ANNUAL ANTENNA ISSUE

QST

DEVOTED ENTIRELY TO AMATEUR RADIO

March 2011 WWW.ARRL.ORG

Hang 'Em High or Keep 'Em Low: All Hams Love ANTENNAS

QST reviews:

Inside:

$4.99 US $6.99 can.

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Official Journal of ARRL The national association for AMATEUR RADIO™

NEW COMPACT HF TRANSCEIVER WITH IF DSP

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

Compact size: 9" X 3.3" X 8.8" and Light weight: 7.9 lb

HF/50 MHz 100 W All Mode Transceiver

FT-450D

With Built-in Automatic Antenna Tuner

- NEW **Illuminated Key buttons**
- NEW **300 Hz/500 Hz/2.4 kHz CW IF Filters**
- NEW **Foot stand**
- NEW **Classically Designed Main Dial and Knobs**
- NEW **Dynamic Microphone MH-31A8J Included**

■ The rugged FT-450D aluminum die-cast chassis, with its quiet, thermostatically controlled cooling fan provides a solid foundation for the power amplifier during long hours of field or home contesting use.

MOS FET RD100HHF1

■ Large informative Front Panel Display, convenient Control knobs and Switches
■ The IF DSP guarantees quiet and enjoyable high performance HF/50 MHz operation

Handy Front Panel Control of Important Features including:

- **CONTOUR Control Operation**
  The Contour filtering system provides a gentle shaping of the filter passband.
- **Manual NOTCH**
  Highly-effective system that can remove an interfering beat tone/signal.
- **Digital Noise Reduction (DNR)**
  Dramatically reduces random noise found on the HF and 50 MHz bands.
- **IF WIDTH**
  The DSP IF WIDTH tuning system provides selectable IF passband width to fight QRM.
  SSB - 1.8/2.4/3.0 kHz, CW - 300 Hz/500 Hz/2.4 kHz
- **Digital Microphone Equalizer**
  Custom set your rig to match your voice characteristics for maximum power and punch on the band.
- **Fast IF SHIFT Control**
  Vary the IF SHIFT higher or lower for effective interference reduction / elimination.

More features to support your HF operation

●10 kHz Roofing filter ●20 dB ATT/IPO ●Built-in TCXO for incredible ±1 ppm/hour (@+77°F, after warm-up) stability ●CAT System (D-sub9 pin): Computer programming and Cloning capability ●Large, Easy-to-See digital S-meter with peak hold function ●Speech Processor ●QUICK SPLIT to automatically Offset transmit frequency (+5 kHz default) ●TXW to monitor the transmit frequency when split frequency operation is engaged ●Clarifier ●Built-In Electronic Keyer ●CW Beacon (Up to 118 characters using the CW message keyer's 3 memory banks) ●CW Pitch Adjustment (from 400 to 800 Hz, in 100 Hz steps) ●CW Spotting (Zero-Beating) ●CW Training Feature ●CW Keying using the Up/Down keys on the microphone ●Two Voice Memories (SSB/AM/FM), store up to 10 seconds each ●20 second Digital Voice Recorder ●Dedicated Data Jack for FSK- RTTY operation ●Versatile Memory System, up to 500 memory channels that may be separated into as many as 13 Memory Groups ●CTCSS Operation (FM) ●My Band / My Mode functions, to recall your favorite operating set-ups ● Lock Function ●C.S. Switch to recall a favorite Menu Selection directly ●Dynamic Microphone included ●IMPORTANT FEATURES FOR THE VISUALLY IMPAIRED OPERATOR – Digital Voice Announcement of the Frequency, Mode or S-meter reading

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.

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

Vertex Standard
US Headquarters
10900 Walker Street
Cypress, CA 90630 (714) 827-7600

Advanced Dual Band Mobile Radio
5.2" x 1.6" Large dot matrix (264 x 64 dots) LCD display
GPS / APRS® / Bluetooth® Features
FTM-350AR

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

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

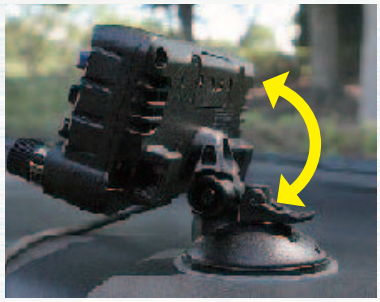
FTM-350AR NEW

220 MHz 1 W (USA version only)

New Features of The FTM-350AR

1. New Vacuum Cup-Mounting Bracket with Angle Adjustment

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



2. Expanded APRS® functions

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

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

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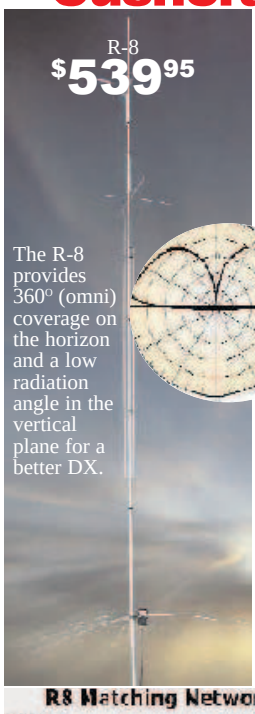
Cushcraft R8 *8-Band Vertical*



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

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

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

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

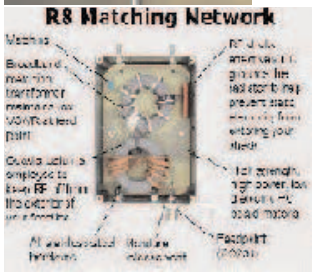
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

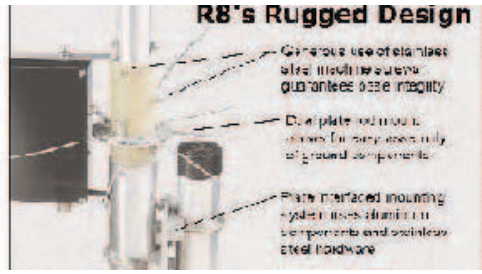
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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

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

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





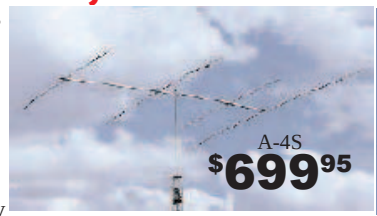
MA-5B *5-Band* Beam

Small Footprint -- Big Signal

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

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

Cushcraft 10, 15 & 20 Meter Tribander Beams



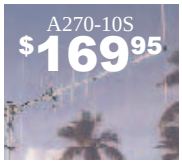
Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to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

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

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

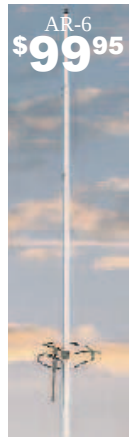
Cushcraft Dual Band Yagis

One Yagi for Dual-Band FM Radios



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

Cushcraft Famous *Ringo* Compact FM Verticals



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

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

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

MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT ON THE DOOR EDGE.

All the mounts attach to van doors, truck side doors, SUV doors, etc... and require no holes. Includes 16' 6" deluxe cable assy w/18" mini RG-1888A/U type coax for weather seal entry.

Choose a mount depending on the antenna size and vehicle mounting location space.

For Small Antennas & Limited Space

MODEL / ANT CONN / COAX CONN

Maldol **EM-5M** SO-239 / PL-259
Footprint: 1.1"x .75"
Max Antenna: 40"

For Medium Size Antennas

MODEL / ANT CONN / COAX CONN

COMET **CP-5M** SO-239 / PL-259
COMET **CP-5NMO** NMO / PL-259
Footprint: 3.4" x 1.25"
Max Antenna: 60"

For Tall or Multi-band HF Antennas

MODEL / ANT CONN / COAX CONN

COMET **HD-5M** SO-239 / PL-259
COMET **HD- 5 3/8-24** 3/8-24 / PL-259
Footprint: 3.75" x 1.1 "
Max antenna: 80"

COMET **BNC-24** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: BNC Super flexible featherweight whip

COMET **SMA-24** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Wavelength: 2M 1/4 wave • 440MHz 1/2 wave • Length: 17" • Conn: SMA Super flexible featherweight whip

COMET **SMA-503** **DUAL-BAND 2M/70CM HT ANTENNA** RX range: 100-1200MHz
• Length: 8.75" • Conn: SMA

Maldol **MH-209** *(BNC Conn)* **MH-209SMA** *(SMA Conn)* **2M/70CM DUAL-BAND HT ANTENNAS**
3" length, soft rubber cover. Good performance in a small package!

COMET **NEW! CSB750A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 1/2 wave, 70cm 5/8 wave x 2 • VSWR: 1.5:1 or less • Length: 42" • Conn: PL-259 • Max Pwr: 150W

COMET **NEW! CSB770A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 5/8 wave center load, 70cm 5/8 wave x 2 center load • VSWR: 1.5:1 or less • Length: 51" • Conn: PL-259 • Max Pwr: 150W

COMET **NEW! CSB790A** **DUAL-BAND 2M/440MHZ W/FOLD-OVER**
Wavelength: 2M 7/8 wave center load, 70cm 5/8 wave x 3 center load • VSWR: 1.5:1 or less • Length: 62" • Conn: PL-259 • Max Pwr: 150W

Maldol **AX-50** **DUAL-BAND 2M/440MHz**
Wavelength: 2M 1/4 wave • 70cm 9/8 wave • Length: 21" • Conn: PL-259 • Max Power: 60W

Maldol **AX-75** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 2M 1/2 wave center load • 70cm 5/8 wave x 2 • Length: 30" • Conn: PL-259 • Max Power: 60W

Maldol **AX-95** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 38" • Conn: PL-259 • Max Power: 60W

COMET **B-10 / B-10NMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/4 wave • 446MHz 1/2 wave • Length: 12"
• Conn: B-10 PL-259 ,B-10NMO - NMO style • Max Pwr: 50W

COMET **SBB-2 / SBB-2NMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/4 wave • 446MHz 5/8 wave center load • VSWR: 1.5:1 or less • Length: 18"
• Conn: SBB-2 PL-259 • SBB-2NMO NMO style • Max Pwr: 60W

Maldol **EX-107RB / EX-107RBNMO** **DUAL-BAND 2M/440MHz**
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • VSWR: 1.5:1 or less • Length:29"
• Conn: EX-107RB PL-259 • Ex-107RBNMO NMO style • Max Pwr: 100W

COMET **SBB-5 / SBB-5NMO** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 146MHz 1/2 wave • 446MHz 5/8 wave x 2 • Length: 39"
• Conn: SBB-5 PL-259, SBB-5NMO - NMO style • Max Pwr: 120W

COMET **SBB-7 / SBB-7NMO** **DUAL-BAND 2M/440MHz W/FOLD-OVER**
Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58"
• Conn: SBB-7 PL-259, SBB-7NMO - NMO style • Max Pwr: 70W

COMET and Maldol Mobile

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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Annual Antenna Issue

This Month in QST

March 2011 ■ Volume 95 Number 3

Technical

News and Features

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

Radiosport

Our Cover
Welcome to our annual antenna issue! You'll find all sorts of antennas that you can build — as well as a guide to buying your first commercial HF antenna. Our cover features a 50 year old Collins 237B-3 Log antenna for 6.5-40 MHz at the Cocoa, Florida QTH of Ray Kassis, N4LEM. Photo by Harold Kramer, WJ1B. Inset photo: The 60 foot Rohn SSV tower at W1AW houses the satellite antennas for 2 meters, 70 and 23 cm, as well as the distinctive receive-only antenna for 2.4 GHz. Photo by Steve Ford, WB8IMY.

Departments

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The radio... YAESU
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	80/40m Band	30/20m Band
RF µ-Tune Kits A	RF µ-Tune Kits B	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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The radio... FT DX 9000

DISTINGUISHED

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.

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

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A TECHNOLOGY BREAKTHROUGH

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

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

Actual Size

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

Actual Size

VX-8DR NEW

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

Optional GPS and antenna unit for GPS/APRS® operation

Attached to the radio (microphone input) using the optional GPS Antenna 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
Wide Band Receive for 108-999 MHz (Cellular blocked – US Version)

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

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

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

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Membership

BPL — Again

"Nothing would please me more than never to have to write another editorial about Broadband over Power Lines (BPL)."

More than 100 *QST* issues ago, in October 2002, this page first sounded the alarm about BPL. We pointed out the absurdity of putting RF energy on unshielded, unbalanced conductors and expecting it not to cause interference to radio communications. We argued that widespread deployment of such systems would create "radio smog" that would degrade the radio environment in much the same way as smog degrades the air we breathe.

In the subsequent months and years the ARRL pushed back against the mindless promotion of BPL as a "third wire" into the home that would offer great benefits to consumers by competing with other broadband delivery systems and driving down prices — despite objective economic analyses that showed BPL to be a more costly alternative. Although we were understandably skeptical about the business model for BPL our objection was to interference, not to BPL as such. If someone could make it work without interfering, they had nothing to fear from the ARRL. Motorola actually developed a system that appeared to do just that, but plans to market it were scrapped. Companies generally don't announce why they make such decisions, but it's a reasonable bet that Motorola realized the product would be unprofitable.

For a while BPL was a hot topic among those looking for a way into the burgeoning consumer broadband market. When it came to interference, many of them — either through ignorance or because they had no technical solutions to offer — simply denied it was a problem. A few companies took it seriously and designed systems with interference minimization in mind, among them Current Technologies and IBEC. While the ARRL disagreed with them on policy issues such as the adequacy of the FCC's BPL interference rules, on technical issues we were able to cooperate to some extent.

While the failure of BPL in Manassas, Virginia is the most celebrated example of the technology's inadequacy — when Manassas finally pulled the plug last year the system was running a $165,000 annual deficit, or more than $300 per customer — other BPL projects across the country have been quietly shelved or abandoned. Nearly all retail marketing of BPL services has ceased. The singular exception is IBEC, which has continued to promote its system to rural electric cooperatives.

Early work with IBEC by the ARRL technical staff was encouraging. IBEC acknowledged that interference was an issue, particularly to Amateur Radio, and voluntarily implemented notching of the amateur bands to reduce the interference potential. It appeared that amateurs could live with the IBEC system, when operated at or below the FCC limits and with notching in place.

Unfortunately, that's not how IBEC systems are being deployed in practice.

In researching interference complaints about IBEC systems, the ARRL has discovered that — contrary to representations made to ARRL staff and to statements in the online BPL database — IBEC's systems are not universally notching the amateur bands. In fact, measurements by ARRL staff and confirmed independently show that IBEC systems are not even notching the aeronautical bands that the FCC rules require BPL systems to avoid. Furthermore, they are operating at power levels that cause radiation well in excess of the FCC limits.

But that's not all. Two IBEC systems were discovered that were not even listed in the online database, despite an FCC requirement that they be listed at least 30 days prior to initiation of service.

On December 29, 2010 the ARRL filed a formal complaint with the FCC documenting these violations, including measurements taken at an amateur's fixed station location in Afton, Virginia that showed the IBEC system radiating more than 20 dB above the FCC limits. Amateur band notches were present at that location but their effectiveness was reduced because of the high level of radiated emissions. Mobile operation in the area is also significantly impaired. In several other locations at which measurements were taken, no notches were in evidence either for the amateur bands or for the aeronautical bands in which no emissions are permitted.

As of this writing, 20 days later, the ARRL has not heard anything either from the FCC or from IBEC in response to our complaint.

We can only speculate as to why IBEC is deploying its BPL system in willful disregard of the FCC rules, but it is reasonable to assume that the system simply won't work reliably if operated at legal power levels. Others who have tried BPL have found that more couplers and other hardware are needed than BPL's proponents had led them to believe. If the technology is uneconomic in a city such as Manassas, it must be even less economic in rural areas where customers are farther apart. The only alternative to adding expensive hardware is to crank up the power.

The ARRL has long argued that the FCC's rules for BPL systems are inadequate. For whatever reason, IBEC is not playing even by those rules. It's time for the FCC to call the foul — several of them, in fact — and to order these systems to cease operation until they comply with the rules and no longer cause harmful interference to licensed services.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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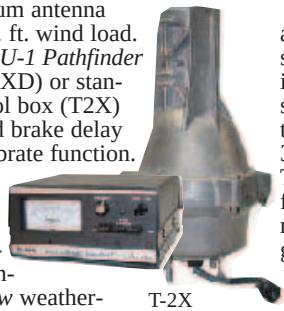

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Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
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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.**

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Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
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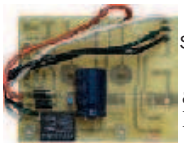

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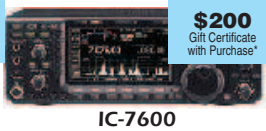

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- The ARRL Board of Directors met January 20-21, 2011 in Windsor, Connecticut. A full report will appear in next month's issue.
- ARRL's Logbook of The World now supports awards based on Maidenhead grid squares, such as VUCC and the Fred Fish Memorial Award.
- Hams spotted and reported tornados and activated nets as twisters swept across Missouri, Illinois and Arkansas, leaving at least seven people dead.
- The FCC has issued a *Hearing Designation Order* to determine, among other things, if the Amateur Radio license of Glenn A. Baxter, K1MAN, of Belgrade Lakes, Maine, should be renewed. Details are in Happenings, this issue.
- In December, the ARRL Executive Committee reviewed grant applications for the ARRL's Education & Technology Program (ETP), awarding equipment valued at nearly $5000 to five schools.
- The *Amateur Radio Emergency Communications Enhancement Act* has been reintroduced in the 112th Congress as HR 81. For more information, see Happenings, this issue.
- In January, the FCC issued a *Citation* to Doctor Radio's CD Shop in Monroe, Michigan for marketing unauthorized radio frequency devices.
- Leonard Andrew "Woody" Woodward, W7KOP, of Mapleton, Utah, the longest continually registered Scouter, passed away December 25, 2010 at the age of 99.
- The ARRL filed a complaint with the FCC documenting ongoing harmful interference and egregious rules violations by Broadband over Power Lines (BPL) systems installed by IBEC, Inc in three states. See Happenings, this issue, for details.
- A GM antenna engineer, Don Hibbard, W8DBH, helped figure out how to install an AM/FM antenna on the new Camaro convertible. See Happenings, this issue.
- Every 10 days or so the ARRL Media and PR Department now posts short audio clips in a series called "Now Hear This." Check it out!
- The winner of the *QST* Cover Plaque Award for January 2011 is "Reflow Soldering for the Radio Amateur," by Jim Koehler, VE5FP.

Media Hits

Allen Pitts, W1AGP
Media & Public Relations Manager

All sorts of Amateur Radio activities made good media hits during December 2010. The holiday season didn't slow down the PIOs at all. Of course there were the "Santa nets" allowing children to radio their hopes to the North Pole. "Hello? Santa?" was a Corpus Christi (TX) *Caller Times* front page story about hams working the Driscoll Children's Hospital. WFTS-TV (FL) covered hams at St Josephs' Hospital where, "With the help of his local two-way radio team, Santa Claus brings a twinkle to children's eyes." The Orange County (NY) Amateur Radio Club visited with hundreds of youngsters at Adams Fairacre Farms in Newburgh according to the *Times Herald-Record*. (Where were you guys when I was growing up over there?) One group went far beyond the usual actions. The *Kent-Ravenna Record Courier* (OH) reported on the Portage County Amateur Radio Service whose members donated $1900 and a carload of food to the Center of Hope in Ravenna for its holiday food distributions.

School activities were also in the news, and one of the best hits came from the *Basehor Sentinel* (KS). "Basehor-Linwood students connect with world thanks to amateur radios" told how the "students weren't examining postcards, but instead cards stamped with call signs from amateur radio operators from around the United States and overseas..."

The technical side of Amateur Radio also appeared in many announcements about various "apps" for hams to use including a logging program *Aether*. An even bigger technical media hit was from the RFCafé.com column, Kirt's Cogitations. Writing about *QST*, he said, "CQ Engineers & Technicians: QST a Great Resource…The articles presented are always, without exception, well-written and chock full of information that is profitable for consumption by engineers and technicians…" But for top-notch, Star Trek level techno-wow you needed to see "Video shows first working invisibility cloak" on Nanowerk.com. "[The inventor] also believes that success in cloaking science requires a body of diverse knowledge, which in his case drew upon experience as an astronomer, and curiously, as a radio ham operator. "I have a Ph.D. in astrophysics and am a retired college professor. But the experience I gained as a young ham radio operator was invaluable in helping me make knowledge connections to make the cloak work," commented Nathan Cohen, W1YW.

"Ham radio geekery fixes Chevy Camaro Convertible's antenna," was the headline on AutoBlog.com. "Chevy brings in ham radio expert to engineer hidden antenna," was CNET.com's line and even the Wall Street Journal reported on Don Hibbard, W8DBH, using his radio skills to hide the antenna.

In politics we had "Just the ham radio operator in me having fun, said ham radio operator [Greg] Walden." But as the new Chairman of the House subcommittee that oversees the FCC, Greg Walden's, W7EQI, use of CW to announce his appointment got lots of media attention.

There were many more deserving hits that I would add here if there were space, but let me conclude with these two: "Amateur radio operators get through one way or another during emergencies" in the *Prescott Daily Courier* (AZ) gave the usual line that "when the Internet, cell phones, electricity and even police and fire radios won't work, amateur or ham radio operators..." Then, like a period to that sentence, came the Carson City (NV) event reported in the *Las Vegas Sun:* "Amateur radio operators, not Clark County officials, supplied the best information on last week's Las Vegas-area flooding to the state's emergency center," and praise from Governor-elect Brian Sandoval.

Florida Club Helps Navy Commission New Destroyer

Joseph Tiritilli, N4ZUW, President GCARA

Our Amateur Radio club was invited to take part in the November 13, 2010 commissioning of the US Navy's newest Guided Missile Destroyer, the USS *Jason Dunham* at Port Everglades in Fort Lauderdale, Florida. We erected a small 3 element Yagi to work the 20 meter band. We also had a 2 meter ICOM ID-800 mobile radio using a makeshift homemade J-pole antenna. Our club's repeater was only a few miles away in Pompano Beach, so we had no problem working the local hams who wanted to check in.

During the morning and afternoon we made over 135 contacts on HF and 2 meter FM. We have sent out Special Event QSL cards to each contacted station.

Many people stopped by to say hello. Our location was perfect: You had to walk past our booth on your way in and out of the event. One highlight was a visit from Lt Col Leo Gray, USAF (Ret), a Tuskegee Airman from WWII. Col Gray was kind enough to take some photos with our club members.

We were all moved and touched by the Commissioning Ceremony. The new Commandant of the US Marine Corps, General James F. Amos, was the keynote speaker. All of the Top Brass from the Navy and Marine Corps were there, along with many other dignitaries. After the ceremony, the entire crew double timed it to take their positions on the ship and bring her into service. Spectacular!

Jason Dunham, a Marine Corporal, gave his life in 2004 in Iraq. To save his fellow soldiers, he dove onto a live hand grenade using only his helmet and his body. The Navy honored his memory by Commissioning its newest destroyer in his honor.

After the event, our club members were led on a Special VIP tour of the ship. We were brought to the bridge and were allowed to take pictures of each other "at the helm." Of course, the Radio Room was off limits as were any other heavily guarded areas.

We would like to thank the US Navy for their support of Amateur Radio. GCARA members who took part were Joey Jet, N4ZUW; Carl Ricks, KJ4VAS; Jared Lambert, K4JJL; Jon Kramer, W4JRK; Steve Feltus, KJ4EUN; Mark Crum, KJ4QYE; David Crane, K4RU, and Art Lewis, WA8VSJ.

JOEY JET, N4ZUW

Our GCARA Yagi above the USS *Jason Dunham*, with the W4BUG QSL card.

Inside HQ

Welcome to the Antenna Issue

I have rarely met a ham who is satisfied with his or her antenna system, because, after the operator, the antenna has the most effect on station performance. We are preoccupied with antennas because there are so many types of antennas and endless variations on where and how we put them up. Indeed, amateur antennas can vary from massive beams stacked on tall towers to a scrap of wire hastily thrown out of a window. Some ops build their own antennas from scratch, but most antennas systems are a combination of home-brew and commercial antenna components. Similarly, we erect some antennas ourselves and some are erected by professionals. In this Antenna Issue we feature some great DIY antenna projects along with an overview of commercial antennas by Joel Hallas, W1ZR, on page 50.

Here at ARRL HQ we also build, erect and maintain our own antennas. We have two separate antenna farms, one for W1AW and one for W1HQ, our club and Lab test station. Joe Carcia, NJ1Q, our Chief W1AW Operator, is responsible for maintaining the W1AW antennas and Lab Manager Ed Hare, W1RFI, maintains the W1HQ antennas.

The W1AW antenna farm consists of one 120 foot tower and three 60 foot towers that are used for two purposes: guest operating and broadcast/bulletin transmissions. The W1AW broadcast antennas are fixed stacked Yagis for 40, 20, 17, 15 and 10 meters. These are beamed approximately northwest and southwest so they can cover the entire country. For the lower bands, we use a four wire 80 meter cage dipole 60 and 160 meter dipoles. One of the 60 foot towers has amateur satellite antennas for 2 meters, 70 cm, 23 cm and a "barbecue grill" 2.4 GHz receive antenna (see cover photo).

For guest operating, there are three 60 foot towers configured with single band rotatable Yagis for 30 through 6 meters. We share the broadcast dipoles for 160 and 80 meters. Guests use the 40 and 20 meter Yagis on the 120 foot tower. We also just installed a wire 160 meter vertical for experimenting and contesting on the 120 foot tower. Our antennas and towers are professionally inspected twice a year. For more, see **www.arrl.org/w1aw-antennafarm**.

W1HQ, our Club and test station is equipped with a donated SteppIR 3 element Yagi for 40-10 meters; 40 and 80 meter dipoles and an HF vertical. Due to a renewed in-house interest in VHF contesting, we added new 6 and 2 meter Yagis last year. We also have antennas for our DStar 144 MHz, 440 MHz and 23 cm repeaters, along with other verticals, and wires used for experimenting and testing.

Few of us have an antenna farm of this magnitude, but, there are always ways to improve our own antenna systems. That's why we publish this annual antenna edition of *QST* along with our many books about antennas. Whether you try a new rubber flex antenna on your handheld or finally put up that 160 meter L, let's never stop learning about these amazing devices that magically send invisible waves through the air.

73,

Harold Kramer, WJ1B
ARRL COO/Publisher *QST*
wj1b@arrl.org

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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

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Radio Clubs (ARRL-affiliated clubs) – **www.arrl.org/clubs**
Hamfests and Conventions – **www.arrl.org/hamfests**
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ARRL Continuing Education Program – **www.arrl.org/courses-training**
Books, Software and Operating Resources – **www.arrl.org/shop**

Quick Links and Resources

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QEX – *A Forum for Communications Experimenters* – **www.arrl.org/qex**
NCJ – *National Contest Journal* – **www.arrl.org/ncj**
Support for Instructors – **www.arrl.org/instructors**
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***No tuning**, no fuss, no worries -- just turn on and operate.* 600 Watts PEP/500W CW, 1.5-22 MHz, instant bandswitching, SWR protected, extremely quiet, SWR/Wattmeter, ALC control. 120/220 VAC. Inrush protected. 9½Wx6Hx12D in. **ALS-600S, $1599,** ALS-600 with 10 lb. switching power supply.

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Eimac 3CX800A7 **Amplifiers**

Suggested Retail
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AL-1500
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AL-1500F
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Imported tube
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In the Spring a Ham's Fancy Turns to Thoughts of...Antennas

Alfred Lord Tennyson didn't word it quite this way, of course, but we all know what he really meant. These are just a few of the best antenna photos that have crossed the editor's desk this past year. Ahead, starting on page 30, you'll find projects ranging from a roof mounted 160 meter receive antenna to a 20 meter flagpole antenna for the stealthy among us to a multiband V beam. In the advertising section, you'll find the annual Antenna Time insert, the best place (at least until Hamvention) to find what vendors are offering this year.

DAVE PATTON, NN1N

What are we looking at here? **No photo software manipulation involved, ARRL HQ staff member Dave Patton, NN1N, shot this view of the snow-covered turf surrounding his 100 feet of Rohn 45. Up top, out of camera range, are 2 el on 40 meters, 2 el on 30, three 9 el 6 meter Yagis and a C31XR tribander. He may never make it into space, but this view is a pretty good approximation!**

Two Towers + Winter Sky = Impressive Photo

Lloyd Berg, N9LB, of Oregon, Wisconsin, captured the essence of a winter sunset. Both towers are "recycled" Rohn SSV self-supporting towers that were formerly commercial two way radio towers headed to the scrapyard. After getting them home, he wire brushed and cleaned them, then sent them out for re-galvanizing. "They now look and work like brand new towers," he reports.

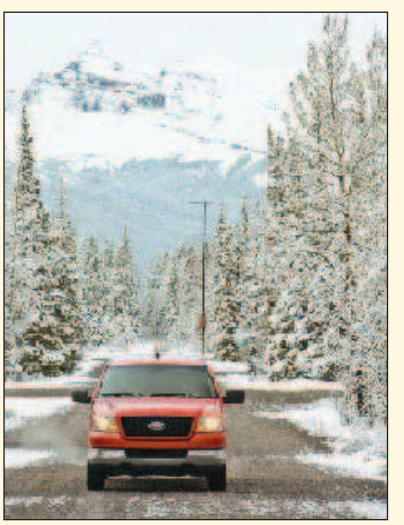
LLOYD BERG, N9LB

The tower on the left holds a HyGain TH11DX multiband beam. The tower on the right holds VHF and UHF antennas for 50-1296 MHz and is gamma matched with copper water pipe running parallel to the legs for 160, 80, 60 and 40 meters. There is an extensive radial system under this tower that extends to the edge of his property. Both towers have ProSisTel rotators and Green Heron control boxes.

JEFF SLUSHER, KE5APC

Jeff Slusher, KE5APC, of Leesburg, Virginia, writes: Here's my new beam — wish I could afford the coax.

JERRY CLEMENT, VE6AB



The long winter of 2010 didn't exactly disappear early for those on the eastern slopes of the Canadian Rockies. Jerry Clement, VE6AB, of Calgary, Alberta described the winter-like scene this way: "I thought 2009 was a fluke when we got a freak snowstorm on June 6. At least last year it was a week earlier!" Jerry shot the photo May 30, 2010 from Alberta's Powderface Trail, elevation 5500 feet ASL.

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PRIVILEGED TO GIVE BACK

♦ David Sumner's, K1ZZ, excellent comments ["It Seems to Us: A Good Year to Upgrade!" Feb 2011, page 9] missed what I believe was the most important reason for upgrading to General or Extra: becoming an ARRL Volunteer Examiner. Many hams — especially those who only operate on VHF and above — don't see a benefit to progress past the Technician license. They should consider upgrading in order to qualify to become a Volunteer Examiner. The process involved is simple and the ability to give back to the Amateur Radio community by becoming an examiner is worth the effort and study involved. ARRL VEs holding General class tickets can administer Technician exams. VEs holding an Extra class license can do it all, which is the best motivation I know of for wanting an Extra class ticket. I can tell you from my own experience as an ARRL Volunteer Examiner that there is no greater pleasure than shaking some kid's hand at an exam session and saying, "Congratulations and welcome. You're now an Amateur Radio operator."

