; Matthias Schumacher, HB9JCI; Peter Sidler, HB9PJT; Rolf Senn, HB9TVR; Eddy Visser, XV1X; Bac Ai Nguyen, XV2A; Quang Huy Bui, XV2B; Michal Horecky, XV9DX; Torsten Hjalmarsson, XV9TH, and Quyn Huong (XV9TH's spouse), on-site translator. Back at home Markus Schuler, HB9DIZ, was our base coordinator and Webmaster, and Leo Marbach, HB9DWL, was our QSL manager. Alex M. Mendelsohn, AI2Q; Joe Iwakura, JA1LZR; Cicero X. Silva, PY7ZY, and Steve Buroker, W7QC, were our pilots.

We departed from Europe on April 5 and flew via Singapore to Ho Chi Minh City and the next day to Hue, where we took a bus to the nearby port city of Duong Ha. On April 8 we made the passage to Côn Có. It was a foggy, drizzly day with medium seas. The trip was uncomfortable sailing aboard

Group photo in front of the flagpole of participating nations.

a Vietnam-War-vintage river-patrol boat not really intended for the open seas. Even so, it was only thanks to the good connections of our local team members that the military supported us with transport in this way, which is normally quite rare.

Strong Military Presence

We disembarked at Côn Có to find an island dominated almost exclusively by the military. The decaying infrastructure left over from the war is visible everywhere. Near one operating site, one team member even found a rusted hand grenade.

Upon arrival, we unloaded our freight and transported it to the sites with the help of local soldiers. We immediately started setting up our CW and SSB stations, which were housed in above-ground concrete bunkers. On each of these two sites we were able to erect a 5 band Spiderbeam on top of the bunker while the CW site had a 30 meter Four Square, SSB had an 80 meter Four Square and both had a selection of verticals for other bands.

The team decided to begin operating the CW and SSB sites as quickly as possible, initially with just one station each. The remaining antennas, including a second Spiderbeam at each site, would then be erected during the course of the next few days, after which we would switch over to planned operation with four parallel stations (two CW and two SSB).

Looking back, this decision to start as early as possible proved wise. During the first weekend we made many contacts on bands from 30 meters to 15 meters using our efficient Spiderbeams and 30 meter Four Square antenna. We also found that with our seashore location, the verticals for the lower bands also performed quite well.

The pileup on 30 meters, for instance, was immense and hardly imaginable if you've never experienced one yourself. We definitely profited from our Four Square antenna. Only thanks to its switchable directivity was it possible for us to work NA, EU as well as JA.

When the antenna is in receive mode its direction can be switched in a flash using the remote-control box located beside the transceiver. Differences in signal strength of 20 dB were not unusual. Later on, when we were able to work 30 meters only with an inverted V, we often thought back dreamily of our Four Square.

Erecting the Four Square at the SSB site during low tide; dismantling it at high tide was a challenge with some team members up to their armpits in water.

For most of the team's time on the island, their transportation was limited to walking, motorcycles and a horse cart provided by the military.

The Situation Changes

On April 11 we learned that a high-ranking delegation from Quang Tri Province would be visiting us. The next day, the 12 person delegation, consisting of representatives of the military and telecom authorities, visited all three operating sites, pulling out their GPS units to verify the location along with cameras and video equipment to document our activity.

It was clear that they had very little understanding of Amateur Radio and we did our best to explain what we were doing. The delegation was very impressed with the extent of our activities and our sophisticated antennas. Everything was checked and recorded in an exacting manner, including a comparison of the equipment models and serial numbers with those on the license.

Following the inspections there was a lengthy meeting between the delegation from the mainland and the island authorities. Unfortunately, their final decision did not fall in our favor. We had to immediately cease radio operations from the CW and SSB sites. We eventually learned that Côn Có Island remains a highly sensitive area and is still considered an important military outpost, and the military was quite uncomfortable with our activities.

On the morning of April 13 we received the order to dismantle our antennas at the CW and SSB sites by dusk. This was discouraging first of all because we had spent so much time and effort putting them up and were only starting to use them; second, because that day was rainy and windy. Things were especially uncomfortable at the SSB site because we had to climb over large slippery boulders to get to the antennas. Because it was high tide, some team members had to go into water up to their armpits to bring down antenna masts.

Despite all the issues that had surfaced, the local military commander worked on our behalf to find a compromise whereby we were permitted to operate from the headquarters site, located across the street from their training grounds, and erect modest antennas.

Moving the Stations to Headquarters

With the antennas dismantled, we moved them together with the remaining radio equipment to the headquarters site. For erecting antennas at that location we had at our disposal a strip of land roughly 80 meters long and 20 meters wide. We were no longer able to put up a Spiderbeam or a Four Square. Thus, we constructed two triband vertical dipoles supported by Spider fiberglass masts: one for 20, 15

and 17 meters and the other for 15, 12 and 10 meters. Furthermore, we found a way to put up a 30 meter inverted V as well as a 40 meter vertical with elevated radials. Unfortunately, we were not given permission to erect an 80 meter vertical on a bluff in the vicinity of a war memorial commemorating the approximately 3000 soldiers who died on the island.

Operating and Propagation

At the headquarters site we didn't experience particularly good propagation. For some 6 hours per day most bands were pretty much dead. Only on 17 meters and 20 meters did we hear occasional stations from Asian areas.

A particular disadvantage was that when there was a band opening, we could take advantage of it on either the CW station or the SSB station but not both. At the CW station there was also interference from the SSB station, which often made it almost impossible to work weak stations. We attribute this interference to the fact that the antennas were located so close to each other, even though we put bandpass filters inline on both stations.

We did have an Internet connection at the headquarters, which allowed us to stay in touch with our loved ones, file reports to publish on our Web site and upload the daily logs.

RTTY and Satellite Operation

Based on these circumstances, we were not able to devote the amount of time and attention to RTTY and satellite operations that we had planned. For RTTY, during the last 3 days we were permitted to erect a 30 meter vertical.

Satellite contacts were handled by Hans-Peter, HB9BXE. As team leader he had his hands full dealing with many unexpected issues and he had to wait a long time until an optimal pass fit in with his schedule. On April 16 at 4 AM he excitedly waited for the AO-51 pass at 22:02:21 UTC but was disappointed to hear only noise.

Part of our goal was to give our Vietnamese colleagues training in RTTY. Rene, HB9BQI, took on this task. Even given the circumstances the RTTY team, consisting of him along with Bac Ai, XV2A, and Huy, XV2B, was able to make contacts with 325 hams around the world.

Infrastructure

To provide continuous power for our stations, our Hanoi-based preparations team purchased four KAMA diesel generators, each rated at 5.6 kW. The generators ran from start to finish to our satisfaction except for a few minor incidents.

Operating in the CW bunker before being forced to move to headquarters. At the rig is Michal, OM2DX/XV9DX.

A small restaurant near the guest house run by a Vietnamese family took care of our meals. There was an abundance of rice every day along with fish and limited amounts of meat, while the vegetable side dishes added variety.

Ending the Operation

On April 19 at 2400 UTC we logged our final contact. It was hard to believe that our 10 days planned for operating had already passed by. Despite the delay, we were able to be on the air for 9 days. By evening we had completed all our packing and departure preparations, and the entire team was invited to meet with the Minister of the Peoples' Committee in his conference room. He thanked us for conducting ourselves in such a good manner despite all the difficulties that had arisen and invited us to return for another visit. In return, we gave the Peoples' Committee one of the generators to express our thanks for all the hospitality and support the island population had given us during the DXpedition.

Conclusion

Although we were not able to reach our intended goal in terms of the number of contacts, we can look back upon a successful DXpedition to Côn Có. A large part of the credit for this lies with the work of the entire 3W6C team, including the base team at home. Despite administrative problems and countless restrictions, we were able to make roughly 18,000 contacts and let many DXers and IOTA hunters get the much-desired AS-185. With pleasure and pride we can say that in the end we were able to run a successful DXpedition.

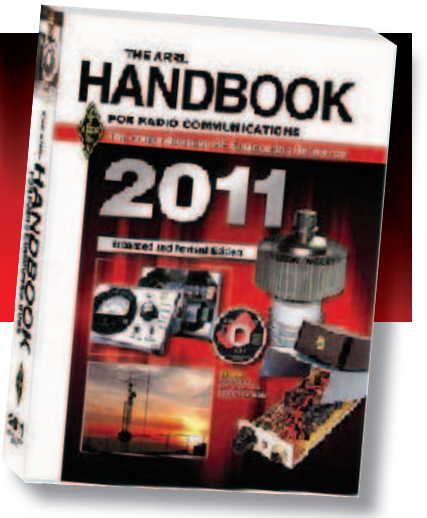
We would like to thank all the DX stations that took the time to contact us. Special thanks go to all the sponsors that made financial contributions. Among those that were especially generous were The Swiss DX Foundation, Lone Star DX Association, Clipperton DX Club, German DX Foundation, Helvetia Telegraphy Club, GM DX Group, The Island Radio Expedition Foundation, The Southeastern DX Club, HB9BE, HB9LU and HB9CF. Numerous other clubs, too many to list here, also helped us as did many hams who made individual contributions, loaned us equipment or supported us in many other ways. We acknowledge all of this generosity on our Web site (**www.3w6c.qrv.ch**). Without this exceptional support we would have never been able to activate 3W6C on Côn Có, IOTA AS-185!

All photos courtesy of Hans-Peter Blaettler, HB9BXE, and Paul G. Schreier, AA1MI/HB9DST.

Hans-Peter Blaettler, HB9BXE, works as a development engineer for a company that manufactures electronic compounds for fuses, switches and connectors. He's been an Amateur Radio operator since 1975 and he enjoys building homebrew equipment, participating in CW contests, experimenting with circuits and has designed and built his entire station by himself. Aside from his family, he has two main hobbies: ham radio and bicycling. Hans-Peter was also a member of the DXpeditions to St Brandon, 3B7RF; Agalega, 3B6RF, serving as team leader, and Mt Kilimanjaro, 5H1BP. Earlier in 2010 he participated in the 3Y0X DXpedition to Peter I Island. You can reach Hans-Peter at Chriesibuel 15, CH-6043 Adligenswil, Switzerland, **hb9bxe@uska.ch**.

Paul G. Schreier, AA1MI/HB9DST, an ARRL member, has been working in Switzerland for the past 9 years as a marketing consultant, technical journalist and translator. He got his Novice license in 1969 and his General in 1970. After a lapse of two decades due to professional and family obligations, he picked up the hobby again in 1992, took all the exams again and got his Extra class license, AA1MI. Paul enjoys low power operating and building kits. While at his seaside home in New Hampshire he earned his DXCC-QRP and WAS QRPp (mW). The Swiss National Mountain Day Contest is a highlight for him every year. 3W6C was his first DXpedition. You can contact Paul at Alte Landstrasse 101, CH-8800, Thalwil, Switzerland, **aa1mi@arrl.net**.

The Next Link in the Chain: The 2011 ARRL Handbook



Ward Silver, NØAX

Last year's *2010 ARRL Handbook* offered readers a massive rewrite and reorganization of Amateur Radio's longest-lived reference text, becoming the largest edition ever. This year, the *2011 ARRL Handbook* keeps the spirit of renewal alive.

Expanded Interference

It's not that we've increased the amount of QRM and QRN (although it probably seems that way on the weekends) but the "Interference" chapter got a complete makeover in the new 2011 edition. With the shift to digital TV, the "Tennessee Valley Indians" (TVI) are no longer the most common bugaboo for hams. That dubious designation now falls to disturbances dealt out by noise emissions and common-mode currents.

To address this brave new world, the ARRL Lab staff and other RFI experts put together a completely new chapter. Starting with a comprehensive treatment of the regulatory and personal aspects of interference, the reader is then tutored on the background and nature of RFI, how to identify and locate RFI sources, then troubleshoot and control it. The *Handbook's* treatment of power-line noise — the most frequent complaint the ARRL Lab staff deals with — was greatly expanded by Mike Martin, K3RFI. A whole new section on RFI in the automotive environment has been contributed by Mark Steffka, WW8MS, and Jeremy Campbell, KC8FEI. (Mark's call was given incorrectly on the *Handbook* title page — sorry, Mark!) Coverage of TV-related interference now focuses on digital TV and cable systems, courtesy of Ron Hranac, NØIVN.

Laying It All Out

Once a technology only available to professionals, software tools for printed-circuit board (PCB) design are now widely available at low or no cost. In addition, small quantities of finished boards can be ordered over the Internet and delivered in a few days at modest cost. To lead the ham through the vocabulary and technology of PCB layout and fabrication, Dale Grover, KD8KYZ, has added a new section to the Computer-Aided Circuit Design chapter. Regardless of what program or board "fab" service you use, the information here will get you started — it's never been easier to create your own professional quality PC boards!

RF Simulation and Circuits

The work of Dr Ulrich Rohde, N1UL, is well-known in the professional RF design world. A long-time supporter of the ARRL and the *Handbook*, Dr Rohde contributed a basket of material to this year's edition. Accompanying a discussion in the CAD chapter of using circuit simulation tools at RF, four additional professional-level papers on RF simulation are included on the *Handbook's* CD-ROM. Dr Rohde also contributed an update to the classic Vackar and other oscillator circuits, a new VHF downconverter front-end circuit, a new mixer circuit and a discussion of mixer test procedures.

More, More, More!

The featured new project in this year's edition is a microprocessor-controlled SWR meter and monitor by Larry Coyle, K1QW. More than just an SWR bridge, the instrument uses digital technology to compute several useful measurements from forward and reflected power, supports data-logging through a USB port, and can even shut down your transmitter when high SWR is detected.

There are too many individual new changes to discuss each one, but here is a list of some of the book's new material:

- Alan Applegate, KØBG, explains how to select batteries for mobile operation.
- Rick Hilding, K6VVA, surveys the ground of building a remote HF station.
- Roger Halstead, K8RI, walks you through tuning an HF power amplifier and discusses using surplus and used parts to build the amp of your dreams. (A section on amp maintenance has also been added to the Troubleshooting chapter.)
- John Fitzsimmons, W3JN, reviews the basics of rebuilding and restoring vintage vacuum-tube equipment.
- Carl Luetzelschwab, K9LA, has updated the Propagation chapter to review the status of solar cycle 24 and the latest predictions.

You can purchase *The 2011 ARRL Handbook for Radiocommunications* from your ARRL dealer or from the ARRL Store, ARRL Order No. 0953 (hardcover 0960). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

On the CD-ROM

The ARRL is trying to make better use of the *Handbook's* digital companion and you'll find more new items on the CD-ROM this year, too:

- *LTSpice* files are provided for several basic analog circuits.
- Jim Tonne, W4ENE, contributed a Low-Pass Filter design program to add to his growing list of design software.
- Paul Wade, W1GHZ, wrote an in-depth paper on receiver noise.

Of course, PDF files of the entire book are included as well, including all the graphics and many referenced *QST* articles.

Making It Easy

One of the drawbacks of providing so much material is that a large text can be difficult to navigate. Last year's improved structure and numbering system were well-received, as was the all-new index. This year, we've provided an extra level of detail in the up-front Table of Contents to help you find what you want even quicker. Following the popular Project Index, you'll find an updated Author Index to recognize the many contributors to this comprehensive reference work.

Where Do We Go Next?

Every edition of the *ARRL Handbook* is a hard act to follow. The technology of ham radio evolves constantly, while keeping deep roots in historic practices and conventions. The key is to support the *Handbook's* mission — to inform, instruct and inspire — by using all the methods available to a publisher: print, digital and online. And through it all, we'll remember that all hams from the newest licensee to the most grizzled veteran use the *Handbook* to learn. If you have ideas, be sure to let us know. The next edition is never far away! QST

The Last CQ — A Survivor's Guide

Seven steps to help your spouse dispose of your ham radio estate.

William Conklin, AF6OH

As much as we would all like to consider ourselves as invincible, there is one thing in life we cannot avoid — and that is the last CQ. Benjamin Franklin is quoted as saying "In this world there is nothing that is certain except death and taxes" — and that includes Amateur Radio operators.

Critically Important

Although the last CQ is not something that most of us plan for, it is critically important for the benefit of those you leave behind. Let's face it a car accident, getting hit by a bus while crossing the street or something as immediate as a heart attack can take you out of the contest instantly. Being proactive and prepared for this eventuality is what this article is all about.

I participated in the decommissioning of a Silent Key's radio station and witnessed firsthand the issues that accompany this type of event. For a spouse, the steps required to disassemble the radio shack and dispose of equipment can be overwhelming. Removing the antennas and cabling, taking down the towers and selling the radio gear and related equipment is arduous even for someone familiar with the systems.

Fortunately, one of his local ham friends and neighbors took on the task of organizing the equipment to be sold. He also arranged for other local hams to meet at the station and disassemble and remove the antennas, towers and associated electronics. They not only created a list of the equipment but also arranged for the sale and disposal of the radios and antennas to local hams and at a local ham swap meet.

Keep in mind that although you may have paid $2800 a number of years ago for that Kenwood TS-870 transceiver with station monitor, that is not what it is worth today. You need to consider what it is worth in today's dollars to local hams or at a ham swap meet. Here you really need to provide your survivors information about the various online auctions and ham classifieds so your spouse or other family members will know if they are getting a fair market price.

Plan Now to Help Later

The reason for planning is twofold: first to eliminate as much headache and hassle to the survivor as possible and second, to help your life partner recover as much money as possible from the sale of the equipment. Your investment can easily run into the thousands or tens of thousands of dollars. Put yourself into their shoes and try to anticipate in advance what they will need to do to decommission your station.

We all seem to have the propensity to collect and assemble more equipment and more antennas, and as a result end up with more things that need to be disposed of after we are gone. That is why the time you spend in preplanning and organizing will help your survivor greatly after you are gone. The more detailed you are, the easier it will be for them and those ham friends who come to help your spouse.

Generally speaking there are usually HF, VHF and UHF radios; antennas; rotators with controllers; antenna towers and masts; coax and interface cables; meters; computers and printed materials including books; manuals and periodicals.

At my station I have initiated what I call the AF6OH Survivor's Guide. Although not all inclusive, it is a good starting point for everyone to consider. I recommend that you start putting your own list together now and not put it off for some later time. If you wish to donate anything to a person or entity (such as a club), be sure to make note of this in your will or estate plan.

Steps to Take

1 Prepare the Inventory

Create an accurate list of your current equipment. There are many free software products available that can help you create an equipment inventory or you can simply make a list on a sheet of paper. The inventory can be as detailed as you want it to be but these critical items must be included:

- Description of product (type of radio, manufacturer, model number)
- Serial number
- Purchase date
- Estimated cost when purchased

Silent Key Notice

To include a Silent Key in the *QST* "Silent Keys" column, one of the following items is required: 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 the column. Current or past ARRL membership is not a requirement for inclusion. Mail, fax (860-594-0303) or e-mail (**sk@arrl.org**) information to the ARRL Silent Key Administrator.

How to Leave a Legacy to ARRL

There are many ways that a radio amateur may choose to support ARRL financially. One way is to provide for the organization's future in their estate planning process. Individuals should consult a financial advisor or attorney to determine the best process and to make arrangements to include ARRL as a beneficiary of a will, bequest, trust, insurance policy or retirement account such as an IRA.

In every case, the following language may be helpful in planning an estate document that includes ARRL:

"…to The American Radio Relay League, Inc, a non-profit corporation headquartered in Newington, Connecticut (Federal ID #06-6000004) I give…."

Or

"I give, devise or bequeath the rest, residue or remainder of my estate, whether real or personal as follows: [state portion] to the American Radio Relay League, Inc headquartered in Newington, Connecticut for its general purposes [or name fund or area of interest]."

Or

"I give to The American Radio Relay League, Inc headquartered in Newington, Connecticut the sum of _____ dollars to be used for its general purposes [or name fund or area of interest]."

The Development Office will include the donor of any estate commitment into the ARRL Legacy Circle that recognizes individuals who have included ARRL in their estate plans. Recipients will receive a unique pin and certificate.

If there are questions, individuals may contact ARRL Chief Development Officer Mary Hobart, K1MMH, by telephone at 860-594-0397 or by e-mail at **mhobart@arrl.org**.

- Using information from online auctions and classifieds, estimated resale value in today's dollars
- If it is an integrated system, list all parts, pieces and components that make up the system.
- Equipment manuals and schematics

Optional:
- Photographs of equipment
- Location of equipment within the shack

2 Ask for Assistance

It is extremely important to ask your ham friends to step in and assist your surviving partner after your departure.

Don't be afraid to talk to your ham buddies about this. We all have a number of ham friends we both trust and respect. Simply "ask them for their help." Explain your goals and desires and your need to have someone your partner is comfortable with assisting with the station decommissioning process. You may want to enter into a pact with your friend and offer to do the same for him or her if they depart first.

3 Identify Your Antenna Removal Team

Many hams out there will have large antenna installations, which can include tower systems, wire arrays and assorted antennas. For these systems you will want to enlist experienced hams who have the skill sets and necessary tools and technologies to safely remove the antennas and towers.

When the antennas come down, your friends should code each piece with a magic marker and organize the parts in a manner that will make them easy to reassemble for the next owner. Keep all elements and large parts together by taping the components and put the smaller items in plastic bags clearly labeled and attached to the larger pieces. This will make it easier to sell later.

4 Consider Which Items You May Wish to Donate

If you are associated with a local Amateur Radio club, consider donating some of your equipment for the club station. Or you might want to donate equipment to a local school to help establish a radio club. If your donation is made to a non-profit organization, some positive tax benefits could accrue. Despite your wish to donate to a particular school or community service group, they may not be able to take it or use it. Learn what options are really possible — or not.

5 Available Resources

In addition to your personal ham friends, consider your local radio clubs and ARES® groups. You may also want to place ads in Amateur Radio magazines or online classifieds. Make a list in advance and keep it with your Survivor's Guide.

6 Update the List

As you continue to add new equipment to your station you need to keep your inventory list up to date. As you add new equipment include it in your list of gear.

7 Explain the Plan to Your Spouse

This is not some type of secret assignment but one that needs to be openly shared with your spouse. Explain, as I have to my "significant other," exactly what you have prepared for them and let them know that your goal is to minimize any problems they may have in the event of your demise. Go over the list with them, point out the equipment, explain the overall goals and describe the action plan. Then be sure they know where you are keeping that list. It does no good hidden away.

Ham radio operators come in all shapes and sizes just as their stations and operational facilities do. So, each station owner must consider their own situation and adapt these concepts and suggestions to their particular station.

Although I never had the opportunity to personally meet the SK before his departure, I realized that he had many local ham friends who pitched in to help his wife after he died. By doing some advance planning, no matter how odd it may feel, you are actually providing a major service for your partner and your friends.

William Conklin, AF6OH, an ARRL member, has been involved in the field of communications security for the last 35 years, most recently in the area of bomb jamming systems for countering improvised explosive devices. Yearning to be a ham for 45 years, he received his Technician and General class tickets in January 2009, followed by his Amateur Extra class license in February 2009. William can be reached at 343 Soquel Ave, Ste 317, Santa Cruz, CA 95062-2355, **af6oh@arrl.net**.

Legal Concerns

While AF6OH offers some good and very helpful advice, it is important when planning for the disposition of your station after your death to remember that all of the equipment, because it has value, is an asset of your Estate. It cannot simply be cleared out and disposed of in accordance with general instructions you make during your lifetime. There are probate procedures that must be followed in all states which might be applicable.

Typically, the Executor or Personal Representative of a decedent's estate must have all assets of the estate appraised and the value determined as of the date of death. Then, the equipment and all other property must be listed in an inventory submitted to the probate court. Finally, the equipment can be disposed of in accordance with the terms of a Will, or the intestacy laws of the State of residence of the deceased ham, and in accordance with the procedures established by the local register of wills or probate office. — *Chris Imlay, W3KD*

Canceling a Ham Radio License

When a ham becomes a Silent Key, his or her license will expire at the normal license expiration date — and after 2 years (the grace period for renewal) it will be canceled.

To cancel the license of a deceased holder before the end of the 2 year grace period, the FCC must receive a signed written request indicating that the current licensee is now deceased (include the deceased licensee's name and call sign in the letter). The FCC also requires that written evidence of death accompany the request. Acceptable documents are a dated newspaper obituary, a death certificate or Social Security/Death Benefits documentation (SSDI).

Use postal mail or send by courier to the FCC, Attn: Amateur Cancellation, 1270 Fairfield Rd, Gettysburg, PA 17325-7245. Faxed documents are not accepted.

Allow the FCC one to two weeks to cancel the license. You can verify that the FCC has canceled the license by looking up the FCC license call sign data at **wireless.fcc.gov/uls**. If the license has been canceled, the FCC will show the license STATUS as CANCELED.

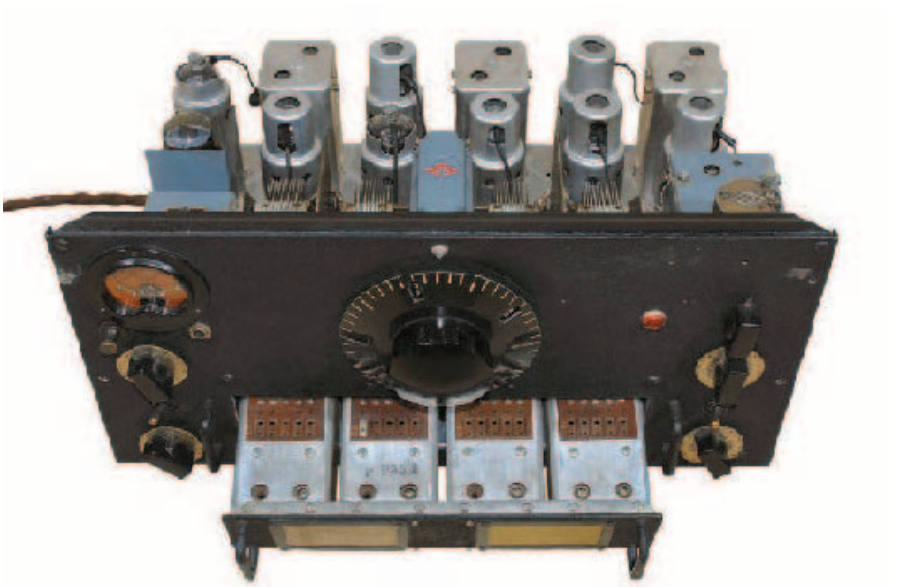
The effective date of the cancellation is the date of the former license holder's death. If that date is over 2 years old, the call sign becomes available to any Amateur Radio operator. If that date is less than 2 years old, only the family member (or a club, with the family's written permission) can acquire the call sign through the FCC's vanity call sign application process.

Note that in either case, the person applying for the call sign must have the appropriate license class applicable to it to be assigned the call. For more information, contact ARRL VEC Assistant Manager Perry Green, WY1O, at **wy1o@arrl.org**.

The National HRO Receiver — A Historical Perspective

A flea market find leads the author on a journey back to the first modern receiver.

Brian R. Page, N4TRB



After: **The author's fully restored 1942 National HRO receiver.**

You know you're an engineer when you fall in love with a piece of machinery. My case of what I expected to be forever unfulfilled love occurred during a visit to the Radio Society of Great Britain museum. John Crabbe, G3WFM, curator of the collection, powered up a brilliantly restored National HRO receiver and allowed me to take it for a spin.

All it took was a couple of turns of the precision worm drive tuning dial and I was smitten.

Then one day the inevitable happened — an HRO followed me home. I became the proud owner of a 1942 National HRO receiver that was in great condition considering its age. Fortunately, there was plenty of information on the Internet to help with its restoration, and I quickly learned about replacing time-worn electrolytic capacitors, cleaning the air variables and lubricating the moving parts.

The HRO is the culmination of technical evolution spanning decades. Before we dive into the HRO's (r)evolutionary technology, let's look at ham receiver state-of-the-art on the eve of the HRO's 1935 debut.

Hams Making History

The 1930s were both tremendously exciting for amateurs and equally challenging. The now famous "1929 Hartley" transmitter design predominated into the mid-1930s, although crystal control steadily gained ground. Without the rock solid stability of crystals, a reply to your CQ might appear literally anywhere in the band.

On the receiving end of the equation, battery-powered regenerative receivers (regens) ruled the day. Receiver selectivity, that ability to discriminate between two adjacent signals, has always been problematic with regens. A *QST* writer observed in a 1935 article that "…the slightest movement of the vernier knob of the tuning control caused the signal to disappear and it was possible to hold the signal for any appreciable length of time only when the operator used a vise-like grip on the tuning knob and held his breath."

Superheterodyne receivers existed since they were invented by Captain Edwin H. Armstrong of the US Signal Corps during World War I. The problem was that many hams considered them suitable only for AM reception. Nevertheless, all receivers of that day, whether regenerative or superheterodyne, suffered from the same problem when receiving CW signals. In heterodyning a local beat oscillator with the fundamental or intermediate frequency (IF), two audio tones were ultimately produced, one on each side of zero beat. From the operator's point of view, each CW signal appeared at two places on the dial.

This is the world into which the National HRO receiver appeared in 1935 and became legendary for its stability, selectivity and bandspread. My research quickly led to a series of remarkable papers, mainly from 1932, by James J. Lamb, W1CEI (1900-1986), technical editor of *QST*.

Improving receiver performance was a major theme in the early 1930s and Lamb published no fewer than seven major articles in *QST* addressing the existing deficiencies. [Members can read Lamb's original articles in the ARRL Periodicals Archive at **www.arrl.org/arrl-periodicals-archive-search**. — *Ed.*]

His efforts were joined by the likes of *QST* Assistant Technical Editor Don Mix, W1TS, together with George Grammer, W1DF; Howard Chinn; James Millen, W1HRX (more about him later); J. B. Dow of the Navy Bureau of Engineering; former *QST* Technical Editor Robert S. Kruse, and *QST* Associate Editor Ross Hull. Perhaps only old timers will recognize these names today, but together they represent a Who's Who in 1930s radio engineering. The designs of these engineers had global impact in both the amateur and commercial worlds.

A Great Leap in Receiver Design

Getting back to my National HRO receiver, its technical excellence grew out of a set of three Lamb articles appearing in 1932. His first article was entitled "What's Wrong with Our CW Receivers?"[1] Therein, he explains the problems and details his suggested new approach utilizing three major innovations:

1. A high order of RF selectivity
2. Exceptional stability
3. Audio modulation that doesn't degrade selectivity and stability.