RAYMOND "WOODY" WOODWARD, K3VSA
Hillsborough, North Carolina

SHOWING HAM SPIRIT

♦ On December 15, 2010, I sat for — and passed! — the General class license exam at an ARRL VE Session. When I turned up at the exam room, there sat five good men and true, ready to proctor the exam. But I was the only one to show up for an exam. By rights and good sense, these men — part of the Dixie Amateur Radio Club in St George, Utah — could have invited me to come again when more candidates might be attending. But no. They smilingly greeted me, got me situated and patiently waited while I chewed a few teeth marks into my pencil as I went through the questions. I cannot tell you how grateful I was not only for their letting me take the exam, but also for displaying what it means to be an exemplary ham.

BOB BRENNAN, KF7MWF
St George, Utah

A TOASTY HAM

♦ The article on reflow soldering using a toaster oven by Jim Koehler, VE5FP ["Reflow Soldering for the Radio Amateur," Jan 2011, pages 30-31] was of special interest to me, as I first heard of this technique on an e-mail reflector several years ago, and wanted to try it.

The discussion on the reflector strongly cautioned to not use the toaster oven that you use for food, since you could run the risk of heavy metal poisoning! So I began searching for a suitable toaster oven at a reasonable price for the experiment. When I searched in the "big box" stores, I found several ovens that looked like good candidates, but they were in the $50 and up range. Not wanting to spend that much, I put the project on hold.

Sometime later, while donating some items to my local Salvation Army store, I noticed they had a selection of used toaster ovens! Looking them over, I found one that was of good quality, was the ideal size *and* had a temperature control knob with a degree scale. It had a tag that said $14, and also had two different color marks on it. When ringing up my purchase, the clerk at the register told me that each colored mark meant that the price had been reduced by half. Therefore, the oven cost me only $3.50!

While the clerk was ringing up my purchase, I explained how I was going to use it and about circuit boards, surface mount devices, solder paste and reflow soldering. She said to me, "Well sir, you will not believe this, but I had a man come in here and buy one of these just last week and he told me the exact same story!" Perhaps there are more hams out there than we suspect!

DAN ALLEN, KB4ZVM
Greer, South Carolina

GOOD LISTENERS MAKE GOOD HAMS

♦ My dad got me my first shortwave radio in 1960. As a boy, I spent all my time listening to the shortwave and ham bands when I wasn't building radios. I collected more than 400 QSL cards, including Radio Moscow.

In 1967, I joined the Navy and was trained in electronics. My first duty station was in Spain. It was our job to listen and record radar transmissions over Eastern Europe, analyze the signals and develop appropriate counter measures. We flew in unmarked planes and never transmitted.

In 1970, I was transferred to the USS *Lexington* out of Pensacola. Our mission was to train pilots for day landings and night onto the carrier landings. I worked in Primary Flight Control for the "Air Boss." It was my job to listen on a stereo headset to two frequencies and write the planes' fuel state on a status board. While I was on duty one night, a plane cut into the pattern; he was one mile from the ship and next in line to land. I picked up on the plane's call sign and realized the mistake: The arresting gear wires on the landing deck were set for a different plane! This would be a disaster, ripping the plane apart! I had to think quickly.

I called out to the Air Boss to wave the plane off. He turned and said to me, "Wood, you had better be right!" I responded, "Yes, Sir! Wave him off!" He hit the red deck foul button; red lights flashed on the deck, warning the plane to abort his landing attempt. As he screamed past our window, the Air Boss could see it was in fact the wrong plane. We finished flight ops and nothing was said about a very close call.

Each day when flight ops ended, the Air Boss would go to dinner and leave the Assistant Air Boss to finish up by bringing the helicopters on board. But this day was different. He sent his assistant to dinner and turned to me, saying, "Wood, could you do me a favor and wrap up air operations for me so I can go to dinner?"

I took the Air Boss's seat and picked up the microphone. I called the first helicopter gave its pilot the wind direction and a signal of CHARLIE, clearing him to make his landing. After securing the helicopters on board, my final act was to call down to the Bridge and turn control of the ship back to the Captain. I was only 21 at the time and didn't realize until years later what an honor that had been. After all that listening, it was finally my turn to talk.

HOYT WOOD, K4YYY
Lake City, South Carolina

"MAD" WITH LAUGHTER

♦ The article by Eric Nichols, KL7AJ ["Op-Ed: Put the Mad Scientist Back in Ham Radio," Jan 2011, page 82] had me rolling on the floor with laughter. It brought back memories of one homebrew project where I made sure that the shack's "Big Switch" was off before plugging in the latest creation into the wall socket. I threw the switch downstairs from the shack. Fortunately I never blew the place up, but the "excitement" of knowing that it might happen is still very clear in my memory from 50 years ago.

There is another excitement that is missing today: working a station with that 6L6 one tube transmitter you built yourself. Clubs need to offer their services to run a project of building a rig — a simple one like some that have appeared in *QST* in the last year or so — to Boy Scout troops and other youth organizations to let them experience the thrill of "I did it myself!"

JOHN GERMAN, W6IET
Ramona, California

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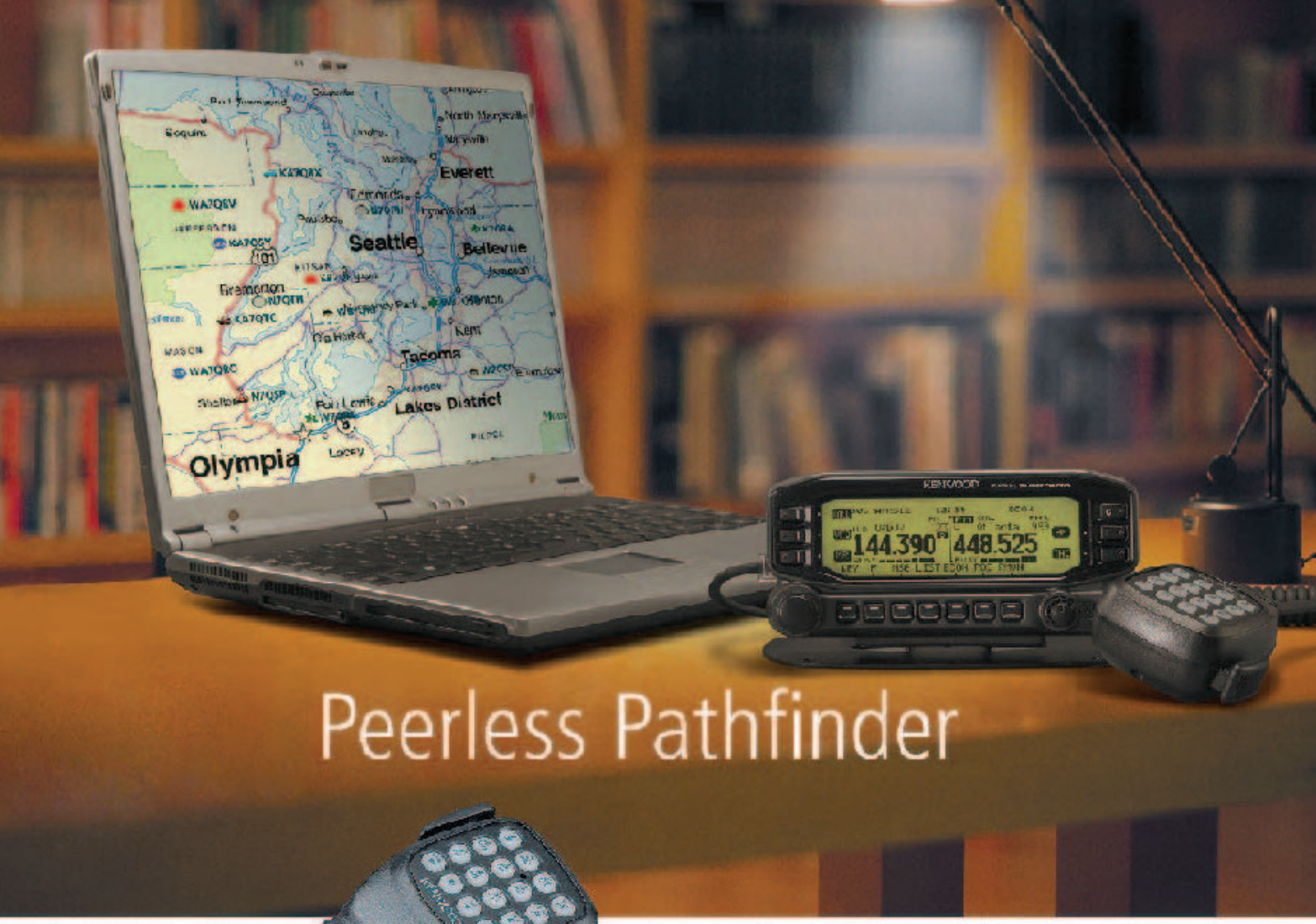

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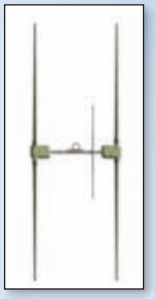
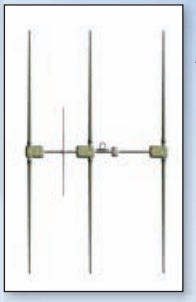
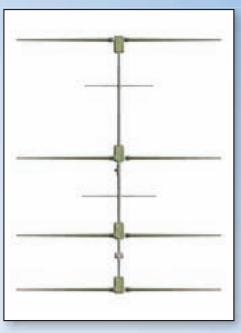


2 Element 20m-6m Yagi
2 element Yagi, 20m-6m continuous coverage; 57" boom, 36 ft longest element, 18.2 ft turning radius, 6 sq ft wind load, 30 lb; SDA 100 controller included.



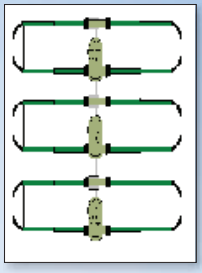
3 Element Yagi 20m-6m
3 element Yagi, 20m-6m continuous coverage; 16 foot boom, 36 ft longest element, 19.7 ft turning radius, 6.1 sq ft wind load, 51 lb; SDA 100 controller included.



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.

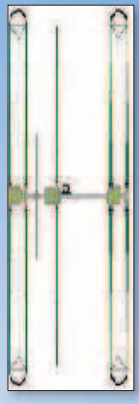
Dream Beam Series Yagi's

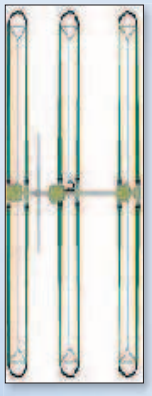
The Dream Beam series offers antennas for both space limited Hams as well as the "Big Guns" who have the space and want the very best.



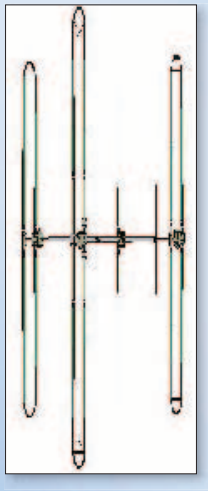
DB11 Yagi Antenna
DB11 Yagi, 18.5 ft element length, 11 ft boom, 10.8 ft turning radius, 61 lb, 5.9 sq ft wind load; 2 active elements on 20m; 3 active elements on 17, 15, 12, 10, 6m.

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.



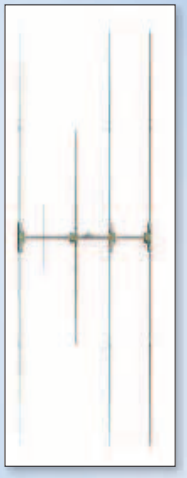


DB18E YAGI
Dreambeam DB18E, 3 el 30m-6m, 2 el 40m, three looped elements, does not include optional 6m passive element kit, 18 foot boom; Includes SDA 100 controller.



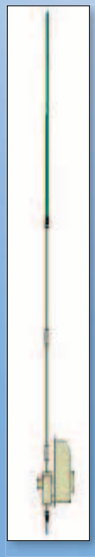
DB36 DreamBeam Yagi, 40m-6m
DreamBeam DB36 4 element Yagi, 40m-6m continuous coverage; 36ft boom, 48 ft longest element, 26 ft turning radius, 17.5 sq ft wind load, 160 lb; SDA 100 controller included.

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.



Vertical and Dipoles

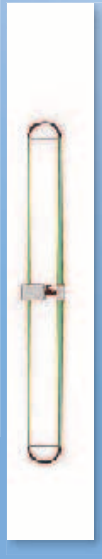
For the ham who may not have a tower, but a tree or two for a dipole. SteppIR verticals work great when there are no tall structures around to hang some wire. And, the low take-off angle can be your friend.



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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- Sky Command II
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- USB port (mini B)
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- Cross-tone

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The GPS and its logging functions can be used for up to 35 hours by turning off the transceiver functions and running in the GPS only mode. Store up to 5000 points of track data, there are three ways to save track data: Interval, Travel Distance or APRS® Beacon.

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A Four Wire Steerable V Beam for 10 through 40 Meters

Sam Moore, NX5Z

This simple to build system provides bidirectional gain switchable between four azimuths.

Ever wished you could work multiple bands and have antenna gain in different directions without the bother, upkeep and expense of a rotator and Yagi? Tired of expensive ice storm damage? Here's one answer.

Enter the V Beam

A simple arrangement of four wires can be used to accomplish this task. A version of this antenna was described in *QST* and is included in *ARRL's Wire Antenna Classics*.[1,2] That version had wires 584 feet long. In this version, each wire is only 106 feet long. Many DX stations have had great success with this type of antenna.

An unterminated V beam gain pattern is bidirectional with two main gain lobes 180° apart if the leg lengths are at least a wavelength long. In Figure 1, a long wire antenna at the left is shown to have a gain pattern of four major lobes. Another long wire antenna positioned 45° from the first is also shown. If these are combined to form a V, it has the gain pattern as shown to the right in Figure 1.

In this design, four 106 foot wires are spaced at 45°. The length of the wire is not as important as that they all be the same length. I installed my V beam with the apex and relay control box at a height of 40 feet with the wire ends 10 feet off the ground in a sloping V configuration. This V beam's gain approximates that of a three element Yagi on 10, 12, 15 and 17 meters and is within a few dB on 20 meters. The antenna provides useful operation on 30 and 40 meters, with essentially an omnidirectional pattern on 40. The beam direction is controlled by simply switching two switches in the station.

Make It Fit Your Space

This antenna may also be built with wire lengths as short as 60 feet to more easily fit on a city lot. There will be a small decrease in gain. The V beam gain increases with the length of the wires. The longer the wires, the greater the gain. As the wire lengthens, however, the beamwidth narrows. The gains and beamwidths of 106 and 60 foot versions are shown in Table 1, based on *EZNEC* analysis.[3] As a reference, the typical two element Yagi has 6 to 7 dBi gain while a three element Yagi can be expected to have a 7.5 to 8.1 dBi gain, depending on design, especially boom length.

The azimuth pattern looking down on a V beam is shown in Figure 2. If the height of the V beam is less than ½ wavelength, the gain pattern will distort and make the antenna more omnidirectional.

To reduce the gain lobe to the rear of the V beam you can terminate the wire ends with

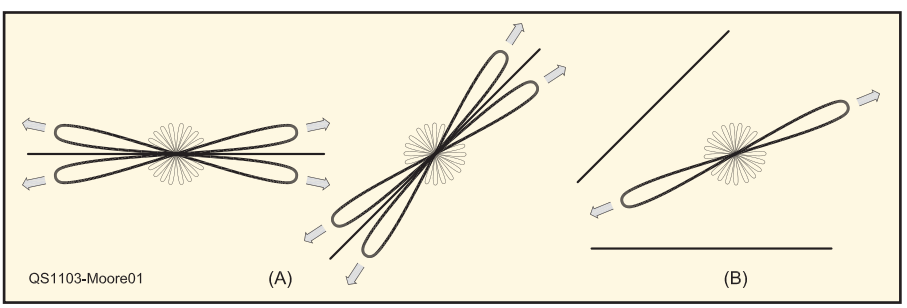


Figure 1 — The azimuth patterns of two long wire antennas are shown at (A). If the two are combined in phase to form a V, the resulting pattern is shown at (B).

[1]Notes appear on page 33.

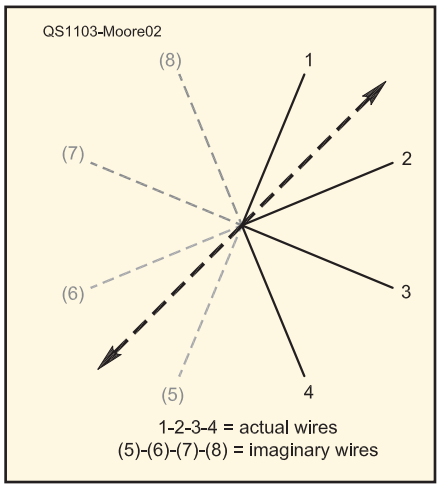


Figure 2 — The selectable azimuth looking down on the V beam. The arrow shows directions of maximum radiation with wires 1 and 2 connected.

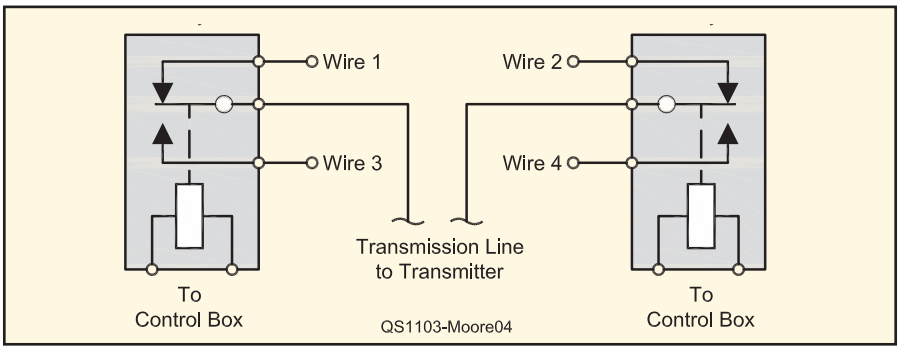


Figure 4 — Schematic diagram of the relay box used to remotely select the V beam wires.

a resistor. I opted to leave mine unterminated so I'd have gain in both directions. If terminated, the antenna would need eight wires instead of four to have gain in all directions.

Since this antenna may be used for multiband operation, the gain waveform changes somewhat depending on the frequency of operation. The higher the frequency, the greater the gain, since the frequency to wire length ratio changes. For example, if your V beam is 1 wavelength long at 20 meters, it is 2 wavelengths long at 10 meters, thus causing greater gain and narrower beamwidth as shown in Table 1. While essentially bidirectional on the upper bands, there is a 1 to 2 dB front to back ratio, with the maximum signal to the open end of the V. The beamwidth shown in Table 1 is of the front beam, with the rear beam generally somewhat narrower. A horizontal, rather than sloping, V beam will be more symmetrical.

The block diagram of the V beam system is shown in Figure 3. The antenna tuner must be able to accept balanced transmission line and a built in or external 4:1 balun is necessary. I made a homebrew air core external 4:1 balun using 1 inch PVC pipe and used a small automatic antenna tuner.

Controls and Indicators

The LED switch box supplies power to the relays in the antenna relay box at the center of the V beam via a three wire cable. I used three wire electrical zip cord for mine, but smaller wires would have worked.

The relay box schematic is shown in Figure 4. Only two switches are needed to power relays 1 and 2. Relay 1 switches between wire 1 and 3 and relay 2 switches between wire 2 and 4. Note that wire 4 is used in combination with wire 1 instead of (imaginary) wire 5. This obtuse angle yields the about same gain and waveform as wire 4 to 5 would have offered, without having to string another wire. Figure 5 shows an assembled relay box in a power entry PVC cover.

The schematic in Figure 6 shows the relay power switches and the 17 LED connections. LED and relay common connections go to a 12 V return. A top view of the LEDs is shown in Figure 7. The LED switch box illuminated LEDs indicate the direction of greatest gain. Note LED 1 is always on,

Table 1

Gain and Beamwidth of the V Beam on Each Band

Frequency (MHz)	*Gain (dBi) at 106'*	*3 dB Beamwidth (°) at 106'*	*Gain (dBi) at 60'*	*3 dB Beamwidth (°) at 60'*
7.15	1.9*	Omnidirectional	2.4*	Omnidirectional
10.12	3.6	133	3.7*	Omnidirectional
14.15	6.7	71	4.1	137
18.11	8.5	42	4.1	136
21.2	9.1	33	6.0	63
24.93	9.7	28	6.1	61
28.3	10.7	23	7.3	40

*Essentially omnidirectional with maximum gain nearly perpendicular to the wire bisector.

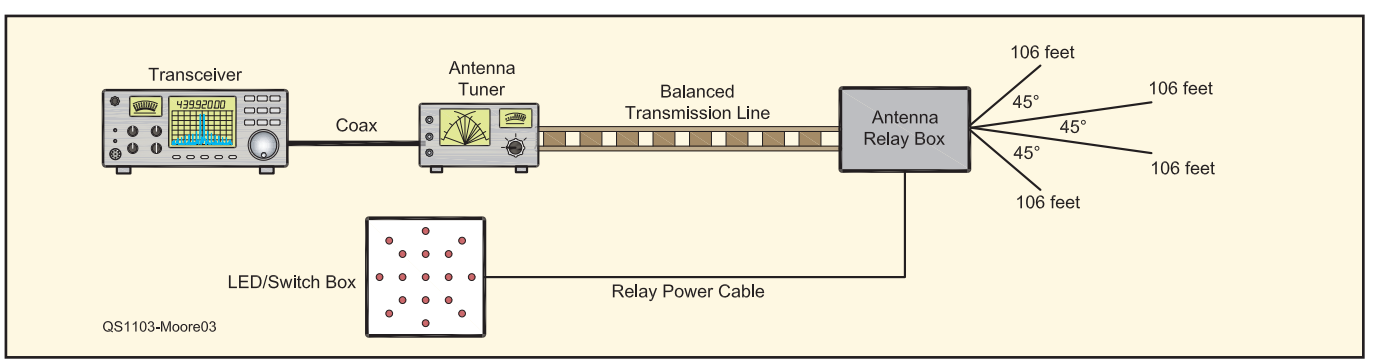


Figure 3 — The block diagram of the V beam system. The antenna tuner must be able to accept balanced transmission line and a built-in or external 4:1 balun is necessary.

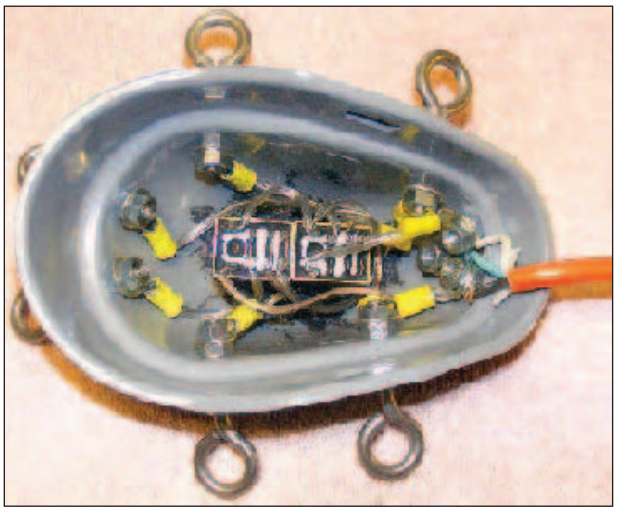


Figure 5 — Relay box assembled in a power entry PVC cover.

QS1103-Moore07

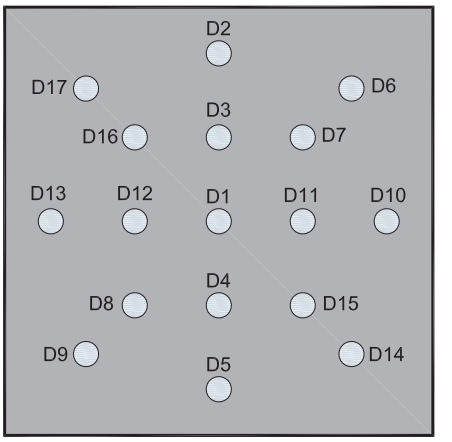


Figure 7 — Top view of the indicator panel showing LED placement.

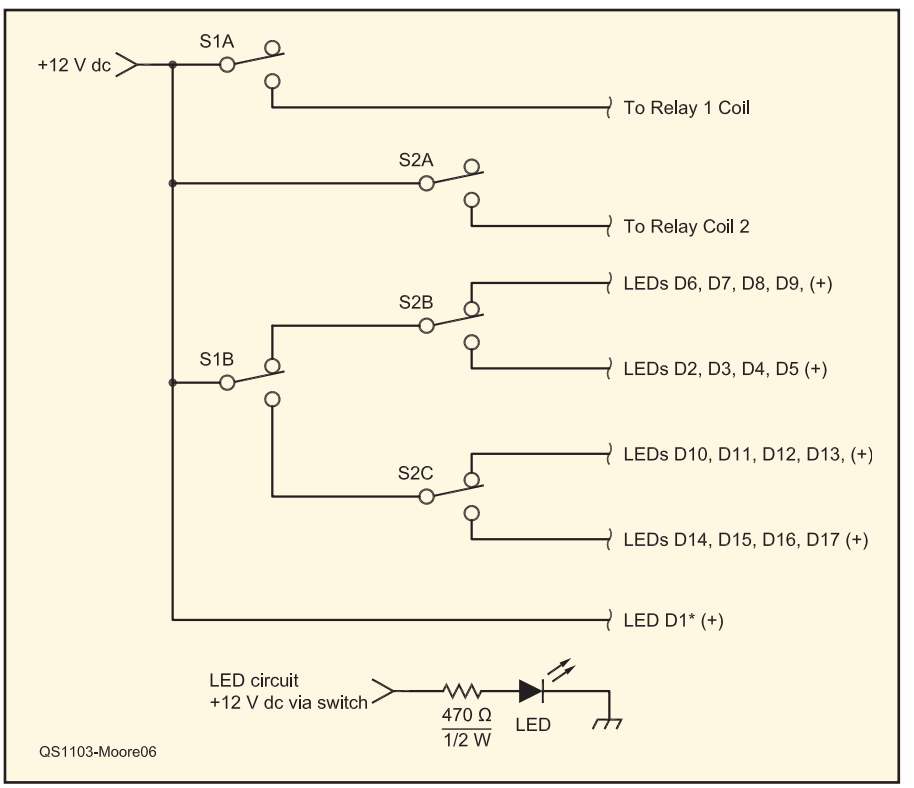


Figure 6 — Schematic diagram of the relay power switches and the 17 LEDs used as direction indicators.

since it's used in all directions. The other 4 LEDs in a particular row, in a bingo board pattern, are connected and supplied with +12 V dc via switch 1 or 2, depending on wires chosen. Since I could not readily find a 3 pole switch for S2, I used two closely spaced DPDT switches and switch them at the same time. A view of an energized LED switchbox is shown in Figure 8.

My total cost was under $50, not counting the balun and balanced transmission line. For my four wires, I used electric fence wire, which accepted solder surprisingly well. You can buy a ¼ mile roll of electric fence wire for only $14 at agricultural supply stores. You may also have a few necessary parts in your junk box.

On Air Results

My autotuner tuned the V beam on all bands from 10 through 80 meters. It was the first weekend of March and a DX contest was in full swing with the best 15 meter openings I've heard in years. Using the V beam on 15 meters, I worked into to Brazil, Argentina, Surinam, the Dominican Republic and many others. On 20 meters, where it was much more crowded, I contacted Switzerland and Spain before the band closed for the evening.

The V beam also has minor lobes, but is definitely directional. Sometimes I would point the V beam off a station to diminish interference. This resulted in the DX station being stronger in proportion to the others, creating a better contact opportunity. There are four direction choices and it is great to be able to flip two switches and direct your signal to different parts of the globe very quickly. No rotor can move this quickly. Ready to build yours?

Hamspeak

Beamwidth — Angular range over which a receiving antenna will accept signals, or a transmitting antenna will transmit signals. Typically stated as the angular range over which power is no less than 0.5 (–3 dB) from the maximum value within the beam.

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

LED, light emitting diode — Semiconductor device from which light is emitted when current flows. These were originally used in place of incandescent bulbs as indicator lights. They now can be used in place of larger light bulbs and form the basis of some display screens. See **hyperphysics.phy-astr.gsu.edu/hbase/electronic/leds.html**.

Yagi — Multielement beam antenna based on straight rod or wire elements approximately a half wavelength in length. Generally only one element is connected to the transmission line. The other elements are *parasitically* coupled by the fields from the driven element.

Figure 8 — A view of an energized LED switchbox with one direction shown illuminated.

Notes

[1]L. Colvin, DL4ZC, "Multiple V Beams," *QST*, Aug 1956, pp 28-29.

[2]*ARRL's Wire Antenna Classics*. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 7075. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

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

ARRL member and Amateur Extra class operator Sam Moore, NX5Z, has a Master's degree in electronics, as well as PhDs in biblical studies and Christian counseling. He spent 24 years as an electronics technician and engineer at Texas Instruments. After he got his license over 30 years ago, ham radio got him interested in returning to college in electronics. He works in the Radio Support Group at the Texas Youth Commission, in a juvenile prison, plays guitar in church and is a retired pastor. Sam enjoys building antennas, low power operation, making homebrew gear and county hunting. He can be reached at 22 Cundiff Dr, Sherman, TX 75092 or at **drsammoore@aol.com**.

Strays

ON HIS WAY TO 18 WHEELER DXCC

◊After parking his tractor in a nearby town, Terry Halbert, KE5HWE, stopped by ARRL HQ for a tour in December while on a run to nearby Massachusetts. Although his home QTH is Rogers, Arkansas, he spends nearly all his time on the road in his 18 wheeler. He's found there's no better way to pass the time than to mine the VHF and HF bands. So far he's worked more than 100 DXCC entities, although some remain unconfirmed. Best DX so far? Papua New Guinea, P29.

Terry Halbert, KE5HWE/m, enjoys working DX and local stations from his 18 wheeler with his Kenwood TS-480SAT transceiver.

JOEL P. KLEINMAN, N1BKE

New Products

ARTICLES ON GROUNDING AND LIGHTNING PROTECTION FROM TIMES MICROWAVE

◊Times Microwave Systems has published several technical papers addressing the subject of lightning protection and grounding solutions for wireless networks. These technical resources are available on the Times website, **www.times-microwave.com/lightning/articles/**, and reprints of these technical publications are also available.

DB6NT 10 GHz POWER AMPLIFIER

◊The MKU PA 101 HLK power amplifier from Kuhne Electronic uses PHEMT technology to provide high linearity and efficiency ratings on the 10 GHz band. Typical power input is 200 mW for 2 W output from 10.3 to 10.4 GHz. The amplifier is intended for all analog and digital modes including SSB, CW, ATV and DATV. The amplifier features a detector output (dc voltage) for monitoring of the forward output power. Power requirements are 12-14 V dc at 1.1 A. Input and output impedances are 50 Ω, and SMA female connectors are supplied. For more information, visit **www.db6nt.com**.

Digital VOX Sound Card Interface

Here's an interface that will get you on the air with PSK31 and other digital modes regardless of the type of computer you are using — no serial or USB cable required!

Howard "Skip" Teller, KH6TY

Most sound card interfaces are powered either by a voltage from the computer serial port, by a voltage taken from the computer accessory port or microphone port, or by a "wall-wart" ac adapter. If the computer has no serial port, and most computers these days have USB ports instead of serial ports, it is also necessary to use a USB-serial adapter to generate a *virtual* serial port that the communications software can use for push-to-talk operation.

It would be more convenient if no dc voltage were needed to power the interface, and also if no serial port or USB-serial adapter were needed, so I wanted to find a way to eliminate both the need for a serial port or USB-serial adapter and a dc voltage. I then realized that computer sound cards have evolved from having both a high level speaker output jack and a line-level audio output jack, to usually having just an earphone/headphone jack and a microphone jack. Measuring the maximum audio output level of this jack on several computers, and also on an external sound card, such as "USB sound adapters" commonly sold to provide microphone and earphone jacks via a USB connector, I found that it was generally around 2.5 V peak-to-peak — not enough to power a switching transistor in an interface.

By connecting the earphone/headphone output to the center tap of a 600:600 Ω isolation transformer, however, that voltage is doubled across the full secondary winding of the isolation transformer to 5 V peak-to-peak — enough to rectify and power a transistor switch for push-to-talk switching. Since all this occurs at the secondary winding of the transformer, the transformer still isolates the computer earphone output and ground from the transceiver itself, thereby preventing any hum or ground loops from disturbing the transmit or receive audio.

By using another isolation transformer for the receive audio, the computer is totally dc isolated from the transceiver, both on the audio input lines for transmit, the receive audio output line for receive, and the push-to-talk switching line for transmit/receive switching. The schematic diagram in Figure 1 shows how this isolation is provided by the transformers.

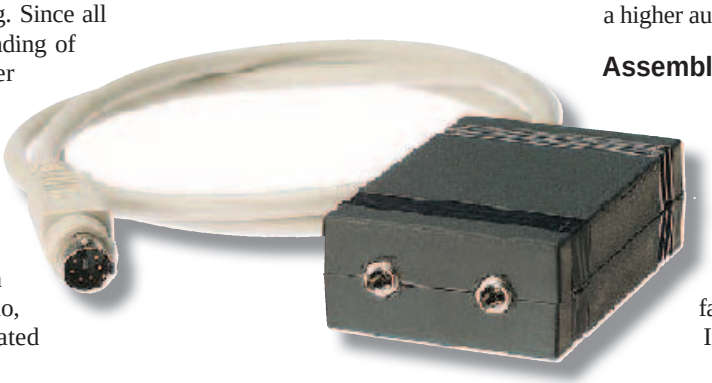
How It Works

See Figure 1. Sound-card-based digital communications software such as *DigiPan*, generates a WAV audio signal when placed in the transmit mode. This WAV audio contains the modulation that you use to communicate with on digital modes, such as PSK31 and others, and is used to modulate the transceiver in the same way that you modulate the transceiver audio with the microphone when operating SSB. Since this WAV audio comes out of the earphone or speaker jack of the computer, that jack is connected to isolation transformer T1, but only between one side of the primary winding and the center tap of the primary winding. When this audio is coupled across the transformer to the full secondary winding, it appears at twice the value that is present between the primary center tap and either end of the primary winding, because the turns ratio of the transformer in that case is no longer 1:1, but 1:2.

The WAV audio is then used to modulate the transceiver through the data, accessory or microphone jacks for digital operating. The audio level is adjusted by means of potentiometer VR1.

In order to switch the transceiver from receive to transmit, this same double-value ac voltage is applied to capacitor C1 and resistor R1, which isolate the transformer audio from the switching action of the following voltage doubler circuit, D1 and D2. These diodes form a classic dc voltage doubler rectifier circuit, which conducts on both positive and negative cycles of the WAV audio. C2 then charges up to the peak value of the ac voltage and holds that charge long enough to drive the base of switching transistor Q1, through current limiting resistor, R2, causing the collector of Q1 to saturate and pull the push-to-talk pin of the transceiver to ground. Q1 gets its operating collector voltage from the push-to-talk circuit in the transceiver, which must be designed, as almost all transceivers are these days, for an "open collector" switch for transmit/receive switching.

Transformer T2 is used to isolate the receive audio to the computer from the transceiver, and the primary is connected to the computer microphone input. The receive audio output voltage is fed from the transceiver through an L-pad consisting of R4 and R3, attenuating the high audio output of the transceiver data jack, or earphone jack, to a suitable level for the microphone input of the computer. It is this input to the microphone of the computer that creates the "waterfall" display of the typical digital communications program that also decodes the WAV audio being transmitted by the other station into characters on the screen. Resistors R4 and R3 can be exchanged in position if the computer audio input requires a higher audio level from the transceiver.



Assembling the Interface

The following steps assume you are building the kit that is available on my Web site at **https://sites.google.com/site/kh6tyinterface/**, although much of this information is also helpful if you are building the interface from scratch.

If you are using the circuit board

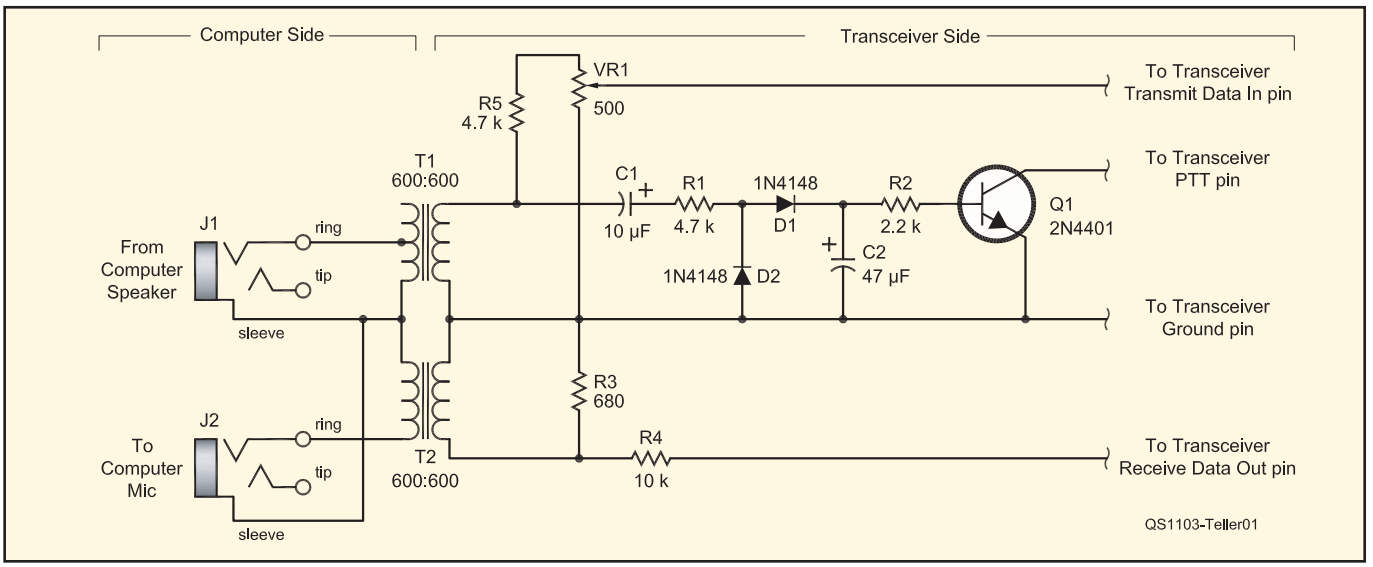


Figure 1 — Schematic diagram of the Digital VOX Sound Card Interface. Vendor part numbers are shown in parenthesis. Components can be obtained from Mouser Electronics, tel 800-346-6873; www.mouser.com. A double-sided, plated-through hole circuit board with legend, or a complete kit with all cables, is available for a limited time at https://sites.google.com/site/kh6tyinterface/.

C1 — 10 µF, 50 V electrolytic capacitor (Mouser 647-UVR1H100MDD1TA).
C2 — 47 µF, 50 V electrolytic capacitor (Mouser 647-UVR1H470MED1TD).
D1, D2 — 1N4148 diode (Mouser 512-1N4148).
J1, J2 — ⅛ inch stereo jack (Mouser 161-3507-E).
Q1 — 2N4401 or other switching transistor (Mouser 512-2N4401BU).
R1, R5 — 4.7 kΩ, ¼ W resistor (Mouser 291-4.7K-RC).
R2 — 2.2 kΩ, ¼ W resistor (Mouser 291-2.2K).
R3 — 680 Ω resistor (Mouser 291-680-RC).
R4 — 10 kΩ, ¼ W resistor (Mouser 291-10K-RC).
T1, T2 — 600CT:600CT isolation transformer (Mouser 42XL016-RC).
VR1 — 10 kΩ potentiometer (Mouser 652-3362-1-501LF).

from the kit, just mount and solder all parts, following the legend printed on the board. Use good soldering techniques and make sure there are no solder bridges between adjacent holes. In the kit the transformers have been partially mounted in place for protection during shipping, so be sure to complete the soldering of all six pins of each transformer. If any hole is accidentally filled with solder, heat the area and thrust a sharp-pointed round wooden toothpick into the hole. On the opposite side of the circuit board, melt away any solder around the toothpick and the hole should be cleared for resoldering.

When installing the resistors, save the cutoff leads, some of which will be used for wire tie points, which are inserted after all other parts have been soldered. It is not absolutely necessary to use the tie points; the wires can just be inserted into either of the two holes for a tie point. However, using the tie points makes it easier to solder the transceiver cable wires to the interface. To create a tie point, bend a cutoff lead in half, making a hairpin shape, place both ends into the two holes on the circuit board, push down until about ⅛ inch over the circuit board, spread the leads sticking out the bottom of the circuit board to hold the wires in place, and solder both holes.

The kit comes with a transceiver cable. Decide how long you want the cable to be and cut off the end with the female connector, leaving about 6 inches on the female connector end in case you are using a different accessory connector, or a microphone connector, rather than the 6 pin MiniDIN connector supplied. In this case, plug the male end of the cable into the female end and strip and tin the wires for connecting to the connector you are going to use. On the cut end of the cable strip off about ⅜ inches of insulation and then strip each wire to expose 3/16 inches of conductor. Tin the wires.

Making Connections

If you are using a microphone plug or an accessory plug that has a dc voltage on it, refer to the transceiver manual for the correct pin connections. If your transceiver uses a MiniDIN jack that is in the same configuration as the kit cable, the easiest way to identify where each wire is connected to the interface is to first plug the cable into the transceiver and then touch each of the wires, in turn, to the electrical ground of the transceiver. The wire that makes the transceiver go into transmit is the push-to-talk wire, which will be soldered to the tie point marked PTT on the circuit board, but before doing that, touch each of the remaining wires to the now-identified push-to-talk wire. The one that makes the transceiver go into transmit is the wire that goes to the GROUND on the circuit board. Now solder both the ground wire and the PTT wire to the correct tie point on the circuit board.

Connect a stereo audio cable from J1 to the computer speaker or earphone/headphone jack and another stereo audio cable from J2 to the computer microphone jack.

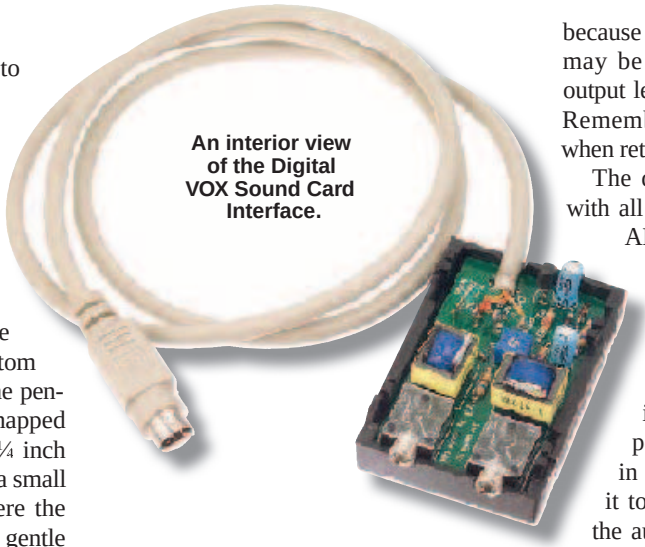
Run digital mode software such as *DigiPan* (**www.digipan.net**) and adjust the audio input level to maximum. If the software you've chosen doesn't provide a means to do this, you'll need to go into *Windows* Control Panel and access the record-audio levels there. Touch each remaining cable wire to the point marked "Data Out Receive Audio" on the kit board. Once you locate the wire that causes a continuous noise signal to appear on the waterfall display, solder it to the "Data Out Receive Audio" connection.

Place the transceiver in SSB mode and the software in transmit mode. There should be no power output from the transceiver because there is no WAV audio coming from the interface. Quickly touch each of the remaining wires to the point marked "Data In Transmit Audio" on the kit board. Solder the wire that causes the transceiver to have RF output to the "Data In Transmit Audio," and cut off the remaining wires.

Now lay the cable down between the two unused holes next to the "Data In" and "Data Out" markings on the circuit board and place one end of a cutoff lead into each hole. Solder one end, pull the other end tight around the wire and solder it also. This will provide a strain relief for the cable. This completes the assembly and wiring of the circuit board.

Modifying the Enclosure

Place the wired circuit board into one half of the enclosure. It will not settle down fully because the jacks and cable holes need to be drilled. Take a pencil and make a mark where each jack and the cable touch the edge of the enclosure. Remove the circuit board, snap on the other half of the enclosure, and drill a small pilot hole where the edges of the enclosure top and bottom meet at the place where you made the pencil marks. Leaving the enclosure snapped together, enlarge the pilot holes to ¼ inch diameter. Open the case by inserting a small screwdriver in the indentations where the enclosure halves meet and applying a gentle twisting motion. Do this on both indentations of one side and the enclosure will pop open. Clear the holes of extra plastic if necessary.



An interior view of the Digital VOX Sound Card Interface.

Adjusting the Transmit Level

Before connecting the audio cables, you should be able to hear the WAV audio in the computer speakers when the software is in the transmit mode. Plug in both cables between the computer and transceiver. With the software waterfall cursor around 1500 Hz and the software in transmit, raise the audio output level until the transceiver switches into transmit. Once again, if the software you are using doesn't offer the means to make this adjustment you'll need to access the audio levels within *Windows* Control Panel.

When the transceiver switches into transmit, increase the audio output level about one more notch to insure there is enough audio for push-to-talk to consistently activate. Adjust the transceiver RF power control for maximum, or if using the microphone jack on the transceiver, to the normal position for SSB phone operation. Now adjust VR1 until the RF output of the transceiver is about 30% of rated maximum power. It should not be necessary to make this adjustment again. Just raise the audio output level control to obtain a little more output power if desired, but at 30% power, you should automatically have a clean PSK31 signal.

After setting the RF power level, place the wired circuit board into the enclosure and snap the two halves together. This completes the assembly and adjustment of the interface. If you find it necessary to adjust the interface very often, it might be convenient to drill a small hole in line with VR1 so a screwdriver can be inserted into the enclosure to adjust VR1. In most cases, however, it should be possible to just set VR1 and leave it alone, doing all the fine power setting adjustments with the software audio level controls. Near the extreme edges of the IF passband, the audio output of the transceiver may decrease because of the shape of the IF filter, so it may be necessary to increase the audio output level to maintain push-to-talk action. Remember to recheck the power output when retuning to the center of the passband.

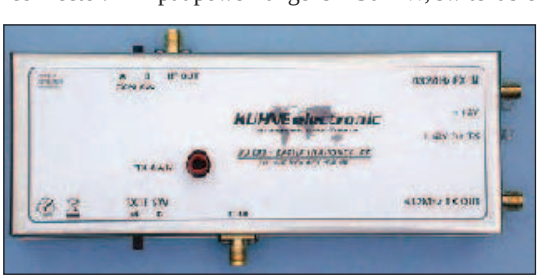
The digital VOX interface works well with all digital modes such as PSK31 and AFSK RTTY, but does not work correctly with sound-card CW or Hellschreiber. If you intend to operate those modes, the Classic Sound Card Interface described on page 37 of the July 2010 *QST* is a better choice because its serial port switching keeps the transceiver in transmit until the software returns it to receive. It is not dependent upon the audio tones being present to keep it in transmit.

Howard "Skip" Teller, KH6TY, is an ARRL member and was first licensed in 1954. He received his commercial First Class Radiotelephone license in 1959 and worked his way through college as chief engineer of several radio stations. He holds a BS degree in electrical engineering from the University of South Carolina and is retired from running a factory in Taiwan, where he manufactured the weather-alert radio he originated in 1974 and is still sold by RadioShack and many other companies now. Skip enjoys developing digital software, such as DigiPan *and* NBEMS, *and designing VHF/UHF antennas. He is currently studying the potential of working 432 MHz DX using the Contestia digital mode. You can contact Skip at 335 Plantation View Ln, Mt Pleasant, SC 29464;* **skipteller@gmail.com**.

New Products

70 CM TRANSVERTER MODULE FROM DB6NT

◊The MKU 432 G2 transverter module from Kuhne Electronic (DB6NT) covers 432-434 MHz with an IF range of 28-30 MHz. The module has two separate IF connectors that can be switched to one common IF connector. IF input power range is 2-50 mW, switchable to 60-2000 µW. Transmit power output is rated at 70 mW minimum. Receiver noise figure is rated at 1.1 dB with conversion gain of 25 dB. Oscillator phase noise is rated at –156 dBc/Hz at 10 kHz. Technically skilled customers can set up their own 432 MHz transverter system with the transverter module and a Kuhne Electronic power amplifier such as the MKU PA 4047-60 HY or MKU PA 4047-120 HY. For more information, visit **www.db6nt.com**.



Feedback

◊ In "Tools for Doing it Yourself" [Jan 2011, p 65] the tin/lead alloy of the usual radio solder was described as 40/60%. The usual designation is 60/40 — 60% tin, 40% lead.

◊ In "Getting on the Air — Feeding a Balanced Antenna with Coax" [Jan 2011, p 65] the toroidal choke balun shown in Figure 2 should not be constructed of coax with foam dielectric. The tight turns will result in the center conductor migrating through the foam and reducing the breakdown voltage or even shorting to the shield. Standard polyethylene dielectric coax should be fine, however.

◊ We inadvertently listed Fred Huykman, WB2SLJ, in the January 2011 Silent Keys column. We regret the error.

One Ham's Fix for Limited Space Antennas

Don't let a lack of real estate keep you off the air — there's always a way.

Steven J. Robeson, K4YZ

Although I've never taken an official poll, I think that if you asked most amateurs what their most significant hurdle was, other than getting a license in the first place, "putting up an antenna" would be number one or two. And in today's world of homeowner's associations and subdivision restrictions, that most important of all station accessories is becoming an even more challenging obstacle to even the most inventive of our members.

The Challenge Hits Home

In September 2001, I had to heed the practicality of moving closer to where I worked rather than driving 52 miles each way despite living in an antenna heaven on a 2000 foot Tennessee ridgeline. Where I once had the liberty of stringing out wires as long as I wanted in any direction needed, wire antennas being a favorite of mine, I now found myself living in a three bedroom duplex with a back yard that was only 40 feet wide by 25 feet deep. Available supports limited my dipoles to 6 meters and up.

Whatever I did, it was going to have to have a small footprint, require few if any radials, and be as stealthy as I could make it. I initially tried a loop in the crawl space that was dubiously called the attic. Even being reasonably limber for my age, there was no way that an antenna was going in there. Then I tried a long wire that stretched around two sides of my end of the duplex. In a word, the noise level was horrendous. Any form of wire antenna against or in the building was going to be out of the question.

I was despondent. No HF. Then, while flipping the pages of *QST* one day, I came across an advertisement for an antenna system that looked to be the answer to my problem. It was portable, could be disassembled in minutes, and was as unobtrusive as it could be. I hurriedly went to the manufacturer's web page, but found the price was beyond my budget. I started looking for alternatives in other ads. What I found was, well, nothing that fit what I was looking for! Time for a little old Amateur Radio jury rigging.

A Solution Appears

The very next week I was traveling along Interstate 75 through northern Georgia when I stopped at a truck stop renowned for its steaks. After topping off on a T bone and paying for dinner, I cruised through the truckers supply store to kill a few minutes. I happened across the CB radio supply aisle. It was there that I saw a *universal antenna mount*. It was a 90° angle bracket with a set of U clamps and a ⅜ inch threaded antenna socket already affixed. I'm sure I looked quite stupefied as I stood there, transfixed at the vacuum-packed bracket on the wall with my "how-can-I-make-this-into-something-I-can-use" stare scaring off other customers. Suddenly a vision came to me — a ground mounted, loaded ground plane. An extra $10 spent at the truck stop and I was on my way again.

I had a 5 foot long piece of 1 inch diameter aluminum tubing on the back porch, abandoned by the previous resident and left there by me as being too much effort to carry to the street for disposal. Score one for being a pack rat. The next step was to run out to the local big box store to obtain a set of steel tent stakes that I had seen on a previous shopping spree. They were less than $4 for a set of four and had a bright orange plastic handle on the head end. I also cruised by a different supply store and picked up five adjustable steel pipe clamps. One was big enough for the 1 inch mast that I was going to use and the others were the absolute smallest ones I could find that fit around the metal part of the tent stake.

Further taking advantage of my pack rat qualities, I unpacked a roll of #16 AWG insulated solid wire that I had bought from a salvage sale. My new mast was exactly 5 feet long. I now cut five guy wires each 8 feet long and took about 1½ inches of insu-

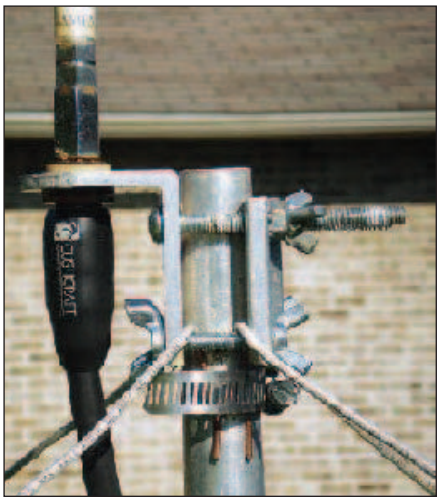


Figure 1 — Mounting plate for HF whips. Note the guy wires enter over the lower bolts and are then secured by the pipe clamp under the bracket.

Figure 2 — Close-up of one of the tent stakes. Remember to remove the insulation before clamping the end of the wire to the stake to aid grounding.

Figure 3 — The two garden-tool clamps are mounted using existing holes and screws on the air conditioning unit. The 2 meter mast is clearly visible.

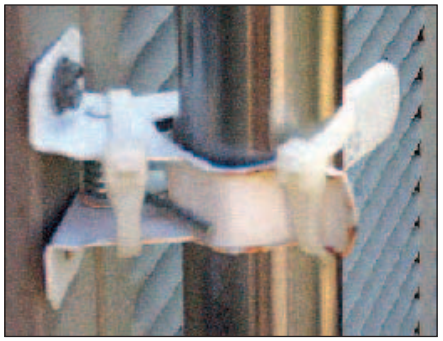


Figure 4 — A close-up of the garden clamps holding the 2 meter mast and the tie wraps securing the pole.

Figure 5 — It's not W6AM's old rhombic farm, but it's mine and it works! The power lines in the background are over 50 yards away.

lation off of each end. Using the supplied universal bracket's U bolts, I mounted the bracket to one end of the tubing. Just below the bracket, I loosely fitted the larger of the pipe clamps. As shown in Figure 1, I brought one end of each wire over the lower set of bolts of the bracket, looped them once, then through the pipe clamp below that. Once all four wires were in place, I securely tightened the clamp.

I then took the opposite end of each of the four guys and ran one end through the hole in the end of the tent stake, after which I wrapped a turn around the metal part of the stake and then tightened the miniature pipe clamp (see Figure 2). I just saved myself most of the cost of a commercial mount.

Raising the Mast

Setting up the mast is a one-person job. Just lay each of the four guys on the ground 90° apart. Then push the stakes into the ground, but *not* all the way in. Once the four corners are approximated, you can stand the mast up. Then pull the slack out of each corner and more precisely align the guys into straight, taut lines. Once you have the mast standing up and the slack pulled out of the guys, you can very vigorously shake the whole system to make sure you've got everything tight. If you've done it right, you will see that even a very aggressive shaking will not topple the mast. The #16 AWG wire guys will not only keep the whole affair sturdy, but will act as a rudimentary ground system.

This arrangement will also work with only three wires. I had the misfortune of misjudging my distance while turning the car around one night and snapped one of the wires. I simply removed the broken wire and rearranged the other three into a three point configuration. It was still as sturdy as it could be and didn't require any retuning.

You Will Need a Radiator

But what about a radiator? Simple — anything you want that has a standard ⅜ inch thread on it, which is almost any of the usual mobile HF antennas. I have been using the stick type loaded whips obtained from hamfests for $15 or less with great success on 75, 60, 40 and 15 meters. I also bought a standard 108 inch CB whip that loads not only on 10 meters via my antenna tuner, but can cover 17 and 12 meters as well. I've also used the mount to deploy my 2 meter collinear mobile antenna at the most distant bikeathon check point station and made solid simplex contact where no contact had been possible before. It is not going to replace a tribander at 50 feet or even a half wave dipole in the trees, but it works! I've worked E5, 3B8, UAØ, most of the usual European and South American entities in addition to most of US states with this antenna.

Refinements Happen

One improvement I made to the mast was to replace the nuts on the bracket with wing nuts and the upper bolts (see Figure 1) with ones 2 inches long. I did this so I could mount a cross bar onto which I could put additional antennas without tools. This has allowed me to put an HF antenna on the centerline, a magnetic mount antenna for 2 meters on one end and a scanner antenna on the opposite side.

This project, by the way, is a great make-it-and-stuff-it-in-the-closet-in-case-of-an-emergency type project. Unfortunately, Mother Nature has a way of mangling even the most robust of antenna installations, and having something you can break out and set up in a hurry is a plus. This is a great option

for anyone involved with emergency services units that have to depend on portable systems. It's very adaptable and can be cobbled together in minutes.

But Wait — There's More

My other antenna challenge was to get something a bit more effective than a ground level magnetic mount antenna on 2 meters. I had a full size collinear in the closet, but that was going to be hard to hide. It was at this point that I had to engage the manager of the duplex about putting up an antenna that might be a bit more visible than the one I had staked in the yard for HF. Her response was that as long as nothing I did required the drilling of holes or pouring of concrete, or could be seen from the front street, she saw no problem with it.

On a previous trip to my big box store, I had spied a utility rod in the households row. Basically, it was a heavy duty, two piece expandable pole, much like a shower curtain rod, that could be used to add to hanging space in a closet. When fully extended, it was almost 10 feet tall. Topped off with my 2 meter collinear it was just below the peak of the roof, meeting the manager's test of not being visible from the front street.

This mast didn't get the same wire and clamp guy arrangement as the HF mast. Instead, I simply removed two screws from the outside central air unit box, fitted two lawn tool garage clamps that sell for less than $3 for a set of five, and replaced the screws (see Figure 3). I then simply snapped the pole into the clamps — instant antenna mount. I took the extra step of placing a plastic tie-wrap around the jaws of the garden clamp to prevent an inadvertent tipover of the pole, yet a firm jerk on the pole allows me to get the antenna down in seconds if need be (see Figure 4).

Now I am no longer dependent on repeaters to work my wife Amy, W5AMY, while I'm going to work. I can now work home directly over most of my 20 mile trip.

Both of these antennas have withstood winds in excess of 30 miles an hour with several gust of over 60. The whole mini antenna farm is shown in Figure 5. For the total dollar outlay (less than $20 all told, not including whips), I couldn't be more pleased!

Photos by the author.

ARRL member and Amateur Extra licensee Steven Robeson, K4YZ, was first licensed in 1972 as WN8OAH. He has since held call signs WD4DEV, KA8GRY, KC8M and K4CAP prior to his current call. He also operated from Okinawa, Japan in 1981 as KA6CM. Steven retired from the USMC as a Gunnery Sergeant in 1992, having served as an avionics technician. Steven is now employed as a life support nurse working in emergency and trauma care.

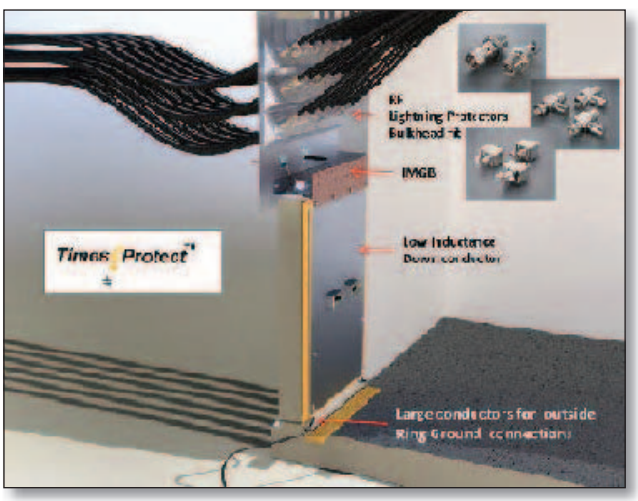
He enjoys operating CW, usually on the bottom end of 80, 40 and 30 meters, and SSB on 17, 6 and 2 meters. He also enjoys foxhunting to enhance his skills for locating aircraft emergency locator transmitters. He is a former member of MARS and the Civil Air Patrol.

He is married to the former Amy McElroy, W5AMY, of Trumann, Arkansas. Steven has written a novel, Shadows of Futures Past, *and a short story* Ashes on the Face of the Sun, *that can be seen at* **www.fanfiction.net**. *You can reach Steven at 151 12th Ave NW, Winchester, TN 37398 or at* **stevenrobeson@yahoo.com**.

New Products

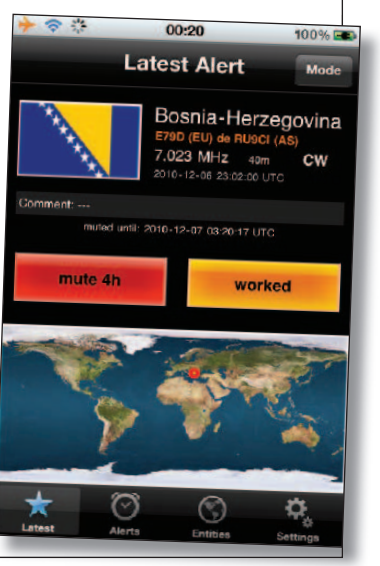
CABLE ENTRANCE PANEL FROM TIMES MICROWAVE

♢The Times-Protect Smart-Panel from Times Microwave Systems is a series of shelter and base station entrance panels designed to eliminate traditional entrance panel shortcomings and improve the protection of base station equipment. The Smart-Panel provides for single point grounding while eliminating external grounding kits. Bulkhead surge protectors mount directly on the panel. Also eliminated are the traditional internal lightning protector and external copper master ground bar so there's nothing to steal outside the building. The Smart-Panel is weatherized, accommodates any wall thickness and is supplied with all the necessary installation hardware including an inside copper master ground bar and low inductance ground plate. The following configurations are available: LP-SP-12N (12 port N hole), $1490; LP-SP-12D (12 port 716 DIN hole), $1490; LP-SP-24N (24 port N hole), $1980; LP-SP-24D (24 port 716 DIN hole), $1980. For more information, visit **www.timesmicrowave.com**.