Lamb's first article was the lead article and occupied eight full pages in *QST*, but it was heavily theoretical. Even though he sketched out a plan for a receiver capable of separating signals a mere 500 Hz apart and

[1]Notes appear on page 73.

rigorously defined "single signal" reception, this opening salvo didn't detail the hardware to back up his theory.

The second and third articles eliminated all doubt that the future had arrived.[2,3] As Lamb explained, the foregoing theory might lead one to anticipate "a fearfully monstrous machine to put those abstractions to work." He went on to say that the ham could "Chuck that illusion right at the start. The rig that does the business is nowhere near as entangling as the principles on which it is based."

In a nutshell, and hardly doing justice to the magnitude of his innovations, Lamb detailed seven stages of signal processing between antenna and headphones. These included a tuned preselector stage to filter interference while also preventing the HF oscillator in the succeeding detector stage from radiating back through the antenna. This first detector and oscillator heterodyned the input signal to the IF stage where extraordinary selectivity was possible via the crucial contribution of crystal filtration. The IF filter was followed by an IF amplifier and then a second detector that heterodyned a beat frequency oscillator (BFO) for CW reception. The single signal that remained was then fed to an audio amplifier.

Lamb made no claim to have invented these technologies. Indeed, he expresses some surprise that his scheme had not been previously explored and adds, "a pretty thorough search and inquiry of people who ought to know have uncovered no previous disclosure of the combination of features that, coordinated, go to make up what we believe to constitute a new order of c.w. receiver performance."

Lamb's 1932 tour de force, comprising theory, schematics, photographs and the testimony of experienced operators was an obvious revolution in receiver engineering. An editorial note with the third article declared, "Extended experiment with this most recent of Jim Lamb's creations has left us with the firm conviction that it is really the set about which we have dreamed all these years." Now with the perspective of time, I will go so far as to say that this is the most influential receiver design ever published in *QST*. One measure of its influence is that all of the innovations introduced by Lamb in this 1932 marvel were quickly adopted by manufacturers of high performance receivers.

The Original Number 1

Since Lamb's prototype was extraordinary and its importance was fully appreciated at the time, I wondered what had become of it. To explore that mystery, I contacted ARRL Archivist Perry Williams, W1UED. A bit of exploration turned up the original Lamb prototype at ARRL headquarters. At this point in my research, finding the original single signal receiver was like finding a long-lost friend.

Lamb's prototype in the collection of ARRL HQ in Newington. As built, it used an ordinary broadcast receiver for the second IF and audio stages.

Those familiar with the National HRO probably recognize its indebtedness to the Lamb design described above. This is no mere coincidence. The HRO was the product of the extraordinary design team led by James Millen, W1HRX; with Herbert Hoover Jr, W6ZH; Dana Bacon, W1BZR, and others. Millen, at the time, had a close association with several of the leading lights at the ARRL, including Lamb. More than a few ARRL lab projects arose from discussions that took place at Millen's rural bungalow in Middleton, Massachusetts.

The HRO achieves perfection through the use of crystal filtered IF selectivity, a spectacular precision worm drive tuning arrangement and micrometer indicator dial designed by National engineer William Graydon Smith.

In addition, there is an innovative coil tray system that permits the use of precisely calibrated coil sets for each band. The HRO was immediately successful and was produced in staggering numbers for service in World War II.

By emphasizing the contribution of James J. Lamb, I'm not in any sense disparaging the efforts of Millen, Hoover and the HRO design team. The HRO is no mere copy of Lamb's single signal superhet. Indeed, the circuitry of the HRO departs from Lamb's design in a couple of areas. But overall the HRO embodies the groundbreaking, truly revolutionary design principles so coherently articulated by Lamb. If Lamb was the choreographer, Millen, Hoover and the National design team were the dancers who gave us a brilliant performance.

Notes

[1]J. J. Lamb, W1CEI, "What's Wrong With Our C.W. Receivers?" *QST*, Jun 1932, pp 9-16, 90.
[2]J. J. Lamb, "Short-Wave Receiver Selectivity to Match Present Conditions," *QST*, Aug 1932, pp 9-20, 90.
[3]J. J. Lamb, "An Intermediate-Frequency and Audio Unit for the Single-Signal Superhet," *QST*, Sep 1932, pp 9-16.

Photos by Brian R. Page, N4TRB.

Brian R. Page, N4TRB, is not an engineer although he has worked as one in the software industry for over 30 years. He received an MA in the History of Science from Virginia Tech in 1980 and now explores the history of radio from his home near Atlanta. Brian holds an Amateur Extra class license and has been an ARRL member for 40 years. You can reach the author at 1717 Tidewell Trce, Lawrenceville, GA 30043, **n4trb@arrl.net**.

New Products

RF PRODUCTS CATALOG FROM PASTERNACK ENTERPRISES

♢Pasternack Enterprises has released a new catalog of custom and standard RF, microwave and fiber optic products. With more than 20,000 different RF components such as cables, adapters and connectors available, this full-size, 250 page catalog includes 325 new items. New products include antenna products for most GPS, ISM, PCS, Wi-Fi, WiMAX, microwave, millimeter wave and other applications. Additional new products include bandpass filters, broadband directional couplers, fiber optic adapters and other items. For more information, or to order components or request a copy of the catalog, visit **www.pasternack.com**.

New Vice Director for Southeastern Division; Southwestern, West Gulf Divisions Remain Unchanged

On November 19, ARRL staff members opened ballots for the Director and Vice Director races in the Southeastern and West Gulf Divisions and the Director race in the Southwestern Division. After all the ballots were counted, there will be a new Vice Director in the Southeastern Division, while the West Gulf Division leadership team remains in place, as does the Director position in the Southwestern Division. Terms for Directors and Vice Directors begin at noon on January 1, 2011 and run for three years.

ARRL Southeastern Division Director Greg Sarratt, W4OZK

The following ran unopposed and were earlier declared the winner of their elections by the League's Ethics and Elections Committee: Pacific Division Director Bob Vallio, W6RGG, and Vice Director Jim Tiemstra, K6JAT; Rocky Mountain Division Director Brian Mileshosky, N5ZGT, and Vice Director Dwayne Allen, WY7FD; and Southwestern Division Vice Director Marty Woll, N6VI. The rules state that if a candidate is running unopposed, he or she shall be declared the winner without balloting.

Southeastern Division

Incumbent Southeastern Division Director Greg Sarratt, W4OZK, of Huntsville, Alabama, faced two challengers for his position: Sherri Brower, W4STB, of Vero Beach, Florida, and Doug Rehman, K4AC, of Mount Dora, Florida. Sarratt was the winner, with 2074 votes. Rehman came in second with 1555 votes, and Brower came in third with 1529 votes. Sarratt has served one term as Director; in 2007 he was elected to replace long-serving Director Frank Butler, W4RH, who retired.

Two candidates were seeking the Vice Director position in the Southeastern Division: incumbent Jeff Beals, WA4AW, of Loxahatchee, Florida, and Andrea Hartlage, KG4IUM, of Grayson, Georgia. Hartlage was declared the winner, garnering 3573 votes; Beals had 1615 votes. Beals was appointed Vice Director in June 2009 upon the death of Vice Director Sandy Donahue, W4RU.

Newly elected ARRL Southeastern Division Vice Director Andrea Hartlage, KG4IUM

Southwestern Division

Current ARRL Southwestern Division Director Dick Norton, N6AA, of Topanga, California, faced challenger Carl Gardenias, WU6D, of Perris, California, with Norton the victor. Norton, who was seeking his third term as Director, had 2218 votes, while Gardenias had 1132 votes.

West Gulf Division

Current ARRL West Gulf Division Director Dr David Woolweaver, K5RAV, of Harlingen, Texas, faced Larry Essary, K5XG, of Lucas, Texas, in the West Gulf Division Director race. With 2387 votes, Dr Woolweaver was declared the winner; Essary received 1262 votes. Dr Woolweaver previously served as Vice Director from 2000 to 2009 and became Director upon the resignation of Coy Day, N5OK.

ARRL Southwestern Division Director Dick Norton, N6AA

ARRL West Gulf Division Director Dr David Woolweaver, K5RAV

ARRL West Gulf Division Vice Director John Robert Stratton, N5AUS

Incumbent West Gulf Division Vice Director John Robert Stratton, N5AUS, of Austin, Texas, squared off against challenger Michael Reynolds, WØKIE, of Tulsa, Oklahoma. Stratton won the race with 2427 votes; Reynolds had 1203 votes. Stratton was appointed Vice Director in August 2010, after the resignation of John Thomason, WB5SYT.

"It is great to see such an interest on the part of members in this election," said ARRL Midwest Division Director Cliff Ahrens, KØCA. "I would like to thank everyone for running and also thank the ARRL members in the Southeastern, Southwestern and West Gulf Division who participated. The big turnout shows the high level of interest our members have in Amateur Radio."

Along with Ahrens, New England Division Director Tom Frenaye, K1KI, and ARRL Chief Executive Officer David Sumner, K1ZZ, served as election tellers; Ahrens and Frenaye are members of the ARRL's Ethics and Elections Committee. Erik Morrissey 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 Atlantic, Dakota, Delta, Great Lakes and Midwest Divisions. In accordance with League's Bylaws, ballots will be counted on November 18, 2011.

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

FCC ISSUES *REPORT AND ORDER* ON VANITY AND CLUB STATION CALL SIGNS

In November 2009, the FCC issued a *Notice of Proposed Rule Making* (*NPRM*) — WT Docket No. 09-209 — seeking to amend the Commission's Amateur Radio Service rules to clarify and codify existing procedures governing the vanity call sign system. The *NPRM* also sought to revise certain rules applicable to club stations. The ARRL submitted its comments to the FCC on March 26. On November 8, 2010, the FCC issued a *Report and Order* (*R&O*) with its decisions. These new rules will take effect 60 days after publication in the *Federal Register*.

In the *Report and Order*, the FCC amended and clarified its rules with respect to Amateur Service vanity call signs "in order to promote processes that are more equitable and administratively efficient." The FCC has amended its vanity call sign rules to clarify the date on which the call sign associated with a license that is canceled due to the licensee's death becomes available for reassignment and clarifies the exceptions to the general rule that a call sign is unavailable to the vanity call sign system for two years after the license terminates. As for club stations, the FCC has placed limits on who can file applications on behalf of a club, how many vanity call signs a club can hold and how many clubs can have the same license trustee.

According to the FCC, almost 80,000 licensees have replaced their sequentially issued Amateur Radio call signs with a vanity call sign since the program began in 1996. When the program began, the Commission established what they called "the broad outlines" of the vanity call sign system, concluding that call signs generally should not be available for reassignment for two years following the death of a licensee, or expiration or termination of the license for that call sign. In doing so, the Commission made exceptions for former holders of the call sign, close relatives of a deceased former holder and club stations of which a deceased former holder was a member.

Here are the highlights of the *Report and Order*:

Availability of Call Signs Assigned to Stations of Deceased Licensees

■ The FCC has codified that a signed request for license cancellation accompanied by a copy of a death certificate, an obituary or data from the Social Security Death Index [SSDI] that shows the date of death is necessary to cancel the license of a deceased amateur.

■ The FCC clarified the rules to provide that the two year waiting period starts on the licensee's date of death.

■ A call sign that is canceled due to the death of a licensee more than two years earlier, or within 30 days of the second anniversary of the licensee's death, will remain unavailable to the vanity call sign system for 30 days following the date the staff takes action to cancel the license.

Exceptions to the Two Year Waiting Period

■ *Former Holders of the Call Sign*: A former holder of the call sign is exempt from the general rule that a call sign shown on an expired, surrendered, revoked, set aside, canceled or voided license is unavailable to the vanity call sign system for two years.

■ *"Close Relatives" of the Licensee*: The term "in-law" includes "only a parent, step-parent, sibling, or step-sibling of a licensee's spouse; and the spouse of a licensee's sibling, step-sibling, child, or stepchild; or the spouse of a licensee's spouse's sibling or step-sibling." The other "close relatives" are the deceased former holder's spouse, children, grandchildren, step-children, parents, grandparents, step-parents, brothers, sisters, step-brothers, step-sisters, aunts, uncles, nieces and nephews.

■ *"In Memoriam" Call Signs*: One exception to the two year waiting period applies to licenses for club stations who request the call sign of a deceased licensee when the club station trustee has the written consent of a close relative of the deceased. The FCC codified that the decedent's club membership need not be current at the time of his or her death, as long as the decedent was a bona fide member of the club at some time during his or her life.

Ineligible Applicants

When a vanity call sign for which the most recent recipient was ineligible is surrendered, canceled, revoked or voided, the two year requirement does not apply; however, the call sign will not be made available to the vanity call sign system for 30 days after information regarding the acknowledgment or determination of ineligibility is posted to the license in the Commission's licensing system.

Other Club Station Licensing Issues

■ *Club Trustee Issues*: Applications requesting a change in trustee are required to include documentation signed by an officer of the club when the application is submitted to the Club Station Call Sign Administrator (CSCSA). This is in order to "prevent a departing trustee from making off with the club license and call sign or refusing to agree to a change in trustee" and "address instances in which a trustee becomes incapacitated."

■ *Class of Trustee*: Novice class licensees may now serve as club station trustees, "for frequency and operating privileges are determined solely by the class of operator license held by the control operator, rather than the license held by the club station trustee." (The FCC noted that "cumbersome" identification procedures are required when a control operator is using privileges that exceed those of the station licensee, however.)

■ *Limits on Club Station Licenses*: Club stations may hold only one vanity call sign, but may hold an unlimited number of sequential call signs. Club stations currently holding more than one vanity call sign may renew or modify their existing station license grants, but not obtain any additional vanity call signs. The prohibition on obtaining additional vanity call signs includes in memoriam call signs formerly assigned to deceased members of the club.

■ *Who May Serve as Trustee*: An individual may be the trustee for only one club station license grant. Individuals who currently serve as trustee for more than one club may continue to serve as trustee of those clubs, but may not be designated the trustee of any additional clubs.

Conforming Rule Changes

■ The FCC amended Part 97 to remove obsolete references to Technician Plus class operator licenses. Technician Plus class operator licenses have now either expired or been renewed as Technician class operator licenses.

■ In 2000, the FCC decided not to renew Radio Amateur Civil Emergency Service (RACES) station licenses. Now that the last RACES license has expired, the FCC amended Part 97 to remove references to RACES station licenses.

■ The FCC revised Section 97.21 to reference Section 1.949 of the rules that requires that renewal applications be filed no sooner than 90 days prior to expiration of the license.

Proposals Not Adopted

■ The FCC chose not to adopt proposals from the ARRL that would have expanded the pool of available call signs and would have limited Group A vanity call signs to United States citizens.

■ Also not adopted were proposals from other commenters to limit vanity call signs to the call area of the applicant's residence and to eliminate the fee to renew a license with a vanity call sign.

ARRL REPLIES TO WIRELESS SERVICES FILING IN 2304 MHz BAND INTERFERENCE DEBATE

On October 28, 2010, the ARRL filed a *Reply* to a Wireless Services *Opposition* filing, the latest in an ongoing series of exchanges regarding the FCC's proposal to allow mobile broadband services, in addition to fixed services, to operate in parts of the 2.3 GHz band. The Amateur Radio Service has a secondary allocation at 2300-2310 MHz.

Here is a brief recap of the previous actions that led to the ARRL's latest filing:

May 20, 2010: The FCC adopted amendments to its rules for Wireless Communications Services (WCS) in the 2.3 GHz band to permit mobile broadband services, in addition to fixed services, in the 2305-2317.5 and 2347.5-2360 MHz bands.

September 1, 2010: Concerned with the potential for harmful interference to amateur operations at 2.3 GHz, the ARRL filed a *Petition for Clarification or Partial Reconsideration* with regard to one aspect of the new rules.

October 18, 2010: The WCS Coalition filed an *Opposition* to the ARRL *Petition*.

In its September 1 filing, the ARRL requested that the Commission affirm:

- That the current out-of-band emission (OOBE) limits for WCS devices set forth at Section 27.53(a)(3) of the Commission's rules continue to apply to mobile, portable and fixed facilities across the *entirety of the 2300-2305 MHz band* following the rule changes implemented in the FCC's original *Report and Order*.
- That Section 2.102(f) of the Commission's rules applies to Wireless Communications Service (WCS) fixed and mobile operations, so that harmful interference that is caused to Amateur Radio Service operations in the 2300-2305 MHz band is to be remedied by WCS licensees.

If the Commission wasn't able to take positive action on these requests, the ARRL asked that the *R&O* be reconsidered.

In its October 18 *Opposition* to this filing, the WCS raised no objection to the first request but opposed the second. The WCS, in essence, claimed that because the Amateur Service is secondary at 2300-2305 MHz and they are primary above 2305 MHz, they are not obligated to protect the Amateur Service from harmful interference.

The ARRL *Reply* states in part: "WCS licensees, under existing rules: (1) have no entitlement to cause interference to licensed radio services outside of the Part 27 allocations beginning above 2305 MHz; and (2) *do* in fact have an obligation pursuant to Section 2.102(f) of the Commission's Rules [47 C.F.R. 2.102(f)] to protect Amateur station operation in the 2300-2305 MHz band from interference due to WCS transmissions above 2305 MHz. Section 2.102(f) states that "(t)he stations of a service shall use frequencies so separated from the limits of a band allocated to that service as not to cause harmful interference *to allocated services* in immediately adjoining frequency bands….

"The 2305-2310 MHz segment is allocated to the WCS now on a primary basis and to the Amateur Service on a secondary basis. There is no doubt but that at 2305-2310 MHz, Amateur operations are secondary to WCS operations and are not protected from interference from WCS facilities. However, *WCS has no allocation below 2305 MHz*, and the Commission's rules (and the domestic Table of Allocations, Section 2.106 of the Commission's rules) are quite clear that WCS licensees enjoy no entitlement to disrupt adjacent band radio services, and never have."

The ARRL *Reply* points out that Section 2.102(f) "is taken almost verbatim from the international Radio Regulations, and so could not have had the limited application that WCSC erroneously surmises that the Commission intended."

ARRL General Counsel Chris Imlay, W3KD, commented: "We are helped by the FCC rule that *specifically says* what we urged the FCC to clarify. That rule comes from the international Radio Regulations."

INFORMATION EXCHANGE AND CAMARADERIE HIGHLIGHT IARU REGION 2 CONFERENCE

The 58 delegates and observers who gathered in Salinitas, Sonsonate, El Salvador for the 17th General Assembly of IARU Region 2 experienced a busy and enjoyable week. The conference began on October 4 and concluded on October 8. Twelve IARU Member-Societies in the Americas were represented in person, with another seven represented by proxy. President Kay Craigie, N3KN, served as the voting delegate for the ARRL and was assisted by International Affairs Vice President Jay Bellows, KØQB, and Executive Vice President David Sumner, K1ZZ. Observers from IARU Regions 1 and 3 and the International Secretariat were present to assist and to learn from the conferees.

The conference was formally opened by Dr Luis Méndez Menéndez, head of SIGET, the telecommunications administration of El Salvador. He brought the welcome news that El Salvador has acceded to the Protocol amending the Inter-American Convention on an International Amateur Radio Permit to extend its benefits to European holders of the CEPT Radio Amateur License and to amateurs from the Americas visiting CEPT countries. This step brings the Protocol of Amendment into force and will allow the regional telecommunications organizations for Europe and the Americas, CEPT and CITEL respectively, to work out the administrative details. The arrangement will apply only to Panama and El Salvador until additional countries in the Americas accede to the Protocol of Amendment. The United States, Canada and Peru already participate in the CEPT arrangement.

Delegates shared presentations on a number of important and useful topics. Vantroi Peña, HI8VP, Secretary of Radio Club Dominicano, graphically described the assistance to Haitian earthquake relief work by amateurs of the Dominican Republic and how the equipment provided by and through the ARRL was put to good use. Delegates of Radio Club de Chile (RCCH) described the effects of the earthquake that struck their country a few weeks later and the communications assistance that radio amateurs were able to provide; they expressed gratitude to Region 2 for its financial support toward repairs to the RCCH club station. Chuy López-Villalobos, XE2N, explained how amateurs in Mexico are using digital modes in emergency preparedness. Delegates of LABRE, the national society for Brazil,

COURTESY IARU REGION 2

Dr Luis Méndez Menéndez, head of SIGET (the telecommunications administration of El Salvador) formally opened the IARU Region 2 General Assembly.

demonstrated a Web site where the exact location of Brazilian amateur stations can be seen. On behalf of the Federación de Radioaficionados de Cuba, Region 2 Director Pedro Rodriguez, CO2RP, described the Caguairán homebrew transceiver project that is intended to improve the emergency communications capabilities of Cuban amateurs. David Sumner, K1ZZ, gave presentations on the WSPR HF beacon protocol and its associated Web site and on the World Radiosport Team Championship held in Russia this past July.

Among numerous items of formal business, the General Assembly made minor corrections and additions to the Region 2 Band Plan; the revised LF/MF/HF Band Plan dated October 8, 2010 is now available (view it at **www.arrl.org/files/media/News/R2_LF-MF-HF_Bandplan_2010.pdf**). With the successful implementation of a new procedure for reviewing and updating the Band Plan, the Region 2 HF Committee was eliminated.

An ARRL paper, "Amateur Radio Operators and Tropical Cyclone Events," was accepted for publication on the Region 2 Web site in both English and Spanish; it provides guidance for amateurs on how to prepare for hurricanes and typhoons.

Region 2 President Reinaldo Leandro, YV5AMH; Secretary Ramón Santoyo V., XE1KK, and Treasurer Noel Donawa, 9Y4NED, were re-elected for three-year terms. José Arturo Molina, YS1MS, was elected to replace Dario Jurado, HP1DJ, as Vice President. Returning as Directors are Daniel Lamoureux, VE2KA; Marco Tulio Gudiel, TG9AGD, and Gustavo de Faria Franco, PT2ADM; they are joined by newly elected Directors Jay Bellows, KØQB, and Galdino Besomi, CE3PG. Santoyo and Donawa will serve as Directors as well as officers. Longtime Director Ron Szama, LU2AH, stood aside in favor of Besomi and delivered a stirring tribute to Region 2 and to the friendships he has made in three decades of involvement with the IARU. Rod Stafford, W6ROD, did not seek re-election as a Director of Region 2 because he now serves as IARU Secretary.

A proposal by the Federación Mexicana de Radio Experimentadores to host the 18th Region 2 General Assembly in 2013 in Monterrey, Mexico was accepted with thanks.

US CHARGES GLENN BAXTER, K1MAN, WITH FAILURE TO PAY FINE

Two US Attorneys have filed a *Complaint* in US District Court against Glenn Baxter, K1MAN, for not responding appropriately to an order that he pay a $21,000 fine for violating several sections of Part 97. The *Complaint* was filed October 25 in the US District Court for Maine.

The civil action was brought under Section 503(b) of the Communications Act of 1934, as amended, and Section 1.80 of the FCC Rules and Regulations.

The fine had been levied, according to the *Complaint*, "for defendant's willful and repeated violations of Sections 97.101(d) [commencing transmissions on top of existing communications on 3.890 MHz] and 97.113(a)(3) [transmitting communications in which the station licensee or control operator has a pecuniary interest] of the Commission's Rules, and for the defendant's willful violation of Section 97.105(a) [exercising control over station] and 97.113(b) [broadcasting] of the Rules, and for failure to file requested information pursuant to an Enforcement Bureau directive." [information in brackets added]

The *Complaint* seeks to force payment of the $21,000 fine along with a filing fee and "such other and further relief as the Court deems just and proper."

ARRL PRESIDENT MAKES FINAL QSO WITH AUSTRALIA'S WIA CENTENARY STATION

The Wireless Institute of Australia (WIA) marked the conclusion of their VK1ØØWIA centennial special event operation on October 31 with a QSO between WIA President Michael Owen, VK3KI, and ARRL President Kay Craigie, N3KN. Logged at 1255 UTC — five minutes before midnight in Australia — the QSO between N3KN and VK1ØØWIA, with VK3KI at the microphone, was the last contact recorded in the Australian special event's log.

The contact was made using EchoLink, with VK1ØØWIA using the VK3ANT node in Melbourne, Victoria. Craigie used the K4IJ 440 MHz repeater in Roanoke, Virginia to access the EchoLink node of the linked North Carolina Hospital Emergency Amateur Radio System repeaters (NCHEARS); the NCHEARS system was also linked to the South Carolina Healthcare Emergency Amateur Radio Team repeaters. Repeater users across three states were able to hear the historic conversation between two continents.

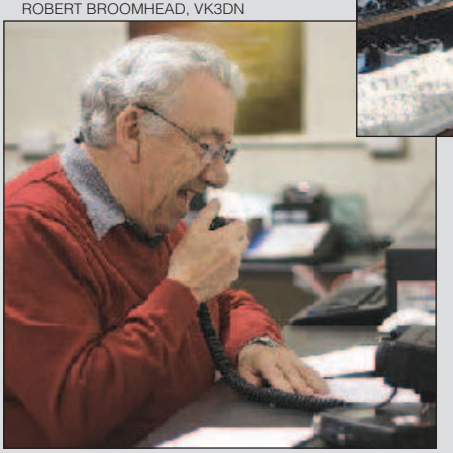
More than 50 WIA-affiliated clubs have used the VK1ØØWIA call sign for almost six months as part of WIA's centennial celebration; the WIA is the oldest Amateur Radio national society. For this contact, VK1ØØWIA was operated portable for the Westlakes Amateur Radio Club, the club privileged to be the last club to use the call sign. Since VK1ØØWIA went on the air in May, it logged 24,439 contacts.

Owen told Craigie that the WIA was pleased that the special event station's final contact could be with her, and thanked the ARRL for its support and for participating in the WIA Centenary Weekend through ARRL International Affairs Vice President Jay Bellows, KØQB. Owen also said that

CARTER CRAIGIE, N3AO

ARRL President Kay Craigie, N3KN, made the final QSO to VK1ØØWIA, the special event station call sign that celebrated the Wireless Institute of Australia's centenary.

ROBERT BROOMHEAD, VK3DN



In Australia, WIA President Michael Owen, VK3KI, chatted with Craigie (who was in Virginia) during the last QSO using the VK1ØØWIA special event call sign.

the WIA was "passing the baton on to the ARRL, as the ARRL would be celebrating its centenary in four years."

Craigie congratulated the WIA on their 100 years of service to Amateur Radio in Australia, wishing them well as they begin their second century. She noted that strong national societies around the world, working together through the International Amateur Radio Union, are essential for the future well-being of Amateur Radio. Owen expressed the WIA's appreciation for the ARRL's contribution to Amateur Radio, especially the League's service as the International Secretariat of the IARU.

"Through their extensive program of centennial observances — including the VK1ØØWIA operation — the WIA has set the bar very high for the ARRL's own 100th anniversary activities in 2014," Craigie said after the QSO. "I am honored to have been invited to be the last station to work VK1ØØWIA on behalf of the ARRL and our members."

In Brief

COURTESY CHAMPA FAMILY

John Champa, K8OCL (SK)

- **John Champa, K8OCL (SK)**: John Champa, K8OCL, of Richardson, Texas, passed away from complications of cancer on November 12. He was 66. An ARRL Life Member, Champa was the former Chairman of the ARRL HSMM (High Speed Multimedia) Working Group and Executive Vice President of AMSAT-NA. He was also the High Speed Multi-Media Radio Contributing Editor for *CQ VHF* magazine. Champa did early work in Amateur Television (ATV) and later Amateur Digital Video (ADV). His recent focus was on PropNET, Automatic Packet Reporting (APRS) and GPS navigation systems, HSMM radio and HF digital modes. Champa is survived by his wife Karen and four children and seven grandchildren. Two of his children are hams: Becca McLaughlin, KE5LVN, of San Antonio, Texas and Patrick Champa, KC8LQA, of Fort Drum, New York. *— Thanks to Walt DuBose, K5YFW, and Doug Kilgore, KD5OUG, for the information*

- **New Amateur Radio Satellites in Orbit**: On November 19, five research satellites were carried to orbit aboard a Minotaur V rocket from Kodiak Island, Alaska. All the satellites use Amateur Radio frequencies and hams have been invited to participate in their missions by monitoring and collecting data. Two of the satellites are FASTRACs — relatively small "nanosatellites" — built by students at The University of Texas in Austin. They enter orbit as a single spacecraft, but then separate into FASTRAC 1 (known as "Sara Lily") and FASTRAC 2 (referred to as "Emma"). Both satellites use 1200 or 9600 baud AX.25 digital communication and transmit at 1 W output, so they should be receivable with omnidirectional VHF or UHF antennas and decodable by ordinary packet radio hardware and software. After their scientific missions are complete, the satellites will be reconfigured to function as digipeater relays for Amateur Radio use, as part of the Automatic Packet Reporting System (APRS). Details, including downlink/uplink specifics for the FASTRAC satellites as well as information on the other three satellites, are at **www.arrl.org/news/hams-invited-to-listen-for-new-satellites**.

- **New Chief for US Air Force MARS**: Richard Jenson — a Program Manager at the Air Force Network Integration Center at Scott Air Force Base, Illinois — has been selected as the new Chief of Air Force MARS (USAF MARS). "I am honored to have been selected to lead this organization of dedicated volunteer radio communicators and am enthusiastic about my new responsibilities," Jenson said. "The members of Air Force MARS can be rightly proud of their service to the nation, and I am eager to work with all of them as we enhance our ability to serve those who serve us."

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Maryland/DC, Nevada, New Hampshire, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas 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. Photocopied signatures are not acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms FSD-129 are available on request from ARRL Headquarters but are not required. A sample nomination form is available on the ARRL Web site at **www.arrl.org/section-terms-nomination-information**.

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 4, 2011. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2011, to full members of record as of March 4, 2011, which is the closing date for nominations. Returns will be counted May 24, 2011. Section Managers elected as a result of the above procedure will take office July 1, 2011.

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, 2011. If no petitions are received from a section by the specified closing date, such section will be resolicited in the July 2011 *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* QST

Ham Radio and Project Lifesaver

Lee Becham, KD4NTS
kd4nts@arrl.net

Sometimes there are things that make you say "this is the perfect opportunity for Amateur Radio to get involved," and Project Lifesaver International (PLI) is such a thing. There may be several of you who are not familiar with PLI. It is my hope that this article will expose members of the Amateur Radio community to this endeavor and to describe the details of how the LaGrange Amateur Radio Club (LARC) of LaGrange, Georgia, has become a helpful tool to the local law enforcement agencies in times of need. Since the author is not affiliated with any first responder agency, an explanation of the project and details from a recent search and rescue operation will be presented with an emphasis from a radio amateur's perspective.

Use Foxhunting Skills to Save Lives

As stated on Project Lifesaver International's Web site (**www.projectlifesaver.org**), the mission is "to provide rapid response to save lives and reduce potential for serious injury for adults and children who wander due to Alzheimer's, Autism, Down's syndrome, dementia and other related disorders." This rapid response is delivered in the form of bracelets with tiny transmitters. The transmitter emits a beacon every second that enables nearby receivers to home in on its location using foxhunting equipment and techniques. The project participant simply has to wear the bracelet like a wrist watch.

In West Point, Georgia, former Chief of Police David Kerr brought PLI to the area after a town resident described how her mother was a participant in Ozark, Alabama. The program was first discussed in December 2007 and the first bracelet was issued only a couple of months afterward. Currently, there are 15 PLI participants in the tricounty area that covers Chambers County, Alabama and the counties of Troup and Harris in Georgia. Most of the project's funding is from local telethons and other fund-raising activities sponsored by the local first responder agencies.

After being introduced to the LARC, its activities and public service capabilities, Chief Kerr divulged that he had been a ham many years ago but had allowed his license to expire. Having now been reintroduced to the benefits of ham radio, Kerr's interest in the hobby was rekindled and soon afterward he earned his ticket to become WB4COP (a fitting call sign).

LEE BECHAM, KD4NTS

The Project Lifesaver Bracelet is about the size of a large wrist watch.

DAVID KERR, WB4COP

The Operations Room of the Mobile Command Vehicle.

After joining the LARC, Kerr, as a promoter of Project Lifesaver, explained the benefits and demonstrated the PLI transmitter and the specialized receiver during a May 2009 club meeting. The transmitting device is about the size of a large sports watch but has no display (see photo). The transmitter has an approximate range of 1 mile under ideal conditions on the ground and up to approximately 7 miles via aircraft. The transmitter emits a short CW chirp at 1 second intervals with a digital unit identifier being transmitted every 10 seconds.

Methods and Equipment

The PLI receiver is an HR2600 Osprey receiver with a 4 MHz bandwidth centered on 216 MHz. It has separate controls for gain and volume to aid in comforting the ears during long searches. The receiver comes with a lightweight pistol-gripped Yagi antenna. The transmitter bracelet and receiver are waterproof to withstand the harshest of weather conditions.

Most handheld Amateur Radio receivers will not tune to the 216 MHz band and a large percentage of those that will cannot change modes to either CW or SSB in order to hear the audible tone from the transmitter. This will present a problem for those who depend on audio signals while foxhunting. On FM and AM the signal will be present only in the form of a silent carrier and searchers will need to use a little ingenuity in their technique. One such technique is to open up the squelch and then home in on the signal that "silences" the squelch. This silence is the brief period during which there is a carrier from the bracelet.

After this initiation into the Project Lifesaver program, LARC began organizing its own search and rescue drills using standard foxhunting equipment. After establishing a writ-

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

ten procedure, the club performed "coordinated" foxhunts in which all participants worked together as a group instead of individually as one would during competition foxhunts.

While using all the same techniques as one would during a foxhunt, the difference in the coordinated drill is that all positions and RF bearings are radioed back to a common station, usually net control, and every team's information is plotted on a common map.

This requires that every team has a compass, a map, a GPS unit (each team's GPS unit must use the same coordinate system and map data) and a common, unambiguous method of representing the coordinates. Believe it or not, this actually takes quite a bit of planning and practice before everyone is operating on the same page. These drills helped prepare us for what was to come.

DAVID KERR, WB4COP

A view of the Radio Room of the Mobile Command Vehicle.

This Is Not a Drill

At 1814 CDT on the night of July 14, 2010, the family of an Alzheimer's patient called the Chambers County, Alabama Sheriff's department indicating that their mother, a PLI participant, could not be located. The family stated that a 2 hour search yielded nothing and also indicated that she could have been missing as early as 1300. Chambers County PLI coordinator Jon Herbert (of the County Sheriff's Department) immediately activated the agencies involved in the tricounty PLI project, which included David Kerr. Kerr notified LARC at approximately 1820. Richard Trainer, KE4YCY, and Shirley Trainer, KE4YCX, activated the emergency call-down list and by 1845, all members of the Amateur Radio club that could be had been contacted. I received my call at 1844 from Gary Sheets, AD4GS, and he was adamant that this was not a drill.

I suspected that my ICOM IC-91AD handheld transceiver would not be adequate to receive the PLI signal, so I called a fellow ham, Steve Mobley, WB4BXO, and asked if I could swing by and pick up his ICOM R-10 all mode, general-coverage handheld receiver. Steve agreed but when I arrived at his house he had decided to come with me and brought his R-10 with him.

We arrived at the staging area at approximately 1915. Several first responders, search and rescue volunteers and hams were already on the scene awaiting instructions. The Incident Commander Jon Herbert and the Operations Officer Mitt Smith (of the West Point Fire Department) were in the process of creating search teams and dispatching them with the PLI receiver equipment. In addition, dive teams were alerted, as well as an aircraft unit complete with a PLI receiver. Due to the lateness of the day, an Alabama State Patrol helicopter was also dispatched with Forward Looking Infrared (FLIR) equipment [an imaging technology that uses body heat to locate people — *Ed.*] that would assist with the search after dusk.

Since we were some distance from the repeater and most amateurs were using their handheld transceivers during the search, we switched to simplex on 146.500 MHz on site and used the club repeater on 146.700 MHz for talk-in or other communications in and out of the site. I started the net at 1922 from my car, some 38 minutes from my callout time and there were over 20 hams on site with more on the way. I also had Richard and Shirley Trainer designated to be the off site, backup net control station in case the Mobile Command Post went silent for some reason. The Mobile Command Vehicle arrived and was operational within minutes, allowing the net control operations to transition from my car to inside the command vehicle at 1925.

The Mobile Command Vehicle is equipped with eight commercial radios, already programmed for every first responder frequency in the area, and one Amateur Radio — a Yaesu FT-8800R (see photo). The "radio room" is at the very back of the vehicle and can be closed off via a standard door. At the front of the vehicle is the "command room" where all the decisions are made. This room is equipped on all walls with dry erase boards and each panel has a specific purpose. One section is for a personnel log, one for search teams, one for a timeline history, one for information about the search subject, another for area maps with clear cellophane overlays for making notations and the last section for logistics (see photo).

Once net control transferred operations to the Command Post, Steve Mobley was the co-net control operator and we both took turns at logging, handling radio traffic and delivering messages to the Incident Commander (IC) and the Operations Officer (OO). Several search teams were dispatched by the IC with five of them equipped with PLI receivers. Other teams were comprised of ground units, ATVs and Amateur Radio operators. Most teams would communicate back to the Command Post via public service radios, while the hams would use Amateur Radios.

The Hunt Begins

Each team was dispatched to a certain area to determine if they could receive a PLI signal. At 2006, the search aircraft was in the area. Within minutes, it received the signal from the bracelet. The pilot reported

Reminder About 2010 SET Reports

Thanks to the many Field Organization Leaders who have been submitting their 2010 Simulated Emergency Test (SET) reporting forms and/or ARRL Emergency Coordinator Annual Reports.

If you are an ARRL Emergency Coordinator (EC), District Emergency Coordinator (DEC), Section Emergency Coordinator (SEC), Net Manager (NM), Section Traffic Manager (STM) or other leader who has been designated for reporting your group's 2010 Simulated Emergency Test results, there is still time to send in your reports. Please send your reports to Headquarters by February 1, 2011.

Links to the 2010 SET reporting forms and the EC Annual Report are available at **www.arrl.org/public-service-field-services-forms**. When on this Web page, scroll down until you see these links titled Form A: EC Simulated Emergency Test Report; Form B: NM Simulated Emergency Test Report; Form C: EC Annual Report. Once you fill out the form, save it and then e-mail the form or forms to ARRL Headquarters via **sewald@arrl.org**.

Photographs showing your SET activities are welcome, too. Please consider sending some of your best pictures of the event and include a caption that identifies who is pictured and who took the photo.

If you mail reports to ARRL Headquarters via the US Postal Service, the mailing address is ARRL Headquarters, 225 Main St, Newington, CT 06111-1494. Thank you!

the coordinates to the Command Post. The pilot also reported that the signal was emanating from a location that was very close to the vehicle of Daniel Leach, KI4WIN, and Leo Cummings, KJ4KOA, who were using amateur foxhunting equipment. Daniel and Leo also indicated that they were receiving the PLI beacon.

Meanwhile, as the aircraft reported receiving the signal from the bracelet, the OO was determining checkpoints where he would send the remaining Amateur Radio operators to form a containment perimeter. Only a couple of operators were dispatched before the information from the aircraft redirected teams.

At 2021, the Net Control Operator relayed visual information from the plane to Daniel Leach indicating that the signal was coming from an area where a small stream crossed over the road and continued into a large field. Daniel asked Benjie Johnson (of the Standing Rock, Alabama Fire Department) if he was familiar with any location matching this description and Benjie responded that he was. He proceeded to the location on his ATV with Daniel and Leo following. By this time Kevin Allen, KJ4SYE, and his wife Amy had rendezvoused with Daniel and Leo and they all were tracking the PLI signal.

At 2025, Kevin reported to net control that the PLI participant had been found and was in good condition. Net control relayed the good news to the IC and the OO. Three minutes later, she arrived at the staging area and EMTs checked her over and found that she was only slightly dehydrated from the day's 100°F heat. David Kerr congratulated every person in the Command Post and shook their hand. After reconfirming that the subject was in good condition, all stations were requested to return to the staging area for a post-event roll call and debriefing.

The Aftermath

The time elapsed from the start of the emergency net to the time the PLI participant was located was 1 hour and 3 minutes. For all practical purposes, this was a successful search. All who participated should be proud of their contributions. The family members were extremely impressed and grateful for the huge turnout, which ultimately included 17 agencies and over 60 personnel!

Was it a perfect operation? Not by any stretch of the word. We had our share of issues and snafus ranging from call-out procedure errors, to net control errors, to stuck PTT errors, to invalid or inappropriate radio traffic. As a club, we have discussed some of the issues and will continue to improve ourselves in the areas we found to be faulty. There is no doubt that we can perform better, but it takes practice exercises and actual events to point out deficiencies. Notwithstanding all the errors, we are all glad and appreciative that the local first responders recognize the added benefits of having hams participate in an operation that seems molded for Amateur Radio.

Conclusion

The amount of time saved by Project Lifesaver is virtually immeasurable. The PLI participant was in a deep rural area with very little street access and practically no buildings around. There is no doubt that without PLI, the search would have lasted well into the night when darkness would have hindered progress even further. It is also feasible that a second operational period may have been needed to relieve the initial responders. Thanks to PLI for making this search and many others a quick and successful one.

If you are not familiar with PLI, I urge you to peruse the Resource Center of their Web site, watch the demonstration videos and encourage your local agencies to get involved. There are countless opportunities waiting for your community including special grants for those that qualify.

If your community is already participating in PLI, then contact the chairman of the project and explain the possible benefits of having an Amateur Radio club join the operations. This is a great opportunity for opening other doors with your local first responders. Ask if your club can be involved with the next PLI drill and describe your club's foxhunt capabilities.

Have your own search and rescue drills using a typical fox and invite the PLI coordinator to observe. Along with the fun of companionship and learning, you could be saving a life one day by utilizing exactly the same techniques used to put that special foxhunt trophy on your mantle.

Don't Forget the Grunts

Mike Corey, W5MPC
ARRL Emergency Preparedness and Response Manager
w5mpc@arrl.org

Over the last few years there has been a large push for emergency communications training and certification. The ARRL has developed courses to teach not only the basics of EmComm but also more advanced EmComm management skills.[1] Additionally, there is a focus on NIMS/ICS training, CERT training, CPR and First Aid, SKYWARN both basic and advanced, and a plethora of FEMA independent study courses. Training and certifications are important, but are they for everybody?

I would bet that almost every ARES® group has members who ask, "Do I have to take XXXX to be an ARES member?" The answer isn't necessarily "Yes." For ARES members who work in Emergency Operations Centers, shelters, public safety facilities and at National Weather Service offices, training is almost always necessary. In many cases, you can't even enter the building during an emergency unless you meet the training and certification requirements.

Not every ARES member or Amateur Radio volunteer serves in these places. There are needs that can be met by those who have the right skill set. Whether during an emergency or a public service event, there are needs for relay stations, station set up and construction, net control operators, traffic handlers, equipment maintenance and a variety of other necessary jobs that must be done. For most grunt work that must be done in an emergency, what is needed isn't a resume full of courses and a wall full of certificates. What is needed is skill and ability. This skill and ability comes through years of being involved as an Amateur Radio operator and a willingness to help when asked. For those who have the skill, ability and willingness to assist in an emergency, kudos to you! For our dedicated Amateur Radio emergency communication leaders, don't forget those who bring more expertise and experience than a classroom can offer.

[1]More information is available at **www.arrl.org/courses-training**.

OP-ED

Put the Mad Scientist Back Into Ham Radio

Eric P. Nichols, KL7AJ

I finally figured it out.

I have, at last, identified the one glaring difference between my generation of Amateur Radio experimenters and the current batch of 2 meter obsessed appliance operators.

In *our* day, it was our job to *create* emergencies. The new EmComm oriented hams are intent on "fixing" emergencies.

It's all so clear now. And the solution to this sad, current state of affairs is on its way.

How many of our "EmCommers" ever stuck a screwdriver into a wall socket when they were toddlers? Precious few, I'd venture to bet.

How many ARES® members in their youth set the carpet, the ceiling or the family cat on fire while attempting to build a Tesla coil or Jacob's ladder in their bedroom? Nary a one, I dare say.

Too Much Safety?

Far too much Amateur Radio "promotional" literature is wasted on trying to portray Amateur Radio as civilized, safe or useful.

I say, let's put the mad scientist back into ham radio where he belongs.

Take a look around you. How many people do you see of the younger generation? And I don't mean the under 55 crowd.

We say we want young blood in the hobby, but do we mean it? Look at what we have to compete with — paintball, bungee jumping and extreme skateboarding.

What do all these activities have in common?

They scare the tar out of you, that's what.

When's the last time you got a good scare out of Amateur Radio? Shucks, you have to really work at it to even get a tingle these days. Something is very wrong with this picture.

On the exceedingly rare occasion when a youngster *does* darken our doors, we generally drive him away with all kinds of excruciatingly boring things like club politics and repeater reports. Shucks, that stuff even bores the snot out of me, and I'm an old geezer.

Smoke and Flames and Moonbounce

I don't know about any of you, but despite my decrepit old age, I lucidly remember what it was like to be a teenager. It was the smoke and flames and moonbounce that attracted me to ham radio in the first place. If I was a teenager investigating the hobby nowadays with its current emphasis on homeland security

HAL KENNEDY, N4GG

and similar useful-but-dull activities, I would take up the daring hobby of stamp collecting instead. At least there would be the danger of getting a paper cut.

It's obvious our "youth recruiting" efforts are not working, because we never see any of them show up more than once. Statistics across the board bear this out.

We've done a pretty good job of scaring kids out of ham radio. It's about time we scared them back *into* it.

Ham radio needs to sizzle, crackle and bang!

Not to mention, *smell*. How many of this new generation even know what ozone smells like?

Come on people. Let's have some action. We've put a lot of emphasis on responding to emergencies. We should at least devote an equal amount of time to generating them. Lots of hams get some sort of vicarious thrill following emergency responders to some disaster site. Once in a while, they should be coming to *our* doors!

My dad understood this, even though he wasn't a ham. He was a helicopter design engineer in what is now Silicon Valley, in the very infancy of helicopter flight. He'd regularly come home with pieces of helicopter rotors that had embedded themselves in the walls of the hangar or other such informative artifacts.

"Well, *that* one didn't work so hot," he'd calmly announce.

It was a scary business, even if you weren't actually flying them yourself.

We radio amateurs *do* have the capacity to compete with paintball and skateboards. If we have the will. We just need to get back to the scary stuff of radio. The fun stuff.

I want to leave this hobby with my eyebrows smoldering and my ears ringing.

I think our kids want to enter it the same way.

Just ask them. I have.

[All who participate in Amateur Radio activities should do so safely — we want to have the pleasure of serving you as an ARRL member for many years to come. Having fun with Amateur Radio and observing basic safety considerations need not be mutually exclusive! — *Ed.*]

Eric Nichols, KL7AJ, an ARRL member, obtained his Novice license, WN6TEE, in Manhattan Beach, California in 1972. His first station was a Johnson Adventurer and a pair of brand new surplus ARC-5 receivers (one for 80 meters and one for 40) for which he paid a grand total of $20.

Eric eventually moved to North Pole, Alaska, to become chief engineer of KJNP Radio. He spent the next 17 years crawling around inside transmitters. He now works at Eielson Air Force Base. Prior to its closing, Eric did consulting work at HIPAS Observatory, an aurora research facility just outside of Fairbanks. Eric is a fanatic homebrewer and CW freak. He enjoys all aspects of low band operation and fiddles around with some 1750 meter operation as well as PSK31. He can be reached at **kl7aj@arrl.net**.

Op-Ed Policy

The purpose of Op-Ed is to air member viewpoints that may or may not be consistent with current ARRL policy.

1) Contributions may be up to 900 words in length.

2) No payment will be made to contributors.

3) Any factual assertions must be supported by references, which do not necessarily have to be included in the body of the article to be published.

4) Articles containing statements that could be construed as libel or slander will not be accepted.

5) The subject matter chosen must be of general interest to radio amateurs, and must be discussed in a way that will be understandable to a significant portion of the membership.

6) With the exception that the article need not be consistent with League policy, the article will be subject to the usual editorial review prior to acceptance.

7) No guarantee can be made that an accepted article will be published by a certain date, or indeed, that it will be published at all; however, only articles that we intend to publish will be accepted, and any article we have decided against publishing will be returned promptly.

8) Send your contributions to ARRL Op-Ed, 225 Main St, Newington, CT 06111 or via e-mail to **qst@arrl.org** (subject line Op-Ed).

This Month in Contesting

Sean Kutzko, KX9X
ARRL Contest Branch Manager, kx9x@arrl.org

LIFE IS SHORT; DO MORE RADIO

January is always a time of renewal. Along with several New Year's resolutions (I opted for the traditional "eat less and exercise more" resolutions myself), perhaps there are a few things we can do to improve our enjoyment of Amateur Radio. Yes, family is important and the well-balanced amateur certainly keeps all things in proportion.

January is the dead of winter. Assuming you already own your own gear, Amateur Radio is inexpensive, keeps you at home where it's warm, and can always provide a new challenge or activity — trying new modes or bands or even homebrewing a project. This is a good response to higher heating and gift-giving bills!

There are several contests coming up this month that you can really sink your teeth into, even with a modest station. The New Year starts off with a non-contest for the CW lover in all of us: **Straight Key Night**. For 24 hours beginning at 0000 UTC on January 1, many an amateur will dust off their old Novice CW key or perhaps an old bug, maybe hook it up to some vintage gear and work CW for the sheer joy of it. There's no rapid exchange, no awards or certificates, and no score to calculate. SKN is simply about enjoying CW the way it was sent for decades. I love using my old Novice key (a RadioShack special I bought in 1982 for $8) and remembering all my time on the 40 and 15 meter Novice bands. Try it yourself — simpler is sometimes better.

The ARRL RTTY Roundup, one of the great digital mode events, is January 8-9. The digital modes are popular in Amateur Radio contesting right now; we've seen a spike in RTTY participation over the last five years. Have you gone digital yet? If not, give it some thought; most major operating awards have digital options, including DXCC and Worked All States.

You can start your awards hunt all over again if you want! Getting into digital operating has never been easier; numerous interfaces are available to connect your rig to your PC's sound card. You could build one of many interfaces as found in *QST*, or commercially built units are available at your favorite ham retailer.

If you're brand new to contesting and have enjoyed the ARRL's new Rookie Roundup events (especially the CW RR last month), January offers an excellent entry-level event: **the North American QSO Party**. Sponsored by the *National Contest Journal*, the NAQP is as simple and straightforward as it can get: There's a 100 W power limit (no amplifiers), and the exchange is simply your first name and your state or province. It's also a short event, running only 12 hours. Single Operators are limited to only 10 of the 12 hours, so there's plenty of time to do other things on the weekend besides contest.

This is one event where a simple station can really shine — even stations compromised by covenants and restrictions. No antenna at all? Make a dipole for 20 or 15 meters and wrap it around the interior walls of your house or apartment as high as possible. It may not be great, but it's better than being off the air and you *will* make contacts with it. The CW version of NAQP runs from 1800 UTC Saturday, January 8 until 0600 UTC Sunday, January 9. For most of the US, this is a Saturday afternoon to late night affair. If you're not a CW operator, no worries — the SSB version is just a week later, from 1800 UTC Saturday, January 15 to 0600 UTC Sunday, January 16.

Fans of VHF+ operating will be able to work lots of stations the weekend of January 22 in **the ARRL January VHF Sweepstakes**. Rovers really have a field day with this event, packing complete multiband stations into a vehicle and operating from several locations during the contest period. As with most VHF+ contests, the exchange is simply your grid square. More on grid squares can be found on the ARRL Web site at **www.arrl.org/grid-squares**.

It's no secret that I'm a VHF contester, and I promote VHF contesting as heavily as I can. Here's a scenario: A ham has a fairly new rig, one that covers 160 through 2 meters (or even up through 440 or 1296 MHz). For some reason, however, the antenna connector on the back of the rig for the VHF/UHF bands doesn't get used as much as the one for HF. Sound familiar? Use this January's VHF Sweepstakes to utilize that rig to the fullest — try something new! A 3 element Yagi for 2 meters is small, and can be put up on a temporary TV mast in the back yard. A dipole for 6 meters is less than 10 feet long — make one and throw it in that tree outside your shack window. Go ahead… get that other antenna jack on the back of that dc-to-daylight rig of yours dirty!

The Importance of Fun

My girlfriend's father succumbed to cancer in October. He was a hard-working guy from Wall Street who had retired to rural Vermont several years ago. My first visit to "meet the parents" was, coincidentally, Field Day weekend. My girlfriend encouraged me to ask her dad if I could string up a wire for the weekend. He was excited about the activity and I discovered he had been a shortwave listener when he lived in Brooklyn while working. He had lots of questions and we had a great talk about his old Hallicrafters receiver.

I strung up a horizontal V in his tall conifers at the top of the hill and made a couple of hundred QSOs with a QRP rig. I wasn't terribly serious about my effort, and took frequent breaks from operating to be sociable. He constantly wanted to know what was going on, asking me if I'd talked with this state or that, what was the farthest contact I'd made, what made this antenna better than that antenna, and so on. He even made the climb up the stairs to the top-floor room I was in to observe what I was doing, despite being really tired from his illness. It was great fun to be able to share this with him.

The next week, I received an e-mail from him, asking me what shortwave receiver he should buy. The next time I went to his place, I rigged up an external wire for him to use with his new SWL rig. He enjoyed listening to the radio again, something he'd let slip past him many years ago because life had gotten in the way. It was a privilege to help him have fun with radio again in his final months.

Last night, after a weekend with my girlfriend with the kids and domestic chores, I sat down to enjoy some QRP CW from her place. Jonah, my girlfriend's 6 year old, has been fascinated with the radio and has been my "antenna helper" on several occasions. This time, though, he wanted to know about my CW paddle. I explained dots and dashes, and soon I was showing him how to send his name and other words in code.

Being a hands-on kid, he wanted to try. He climbed into my lap and I slowed the keyer down to 10 words per minute and let him have at it. After a couple of minutes of just enjoying making noise, he asked how to send certain words. Soon, broken CW was coming from the keyer's speaker. He went to bed vocalizing dits and dahs in random order, and now wants a poster with a Morse code guide for his wall. I don't know if you'll hear him sending CQ TEST anytime soon, but it was great being able to share radio with the little guy.

You never know when your time is up. Work when you have to, play when you can and share the fun with somebody else. If you're lucky, sharing the fun of radio and togetherness with the family can happen at the same time.

CONTEST CORRAL

in association with the *National Contest Journal*

JANUARY 2011

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site 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 1, 1500Z - Jan 2, 1500Z	3.5-14		Original QRP Contest		✘		RST, serial, and category	**www.qrpcc.de**
Jan 1, 2000Z - See Web site	1.8		EUCW 160 Meter Contest		✘		RST, serial, club name, member nr or "NR"	**www.uft.net**
Jan 2, 1800Z - Jan 2, 2400Z	**3.5-28**		**Kids Day**	✘			**Name, age, location, favorite color**	**www.arrl.org/kids-day**
Jan 4, 0200Z - Jan 4, 0400Z	3.5-28		ARS Spartan Sprint		✘		RST, S/P/C, and power	**www.arsqrp.blogspot.com**
Jan 8, 0000Z - Jan 8, 2400Z	3.5-28		070 PSKFest			✘	Call sign, RST, S/P/C	**www.podxs070.com/**
Jan 8, 0000Z - Jan 9, 2359Z	1.8-28		Hunting Lions In the Air	✘	✘	✘	RS(T), serial or name, club name, district	**lionshuntingintheair.lionwap.org**
Jan 8, 1200Z - Jan 9, 2359Z	1.8-28	50	MI QRP Club Jan QRP Contest		✘		RST, S/P/C, MI QRP number or power	**www.miqrp.org**
Jan 8, 1800Z - Jan 9, 2400Z	**3.5-28**		**ARRL RTTY Roundup**			✘	**RST, state/province/serial**	**www.arrl.org/contests**
Jan 8, 1800Z - Jan 9, 0600Z	**1.8-28**		**North American QSO Party**		✘		**Name and S/P/C**	**www.ncjweb.com/naqprules.php**
Jan 9, 0900Z - Jan 9, 1059Z	28		DARC 10 Meter Contest	✘	✘		RS(T), serial, DOK code	**www.darc.de/referate/dx/fedcz.htm**
Jan 9, 1000Z - Jan 9, 1400Z	3.5-28		Midwinter QSO Party	✘	✘		RS(T) and serial	**trafficbureau.veron.nl**
Jan 12, 2300Z - See Web site	1.8-7		Linc Cundall Memorial CW Contest		✘		See Web site	**www.antiquewireless.org/hamevents2010.htm**
Jan 15, 0000Z - Jan 15, 0400Z	3.5, 7		LZ Open Contest		✘		6-digit serial and serial from previous QSO	**www.lzopen.com**
Jan 15, 0600Z - Jan 15, 1400Z	3.5-28	144/ 432/1.2G	Int'l United Teenager Contest	✘	✘		RS(T) and age or "RT"	**www.qrz.ru/contest/detail/140.html**
Jan 15, 1200Z - Jan 16, 1200Z	3.5-28		UK DX RTTY Contest			✘	RST and serial	**www.ukdx.srars.org**
Jan 15, 1200Z - Jan 16, 1200Z	1.8-28		HA DX Contest	✘	✘		RS(T) and serial	**www.ha-dx.com**
Jan 15, 1600Z - Jan 15, 1800Z	1.8-28		Feld-Hell Gridloc Sprint			✘	RST, QTH, Feld-Hell number	**www.feldhellclub.org**
Jan 15, 1800Z - Jan 16, 0600Z	1.8-28		North American QSO Party	✘			Name and S/P/C	**www.ncjweb.com/naqprules.php**
Jan 20, 0130Z - Jan 20, 0330Z	3.5-14		NAQCC Monthly QRP Sprint		✘		RST, S/P/C, and NAQCC mbr nr or power	**home.windstream.net/yoel/**
Jan 20, 0200Z - Jan 20, 0300Z	3.5-7		Locust QSO Party		✘		Name, state or province or 'DX'	**www.k6vva.com/lqp**
Jan 22, 0000Z - Jan 23, 2359Z	1.8-28		YLISSB QSO Party	✘			Call sign, RS(T), ISSB number	**www.ylsystem.org**
Jan 22, 1200Z - Jan 23, 1200Z	3.5-28		BARTG RTTY Sprint			✘	Serial	**www.bartg.org.uk**
Jan 22, 1900Z - Jan 24, 0400Z		**50+**	**ARRL January VHF Sweepstakes**	✘	✘		**Grid square**	**www.arrl.org/contests**
Jan 28, 2200Z - Jan 30, 2200Z	1.8		CQ WW 160 Meter Contest		✘		RST and S/P/C	**www.cq160.com**
Jan 29, 0600Z - Jan 30, 1800Z	3.5-28		REF French Contest		✘		RST and serial or department ID	**www.ref-union.org/concours**
Jan 29, 1300Z - Jan 30, 1300Z	3.5-28		UBA Contest	✘			RS, serial, and ON province	**www.uba.be/en/hf**
Jan 29, 1700Z - Jan 30, 1700Z	1.8-28	50+	Winter Field Day	✘	✘	✘	Call sign, RS(T), category, local temp	**www.spar-hams.org**
Jan 29, 1900Z - Jan 29, 2300Z	1.8		WAB Top Band Phone Contest	✘			See Web site	**www.worked-all-britain.co.uk/contest**
Jan 31, 1400Z - Feb 1, 0800Z	1.8-28	50, 144	Classic Exchange		✘		RST, QTH, model of rcvr and xmtr	**www.classicexchange.org**

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates.
Refer to the contest Web sites 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. XE = Mexican state.
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

JANUARY 2011 W1AW QUALIFYING RUNS

W1AW Qualifying Runs are 10 PM EST Friday, January 7 (0300Z January 8) (35-10 WPM) and 9 AM EST (1400Z) Thursday, January 20. The West Coast Qualifying Run will be transmitted by station K6YR on 3590 kHz at 9 PM PST Wednesday, January 12 (0500Z January 13)(40-10 WPM). Unless indicated otherwise, speeds are from 10-35 WPM.

In the January/February "Contesting 101"

"Contest Management." We hear from guest author Doug Smith, W9WI, on all the things you have to keep track of for a contest. Contesting 101 can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

2010 ARRL UHF Contest Results

"Thirst for QSOs satisfied…"

John (JK) Kalenowsky, K9JK
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After the widespread episode of roving across the country in the August 2009 contest, the ARRL Contest Branch was on high alert for a possible repeat of UHF+ rovers in this year's competition. After the dust had settled on the highways and byways, 2010 produced fewer rovers (41 total Rover logs versus 67 in 2009) but Southern California was still a hotbed of rover activity with 10 "slash-R" stations submitting logs.