DX-HUNTER iPHONE APP

♢*DX-Hunter* by Michael Schneider, DJ1MS, is an application (app) for the iPhone, iPad or iPod touch that monitors worldwide DX Cluster spots and notifies the user when a wanted/needed station appears on the 160 through 10 meter bands. The *DX-Hunter* server forwards spots to your mobile device according to the user's logbook entries and/or individual app settings. Spots can be filtered by band, mode and other criteria. Entries in a current log can be uploaded to *DX-Hunter* in ADIF format. For stations marked as worked in *DX-Hunter*, log files are provided to download. When the app is closed, the user is alerted by a sound and a short message on the display. If the app remains closed, *DX-Hunter* will store alerts of the last four hours (up to 500 entries). *DX-Hunter* can be purchased at Apple's AppStore for $11.99.



A Roof Mount for a Rotatable 160 Meter Receiving Loop

Maximize your receive signal to noise ratio with this rotatable loop.

Steve Lawrence, WB6RSE

Figure 1 — The rotatable flag receiving antenna in place and ready for those rare West Coast to Europe openings.

An effective receiving antenna is essential for successful DXing on 160 meters. This is especially the case on the West Coast of the US. My station is located on a small city lot on the west side of Los Angeles. There is absolutely no space for phased arrays, Beverages or any ground mounted antennas. The roof of my house is the only option, necessitating a ground independent design. Figure 1 shows a 14 × 29 foot rotatable flag receiving antenna in place and ready for those rare West Coast to Europe openings.

I've built a variety of large loops — diamonds, triangles, flags — all in fixed orientations with the mast attached to a pipe extending out of the roof. The 14 × 29 foot flag, the largest of the designs tried, not surprisingly proved to be the best performer.

This article is not intended as a how-to with a parts list and a design to duplicate. It's meant to illustrate some ideas you might want to consider adapting to your unique situation.

The Mount

Figure 2 is a drawing of the antenna support. It uses a 5 foot length of 2 inch galvanized threaded water pipe with T couplings at both ends and shorter threaded pieces of 2 inch pipe in line on the far ends of the couplings. A hole is made in the roof, and sealed with standard flashing and roofing materials, the same type of construction that's used for plumbing vent pipes. Inside the attic, a threaded pipe flange, located directly below this hole, is screwed into a ceiling joist. A short piece of pipe and T are screwed into this flange. The section of longer pipe and a T with a shorter piece of pipe are inserted from the top through the hole in the roof. The Ts allow almost the entire lengths of coax and rotator control cable to be protected from the weather as they run inside the attic to the shack. The pipe connections on the outside T are welded. Inside the attic, the pipe is secured with an automotive muffler clamp to a steel plate that is then bolted to the rafters. These precautions provide added lateral bracing and prevent antenna wind loading from rotating the pipe in the base flange, causing rotator direction errors. The parts of the mount that are above the roofline are primed and painted.

The rotator is a CD45. Its standard lower mast support was replaced with the heavy duty version and secured with U bolts and a bolt through the mast stub, again to prevent any rotation. The rotator control cable was attached before the rotator was placed on top of the mount.

The Raising Fixture

The top of the mount pipe is several feet above the roofline to allow clearance for a full 360° of rotation. In order to get the bottom of the antenna mast onto the top of the rotator, a fixture was made with a length of 2 inch pipe, automotive muffler clamps and two steel construction grade L brackets. These brackets are joined by a ½ inch bolt, which creates a rotary joint when attached to the bottom of the mount. An aluminum plate

Hamspeak

Beverage antenna — Long (typically greater than a wavelength) horizontal receiving antenna situated around 6 feet above the ground. Named after the inventor, this antenna is directive, receiving vertically polarized signals that travel along the antenna. Signals are weak, but the noise is even weaker, resulting in an improved signal to noise ratio compared to most more efficient antennas.

Phased array — Multielement antenna system consisting of spatially displaced elements driven with a particular phase relationship to provide a desired azimuthal direction pattern.

Quad — Multielement directional antenna array in which the elements are made of square, rectangular or round loops approximately 1 wavelength in circumference.

UHF (PL-259/SO-239) connector — Coaxial cable connector family developed before WWII for the "ultrahigh frequencies" then starting at 30 megacycles (now MHz). On right in photo.

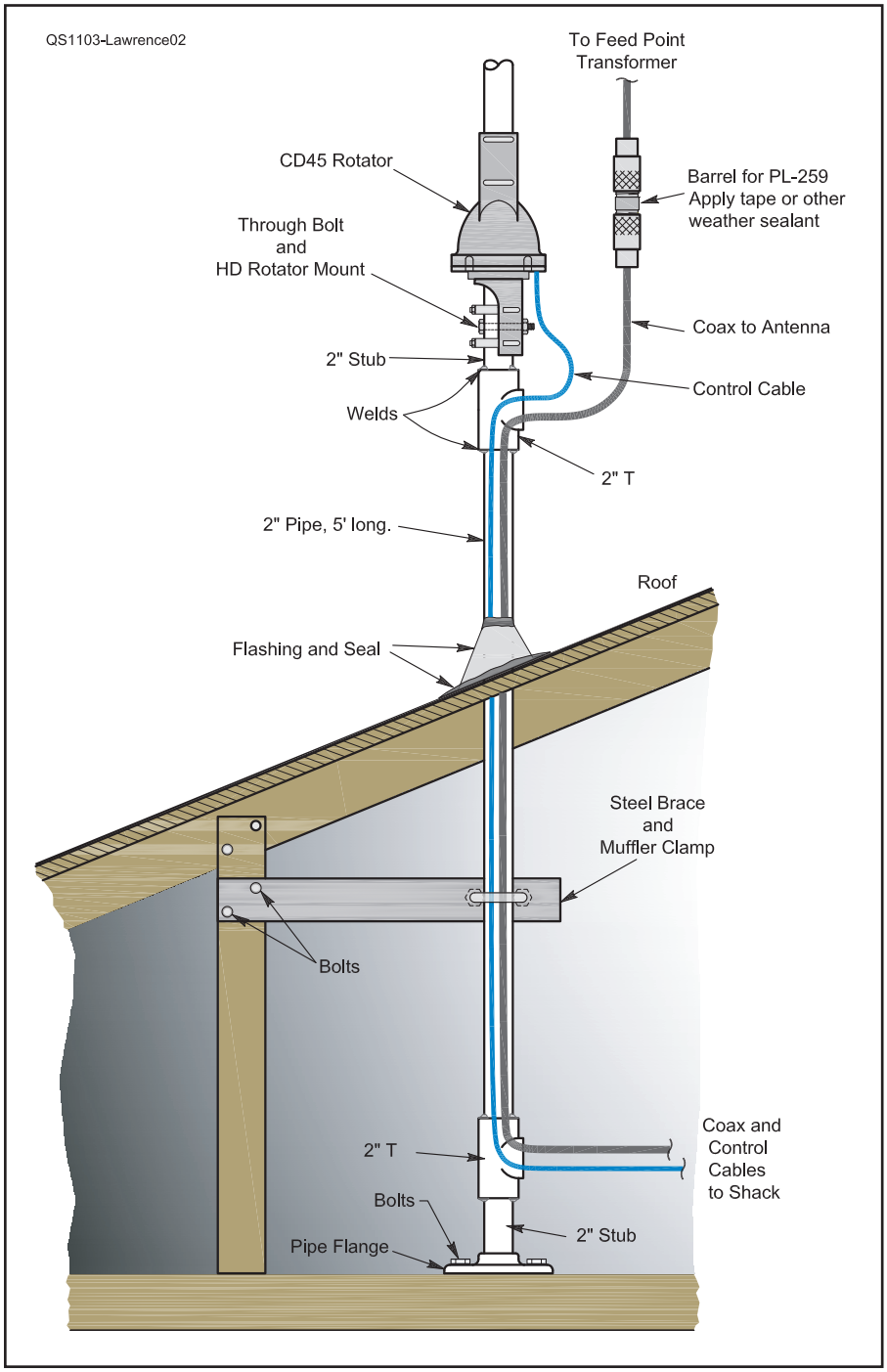


Figure 2 — Drawing of the antenna support. It is made largely of 2 inch galvanized threaded water pipe as described in the text.

Figure 3 — The base of the fixture clamped in place while it lies on the roof.

with U bolts is used at the top end of this pipe to create a temporary offset mast extension. The base of the fixture is clamped in place while it lies on the roof as seen in Figure 3. With the antenna also lying on the roof, its mast is secured to the upper plate with U bolts. With proper attention to lateral and vertical positioning, the antenna is easily rotated up and into place just above the seat point at the top of the CD45 bell housing. The rotator to mast clamp plate and U bolts are then installed finger tight as seen Figure 4. The U bolts holding the antenna mast to the top plate of the raising fixture are carefully loosened, allowing the antenna mast to seat. The raising fixture is then removed and the antenna mast is rotated for proper alignment and the clamps are fully tightened.

Caution

As with any antenna, wind loading of the structure will create a significant side load on the roof where the pipe exits. Be sure that the roof is securely braced at that point, especially if you live in a high wind locale. You might want to consider using several guy wires at the base of the rotator, as well. Many older roofs may not use solid plywood as the roof base as required for reroofing or new construction in many areas. The rotator you use should also be robust enough to handle the anticipated wind load. For safety, raising the antenna into position is best accomplished with two people. Make certain that all bolts on the raising fixture are sufficiently tight to prevent slippage.

Do not attempt this or any similar construction and installation if you have any doubts about its ability to survive your weather conditions!

The Antenna

The antenna is a flag as described by Earl Cunningham, K6SE (SK) and is electrically the same as that built by Larry Molitor, W7IUV.[1,2] My mechanical design differs in that mine is constructed as a rectangular quad element. A quarter inch aluminum plate was drilled for U bolts to hold the quad arms at the proper angles for the required rectangular shape. The spreader arms and mast are fiberglass, reinforced at the U bolt clamp points to prevent crushing. The mast is 2 inches at the base and reinforced throughout its length with additional tubing.

[1]Notes appear on page 42.

Figure 4 — The rotator to mast clamp plate and U bolts installed finger tight.

The bottom 3 feet of the mast are reinforced with a thick walled aluminum tube. This reinforcement along the mast's length is critical if you use a fiberglass instead of a metal mast.

An 8 foot piece of fiberglass extends horizontally from the plate as a support to reduce sagging of the feed point coax — a 25 foot run with PL-259 type UHF plugs on each end, installed while the antenna is assembled on the ground. It's routed across the arm and down the mast and provides a convenient attachment point when used with a coax barrel to connect to the coax that runs to the shack. The coax and control cable come from the shack, through the attic, into the inside T, up and out the outer T and then through a hole in a rubber cap. The cap acts as a seal pressed onto the T opening.

Maximum antenna directivity is in the plane of the loop with the feed point transformer in the desired direction. The antenna is also a good performer on 80 meters. In practice, the antenna is usually turned to minimize or null interference. If you construct it correctly, you can expect to achieve a 30 dB front-to-back ratio (F/B). A preamp is used in the shack at the radio. On 160 meters, this antenna will interact with nearby resonant structures, which then require detuning during receive. If you run any significant power and use a RECEIVE ONLY input on you radio, you should consider an RF limiter to protect your receiver's front end from signals coupled from your transmit antenna.

If you're interested in an effective receive antenna for 160 and 80 meters on a small lot, a large loop is definitely worth trying. The referenced article and website are highly recommended reading.

Notes

[1]E. Cunningham, K6SE (SK), "Flag, Pennants and Other Ground-Independent Low-Band Receiving Antennas," *QST,* Jul 2000, p 34.

[2]L. Molitor, W7IUV, "Rotatable Flag," from his website at **w7iuv.com/flag.htm**.

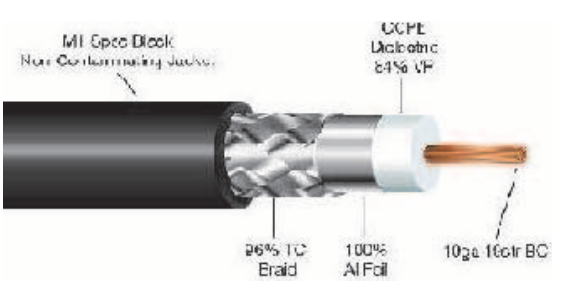
ARRL Life Member Steve Lawrence, WB6RSE, was first licensed in 1959 as a Novice with the call sign WV2GWG. He holds an Amateur Extra class license and received his current call in 1965 after moving to the West Coast. He holds a BS in Physics from UCLA and an MSEE from USC. He retired from Hughes Electronics/Boeing Satellite Systems as an engineering manager in 2002. He is at the top of the mixed and phone DXCC Honor Rolls and needs only P5 to have worked them all on CW. He's been known to refer to 160 meters as "the cruel band."

You can reach Steve at 3642 Coolidge Ave, Los Angeles, CA 90066 or at **wb6rse1@mac.com**.

New Products

LOW-LOSS RG-8 TYPE CABLE FROM ABR INDUSTRIES

◊ABR Industries offers a new low loss RG-8/U type coaxial cable that is manufactured in the USA. The cable features a #10 AWG stranded center conductor, foamed polyethylene dielectric, and a shield made from aluminum composite tape and tinned copper braid. The jacket is weather and UV resistant, non-contaminating and rated for direct burial. Attenuation specifications (dB per 100 feet): 30 MHz, 0.8; 50 MHz, 1.1; 150 MHz, 1.8; 220 MHz, 2.2; 450 MHz, 3.3; 900 MHz, 4.7. Prices: 100 feet with PL-259 connectors installed, $108.95; 100 feet with N male connectors, $113.95. Other stock and custom lengths are available. For more information, visit **www.abrind.com**.



A Factory Style Mobile Antenna Installation

Install a dual band antenna without making your car look like an antenna farm or fishing trawler.

Dev Palmer, AI4WT, and John Swartz, AF4ZE

Figure 1 — The factory AM/FM antenna on Rattler, Dev's 1997 Dodge Intrepid.

Most amateurs have seen that sticker that says "As a matter of fact, I *don't* have enough antennas on my car" on the bumper of a car with a dozen antennas covering frequency bands from ELF to MGILW (my goodness, it's light waves). As practicing electrical engineers and Amateur Radio enthusiasts, we certainly can understand the allure, but for now we are more interested in communicating through the local 2 meter repeaters while driving to and from work, while still maintaining a low profile. A handheld transceiver just didn't have the range for that — something needed to be done.

A Virtual Factory Approach

What we wanted to achieve was an antenna installation that looked as much like original equipment as possible, with connections inside the car that make the radio easy to pop in and out to allow moving it into the house, if desired. It's not just for the looks and convenience — the antenna and radio have to work, too. Luckily, the two of us were able to pool our talents to work through the installation, and we also were able to rope in Dev's son by giving him a chance to punch a hole in his dad's car (and maybe learn something about radio electronics in the bargain).

The mobile platform is Rattler, Dev's 1997 Dodge Intrepid (see Figure 1). Still in great shape with plenty of miles left to go, and a much easier sell than his wife's Camry, for the hole-punching part anyway. You can see the AM/FM antenna mounted on the rear passenger side quarter panel in Figure 1. The antenna is mounted through a rubber grommet that holds it at a particularly stylish angle.

Making it Happen

Dev purchased a used ICOM IC-207H dual band FM transceiver and set about planning the installation. The first step was to pick an antenna that is roughly the same size as the factory antenna. For this project, the Maldol EXCEED EX-107 fits the bill, both because it meets the size criterion and because it covers both the 2 meter and 70 cm bands accessible by the ICOM radio.

The next step was to comb the local junkyards for an Intrepid with the same antenna mount in order to scavenge the grommet. One of the local junkyards happened to have the same model year Intrepid with an intact rear section, and they sold the AM/FM antenna with mounting bracket and grommet for $25. Now we had the grommet, plus

Figure 2 — Tracing the hole for the AM/FM antenna and locating it relative to the edge of the passenger-side quarter panel.

Figure 3 — Transferring the hole pattern to the right spot on the driver-side quarter panel.

Figure 4 — How often do you get asked to punch a hole in your dad's car?

an extra AM/FM antenna in case the original ever breaks off.

The plan was to install the antenna on the rear driver side quarter panel, mirroring the placement of the AM/FM antenna. First step was to completely remove the existing AM/FM antenna and grommet so that we could see how to mimic the installation on the other side. Careful inspection of the grommet revealed that the mounting hole was 13/16 inch diameter with a small square key at the outermost point. Fortunately, the inside bore of the grommet is just large enough to accommodate a UG-363 bulkhead adapter (the long version of the PL-258 coax barrel). A local hamfest yielded a 4 inch UG-363, long enough to stick up past the top of the grommet to make a solid electrical and mechanical connection with the antenna. It extended far enough down past the inside of the fender to mount it on a custom made metal bracket and still have enough thread left for the antenna cable.

Doing the Deed

Figure 2 shows how we used a paper stencil to capture the size, shape and position of the hole on the passenger-side rear fender. The distance from the stencil to a convenient point on the inside of the trunk rim was determined using a measuring tape. Then we used the stencil, measuring tape and a permanent marker to mark the driver-side rear fender for the new antenna, as shown in Figure 3.

Even though it's an old car we didn't want to tear up the paint, so after the new hole was marked we covered the location with a strip of wide clear plastic packing tape. Some folks say that there are two kinds of tape — the kind that won't stay on and the kind that won't come off. Fortunately, modern science has provided us with a happy medium.

With the hole marked and the tape in place it was time to bring out the power tools. This job required a power drill, center punch, 1/8 and 3/8 inch drill bits [a step drill would be less likely to damage paint — *Ed.*], a 13/16 inch round chassis punch, a rectangular metal file and of course the appropriate personal protective gear starting with a pair of safety glasses. First, the center punch defined the exact middle of the mounting location. Then, the small drill bit followed the center punch through the fender. The large drill bit expanded the hole to fit the center screw on the chassis punch. Then the chassis punch expanded the hole out to its final size. A few quick strokes of the file defined the slot for the square key. The clear packing tape was removed, and that part of the job was done. Note the expression of glee on Dev's son's face in Figure 4 — how often does a dad ask a boy to wreak this kind of havoc on his car?

If you do this on a new car, it might be worth touching up the bare metal inside the new hole with a dab of rust primer and maybe even a layer of topcoat before inserting the grommet. The grommet was a good tight fit, so a squirt of silicon lube was needed to make the job go smoothly. At this point, the grommet was mechanically strong enough to hold the UG-363, even with the antenna attached, so we went ahead and installed both to see how the installation compared, cosmetically at least, to the AM/FM antenna on the other side. So far, so good (see Figure 5)!

With the bodywork done, it was time to make the mounting bracket. The UG-363 and antenna were adjusted so that the angle matched the angle of the AM/FM antenna on the other side, and then a mock-up of the mounting bracket was made using a piece of cardboard. The bracket was sized to go from the UG-363 to the closest interior point with enough room to take a few screws. The cardboard template was transferred to a strip of 1/16 inch aluminum stock that was then drilled out for the UG-363 and mounting screws, and bent to the necessary shape in a bench vise. Self tapping screws were used to attach the bracket to the car body, and the

Figure 5 — The EX-107 mounted on a 4 inch UG-363 type barrel connector through the new grommet.

Figure 6 — A cardboard pattern for the mounting bracket. Inset shows the bracket realized in aluminum stock.

Figure 7 — The ICOM IC-207H snugly mounted on the transmission hump using an aluminum bracket and hook and loop tape.

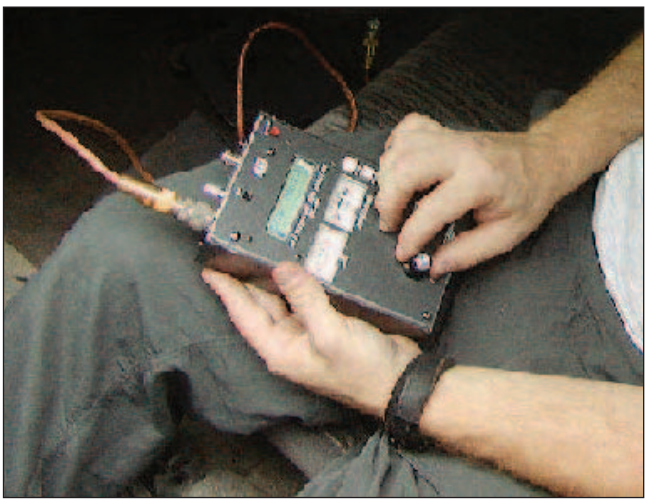


Figure 8 — Radio John verifies the quality of the antenna connection.

UG-363 was secured with two nuts and two lock washers (see Figure 6).

Another strip of the same aluminum stock, spray-painted black, was formed to make a bracket holding the ICOM 207H on the transmission hump. A couple of self-stick hook and loop fastening pads were used to keep it from sliding around on the carpet (see Figure 7). Power and antenna wiring was straightforward; heavy gauge wire was run directly from the battery, through fuses in both leads, through the firewall using grommets anywhere there was any chance of wearing through the insulation, and into the passenger compartment through the door bellows. The power wires were terminated with a standard power plug for easy removal. The RG-58 antenna cable was routed under the dash, under the door trim and around the back seat into the trunk. A PL-259 connector was attached to the end of the antenna cable and screwed on to the UG-363.

Making it Play

Before we hooked up the transceiver, Radio John checked the antenna lead with his SWR meter (see Figure 8). The results were good: SWR of about 1.2:1 in the center of both the 2 meter and the 70 cm bands.

The total cost for the whole installation (excluding the chassis punch, which you may be able to borrow from another ham or your local machine shop) is comparable to a commercial magnet or trunk lid mount. Now the radio can pick up a repeater from any of the local ham radio groups, the Durham FM Association (145.450 and 147.225), Raleigh Area Radio Society (164.640) or the Orange County Radio Amateurs (442.150 MHz), and hit it for the whole commute. As projects go, this one was a great success. The antenna looks built in, the installation was a fun activity with good friends, and who knows, it may even have piqued Dev's son's interest in radio electronics so that we can keep the hobby moving forward!

Photos by the authors.

ARRL member Dev Palmer (AI4WT) works as an electrical engineer for the US Department of Defense. He was first licensed in 2004 as KI4GUS and earned an Amateur Extra class license in 2007. He is a member of the Smith Chart Amateur Radio Society, Durham FM Association and the Possum Trot Net and is a Senior Member of the IEEE. You can reach Dev at 146 Pinecrest Rd, Durham, NC 27705-5813 or at **ai4wt@arrl.net**.

ARRL member John Swartz (AF4ZE) is product development director for a privately held electronics manufacturer. He earned the Technician Plus class license in 1997 (KB1DLB) and upgraded to Amateur Extra class in 2000. He is an avid bicyclist and a Senior Member of the IEEE. You can reach John at 6203 Chesden Dr, Durham, NC 27713-8944 or at **af4ze@arrl.net**.

Hamspeak

2 meter repeater — Radio transmitter and receiver that simultaneously receives on one 2 meter frequency and retransmits on another. Used to extend the range of mobile and portable stations.

70 cm band — Radio frequency range of 420 to 450 MHz, allocated by the FCC to the Amateur Radio Service, on a shared basis with the US government in the US. This band is the lowest frequency amateur band in the UHF range and is popular for FM use with repeater stations, amateur television, single sideband, CW and data modes via space or other propagation modes.

Antenna farm — Amateur Radio expression for a large tract of land filled with antennas.

PL-258 coax coupler — A UHF type coaxial fitting designed to accept two male UHF coaxial plugs (PL-259) and thus splice two cables. Sometimes it is known as a *barrel* connector, because of its appearance. See the center in the photo.

PL-259 — Male UHF type coax connector. Part of a coaxial cable connector family developed before WWII for the "ultrahigh frequencies" then starting at 30 megacycles (now MHz). On right and left in photo above.

Transceiver — Radio transmitter and receiver combined in one unit. In many cases some circuitry is shared between the two functions.

A Near End-Fed Antenna for Low Power 20 Meter Operation

This simple antenna may be what you need for your next radio camping expedition.

Herman J. Birkner, W2FRH

On past vacations and camping trips I have had a lot of fun working portable low power (QRP), especially on 20 meter CW. Most of the time I have used the half wave center fed dipole described by Rich Wadsworth, KF6QKI.[1] It is made entirely from 300 Ω TV twinlead, needs no antenna tuner, is easy to backpack and has been very effective. But in some locations it has been hard to find two supports for it, and it seemed not to work as well when used with only one support as a sloper. Because of this, I looked into the possibility of using an end-fed wire that would work well with just one support.

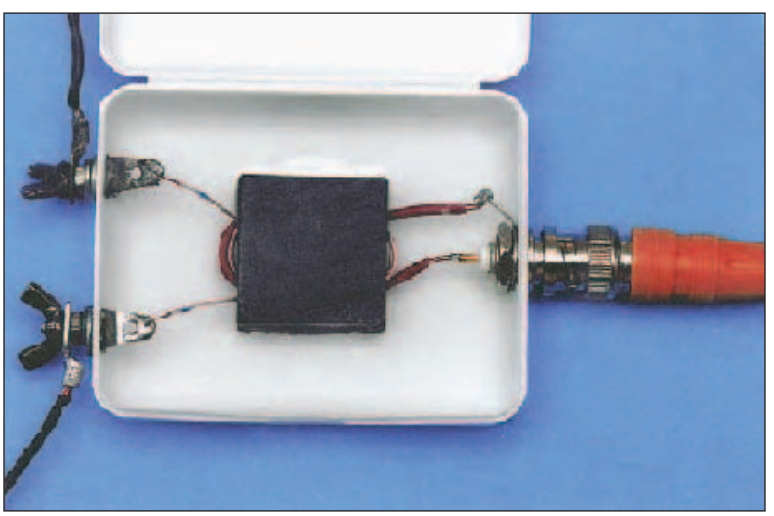


Figure 1 — RF transformer with 4:1 turns ratio on binocular core.

Trial and Error, and Error…

At first I tried a quarter wave wire with an equally long counterpoise but I could seldom get the SWR below 3:1 without using an antenna tuner. A half wave wire can be end fed with an antenna tuner along with an RF ground or a counterpoise, or even with a quarter wave matching section, but each of these solutions required carrying more stuff than I would like. This led to a search of recent articles on the topic and I found some very helpful ideas.

Les Moxon, G6XN, described a way to end feed a wire about a half wave long by using a short counterpoise, a loading coil, a series capacitor and a matching transformer.[2] Steve Yates, AA5TB, did the same with a 64:1 RF transformer that had a variable capacitor across the high impedance side, similar to a system proposed by Tom Rauch, W8JI.[3,4] Rauch also devised a version that didn't need a tuner by using a 60:1 transformer and an RF ground. But what I found most attractive is the antenna suggested by Ron Skelton, W6WO.[5] He fed a half wave wire just 10% from one end at which point the impedance was about 800 Ω, matching it to 50 Ω by means of a 16:1 transformer wound on a rather large binocular core. W6WO's idea seemed to be one of the simpler solutions to the end-feed problem, so I thought I might try scaling it down for QRP.

Figure 2 — Complete antenna with RF transformer, 27.5 foot radiator, 1 foot counterpoise and 3 feet of RG-58 feed line.

A Solution at Hand

I bought a small binocular ferrite core, an Amidon BN43 7051, wound a primary with one turn of #18 AWG wire and a secondary with four turns of #26 AWG, both plastic coated. It easily fit into a 3.5 × 2.5 × 1 inch plastic box (see Figure 1). With a known resistance connected across the secondary winding, measurements using an MFJ-259B antenna analyzer confirmed a resistance transformation of 16:1 across the 20 meter band. So the transmitter would see about 50 Ω at the

[1]Notes appear on p 47.

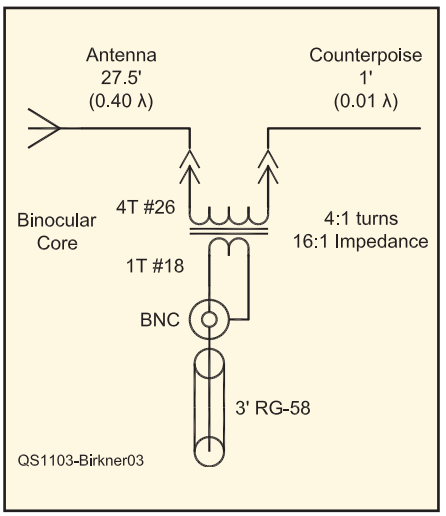


Figure 3 — Schematic diagram of the antenna. The binocular core is available from www.amidoncorp.com.

antenna feed point. Trials with different lengths of antenna wire, counterpoise and feed line revealed several successful combinations.

One that worked especially well was 27.5 feet (0.40 wavelengths) of antenna wire, just 1 foot (0.01 wavelengths) of counterpoise and 3 feet of RG-58/U feed line, as shown in Figures 2 and 3. This arrangement had a relatively flat SWR across the 20 meter band, ranging from 1.1:1 to 1.5:1. This held true with the antenna in a horizontal position, at a 30° slope and as an inverted L, fed from the top or fed from the bottom.

To test the transformer's efficiency I enclosed it in a thermally insulated container with small holes for the leads and feed line. A steady 10 minute application of 5 W of RF at 14.175 MHz caused no rise in its temperature, so losses seemed to be low.

Encouraged by these results I gave it a try in the field, actually my backyard, just several feet above sea level. The antenna was strung as an inverted L and fed from the bottom with the flat top at a height of 12 feet. My first call with 5 W on 20 meter CW raised a W7 at a distance of 2400 miles — not bad for a sunspot null — and the antenna has continued to work very well since then.

There are a number of potential drawbacks to this antenna system. The 16:1 transformer, if wound as described, has an inductive reactance of 25 Ω across the 20 meter band. Theoretically, this could make it difficult to obtain a satisfactory SWR, but this proved not to be the case. It remained less than 1.5:1 from 14.00 to 14.35 MHz.

The coax feed line presents another possible problem. A change in its length also changes the SWR, so if you need a feed line length other than 3 feet it will be necessary to experiment with different lengths of antenna wire and counterpoise, but that is not hard to do. In fact, it proved to be much easier than trying to trim a standard dipole to an optimal length. Also, no attempt has been made to suppress common mode currents. The amount of radiation arising from unbalanced current in this short a feed line is likely to be quite small. [Alternately, a few turns of the coax on an FT-240-43 toroid core should remove the common mode currents. — *Ed.*]

Along with the time-tested KF6QKI dipole, this antenna has proved to be a useful addition to my portable QRP gear. I hope you also find it helpful.

Hamspeak

300 Ω twin lead — Type of transmission line used for almost all TV receive antennas before the advent of coaxial cable. Twin lead was a balanced line with two conductors separated by a plastic web of about ½ inch width. Some amateurs used this line for antenna connections.