A total of 222 logs were submitted, with those from fixed stations increasing to 181 compared to 177 last year. Single-Operator, Low Power remains the most popular category with 112 logs submitted, growing from 103 in 2009. The extra "A" category logs made up for slight year-to-year drops in log counts for High Power (56 down from 58) and Multioperator (13 down from 16). Even with this 9% drop in log counts, the total number of QSOs reported in this year's logs, over 16,500, only dropped by about 5% from the approximately 17,400 QSOs in 2009. The 41 Rover log submissions consisted of 33 classic Rovers, 7 Limited Rovers and 1 Unlimited Rover, representing a total of 206 grid activations, an average of 5 grids activated by each Rover.

Tables of "Activity by Band" and "Participation by Number of Bands" return for another year, now including and comparing five years of activity; 2006 to 2010.

Where the Action Was

Before detailing the "where" for 2010, the contest data analysts apologize for an error in last year's article: grid squares in Southern California were identified with "EN" prefixes when they should have been "DM." A regrettable error, but one not to be repeated in future write-ups.

Contacts were reported with 217 grid squares in 2010, which included three stations reporting contacts on 432 MHz with K2DY/MM out in wet FM39.

Among fixed stations submitting logs, a total of 95 grid locators were represented with 56 of them activated only by fixed stations. FN31 was most popular among the fixed stations with 9 logs received, followed in popularity by FN42 (7 logs), EM86 (6 logs), EN82 (6 logs) and FM19, CN87 and FN20 (5 logs). The 206 grids activated by Rovers included 91 unique grid locators with 52 of those visited only by Rovers.

PETE HEINS, N6ZE

A nice view of the Western Washington horizon from Whidbey Island (CN87tw), one of N6ZE/R's two stops at the north end of his "TransCoast Rove."

As mentioned earlier, the highest area of Rover activity was in Southern California, with 10 Rovers visiting DM03 and DM04, 9 visiting each of DM05, DM13, DM14 and DM15, leaving CM95, CM96 and DM06 to be visited by "only" 8 of them. Those 9 grids represent almost 40% of the total activations. The next most popular grids among Rovers that submitted logs were EN35 (6 rovers visited), EN34 (5 visits), EN52 (5 visits) and FN03 (4 visits).

Top Scorers by Category

For what appears to be a UHF Contest first, Single-Op, Low Power has been won from Southern California as **Steve, WB2WIK** piloted the home station of N6NB to the top score in that category. Frequent top scorer **Bob, K2DRH** claims the second spot from Illinois followed by **Paul, W3PAW** from Western Pennsylvania.

The six year "chain" of Single-Op, High Power first, second, and third place finishers being Mike, KMØT, Don, WW8M, and Jeff, K1TEO has been broken with no log received from WW8M in 2010. **Mike, KMØT** from his Iowa location, continues as "top dog" here, **Jeff, K1TEO** moved up to second spot from Connecticut and **Herb, K2LNS** piloted Eastern Pennsylvania's **WA2FGK** station to third in the category.

In the Multioperator category, **Dave, K1WHS** with assistance from N1JFU, operated from Dave's hilltop in Maine to claim the top spot. **Gary, KBØHH** assembled a team at his Oklahoma station to wrap up second place and **Ken, KA2LIM** and four others took "The Limo" to their favorite Western New York location and achieved a third place finish.

Among the 33 classic Rover entrants, the top three scorers for 2010 are the same as for 2009, **Wayne, N6NB**, **Carrie, W6TAI** and **Art, W6XD**, all operating from Southern California. Wayne and Carrie added 24 GHz to have 9 bands and they single-op'd, activating 9 grids while Art was accompanied by **Kate, K6HTN** visiting "only" 6 grids and having a mere 8 bands. Among seven Limited Rover entries, **Mike, W6YLZ** repeats as top scorer,

Single Operator, Low Power

Call	Score
WB2WIK	177,531
K2DRH	101,136
W3PAW	49,464
W3SZ	49,248
AF1T	39,852
K2KIB	34,398
WØUC	31,671
W2BZY	29,640
W9SZ	25,920
WB1GQR	24,702

Single Operator, High Power

KMØT	338,574
K1TEO	177,708
WA2FGK	169,344
KØVXM	99,330
K3CB	93,627
K1GX	61,977
K8TQK	59,058
W4ZRZ	57,057
WJ9B	55,176
W2SJ	44,520

Multioperator

K1WHS	110,403
KBØHH	32,538
KA2LIM	22,134
K4EJQ	19,035
W9RM	11,178
AG4V	10,350
W3KWH	10,296
N1KAT	6,630
WA6ZTY	3,510
W6DQ	1,716

Rover

N6NB/R	517,500
W6TAI/R	487,746
W6XD/R	393,708
N6VI/R	382,344
KJ6CNO/R	378,072
N6HC/R	377,910
N6UWW/R	352,086
K6B/R	349,845
W9FZ/R	74,496
N2CEI/R	63,804

Limited Rover

W6YLZ/R	93,708
K9JK/R	20,424
KK6MC/R	1,887
N6ZE/R	864
KD5IKG/R	378
AB2YI/R	189
WBØKSL/R	126

Unlimited Rover

WA3PTV/R	54,462

Activity by Band, 2006 through 2010

	2006		2007		2008		2009		2010	
Band	QSOs	Stations	QSOs	Stations	QSOs	Stations	QSOs	Stations	QSOs	Stations
222 MHz	3229	152	2767	130	2700	156	4363	190	3597	165
432 MHz	4618	189	4204	165	3741	192	5422	240	5167	216
902 MHz	1037	90	850	77	906	88	1877	115	1658	102
1.2 GHz	1613	131	1520	108	1378	137	2418	154	2339	147
2.3 GHz	585	67	414	51	679	73	1072	80	1159	77
3.4 GHz	337	49	306	40	489	48	743	54	889	56
5.7 GHz	222	36	181	27	353	24	653	44	782	47
10 GHz	389	56	316	43	567	50	847	64	884	62
24 GHz	38	14	28	11	11	7	22	9	39	12
47 GHz	0	0	2	2	0	0	3	3	0	0
Light	1	1	0	0	10	6	11	5	6	6

Participation by Number of Bands, 2006 through 2010

Bands	2006 Logs	2007 Logs	2008 Logs	2009 Logs	2010 Logs
1	26	26	27	40	40
2	32	36	32	52	43
3	40	21	35	35	31
4	25	24	29	34	34
5	8	15	20	22	10
6	18	16	15	15	16
7	12	4	16	9	9
8	19	18	15	33	28
9	10	2	3	1	8
10	0	4	2	3	3

Division Leaders

Single Operator, Low Power		
Atlantic	W3PAW	49,464
Central	K2DRH	101,136
Dakota	KØSIX	900
Delta	N4QWZ	14,040
Great Lakes	K8JA	3,300
Hudson	K2KIB	34,398
Midwest	NØTTW	3,612
New England	AF1T	39,852
Northwestern	KE7SW	1,755
Pacific	K6XN	4,020
Roanoke	K4FJW	7,650
Rocky Mountain	NØYE	4,446
Southeastern	W2BZY	29,640
Southwestern	WB2WIK	177,531
West Gulf	W5AAC	420
Canada	VE3OIL	3,402
Single Operator, High Power		
Atlantic	WA2FGK	169,344
Central	W9GA	15,408
Dakota	WØZQ	35,442
Delta	AA4H	7,344
Great Lakes	K8TQK	59,058
Midwest	KMØT	338,574
New England	K1TEO	177,708
Northwestern	N7EPD	6,420
Pacific	KC6ZWT	6,825
Roanoke	K4QI	38,868
Southeastern	KØVXM	99,330
Southwestern	N6EQ	5,400
West Gulf	W5VHF	2,652
Canada	VE3ZV	42,210
Multioperator		
Atlantic	KA2LIM	22,134
Central	W9RM	11,178
Delta	AG4V	10,350
New England	K1WHS	110,403
Pacific	WA6ZTY	3,510
Roanoke	K4EJQ	19,035
Rocky Mountain	KØYB	360
Southwestern	W6DQ	1,716
West Gulf	KBØHH	32,538
Rover		
Atlantic	K2QO/R	13,899
Central	W9FZ/R	74,496
Dakota	KCØP/R	8,712
Delta	N4OFA/R	5,874
Midwest	KAØKCI/R	16,632
New England	W1AUV/R	24,231
Northwestern	K7HPT/R	2,520
Pacific	N6NB/R	517,500
Southeastern	N2CEI/R	63,804
Southwestern	W6XD/R	393,708
Canada	VE3SMA/R	36,288
Limited Rover		
Atlantic	AB2YI/R	189
Central	K9JK/R	20,424
Midwest	WBØKSL/R	126
Northwestern	N6ZE/R	864
Pacific	W6YLZ/R	93,708
Rocky Mountain	KK6MC/R	1,887
West Gulf	KD5IKG/R	378
Unlimited Rover		
Atlantic	WA3PTV/R	54,462

activating 9 grids in and around southern California. Your author, **John, K9JK** claims the second spot here, having visited 6 grids in Illinois and **Duffey, KK6MC** (despite a fiery finish to his rover vehicle — he's fine, though) finished in third place, visiting 8 grids in New Mexico. There was only one entry in Unlimited Rover in 2010, that being **Joe, WA3PTV** who piloted his 8 band station through 3 grids in Western Pennsylvania.

Division Records Continue to be Updated

A total of 13 Division category records were bested in 2010. The Southeastern Division was the "busiest" with three hurdles being cleared; **Bob, W2BZY** bettered a best for Single-Op, Low Power that he'd just set in 2009. **Chuck, KØVXM** joined in with a new level for Single-Op, High Power. With his 2010 effort in Rover, **Steve, N2CEI** now has the top Division score for Rover to add to the top Limited Rover score that he claimed in 2009.

Steve, WB2WIK's top score in Single-Operator, Low Power is a new record for that category in the Southwestern Division and **Todd, N4QWZ** raised the bar for "A" category in the Delta Division. In addition to what Chuck, KØVXM did in Southeastern, **Russ, K4QI** set a new standard for Single-Op, High Power in the Roanoke Division.

With a shift of activity to be more in the San Joaquin Valley Section, which is in the Pacific Division, **Wayne, N6NB's** high scoring effort for 2010 (which is also a new top Rover score from all entries) now has him holding Rover category top scores for two Divisions; Pacific for 2010 and Southwestern for 2009.

Being newer categories, Limited and Unlimited Rover remain fertile for new records to be established or updated, with six entrants setting new standards here, including one in Unlimited Rover by **Joe, WA3PTV** for Atlantic and five in Limited Rover; **John, K9JK** for Central, **Duffey, KK6MC** for Rocky Mountain, **Pete, N6ZE** for Northwestern, **Tim, KD5IKG** for West Gulf and **John, WBØKSL** for Midwest.

Clubs Continue to be a Factor

With this being the second year for Affiliated Club Competition in the UHF Contest, it was again a positive factor for activity. While the count of logs submitted dropped a bit, the percentage of logs listing a club name, 137 of the 222 or just over 60%, is about the same as last year. Thirty-five different club "names" were submitted (after some massaging of spelling variations, still including the "NONE" Club). Only two names failed to match the ARRL's official Contest Club List at **www.arrl.org/contest-club-list**. This left 33 possible clubs, but with the Club Competition rules requiring a minimum of 3 logs to be submitted by a club to be eligible to race for the gavels, the number of competing clubs was reduced to 15 with 13 in the Medium category and 2 in the Local category.

Congratulations to the Bristol (TN) ARC for claiming this year's gavel in the Local Club Category, with an aggregate score of 31,377 from their 4 entries. Eleven logs from the Southern California Contest Club resulted in an aggregate score of 3,566,940, repeating last year's capture of the Medium Club Category gavel for SCCC. See the table for complete Club Competition results.

Top Ten by Category Club Competition

Club Name	# of Logs	Total Score
Medium Club		
Southern California Contest Club	11	3,566,940
Northern Lights Radio Society	5	469,380
North East Weak Signal Group	14	372,624
Florida Weak Signal Society	11	308,535
Badger Contesters	11	246,918
Potomac Valley Radio Club	4	177,093
Society of Midwest Contesters	6	138,669
Mt Airy VHF Radio Club	6	135,513
Contest Club Ontario	5	101,022
Rochester VHF Group	5	36,576
Yankee Clipper Contest Club	3	35,286
Pacific Northwest VHF Society	12	18,969
Northern California Contest Club	3	7,626
Local Club		
Bristol (TN) ARC	4	31,377
Mad River Radio Club	3	7,491

Summary

1800 UTC on August 6, 2011 will be here only too soon to begin another 24 hours of radiosport on the bands at 222 MHz and up. I'm already planning to be out roving, hopefully with some additional bands (so no longer a "Limited" Rover)…how about *you*? Can we make the 250-log barrier fall?

Adding to Bill Seabreeze's famous directive to *"listen for the weak ones!"* I recently discovered Lloyd, NE8I's statement that "Activity happens because we make it happen." So, whether weak or strong, why don't "we" make a *lot* of activity happen in 2011!

More Results Online!

The online, extended version of this article contains much more analysis, Regional highlights, and a nice sidebar by N6ZE on his "TransCoast Rover" adventures. Tune to **www.arrl.org/contests** and put a new one in the log!

The ARRL Foundation Goes Electronic!

As announced earlier in the fall, the application process for ARRL Foundation Scholarships is all electronic this year. Students wishing to apply for one of the more than 60 awards that will be made in the spring of 2011 must apply before February 1, 2011. The application form is on the Web at **www.arrl.org/scholarship-application**.

Some application nuts and bolts: Applicants must fill in *every blank* on the form before submitting the application. If not, the application will not be accepted. Successfully completed forms will receive a message confirming completion of the form. Transcripts are required for all applicants and should be e-mailed to **mhobart@arrl.org** as should any letters of recommendation.

Scholarship winners are notified by letter in May and awards mailed to the winners' schools in July. The list of winners will be posted on the ARRL Web site.

Likewise, applications for project grants to Amateur Radio groups are made using the electronic form on the Web at **www.arrl.org/grant-application**. Supporting budget forms should be send via e-mail to **mhobart @arrl.org**. There is no formal application period for grants. The Foundation's Proposals Committee reviews applications and submits its recommendations to the ARRL Board for approval.

Questions about the scholarship or grant application process can be directed to **mhobart@arrl.org**. QST

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The 2011 School Club Roundup

Monday, February 14 – Friday, February 18, 2011
Operate from 1300 UTC through 2359 UTC each day.

NICOLENE EMERSON

- Is your school "radio-active"? If not, get involved with the School Club Roundup! This week-long event promotes Amateur Radio at school with a fun, gently competitive atmosphere on the digital, SSB and CW modes. This is a great opportunity to assist and encourage students participating in Amateur Radio!
- Separate categories for Elementary, Middle, High School and College clubs.
- Send logs to **scr@limarc.org**. All logs must be received by March 14, 2011.

Coat and tie optional: **John Mohorcic (left) and Alexander Corkwell, KD8OQB, students at Gilmour Academy in Gates Mills, Ohio take their School Club Roundup activities very seriously!**

Complete rules, logging sheets and other info can be found at
www.arrl.org/school-club-roundup

W3UR

HOW'S DX?

The PJ Party — PJ7E Sint Maarten 10/10/10 for 10 Days

On October 10, 2010 at 0400Z an unprecedented four new DXCC Entities were added to the ARRL DXCC list. This month we have the PJ7E story from St Maarten. Next month we plan to run the PJ6A story from Saba. — Bernie McClenny, W3UR

Craig Thompson, K9CT (**k9ct@arrl.net**) *and Joe Pater, W8GEX* (**w8gex@aol.com**)

CHARLIE WOOTEN, NF4A

The NCDXF team, from the left: Bruce Butler, W6OSP; Joe Pater, W8GEX; Don Dubon, N6JRL; Craig Thompson, K9CT; Charlie Wooten, NF4A; Max Mucci, I8NHJ; Jim Cochran, KØRH; Franz Langner, DJ9ZB; John Miller, K6MM; Janet Pater, W8CAA; Dave Anderson, K4SV; Bill Beyer, N2WB, and Charlie Spetnagel, W6KK. Missing is Ralph Bellas, K9ZO, who had to leave for his son's wedding!

The K4M Midway Island team met in Visalia, California in April 2010 as Bruce Butler, W6OSP, and Tom Harrell, N4XP, were presenting the DXpedition story. I, wanted to attend Visalia as it was my first time to this DX Convention. Joe, W8GEX, and Janet, W8CAA, greeted me and Joe pulled me aside to discuss a DXpedition. Joe, and another Joe, AA4NN, had a plan to operate from St Eustatius as a possible new entity. AA4NN recently had to drop out and Joe, W8GEX, asked if I could colead the DXpedition. We had all worked together on the K4M Midway team and I was very comfortable helping out.

Joe had announced their intentions prior to Visalia. After doing some quick research, it appeared that Sint Maarten would be granted independence and be more acceptable to DXCC than the other possible scenarios. So we planned on visiting Sint Maarten, PJ7, as soon as practical after Dayton. In the meantime, I had talked to Bill Blick, W8EB, who had visited PJ7 for many years and talked with him about the local conditions and hams.

Joe had contacted a couple of the local hams to guide us in the right direction when we arrived in Sint Maarten. Marco, PJ7MF, and Mort, PJ7UQ, were very helpful, giving us contact information and directions. Mort's assistance was invaluable in locating our operating locations and licensing. Marco is a local businessman and is probably one of the most active PJ7 operators.

Searching for Radio Real Estate

Joe and I arrived in Sint Maarten on July 12 and left on the 15th. This DXpedition would need to be operated from a rented location. In looking around, we could find no locations along a beach with a good shot to NA and EU. The properties were secure with fences and gates everywhere. We also wanted to separate the phone and CW sites to avoid interference.

FRANZ LANGNER, DJ9ZB

The flag of the newly independent St Martin.

Mort, PJ7UQ, suggested a vacation rental company and we sought their guidance. We were immediately in the good hands of a local professional who really understood our requirements. She got on the phone and was quite persistent in locating just the right villa.

Joe and I discussed what our goals were to be for our DXpedition. We knew we wanted to have at least 10 days of operating. The pileups would be huge and we wanted to maximize the number of contacts. This was not going to be a vacation but a seriously fun type DXpedition.

We wanted the equipment to be donated so that we could operate as a team and minimize costs. We quickly put together a budget that approached $3000 per operator that covered housing, shipping and miscellaneous equipment cost. ICOM and Alpha were on board. Soon we had support from SteppIR, DX Engineering, Tennadyne, MFJ, DX Store and Hexbeam. Unfortunately, the space at each of our sites precluded the Tennadyne antenna setup, but we really appreciated their support. Each operator was responsible for their transportation and food on the island.

Early in the process, we had decided not to seek any support from the foundations and clubs. But it was apparent that credibility to the ham community would be enhanced with their assistance so we sought support from NCDXF and INDEXA. Unsolicited support came from GDXF, NDXA, SEDCO and DDXG, and we thank them for their generosity.

The Word Goes Out

We distributed our first DX press release in July while we were on Sint Maarten. Our confidence in the granting of independence was reinforced only a few days later when the constitution of Sint Maarten was adopted and the election of the new Parliament was set.

Our goal was to have two stations running simultaneously on both CW and SSB. It was important to have enough separation at each site to pull that off. We had Yagis at each site for daytime operation but still needed to be able to get on 30, 40, 80 and 160 meters at night. A third radio at each site was to be a spare and used for RTTY/digital if an operator was available and there wasn't any interference.

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Aside from Joe, W8GEX, and myself, early team members included Joe, AA4NN; Tom, N4XP; Dave, K4SV; Bill, N2WB; Charlie, NF4A; Kevin, K6TD, and Charlie, W6KK. Most of this early group had been on the K4M trip in 2009. Joe, Tom and Kevin had to drop out and we quickly filled the team with Ralph, K9ZO; Franz, DJ9ZB; Max, I8NHJ; Bruce, W6OSP; John, K6MM; Jim, KØRH, and Don, N6JRL.

Tom, N4XP, could not go but took the reins for treasurer and QSL duties. Bill, N2WB, became responsible for gathering all of the equipment for shipment to Miami and then to Sint Maarten and back. K6TD was unable to go because of work but still prepared our 80 and 160 meter antennas plus the onlne QSL (OQSL) duties. Many operators checked out the antennas and equipment before shipping to Bill. We wanted to make sure we had been thorough.

FRANZ LANGNER, DJ9ZB

A Boy Scouts group attending the Scouting Jamboree on the Air visited the PJ7E SSB site. Bill, N2WB, explains ham radio and then helps the scouts make a few contacts.

Crowd Control

There was a whirlwind of announcements in late August and early September of DXpeditions to these new countries and the anticipated DXCC entities of Saba, St Eustatius and Bonaire. We knew that the frequency spectrum would become quite tangled if an effort to coordinate all of this activity was not at least attempted. Thankfully, cooperation and coordination between all of the groups was started via e-mail. It was decided to let four of us work on the major elements and bring back a final draft for review by all groups. After input from everyone and reviews of the IARU and ARRL band plans, we were set to announce the combined plan. We are so grateful to every DXer and DXpedition team for this unprecedented effort that paid off for everyone.

Our equipment ship left the port of Miami bound for Sint Maarten every Friday and arrived on Tuesday. Bill, N2WB, had everything ready to go and it was picked up on September 22 for delivery to the ship warehouse. It arrived but for some reason still unknown to us did not get loaded on the ship. Joe called repeatedly the following week to assure that the squeaky wheel got the grease and sure enough it was loaded and on the way to Sint Maarten on the first of October.

Joe and I planned our arrival for October 6 so we could get to the shipping dock and arrange for transporting the equipment to the station sites on the morning of the 7th. Well not only did Joe and I arrive, but so did Otto, the tropical storm. Otto barreled into the island and dumped over 20 inches of rain plus very strong winds. The port was closed and no sea traffic was allowed.

CRAIG THOMPSON, K9CT

The CW station digging into the pileup with Dave, K4SV, and Max, I8NHJ, at the controls.

As the team members arrived, each of the successive 2 days was the same — rain, wind and more rain and wind. We could not set up and we were running out of time.

The weather finally cleared but the port was unopened. No equipment until Monday! Saturday, October 9 arrived and both teams were now ready to make some low power contacts. At midnight, the CW team decided to start letting everyone run 1 hour and rotate. This worked quite well and on the first day we put over 5000 contacts in the log with these small stations — but it was a new DXCC country after all.

The Big Rigs Arrive

The day finally arrived when they opened the port and our ship arrived. We kept operating while waiting for our pallets to be transferred to the warehouse. Joe, W8GEX, drove to the warehouse and was met by Sidney DeWeever, the telecommunications officer for PJ7. He brought a truck and they loaded the SSB equipment. Joe called and told me that Sidney had just dropped off the equipment and was on the way back to the warehouse to get the CW site equipment. The PJ7E operations stopped as we helped unload. We decided to keep the station on the air while we split into teams to get the antennas and other radios set up.

Propagation was awesome. There was a scare early as we thought there was some absorption but 15, 12 and 10 meters had great openings. The operators watched the spots on the Internet and were conscious of any band openings. We had some very nice runs on those bands on phone, CW and RTTY.

On Saturday the 16th, the international Scout Jamboree on the Air was on. Sidney asked if some scouts from the Netherlands Antilles could see our operation. The scouts visited the SSB site while we were operating and saw and heard about ham radio. Some even made a contact or two. At the same time, we were visited by a local ham, Samuel Adams, PJ7SA, who has a local news organization. He did an interview and published it on their Web site, **www.sxmislandtime.com**. Joe, W8GEX, did a live interview for the local PBS station. So ham radio got a huge PR boost from our PJ7E operation.

Our flights out were the 21st and we decided to take everything down on the 20th. The CW team shut down at sunrise and started packing everything up. By noon, the truck arrived and took everything away. The CW team traveled to the SSB site to observe their final contacts. When we arrived at the SSB station they were still making many contacts and Max, I8NHJ, got on PSK.

The team had no complaints about any part of the operation. The DXers were courteous and well mannered. Our team just kept the pileups moving along and no frustration was ever noted.

We appreciate the cooperation of the local authorities who really embraced the ham radio aspect of their new country. They were amazed at the international interest. They liked our Web site, **www.pj7e.com,** and the fact that many hams from all over the world were calling us. We contributed some of the cables, antennas and hardware to the local hams. The Red Cross facility needed some radio repairs and we were able to assist them.

The team would not have functioned as well without the early support of ICOM, Alpha, ACER, SteppIR, Hex Beam, MFJ, DX Engineering, The DX Store, W2ENY and N4AA, DX Publishing. Our finances and credibility were strengthened by the support of NCDXF, INDEXA, NDXA, GDXA, W4DXCC and Dominion DX Group.

We are certain that this was a success from the team's vantage point. After almost 75,000 contacts in the log, we hope that everyone in the DX community enjoyed our PJ7E operation. QST

W3ZZ

THE WORLD ABOVE 50 MHz

Magic Days on "The Magic Band" Long Path on 50 MHz — *Part 1*

Given the sunspot cycle predictions for the current Cycle 24 and beyond, most of us may never again experience the king of all propagation modes — F-layer, F2 —on 6 meters. Yet some amazing contacts have been made over the years since Cycle 18 in the 1940s. Readers with long memories will remember Bob Cooper's (ZL4AAA) fascinating description of transatlantic tropospheric ducting in the March 2003 column. Now Bob returns to discuss F2 long path, a subject well-known on HF but almost never probed on 6 meters. Return with us to the heady days of 2001-2002 when the Magic Band was truly magic.

JG3IFX

Figure 1 — Yutaka, JG3IFX/2, operating portable in southern Japan.

The past Northern Hemisphere "summer E_s season" produced many two-way 50 MHz contacts over distances as great as 13,000 km at the virtual "bottom" of the solar sunspot cycle. Magic Band enthusiasts have always viewed such distances as solar-cycle dependent and requiring high sunspot numbers. Equally unexplained are contacts during peak sunspot years that exceed 20,000 km; "half-way around the planet" or the so-called "long-path." Research has uncovered several hundred such contacts, some exceeding 30,000 km distance (roughly 75% around our globe), and the more spectacular of these form the basis of the following discussion.

This study began as a personal quest; a "disagreement" between ZL4AAA and those who maintain "longest distance VHF-UHF records" for New Zealand's NZART. By definition they limit records only to great circle short path so the ODX (greatest distance) cannot exceed halfway around the world or ~20,000 km regardless of the actual path. For instance, for contacts between ZL1MQ and ZBØT and ZS3E during Cycle 21 April 17, 1981, both peaked due north at essentially 0° for ZL1MQ. The short path to ZBØT is at a 160° heading so this was ostensibly *not* short path.

For those who do not subscribe to this particular geometric rationale, we begin our quest.

"He Simply Appeared out of the Noise . . .!"

On April 7 (UTC), 2001, Yutaka, JG3IFX/2 portable in PM84jj with his friend JN3NFQ (K1GI), on a mountainside overlooking the Pacific with a 5 over 5 Yagi (Figure 1), worked a series of four contacts in the eastern Mediterranean including OD5/OK1MU. The distance? If you were on the US East Coast pointing your 6 meter antenna "east" and found KH6/K6MIO only on that heading (as in "long path"), you'd be in the same league. Provided he *only* found you when pointing "west." Long Path is a generic description of any contact that exceeds halfway around the Earth, a distance in excess of 20,000-20,035.5 km given that at the equator the Earth is 40,075 km in circumference. To understand "LP" it helps if you first appreciate "antipode" contacts. And while the subject is 50 MHz, what immediately follows works for any ham frequency, dc to daylight.

In modern English, "antipode" is defined as "the exact opposite point on Earth from you"; it is *always* in the other hemisphere (if you are north of the equator; your antipode point is south of that line). For Amateur Radio, if you contact someone at "your antipode" he or she will be so located as to have an *infinite* number of "ionospheric radio paths" to you; *any direction* their beam points will be the *same distance* to you. From Washington (DC) the antipode sits off the coast of Western Australia (think VK6PA near Perth [18,493 km for W3ZZ] and keep going for another 1507 "very wet" km). From Auckland, New Zealand, Madrid (Spain) is close (if not precisely) to antipode.

Beginning at 2043Z April 7, 2001 JG3IFX/2, made the first of four "LP" contacts in an all-too-brief 19 minute opening. It is not possible to calculate the actual distance the signals traveled for none of the stations found the other's signal while pointing their directional beam antennas either short path (SP) or precisely the LP opposite. Pavel, OD5/OK1MU, recalls, "*Yutaka was the only* (DX) *signal on the band — for 24 hours prior and 24 hours after. He simply appeared up out of the noise, we worked (RST559/559) and he faded out (2152).*" The SP distance would have been 8893 km and pure LP (by Williams' calculation —

This Month

January 4	Quadrantids Meteor Shower
January 22-24	ARRL January Sweepstakes
*January 23	Very good EME conditions*

*Moon data from DL7APV

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see sidebar) would have been 40,075 – 8893 or ~31,182 km. But the actual distance being something other than pure LP is something else again.

JG3IFX/2 had four LP 50 MHz contacts between 2143Z and 2152Z: 4X1RF at 2143Z, JY9NX at 2148Z, 5B4FL at 2149Z and OD5/OK1MU at 2152Z. At 2202Z he heard SV1DH along the same path, but Costas, who reports "*one of the problems associated with living in an urban area is a high 6 meter noise level*," did not hear Yutaka's CW responses. Here forensic backtracking becomes interesting. Remember Pavel's comment about hearing only Yutaka.

Yutaka was pointing southeast with his 5/5 at ~140°. OD5/OK1MU and 5B4FL report they found the Japanese signal at around 210-240°. The "true" LP heading from OD5 to JA would have been ~235° and very similar for the other stations. We might label the *actual* path "Long Path *Enhanced*" (LPE), a term I create knowing it will bring a smile to the face of my friend Jim Kennedy, KH6/K6MIO (see **www.bobcooper.tv**).

On Easter Island South Dakota's W7XU was portable CEØY with his spouse Holly NØQJM. Their DXpedition lasted slightly longer than a week. It began March 30 on 6 meters with Arliss initially commandeering the triband HF beam at XQØYAF and soon thereafter installed a 7 element 6 meter beam. While working 5B4FL on April 7 at 2115Z, he heard "various PYs, the TRØA/beacon and attracted TR8KPJ at 2137Z" (when was the last time you worked Chad on *any* band?). JG3IFX/2 heard none of this although his antennas were pointed essentially at CEØY. Six minutes after Arliss logged TR8KPJ, Yutaka began his run. In fact Yutaka and Arliss would work April 8 at 0224Z — just over 4 hours later, on the same beam heading Yutaka had used on the 7th.

Nick, 5B4FL notes "at 2100Z I worked KH8/N5OLS 57, CEØY/W7XU at 2115Z and then nothing until JA3IFX/2 popped through at 2149Z." No other JA signals were heard; in fact, 5B4FL heard no other DX until hours later (April 8 UTC). One of Japan's leading 6 meter operators, JA1VOK, labels the OD5/OK1MU contact as "unique." Except it was *not* quite unique. On October 13, 2001 OD5/OK1MU appeared again — this time at JA3IFX/3 who was now located at Shiono-misaki (PM73rg) in Yamaguchi prefect, which happens to be the southernmost land point on mainland Japan. JA1VOK reports this was a date (~23-24Z) when he and many other JAs worked LP to CT, EA and 5B4. *But* no other JA worked the Middle East, only Yutaka, who had an apparent geographical advantage (when in doubt, move closer to the geomagnetic equator).

The period between April 4 and 10, 2001 is still labeled "the magic days" in Europe. IØWTN explains. "That night [April 8] we still call 'the magic night' here — very peculiar propagation conditions from our grid square to a wide side of the Pacific! We were four stations of Roma (IØJX, IKØFTA, IWØFFK and I); a few minutes after contacting KH8/N5OLS we were able to work CEØY/W7XU." CEØY appeared at 2122Z; of interest, although dozens of other Italian stations were glued to their 6 meter radios, CEØY did not appear beyond the immediate "Roma Grid Square" (six others outside Rome did work KH8, however).

A "forensic signature" is beginning to appear here: JA3IFX/2 to OD5 and other eastern Mediterranean stations, Italian stations to not just KH8 (AH45su) but also CEØY (DG52iv). Stay tuned — it gets better!

The key player in this bit of "magic" would turn out to be CEØY/W7XU. A veteran of previous 6 meter jaunts, Arliss first found 50 MHz signals on his arrival with the triband HF Yagi March 30. By 2030Z that day he had his 6 meter antenna functional and immediately began working DX, which virtually anyone would find "beyond magic." Mixed into his first serious contacts was 4X1RF (16,499 km at 2222Z March 30), the tip of a giant incredible long-haul propagation iceberg that lasted throughout his Easter Island jaunt.

The Long Path 50 MHz World

Accept that anything passing calculated "half-way-around" is subject to controversy and naysayers maintaining, "You don't know the front of your beam from the back." Given the nonstandard world of collecting such reports, nobody is going to do justice to 6 meter contacts that approach the antipode or "magically" exceed that point. This discussion is merely a set of examples that *probably* did happen (and gives you something to fantasize about while Cycle 24 stumbles and trips on its nonproductive self).

Steve Gregory, VK3OT, one of the 50 MHz legends of our time, maintains excellent records from a location where his antipode falls someplace into the Atlantic well off the coast of Nova Scotia. In other words, he cannot claim an Antipodean 50 MHz contact on land. Australian records claim contacts on "long path" (spread over two consecutive cycles from 1989-2002) between 25,517 km (VK9ML to PY5CC; 15-IV-2002) and 28,397 km (VK6JQ to TL8MB 03-IV-1991). Of the "record long path" contacts, all six occurred in the month of April spread over 13 years. *Is April "magic"?*

Using the July 2001 *QST* "World Above" column, we find references to April 2001 contacts that "exceed expectations": VK4CP-LU8MB (28,076 km) on the 3rd at 1430Z, KH8/N5OLS-IØWTD (23,106 km) on the 8th at 2115Z approaching that "magic hour" again, PY5CC-VK8MS and VK8AH (24,493 km) on the 25th at 1230+Z.[1] And *the capper* CEØY/W7XU to a trio of Indonesian stations at ~25,500 km. *These* deserve further investigation.

Arliss notes, "…(during my time on Easter) the openings were pretty impressive to a guy from South Dakota where working any DX on 6 meters is a big deal." Indonesia from Easter, on a path that was not SP but as we will see cannot be traced even forensically, works out by Ed Williams' calculation (see sidebar) to at least 25,400 km. Indonesia is an "interesting" spot for 6 meters for (as Pacific region 6 meter DXers know); "*they use it like expensive CB and even have a six meter-only license.*" Since many YC-YF licensees only use FM, actually working the country on 6 meters can be a challenge in spite of high "activity" levels. CEØY/W7XU managed to entice several of these "amateurs" to answer his calls on April 3, 2001: YBØCBI (Jakarta; 25,402 km) at 1607Z; YC1MH (Bogar; 25,412 km) at 1610Z and YF1OO also in Bogar at 1746Z. Some like YC1MH would repeat (on April 6 at 1701Z) and of forensic interest here, *all* of the Indonesian stations identified and worked fell into a 50 km diameter "ionospheric worm hole" at local Indonesian time between 10 PM and midnight.

Next month Bob will conclude this interesting discussion of 6 meter long path. Still more fascinating contacts are in store.

[1]E. Pocock, W3EP, "World Above 50 MHz," *QST*, Jul 2001, pp 95-97.

Distance Calculations

There are many great circle distance calculation tools. After comparing results, ZL4AAA settled on the Williams tool at **williams.best.vwh.net/gccalc.htm**. This JavaScript-based calculation allows modification of longitude, latitude, beam heading and/or path length for either station. Some of the calculations in this column use distances derived from the source stations or from the July 2001 "World Above 50 MHz" column; the remainder utilize the Williams tool. Williams (on short path) *initially* assumes "most-direct-path."

ON THE BANDS

EME. This was an extraordinary month on 70 cm EME. Matej, OK1TEH completed what is believed to be the first single Yagi WAC on 432 by working PY1KK on JT65b. He was running an 800 W solid state amplifier to a 23 element Yagi on a 5.7M boom. After more than 30 years, Al, K2UYH completed 432 MHz DXCC, the third 70 cm DXCC after DL9KR and HB9Q and the first from outside of Europe. Al completed the first above 6M WAC in 1976. Al's DXCC was accomplished with the aid of digital techniques. He notes that with his current noise levels and tree blockage to the east and west, there is no way he could have done it without using JT65. [Thanks K2UYH]

Lance, W7GJ reports that he, 3D2LR and Bob, ZL1RS/3D2RS completed a very successful 6M EME DXpedition from the Fiji Islands from Sep 27 to Oct 9. Lance operated 6M while Bob operated 2M. The DXpedition took advantage of optimal EME conditions, the first weekend of the ARRL EME Contest and common windows with EU during their moonrise and moonset. Bob was pleased to work many new call signs and worked 198 different stations in 41 DXCC entities. He was using a pair of 8 element homebrew Yagis.

On 6M, Lance worked a total of 52 different stations in 17 DXCC (20 EU, 29 NA, 2 OC, 1 AS), with 17 additional stations copied but not worked in an additional six DXCC (9 EU, 5 NA, 2 OC, 1 AS). He used an Elecraft K3 driving an M^2 solid state kW amplifier to an M^2 6M8GJ Yagi that could be elevated manually up to 65°. Many small horizon-only antennas were worked; the smallest was N3CXV's single 6M5X Yagi. Lance thanks all for their support and contacts! More details are at **www.bigskyspaces.com/w7gj/** and **www.qsl.net/zl1rs/**.

Ray, WA4NJP continues to work new stations on 222 MHz after putting a 222 feed in his dish with two new states — AZ and ID — added to his totals. Ray has also had fun working DXpeditions in 3D2 on 6M, 3D2, CE and CEØY on 2M and CE and CEØY on 70 cm.

6 meters. Six meters was virtually nonexistent in October. NØJK notes the band open from the southeast to ZF1 on the 17th and TEP between PJ and PY 2,4,5,7. On Oct 24 Jon worked FM16 as part of a marginal opening from the southeast to the Far Midwest [OK/KS]. On Oct 24 DM03 heard beacons on Oahu and the Big Island under high geomagnetic field conditions (k=5). On Oct 26 Bob, K6QXY heard ZL video around 0100Z. The mechanisms supporting either of the latter observations are not clear.

2 meters and up. October often brings decent tropo conditions but not this year. East Coast conditions in the 432 Sprint Oct 6-7 were dreadful. On Oct 11 Vic, WB4SLM (EM82) worked KØVXM in EL98 on 2304 but noted that his signals were weaker the lower in frequency they went. Vic worked stations down to EL87 on 70 and 23 cm. Dave, N9HF (EL99) encountered a better than normal Orionids meteor shower Oct 21 and used it to work state #48 WV on 2M. On October 5 CT1HZE worked a station in France on 2M E_s, the first October 2M E_s reported in Europe. Finally Flavio, PY2ZX reports 2M TEP between PY (GG65, GG48) and Martinique.

HERE AND THERE

ARRL VHF Sweepstakes. This contest begins at 1900Z on Jan 22 and ends at 0359Z Jan 24. Conditions are often not good because of the cold weather but club interest increases the amount of activity. Further information may be found in Dec 2010 *QST* and on the ARRL Web site at **www.arrl.org/january-vhf-sweepstakes**.

Quadrantids Meteor Shower. The Quadrantids are a short duration but energetic shower with a ZHR (zenith hourly rate) of 60-120 at speeds up to 40 km/h. This year the peak is predicted at 0000Z Jan 4.

50 MHz Standings by DXCC Entities Worked

Call Sign	State	States Worked	DXCC Entities Worked	Grids	DX (km)
1					
K1TOL	ME	50	178	1,416	15,185
K1SIX *	NH	50	171	1,060	15,549
W3EP/1	CT	50	150	1,121	15,750
K1AC	NH	50	145	—	14,535
K1MS	MA	50	142	—	14,696
W1AIM	VT	50	132	561	14,928
2					
K2ZD	NJ	50	156	468	15,610
K2MUB	NY	50	156	—	16,784
NY2NY	NY	50	118	573	13,124
K2QE	NY	50	116	700	—
3					
W3JO	PA	50	159	—	14,929
W3VZ	MD	50	148	823	14,038
W3ZZ	MD	50	143	879	15,769
AE3T	PA	50	140	—	16,664
N3DB	MD	50	135	970	15,083
N3II	MD	50	134	793	15,876
W3TC	PA	50	133	790	15,221
W3CMP	PA	50	129	—	—
AK3E	MD	50	117	815	—
W3UR	MD	50	116	619	10,590
4					
K4MM	FL	50	152	—	16,326
W4UM	FL	50	142	—	—
N4MM	VA	50	141	939	—
W4TJ	VA	50	136	755	15,688
WA4LOX	FL	50	134	—	15,664
K4QI	NC	50	129	945	—
K4PI	GA	50	128	800	12,522
KE4WBO	FL	49	120	600	11,060
K4RWP	TN	50	116	767	15,228
W4WA	GA	50	110	348	9,860
AA4H	TN	50	109	721	12,580
KB4ET	FL	50	106	—	—
W4AS	FL	50	100	176	—
5					
W5OZI	TX	50	164	1160	15,131
WD5K	TX	50	151	1202	14,924
K5UR	AR	50	146	1248	—
K5SW	OK	50	143	—	16,746
K5AM	NM	50	144	853	17,861
W5HNK *	TX	50	120	733	14,815
W5HJV	TX	50	115	—	15,106
AA5AM	TX	50	112	748	14,963
W4UDH	MS	50	109	907	13,903
W5LUA *	TX	50	102	—	—
6					
K6QXY *	CA	50	158	—	15,555
N6CA	CA	50	127	500+	18,464
KB6NAN	CA	50	91	782	16,638
KR7O *	CA	50	78	672	12,783
N6ZE	CA	47	70	330	—
7					
W7GJ *	MT	50	159	710	16,102
W7KNT	MT	50	114	778	15,557
W7MEM *	ID	50	72	658	16,106
K7CW *	WA	50	57	651	13,330
8					
K8MFO	OH	50	156	—	—
W8UV	OH	50	107	350	12,349
W8TN	WV	50	105	492	12,436
K4OM	WV	50	100	—	15,533
N4DB	OH	50	91	487	11,037
K8ROX	OH	50	85	620	11,037
WA8RJF	OH	50	84	587	15,365
9					
W9RPM	WI	50	132	829	16,059
W9RM	IL	50	110	757	13,712
W9VHF	IN	50	109	608	13,766
W9JUV	IL	50	109	400	15,903
W9VA	IL	50	102	550	13,670
KC9KBB	IL	50	102	—	14,050
K9MU	WI	50	63	540	10,447
W9GM	WI	50	57	410	11,312
WA9PWP	WI	50	57	455	10,400
Ø					
NWØW	MO	50	134	—	14,675
KØAZ	MO	50	127	762	14,392
KØFF	MO	50	126	741	16,246
NØLL	KS	50	125	872	14,901
KØGU	CO	50	123	885	17,142
WAØKBZ	MO	50	105	627	16,354
KØCS	CO	50	84	533	13,409
NØPB	MO	50	75	503	13,246
KBØPE	MO	50	63	502	10,211
KØKP	MN	50	54	554	10,051
KØAWU	MN	50	53	518	15,578
WØLD	CO	50	42	180	—
WØRT	KS	50	40	170	13,651
Canada					
VE1YX	NS	50	177	1,261	15,515
VE3KKL	ON	50	119	618	18,207
VE2XK	PQ	50	73	579	7,495
VE2PIJ	PQ	49	57	433	6,104
VE3KH	ON	48	27	246	7,769
International					
IKØFTA	I	38	233	1117	18,236
GØJHC	G	42	218	1199	15,951
SM7FJE	SM	43	210	1034	15,912
NP3CW	PR	50	118	585	13,533
W3CMP/ VP9	VP9	36	39	—	—

*Includes EME contacts
— Not given

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jan 1-Jan 2, 1300Z-1900Z daily, K1R, Brooklyn, NY. 72 Rag Chew Group. New Years Special Event. 7.271 (8-9 AM) 7.272 (9-2 PM). Certificate. Robert Lobenstein, 1958 E 36th St, Brooklyn, NY 11234. **www.ragchewers.net**

Jan 1-Jan 31, 0000Z-2359Z, K3Y, All US call areas. Straight Key Century Club. Celebrating five years of steady growth — over 7200 members on CW. 14.050 10.120 7.055 3.550. Certificate. Dan Rhodes, KA3CTQ, 618 Seminole Dr, Erie, PA 16505. **www.skccgroup.com**

Jan 6-Jan 7, 1000Z-2359Z, W3M, Reading, PA. The Great Outdoors Radio Club. GORC Morse Telegraph Event. 14.070 14.035 7.035 3.535. Certificate & QSL. GORC Morse Telegraph Event, W3M, 775 Moonflower Ave, Reading, PA 19606. Celebrating the first successful demonstration of the telegraph in the US at the Speedwell Iron Works on January 6, 1838. **www.wa3wsj.org/Morse_Telegraph_Event.html**

Jan 8, 1400Z-2100Z, N4F, Port Saint Joe, FL. Gulf Amateur Radio Society. State of Florida 172nd Constitution Convention Commemorative Special Event. 28.372 21.372 14.272 7.272. QSL. Norm Bixler, 2003 Cypress Ave, Port Saint Joe, FL 32456.

Jan 8, 1400Z-2200Z, N4FL, Deerfield Beach, FL. Gold Coast Amateur Radio Association. 2nd Annual Festivus for the Rest of Us Event. 14.260. QSL. Joey Tiritilli, PO Box 773, Pompano Beach, FL 33061. **www.w4bug.org**

Jan 8, 1500Z-2100Z, W9LY, Michigan City, IN. Michigan City Amateur Radio Club. 2011 Boy Scout Klondike Derby Camp Topenebee. 14.240 7.240 3.940 14.070 PSK. QSL. Michigan City ARC, PO Box 148, Michigan City, IN 46361.

Jan 8, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV41) Museum Radio Operations Room. *Nautilus* first ship underway on nuclear power 1954; Bathyscaph Trieste descends 37,799 feet into Marianas Trench 1960; Navy SEAL Teams established 1962. SSB 14.320 7.250 D-STAR 012C 2 m/70 cm SOCAL rptrs. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Jan 8-Jan 9, 1800Z-2359Z, VE8SUN, Inuvik, NT. Inuvik Amateur Radio Club. Inuvik Sunrise Festival. 14.250 7.250. Certificate & QSL. Inuvik Amateur Radio Club, PO Box 3099, Inuvik, NT XØE ØTØ, Canada. **ve8ev.blogspot.com/p/sunrise.html**

Jan 10-Jan 20, 1200Z-1200Z, 4V1, Port-au-Prince, Haiti. Radio Club D'Haiti. 4V1 Activates Remembering Haiti Earthquake of 12 Jan 2010. 14.300. QSL. Gary D. Mentro, 11028 Ewing Dr, Dade City, FL 33525-0931. Frequency and times will be announced on 14.300 MHz (Inter-Con and MM Net Frequency) in recognition of the assistance the nets provided for months following the massive earthquake.

Jan 14-Jan 16, 2100Z-2100Z, WØJH, Stillwater, MN. Stillwater Amateur Radio Association. "Lake Mille Lacs Ice Fishing Shack" Special Event. 21.358 14.258 7.258 3.858. Certificate. Dave Glas, 1455 Oakgreen Ave N, Stillwater, MN 55082. QSL certificates will *only* be sent via e-mail. Complete "eQSL Request Form" (you do *not* have to send a printed QSL card). Required QSO info includes call sign, date, time, freq and RST report. A file, with 8.5" × 11" color QSL certificate suitable for printing, will be sent to you via e-mail. **www.radioham.org**

Jan 15, 1500Z-2100Z, W9AML, Bloomington, IL. Central Illinois Radio Club. 77th Anniversary. 28.450 21.350 14.250 7.250. Certificate & QSL. CIRC, PO Box 993, Bloomington, IL 61702. Operating from the American Red Cross, McLean County. **www.qsl.net/w9aml**

Jan 28-Jan 30, 0000Z-2359Z, GB4CLB, Cromer, Norfolk, Great Britain. Norfolk County RAYNET. Cromer Life Boat — Sea Over Sand and SOS Radio Week. 80 m SSB CW RTTY. QSL. Via bureau or direct to Terry Owen, G4PSH, Touchwood, The Street, Sutton, Norwich Norfolk NR12 9RF, Great Britain. **www.norfolkraynet.org.uk/page92.html**

Jan 29, 0100Z-0800Z, WD6RAT, Palm Springs, CA. Desert RATS Club of Palm Springs. Palm Springs Hamfest 2011. 14.251 7.240 3.672. QSL. Desert RATS Club, 11445 Western Ave, Desert Hot Springs, CA 92240. Held in conjunction with our ARRL Sponsored Hamfest. **desertrats.am**

Jan 29, 1600Z-2100Z, KSØKS, Olathe, KS. Santa Fe Trail Amateur Radio Club. Kansas 150th Birthday. 14.250 7.250 10.120. QSL. Dan Reed, 29545 West 152nd Ter, Gardner, KS 66030.

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 Web site.

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 also available at that site. You can also request a copy by e-mail or send a self-addressed, stamped envelope (SASE) (Special Requests, ARRL, 225 Main St, Newington, CT 06111; write "Special Events Form" in the lower left-hand corner.) 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 Events page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through November 10. You can view all received Special Events at **www.arrl.org/special-event-stations**. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

Strays

QST congratulates...

◊ ARRL Life Member Don Carlson, KQ6FM, of Sparks, Nevada, who has been named Pacific Division Ham of the Year. He was given a plaque at Pacificon, the ARRL Pacific Division Convention, in October for his contributions to the ARRL's audio public service announcements and his other contributions to the ARRL Public Relations program. Don also serves as Section Emergency Coordinator.

◊ former Astronaut Susan J. Helms, exKC7NHZ, who has been named Commander of Vandenberg Air Force Base, California. Major General Helms, who flew five Shuttle missions, was the first US military woman in space. — *tnx Eric Lemmon, WB6FLY*

◊ ARRL member Ron Hranac, NØIVN, of Littleton, Colorado, who has been inducted into the Society of Cable Telecommunications Engineers (SCTE) Hall of Fame. A Technical Leader with Cisco Systems, Ron serves the ARRL as a member of the EMC Committee. In that capacity, he is the primary liaison between the ARRL and the cable TV industry for cable-related interference issues.

◊ Mark Turner, G7LEU, who has developed a free iPhone/iPad/iPod touch app, *Ham Square*, that uses your device's built-in GPS receiver to determine and display your location in decimal degrees along with the corresponding Maidenhead Locator (grid square).

◊ ARRL member Jerry Spring, VE6CNU, whose self-published humor book, *Hogwash for Hamsters*, is now available as an e-book from Amazon, Barnes & Noble and Books on Board.

◊ ARRL Life Member David C. Goggio, W4OGG, of Memphis, Tennessee, who, at age 93, served as Grand Marshal for the parade honoring the 70th Reunion Class of Washington University, St Louis.

WB8IMY

ECLECTIC TECHNOLOGY

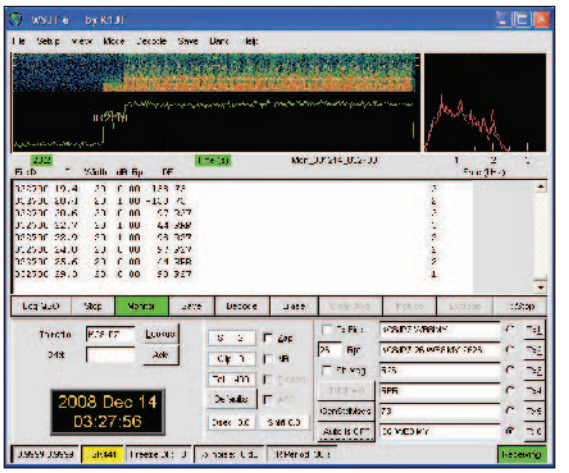
The *WSJT* Evolution Continues

Joe Taylor, K1JT, instigated a small a revolution a few years ago. Back then, moonbounce and meteor scatter were considered exotic activities enjoyed by a vanishingly small number of amateurs. If you wanted to work someone by bouncing your signal off the lunar regolith, you needed big antennas and equally big power. Meteor scatter wasn't quite so demanding, but it was an activity most hams enjoyed only when meteor showers provided sufficient opportunities.

When Joe unleashed his *WSJT* software suite, that part of the Amateur Radio world was turned upside down. If you wanted to try your hand at making a digital moonbounce contact with the big boys, all you needed was a computer with a sound card, a long-boom Yagi antenna for your VHF band of choice and a hundred watts or so.

Meteor scatter was made almost absurdly easy with *WSJT*. Using its FSK441 mode, hams with modest stations were ricocheting RF off the fiery trails of meteors at any time of the day or night. They didn't have to wait for showers; meteor contacts were available 24/7. When I say "modest" stations, I mean *really* modest. I've made many FSK441 contacts running just 100 W on 6 meters to dipole antennas.

Joe hasn't allowed *WSJT* to stand still. Not long ago he announced the beta release of version 9.0 on his Web site at **www.physics.princeton.edu/pulsar/K1JT/**. Among other things, this version offers a new mode called ISCAT, which replaces JT6M, as well as enhanced features and performance for FSK441.



A powerful meteor scatter burst received with *WSJT* during the 2008 Geminids shower.

Using *WSJT* to work Ray, K9KHW, via meteor scatter in March 2009. I was running just 50 W to a 6 meter loop antenna at the time.

The software is free. If you're already set up for digital operating with PSK31, RTTY or other modes, you can be up and running with *WSJT* in minutes. I'd recommend starting with FSK441 meteor scatter on 6 meters. Read the *WSJT* user manual thoroughly and then park your SSB rig on 50.260 MHz. Activate the software in monitoring-only mode and go away for an hour or so. (Weekend mornings and evenings are particularly good times.) When you return to your computer, don't be surprised if you see call signs on the screen!

Amateur Radio Digital Voice Codec

A while ago I discussed the fact that most voice codecs — the kind that make digital voice communication possible — were proprietary closed-source creations. This has been a serious impediment to developing new Amateur Radio digital voice technologies. Obtaining a license to use a proprietary codec can be difficult . . . and costly.

The good news is that Dave Rowe, VK5DGR, has just released an open-source speech codec. Dave says that his new CODEC2 needs additional work, but the speech quality of the Alpha release is pretty good. He has a few audio samples on his Web site at **www.rowetel.com/blog/?page_id=452**.

Sony's New "Single Wire" Interface

Hams are painfully familiar with the headaches of multiconductor cables, especially the kind that are required to flex back and forth repeatedly. Microphone cords and antenna rotator cables come to mind. With enough motion and enough time, one of the wires will eventually break, usually at a point that is the most difficult to find or access.

The problem of flexing cables is even worse among mobile devices such as cellular telephones and notebook or laptop computers. I can't help but cringe a little whenever I close my station laptop. I can just hear the wire harness that connects the LCD screen to the motherboard screaming for mercy.

Sony apparently has been dwelling on this problem too. They've developed what they are calling "single wire interface technology" that allows bi-directional transmission of multiple signals, including video, audio and even dc power, on a single copper cable. They are using a time division duplex and multiplex system to move data packets in both directions more or less simultaneously. Sony is claiming transmission speeds of up to 940 Mbps with a device consisting of a digital circuit that performs multi-level encoding, an analog portion that sends and receives signals, and a third circuit that combines signals with dc power (or separates them from dc power).

In order to get the technology to market as soon as possible, Sony prototyped a chip in cooperation with the Rohm Corporation. According to Sony, the chip should begin showing up in products this year. QST

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

K2TQN

VINTAGE RADIO

What Happened After the Rescue?

This month is the epilogue of Jack Irwin and the Airship *America* story. Here I want to extend the history by talking about what followed for Jack and others of the *America*'s crew.

The Lightning Jerker

In the November 1911 issue of the *Marconigraph* (a Marconi company employee magazine), Jack Irwin related his story about the Airship *America* and its rescue. He also commented on what happened next in his life. When he arrived in New York he found his services were in demand, not as a radio operator but in vaudeville. Surrounded by booking agents, he signed a 10 week contract at a "satisfactory salary." After that he signed with the Sullivan and Considine circuit [Sullivan and Considine operated a chain of vaudeville theaters in the US and Canada. — *Ed.*]. He commented, "I remained on the stage 8 months enjoying a tour of the United States and part of Canada, which seldom comes the way of a "lightning jerker." ("Lightning jerker" is early slang for telegraph operator or professional radio operator.)

"In July of this year I returned east and was offered the position of Marconi operator with Vaniman's new airship '*Akron*,' in which he will again tempt the fates in an attempt to reach Europe by dirigible balloon. I promptly accepted, and am now assisting in its construction. The new airship will be 258 feet long; it will contain 400,000 cubic feet of hydrogen, and have a lifting capacity of 13 tons. It will have a total of 317 horsepower and will carry a 3 kW Marconi set of special construction."

The *Akron* Flight in 1912

Melvin Vaniman had contacted the Goodyear Company and arranged for them to sponsor the new airship. Goodyear would manufacture the balloon portion, which would hold the hydrogen. At this point Walter Wellman was also involved. The huge hangar in Atlantic City would again be host to the team and house the airship as it was being constructed.

On the trial flight the crew of six contained three of the original 1910 crew, Melvin Vaniman, Louis Loud and Jack Irwin. The three new crew members were Calvin Vaniman (Melvin's brother), George Riffard and Thomas Blottcher.

Newspaper reports hinted that all was not happy with the crew as there were disagreements between some of them. I gathered from some of the reports that they were critical of Vaniman as he seemed to be rushing the construction and testing.

On Tuesday, July 2, 1912 the *Akron* was brought out of the hangar with fire and police crews assisting, as in 1910. The crew had some major changes indicating the severity of the disagreements. They were Melvin Vaniman, skipper; Calvin Vaniman, steersman; George Bourtillion, electrician (and presumably also the wireless operator); Frederick Elmer, deckhand, and Walter Guest, deckhand.

The newspapers would report that all started well and the airship rose to above 1000 feet. Then a plume of black smoke appeared, the balloon exploded and the remains fell into about 10 feet of water. Rescue boats were soon on the scene but no survivors were found.

It was reported in one paper (reports vary) that Mrs Vaniman and the three other widows, Mrs Elmer, Mrs Bourtillion and Mrs Guest, were sitting on the balcony of the Vaniman cottage watching the balloon when it exploded. "They are all suffering and are in the care of physicians," the paper reported.

Searching for bodies started immediately and four were recovered within a couple of days. The bodies of Melvin Vaniman and Fred Elmer were finally found on July 15, 1912.

The remains of the airship were piled on a barge and towed to Gardners Basin in Atlantic City; then they were shipped to Goodyear in Akron, Ohio, for examination. The gasoline tank was intact and had not exploded. Parts of the airbag were examined and it was found that it had not burned but burst. It was believed that the gas within expanded and split the seams. (The entire gasbag was not examined due to souvenir hunters having taken pieces.)

Jack Irwin continued his career in radio working at the *Radio Broadcast* magazine laboratories and writing articles. He served honorably in the Army during World War I and served with the Signal Corps at Fort Monmouth. Colonel Jack Irwin died in action during World War II. General order 42, November 30, 1945 designated Irwin Avenue at Fort Monmouth.

ANTHONY SIMON

Murray Simon looking over the *Trent*'s rail.

ANTHONY SIMON

Crew of the *America*, from the left: Fred Aubert, Walter Wellman, Melvin Vaniman, Jack Irwin, Louis Loud and Murray Simon.

ANTHONY SIMON

Anthony Simon, grandson of Murray Simon.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

K2TQN COLLECTION

The *Akron* during an early test flight over Atlantic City.

K2TQN COLLECTION

The remains of the *Akron* were shipped to Goodyear in Akron, Ohio, for examination.

K2TQN COLLECTION

Remains of the *Akron* being loaded on a barge before being towed to Gardners Basin in Atlantic City.

ANTHONY SIMON

Air and Space Museum Senior Curator of Aeronautics Tom Crouch, in front of *Akron* and *America*'s surviving lifeboat.

Kiddo

Kiddo, the feline mascot, was renamed Trent after the rescue ship and for a while he was displayed in a gilded cage in the window of Gimbels department store. He would later go home with Wellman's daughter, Edith, and live a quiet life.

K2TQN COLLECTION

Murray Simon the British Navigator

Murray Simon later wrote: "You must never cross the Atlantic in an airship without a cat - more useful to us than any barometer."

I recently met Anthony Simon, a retired executive who lives in Belgium and is Murray Simon's grandson. He has forwarded some additional information.