Antenna tuner — Device that sits between an antenna and a transmission line, or a transmission line and a radio, and transforms the impedance to match the radio or line.

Binocular core — Dual ferrite core structure often used in RF transformers.

Counterpoise — Artificial ground system raised above earth ground and typically used as one side of the connection to a vertical monopole antenna.

CW — Abbreviation for *continuous wave;* another name for *Morse code* telegraphy by radio. Also, International Morse code telegraphy emissions having designators with A, C, H, J or R as the first symbol; 1 as the second symbol; A or B as the third symbol, and emissions J2A and J2B.

Dipole — An antenna often, but not always, center fed with two halves along the same line. Usually 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.

Inverted L — Common name for a ¼ wave vertical monopole antenna with too short a support for the full required height. The antenna is bent to horizontal at the highest point to provide the required length, giving it the appearance of an inverted letter L.

Loading coil — An inductor inserted into an antenna to make it electrically longer.

QRP — Strictly speaking, operating shorthand for "I am sending with low power." In common use, refers to low power, typically under 5 W output, operation viewed as a special challenge by many amateurs.

RG-58/U coaxial cable — Coaxial cable type with typically 50 Ω (some variants at 52 or 53 Ω) characteristic impedance and 0.195 inch outer diameter. Compatible with a PL-259 coaxial plug with the use of a sizing adapter.

Sloper — Common name for a sloping dipole or top fed monopole. The sloping configuration provides some directivity away from the direction of the support.

SWR — Standing wave ratio. 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 3:1, sometimes higher. Solid state transmitters frequently require an SWR of 2:1 or less for proper operation.

Toroid core — Circular donut shaped structure made from metal oxides in a ceramic material. Used as the basis for inductors that have the property that they are self-shielding in that the magnetic fields stay within the core.

Notes

[1]R. Wadsworth, KF6QKI, "A Portable Twin-lead 20 Meter Dipole," *QST*, Feb 2002, pp 36-37.
[2]L. Moxon, G6XN, "Ground Planes, Radial Systems and Asymmetric Dipoles," *ARRL Antenna Compendium*, Volume 3, pp 19-27.
[3]S. Yates, **www.aa5tb.com**.
[4]T. Rauch, **www.w8ji.com**.
[5]R. Skelton, W6WO, "Exploring Near End-Fed Wire Antennas," *QEX*, Mar/Apr 2009, pp 33-34.

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He received his Novice call, WN2EIH, in 1951, followed thereafter by W2MNE and then DL4HK during an Army tour. He upgraded to Amateur Extra in 2001.

Herman's major Amateur Radio interests are antennas, homebrew QRP and CW on the satellites, especially VO-52. He also makes some time for sailing and has a commercial pilot certificate. You can reach Herman at 1537 Caribbean Dr, Sarasota, FL 34231 or at **hbirkner@gmail.com**.

Using a Noise Bridge and Spectrum Scope to Adjust Your Antenna Tuner

This slick visual method will predetermine your antenna tuner settings.

Walter G. Mellish, KC2KZJ

For transceivers with built-in spectrum scope capability, it is possible to adjust a manual antenna tuner to a narrow bandwidth antenna with a noise bridge. This visual technique avoids interfering with other stations and reduces possible stress on the transmitter.

The Usual Tuning Method

In the conventional method of finding the capacitance and inductance tuning parameters, you put power from the transmitter to the antenna tuner and antenna and adjust the tuner setting for the lowest SWR. Particularly in the case of a nonresonant or unknown experimental antenna, the antenna may not readily absorb and radiate a large part of the energy sent to it. This may result in very high SWR, high voltages and currents in the cables and stress on the antenna tuner and on the transmitter final amplifier. Also, with a lot of trial and error you could burn the tuner inductor contacts.

It would thus be handy to have a device that would inject a very small amount of energy into the receiver, tuner and antenna to determine if you have a match.

At my station, I have an ICOM IC-756PROII transceiver that includes a built-in spectrum display. This technique is useful with other similar transceivers, or any with a connected external panadapter. My transceiver drives a linear amplifier, manual antenna tuner and then a commercial multiband wire antenna fed with coax cable. I enjoy contests and would have liked to participate in the three 160 meter contests during a recent winter but I did not have a 160 meter antenna. I originally decided to try to use my too short antenna on 160 meters and then, after carefully rereading the instructions, discovered that it includes a gas tube static discharge module in the center connector. High voltages resulting from a severe mismatch at the antenna center might have caused the bulb to fire, resulting in a short across the antenna connections and damage to my transmitter or amplifier. So after studying what was available I purchased a different antenna that did not have the discharge tube for use on 160.

The Noise Bridge Method

The noise bridge is a battery powered, very low power, broadband noise generator feeding through a previously calibrated bridge circuit containing a variable capacitor and resistor. The noise bridge is usually described as an analytical device and, if used as such, one side is connected to a receiver and the other side connected to the coax or antenna. The receiver is set to the desired frequency and the variable capacitor and resistance adjusted until the bridge balances. Balance is indicated by a null in the noise heard in the receiver — hence its name. The reactive and resistance values for the coax or antenna at that frequency can then be determined from the capacitance and resistance dials.

In this application, however, I was not interested in the actual values of reactance and resistance at the node between antenna feed coax and antenna tuner. I was interested in matching the coax at that node to a 50 Ω impedance that my radio system wants to drive. Using a 50 Ω coax jumper to the input to the antenna matcher, the transceiver will only see 50 Ω impedance if the output of the tuner makes that node equivalent to 50 Ω. The noise bridge is set at 50 Ω resistance and 0 Ω reactance and placed in the antenna circuit between receiver and antenna matcher. If the receiver is then tuned to the desired frequency, the noise bridge will only balance, and the noise null, if the antenna system matches 50 Ω.

I have an MFJ-202B RF noise bridge that I had previously used to find the manual tuner set points when connected to my antenna. Using 50 Ω coax jumpers I connected the noise bridge RECEIVER connector to the 'PROII SO-239 antenna connector and the UNKNOWN connector to the RF INPUT of the tuner. The 50 Ω coax to the antenna is connected to the output connector of the tuner.

Note that the linear amplifier is not in this circuit at this time. I set the bridge resistance to 50 Ω and the reactance to 0 Ω and turned it on. On the 'PROII I unplugged the PTT switch connector so that it could not accidentally transmit, then turned the receiver on and set it to the first frequency, 1850 kHz.

Figure 1 — Photograph of the display on the 'PROII showing the displayed spectrum with the notch in the center.

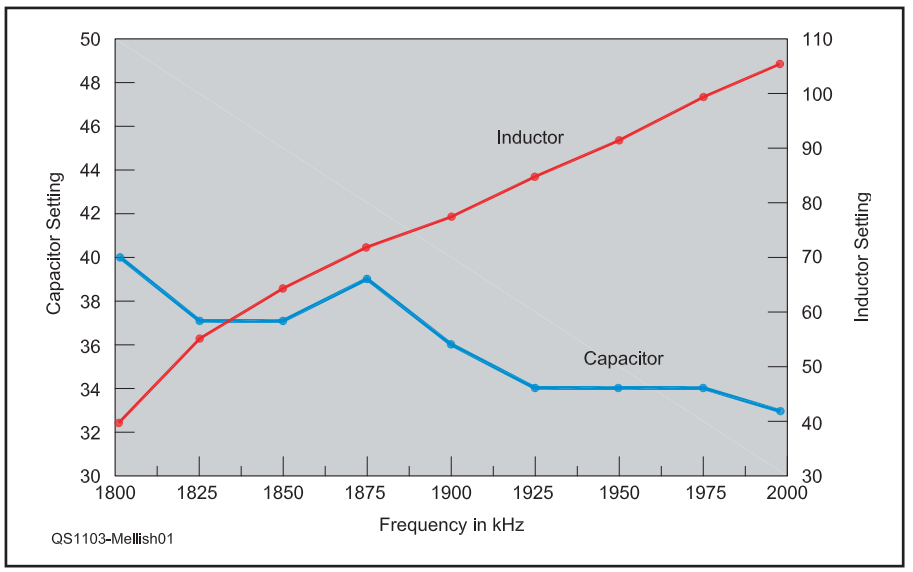


Figure 2 — Graph of my capacitor and inductor settings plotted against frequency to make interpolation quicker, and perhaps more error proof.

I turned off the auto tuner, the preamplifier and the automatic gain control (AGC). If the AGC is left on it will fight you during adjustments by turning up the gain to eliminate the null point. If you cannot turn the AGC off on your transceiver, set it to SLOW and you will have to crank the capacitance and inductor at a good rate so the slow AGC does not have time to compensate before you hear the null.

The procedure here is to set the desired frequency on the receiver, turn the noise bridge on, hear noise in the receiver and tune the antenna tuner inductance and capacitance to minimize the noise. That null is your tune point at the frequency. One notable benefit of this procedure is, since you are not putting power into the antenna circuit, you do not have to worry about burning the inductor contacts as you crank the inductor across its range. I have used this approach before on resonant antennas and the null pretty well corresponds to the point of minimum SWR on transmitting.

So I set up and did this procedure for my 160 meter antenna at 1850 kHz. The first two times I cruised almost the full range of the tuner's inductor without being able to hear any null. I had set the capacitor to about 75%, then 50% of scale. I then changed the capacitor setting to 30% of scale and made another sweep and seemed to hit a null right near the maximum inductance end of the inductor [often the case on 160 meters — *Ed.*]

Adding the Visual Dimension

The 'PROII has spectrum display capability and I had this screen up on the range ±25 kHz. At the null points the spectrum showed a high, tight wall of noise evenly across the whole width except in the center where it showed a nice, smooth little valley, centered right on the vertical dashed line which represents the frequency the radio is set to. Figure 1 is a photograph of the display on the 'PROII showing the spectrum display with the notch in the center. As I tuned the antenna tuner inductor, the notch moved across the screen. I found that I could define the tune point more easily and accurately by watching for the valley on the spectrum scope and centering that on the dashed line than I could by listening to the audible noise null.

Then I did the same for the frequencies in the range 2000 to 1800 at 25 kHz intervals, with the end points at 1998 and 1802 for my operating table and got good nulls for each, showing progressive settings on the inductor, all near scale end. For each frequency the spectrum display made it much easier to define the tune point parameters than by trying to tune by noise null. The null point was solid and steady on the spectrum scope screen during these trials done in dry weather. I tried this same procedure the next day during a rain storm to take pictures of the spectrum display and found that the display was jumping around resulting in fuzzy pictures. So the Figure 1 photo was taken two days later on a dry day when the spectrum display was again steady.

Note that if you cannot get a null, this is a warning that the antenna tuner cannot match your antenna circuit. In this case, *do not* go to transmit to put power to the antenna system. A great advantage to this method of tuning is that you get this warning without stressing or damaging your transmitter or your tuner.

The noise bridge must be removed from the receiver and tuner circuit and the transceiver antenna reconnected directly to the antenna tuner input before transmitting at a lower power level to confirm proper operation. Leaving the noise bridge in the circuit will burn it out and possibly damage the transmitter.

Keeping the 'PROII auto tuner turned off and checking each of the tune points in transmit at about 30 W output shows the SWR on the antenna tuner's meter to be 1.3:1 or lower at each point. So I have tabulated tune points for frequencies across the entire 160 meter band at intervals that will allow me to estimate settings in between frequencies. To make it easier to interpolate, I plotted the curves in Figure 2 that will more accurately allow me to set up between the measured points.

Figure 2 is a graph of my capacitor and inductor settings plotted against frequency to make estimation quicker, and perhaps more error proof. I especially appreciate this kind of plot when I suddenly have to work a difficult station split at 1 AM Sunday during a contest.

So I have demonstrated a method which can be used to develop a table of capacitor and inductor settings for different frequencies as I move across a band. This table can be quickly laid out and the inductor cranked continually without fear of burning the contacts. An advantage of easily developing such a table, particularly for the 160 and 80 meter bands with their usual narrower tuning range, is apparent during a contest. With a table or plotted curve, you can immediately set up the tune parameters on a crowded band without disrupting others by tuning up or retuning under power as you move across the band.

This can be particularly useful during a wide range split operation where you are listening on one frequency and then must quickly set up to transmit on a different frequency. This method is also advantageous when first setting up and testing a random wire antenna or an experimental antenna for which you may have no idea what the tune parameters should be and it may take a lot of cranking on the inductor to find the tune points.

ARRL member and Amateur Extra class operator Walter G. Mellish, KC2KZJ, received BS, MS and PhD degrees in Chemical Engineering from Clarkson University. For 34 years he worked in plastics development, reaction kinetics, high purity distillation and computer control until his retirement in 2002.

Walter collects Hallicrafters and Hammarlund gear from the '50s and '60s, is a member of the Roseland, New Jersey Amateur Radio Club, participates in public service functions and operates all HF modes. You can reach him at 13 White Oak Dr, Livingston, NJ 07039 or at **wmellh@aol.com**.

Choosing Your First Commercial HF Antenna

Looking at this issue of QST might make you think you have to build all your own antennas — there are other options.

Joel R. Hallas, W1ZR

Figure 1 — A "horizontal dipole" doesn't have to be perfectly horizontal. This commercial dipole antenna was simply installed to fit the available space.

Many amateurs enjoy building their antennas, perhaps because a few trips to the hardware or home supply store can yield the parts needed to make an effective antenna. This is not usually the case for other amateur equipment, which often requires special skills or test equipment to duplicate.[1]

Do-It-Yourself Isn't for Everyone

For those without the time or resources to build their own, commercially made antennas are available in virtually every configuration feasible. A quick look through the back of any issue of *QST*, or an Internet search for a particular antenna type, will often lead to a manufacturer who will be happy to provide exactly what you want.

Keep in mind that selecting and obtaining the antenna is just the first step. Actually getting an antenna up in the air may be even more challenging. Here again, help is available. There are some companies that specialize in the installation of amateur antenna systems, however, they are generally focused on the installation of larger tower mounted antennas. For smaller antennas, you may have success with the few remaining TV antenna installers, arborists or other contractors who have the facilities to reach the desired location. The key here is to make sure you can understand and explain exactly what you want the contractor to do, and watch to make sure they do it right. Members of your local Amateur Radio club may be able to make suggestions or even assist with the project.[2]

Picking Your First Antenna

There are many antennas that can be candidates as a *first* antenna. Which one will be best for you will depend on a number of factors that are based on your needs, expectations and especially the amount and character of the available space. Some key considerations include:

■ Where are you permitted to put an antenna? If you own your own house, and live some distance from others, there may not be many restrictions. Unfortunately, that doesn't describe many of us these days. If you rent a property, your possibilities are likely based on rules of your landlord. If you own your own house and yard, your location may be subject to zoning bylaws (if antennas aren't specifically addressed, look for the definition and size restrictions on *structures* to see if they apply). Sometimes any deed limitations or homeowner association restrictions can be even more onerous, and even harder to appeal.

■ What bands do you want to operate on? Often the first antenna a new ham wants is to extend the range of a VHF FM handheld to allow operation through local repeaters. This is usually very easy to provision without coming afoul of anyone. I have been known to use a mobile magnetic mount antenna attached to the top of a water heater, filing cabinet or refrigerator with good results. More advanced omnidirectional antennas for VHF FM are often compact enough to go almost anywhere. The major issues tend to come up for those who want to operate on the HF bands, or perhaps the VHF or UHF bands for advanced long haul operation. We will focus on HF in the following sections.

■ How much room do you have available? A horizontal antenna that has dimensions in the range of ½ wavelength is considered a full size antenna. For the HF bands, this covers the range of about 140 feet for 80 meters to about 17 feet for 10 meters. If you try to imagine something either that wide, or about half that tall, for a ¼ wave vertical antenna in your available space, you can get an idea of what bands you can operate with a full size antenna. Of course, some antennas can be modified to fit the available space. See Figure 1.

Most HF operators would like to operate at least as low as on 40 meters, since the higher frequency bands are less likely to work reliably in the current sunspot environment (but it is improving, and 20 and even 17 meters are frequently open to somewhere in the world). That means about 70 feet for a full size half wave horizontal. This is just

[1]Notes appear on page 51.

not in the cards for many households.

Fortunately, there are more compact alternatives — after all, I've worked all over the world from my car — so there must be a way. The use of a compact antenna generally means accepting compromises — less efficiency, less bandwidth or both. This is an area in which many commercial manufacturers have made contributions. Various clever designs overcome the bandwidth limitation by providing remote tuning to shift the operating frequency. Look for short vertical antennas with motor controlled adjustable loading coils, or loop antennas with special tuning circuits. If possible, find local amateurs who have used the type you are interested in to get an idea of how it works in your area. If not discussed in a *QST* Product Review or Short Take (see **www.arrl.org/product-review** for every review since 1980), you can often gather opinions by looking at Internet forums such as at **www.eham.net/reviews**.

How far do you want to reach? This question will play an important part in your decision on which antenna to select. While we all will want to work into all parts of the world whenever conditions permit, some antennas will provide better performance at long ranges, at the expense of shorter ranges — and vice versa. This has to do with the elevation angles that the antenna launches its power to — a subject for other articles, past and future.[3] The short summary is that with HF propagation via ionospheric refraction, radiation at lower angles, typically below 10°, can go further on each hop and thus reach longer distances with stronger signals. Conversely, radiation at high angles, including almost straight up, results in effective communication at relatively shorter distances. Note that neither is an absolute, since contacts at various distances will happen in either case — but your success probability will be higher if the antenna is designed for what you want to do most.

All of this is a lead up to a discussion of the antenna polarization you want for your first commercial antenna. For terrestrial VHF (satellite is another story) it needs to match the antenna at the other end, slam dunk — for FM it's vertical, for SSB or CW it's horizontal. For HF, this is where it all comes together — available space and operating objectives. A short summary of the implications of the two choices follows.

Horizontal polarization generally provides a stronger signal at some elevation angles than most vertical antennas, but needs to be at least half a wavelength high to provide significant low angle radiation. Most horizontal antennas, including the half-wave dipole, are directional — that is, they work better in some directions than others. This can be an advantage if oriented to cover particular areas, however, for full geographical coverage, a horizontal antenna will either need to be rotatable, or multiple antennas will be needed. We discussed building a first dipole in an earlier article, but all applies to a commercial horizontal wire antenna as well.[4] Many manufacturers provide multiband versions using traps or other techniques to provide multiple resonances.

Perhaps the most effective antennas for HF long haul operation are rotatable Yagis on towers of more than a half wavelength in height. These are generally available for 20 meters and up, with some going as low as 40 meters — usually with shortened elements. A rotatable multiband tower mounted Yagi is certainly possible, however, it will require a serious investment in time and money — perhaps moving out of consideration as a first antenna for many new amateurs. In addition to the cost of the antenna, rotator and tower, additional investment will be required for permitting in many areas, as well as engineering and construction.

Vertical polarization may start to look good to many. A vertical monopole, by itself, takes up very little real estate and may be easier for some to deal with aesthetically. There are many multiband verticals available commercially, one might be a perfect fit for your surroundings. Generally, an HF vertical monopole works well at low heights — even with a base on the ground.

If a vertical is based on being an electrical ¼ wavelength long, it will require a ground system for efficient operation, often a limitation in some surroundings.[6] Some commercial multiband verticals are based on an electrical ½ wavelength design and these do not require much in the way of grounding, so may be easier to install in some locations.

Figure 2 — Vertical antennas going up during the 3W6C DXpedition to Côn Có Island, Vietnam. The seawater in the background was the secret ingredient to their great signal.

Single element verticals are omnidirectional — they can communicate to all directions equally, however, if on most terrain, will not put out as strong a signal as a horizontal antenna at optimum height — every antenna is some kind of compromise. Vertical monopoles have an overhead null, making them work better for long distances than short — often, but not always, an advantage. The waves that would leave near the horizon are attenuated by the losses of the earth along the path, so the low angle radiation is generally reduced to below that of an optimum height horizontal — but that might not be possible, especially on the lower bands. A vertical monopole adjacent to sea water, and working in directions over the water, is a whole different animal. In this case, the sea water reflection adds near the horizon providing a very strong signal at the lowest angles. It is no accident that many DXpeditions to remote islands employ arrays of vertical antennas at the water's edge (see Figure 2). This may explain why waterfront property tends to be more expensive!

Wrapping it Up

So if you're not interested in the nitty gritty of designing and fabricating your own antennas, or not up to climbing trees to install them, there are options for you from antenna manufacturers. Whatever route you want to take, start with a long look at your physical situation, combined with your operational interests, and you're sure to find some products that meet your needs.

Notes

[1]Not always the case see, for example: C. Jackson, AC5HM, A Shower Head Microphone," *QST*, Mar 2007, pp 52-54; or D. Holdeman, N9XU, "A Shower Head Microphone," *QST*, Oct 2008, p 76-77.

[2]You may search for an ARRL affiliated club in your area at **www.arrl.org/find-a-club**.

[3]See for example, J. Hallas, W1ZR, "The Antenna Elevation Pattern -- What's the Big Deal?" *QST*, Mar 2010, pp 39-40.

[4]J. Hallas, W1ZR, "Getting On the Air — Your First HF or 6 Meter Antenna," *QST*, Jan 2008, pp 65-66.

[5]D. Straw, N6BV, "I Just Got My License and a Used HF Transceiver — Now What?" *QST*, Mar 2008, pp 39-41.

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

Joel Hallas, W1ZR, is the QST Technical Editor. You can contact Joel at **w1zr@arrl.org**.

A 20 Meter Flagpole

This single band flagpole antenna needs no tuner.

Ed Esborn, K1UQE

Figures 1 and 2 show the 20 meter flagpole antenna I fabricated to allow operation in the no visible antenna environment of my retirement home.

Construction Details

The base is constructed of a 30 inch length of 2 inch diameter PVC pipe placed in the center of an 8 inch diameter by 24 inch long cardboard form. The PVC pipe is then held in place by filling the 8 inch tube with cement. The flag pole is made of three 6 foot sections of aluminum tubing. The lower one is 2 inches, the center one 1⅞ inches and the top one is 1¾ inches in diameter.

The upper sections are overlapped by 6 inches with the lower unit inserted into the PVC pipe. Two stainless steel ¼-20 × 3 inch machine bolts 4 inches apart and 90° from each other fasten the lower unit to the PVC pipe. The other sections are held together with #6 sheet metal screws. The QST-in-Depth website has some sketches that might be helpful.[1]

This gives a height of about 16.5 feet. The pole was then finished off with standard flag pole hardware. There are six 18 foot radials, three stretched out to the south and three to the north about 1.5 feet apart. This pattern was chosen because of a very narrow lot.

Flagpole On the Air

I live in SW Florida and using this antenna I maintain an operating schedule with friends in Connecticut and Illinois every morning at 0900 on SSB. I've also worked Denali National Park in Alaska and broken a few DX pileups on CW using just 90 W.

If you are space limited as I am, I recommend giving something like this a try. It was great fun to build and I figure I have only about $100 tied up in the whole project.

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

Figure 1 — Details of the connections at the antenna base. The connection on the left is that of the coax shield to the radials. After connections are made, be sure to seal the coax against moisture.

Figure 2 — The resulting base looks like it belongs there. After the flowers fill out, no one will be the wiser.

ARRL Life Member Ed Esborn, K1UQE, was first licensed in 1962. He earned an AS in tool technology from Hartford State Technical Institute and then a BS in vocational education from the Central Connecticut State University. He was employed for 10 years as a mechanical design engineer for Pratt & Whitney Aircraft and then for 23 years as machine drafting instructor for the Connecticut State Vocational School system. He is now retired.

His favorite mode is CW and he is most interested in using it in support of the ARRL National Traffic System (NTS). Ed also enjoys developing and building stealthy antennas. You can reach Ed at 837 Tall Oaks Rd, Naples, FL 34113 or at **k1uqe@arrl.net**.

ICOM IC-V80 Handheld VHF Transceiver

Reviewed by Rick Palm, K1CE
ARRL Contributing Editor

Handheld radios are a dime a dozen (almost literally — there are a lot of choices for around $100), so what sets one model apart from the others? That was the main question on my mind as I tested the IC-V80, along with my mindset and perspective as an ARES® emergency communications field operator. If a transceiver can get the job done under the potentially extreme conditions of a disaster area, then surely it would meet the more benign needs of casual operation.

Taking It for a Test Ride

To answer this question and others, I took the IC-V80 out to try to simulate demanding, if not extreme, conditions: I rode my bicycle up and down coastal route A1A on the upper east coast of Florida with the high ambient noise of the ocean and wind, with the review unit tucked in a Camelbak waist pouch strapped around my back. The flexible antenna stuck up through a notch sewn on top of the little pack (a perfect way to carry a small handheld, by the way: the model is the Camelbak FLASHLO with the water bladder removed).

One of ICOM's main claims for this radio is loud audio, which would obviously be a huge asset in a noisy disaster area (think mammoth government response vehicles lumbering around, and banks of gasoline engine driven generators chugging away). ICOM says that the unit puts out 750 mW of "loud and intelligible" audio from a "larger" (36 mm) speaker, employing a BTL (bridge-tied load) amplifier that doubles the audio output.

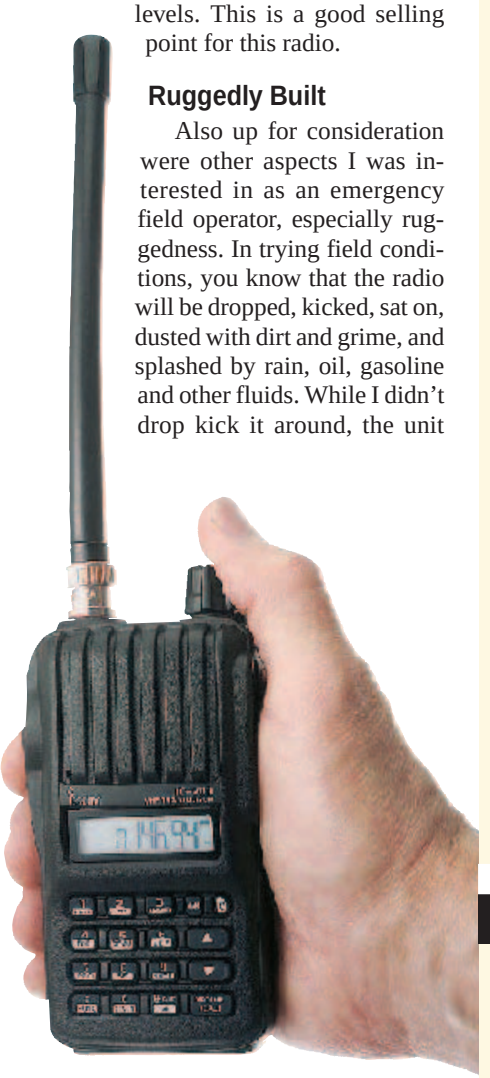
Note that the Lab tests were performed with the external speaker jack, which has a lower audio output rating. See Table 1 for details.

I was able to easily hear the other operator's intelligible voice from a local repeater as I rode along the ocean, albeit with the volume turned up to the maximum limit. But, even with max audio, the audio was easily understandable. In this regard, the claims for this unit meet actual performance standards in my little field test.

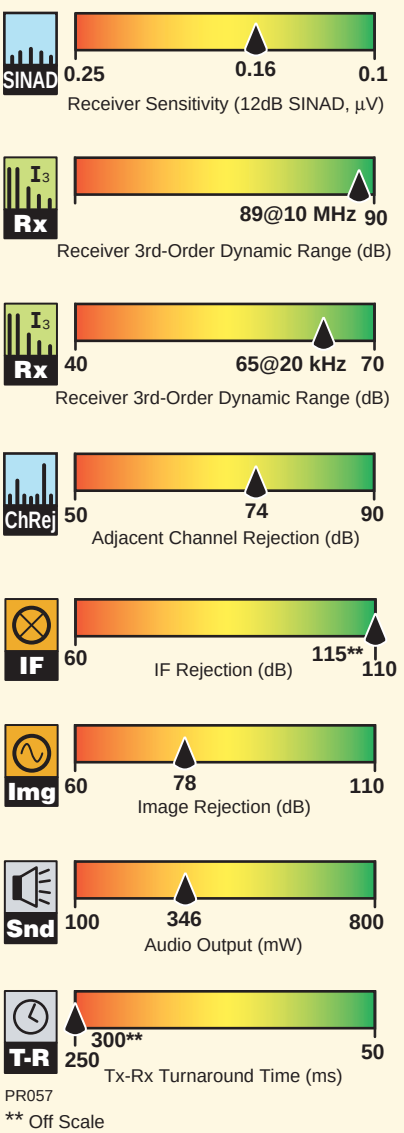
Test #2 — I tried the same set-up, only this time I rode my noisy Harley-Davidson Sportster to see if I could still copy the audio from the radio. Result: I could copy voice transmissions with no problem with my helmet on, engine idling and the motorcycle stopped. However, it was too much to ask of the radio when I was actually riding with the engine louder and the wind blowing in my face. I could not copy the voice, and indeed I could hardly hear it at all. The bottom line as far as audio output goes, is that it is superior to other radios I have used and an asset in field conditions with high ambient noise levels. This is a good selling point for this radio.

Ruggedly Built

Also up for consideration were other aspects I was interested in as an emergency field operator, especially ruggedness. In trying field conditions, you know that the radio will be dropped, kicked, sat on, dusted with dirt and grime, and splashed by rain, oil, gasoline and other fluids. While I didn't drop kick it around, the unit



Key Measurements Summary



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** Off Scale

Bottom Line

The IC-V80 is a rugged 2 meter handheld with attractive features for emergency communications as well as daily use.

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

does seem to be tough. The unit comes with a robust belt clip, not a flimsy little clip as with some radios I have owned, and I have had a lot of them over the years.

The manufacturer claims that the unit is *water-resistant* (which does not equate to *waterproof*, in my understanding) and has protection against dust and dirt under an industrial code of IP54. (IP is an Ingress Protection rating used to specify the environmental protection — electrical enclosure — of electrical equipment. The first number refers to protection against solid objects — "5" in this case means that the unit is "protected against dust limited ingress." The second number refers to protection against liquids — "4" in this case means that the unit is protected "against water sprayed from all directions — limited ingress permitted." Search the Internet for more info on this rating system.) ICOM also claims the unit has been "tested to and passed 11 categories of MIL-STD-810 environmental tests."

I personally like, and have always liked, the classic, bombproof BNC connector and flexible antenna system that is employed on this radio. There is plenty of transmitter power, also potentially important in remote or mountainous search and rescue (SAR) or disaster areas: the HIGH power setting will yield 5.5 W (see Table 1 for tests conducted by the ARRL Lab). A more conservative (and battery saving) 2.5 W is the MID level, and the LOW level provides 0.5 W output. ICOM claims that the operator can get up to 13 hours of operating time with the supplied 7.2 V 1400 mAh NiMH battery pack (BP-264), or up to 19 hours with the optional Li-ion battery pack (BP-265).

The size of the unit seems perfect to me — not too big, like the old units of the '70s, and not too small, like some of the current miniature radios. The keypad, while not illuminated, is easy to read and the buttons are large enough for ease of pushing. (I found that I didn't miss the illuminated keypad.) The ON/OFF button, however, is curiously small, compared to the other buttons. A big VOLUME (and SET function selector) knob on top of the rig is easy to use, even with HAZMAT gloves on.

Table 1
ICOM IC-V80, serial number 25001171-9

Manufacturer's Specifications	*Measured in ARRL Lab*
Frequency coverage: Receive, 136-174 MHz; transmit, 144-148 MHz.	Receive and transmit, as specified.
Modes: FM, NFM.	As specified.
Power requirements: 7.2 V dc (battery only)† receive, 310 mA (max audio, internal speaker), 180 mA (max audio, external speaker), 65 mA standby, 20 mA power save; transmit, 1.4 A (high), 0.9 A (middle), 0.6 A (low).	Receive, battery power, 266 mA (max volume, no signal, lights on); 174 mA (max vol, no signal, lights on, external speaker); 68 mA (standby, lights off), 20 mA (power save on). Transmit, 1.4 A (high), 0.95 A (middle), 0.5 A, (low) at 8.2 V dc (full charge).
Receiver	***Receiver Dynamic Testing***
FM sensitivity: 12 dB SINAD, 0.14 µV.	For 12 dB SINAD, 146 MHz, 0.16 µV; 162.4 MHz, 0.14 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 65 dB; 10 MHz offset: 89 dB
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 87 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset: 74 dB.
Spurious response: Not specified.	IF rejection, 115 dB; image rejection, 78 dB.
Squelch sensitivity: 0.1 µV.	At threshold, 0.1 µV; 0.27 µV (max).
Audio output: 0.75 W at 10% THD into 16 Ω (internal speaker), 0.45 W at 10% THD into 8 Ω (external speaker).	346 mW at 3.2% THD into 8 Ω (external speaker).*
Transmitter	***Transmitter Dynamic Testing***
Power output: 5.5 W (high), 2.5 W (middle), 0.5 W (low).	5.7 W (high), 2.5 W (middle), 0.5 W (low). at 8.2 V dc (full charge).
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, 300 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	134 ms.
Size (height, width, depth): 4.4 × 2.2 × 1.2 inches; weight, 12.4 ounces.	
Price: IC-V80, $120. OPC-478UC USB cable, $60; CS-V80 software, $50; HS-95 headset, $160 and OPC-2004 cable, $25.	

†BP-264 7.2 V, 1400 mAh NiMH battery and wall charger supplied. Available options: BP-265 7.4 V, 1900 mAh Li-ion battery, $70; BC-191 drop-in rapid charger for BP-264, $70; BC-193 drop-in rapid charger for BP-265, $70; BP-263 battery case for 6 AA cells, $30; OPC-515L dc power cable, $20.
*Volume set to level 18. Maximum output is attainable, but exceeds 10% THD. The volume control changes in steps rather than continuously. Measurements with an 8 Ω load at the speaker jack: level 18, 346 mW at 3.2% THD; level 19, 435 mW at 14.5% THD; level 24, 480 mW at 22% THD. THD at 1.195 V RMS, 2%.

Plenty of Useful Features

There are 207 memory channels available, including 200 regular channels, six scan edges and one call channel. They are easy to program. The channel name is programmable with five characters for easy recognition — likely handy in a disaster area with unfamiliar repeater frequencies. You could program a channel as "ICP," for example, for Incident Command Post, or "HBASE" for Helibase under the Incident Command System nomenclature.

Built-in CTCSS/DCS tone codes provide quiet standby and allow you to use tone access repeaters. The tone scan function detects the subaudible tone that is used for repeater access, also very useful in unfamiliar territory.

The IC-V80 has an internal VOX (voice operated transmit) function for what ICOM calls "convenient hands free operation with a compatible optional headset and plug adapter cable," but I did not test this option. The VOX gain and VOX delay time are adjustable.

A large keypad button cycles among four settings: VFO/MR (memory recall)/CALL and, although not labeled, weather channel (10 channels), also handy for field deployments. There is also a weather alert function.

The usual scan, program, memory, skip and priority functions are available, along with a power save function, time-out timer setting, repeater lockout and busy channel lockout. It's PC programmable with optional CS-V80 software, and transceiver-to-transceiver cloning is also optional. Frequency selection is by direct keypad entry or the large UP and DOWN ARROW buttons. Other functions are provided including DTMF memory channels, auto power off, LCD backlight and wide/narrow channel spacing.

I like the large display characters that are easy to read, even though my eyesight isn't

what it used to be. I like the fact that the unit is easy to use, simple with just the most basic functions, without superfluous functions that only a total techno-geek would use. It feels rock solid.

The IC-V80 comes with a BC-192 drop-in slow battery charger, which I liked, and a drop-in rapid charger is available. This charger can also run from 12 V dc, so you can charge the battery while operating in a vehicle.

A simple AA battery case is also available and would be extremely important in a disaster situations in which there is no power with which to charge batteries. All you would need to operate for days is a decent stock of AA alkaline batteries. The IC-V80 Sport model comes standard with the AA cell holder instead of a rechargeable battery and is available at a lower price.

The audio quality reports I received from both repeater users and simplex operators were all fine. Microphone gain can be changed in the SET MODE, along with a whole host of other adjustments that are standard on most other radios today.

The ultimate litmus test for any review unit is whether or not the reviewer would buy one for him or herself. Not only would I consider buying one, I did.

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

ICOM IC-T70A Handheld Dual Band Transceiver

Reviewed by Rick Palm, K1CE
ARRL Contributing Editor

The IC-T70A is the dual band (2 meter and 70 cm) sister of the IC-V80. Physically it appears to be almost identical to the 'V80, but there are a few differences. The display window is taller, allowing for a better signal strength meter than the tiny meter on the 'V80. (I question the utility of having a signal strength meter at all on a handheld radio; I'd rather have the space used for larger display characters). The dual band flexible antenna connector is the SMA screw-in type. A BNC adapter is available.

Power Options

There is a dc input jack on the 'T70A, which is absent on the 'V80. Thus, a desktop drop-in charger is employed to charge the 'V80, while a regular (wall cube) charger is connected to the dc input jack of the 'T70A. It takes about 8 hours to charge the standard NiMH battery pack. An optional quick-charge desktop drop-in charger is available — the BC-191. An optional Li-ion battery pack (BP-265) is available and requires the BC-193 desktop charger.

A nice feature of the dc input jack is that the radio can be used with an external dc power supply with an optional adapter (OPC-254L). A cigarette lighter socket can also be used with another optional adapter. The standard battery pack (BP-264) is 7.2 V with a capacity of 1400 mAh. The Li-ion pack is 7.4 V with about 2000 mAh of capacity. ICOM claims about 10-12 hours of radio operation with the BP-264, depending on transmitter power output, of course. This is based on a ratio of 5% transmit time, 5% receive time, and 90% of standby time if the auto power save function is employed. The BP-265 offers a couple of hours more.

A nice feature of the unit is that while the battery is being charged, CHARGE is seen in the display screen, and it disappears after the battery is fully charged. This eliminates the guessing game as to when the unit is charged. There is no such function for the IC-V80, although the charger has an LED to indicate charge status.

For emcomm use, I recommend getting the optional AA battery holder case and a good supply of AA batteries, which will last a long time in the absence of commercial mains to charge the NiMH battery pack as discussed in the IC-V80 review.

Features and Functions

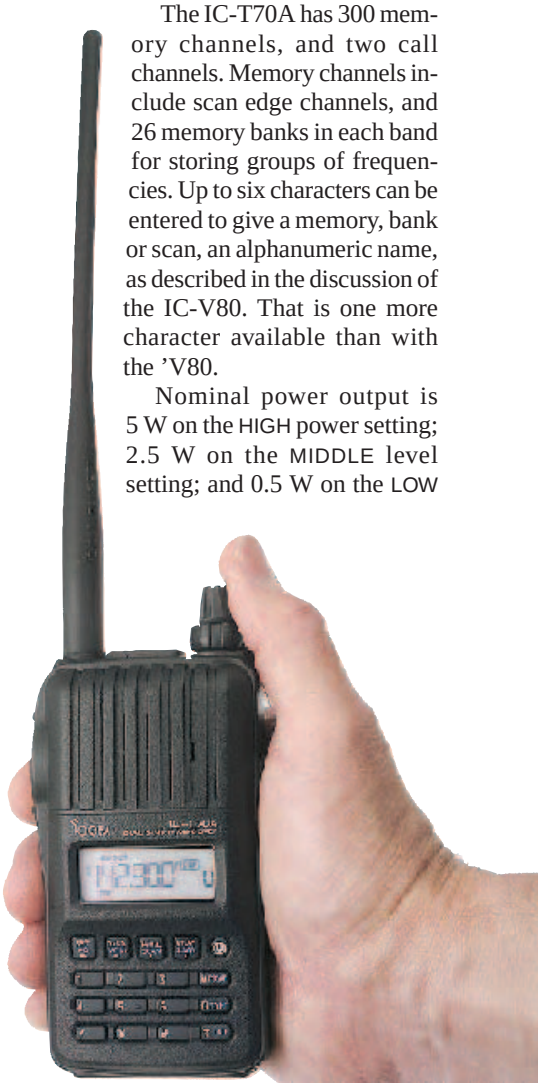
Functionality is also different from the 'V80: There is a concentric knob on top of the radio that allows selecting the operating frequency in both VFO and memory recall (MR) modes, SET mode selections, scanning direction, squelch level (while pushing the MONI squelch defeat button), and programmed memory bank. The outer knob is the VOLUME control and during SET mode operation, it is rotated to select the options.

The keypad seems simpler to operate because there is no FUNCTION key to press prior to setting power levels and operating modes (VFO/MR/Call/WX). Instead, the operator merely holds the corresponding button down for one second to enter SET mode or change the band, start a scan or tone scan, or turn the subaudible tone on. The result is a cleaner look to the keypad and only one button to push versus the two steps required to change a mode on the IC-V80. I like it better than the 'V80's keypad.

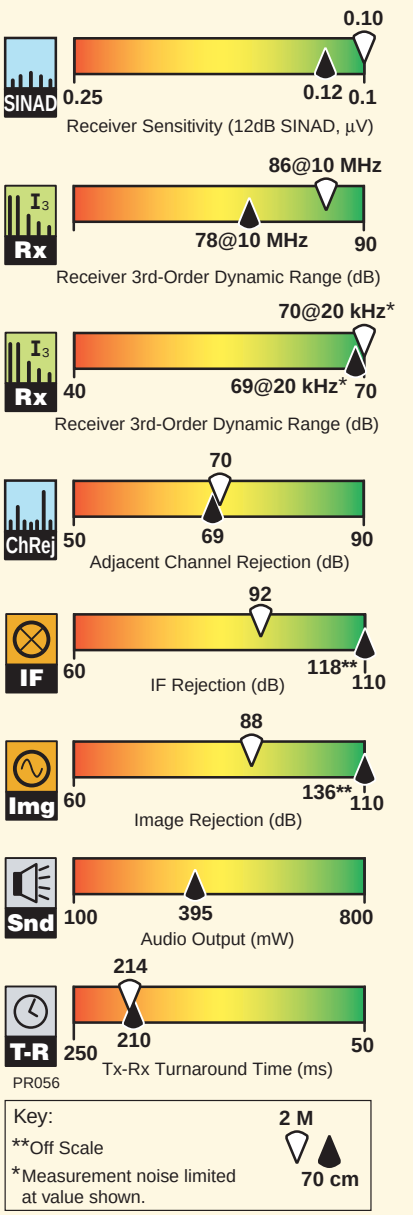
As with the 'V80, there is plenty of audio for outdoor use or operation in noisy locations. I ran the unit through the same tests described in the IC-V80 review with roughly the same results.

The IC-T70A has 300 memory channels, and two call channels. Memory channels include scan edge channels, and 26 memory banks in each band for storing groups of frequencies. Up to six characters can be entered to give a memory, bank or scan, an alphanumeric name, as described in the discussion of the IC-V80. That is one more character available than with the 'V80.

Nominal power output is 5 W on the HIGH power setting; 2.5 W on the MIDDLE level setting; and 0.5 W on the LOW



Key Measurements Summary



Bottom Line

The IC-T70A is a solid dual band handheld transceiver that includes a wide range of features yet is easy to operate.

power setting. All audio reports received from both repeater and simplex operators were fine. Mic gain is adjustable in the SET mode. The IC-T70A has an internal VOX (voice operated transmit) function as does the 'V80, but I did not test these functions. An optional headset and plug adapter cable are necessary. VOX level and VOX delay time are adjustable.

The unit seems very rugged and falls under the same codes (IP54 and MIL-STD 810) as discussed in the IC-V80 review.

Other features include a NOAA weather alert, power save function, a time out timer to save the transmitter, PC programmable with the optional cable and software, transceiver-to-transceiver cloning (also optional), 16 DTMF autodial memories, auto power off and an LCD backlight.

If there is 70 cm activity in your area, the IC-T70A would be a good choice, although it is a bit more expensive with prices about $100 higher than the 'V80. The manuals for both radios are very good and easy to understand. After a 5 minute quick read, you are on the air.

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

Table 2

ICOM IC-T70A, serial number 05001097

Manufacturer's Specifications	*Measured in ARRL Lab*
Frequency coverage: Receive, 136-174, 400-479 MHz; transmit, 144-148, 420-450 MHz.	Receive and transmit, as specified.
Modes: FM, NFM.	As specified.
Power requirements: 7.2 V dc (battery)† or 10-16 V dc external supply; receive, 450 mA (max audio, internal speaker), 300 mA (max audio, external speaker), 90 mA (standby), 40 mA (power save); transmit, VHF, 1.4 A (high), 1.2 A (middle), 0.6 A (low); UHF, 2.1 A (high), 1.5 A (middle), 0.8 A (low).	Receive, battery power, 432 mA (max volume, no signal, lights on); 280 mA (max vol, no signal, lights on, external speaker); 86 mA (standby, lights off), 42 mA (power save on). Transmit, battery power, VHF, 1.7 A (high) 1.2 A (middle), 0.8 A, (low); UHF, 2.4/1.7/0.8 A at 8.2 V dc (full charge). External 13.8 V dc supply, VHF, 1.6/1.2/0.6 A; UHF, 2.2/1.7/0.8 A.
Receiver	***Receiver Dynamic Testing***
FM sensitivity: 12 dB SINAD, 0.18 µV.	For 12 dB SINAD, 146 MHz, 0.10 µV; 162.4 MHz, 0.14 µV, 440 MHz, 0.12 µV.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 146 MHz, 70 dB*; 440 MHz, 69 dB*; 10 MHz offset; 146 MHz, 86 dB, 440 MHz, 78 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	146 MHz, 86 dB, 440 MHz, 118 dB.
Adjacent-channel rejection: Not specified.	20 kHz offset: 146 MHz, 70 dB, 440 MHz, 69 dB.
Spurious response: Not specified.	IF rejection, 146 MHz, 92 dB; 440 MHz, 118 dB. Image rejection, 146 MHz, 88 dB; 440 MHz, >136 dB.
Squelch sensitivity: 0.18 µV.	At threshold, 146 & 440 MHz, 0.38 µV, 0.11 µV (auto), 1.22 µV (max).
Audio output: >700 mW at 10% THD into 16 Ω (internal speaker), >400 mW at 10% THD into 8 Ω (external speaker).	395 mW at 10% THD into 8 Ω (external speaker); THD at 1 V RMS, 1.5%.
Transmitter	***Transmitter Dynamic Testing***
Power output: 5.0 W (high), 2.5 W (middle), 0.5 W (low).	Battery (8.2 V) or ext 13.8 V dc power: VHF, 5.2/2.5/0.5 W; UHF, 4.6/2.3/0.4 W
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, 146 MHz, 214 ms, 440 MHz, 210 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	146 MHz, 196 ms; 440 MHz, 194 ms.
Size (height, width, depth): 4.4 × 2.3 × 1.2 inches; weight, 13.4 ounces.	
Price: IC-T70A, $225. OPC-478UC USB cable, $60; *CS-T70* software, $50; HS-95 headset, $160 and OPC-2006 cable, $25.	

*Measurement was noise limited at the value indicated.

BP-264 7.2 V, 1400 mAh NiMH battery and wall charger supplied. Available options: BP-265 7.4 V, 1900 mAh Li-ion battery, $70; BC-191 drop-in rapid charger for BP-264, $70; BC-193 drop-in rapid charger for BP-265, $70; BP-263 battery case for 6 AA cells, $30; OPC-515L dc power cable, $20.

Array Solutions VNA 2180 Vector Network Analyzer

Reviewed by Phil Salas, AD5X
QST Contributing Editor

In August 2007 *QST*, the ARRL reviewed the Array Solutions AIM 4170 antenna analyzer.[1] The reviewer pointed out that "… the accuracy is exceptional and caused us to go back and check the calibration of our reference loads…" and "… the AIM 4170 is really more of a laboratory instrument…." I couldn't agree more as I've found the AIM 4170 to be indispensable for my home lab work. And while the AIM 4170 has been outstanding in all that it does, I've wanted a two port version so I could design and analyze two port devices. Enter the VNA 2180 Vector Network Analyzer, developed by Bob Clunn, W5BIG, and Array Solutions — the same team that brought the AIM 4170 to market.

What is a Vector Network Analyzer?

A vector network analyzer (VNA) applies an RF signal to the device under test (DUT) and measures the resulting voltages and currents. The word *vector* in its name means the VNA measures both the magnitude *and* phase of these parameters. The term VNA is usually applied to an instrument with separate output and input ports. For convenience, these ports can be labeled A and B. A related instrument, referred to as a vector impedance meter or antenna analyzer, has a single port.

The VNA measures the impedance of antennas or components at port A. Port B provides additional capability for measuring more complex circuits, such as filters and amplifiers, which have separate inputs and outputs.

Measurement accuracy is significantly improved by calibrating the system with loads that have known characteristics. Typically, the calibration procedure uses four items: a short circuit, an open circuit, a resistor and a cable. The open, the short and the resistor are used to calibrate one port and the cable is connected between both ports to calibrate their relative gain and phase. The raw measurement data is compensated with the calibration data and then used to calculate properties of the DUT. These data are displayed in a variety of ways such as resistance, reactance, SWR, return loss, Smith charts and S-parameters.

S-parameters, or network scattering parameters, are the complex transmission and reflection coefficients of the DUT. Detailed information on S-parameters is beyond the scope of this discussion and the interested reader is encouraged to pursue this subject via Internet sources. For purposes of this review, Port B S21 data (transmission) is displayed as gain/loss in dB, and S11 data (reflection) is displayed as return loss in dB.

VNA 2180 Description

The VNA 2180 is a two port instrument in which Port A is an enhanced version of the AIM 4170 featuring increased frequency range, a higher output signal with a programmable level and the ability to handle a higher interfering signal level while making antenna measurements. The VNA 2180 also has a built-in optically isolated USB interface that reduces the effects of ground loops. As this review focuses on the Port A-to-Port B transmission path capability of the VNA 2180, refer to the AIM 4170 review for the Port A features. The complete VNA 2180 specifications are shown in Table 3.

As with the AIM 4170, the VNA 2180 relies on your computer for calculations, display and control functions. The software is very intuitive and software updates are readily available. The software has been tested with *Windows* 2000, *XP* and *Vista*, as well as the 32 and 64 bit versions of *Windows* 7. It requires no installation procedure — it can run directly from a flash drive or CD if desired. You can even download the VNA 2180 manual and software from **w5big.com** and run the software in demo mode to get a feel for the product prior to purchasing it.

Bottom Line

The Array Solutions VNA 2180 brings powerful vector network analyzer capabilities to the home workshop. It harnesses the power of your computer for control and display functions, bringing the cost to a level comparable to surplus commercial equipment with unknown issues or accuracy.

Preparing to Use the VNA 2180

The VNA 2180 hardware is housed in a small metal cabinet with two type N connectors and indicator LEDs on the front. The back panel has a POWER jack, USB jack for connection to your computer and an expansion port for future use. (A six channel multiplexer is available for use in setting up antenna arrays.)

Included with the package are three standard N connector calibration loads (open, short and 50 Ω load — Figure 1), an ac power supply, a 2.1 mm dc cable, two short N male terminated cables and a USB interface cable. An optional universal global power supply is available. The latest software and manual can be downloaded from **w5big.com**.

Calibration requires no tools or adjustments, and you'll have everything up and running in a few minutes. The VNA 2180 uses N connectors for both Ports A and B, so you may want to purchase appropriate adapters for measurements on devices requiring BNC and UHF connectors. While not absolutely necessary for many lower frequency measurements, for maximum accuracy you'll also want BNC and UHF calibration loads. Fortunately, these are easy to build. See my companion article on the QST-in-Depth website for details on building your own calibration loads.[2]

Using the VNA 2180

My first project was a low pass filter needed to clean up the square wave output

[1] J. Hallas, W1ZR, "Three Antenna System Measurement Devices," Product Review, *QST*, Aug 2008, pp 67-73. Past *QST* reviews are available to ARRL members at **www.arrl.org/product-review**.

[2] See "Building BNC and UHF Calibration Loads for the VNA 2180" available on the ARRL website at **www.arrl.org/qst-in-depth**.

Figure 1 — The Array Solutions VNA 2180 Vector Network Analyzer is supplied with three calibration loads.

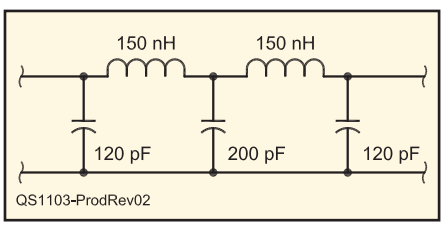


Figure 2 — Low pass filter schematic.

of a 50 MHz TTL clock oscillator for use as a standard signal source for calibrating attenuators. The schematic of the filter is shown in Figure 2.

The VNA 2180 measured filter response is shown in Figure 3, which highlights the ability to set vertical markers on the swept response, as well as to simultaneously display S11 (blue trace) and S21 (green trace). Up to 20 vertical markers can be set. I set markers at the 50 MHz fundamental and 2nd harmonic (100 MHz). The vertical cursor is placed at the 3rd harmonic (150 MHz), where I wanted maximum rejection. Note that if scanning a filter, Port B provides a 50 Ω termination for the filter's output port.

My next project was a resistive 50 dB tap covering 1.8 to 148 MHz to permit looking at transmitter RF output on a spectrum analyzer. The circuit is shown in Figure 4. The two paralleled 16 Ω, 2 W metal film resistors provide the necessary power dissipation for up to a 600 W amplifier.

The VNA 2180 software permits setting an offset attenuation value while simultaneously permitting a fine attenuation range. In this way you can look at fine variations in attenuation, even at the 50 dB tap point. I set an offset of 45 dB with a measuring resolution of 0.5 dB. In my initial circuit, the isolation degraded at higher frequencies because of stray capacitance across the paralleled resistors (even a few picofarads impacts isolation at higher frequencies in a high impedance circuit). I added a 62 pF capacitor across the 50 Ω resistor to compensate for this. Figure 5 shows the final swept response. The three horizontal markers are on the 10, 6 and 2 meter ham bands. Horizontal rulers at –49 dB and –51 dB show that the tap circuit provides 50 dB ±1 dB attenuation in all ham bands through 2 meters.

Next I wanted to characterize a homemade four element crystal filter. I ran two scans. The first (not shown) measured the ultimate rejection of this crystal filter, which is in excess of 100 dB just 5 kHz to either side of the 9.998 MHz center frequency.

The second scan (Figure 6) has a narrowed passband and increased vertical resolution to better see the passband response. The VNA 2180 software calculates the shape factor of the filter for you if you insert horizontal rulers at the desired measuring points. Because the filter loss is approximately 4.5 dB, horizontal rulers were set at

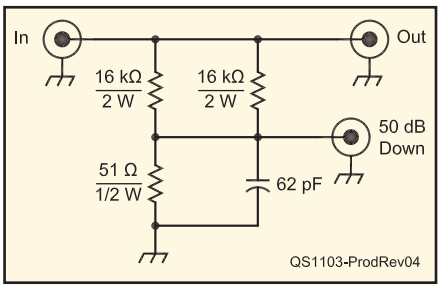


Figure 4 — Schematic of the 50 dB resistive tap. After measuring the initial circuit with the VNA 2180, the 62 pF capacitor was added to compensate for stray capacitance.

–10.5 dB and –64.5 dB so as to calculate the standard 6/60 dB shape factor.

Finally, I looked at a commercially available 40 meter bandpass filter. This type of filter is used in contest environments to protect a receiver from high power adjacent band transmitters and nearby antennas. A broadband scan is shown in Figure 7. This filter has rejection specifications of 42 dB (horizontal red ruler) on 80 meters, and 70 dB (horizontal blue ruler) on 20 meters. Note the simultaneous display of both S11 (dark blue trace) and S21 (dark green trace). Vertical markers are set at 4 MHz and 14 MHz. The vertical cursor is placed within the 40 meter band to show the in band insertion loss (0.430 dB).

Conclusion

The VNA 2180 is a lab grade analyzer that you will find to be an indispensable item for both home and industrial lab environments. With software and firmware updates available for download at no charge, you don't

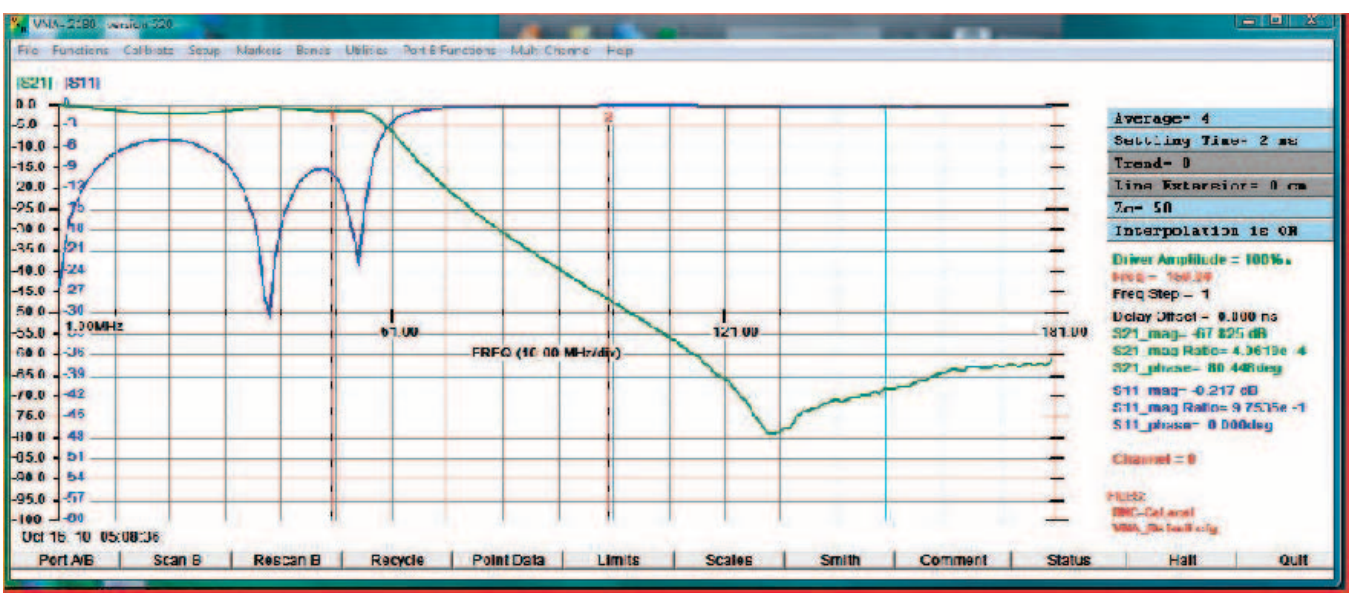


Figure 3 — Low pass filter swept response. Markers are at 50, 100 and 150 MHz.

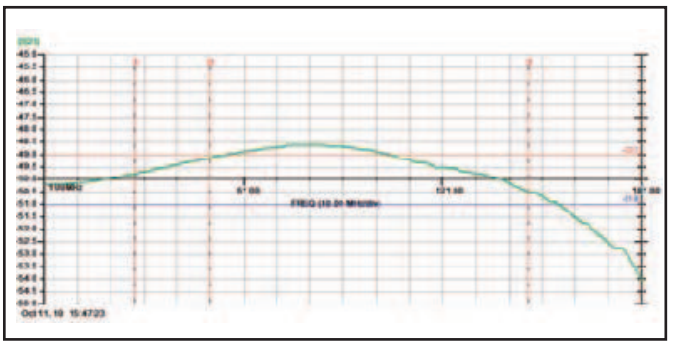


Figure 5 — Sweep of the compensated 50 dB resistive tap. Vertical rulers are on 10, 6 and 2 meters. Isolation at higher frequencies is much improved compared with the original version.

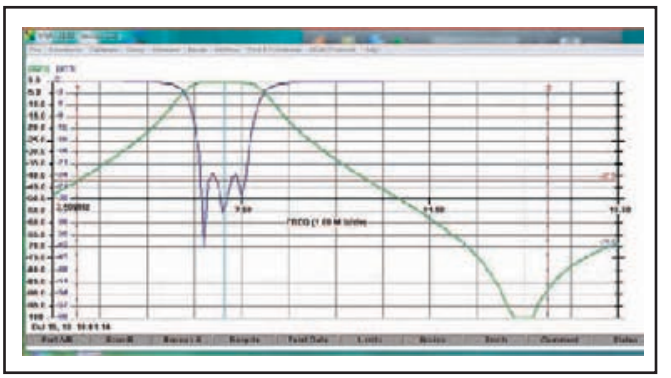


Figure 7 — 40 meter band-pass filter response.

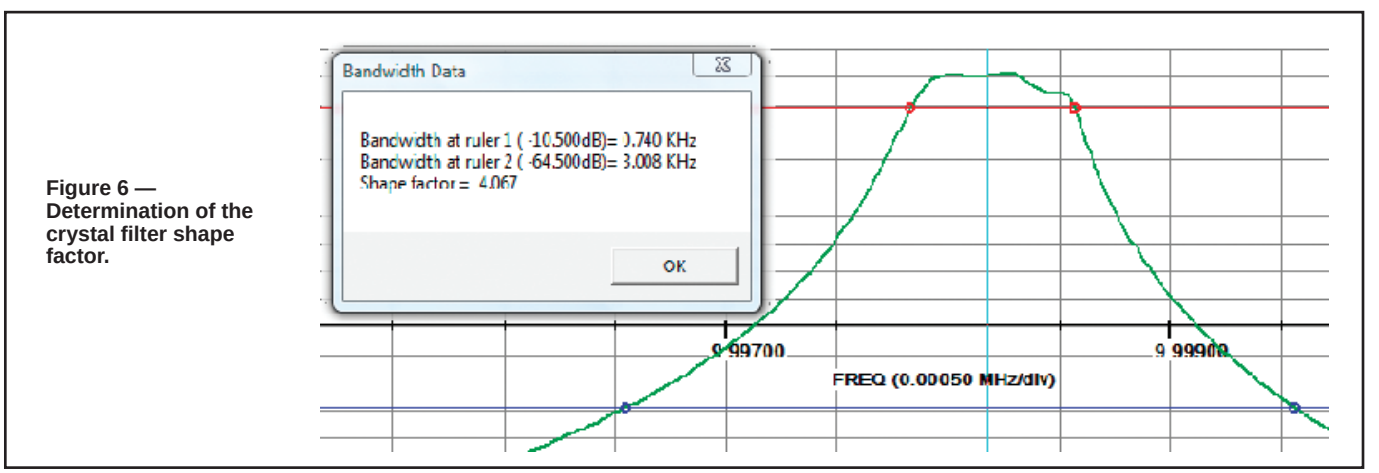


Figure 6 — Determination of the crystal filter shape factor.