"My grandfather received marriage proposals from damsels captivated by his adventure," Anthony Simon told the BBC (**www.bbc.co.uk/news/world-us-canada-11547569**): "Offers for vaudeville, lectures and articles rained down from the skies."

Anthony continued, "In 1936, to his great joy, he was invited to fly on the maiden transatlantic voyage of the *Hindenburg*, at that time the biggest airship in existence."

In an interview with a fellow passenger on the *Hindenburg*, Murray Simon said, "I vowed at the time that I'd fly across the Atlantic yet - and now that moment has come. I'm supremely happy." Simon died in 1969.

Lifeboat Found in Ohio

Constructed by S. E. Saunders of East Cowes on the Isle of Wight in 1910, the boat was thought locally to have been destroyed in the crash, but it has been in storage since 1912 at Goodyear. It was the only significant piece to be recovered from the *Akron*'s accident.

The Goodyear Tire & Rubber Co has made the lifeboat a gift to the Smithsonian National Air and Space Museum where visitors learn that "The 100 year old lifeboat is from Goodyear's earliest lighter-than-air endeavor, the ill-fated airship *Akron* in 1912. It was also used in 1910 on Wellman's airship *America*."

"The National Air and Space Museum is delighted to add this survivor of the very first Goodyear airship to its collection of historic air and spacecraft," Senior Curator of Aeronautics Tom Crouch said in a press release. "It will have a place of honor in a section of the Steven F. Udvar-Hazy Center housing the *Double Eagle II*, the first balloon to fly the Atlantic, and the Concorde, which whisked travelers across the Atlantic at supersonic speeds."

Where Did Airship *America* End Up?

No one knows for sure, but A. H. Savage-Landor, in *Across Unknown South America*, volume II, p 425, tells a story that was told to him by the people of Porto Principal, Peru, in January 1912. Some years before, a ship had been seen in the sky, passing over the town, not far above the tree tops. According to his interpretations, it was a "square globe," flying a flag of Stars and Stripes. Mr Savage-Landor thinks that the object might have been the airship that Wellman abandoned about 400 miles east of Hatteras in 1910. Whatever this thing in the sky may have been, or we think that it may have been, it returned at night and this time it showed lights.

More information and a 45 minute video presentation about the airship and rescue is available on my Web site, **www.k2tqn.com**. — *K2TQN*

W1GHZ

MICROWAVELENGTHS

Microwave Homebrewing

One of the fun things about microwaves is being able to build your own equipment, with the satisfaction of making something that not only works but works well. Few of us could build an HF transceiver competitive with commercial offerings, but most of us can homebrew some useful parts of a microwave system. We can start with simple modules or kits and progress to more complex things or higher frequencies as we develop new skills.

In the October 2009 "Microwavelengths" column, I described some simple microwave transverters that I designed.[1] One of my intents was to make them reproducible — the magic is in the PC board pattern, so that there is a high confidence that the circuit will work if assembled correctly. You don't have to be a microwave expert, just know which end of a soldering iron to hold.

Another View

David Palm, W9HQ, recently wrote to me describing his experience in building some of these transverters:

> UHF and SHF weak-signal operation is an aspect of ham radio that held no interest for me, until recently. Now, however, I've been totally hooked by this new frontier in radio. The circuits needed to generate such high frequencies have always been mysterious to me and the technical challenges and sometimes esoteric materials involved discouraged me from seriously pursuing any sort of equipment building.
>
> Fortunately, the levels of integration available in individual RF parts capable of functioning way up into the GHz frequencies is such that the really hard work has been done for us. The amplifier, mixer, and filtering blocks are cheap, readily available, and highly optimized. What's left is combining these building blocks into a design capable of operating in the ham bands.
>
> The transverter circuits created by W1GHZ are delightfully simple and just examining the schematics and reading his description of how he designed them is an excellent tutorial in transverter operation. Fundamental operations such as frequency multiplication, filtering, and IF/LO mixing suddenly become clear when confronted with such a clear and basic design. Once you understand Paul's simple designs, more complex transverters are easy to understand. They all work the same way!
>
> Aspiring builders can get the PC boards from W1GHZ, but then you're on your own to acquire the necessary parts from various sources. A fine pointed soldering iron, a little magnification, and a steady hand are all that are needed to stuff the small surface mount parts to the boards. But this is not kit building, so definitely not for the beginning builder. There are no part by part instructions on how to assemble these boards and the means of final check-out is entirely up to the individual. That brings up a potential obstacle for some builders. At least in my opinion, check-out of the modules would be very difficult without at least some access to a spectrum analyzer. With an analyzer I was able to bring up the 1152 MHz LO for the 1296 MHz transverter and found immediately that, although it was oscillating, its

[1]P. Wade, W1GHZ, "Microwavelengths," *QST*, Oct 2009, pp 97-98.

DAVID PALM, W9HQ

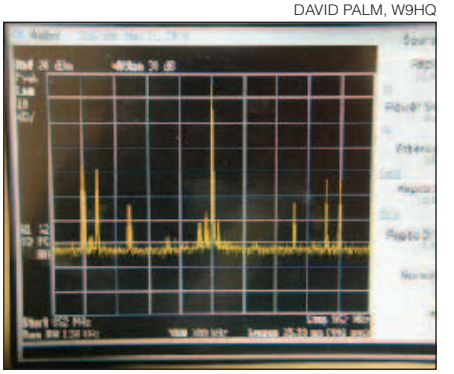


Figure 3 — Output spectrum of the transverter shown in Figure 1, with an output of +15 dBm.

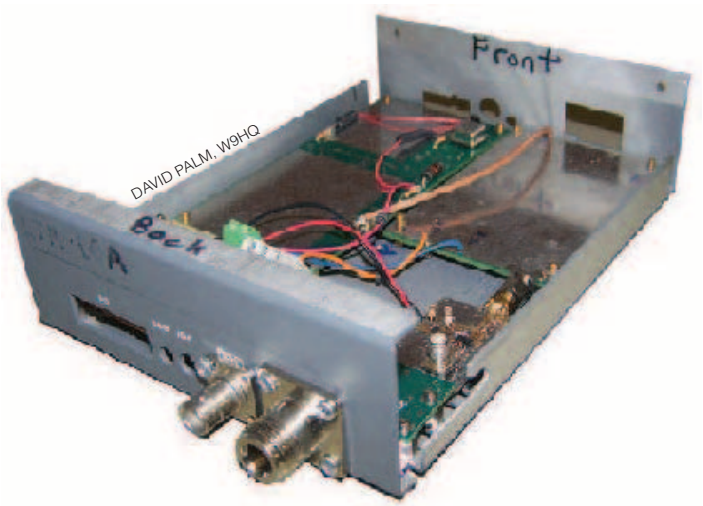


Figure 1 — Transverter for 902 MHz built by David, W9HQ.

DAVID PALM, W9HQ

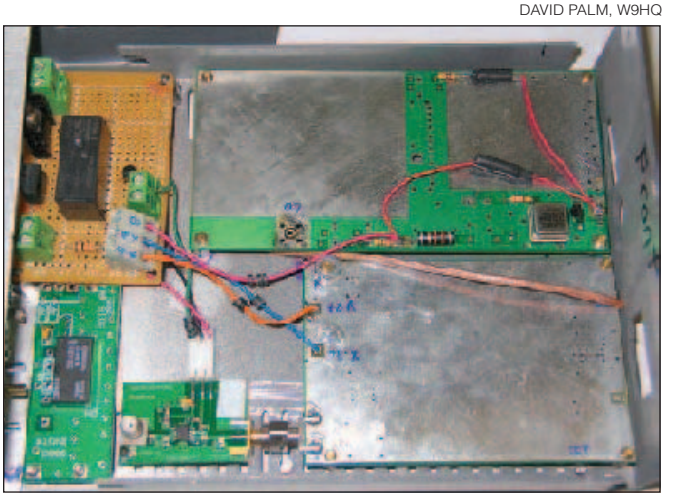


Figure 2 — David's, W9HQ, 902 MHz system assembly.

Paul Wade, W1GHZ ♦ 161 Center Rd, Shirley, MA 01464 ♦ w1ghz@arrl.org

Figure 4 — Feeding frenzy at the Microwave Update swap session that filled the Sheraton Cerritos parking lot.

Figure 5 — Antenna range source on hotel roof to create a slant range.

Figure 6 — Antenna measuring was conducted by Kerry Banke, N6IZW, shown here measuring the 5.7 GHz dish of Michelle, W5NYV.

output was extremely low. Working back over my board revealed that I had misconnected one end of the bias resistor to the final amplifier stage. A quick rework brought the LO up to its desired output. I can't really imagine how I would have found something like that without a spectrum analyzer.

"I'm learning incredible amount both in theory and practice by building my W1GHZ transverter boards. I can't wait to get one on the air — that first contact with a SHF transverter that I built myself will be thrilling indeed.

Those interested in joining an on-line group dedicated to building W1GHZ transverters are encouraged to visit **http://groups.yahoo.com/group/w1ghz-transverter-builders**."

David also sent some pictures, one of his transverters for 902 MHz (see Figure 1) and of the system assembly in a cabinet (see Figure 2). The transmit output spectrum (see Figure 3) is very similar to what I have measured on my transverters, demonstrating that these simple modules are reproducible. The spectrum is also a reminder that these units are fine for low power work, but more filtering is needed if they are to drive higher-power amplifiers.

While David feels that a spectrum analyzer is important, I have avoided using one while assembling and testing the modules, relying instead on an RF power indicator — a simple diode detector like the one in the January 2010 "Microwavelengths" is adequate.[2] For receive testing, the signal source in the August 2010 column will do, with an oscillator chosen to produce harmonics in the desired band.[3] The modules with printed filters will be tuned to the desired band, but the higher frequency modules with pipe-cap filters do require tuning — I use an inexpensive frequency counter to check the frequency.

David also makes the point that these are not kits and may be daunting for the beginning builder. Since the whole idea is to get beginners started in microwaves, I'll have to address homebrew surface-mount construction techniques in a future column. It's not that hard, once you see how to do it and have a bit of practice.

Microwave Update

A VHF or microwave gathering is always good for some new ideas and inspiration, as well as seeing old friends and meeting new ones. The Microwave Update 2010 conference in Cerritos, California was sponsored by the San Bernardino Microwave Society (**www.ham-radio.com/sbms**). The folks of SBMS did a great job putting on a conference that featured 2 days of excellent technical talks, a tour of the Jet Propulsion Laboratory in Pasadena, a swap meet with a great selection of microwave goodies (see Figure 4) and microwave antenna measuring. The antenna range was a slant range, with the source on the hotel roof (see Figure 5), which reduces ground reflection. Measurement takes place on the ground, as shown in Figure 6. A future "Microwavelengths" column will discuss antenna measurement.

The talks and papers covered the gamut from beginner topics to some incredible projects, like 47 and 78 GHz equipment that I'm not ready to tackle yet. Also valuable are the informal discussions, a rare opportunity to share ideas with hams from all over the world.

The next Microwave Update will be in Enfield, Connecticut, sponsored by the North East Weak Signal Group (**www.newsvhf.com**), on October 13-16, 2011. Details will be available at **www.microwaveupdate.org**. Hope to see you there.

Photos by Paul Wade, W1GHZ, except as noted.

[2]P. Wade, W1GHZ, "Microwavelengths," *QST*, Jan 2010, pp 94-95.

[3]P. Wade, W1GHZ, "Microwavelengths," *QST*, Aug 2010, pp 96-97.

AB1FM

EXAM INFO

Question Pool Update, 2011 Exam Fee

QPC Releases General Class Question Pool

A revised General class question pool will take effect for all Element 3 General class license written exams on July 1, 2011. Released to the public in December 2010 by the Question Pool Committee (QPC) of the National Conference of Volunteer Examiners, the new question pool does not contain significant changes. 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 consists of Chairman Roland Anders, K3RA, of the Laurel Amateur Radio Club Inc VEC; Perry Green, WY1O, of the ARRL VEC; Larry Pollock, NB5X, of the W5YI VEC; Jim Wiley, KL7CC, from the Anchorage Amateur Radio Club VEC and Mike Maston, N6OPH, of the SANDARC VEC. They can be reached by e-mail at **qpcinput@ncvec.org**.

With the General class exam changing July 1, 2011, ARRL VEC will be supplying all its (nearly 1000) Field Stocked VE teams with new test booklet designs about the third week in June. Current ARRL VEC-supplied General class test booklets versions are valid until June 30, 2011. The ARRL VEC VE Exam Maker Software will get updated too and will be available about mid-June 2011. The Question Pools can be viewed on the ARRL Web at **www.arrl.org/question-pools**.

2011 ARRL VEC Examination Fee Remains at $15

The ARRL VEC exam fee for 2011 will remain at $15. Remember that a $15 fee is charged to every person seeking a new license or upgrade as listed on your ARRL VEC Candidate Roster. That 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).

ARRL VE teams may retain up to $7 of this fee to directly reimburse their team's out-of-pocket examination expenses incurred in setting up and conducting their examination sessions. As long as the expense is warranted and has been prudently incurred — and the expense is specifically related to exam administration — then the fee can be retained. The team should keep a complete record of the expenses paid (with receipts) in team records for two years. Records must be made available to ARRL VEC upon request. Costs not related to the exam session processes or paperwork are not reimbursable.

The FCC allows VECs to collect an examination reimbursement fee from each candidate who takes one or more exam elements. VEs and VECs may be reimbursed by examinees for out-of-pocket expenses incurred in preparing, processing, administering or coordinating an examination for an amateur operator license (FCC Rule §97.527). These exam fees help the VEC recover its costs of providing its services. There's more about exam fees — and every aspect of the ARRL VEC — at **www.arrl.org/vec**.

Question Pool Schedule

- Technician class (Element 2) Pool was effective July 1, 2010 and is valid until June 30, 2014.
- General class (Element 3) released December 2010 will become effective July 1, 2011.

The current General Pool will only be valid until June 30, 2011.

- Extra class (Element 4) Pool was effective July 1, 2008 and is valid until June 30, 2012.

2011 ARRL National Exam Day Weekends

ARRL sponsored national exam day weekends are held annually on the last full weekends of April and September.

- Spring national exam day weekend is April 23-24, 2011.
- Fall national exam day weekend is September 24-25, 2011.

We thank you for your support of these events!

Submitting Exam Results to the VEC

Using United States Postal Service (USPS) Priority Mail and ARRL VEC Pre-paid postage label: For shipping your test session results to ARRL VEC office, use the USPS Priority Mail envelopes and ARRL VEC self-adhesive first class Business Reply Mail (BRM) labels. Please do not use other envelopes, such as plain brown or plain white. Some post offices assume these are Third Class mailers and will inadvertently delay delivery significantly! The USPS Priority Mail envelopes are available free of charge from either us or your local post office.

A handful of VE Teams have found that Postal Service staff may object when they are presented with the Priority Mail envelope with the ARRL VEC First Class BRM label at a post office window. If this should happen to you, politely state that this method is acceptable since the postal charges are the same for either Priority or First Class mail. If you still have difficulty, ask to speak with the window supervisor and refer them to the BRM notice below. And if that's not satisfactory, ask to speak to the next higher staff person or the postmaster. The ARRL VEC has confirmed with various USPS staff supervisors/postmasters, in each instance where this procedure is questioned, that we are doing it right!

Include the teams' or the Liaisons' return address on the envelope. USPS stipulates that this information must be displayed on the envelope. Any post office can refuse a package that does not have a return name and address label attached.

To view or print the USPS BRM notice information, see the VE Resources page at **www.arrl.org/resources-for-ves**. QST

Evolution of the Number of US Amateur Radio Licenses

Year	*Novice*	*Tech/Tech+*	*General*	*Advanced*	*Extra*	*Clubs***	*Total*
2010 (through Oct)	15,971	341,585	155,126	59,634	122,358	10,760	705,434
2000*	40,155[1]	319,735[1]	38,625[1]	86,545	97,977	4,745	687,782
1990	87,333	122,344	124,979	105,418	51,948	2,285	494,307
1980	82,479	92,620	121,561	96,509	36,782	2,625	432,576
1970	24,903	87,441	97,280	58,316	13,391	3,650	284,981

*FCC License Restructuring began April 15, 2000.
[1]No new Advanced, Tech Plus or Novice licenses issued by the FCC after April 14, 2000. Technician Plus renewals converted to Technician licenses.
**Estimate

Maria Somma, AB1FM ♦ ARRL VEC Manager ♦ msomma@arrl.org

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Alabama (Locust Fork) — Jan 8 D H R T V
8 AM-3 PM. *Spr:* Blount County ARC. Locust Fork Baptist Church, 30580 State Hwy 79. *TI:* 146.7 (91.5 Hz). *Adm:* Free. Tables: Free. Bill Pond, AE4IE, 150 Smoke Rise Ln, Warrior, AL 35180; 205-647-5705; **ae4ie@juno.com**; **freezefest.com**.

Arizona (Glendale) — Jan 8 D F H R V
Set up 5:30 AM; public 7 AM-noon. *Spr:* ThunderBird ARC. Thunderbird School of Global Management-Activity Center, 15249 N 59th Ave (59th Ave and Coral Gables Ln). *TI:* 146.7 (162.2 Hz), 446.15 (100 Hz). *Adm:* $2. Tables: 2 for $5 (extra table $5). Jack Lunsford, KD7RCJ, 6646 N 30th Dr, Phoenix, AZ 85017; 602-242-2411; **j.lunsford@cox.net**; **www.w7tbc.org/Hamfest_2011html**.

California (Palm Springs) — Jan 29
D F H R T
9:30 AM-4:30 PM. *Sprs:* Desert Radio Amateur Transmitting Society and Palm Springs DX Club. The Boskovich Estate, 4193 Matthew Dr. 2nd Annual Winter Field Day. *TI:* 146.94 (107.2 Hz). *Adm:* $1. Tables: not supplied, except by pre-arrangement. Peter Reinzuch, VE7REZ, 11445 Western Ave, Desert Hot Springs, CA 92240; 760-318-0186; **ve7rez@desertrats.am**; **desertrats.am**.

Colorado (Loveland) — Jan 15 D F H R V
8:30 AM-1 PM. *Spr:* Northern Colorado ARC. Larimer County Fairgrounds, 5280 Arena Cir. *TI:* 145.115 (100 Hz). *Adm:* $5. Tables: $10. Charles Hess, KDØGMW, 5502 Tripp Ct, Fort Collins, CO 80525; 970-667-4357; **sales@667help.com**; **www.ncarc.net**.

Florida (Arcadia) — Jan 29 D F H R T V
7 AM-1 PM. *Spr:* DeSoto ARC. Turner Civic Center Exhibit Hall, 2260 NE Roan St. *TI:* 147.075 (100 Hz). *Adm:* $5. Tables: inside $10; outside first free, $5 for each additional table. Jim Ebner, N8JE, 5905 NE Cubitis Ave, Lot #124, Arcadia, FL 34266; 863-244-2667; **n8je@arrl.net; www.desotoarc.org**.

SOUTHERN FLORIDA SECTION CONVENTION

January 15, Fort Myers
D H R S T

The Southern Florida Section Convention (Southwest Florida Hamfest and Computer Show), sponsored by the Fort Myers ARC, will be held at the Araba Shrine Auditorium, 2010 Hanson St. Doors are open for setup on Friday 4-9 PM and Saturday 6-8 AM; public Saturday 8 AM-3 PM. Features include dealers, vendors, tailgating ($10 per space, includes 1 admission ticket; additional spaces $5 each), refreshments, handicapped parking. Talk-in on 147.165 (127.3 Hz), 147.345 (136.5 Hz). Admission is $5 (12 and under are free with paying adult); $3 (students 13-18 with valid student ID). Tables are $15 (plus admission). Contact Larry Zimmer, W4LWZ, 1719 NW 21st St, Cape Coral, FL 33993; 239-282-1526; fax 239-282-1536; **w4lwz@arrl.net**; **fmarc.net**.

Florida (Silver Springs) — Dec 11 D F R S T
8 AM-3 PM. *Spr:* Silver Springs Radio Club. Booster Stadium, 3050 NE 36th Ave. *TI:* 146.61 (123 Hz). *Adm:* advance $4, door $5. Tables: $10. Carlos Cheker, K4CCJ, 2701 NE 10 St, #307, Ocala, FL 34470; 352-208-3413; **ccheker@gmail.com**; **k4gso.com**.

Coming ARRL Conventions

January 8
Delta Division, Hammond, LA

January 9
New York City/Long Island Section, Bethpage

January 15
Southern Florida Section, Fort Myers

January 28-29
Mississippi State, Jackson

February 5
South Carolina Section, Ladson
Virginia State, Richmond

February 11-13
Southeastern Division, Orlando, FL

February 18-19
Arizona State, Yuma

February 26
Vermont State, Colchester

March 5
South Texas Section, Rosenberg

March 5-6
Alabama Section, Birmingham

Florida (Tampa) — Jan 22 D F H R T V
8 AM-1 PM. *Spr:* Tampa ARC. TARC Clubhouse, 7801 N 22nd St. TARCFest XXIV.V. *TI:* 147.105 (146.2 Hz). *Adm:* $2. Tables: $3. William Bode, N4WEB, 14302 Capitol Dr, Tampa, FL 33613; 813-382-9262; **n4web@hamclub.org**; **www.hamclub.org**.

Georgia (Lawrenceville) — Jan 8 H Q R T V
8 AM-2 PM. *Spr:* Gwinnett ARS. St Marguerite d'Youville Church, 85 Gloster Rd. 13th Annual TechFest, technical displays of Ham Modes and gear. *TI:* 147.075 (82.5 Hz). *Adm:* Free. Tables: Free. Norman Schklar, WA4ZXV, 480 N Peachtree St, Norcross, GA 30071; 770-313-9410; **schklar@gmail.com**; **gars.org**.

Illinois (Collinsville) — Jan 29 D F H R S V
8 AM-noon. *Spr:* St Louis and Suburban RC. Gateway Convention Center, One Gateway Dr. Winterfest 2011. *TI:* 146.76, 146.94. *Adm:* advance $6, door $7. Tables: $20. 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 23 D F H R S V
8 AM-1 PM. *Spr:* Wheaton Community Radio Amateurs. Kane County Fairgrounds, 525 S Randall Rd. *TI:* 145.31 (107.2 Hz), 146.52. *Adm:* advance $7, door $9. Tables: $25. John Faber, WT9Y, 1586 Scottdale Cir, Wheaton, IL 60189; 630-604-0157 (phone and fax); **info@w9ccu.org**; **www.w9ccu.org**.

Kansas (LaCygne) — Feb 5 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. *TI:* 147.285. *Adm:* Free. Tables: $10. Ron Cowan, KBØDTI, Box 36, LaCygne, KS 66040; 913-757-3758; fax 913-757-4455; **kb0dti@arrl.net**.

DELTA DIVISION CONVENTION

January 8, Hammond, Louisiana
D F H Q R S V

The Delta Division Convention (30th Annual Hammond Hamfest), sponsored by the Southeast Louisiana ARC, will be held at the SLU University Center, 800 W University Ave. Doors are open 8 AM-2 PM. Features include swap and vendor tables; commercial dealers and displays; forums; special guest from ARRL HQ Dave Sumner, K1ZZ, CEO; VE sessions (8:30 AM, $15 cash only); Wouff Hong ceremony; RVs welcomed (no hookups). Talk-in on 147.0 (107.2 Hz). Admission is free. Tables are $15. Contact Tyrone Burns, N5XES, Box 442, Springfield, LA 70462; 985-351-8315; fax 985-345-4410; **n5xes@arrl.net** or **wb5net@arrl.net**; **www.selarc.org/selarchamfest.htm**.

Maryland (Odenton) — Jan 23
D F H Q R T V
8 AM-noon. *Spr:* Maryland Mobileers ARC. Odenton Volunteer Fire Department Hall, 1425 Annapolis Rd (Rte 175). 17th Annual Post Holiday Hamfest. *TI:* 146.805. *Adm:* $5. Tables: $13. Frank Winner, N3SEO, 283 Oak Ct, Severna Park, MD 21146; 410-647-3335; **n3seo@aol.com**; **www.mobileers.org**.

Michigan (Hazel Park) — Jan 16 D F H Q R
8 AM-noon. *Spr:* Hazel Park ARC. Hazel Park High School, 23400 Hughes St. 45th Annual Hamfest. *TI:* 146.64 (100 Hz). *Adm:* $5. Tables: $15. Walt Carter, KD8LWC, Box 368, Hazel Park, MI 48030; 248-548-4645; **kd8lwc@yahoo.com**; **www.hparc.org**.

MISSISSIPPI STATE CONVENTION

January 28-29, Jackson
D F H Q 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, DXCC card checking, 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 James McCarty, KA5TJW, 226 Sunchase Dr, Brandon, MS 39042; 601-238-3800; **ka5tjw@arrl.net** or **hamfest@msham.org**; **www.msham.org**.

Missouri (Springfield) — Jan 8 D H R S T V
8 AM-2 PM. *Spr:* Ozark Mountain AR Group. Faith Lutheran Church, 1517 E Valley Water

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

Mill Rd. *Tl:* 146.52. *Adm:* $5. Tables: Free. James French, KCØTQD, 1505 E Glenwood St, Springfield, MO 65804; 417-425-9962; **kc0tqd@w0omd.org**; **www.w0omd.org**.

New Jersey (Bergenfield) — Dec 11 D F H R
7:30 AM-4:30 PM. *Spr:* Boy Scout Troop 139. Conlon Hall, 19 N William St. *Tl:* 146.955 (141.3 Hz), 146.52. *Adm:* Free. Tables: $20 (vendor spaces only). Gordon Beattie, W2TTT, 29 N Washington Ave, Bergenfield, NJ 07621; 201-314-6964; fax 201-387-8896; **w2ttt@arrl.net**.

New Mexico (Albuquerque) — Jan 29
D F H R T
Sunrise-2 PM. *Spr:* Albuquerque 146.580 Simplex Group. Transcore Amtech Technology Center, 8600 Jefferson St. *Tl:* 145.33, 146.94 (both 100 Hz), 146.9 (67 Hz). *Adm:* Free. Tom Ellis, K5TEE, 912 Lomas Ct NE, Albuquerque, NM 87112; 505-291-8122; **tl_ellis@att.net**.

NEW YORK CITY/LONG ISLAND SECTION CONVENTION

January 9, Bethpage
H Q R S V
The New York City/Long Island Section Convention (12th Annual Ham Radio University), co-sponsored by the ARRL New York City/Long Island Section and the Kings County Repeater Assn, will be held at Briarcliffe College, 1055 Stewart Ave. Doors are open 7:30 AM-6 PM. Features include "Ham Radio University 2011" ("Spreading Ham Radio Knowledge and Know How" — a day of education to share ideas, experiences, knowledge and fellowship among Amateur Radio operators); forums about different aspects of Amateur Radio, focus will be "hands on" with many demonstrations and emergency communications; Keynote speaker ARRL President Kay Craigie, N3KN; Amateur Radio Club and organization tables; Special Event Station W2V on the air with traditional modes as well as PSK-31; VE sessions; handicapped accessible; refreshments. Talk-in on 146.85 (136.5 Hz). Admission is by $3 donation. Contact Tom Carrubba, KA2D, 226 Sheffield Ave, W Babylon, NY 11704; 631-422-9594 (phone and fax); **ka2d@arrl.net** or **info@hamradiouniversity.org**; **www.hamradiouniversity.org**.

New York (Lockport) — Jan 29 D F H R
8 AM. *Spr:* Lockport ARA. South Lockport Fire Company, Transit and Ruhlman Rds. *Tl:* 146.82 (107.2 Hz). *Adm:* $5. Tables: $5. Duane Robinson, W2DLR, Box 142, Ransomville, NY 14131; 716-791-4096; **w2dlr@arrl.net; lara.hamgate.net**.

New York (Marathon) — Jan 15 D F H R V
7 AM-noon. *Spr:* Skyline ARC. Marathon Civic Center, Peck Ave and Brink St. *Tl:* 147.18. *Adm:* $3. Tables: $5. Patrick Dunn, KC2BQZ, 1302 Rams Gulch Rd, Jamesville, NY 13078; 315-308-0482; **kc2bqz@gmail.com**; **www.skylineradioclub.org**.

North Carolina (Winston-Salem) — Jan 8
D F H R T
8 AM-noon. *Spr:* Forsyth ARC. Summit School Athletic Complex, 2100 Reynolda Rd. "Winston-Salem FirstFest." *Tl:* 146.64 (100 Hz). *Adm:* advance $4 with coupon from **hamfest.w4nc.org**, door $5. Tables: $15. Terry Brown, AK4D, Box 11361, Winston-Salem, NC 27116-1361; 336-245-5740; **firstfest2011@w4nc.org**; **firstfest.w4nc.org**.

Ohio (Nelsonville) — Jan 16 D F H R T V
8 AM-2 PM. *Spr:* Sunday Creek AR Federation. Tri-County Vocational School, 15676 State Rte 691. 15th Annual Hamfest. *Tl:* 147.15. *Adm:* $6. Tables: $5. Jeramy Duncan, KC8QDQ, 10847 Walnut St, Glouster, OH 45732; 740-767-2554; **duncan10847@embarqmail.com**.

Ohio (Strasburg) — Jan 30 D F H R T
8 AM. *Spr:* Tusco ARC. Wallick Auction House, 965 N Wooster Ave. 21st Annual Hamfest. *Tl:* 146.73 (71.9 Hz). *Adm:* $5. Tables: $10. Kyle Quillen, KD8HDJ, 518 Fair Ave NW, New Philadelphia, OH 44663; 330-204-0944; **hamfest@tuscoarc.org**; **www.tuscoarc.org**.

Oklahoma (Ada) — Feb 5 D F H R S V
Set up Friday (Feb 4) noon-5 PM; public Saturday 7:30 AM-12:30 PM. *Spr:* Ada ARC. Chickasaw Community Building, 700 N Mississippi. *Tl:* 147.285 (114.8 Hz). *Adm:* $5. Tables: $8. Jack Skinner, KB5KKT, Box 1147, Kingston, OK 73439; 580-564-4186; **kb5kkt@arrl.net**.

Pennsylvania (Harrisburg) — Jan 15
F H Q R V
8 AM-noon. *Spr:* Harrisburg RAC. Paxtang Firehouse, 3423 Derry St. *Tl:* 146.76 (100 Hz). *Adm:* $3. Tables: Free (half table). Glenn Kurzenknabe, K3SWZ, 23 Carriage Rd, New Cumberland, PA 17070; 717-774-1728; **k3swz@arrl.net**; **www.w3uu.org**.