Table 3
Array Solutions VNA 2180, serial no. 5107

Parameter	*Manufacturer's Specifications*
Power requirements:	11-15 V dc, 500 mA max.
Frequency range:	5 kHz to 180 MHz.
Stability:	±25 ppm.
Frequency step size:	1 Hz minimum.
ADC resolution:	12 bits.
SWR measurement range:	1 to 20.
Impedance measurement range:	1 Ω to 5 kΩ.
Accuracy:	±5% to 60 MHz, ±10% to 180 MHz.
Phase angle:	±180° (true phase).
RF output:	+8 dBm max, nominal output Z = 50 Ω.
Spurious output	–30 dBc or better.
Max stray RF input while measuring:	2 V peak (+16 dBm).
Max safe RF input:	5 V peak (+24 dBm).
S21 nominal dynamic range:	100 dB up to 50 MHz, 80 dB to 160 MHz.
Port B nominal input impedance:	50 Ω (return loss >30 dB).

Display: Graphics output on PC. Mouse controlled cursor for digital parametric readout. User-specified frequency markers. Audible tone and speech output for SWR. Displayed parameters: SWR, S11, Return loss, |Z|, Phase angle of |Z|, S21, R_S, X_S, R_P, X_P. Reactance shown as inductance (µH) or capacitance (pF) according to phase angle. Two Smith Charts with zoom, phase offset and markers. Data can be referenced to the antenna terminals. Calibration is software controlled.

Size (height, width, depth): 1.5 × 7 × 5.3 inches.

Price: $1495 with standard US ac power supply.

have to worry about product obsolescence.

I've only touched on some of the transmission capabilities of this instrument. As an example, group delay measurements permit you to determine the length of cables and potential distortion in filters. There is also an external port with both digital I/O and analog input capability for possible control and monitoring of other accessories. Finally, there is a wealth of measuring and analysis capabilities associated with Port A. Detailed information and the complete manual are available for further investigation at **w5big.com**.

Manufacturer: Array Solutions, 2611 North Beltline Rd, Suite 109, Sunnyvale, TX 75182; tel 214-954-7140; **www.arraysolutions.com**. Price: $1495 with the standard US ac supply; $1524 with the universal global ac supply.

TECHNICAL CORRESPONDENCE

WATCH YOUR GAUGE SIZES

♢Hams typically use #10 or 12 AWG wire for 12 V dc supplies to 100 W transceivers that draw 20 to 23 A at peak power output. You can see those red and black hook-up cables at many hamfests being sold by vendors by the foot, on spools and as a plug and play item with in-line fuses and connectors on them.

Suppose you purchased a 10 foot run of red/black power cord mislabeled as #12 AWG but in reality was #14 AWG. The marked as #12 AWG labeled wire that is sold by many vendors may actually be #14 AWG or slightly thinner if the wire was not made by a reputable US company, is imported or if the cable lacks UL certification. The same may hold true for other gauges of imported wire. For example, #10 AWG could really be #12, #14 AWG is really #16, and so on.

A 10 foot run of #14 AWG wire will develop a full 1.0 V drop at 20 A. The table in *The ARRL Handbook* shows the resistance of #14 AWG wire is 0.0025 Ω/foot and a 10 foot double run of one black and one red lead has a total length of 20 feet and therefore a total resistance of 0.05 Ω.[1] At 20 A current through that resistance, a full 1.0 V drop will occur at the transmitter input as predicted by Ohm's law.

That might not be a problem using a power supply at 13.6 V, but dropping 1 V while under battery conditions, from 12.5 V (for a fresh fully charged battery under a 20 A load) to 11.5 V at the transceiver, would begin to cause problems while transmitting. The danger is that although the transmitter might appear to function normally, the radio will generally no longer meet spurious response specifications and may splatter all over the band. And that does not include the additional voltage drops from the inline fuses and connectors that ordinarily account for another 0.5 V loss at 20 A. Those combined losses will yield 11.0 V at the radio (12.5 V minus 1.5 V) and that is under the best scenario with a new healthy battery, just fully charged and at warm temperatures.

[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**.

Add to this: a partially discharged or not recently charged battery, an aging battery or a cold climate, and that poor performance would worsen significantly. Under the usual circumstances with a battery that is 3 or 4 years old and in cold weather and after a few minutes of discharge at 20 A, the voltage at the radio could easily fall below 10 V. Few 100 W ham transmitters will work there at all.

That could mean life or death under emergency circumstances. I would predict that the extra ⅓ V drop for the #14 AWG mislabeled as 12, compared to true #12 AWG wire would shorten battery run time by about 30% under average circumstances while running 100 W. But a true #10 AWG wire of the same 10 foot length will have only a 0.4 V voltage drop at the transmitter and that would mean about a 50 to 100% longer battery runtime as opposed to the #14 AWG wire that is mislabeled as #12.

So my recommendation is to make sure that you use true #10 AWG wire for 12 V battery applications requiring 20 A loads, especially if safety depends on having a viable working transmitter. The conductors in true #10 AWG wire measure 0.1 inch in diameter for solid conductor and 0.125 inch for a stranded conductor (see Figures 1 and 2).

The disparity in a side by side view of the ends is quite alarming. The wires in both photos are both labeled as #10 AWG. Both wires were freshly cut with a new cable cutter. Take a piece of true #10 AWG with you when you shop and don't let the writing on the jacket be pulled over your eyes.

For emergency backup use in repeaters, marine and mobile installations, additionally make sure your battery is healthy and cycled to certify its capacity on a routinely scheduled basis. Just as important, make sure of the real size of the wire you have used and be wary of the numbers printed on "bargain" imported products.

Figure 2 — Take a wire size gauge, calipers, ruler or piece or real #10 AWG wire with you for comparison when buying cable.

One last word here: If you do find vendors selling substandard or mislabeled wire, let them know and tell your friends in person and on the air so we can all avoid those who would cheat us and put profit over our safety. Rewarding dishonesty penalizes those who are honest. — *73, Mal Eiselman, NC4L, 3650 N 55th Ave, Hollywood, FL 33021;* **nc4lmal@aol.com**.

A POOR MAN'S BAND SPECTRUM DISPLAY

♢ The computer monitor in a software defined receiver (SDR) setup provides a good panoramic band display. Depending on the sound card's sampling rate, it will show either 48 or 96 kHz of an amateur band, enough to observe the pileup on a rare station. Another SDR mode of display, the *waterfall*, with visible Morse code, is handy while chasing CW stations.

Hans, SU9HP/SM6CFO, showed me how to operate an SDR in parallel with my main radio. Most transceivers have provisions to listen on a second antenna while transmitting on the primary one. Using a *Magic T* splitter/combiner (see **www.w8ij.com/combiner_and_splitters.htm**) with its input port connected to the primary antenna and its output ports to the SDR and the transceiver's secondary antenna jack, both receivers can listen on the same antenna. The Magic T is a simple device, made with a few

Figure 1 — All three conductors are labeled as #10 AWG. Two of the three are obviously mismarked. It appears that the manufacturer in the lower two wires just adds insulation material to cover up its deception for the reduction in copper. Is it possible that plastic is less expensive than copper?

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

turns of wire on two ferrite cores, and the insertion loss is less than 1 S-unit.

The front end of a transceiver has a TR device that switches the antenna during transmission from the receiving to the transmitting circuitry of the radio. This is usually an SPST relay. In most transceivers, if switched over to listen on a secondary antenna, the "receive" contact on the relay is left open. Instead, the receiving circuitry is connected to the rear panel jack for that antenna.

To listen on a second antenna, my Yaesu FT-1000 Mark V Field has a front panel controlled DPDT relay to transfer the receiving circuitry from the TR relay to the secondary antenna jack. At the same time, that relay connects the "receive" contact on the TR relay to a designated antenna-out jack on the rear panel. In other words, the primary antenna is available on that jack when the DPDT relay is closed, except during transmission.

Thanks to this design, all I needed was coax cables from those two jacks to the input and one output port of the Magic T and from the second output port to the SDR. Other model transceivers have rear jumpers for a secondary antenna or may require additional internal wiring and rear panel jacks to get similar circuit access, a job for an experienced technician.

My SDR was built from a SoftRock V9.0 kit (producer: Tony Parks, KB9YIG), easily assembled from excellent building instructions. The software used, as recommended by Tony, is Rocky 3.6, a free download. The resulting receiver was surprisingly sensitive, a 14.1 MHz CW signal as low as –118 dBm could just be detected at the noise floor.

The main problem we encountered was sensitivity to computer noise and audio feedback that produced a lot of *grass* in the display, masking weak signals. Good shielding of all cabling, including the 12 V dc power supply lead, was necessary. That lead and the stereo cable were also fitted with ferrite beads. Both the SDR and the Magic T were enclosed in metal boxes. All input controls for the computer's sound card except LINE IN had to be set to 0 and cables to that card not in use for SDR were removed.

By design, an SDR is a sensitive, wideband receiver and as such will react to your own transmissions even with the TR relay in transmit position. There will be noises in the computer speakers and minor changes in the monitor display that disappear in a second after listening resumes. A practical mode of operation has been to shut off the speakers, move the display cursor out of the way and use the SDR only as a band scope. The transceiver can then be tuned to interesting signals as observed, ready to transmit at will. — *73, Jan Moller, K6FM, 1855 Meadow Glen, Grants Pass, OR 97527;* **jankuno@uci.net**

RIGHT ANGLE COAX ADAPTERS

♢The March 2010 *QST* "Doctor is In" column discusses the use of right angle coax adaptors in the UHF and near microwave region (see Figure 1).[2] I thought I would share some experiences I have had with such fittings. Several years ago I was maintaining an 800 MHz commercial trunking radio system. The radios and antennas in our mobiles came equipped with standard high quality SO-239 coax sockets so we were forced into the use of PL-259 type mating plugs.

Figure 3 — Amphenol UG-646/U UHF type right angle adapter. The author found them unsatisfactory in his 800 MHz installation.

First, as the Doctor pointed out, there is a huge difference in the quality of connectors from different manufactures. The best PL-259s which we found were silver plated and had an insulator that looked pure white rather than the more common brown. Almost as good were a line of nickel plated connectors with a light green insulation. Absolutely unusable at 800 MHz were connectors with the typical light brown or dark brown insulation.

My second observation is specifically regarding the use of right-angle adapters at that frequency — don't, they won't work. In our installations we were using 35 W radios with about 17 feet of high quality RG-58/foam feed line and two high quality PL-259 connectors as noted above. This resulted in slightly over 2 dB of loss or about 20 W to the antenna. The SWR measured at the transmitter was a virtually flat 1:1, and in the worst case less than 1.5:1 measured at near the antenna. No surprise there, considering the effects of feed line loss on SWR measurement at the radio end.

The problem was that in many cases we had difficult access connecting to the antenna making the use of a some kind of right angle connection necessary. We learned in short order that simply adding a single right angle adapter, such as the Amphenol UG-646/U shown in Figure 1, increased our total feed line loss by over 3 dB. Since that amount of loss was totally unacceptable we were forced to find another solution.

Our solution turned out to be a true right angle coax plug, Amphenol part number 83-59. That connector could be used with no noticeable increase in system loss. The 83-59 uses the same UG-175 or UG-176 adapters as the standard PL-259. The 83-59 connector is somewhat more difficult to assemble, but not too bad once you've learned how to do it.

The bottom line is that, at least at UHF if you use PL-259 type hardware, it is necessary to carefully test each component type in a system and then change (or add) just one piece to make sure that the system loss remains within acceptable limits. I hope this information will be interesting and useful. — *73, Paul Walcott, WD8H, 22427 Thomson, Clinton Township, MI 48035-4921,* **wd8h@arrl.net**

[2]"The Doctor is In," *QST*, Mar 2010, pp 56-57.

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. QST

New Products

2011 KLINGENFUSS RADIO MONITORING PRODUCTS

♢Klingenfuss has published new editions of its popular line of frequency guides and products for shortwave listening and monitoring enthusiasts. Now available are: 2011 *Super Frequency List on CD*; 2011 *Shortwave Frequency Guide*; 2011/2012 *Guide to Utility Radio Stations*; 2011 *Frequency Database for the Perseus Software-Defined Receiver*; and 1997-2010 *Digital Data Decoder Screenshots on CD*. For more information visit **www.klingenfuss.org**. Available from the ARRL at **www.arrl.org/shop:** 2011 *Super Frequency List on CD* ($44.95, order no. 0137) and the 2011 *Shortwave Frequency Guide* ($59.95, order no. 0113).

W1ZR

THE DOCTOR IS IN

Q Mike, KDØSZ, asks: When my house was built, no cable TV service was available so it was wired for satellite TV. Now we use cable and the dish is no longer there, but I have a sturdy 5 foot steel pole at a relatively high point of my property. Dual, double shielded RG-6 coaxial cable runs underground from the pole to the room in the basement I use as a shack. I am tempted to mount a vertical antenna on the pole, or perhaps put an extension on the pole and use it as the center support for a dipole of some variety. I operate HF, never more than 100 W. If there were a way to use the existing coax as a feed line, it would be a good deal for me.

I first considered simply using one of the 75 Ω RG-6 conductors. Would that be close enough for a reasonable match to 50 Ω on the antenna end, or would I need a transformer?

I also considered using both the conductors as a balanced feed line, but I don't know how to calculate the impedance. Should I just forget the whole thing and hang a flower pot from the pole?

A 75 Ω coax is frequently used for amateur applications and works well, although not a perfect match to a 50 Ω antenna as you note. RG-6 has less loss than RG-58 and even RG-8X, so a small mismatch doesn't hurt too much. Unbalanced to balanced transformers with a 1.5:1 ratio are available commercially for the purpose, but often aren't needed.

Of course, if you have a 75 Ω antenna, it is a perfect match to the coax, and will be an SWR of (75/50) 1.5:1 at the transmitter — no problem in most cases. If you have a 50 Ω antenna, the SWR on the line will be 1.5:1 and the Z at the transmitter could be from 50 to 112 Ω resistive, or some complex impedance with a 50 Ω SWR of up to about 2.2:1. If your radio has an internal tuner that should be no problem either. If there is no tuner, you may find that you have to adjust the line length to make it work on some bands, since many transmitters start "folding back" at an SWR of around 2:1. Still you should be able to make it work without much difficulty.

To make it into a balanced line, just connect the shields together at both ends and feed the two center conductors. It will have a balanced Z_0 of 150 Ω. There are no particular advantages to this, unless you happen to have a 150 Ω balanced antenna, since the loss will be the same as with a single coax. I would save the second coax for your next antenna.

The one problem I've had with RG-6 is installing standard connectors to the foil type shield. I have had the best success using TV type crimp-on CATV type F connectors (perhaps already on your cable?) and then using an adapter from type F to either UHF or BNC series connectors, depending on what the equipment likes. The adapters are available at electronics retail stores.

Q Eric, K1NUN, asks: I wonder what you can tell me about matching to an antenna with a T matching network? I recently acquired a 50 year old, five element 6 meter beam that has a T match and a loop balun made of about 6 feet of RG-11 coax.

Is it true that the T match fell into disfavor shortly after the time this antenna was made, in favor of the gamma match? I find no mention of the T match in my old *ARRL Handbooks*, other than to say the gamma match is preferred for ease of tuning. I wonder, therefore, if tuning the sections will be difficult. Do you have any advice for tuning the T match?

I can recreate the loop balun, but I wonder if I can substitute a 4:1 balun I have on hand, mounted below the rotator, and use 450 Ω balanced line from there up to the beam? Is the length of balanced line critical?

A I believe that a T match and 4:1 coax loop balun make one of the best matching arrangements for a VHF Yagi. A gamma match may be slightly easier and cheaper, but has an additional adjustment in that the two halves of the driven element need to be of somewhat different length — alternately, an additional capacitor needs to be in gamma circuit to make it resonant. This throws off the symmetry of the Yagi in a way that doesn't happen with the T match, a naturally balanced arrangement. Figure 1 shows the two arrangements. The T match doesn't need the capacitor, since both ends of the dipole can be shortened to reach resonance. Since the sliding T connections and the ends must be moved together, it really comes down to the same two adjustments, without the need for a capacitor.

To make a replacement loop, put a temporary short on one end of the cable and adjust the length until an antenna analyzer shows 0 + *j*0 on the other end at your desired frequency. You will find the adjustment is quite broad, and you can likely get close enough using a ruler and the cable manufacturer's relative velocity data.

Then use your SWR meter (or the analyzer) to move the two arm adjustments equally along the matching rods until you get the best match. If it doesn't read 1:1, change the length of the element, equally at both ends, and repeat. This is best done at its final location, but can come quite close on the top of an 8 foot wooden step ladder with the antenna pointed up at a 45° angle.

While you could use a commercial 4:1

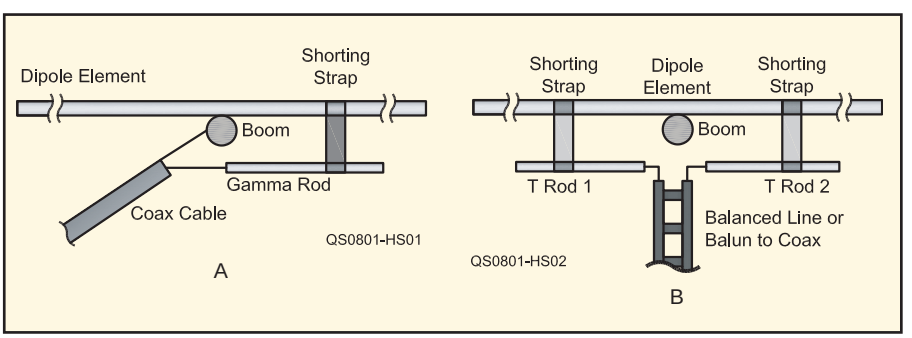


Figure 1 — At A, driven dipole element with gamma match. At B, the symmetrical, balanced T match with ½ wave loop balun.

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

balun, check carefully to see the frequency range it is designed for — most I've seen are only designed to work to 30 MHz. The commercial balun will be heavier and more expensive than the ½ wave loop of coax, and offers no real advantage. I would think either type balun would be best at the antenna so that coax could be used to go around the rotator. It would certainly be possible to feed the antenna with 450 Ω window line, however. This would be a benefit in terms of loss if it is a long run to the station, where a tuner or other matching device would be needed.

If desired, the T match could first be adjusted to match the usual 200 Ω using a 50 Ω SWR meter and 4:1 balun at the antenna. Then a ¼ wave section of 300 Ω coax could be used to match the 200 Ω at the T to 450 Ω of the window line. The approximate 2:1 SWR of going directly to window line, however, should not add significant loss.

If you wanted to use the balun beneath the rotator for some reason, making the window line section an electrical half wave long, or a multiple, would repeat the 200 Ω of the T match to the balun, providing a good match to the coax on the far side.

Q John, WA4ERU, asks: I have an automatic antenna tuner on more than one radio and with more than one antenna. I have found the tuner seems to work fine sometimes, and at other times it just will not tune the antenna. I can, however, get the antenna tuned if I do it manually. Sometimes when it does not tune properly, I can fool the transceiver into thinking it's tuned by turning the tuner on, but it only stays fooled briefly. Can you shed any light on this problem?

A Many automatic antenna tuners memorize the setting based on operating frequency, under the assumption that you will always use the same antenna on that frequency. The benefit of this is that it can tune in milliseconds instead of seconds.

If the tuner doesn't find a match, it may start the tuning algorithm from the memorized point instead of its default settings and might not get to an optimum solution. Most tuners have a process by which the memory can be cleared out so you can start from scratch. Then once it memorizes the new settings you'll be good to go — at least until the next time you change configurations.

Some tuners (recent LDG tuners come to mind), instead of memorizing by frequency, just memorize the last perhaps 100 tuning solutions. This means the tuner doesn't have to measure frequency, and also works better with multiple antennas.

Check you manual and see if you can see how to clear the memories. If you can figure it out, always clear them whenever you go to different antennas.

Of course, you could also have an intermittent somewhere, or a problem with your tuner.

♦Dave, W7KFO, provided an interesting and potentially helpful comment regarding my discussion of interference from Ethernet routers from the December 2010 column. He also uses a Linksys model WRT54GL, and notes:

*I used mix 31 ferrite beads on the power wiring and the Ethernet cables. Since my HF antenna is an attic mounted stealth model, I was still suffering from high amplitude birdies. The birdies are gone since I switched to STP — shielded twisted pair. Most Ethernet cables are UTP (unshielded twisted pair), and I wound up mail ordering mine from Cables To Go (***www.cablestogo.com***). Not all routers have grounding jacks to allow taking advantage of STP cables, but the WRT54GL does.*

♦Peter, W8TWA, provided another approach to reduction of interference from Ethernet routers. He notes:

This partial solution to router EMI hash has been suggested elsewhere — I'm not the first to discover it.

The communications signaling rate used by the router is controlled by the Ethernet adapter in each connected computer. Most current Ethernet cards support signaling rates of either 10 or 100 Mbps and they seem to default to 100 Mbps. By changing the signaling rate to 10 Mbps, the router EMI is generally significantly reduced. This change is independent of and can be applied in addition to the suggestion above from Dave, W7KFO, to use shielded cable. To make this change, you need to change the rate of the adapter card in each connected PC. The general procedure for Windows*-based PCs is as follows:*

1. In the control panel, select START/SETTINGS/CONTROL PANEL.

2. Double click on the NETWORK CONNECTIONS icon.

3. Double click on the name of your particular LAN connection associated with the Ethernet router.

4. In the GENERAL tab, click on the PROPERTIES button.

5. Find the name of your Ethernet adapter (for example, it might be Realtek XXX) and click on CONFIGURE.

6. Click on the ADVANCED tab.

7. Select LINK SPEED/DUPLEX from the choices in the pull down menu.

8. In the VALUE window, select 10 FULL MODE. This selects 10 Mbps full duplex.

9. Click OK as you close each window returning to your desktop.

Still, in my opinion, the best solution to eliminate HF and VHF interference is to totally do away with Ethernet connections between the router and PCs and go wireless. I bought some of the inexpensive USB wireless adapters for each PC and disconnected all the Ethernet cables. The result — I now hear only galactic noise in my HF and VHF receivers!

Hamspeak

Automatic antenna tuner — Device connected between radio equipment and antenna system to transform the antenna system impedance to the value that the radio is designed to operate with, usually 50 W. In an auto tuner, rather than a manual one, the mismatch is sensed automatically; adjustments are made without operator intervention.

Balun — BALanced to UNbalanced transformer. Provides a transition between balanced transmission lines such as ladder line or open wire line and unbalanced transmission lines such as coaxial cable.

Coax — Coaxial cable. Kind of 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.

Ethernet — Local-area network (LAN) protocol. Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbit/s, 100 Mbit/s, 1 Gbit/s and 10 Gbit/s. Ethernet uses the carrier sense multiple access with collision detection (CSMA/CD) to allow shared user access. It is one of the most widely implemented LAN standards.

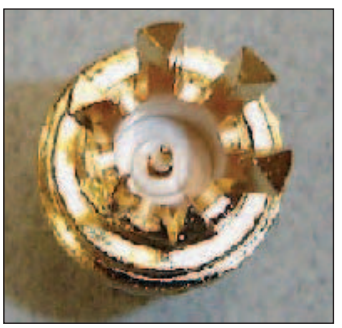
HF — High frequency, the portion of the radio spectrum extending from 3 to 30 MHz, also called *shortwave* and including the 80 through 10 meter amateur bands. HF is above MF (300 kHz to 3 MHz, and includes the 160 meter amateur band) and below VHF (30 MHz to 300 MHz, which includes the 6 and 2 meter and 125 cm amateur bands).

Router—A multiport network packet switch. In a local area network environment, the router receives network packets into a port, reads the packet's destination address field and routes the packet to the best output port to forward the packet toward its destination. In packet radio, a network-level relay station capable of routing packets received off the air to another node on its way to the destination.

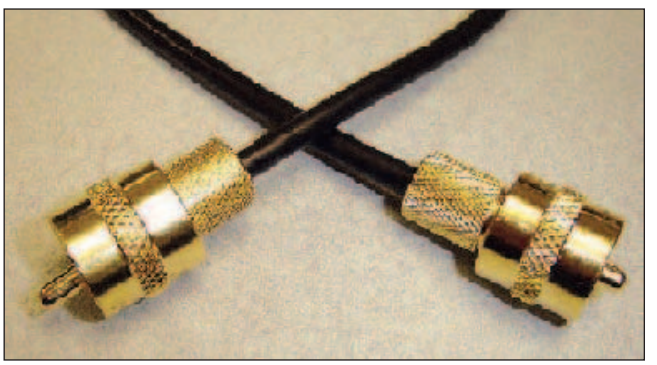
Do you have a question or a problem? Ask the Doctor! Send your questions (no telephone calls, please) to "The Doctor," ARRL, 225 Main St, Newington, CT 06111; doctor@arrl.org.

Shakespeare PL-259-CP-G Coax Connector

Bob Allison, WB1GCM
ARRL Lab Engineer



A view of the inner workings of the Shakespeare connector. You firmly push the coax into the center of the "head" of the connector until it stops. The guide cap centers the gold plated pin, which gets pushed into the center conductor of the coax.



The finished jumper cable survived repeated abuse at the hands of the author.

I enjoy using a soldering iron as most other hams do. I also believe coax connectors, such as the ubiquitous PL-259, should be soldered whenever possible. Yet there are times when I'm away from the workbench and there isn't a soldering iron in sight. Or, have you ever been outside on a cold day when no soldering iron or gun is hot enough to do the job? Yes, there are some good-quality crimp-on connectors out there with specialized tools that will do the trick. Yet, I've wondered if there could be an easier way to attach the connector firmly to the coax without solder? I wonder no more.

Shakespeare Marine offers an interesting PL-259 connector for RG-58 A/U and RG-8X coax that doesn't require any specialized tools; just your average side cutter and needle nose pliers. All metal parts are gold-plated brass, great for use in a marine environment. There are only five components to the connector (Figure 1): the "head" of the connector with the center pin and piercing fingers, the coupling ring, a rubber O-ring, the cover ring and a small plastic guide cap for use with RG-58 A/U coax only.

Installation

I had a short length of RG-58 A/U coax in the ARRL Lab and decided to make a jumper cable. Installation takes less time than it takes to explain it here. First, cut the end of the coax off clean and flush. Next, slide the O-ring and coupling ring onto the cable with the threads facing the connector. Place the plastic guide cap over the end of the coax if the cable is RG-58 A/U. Now push the coax firmly into the center of the "head" of the connector until it stops. The guide cap centers a gold plated pin, which gets pushed into the center conductor of the coax. Pliers are now used to evenly squeeze the barbed piercing fingers tight against the rubber jacket. The points on the end of the fingers pierce through the rubber jacket, making solid contact with the braided outer conductor (Figure 2). Slide the O-ring up to the piercing fingers and tighten the cover ring and you're done!

Durability Test

Once passing the continuity test, I looked for any unusual loss at 450 MHz using our IFR 2041 signal generator and HP-437B power meter. Little loss was found, except the expected cable loss at that frequency. My new coax jumper was then put to the test of passing 200 W on the 10 meter band (with a dummy load) for three minutes. No arcing, smoke or even any heating of the connectors occurred. Not yet satisfied with the result, I pretended to be David against Goliath, viciously swinging the cable. I then slammed it on the floor repeatedly, jumped upon it incessantly and kicked it out of the Laboratory screen room. Mind you, this is *not* the way I normally test products! With 200 W applied again and the operator wiggling the cable madly, no variations in output power were detected.

Conclusion

The Shakespeare PL-259-CP-G connector is a good alternative when soldering is impractical, or if you would rather avoid the soldering iron altogether. If you're either safe at home or on the go in a real emergency, this connector is good to have around. I'm sure they will be very useful during my next sub-freezing New England antenna party.

Manufacturer: Shakespeare Marine, 3801 Westmore Dr, Columbia SC 29223; tel 803-227-1590; **www.shakespeare-marine.com**. *$10.95.*

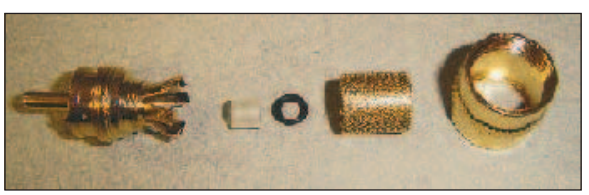


Figure 1 — There are only five components to the Shakespeare connector: The "head" of the connector with the center pin and piercing fingers, the coupling ring, a rubber O-ring, the cover ring and a small plastic guide cap for use with RG-58 A/U coax only.

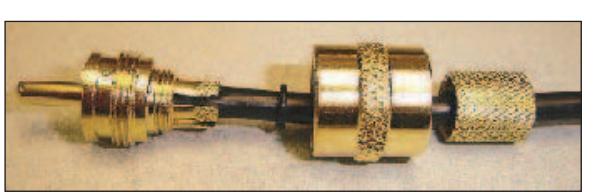


Figure 2 — Assembling the connector onto a piece of RG-58 coaxial cable took only a couple of minutes.

W1ZR

GETTING ON THE AIR

Get Ready for Sunspot Cycle 24

After many cycles of what seemed like a fairly regular 11 year sunspot cycle, at the end of cycle 23 we were faced with a long wait for the start of cycle 24. We were always somewhat aware that the 11 year interval was really just a fine grain effect of a much more complex waveform extending back to the birth of the sun. An article a few years back looked at 300 years of data, but that is still just a relatively small sample.[1] Our recent observations may serve as the latest blip on our radar to provide another data point to those who try to predict such things for the long haul.

"After a long dry spell, it looks like sunspot cycle 24 is finally heating up. Be sure you're ready when it gets here."

So What's Happening?

After many years of waiting with mediocre HF propagation conditions, we may finally be turning the corner into a new upward trend — cycle 24 *may* be off and running! The usual effect is that the solar activity will increase over a few years into a relatively broad peak lasting a few more, and then head into another decline. Right now it appears that we are on the upswing. The East Coast of the US has seen almost daily occurrences of 10 meter medium range openings that haven't been seen for years. Even though we are just starting to see the benefits of our few sunspots, the improvement over what we've had seems dramatic.

We can expect the maximum useable frequency (MUF) to increase as the sunspot numbers rise. The MUF at a given moment is different for each path under consideration, however, there are a few general effects that amateurs will likely observe:

- Signals at frequencies above the MUF for our path will not be refracted to our desired destination — that's what we mean by *maximum* usable frequency.
- Signals at frequencies close to the MUF will propagate with less attenuation than those on lower bands. During daylight hours, signals well below the MUF will be refracted or attenuated by lower layers of the ionosphere as shown in Figure 1.
- The fact that atmospheric noise generally goes down as frequency increases, in combination with the above, will result in the signal-to-noise level (S/N) of received signals near the MUF being significantly higher than if we tried to reach our destination on a lower frequency.