SOUTH CAROLINA SECTION CONVENTION

February 5, Ladson
D F H R S T V
The South Carolina Section Convention (38th 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**.

Texas (Fort Worth) — Jan 14-15
D F H R S T V
Friday 3-8 PM; Saturday 8 AM-3 PM. *Spr:* Lockheed Martin ARC. Lockheed Martin Recreation Area, 3400 Bryant Irvin Rd. Cowtown Hamfest. *Tl:* 147.28 (110.9 Hz). *Adm:* advance $8, door $9. Tables: $30. Gary Persons, W5MTF, 217 Dominion Ct, Saginaw, TX 76179; 817-996-6756; **kd5day1@sbcglobal.net**; **www.cowtownhamfest.org**.

Texas (Schertz) — Jan 22 D F H Q R S T V
8 AM-2 PM. *Spr:* San Antonio RC. Schertz Civic Center, 1400 Schertz Pkwy, Bldg 5. Amateur Radio Fiesta. *Tl:* 146.94 (179.9 Hz). *Adm:* advance $4, door $5. Tables: advance $7, door $8. J C Smith, N5RXS, 8734 Melrose, San Antonio, TX 78250; 210-522-6167; **n5rxs@satx.rr.com**; **w5sc.org**.

VIRGINIA STATE CONVENTION

February 5, Richmond
D F H Q R S V
The Virginia State Convention (Frostfest 2011), 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 ($75/$100), new equipment dealers, major manufacturers, forums and meetings, VE sessions (noon-3 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 Cas Grys, KF6CUE, 27 Oak Knoll Pl, Bumpass, VA 23024; 540-872-5949; **info@frostfest.com**; **www.frostfest.com**.

Wisconsin (Waukesha) — Jan 8
D F H R S V
8 AM-2 PM. *Spr:* West Allis RAC. Waukesha County Expo Center Forum, 1000 Northview Rd (County Hwy FT). 39th Annual Midwinter Ham Radio, Computer, and Electronics Swapfest. *Adm:* advance $4, door $5. Tables: 8-ft, advance $20 (until Dec 31), $22 (Jan 1 and after); electrical outlet $20 (advance only). Phil Gural, W9NAW, S67 W12944 Larkspur Rd, Muskego, WI 53150; 414-425-3649; **janphil68@att.net**; **www.warac.org**.

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, online and 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 prizes or any kind 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**.

Strays

HORKHEIMER PRIZE 2011

◊A prize bearing the name of one of the first radio amateurs in Germany, Rudolph Horkheimer, will be awarded by the Deutscher Amateur Radio Club at Ham Radio 2011 in Friedrichshafen, Germany. Any member of an Amateur Radio Society in the IARU is eligible. The prize will be awarded to an active radio amateur who promotes Amateur Radio in a selfless manner. For more information, contact DARC, Lindenallee 4, 34225 Baunatal, Germany, or via e-mail to **darc@darc.de**. Applications are due March 31, 2011.

75, 50 AND 25 YEARS AGO

January 1936

- The cover photo shows a ham admiring his new WAC certificate.
- The editorial begins with, "There are some practices in the 'phone bands that to us do not smell so good," and goes on to relate some of the common but non-amateur practices being used by some voice hams.
- "New Cosmic Phenomenon," by J. H. Dellinger (Chief of the Radio Section of the National Bureau of Standards), reports "…my suspicion that [radio propagation] fade-out is due to an eruption on the sun has been confirmed."
- "28-Mc. Activity at an All-Time High" reports that W6FQY made WAC on 'phone, and that 21 stations have reported Working All Continents on 10 meters.
- George Grammer, W1DF, helps the ham community get on the hot new band, with "Transmitters for Ten Meters."
- R. O. Lund, W9SGA, and W. C. Howe, W9UVP, discuss "Considerations in Speech-Amplifier Design."
- Ed Handy, W1BDI, announces "W9NY 28-Mc. Contest Winner!" The contest was held from October 1, 1934, to October 1, 1935.
- W. Van B. Roberts, W3CHO, tells about building "Pocket Superregen Receivers" so small they will fit into a suit-coat pocket!
- The "M.R.A.C-A.R.R.L. 56-Mc. International DX Contest!!!" is announced, to run from January 1 through December 31, 1936.

January 1961

- The cover photo shows an adjustable experimental antenna setup for 1215 Mc. that W1HDQ and W1CUT are "playing with."
- The editorial takes a look at "The Year in Review," noting great achievements at v.h.f. and above: Amateur two-way moonbounce contact between W1BU and W6HB. W7JIP and W7LHL's record 265-mile QSO on 10,000 Mc. W6NLZ and KH6UK's receiving the ARRL Merit Award for their work in 144- and 220-Mc. tropospheric propagation. And so on….
- W. O. Troetschel, K6UQH, and H. J. Heuer, KH6CYI, tell us about "A Parametric Amplifier for 1296 Mc."
- Lew McCoy, W1ICP, presents "A Novice T.R. Switch" that uses a 6AH6.
- "Not Just a Novelty," by Davis Helton, WØPME, discloses "the secret of mobile C.W. operation."
- Ken Lamson, W1ZIF, tells us about "A 4-400A Amplifier for C.W., S.S.B. or A.M."
- James Lee, W6VAT, presents "Some Applications of the Semiconductor Diode" that address simplified keying and control circuits.
- "A Brief-Case Portable Antenna," by Jo Emmett Jennings, W6EI, describes his compact loaded dipoles for 80 through 10 meters.
- "Communication on 52,000 Mc.", by M. C. Gale, K2VND, tells about the first QSOs made on the highest frequency yet used by amateurs.
- "A Dead Art?" shows WØQKZ's nice-looking — and very effective — homebrew 1 kw rig that uses a Collins PTO for frequency control.

January 1986

- The cover photo shows Scout leader W3FTG demonstrating amateur radio to Scouts at Jambo '85.
- The editorial announces, "New Year, New Opportunities," and tells the reader what's been going on and how to participate in the League's various efforts.
- "Up Front in *QST*" reports that the SAREX (Shuttle Amateur Radio Experiment) videotape is now available for purchase. The tape was produced by K6DUE, N6ENV, WA6ITF, WA3VJB, and many others.
- Clark Greene, K1JX, gives us the interesting story of "Meteor-Scatter Communications" and how you can join the fun.
- "In Search of the Perfect Picture," by Clayton Abrams, K6AEP, is Part 2 of his informative article on SSTV.
- "Send Error-Free Code with One Hand," by W. E. Quay, W4MKC, and R. H. Turrin, W2IMU, describes their small, one-hand, six-switch keyboard that's based on the Braille key codes.
- Doug DeMaw, W1FB, once again presents valuable information to the beginner, in Part 5 of "The Principles and Building of SSB Gear."
- George Murphy, VE3ERP, says, "Meet the SWAILER" — Standing Wave Audible Indicator and Level of Effective Radiation monitor.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

OCTOBER 2010

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**.

870 W7TVA
675 AC6C
579 W4CAC
574 KT5SR
455 KØIBS
425 KA2ZNZ
400 KI4KWR
375 K2HAT
370 KT2D
325 N2LTC
310 WB9YBI
304 K6NCX
295 W2MTA KT4YA
285 KB2RTZ
275 W5KAV
265 K2DYB
262 K8OLY
260 K9LGU KB2ETO
245 N5NVP
225 W5DY K8RDN
223 WB9FHP
221 KK5NU
220 N1UMJ
218 W5QQ NC4VA
211 WB8RCR
210 AK2Z
205 WD9FLJ N7CM
202 KBØDTI
200 KA3OCS
199 WA2BSS
195 K7EAJ
190 N4ELI WB9JSR
189 K2ABX
186 KC2SFU
180 NX8A
175 N9VC WE2G
169 KK7DEB
165 KE5HYW NX9K WD8USA
163 W7JSW
161 W7ELI
160 KGØGG
155 AG9G
150 KD1LE KK3F
148 KB5PGY N9DVL
145 K7OAH AA3SB N5ASU
144 KA8ZGY
140 K7BFL N2GJ W4DNA
136 KF7GC
135 N1QLN
W3YVQ
134 N4EJF
130 NN7H K6JT WØLAW WB2FTX N7IE K4IWW N2JBA
125 KB8GT
122 KØLQB
120 K6HTN KA4FZI N2GS N3RB KB2BAA W1GMF KW1U N1LKJ WM2C WB8WKQ
119 K4DND
115 KF5CRX W4OTN N1IQI KB8RCR N9WLW
111 KJ4MNW
110 W7QM W7GB KE4CB KC5OZT WI2G NM1K K1HEJ KB1NMO K5KV WB6OTS N7XG K1YCQ KB3LNM N9MN W2EAG
108 W3CB W1PLW
106 KO6V NA9L
105 AD4BL
N7YSS
102 W2CC
101 N2VC K9EOH
100 N7EIE WØCLS NØMEA WAØVKC N4ABM N9VT K4SCL N5OUJ N1JX K5MC WA2NDA N3SW W3TWV KC2UVQ K2TV NR2F W4TTO WK4P
99 KJ7NO
98 KS3Z K8VFZ W9LW W9WXN
95 KCØM KC5MMH KK1X KC8CYK
93 W8CPG
91 AD5CQ KØBXF
90 NIØI K4MSG K5GLS WA2CUW N3KB N3ZOC K3IN WD8DHC W3GQJ KA1EHR W8IM K4JGA K1JPG NU8K KZ8Q KI4YV W9MBT
88 W8QZ
86 KD7OED
85 KK7TN
83 W5ESE
82 N2DW
81 W2DSX N8NMA
80 K7MQF KCØZDA AD8BC KI4AAN KJ4HGH W2SFD K8KV KD8LZB
79 W4QAT
78 KB3LFG
77 WDØGUF
74 NA7G KC4PZA
73 W5GKH NS7K
72 W6WW KD7THV
71 W5XX
70 KØDEU NØDLK NØDUW NØDUX NUØF KAØFUI KBØJKO NØMHJ N3NTV KØPTK KØOR KØRXC NØUKO KD7ZUP AC5CW AA2SV

The following stations qualified for PSHR in previous months, but were not properly recognized in this column: (Sept) KI4KWR 595, KØBIS 580, W4CAC 466, W4OTN 270, K4DND 259, K7BC 232, N5NVP 110, KA3OCS 110, WS6P 104, K5MC 100, N4ABM 94, K5GLS 90, K4MSG 90, N9VT 90, W2SFD 88, KI4JQB 84, AC5CW 80, K6RAU 72. (Aug) WB9YBI 290, N2JBA 130, K6RAU 81.

Section Traffic Manager Reports

The following Section Traffic Managers reported:
AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, IL, IN, KS, LA, LAX, MDC, MI, MN, MS, NC, NFL, NLI, NNJ, NNY, NTX, OH, OK, OR, ORG, SD, SFL, SNJ, STX, TN, UT, VA, WCF, WI, WMA, WNY, WPA, WV, WY.
(The Virginia STM reported September activity, but was not acknowledged in the December *QST* column.)

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported:
AZ, EWA, GA, IA, IN, KS, MDC, ME, MI, MN, MO, MT, NC, NLI, NM, OH, SFL, STX, SV, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

W1GMF 2436, KK3F 1602, N1IQI 1543, W8UL 1496, KA9EKG 1418, KW1U 1007, KZ8Q 912, WB8WKQ 841, WB9JSR 697, N8IXF 686, WB5NKC 659, N1LKJ 609, N1UMJ 596, K1JPG 584, NX9K 571, K6JT 523, K4IWW 504.

Stations earning BPL by Originations plus Deliveries: KA3OCS 180, NM1K 117.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

K1CXW **Wescott**, Lawrence J. Jr, Windham, ME
KA1DBS **DeMarco**, Charles R. "Charlie" Jr, Southington, CT
♦W1DNM **Bechard**, Rev Bernard J., Sheldon Spgs, VT
WA2ADB **Blakeley**, William C.,Wall, NJ
W2BLH **Berger**, Abraham L., East Meadow, NY
WB2FJL **Richardson**, Winfield W., King of Prussa, PA
WB2OIS **Catalano**, Joseph, Oneida, NY
W2QZJ **Rand**, Simon, Chelmsford, MA
WB2SLJ **Huykman**, Fred L., Mount Arlington, NJ
W2USN **Bachorz**, Paul M., Ballston Spa, NY
WA2YSO **Friedman**, Florence O., Tupper Lake, NY
KA3DTD **Montgomery**, Grant E. Jr, Douglassville, PA
KB3HZS **Robertson**, Larry K., Burlington, KY
KA3MLY **Felix**, August D., Elkins Park, PA
W3ZIP **Evangelista**, Albert A., Chambersburg, PA
♦KA4AEF **Fast**, Norman D., Memphis, TN
W4AKU **Stewart**, Gwyn D., Gibsonville, NC
AG4DN **Mait**, Martin B., Charlottesville, VA
♦KD4ED **Van Bloom**, J. C., Dunnellon, FL
KE4ESN **Eastabrooks**, Fred H., Fort Thomas, KY
W4GO **Holtman**, H. Bernard., Louisville, KY
AB4HR **Akins**, Charlie K., Quinton, AL
K4IJS **Swallick**, Ted W., Saint Cloud, FL
WB4JCM **Johnson**, Bob, Gainesville, FL
K4MMF **Brown**, Julian C., Chickamauga, GA
WB4NVN **Smith**, Dennis W., Oak Ridge, NC
W4QVA **Scheuchenzuber**, John R., West Palm Beach, FL
AE4RA **Lunsford**, Dan H., Chatsworth, GA
WA4RMC **Gregory**, Barbarra R., Chattanooga, TN
W4SAM **Adams**, Samuel L. Sr, Clover, SC
K4SWU **Underhill**, Sam W., Ellijay, GA
K4TTD **Wimbish**, George E., Newell, NC
♦K4UF **Green**, Robert W., Charlotte, NC
♦N4UVO **Dalton**, Jennifer, Louisville, KY
KG4VVZ **Wagner**, Dale R., Palmyra, VA
N4WQD **Peppers**, David L., Louisville, KY
♦K5AS **Krueger**, Stanley W., Fayetteville, AR
ex-K5BOB **Broyles**, Clyde A., Hot Springs,AR
KJ5CA **Hume**, Richard R., Greers Ferry, AR
K5CEY **Dillon**, John P., Irving, TX
WA5CLU **Reeves**, Raymond J., Kirbyville, TX
KD5EFG **Cates**, Mike H., Guntown, MS
♦W5HHS **Liljedahl**, Forrest M., Denton, TX
K5IT **Castleberry**, Jack H., Orange Grove, TX
KC5JNT **Adams**, John R. Jr, Gonzales, TX
KB5MVP **Greathouse**, Bruce H., Tyler, TX
AC5NQ **Radbill**, John M., Albuquerque, NM
KC5NT **Middlebrook**, Edward R., West, TX
KC5PIF **Robertson**, Ralph A., Waco, TX
KB5STN **Truxton**, Perry E., Alamogordo, NM
KC5VGF **Smith-Walker**, Mary, Joplin, MO
K6AHM **Wood**, Dana B., Los Angeles, CA
KG6AKL **MacDonald**, Doug M., Morro Bay, CA
KR6AN **Hanson**, Donald E. Jr, Gilbert, AZ
WA6BFH **Wendt**, John P., Mira Loma, CA
WA6CIF **Hathaway**, Richard L. "Buck" Jr, Coronado, CA
W6DO **Lukenbill**, Robert S. "Bob," Long Beach, CA
♦K6IVY **Killeby**, Dennis W., Umpqua, OR
♦W6KPC **Clement**, A. J., Bakersfield, CA
KB6LLH **Humphrey**, B., Richmond, CA
W6RET **Deane**, William W., El Cajon, CA
W6VTK **Conant**, Donald E., Cupertino, CA
W6ZRZ **Hawley**, Willis C. "Bill," Los Angeles, CA
AE7AC **Olsen**, Steven Lee, Salt Lake City, UT
WA7AIQ **Watson**, Thomas H., San Angelo, TX
N7CQM **Weddle**, Richard M., Dewey, AZ
K7GXZ **Marsh**, Harvey E., Liberty Lake, WA
KE7INH **Casselman**, Thomas N., Beaverton, OR
N7PHX **Jones**, James D., Tempe, AZ
N7SKR **Smith**, Betty L., Flagstaff, AZ
KB7TRR **Sherman**, James W., Los Lunas, NM
KC7TVD **Tate**, John E., La Pine, OR
*K7UU **Heidergott**, Kurt W., Bellevue, WA
W7XV **Urie**, Bill, Port Orchard, WA
WA7ZXP **Necker**, Dan, Amity, OR
W8BEZ **Boehnlein**, Albert W., Ludington, MI
K8DIT **Kadish**, Benjamin, Kailua Kona, HI
N8HC **Gantz**, Luther T. "Lutie" Jr, Sandusky, OH
♦W8LU **Schang**, Kenneth "Ken," Plymouth, MI
W8OGL **Parsons**, Gilbert A., Ross, OH
W8PCB **Sullivan**, Francis G., Raleigh, NC
♦WB8PDG **Slater**, Tom, Adamsville, OH
W8QEZ **Groves**, Donald E., New Albany, OH
KB8SBK **Tighe**, Francis T. "Frank," Dayton, OH
N8VTW **Mezzacapo**, Jerry F., Spring Hill, FL
W8WH **Klukan**, Ronald J., Walton Hills, OH
W8ZCR **Missall**, John W., Dayton, OH
KB9BGY **Duffy**, Kevin B., Belleville, IL
W9BTZ **Marty**, John C., Kendallville, IN
KC9CFK **Osborne**, Carol L., Bargersville, IN
N9COP **Neitzel**, Robert A., New Carlisle, IN
N9DCA **Murphy**, Michael E., Churubusco, IN
KA9EXM **Hallowell**, Jimmy K., Maryville, IL
W9FBO **Priester**, Harry L., Baraboo, WI
WA9HNK **Winko**, Robert W., Nineveh, IN
N9LIJ **Fitzl**, James B., Eau Claire, WI
♦WB9PUJ **Bokern**, Richard E., Fort Wayne, IN
WA9Q **Vokorokos**, James C., Chesterton, IN
W9VAK **Kroes**, Donald P., Fond Du Lac, WI
N9VGB **Trunnelle**, Robert I., Mesa, AZ
KEØAM **Barrett**, Robert M., Eldridge, IA
KAØCJM **Anderson**, Thelma "Dee," Wellsville, MO
KBØCLY **Van De Walle**, Matthew J., Columbus, NE
WDØCQI **Van Arkel**, Eldon, Albion, IA
KCØDCK **Modrell**, Donald L., Laurinburg, NC
WDØFNU **Deck**, Dale A., Hoskins, NE
WØHB **Anderson**, A. M., Minneapolis, MN
♦NØKJT **Kirkendoll**, John C., Liberty, MO
KAØNNB **Vogelsang**, Casper H., Edwards, MO
NØOEV **Laughlin**, Dennis E., Independence, MO
KØROD **Eldridge**, Roscoe "Steve," Port Ritchey, FL
ex-WNØBQY **Couture**, Stephen H., Clive, IA
♦VE4JP **Fysh**, D. O., Strathmore, AB, Canada
EA3EJA **Pascual**, Manuel Dotu, Barcelona, Spain

♦ 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

Gail Iannone ♦ Silent Keys Administrator ♦ sk@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.

♦ **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 on 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 2011, Headquarters and W1AW are closed on New Year's Day (observed December 31, 2010), Presidents' Day (February 21), Good Friday (April 22), Memorial Day (May 30), Independence Day (July 4), Labor Day (September 5), Thanksgiving and the following day (November 24 and 25) and Christmas (observed December 26). For more information, visit us at **www.arrl.org/w1aw.html**.

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

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(877) 520-9623
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Hwy. 163 & Claremont Mesa
sandiego@hamradio.com

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(877) 892-1749
Jon, K6WV, Mgr.
So. from Hwy. 101
sunnyvale@hamradio.com

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(Near Philadelphia)
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(800) 644-4476
Chuck, N1UC, Mgr.
RT.13 1/4 mi., So. I-295
newcastle@hamradio.com

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(800) 765-4267
Bill, K7WCE, Mgr.
Tigard-99W exit
from Hwy. 5 & 217
portland@hamradio.com

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(800) 444-9476
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denver@hamradio.com

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(800) 559-7388
Gary, N7GJ, Mgr.
Corner of 43rd Ave & Peoria
phoenix@hamradio.com

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- Wideband RX - 900 Memories
- 5W TX (300mw 220Mhz)
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- Built-in CTCSS/DCS
- Internet WIRES compatible

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Now available in Black!

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2M/220/440HT

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• D-STAR & GPS upgradeable 2M/70CM • 50/15/5W RF output levels • RX: 118-173.995, 375-549.995, 810-999.99 MHz** • Analog/digital voice with GPS (optional UT-123) • 500 alphanumeric memories

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• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation

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2M + 70CM • 5/2.5/0.5 Watts Output Power • RX: 136-174, 400-479 MHz** • 302 Alphanumeric Memory Channels • 700mW Loud Audio • Ni-MH 7.2V/1400mAh Battery

†This device has not been approved by the Federal Communications Commission. This device may not be sold or leased, or be offered for sale or lease, until approval of the FCC has been obtained.
*Except 60M Band. **Frequency coverage may vary. Refer to owner's manual for exact specs. ***Tested to survive after being under 1m of water for 30 minutes. *1 AA Alkaline batteries not included, radio comes with a AA alkaline battery tray. *2 For shock and vibration. *3 Optional UX-9100 required. ✦Instant savings, gift certificates and Icom mail-in rebates expire 12/31/10. Contact HRO for promotion details. QST JAN 2011. The Icom logo is a registered trademark of Icom Inc. 20252

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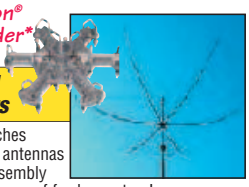

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DXE-CBC-008JU006	6 ft.	**$24.99**
DXE-CBC-008JU012	12 ft.	**$30.99**
DXE-CBC-008JU025	25 ft.	**$36.99**
DXE-CBC-008JU050	50 ft.	**$54.99**
DXE-CBC-008JU075	75 ft.	**$72.99**
DXE-CBC-008JU100	100 ft.	**$97.99**
DXE-CBC-008JU125	125 ft.	**$114.99**

RG-8X JSC-3060 Cable Assemblies with PL-259 Connectors

DXE-CBC-8XJU002	2 ft.	**$13.99**
DXE-CBC-8XJU003	3 ft.	**$14.99**
DXE-CBC-8XJU006	6 ft.	**$16.99**
DXE-CBC-8XJU012	12 ft.	**$19.99**
DXE-CBC-8XJU025	25 ft.	**$23.99**
DXE-CBC-8XJU050	50 ft.	**$33.99**
DXE-CBC-8XJU075	75 ft.	**$43.99**
DXE-CBC-8XJU100	100 ft.	**$53.99**

Custom Lengths Available—Contact Us
See DXEngineering.com for complete information!

maxi-core™ High Performance

Current Baluns and Feedline Current Chokes

- 5, 10 and 10 kW+ Baluns and Current Chokes
- High efficiency, low loss—W8JI design
- All standard ratios available

Starting at just $84.95 for FCC050-H05-A
See April 2009 QST Short Takes!

Better than the Other Guys! New Un-Slit Lengths, Smoothly Telescoping. Pre-Slit Just Add Clamps & Slide It Together for a Complete Antenna Element!

6063-T832 Aluminum Tubing

The Best Aluminum Tubing Available
>> Same Price as the Other Guys <<

- Custom made just for DX Engineering
- Order from us and the other guys—We guarantee that you'll send theirs back!

3 foot lengths .058 wall - 3/8" to 2 1/8" OD
6 foot lengths .058 wall - 3/8" to 2 1/8" OD
Perfect for Most Elements
6061-T8 .120 wall - 1.5" to 3" OD
For Booms and HD Element Designs

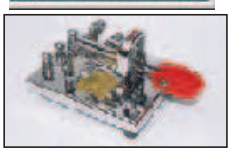
See DXEngineering.com for specs and additional tubing.
DX Engineering Has All-Stainless Steel Element Clamps That Fit Exact Tubing Sizes!

Best Antenna Value Anywhere!

DX Engineering now stocks replacement parts for all BTV antennas
Easiest assembly and tuning of any multi-band vertical!

HUS-4BTV	(10, 15, 20, 40m)	**$124.95**
HUS-5BTV	(10, 15, 20, 40, & 75-80m)	**$159.95**
HUS-6BTV	(10, 15, 20, 30, 40, & 75-80m)	**$189.95**
DXE-8X19-RT	Coax Jumper Cable to BTV Base	**$16.95**
DXE-A0K-DCF	SO-239 Add-On Kit for BTV Base	**$22.95**
DXE-A0K-12M	12m Add-On Kit for BTVS	**$59.95**
DXE-A0K-17M	17m Add-On Kit for BTVS	**$69.95**
DXE-A0K-60M	60m Add-On Kit for BTVS	**$74.95**

Vibroplex© IAMBIC Deluxe



The Vibroplex IAMBIC is the modern descendant of the original CW bug. It has the traditional Vibroplex look but is designed for use with modern electronic keyers. Code speed depends on your electronic keyer—you get the same crisp operation at 5 words per minute as you do at 50+ wpm. The IAMBIC Deluxe has a highly polished chrome base and jeweled movements.

VIB-IAMBIC-D **$189.95**
Check DXEngineering.com for more Vibroplex products.

Amplifiers

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AMR-AL-811H
800 Watt Amplifier
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Microphones

HEI-GM-4	GOLDLINE 2-element Mic, HC4	$129.00
HEI-GM-5.1	GOLDLINE 2-element Mic, HC5.1	$129.00
HEI-HM-10-DUAL	Desk Mic, HC4 & HC5 Elements	$119.00
HEI-ICM	Desk Mic for ICOM, 8 ft. attached	$99.00
HEI-PR781	Dynamic Cardioid Studio Quality Mic	$169.00

Headsets

HEI-PROSET-4	Boom Mic/Headset, HC4	$125.00
HEI-PROSET-5	Boom Mic/Headset, HC5	$125.00
HEI-PROSETIC	Boom Mic/Headset/Adapter, ICOM Electret	$139.00
HEI-PSE-6	**PROSET Elite** with HC-6 element	$165.00

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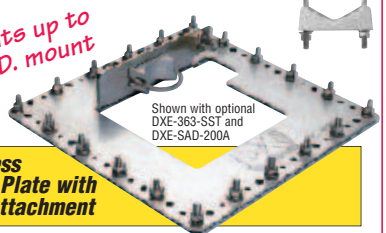


Stainless Radial Plate with Coax Attachment

NOT CHEAP ALUMINUM!
GUARANTEES BEST RADIAL SYSTEM CONDUCTIVITY OVER TIME

Makes radial attachment a snap!
- Fits 3" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

New!

DXE-RADP-3	Complete with 20 stainless bolt sets	$54.50
DXE-RADP-1HWK	20 sets of 1/4" stainless hardware	$7.50
DXE-SSVC-2P	Stainless Saddle Clamp for attachment to round tube 1" to 2" O.D.	$11.95
DXE-SSVC-3P	Stainless Saddle Clamp for attachment to round tube 2" to 3" O.D.	$14.95
DXE-363-SST	Silver/Teflon® bulkhead connector	$6.95
DXE-VFCC-H05-A	Vertical Feedline Current Choke	$134.95
DXE-RADW-500K	Radial Wire Kit, 500 feet of wire, 20 lugs, 100 steel anchor pins	$61.90
DXE-RADW-1000K	Radial Wire Kit, 1,000 feet of wire, 40 lugs, 200 steel anchor pins	$123.95
DXE-STPL-100P	Steel Radial Wire Anchor Pins, 100 pack	$16.00

Biodegradable Anchor Pins Also Available

hy-gain

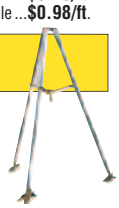
Antenna Rotors

HYG-AR-35	Light Beam/TV	$89.95
HYG-CD-45II	8.5 Sq. Ft. Rating	$419.95
HYG-HAM-IV	15 Sq. Ft. Rating	$594.95
HAM-HAM-V	15 Sq. Ft. Digital Control	$919.95
HYG-T-2X	20 Sq. Ft. Rating	$689.95
HYG-HDR-300A	25 Sq. Ft. Rating, Heavy Duty	$1,339.95

Rotor Accessories

DXE-CW8	8-Wire Rotor Cable	$0.48/ft.
DXE-CW8-HD	8-Wire Heavy Duty Rotor Cable	$0.98/ft.

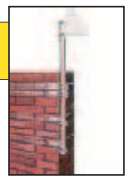
Heavy Duty Tripod Roof Mount



- Ideal for medium size antennas like the DX Engineering HEXX Beam or small HF and VHF Yagi or tri-band antennas
- 1 1/2" O.D. heavy-duty steel legs, 10" long mounting feet with tar strips
- 30 lag bolts included
- 5 ft. tall, 2" O.D. steel antenna/rotor mounting mast

RON-1011 ..... $149.95

Heavy Duty Chimney Roof Mount



- Ideal for medium size antennas with rotors like the DX Engineering HEXX Beam or small HF and VHF Yagi or tri-band antennas
- 24 ft. long stainless steel straps
- Rotor-ready 24" upper and 42" lower masts
- Fits multiple-flue residential and commercial chimneys
- Four 1 1/2" wide, 11 gauge steel corner brackets
- Shipped partially assembled

RON-3324 ..... $149.95

The Experts in Phased Antenna Systems!

Four-Square Hybrid Controllers

Our hybrids offer 20dB F/B and up to 5dB gain at a lower cost than most beams. Available for 160 through 10 meters.

COM-ACB-4 Series ..... from $364.95

2-Element Vertical Controllers

No space for a four-square phased vertical array? Three switched patterns—available for 160 through 10 meters.

COM-PVS-2 Series ..... from $333.95

Stack Yagi Switches

The STACK-2 is ideal for tribanders, logs or monobanders. The K3LR-design STACK-3 is for monoband 3-stack Yagis. Select any combination.

COM-STACK-2 ..... $221.95
COM-STACK-3 ..... $399.95

Call us for custom-tuned phasing cables and monoband antenna systems!

ONE MAN TILT OVER

Thick, Laser Cut Stainless Steel Tilt Base

- Patented cam action allows you to easily raise or lower DX Engineering, Hustler, Hy-Gain, or Butternut for tuning, weather or CC&R accommodation.

DXE-TB-3P	For Hustler BTV verticals	$62.50
DXE-TB-4P	For DX Engineering 40VA-1, Butternut, most Hy-Gain 1/4-wave verticals	$87.50
DXE-TB-6P	For Hy-Gain 14AVQ	$87.50

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TIG-SL-USB $86.95

Then choose a cable for each radio!

Any Radio Interface Cable*, only **$12.95** when purchased with SignaLink™ unit

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For your complete digital solution!

**except the special Elecraft K3 cable*

- Easiest installation and setup—Macintosh or PC
- Software CD ROM included
- Built-in low noise sound card
- USB port powered
- Works with ALL radios
- Supports all sound card digital and voice modes
- Requires radio interface cable

Coaxial Cable Prep Tools

New!

- 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
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FREE Surge Protector

with purchase of any new LDG tuner!

Purchase any new LDG tuner between Oct 15 2010 and March 15, 2011 and receive a Free SP-200 200W Surge Protector from LDG*.

NEW! AT-600Pro

The LDG AT-600Pro will handle up to 600 watts SSB and CW, 300 on RTTY (1.8 – 30 MHz), and 250 watts on 54 MHz. It will match 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 the AT-600Pro with longwires, random wires and antennas fed with ladder line just by adding a balun. It has two antenna ports with a front-panel indicator, and separate memory banks for each antenna. Easy to read LED bar-graph meters showing 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 Icom interface cable, DC power cable and coax jumper. ***Suggested Price $359.99***

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***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-100ProII

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch with LEDs, allowing you to switch instantly between two antennas. The AT-100ProII requires just 1 watt for operation, but will handle up to 125 watts. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $229.99***

Z-11ProII

Meet the Z-11ProII, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes Icom interface cable, DC power cable and coax jumper.
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. A coax jumper cable is also induced for fast hook up.
Suggested Price $129.99.

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes Icom interface cable, DC power cable and coax jumper.
Suggested Price $159.99

*To receive your free SP-200, simply fill out the rebate form available at www.ldgelectronics.com and mail to LDG along with a copy of your dated sales receipt. All rebate forms must be received by LDG before March 31, 2011. Limit one per household, valid worldwide.

LDG Electronics, Inc. 1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

The #1 Line of Autotuners!

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 Icom interface cable, DC power cable and coax jumper. ***Suggested Price $599***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-200Pro

The AT-200Pro features LDG's new "3-D memory system" allowing up to eight antenna settings to be stored for each frequency. Handles up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz (including 6 meters). Rugged and easy-to-read LED bar graphs show power and SWR, and a function key on the front panel allows you to access data such as mode and status. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $249***

NEW! YT-450

LDG's newest tuner is specially designed for Yaesu's newest 100 watt radios. The YT-450 interfaces directly with the Yaesu FT-450 and FT-950 radios, making integration easier than ever. Simply connect the tuner to the radio with the supplied cables and you are ready to operate. DC power and all control is done through the interface cable. Just press the tune button on the tuner and the rest happens automatically: mode and power are set, a tune cycle runs and the radio is returned to its original settings. 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! An extra CAT port on the back allows seamless connection to a PC. You have the newest radio, now get the newest tuner to go with it! ***Suggested Price $249.99***

IT-100

Matched in size to the IC-7000 and IC-706, the new IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can 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. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible.
Suggested Price $179.99

KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. The LEDs on the front panel indicate tuning status, and will show a match in seconds, or even less of you've tuned on or near that frequency before. Has 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers.
Suggested Price $199.99

YT-100

An autotuner for several popular Yaesu Radios. An included cable interfaces with your FT-857, FT-897 and FT-100 (and all D models) making it an integrated tuner, powered by the interface. Just press the tune button on the tuner, and everything else happens automatically: mode and power are set, a tune cycle runs, and the radio is returned to its original settings. It's the perfect complement to your Yaesu radio.
Suggested Price $199.99

Meters!

FT Meter 2.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Still Only $49***

FTL Meter For Yaesu FT-857(D) and FT-897(D). 4.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Suggested Price $79.99***

NEW! M-7600 For IC-7600. It will display S-meter on receive, or power out, SWR, ALC level or supply voltages, all selectable from the radio's menu. What's more, the M-7700 and the virtual meter on your radio can work together.
Suggested Price $79.99

NEW! 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! The mode is set to carrier and the RF power is reduced, a tune cycle runs and the radio is returned to the original settings. Also includes coax jumper cable. ***Suggested Price $249.99***

Visit our website for a complete dealer list.

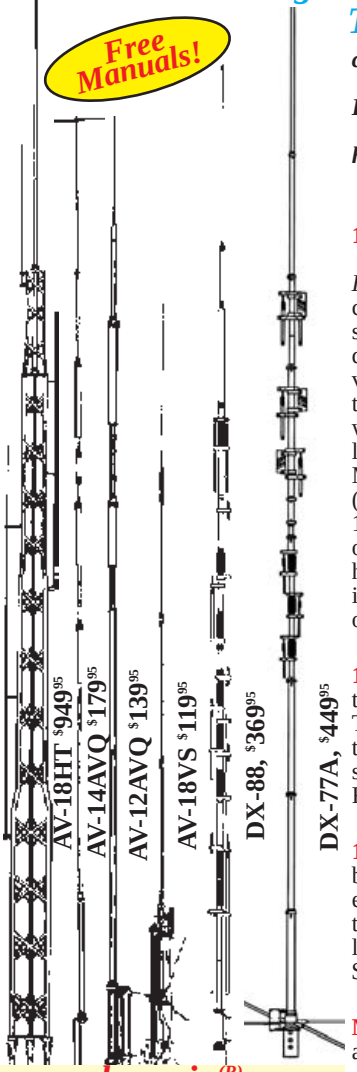
Call or visit your favorite dealer today! ***www.ldgelectronics.com***

LDG

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.

Stealth Operation

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

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TS-590S 100W HF/6M Transceiver

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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

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 G5 & EchoLink® ready

TH-K2AT 2M FM HT

- TX: 144-148 • RX: 136-174
- Power: 5/1.5/0.5W • Memories: 100

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

TS-2000 100W HF/VHF/UHF Transceiver

- TX: HF/6M/2M/440 MHz • RX: 0.03-60, 142-152, 420-450 MHz • Power: 10-100W (10-50W on 440 MHz)
- Memories: 99 • HF/6M Auto Antenna Tuner
- IF/stage DSP on main band, AF/stage DSP on sub-band

TS-B2000 Same as the TS-2000 with no front panel controls. Includes PC control software.

TS-2000X The TS-2000 with 1.2 GHz @ 10W.

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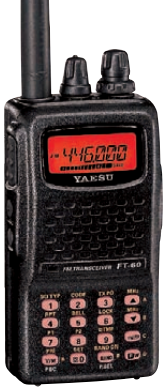
FT-250R



FT-60R

FT-250R 2M FM HT

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 5/2/0.5W • Memories: 209

FT-60R 2M/440 FM HT

• TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 5/2/0.5W • Memories: 1000

VX-8DR

VX-8GR

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

VX-8GR 2M/440 FM HT w/Built-in GPS

• TX: 144-148, 430-450 MHz
• RX: 108-999 MHz (cell blocked) • Memories: 1200+
• Power: 5/2.5/1/0.05W • Waterproof 3' for 30 min
• GPS unit and antenna is built-in for APRS® data

FT-2900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 75/25/10/5W • Memories: 221

Comes with a standard DTMF hand mic.

FTM-350R 2M/440 FM Mobile

• TX: 144-148, 430-450 at 50/20/5W and 222-225 at 1W
• RX: 0.5-1.8, 76-250 & 300-1000 MHz (cell blocked)
• Memories: 500 + 500 • Optional internal GPS FGPS-1 or external FGPS-2 & CT-136 adds GPS and APRS® features

FT-450AT

100W HF/6M Compact Transceiver

• TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
• Memories: 500 • IF DSP Technology
• Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter and clarifier
• Includes Auto Antenna Tuner

FT-950 100W 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
• Optional DMU-2000 Data Management Unit displays various operational conditions
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000 100W 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 DMU-2000 Data Management Unit displays various operational conditions
• Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000D 200W HF/6M Transceiver

• FT-2000 except RF output is 200W and supplied power supply 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" 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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RX-7-05

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RX-7-05 Wideband Receiver

• RX: 150 kHz - 1300 MHz (cell blkd) • Memories: 1650 • AM, FM Narrow & Wide Mode • Scans 100 Channels per second • 1100mAh Lith-Ion Battery & Charger

ID-880H 2M/440 FM Analog & D-Star Digital Dual Bander Mobile

• TX: 144-148, 430-450 • RX: 118-173.995, 230-549.995, 810-999.99 MHz (cell blkd) • Power: 50/15/5W • Memories: 1052 • D-Star Digital Ready • Improved User Interface

IC-2820H 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz • RX: 118-549.95, 810-999.990 MHz (cell blkd) • Power: 50/15/5W • Packet ready (9600 BPS – 6-pin DIN) • Upgradable D-Star DV (digital voice) & GPS capabilities w/optional UT-123

IC-703 PLUS

HF/6M QRP Portable Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 10W @ 13.8VDC, 5W @ 9.6VDC • Memories: 105 • Built in HF automatic antenna tuner

IC-7200 HF/6M Portable Transceiver

• TX: HF/6M • RX: 0.03-60 MHz • Power: 2-100W • Memories: 201 • Rugged design for outdoor use • 32-bit IF-DSPs + 24-bit AD/DA Converters • USB Port for CI-V Format PC Control and Audio In/Out

IC-7600 Multimode 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 Multimode 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

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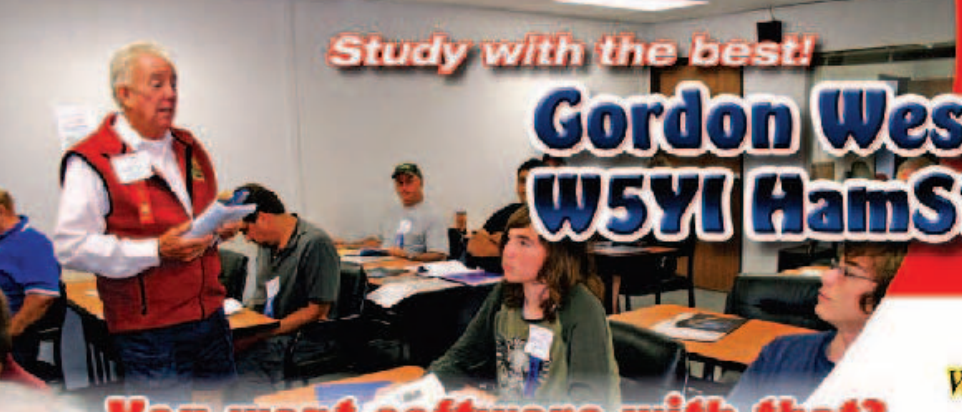

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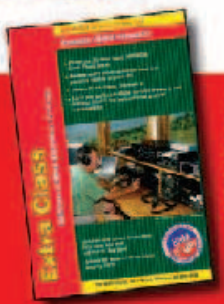

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You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

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...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

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 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926 $399.95

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 $259.95

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

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MFJ TUNERS

Ham Radio's *Most Popular* 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a world-wide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas . . . Use coax, random wire, balanced lines. Has heavy duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, *Teflon*(R) insulating washers and proper L/C ratio gives you *arc-free* no worries operation

MFJ-949E
$179.95

up to 300 Watts PEP transceiver input power.

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-901B
$99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-902
$99.95

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-16010
$69.95

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-906
$99.95

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-921/924
$89.95

MFJ-931 ***artificial*** RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931
$109.95

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MFJ high-accuracy *Digital* SWR/Wattmeter

MFJ-826B
$179.95

New!

MFJ's high-accuracy digital SWR/Wattmeter gives you three 10-bit frequency compensated power ranges!

An optimum power range is automatically selected. Each range has full 10-bit resolution. A low range (25 Watt full scale), a mid-range (250 Watt full scale) and a high-range (1500 Watts full scale) covers the entire amateur power spectrum with high accuracy.

A built-in frequency counter selects the appropriate frequency compensated data set to insure highest accuracy for each band. It also displays your transmitted frequency and provides digital frequency readout for older rigs and QRP rigs such as MFJ-9420/9040/9340.

True peak or average forward and reflected power, SWR and frequency are *simultaneously* displayed.

Bargraphs makes tuning antenna tuners, amplifiers and transmitters easy. You can select bargraphs to display forward and reflected power *or* forward power and SWR *or* SWR only.

MFJ's PeakHold™ freezes high-est forward power displayed (bar segment also) for 1, 2 or 3 seconds.

MFJ's *TrueActive*™ peak reading circuit gives you *true* peak or average power.

When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds.

Has large high-contrast *backlit* LCD display.

Use 12 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2⅝Hx6D inches.

MFJ *giant* 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.

New!
Giant 144/220/440 MHz SWR/Wattmeter
MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

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
$59.95

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!

MFJ-1164B
$79.95

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.

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-655B
$219.95

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.

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QST QuickStats

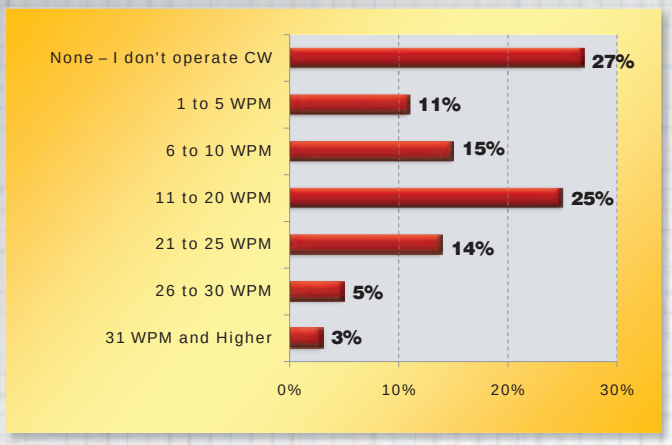
sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/Quickstats

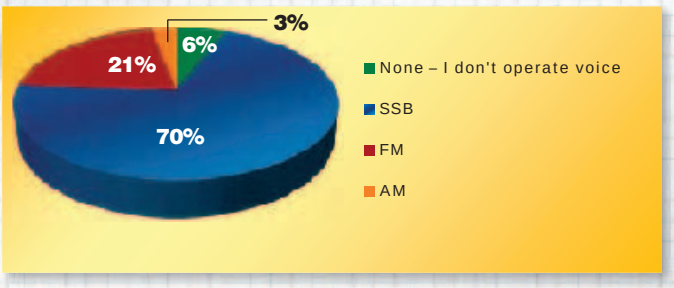
Online QuickStats Poll Results for October 10 through November 10.

Get on the Web and vote today at **www.arrl.org/quickstats**!

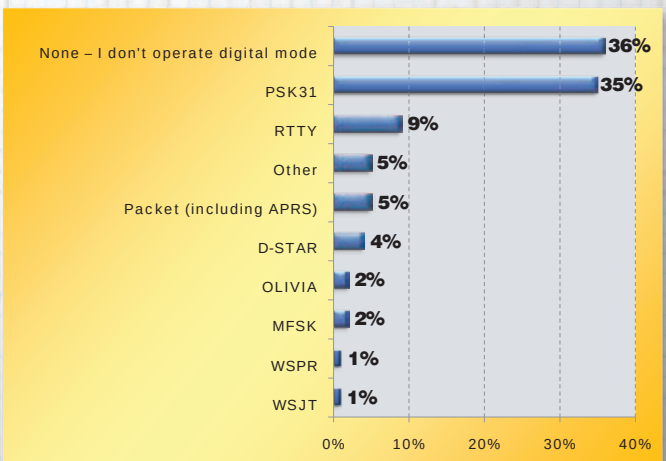
What is your comfortable CW receiving speed?



What is your favorite analog voice mode?



What is your favorite digital mode?



Start the Presses! *QST* Printing Trivia...

Where is *QST* printed?	RR Donnelley Pontiac, IL
How many copies of each issue are printed?	150,000
How much paper is required?	59 tons
How long does it take to print?	26 hours
How long does it take to bind and address?	37 hours

The ARRL Isn't Just an Organization for American Amateurs.

There are League members in 162 different countries. The top-five nations with the largest number of ARRL members (in descending order):

Canada

United Kingdom

Japan

Germany

Italy

Courtesy of Amy Hurtado, KB1NXO, ARRL Circulation Manager

MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

***The** famous G5RV antenna is the most popular ham radio antenna in the world!* You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

MFJ-17754, $59.95. Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A
$69.95
160M, 265 ft.

MFJ-1779B
$49.95
80-40M, 135 ft.

MFJ-1779C
$29.95
20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz.

MFJ-919, $59.95. 4:1 current balun,1.5 kW.

MFJ-913, $29.95. 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D in.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators.

MFJ-16B01, $19.95. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.

MFJ-18G100, $24.95. 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.

MFJ-58100X, $49.95. 100 ft. 50-Ohm RG-8X with PL-259s on each end.

MFJ-18H100, $34.95. 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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MFJ *Switching* Power Supplies

Power your HF transceiver, 2 meter/440 MHz mobile/base and accessories with these highly reliable 15, 22, 30, 40 or 75 Amp MFJ Switching Power Supplies!

No RF hash . . . Super lightweight . . . Super small . . . Volt/Amp Meters . . .

MFJ's adjustable voltage switching power supplies do it all! Power your HF or 2M/440 MHz radio and accessories.

MFJ's *MightyLites*™ are so light and small you can carry them with one hand! Take them with you anywhere.

No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

MFJ-4125

$84.95

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

MFJ-4125P, $94.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4225MV

$99.95

40 Amp Continuous

MightyLite™

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4245MV

$149.95

75 Amp Continuous

75 Amps continuous. Adjustable 13.8-14.2 VDC output. Reverse polarity, over-current/temperature, brown-out input protection, 7.8 lbs. 6½Wx3½Hx10D in. 108-132 VAC. Great for Ameritron's ALS-500M mobile amplifier!

MFJ-4175

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High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a single DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118

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MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

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MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117

$64.95

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

MFJ-1128

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MFJ-1128, $104.95. 3 high-current outlets for transceivers. 9 *switched* outlets for accessories. Mix & match included fuses as needed (one-40A, one-25A, four-10A, four-5A, three-1A fuses installed). 0-25 VDC *Voltmeter*. *Extra* contacts, fuses. 12Wx1¼Hx2¾D".

MFJ-1126

$84.95

MFJ-1126, $84.95. 8 outlets, each fused, 40 Amps total. Factory installed fuses: two 1A, three 5A, two 10A, one 25A, one 40A. *0-25 VDC Voltmeter*. Includes *extra PowerPoles®, extra* fuses -- *no extra cost*. 9Wx1¼Hx2¾ inches.

MFJ-1129

$114.95

PowerPoles™ AND 5-Way Binding Posts

MFJ-1129, $114.95. 10 outlets each fused, 40 Amp total. 3 high-current outlets for rigs -- 2 *PowerPoles®* and one 5-way binding post. 7 *switched* outlets for accessories (20A max) -- 5 *PowerPoles®* and 2 binding posts. Fuses include (1- 40A, 2-25A, 3-10A, 3-5A, 2-1A installed). *0-25 VDC Voltmeter*. Includes extra *PowerPoles®* and fuses, 12½Wx1¼Hx2¾D inches.

MFJ-1124

$64.95

MFJ-1124, $64.95. 6 outlets each fused, 40 Amps total. 4 *PowerPoles®*, 2 high-current binding posts, Installed fuses: 1-40A, 2-25A, 2-10A, 1-5A, 1-1A. Includes extra *PowerPoles®* & fuses -- *no extra cost.*

15 Amp Continuous

15 Amps continuous, 17 Amps max at 13.8 VDC. Over-voltage, over-current protection. 5-way binding posts. Load fault indicator and automatic shutdown. 90-130 VAC input. 1½ lbs. Tiny 3¾Wx2¼Hx3¾D inches fits easily in an overnight bag.

MFJ-4115

$59.95

30 Amps Continuous

Linear with 19.2 lb.Transformer

No RF Hash!

This heavy-duty linearly regulated MFJ-4035MV has *abolutely no RF Hash*. It delivers 30 Amps continuous, 35 Amps maximum from its massive 19.2 lb. transformer. Front panel adjustable 1-14 VDC output with convenient detent at 13.8 VDC. Volt/Amp Meters. 1% load regulation, 30 mV ripple. Over-voltage/current/temperature protection, 5-way binding posts, 2 pairs of quick-connects and a covered cigarette lighter socket for mobile accessories. Front panel replaceable fuse. 110 VAC input. 9½Wx6Hx9¾D in.

MFJ-4035MV

$149.95

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MFJ Dummy Load/Wattmeter

1.5 kW Dry Dummy Load has built-in precision, true peak-reading SWR/Wattmeter switchable to external antenna!

MFJ-267 $159.95

World's most versatile 1.5 kW dummy load has a *built-in* true peak reading SWR/Wattmeter that you can switch and use independently!

You'll find tons of uses!

Tune up your transceiver, linear amplifier or antenna tuner into a safe 50 Ohm dummy load at *full power*. Then instantly switch to your antenna and monitor SWR, forward and reflected power.

Use for testing/tuning transmitters, transceivers, amplifiers, antenna tuners, baluns, transformers, filters, matching networks, coax, stubs, transmission lines and antennas.

The 50-Ohm dry dummy load works DC to 60 MHz. SWR is below 1.3:1 at 30 MHz. Can handle 100 Watts for ten minutes or 1500 Watts for ten seconds. Comes with power derating curve.

Extra-large three-inch lighted Cross-Needle meter reads SWR (1:1 to 8:1), forward and reflected power *simultaneously*.

Reads *true peak* PEP or average power on 300/3000 Watts forward and 60/600 Watts reflected power ranges 1.8-54 MHz.

High accuracy comes from a carefully designed directional coupler, an accurate active-peak reading circuit and a precision d'Arsonval meter movement.

RF tight perforated aluminum cabinet. 4½Wx3½Hx10½D inches. Uses 12 VDC or 120 VAC with **MFJ-1312D, $15.95.**

MFJ HF/VHF/UHF Dummy Loads

Dry 300 Watt *HF /VHF* Dummy Load

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Air-cooled, non-inductive resistor in a perforated metal housing; Has SO-239 connector. Full load for 30 seconds. Silk-screened derating curve to 5 minutes. Handles 300 Watts. SWR is below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz. Compact 2¼x2¼x7 inches. **MFJ-260CN, $49.95.** With type "N" connector.

Dry 1.5 kW *HF/VHF/UHF* Dummy Load

MFJ-264 $74.95

Ham radio's most versatile 50 ohm *dry* dummy load. Works with all radios from 160 Meters through 650 MHz. SWR below 1.3 to 650 MHz and below 1.1 at 30 MHz. Handles 100 watts for ten minutes, 1500 Watts for 10 seconds. 3Wx3H x9D inches. Has SO-239 connector. **MFJ-264N, $84.95.** With type "N" connector.

Oil-Cooled 1 KW CW, 2 KW SSB VersaLoad ™

MFJ-250X $49.95

Run 1KW CW or 2 KW PEP for 10 minutes. Run *continuous duty* with 200 Watts CW or 400 watts PEP. Transformer oil not included. Low VSWR to 400 MHz. Under 1.2:1 to 30 MHz. SO-239 connector. Safety vent with cap, carrying handle. 7½Hx6⅝D inches. **MFJ-250, $69.95.** Includes transformer oil (no PCB).

3 GHz, 300 Watts Dry Dummy Load

MFJ-263 $99.95

New high-tech metal film resistor gives low SWR up to 3 GHz at 300 Watts! Mounted on large heavy-duty air-cooled heatsink. SWR is less than 1.1 DC to 1 GHz, 1.2 at 1.5 GHz and 1.5 at 3 GHz. Handles 125 Watts *continuous* and 300 Watts for ten seconds. High quality *Teflon*(R) N connector. 10¾Wx2¼Hx5¼D in. New!

MFJ Frequency Counters

MFJ-886 $129.95

MFJ-886 covers 1 MHz to 3 GHz with 300 MHz direct count, 0.1 Hz resolution. 4 gate times. 10-digit high-contrast 3/4 inch LCD display. Lock display button. Bargraph shows RF field strength. Includes rechargeable Ni-Cad batteries, charger, telescopic antenna. Black anodized aluminum. 2¾x2¼x1¼ inches.

MFJ-888 $199.95

MFJ-888, like MFJ-886, but covers *10 Hz*-3 GHz. Measures frequency/ period, has 50/1M Ohm input, auto hold, LED backlight, beeper. 2¾x4¼x1¼ inches

Field Strength Meters

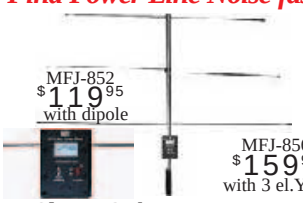
MFJ-802 $49.95

MFJ-802 shows relative antenna field strength. Use to determine radiation pattern. Has large 3 inch meter. Telescoping *dipole* reduces influence of surrounding objects and is more reliable and repeatable than monopole. Sensitivity control. Jack for remote sensor. **MFJ-802R, $34.95.**

MFJ-801 $29.95

MFJ-801 has 1¾ inch meter, sensitivity control, 20 inch extended telescoping monopole antenna.

Find Power Line Noise fast!



MFJ-852 $119.95 with dipole

MFJ-856 $159.95 with 3 el.Yagi

Choose 3 element Yagi or compact telescoping dipole to quickly pinpoint noise. Walk or drive with these handheld, directional noise finders to search out leaky insulators, loose hardware and corroded ground lines quickly. Track noise directly to pole, transformer, insulator or others. Has field-strength meter, headphone jack to listen or record. Operates in optimum 135 MHz region. Sensitive .3uV receiver, 70 dB AGC.

81 dB Step Attenuator

MFJ-762 $89.95

81 dB Attenuator in 1 dB steps. 50 Ohms. Usable to 500 MHz. 250 milliwatt maximum input. BNC connectors. Shielded stages. Connect between receiver and antenna and use S-meter as a precision calibrated field strength meter. Prevent receiver blocking, cross-modulation. Determine gain/loss, ideal for fox hunting. Evaluate linearity. Isolate circuits. Extend range of sensitive equipment. Measure input/output level differences.

Compact Cross-Needle SWR/Wattmeters

MFJ-822 $59.95

MFJ-822, $59.95. Large 3-inch *lighted* Cross-Needle meter covers 1.8-200 MHz in 2 power ranges: 30/300 Watts. Read forward, reflected power, SWR *simultaneously*. Compact 3¼Wx3¼Hx3¼D inches takes little space. Perfect for home, mobile or portable use. SO-239 connectors. Use 12 VDC for lamp (cable included). **MFJ-842, $59.95.** Like MFJ-822, but covers 140-525 MHz, 15/150 Watt ranges.

25-1300 MHz Discone Antenna

MFJ-1868 $59.95

Ultra wide-band antenna receives 25-1300 MHz. Perfect for scanners. Transmit 50-1300 MHz. Handles 200 Watts. Ideal for 6/2/1¼Meters, 70/33/23 CM ham bands. Excellent for testing various transmitters on single coax. SO-239, 50 feet coax, stainless steel elements.

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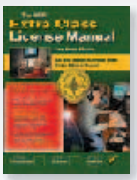

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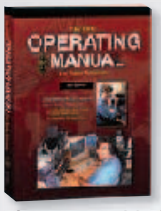

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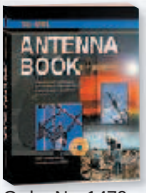

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Continued on page 134

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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.

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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	160	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 **$119.95**

35 Watts, $99.95, FM only

B-34, $99.95. 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.

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100 Watts for 2M HT

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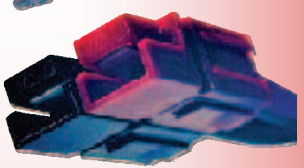

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QST Advertising Deadlines:

Issue	Reservation Date	Materials Due Date
February 2011	Monday, December 13, 2010	Wednesday, December 15, 2010
March 2011	Thursday, January 13, 2011	Monday, January 17, 2011

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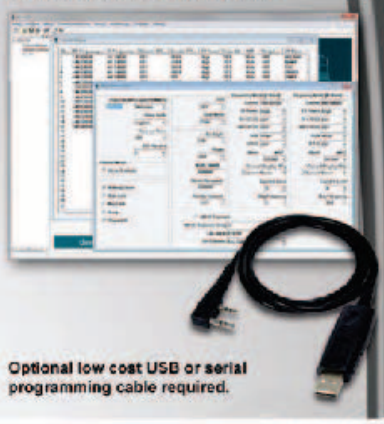

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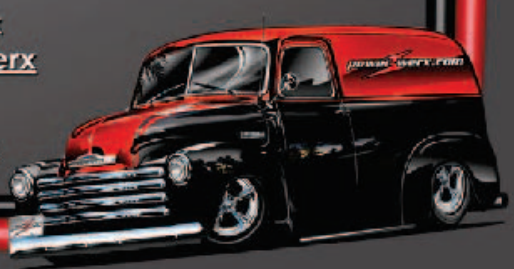

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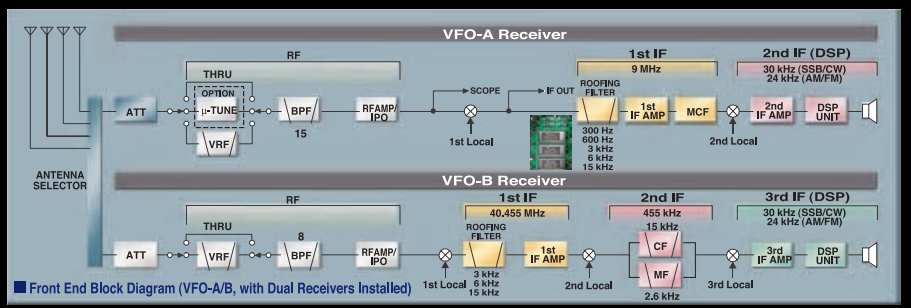

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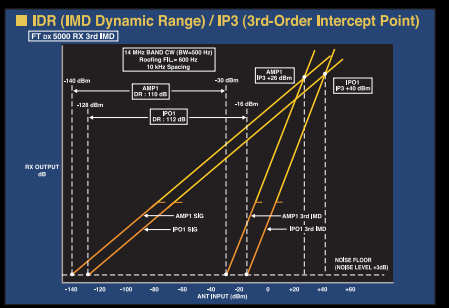

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