What this means is that as the MUF reaches the upper region of HF (and sometimes into the lower VHF region — perhaps to 6 meters), our upper HF bands will be "open" to many parts of the world much of the day. Signals will pop out of our receivers sounding like locals, even if continents away.

The ionizing radiation stops as the day turns to night with the result that the ions that make up the layers recombine into neutral gas molecules and the layers effectively disappear. The Earth's gravity makes the layers closest to the Earth more dense than those further away with the result that they combine the most quickly. With large amounts of daytime radiation, there is enough F layer ionization that at the peak of the cycle it may provide worldwide communications during the night as well as in daylight.

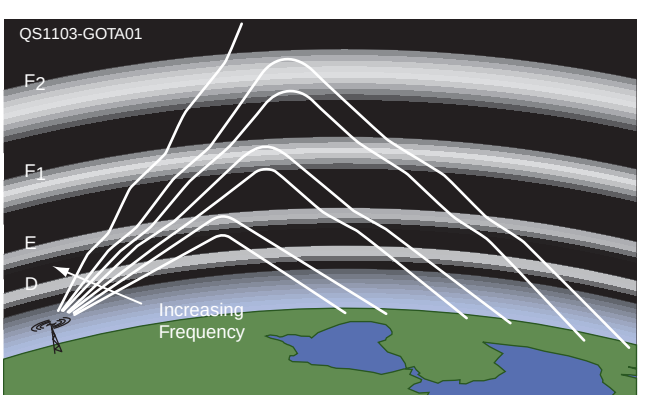


Figure 1 — Signals of different frequencies enter the ionosphere during daylight. Signals above the MUF are not refracted toward our destination and, if above the critical frequency, head for outer space. Signals well below the MUF are refracted or absorbed by lower layers.

Taking Advantage of Those Spots

In order to benefit from this phenomenon, it is important to know where and when to look for the signals you want. There are a number of approaches that can be taken. Some make use of data, some are more brute force, but give them all a try and see what works for you.

Playing the Odds

F-layer ionization will be maximum in the regions that are sunny, at least until the sunspots increase significantly. Thus good propagation near the MUF can usually be found between areas in common daylight. There are many programs that show the parts of the world in daylight, often with additional information. Our government will show you the sunny region and also give you the correct time at **www.time.gov**. Just click on your region and you'll have it. During times of high sunspot activity, the higher, less dense F layers will combine, while the denser lower layers will disappear as evening progresses. This will provide very good propagation on the longest paths (see Figure 2).

If you have a rotatable antenna, swing it into the daylight direction and listen, starting with the highest band you can receive. Once you find signals, their location will give you an idea of some of the paths that are supported on that band. Of course, if everyone did that, no one would ever hear anything. It can be helpful to record the background noise level on each band with your S-meter. Generally, if a band is open, there will be a higher noise level

[1]P. Argo, J. Hill, R. Rose, K6GKU, and M. Gannis, "Radio Propagation and Solar Activity," *QST*, Feb 1977, pp 25-28.

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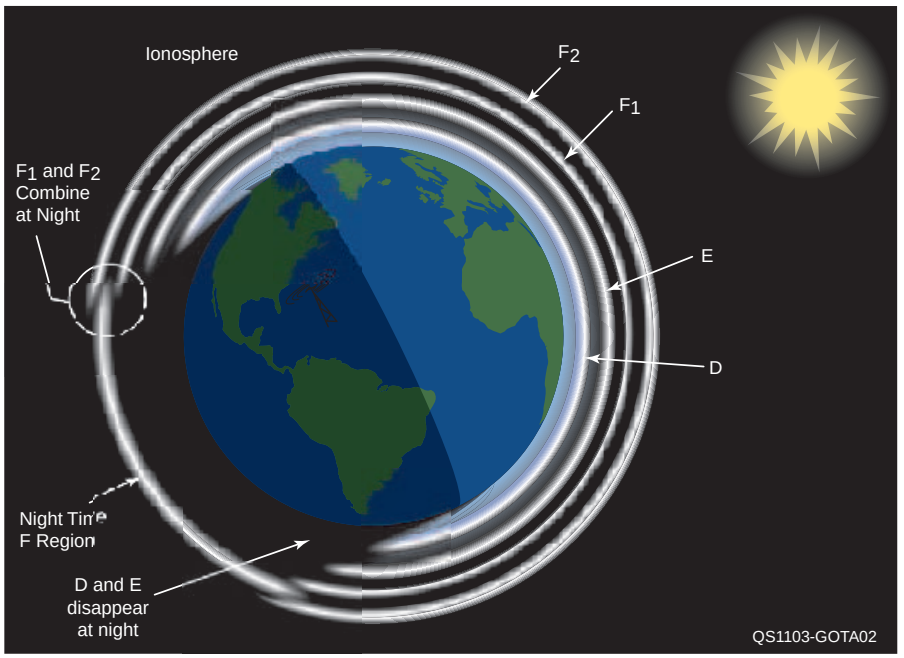

Figure 2 — Effect of sunlight on the ionospheric layers. Note that at night the higher, less dense, F1 and F2 layers combine, while the denser lower layers' ions tend to recombine making the layers neutral and effectively gone for the night. Depending on how highly ionized the F layer was, it may stay in place and be useful for minutes after sunset to as long as all night.

because the noise will also propagate in from other regions. If it sounds like an open band, and you don't hear signals, call a CQ and see what happens. You might be surprised at who comes back!

A special case of this is the use of gray line propagation. Note that, all things being equal, the longest ionospheric propagation paths will be available if you operate near sunrise or sunset — since you will be at the edge of the daylight region. An additional factor comes into play here — the ionosphere's D layer, responsible for absorption of HF signals as night falls, takes some time to re-form and the F layer that we want to use is still ionized. Thus there is a time just into darkness during which optimum long haul communication can occur along or out from the gray area.

Listen to Available Signals

Instead of looking for stations to work on each band, there are a number of stations that are always on the air and can thus let you know what's happening across the HF region. A simple example is again from our government. The National Institute of Science and Technology operates time and frequency standard (WWV) transmitters in Ft Collins, Colorado on 2.5, 5, 10, 15 and 20 MHz. While not quite on our bands, and only from one spot (well there is also WWVH in Hawaii, but most of the US can't hear it since it's on the same frequencies), it can be used as a reliable signal source. Still, if a band is open to Colorado, there is a good chance it is or will be open to the Pacific some time later.

A more sophisticated and generally more useful set of signals is available from a worldwide network of HF beacons provided by the Northern California DX Foundation (NCDXF) in cooperation with the IARU. These beacons transmit on 14.100, 18.110, 21.150, 24.930 and 28.200 MHz in a timed sequence from every corner of the globe. Information, and software to aid in observing the beacons, is available from the NCDXF website at **www.ncdxf.org/pages/beacons.html**. The use of this network was described in a recent *QST* article.[2]

Use Predictive Software

Listening, as described above, will tell you what's happening at the moment you're at the radio, but often it's nice to know ahead of time when a good path to a particular location is likely to be available. This allows you to plan your operating schedule along with your other activities. Unlike listening that provides the real story, propagation forecasting can only provide a probabilistic prediction — much like weather forecasting. Still, having an idea of the most likely time to make a contact can save a lot of wasted effort.

There are a number of propagation prediction programs available. One I like is *W6ELProp*, available without charge for amateur use at **www.qsl.net/w6elprop**. Click on PREDICTIONS, then ON-SCREEN. You will need to know your latitude and longitude coordinates (available at **www.qrz.com**, if you don't know them), the far end of the desired path (by call sign prefix or latitude and longitude) and the predicted solar conditions. The solar flux index and K index are needed, and they are available from a number of web locations including **www.wm7d.net/hamradio/solar/index.shtml**. The program responds with a summary including short and long path bearings and lengths, grey line times and directions and other information. Then click the SHOW PREDICTION button. The program will output the predicted MUF and your choice of the predicted signal level on each band or the S/N in 30 minute increments throughout the day. While the program is intended to provide information about a specific path, the use of a set of prefixes from around the world should provide the more general information.

Lots of Choices — Sounds Complicated!

Well, it's not really *that* complicated. After all, you can just turn on your radio and see what's happening. Most amateurs use a combination of the above techniques, depending on operating styles and events. Whatever you do, don't miss out on cycle 24 — it's been a long wait! QST

[2]S. Sant Andrea, AG1YK, "Use Beacons to Spot Band Openings," *QST*, Nov 2010, p 75.

Strays

HAM RADIO FOR TEENS

◊Radio for Teens (**www.radioforteens.com**) is a website I founded and would like to share with you. The website is a blog/podcast that is mainly intended for teen radio operators such as myself. I created the website with the help of Paul Shirey, KC9QYB, and Jerry Taylor, KDØBIK, with the intention of reaching out to younger operators and to generate interest among them.

I created this website not to act as an overall Elmer (as most young radio operators need to have as well), but as a guide to compare experiences and to explore teens' perspectives on ham radio.

Anyone from anywhere can send in their own childhood Amateur Radio stories to me for possible publication on the site (e-mail your story to **wjhaydon@gmail.com**).

Radio for Teens is only a loose description of the site. It's about memories, family, happiness and accomplishment. — *Will Haydon, KI4WXL*

NØAX

HANDS-ON RADIO

Experiment 98
Linear Supply Design

Way back in Experiment #8, "Linear Regulators," we learned about using transistors, op amps and three terminal regulators to tame dc power and create nicely controlled power sources for electronic circuits.[1] Many Hands-On Radio experiments require just such a supply and even one capable of supplying both positive and negative voltages. While kits and surplus lab supplies are available, designing and building your own simple linear power supply is a great way to get started with electronics. And if you save a little money along the way, so much the better.

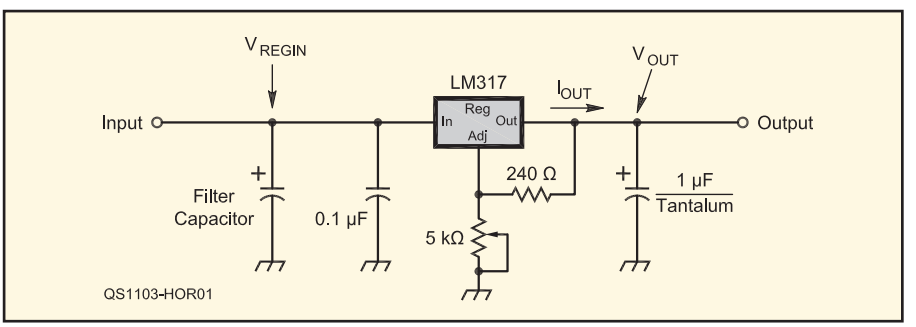

Figure 1 — The basic regulator circuit including the filter capacitor. The 0.1 µF and 1 µF capacitors are for stability and should be mounted close to the LM317.

AC to DC

The usual source of power for power supplies is the 120 V ac line. A suitable transformer is selected and the secondary windings are connected to a full wave rectifier — either center tapped or bridge. (Full wave rectifiers are explained in Experiment #6.) The output of the rectifier is filtered with a large capacitor, and a regulator circuit takes it from there. That's your basic linear or analog power supply in a nutshell.

Step one, however, is to determine how much voltage you need the transformer to supply. As with many design problems, you have to work backwards from the desired end result. Let's say you want a supply that can deliver ±15 V. That is the required output from the regulator circuit, assuming no other components are in series with the output current to create voltage drops.

The regulator IC in Figure 1 will have some voltage drop across it in order to increase and decrease output current and maintain the output voltage at a steady level. In this sense, a linear regulator acts like a *smart resistor* that changes its value to maintain a constant output voltage by varying its I × R voltage drop.

Assuming you are using a three terminal regulator such as the LM317, the next step is to determine the *minimum* voltage drop across the IC, called the *dropout voltage*. If there isn't enough voltage across the regulator from input to output, the IC can no longer regulate the output voltage and is said to *drop out* of regulation. If you download an LM317 datasheet you can find a graph of dropout voltage versus temperature, with different curves at different current levels.

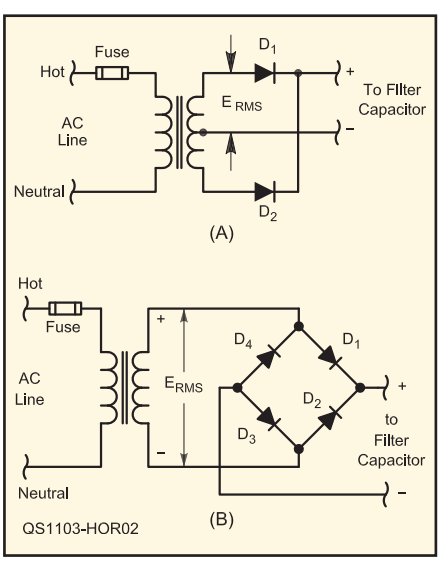

Figure 2 — Full wave rectifier circuits. A full wave center tapped circuit is shown at (A), while (B) is a full wave bridge circuit.

The higher the output current, the higher the dropout voltage. The rectifier circuit's output voltage must be at least higher than the desired output voltage times the dropout voltage, plus some margin for other factors, such as ac line voltage variation.

Let's say our maximum output current will be 1 A. From the datasheet, the dropout voltage is a bit less than 2 V across the normal workbench temperature range. A commercial product designer would have to accommodate a range of input voltages, component tolerances, transformer efficiency and all sorts of other variations to minimize the cost of the supply, while guaranteeing proper performance under all specified conditions. We will simply use a rule-of-thumb to double the maximum dropout voltage, add that to the power supply output voltage and call that the minimum regulator input voltage.

$$V_{REGIN} = V_{OUT} + 2 \times V_{DROPOUT}$$
$$= 15 + 2 \times 2 = 19 \text{ V}$$

Let's keep working backward. Since we are going to operate from the 60 Hz ac line and are using a full-wave rectifier circuit, the filter capacitor will be recharged with current pulses at 120 Hz. Between pulses, the rectified ac voltage will be below the capacitor voltage and the capacitor will discharge into the regulator, creating *ripple* in the regulator input voltage. To determine the minimum capacitance, we need to specify the maximum amount of ripple. The smaller the amount

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

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of ripple we allow, the larger the capacitor must be, according to the following equation:

$$C = (I_{OUT} \times t) / E_{RIPPLE}$$

where *t* is the time between current pulses from the rectifier; in this case 1/120 Hz = 8.33 ms. Our output current is 1 A and if we allow 5% ripple (19 × 0.05 = 0.95 V), the capacitor must be at least 1 × 0.00833 / 0.95 = 0.0087 F = 8700 µF. The nearest larger standard size is 10,000 µF (0.01 F). What size capacitor is needed if a half wave rectifier is used instead? (A 60 Hz recharge rate requires 17,400 µF.) Try changing the amount of ripple to see the effect on capacitor size.

We are almost ready to pick our transformer, but we need to decide whether the rectifier will be a full wave center tapped (Figure 2A) or full wave bridge (Figure 2B) circuit because each diode in the current path adds voltage drop. Center tapped rectifiers have the advantage of only one diode in the current path and the disadvantage of requiring a center tapped secondary. Bridge rectifiers can use a single secondary winding but have two diodes in the current path. We'll go with a full wave bridge circuit because of the simpler (and possibly less expensive) transformer and widely available full wave rectifier bridge ICs. If the forward voltage drop, V_F, of each diode is 0.7 V, the peak output voltage of the transformer secondary at our 1 A current load must be:

$$V_{PK} = V_{REGIN} + 2 \times V_F = 19 + 2 \times 0.7 = 20.4 \text{ V}$$

You'll remember from last month that converting peak voltage to RMS requires multiplying V_{PK} by 0.707, so V_{RMS} = 20.4 × 0.707 = 14.4 V. A transformer with a 15 V_{RMS} secondary would do nicely and give us a little more voltage headroom. If we are designing a bipolar supply, then we need a transformer with a 120 V primary and two 15 V secondary windings. Each winding has to supply 15 V at 1 A, so it must be rated at 15 VA and the whole transformer 30 VA at a minimum. It would be wise to overrate the transformer by at least 25% to keep it cool, so a 40 VA transformer will do nicely. Again, we add design margin by going up to the next higher rating.

A Supply Afloat

What if a transformer with a single 30 V, center tapped secondary were available — could we use that? Yes, but only as long as the positive and negative regulator circuits could share the common connection to the center tap. If you want independent or *floating* outputs, the transformer windings will have to be independent, too. Figure 3 shows the difference. For a supply to be floating from some other circuit, it must not share any electrical connection to the circuit. Our dc power supply should clearly float from the ac line.

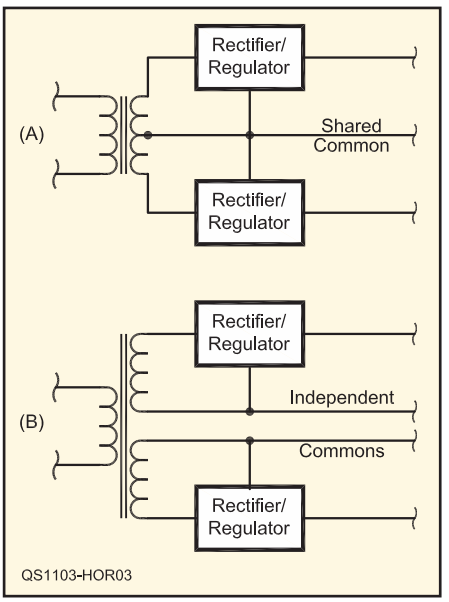


Figure 3 — At (A) the two output regulator circuits share a single common connection to the transformer secondary center tap. At (B) the regulators are floating and have no common connection.

Dwelling on the Negative

What about generating negative output voltage? The LM317's sibling, the LM337, makes a great companion regulator with the same simple circuit. Watch out for the slightly different pin assignments!

Floating does require attention to safety, however. It is common practice to tie the common connection of a bipolar supply to the ac safety ground unless you absolutely need the supplies to float from ground. Even if floating, the power supply should be built in a metal enclosure that is connected to the ac safety ground and operated from an ac circuit protected by a ground fault circuit interrupter (GFCI).

Heat Sinking

All this design margin and headroom are great except that the higher the regulator input voltage, the more power it must dissipate. The power to be dissipated is easily calculated:

$$P_{DISS} = (V_{REGIN} - V_{OUT}) \times I_{OUT}$$

Notice that as the output voltage decreases, the regulator must dissipate *more* power. If the lowest output voltage we allow is 3 V, the regulator will be dissipating (19 – 3) × 1 = 16 W. That's a fairly hefty heat load. Read Experiment #24 for more information on heat sinking. From the datasheet, you might consider using the TO-3 package LM317K since it can handle more heat.

Alternate Power Sources

My assumption has been that the power supply will operate from ac line voltage and you will be selecting a transformer and rectifiers. An alternative is to repurpose another power supply.

Make a visit to your local PC recycling facility or used computer store and ask them if they sell used laptop power supplies. Take along a pocket DVM, plug the supplies into a wall outlet and verify they operate (some require special control signals from the computer — avoid those). Confirm that there is an open circuit from the ac hot and neutral to the output power connections. A low resistance connection between a three conductor ac line cord ground and the output connector's common terminal is okay, although you'll have to remove this connection if you want a floating power supply.

Another inexpensive way to make a power supply is to use *wall wart* transformers and power supplies. The regulation of these supplies is not bench top quality, but as the source of the regulator input power, they are fine.

You can also use gel cells or a pack of D cell batteries to supply the regulator circuit. A benefit of using batteries is that they create a floating supply by definition, provide ultra clean dc power and make a good portable power supply.

Recommended Reading

Power supplies are a great way to get started with analog circuit design — and you get a good workbench tool, too. A book that tackles learning electronics from this perspective is the *Tab Electronics Guide to Understanding Electricity and Electronics* by G. Randy Slone. If you'd like to review a complete project, the 13.8 V, 5 A power supply in the 2010 and 2011 *ARRL Handbook* is a good example.[2]

[2]*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**.

AG1YK

HINTS & KINKS

FAN SPEED CONTROL FOR THE W6JL 50 W AMPLIFIER

♢As a young ham I really disliked the background noise of amplifier fans. Aging made me more tolerant, but hearing aids suddenly brought back my irritation. After splurging $28.36 on the parts for W6JL's prize-winning 50 W 40 meter amplifier, I noticed from the schematic that the fan was always on. I decided to add a fan speed control.[1] In the spirit of the Homebrew Challenge II, I kept my budget to $2.83 (10 percent of the original cost). Figure 1 shows my design.

J3 on the original amplifier schematic is the PTT/QSK line. It connects to R5 of the fan controller. The only other change to the original circuit is connecting the minus lead of the fan to D1 of the controller. The controller has three speeds: low, medium and high. When the amplifier is idling the fan runs at low speed because both Zener diode D1 and resistor R7 reduce the fan voltage. When the PTT line goes low for more than about ½ second, the fan switches to high speed. The negative side of the fan is connected directly to ground by Q3. When the PTT line is released, Q3 turns off 15 seconds later. Q4 keeps the fan running at medium speed for an extra 15 seconds. Q4 shorts R7 to ground, so only D1 is limiting the fan speed.

Q3 and Q4 use nearly identical circuits for timing. When the PTT line goes low Q1 and Q2 turn on. R1 charges C1, so R1 determines how quickly the fan starts up. When the PTT line is released, C1 discharges through R2. That time is about 15 seconds because I chose a value of 10 µF for C1. Q4 uses C2, R3 and R4 for timing. Because C2 is about twice as large as C1, the "hang time" is twice as long. I set R3 to half the value of R1, because C2 is twice the size of C1; that way they have about the same startup speed.

It is very easy to modify the components to match your operating needs. D1 and R7 can be chosen for different fan speeds. C1 and C2 can be chosen for different "hang times" and R1 and R3 can be selected for very slow or very fast startup times. The values in the schematic work great for SSB with the amplifier as described in the article. — *73, Andrew Mitz, WA3LTJ, 4207 Ambler Dr, Kensington, MD 20895,* **arm@gnode.org**

[1]D. Huff, W6JL, "Homebrew Challenge II Winner #1 — The Lowest Cost Entry," *QST*, Jun 2010, pp 30-33.

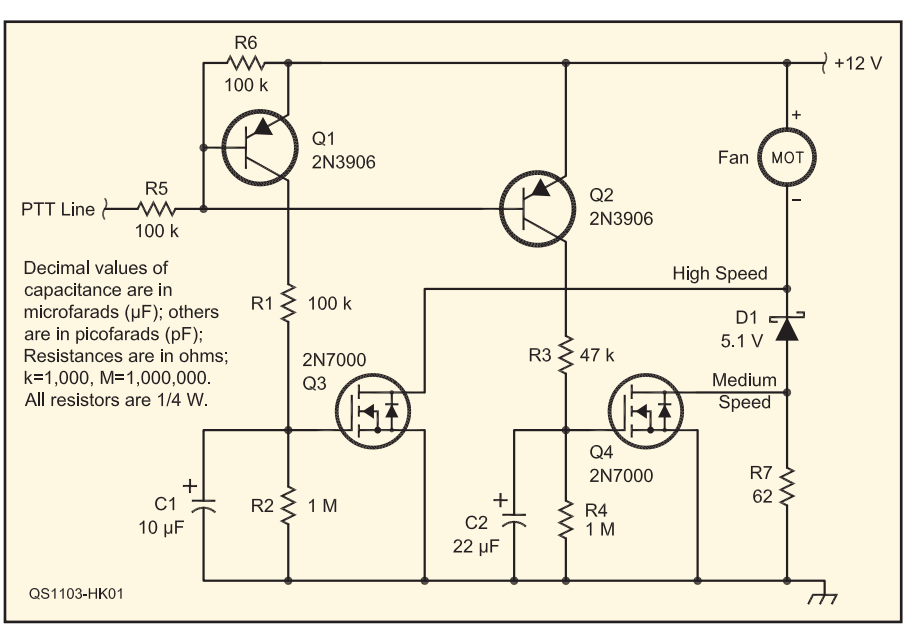


Figure 1 — The schematic diagram of the three-speed fan controller. All resistors are ¼ W.

WELL WIRE

♢During these tough economic times everyone is looking for a bargain or a way to reduce costs. This suggestion may be of interest to those looking for an economical supply of radial wires for a vertical antenna.

I acquired 200 feet of three-conductor well wire (#12 AWG) with plastic insulation. This gave me twelve 50-foot lengths of radial wire for use with my antenna. All this wire was obtained at zero cost as it came out of a water well that was being replaced. I am told that the old wire is not reused but scrapped or given away.

I suggest contacting a water well maintenance company for a source of this wire and enjoy an almost endless supply of free or low cost radials. — *73, Michael Janis, KE3OQ, 149 Silo Cir, Nazareth, PA 18064,* **mjanis@ptd.net**

L-BRACKET CABINETS

♢I, too, have joined the homebrew enclosure club (January 2010 *QST*), as the cost of commercial cabinets — even small ones — is prohibitive.[2]

While constructing a seven band CW transmitter, I found that an economical cabinet for it would cost about $65, locally or imported. So I made my own.

It consists of 0.080 inch sheet aluminum panels and ½ × ½ inch aluminum L-bracket stock (from Home Depot). I cut Vs into the bend sites and bent the L-bracket into rectangles for the front and rear cabinet openings (see Figure 2). I drilled #43 drill holes in the L-bracket, which is thick enough (⅛ inch) to sustain threads, and tapped them for 4-40 fillet-head machine screws. The panels are drilled with a #33 drill for screw clearance.

Reality must creep in here. L-bracket aluminum bends readily, but snaps off if you bend it too far then try to bend it back. In addition, the open corner of each frame must be secured. I used short pieces of L-bracket, epoxied into place and left to

[2]S. VanSickle, WB2HPR, "Homebrew RF Enclosures — Another Approach," *QST*, Jan 2010, pp 64-65.

CHARLES HOOKER, VE3CQH

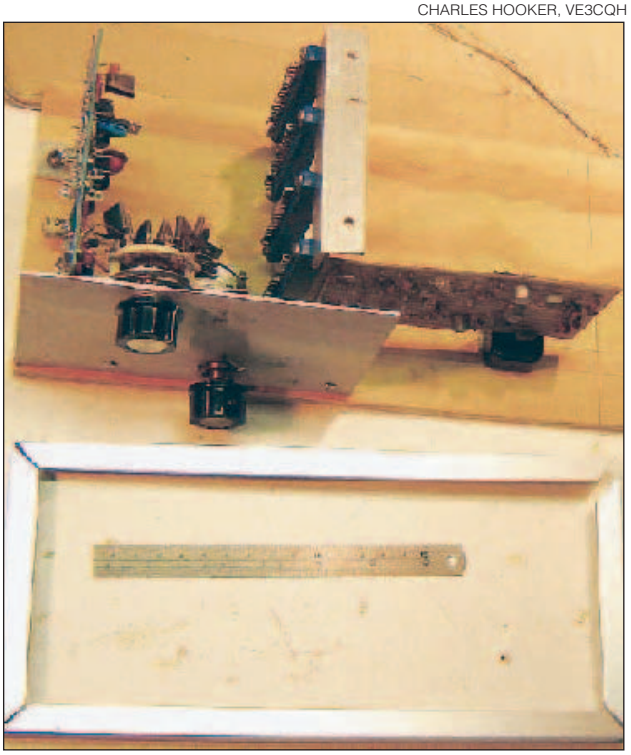


Figure 2 — A piece of aluminum L-bracket that has been cut and bent to form a rectangular frame. The transmitter breadboard is shown above.

CHARLES HOOKER, VE3CQH

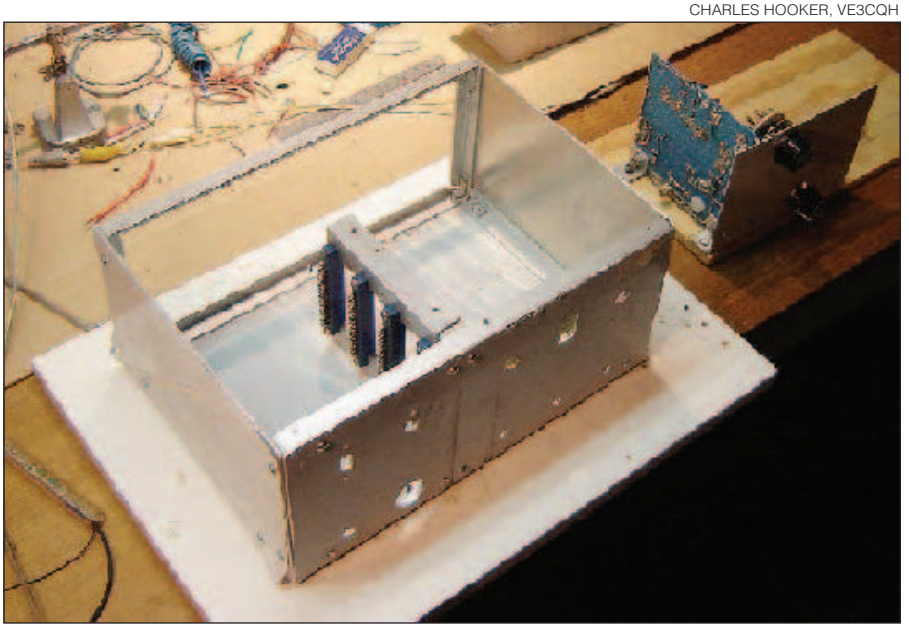


Figure 3 — The completed enclosure showing details of the final assembly. Note the reinforcing bracket pieces in the corners.

dry overnight (see Figure 3). Epoxy is not the strongest of glues, but it does not expand like some other types. An alternative is to machine-screw the corner pieces into place.

As I'm not the most accurate machinist in the world, some of the clearance holes had to be "adjusted" to enable the screws to grasp the threads in the frames through the panels. I used a thin rat-tail file and a lot of patience. [To improve accuracy, clamp the panel to the frame and drill the #43 holes through both and then enlarge the panel holes with the #33 drill. — *Ed.*]

The front panel of this transmitter is in two pieces to allow me to add and subtract parts as the design matures. The cabinet corners are approximately square, good enough to contain the transmitter.

A plywood board was employed as a base for prototyping; otherwise I would not have been able to determine the required cabinet size. — *73, Charles Hooker, VE3CQH (ARRL Life Member), 431068 19th Line, RR #2, Orangeville, ON L9W 2Y9, Canada,* **chuckh@sympatico.ca**

ROTATOR BREAK-OUT BOX

◊Like many hams, I have an antenna rotator on the top of my tower, with the control box inside the house, and in my case, in the basement "shack."

Any form of troubleshooting of the rotator operation is very difficult, usually requiring someone inside to operate the control box and someone outside to verify operation of the rotator. Otherwise, a lot of running back and forth is required.

DON DORWARD, VA3DDN

Figure 4 — The rotator break-out box mounted to the side of the tower. Note the modified wine bottle cork to seal the bottom cable entrance and the weatherproof seal between the cover and the box.

A simple solution is to install a rotator "break-out box" at the base of the antenna (see Figure 4) so it's easy to access the rotator connections from the outside. This is a good thing to do at the time of installation. It allows you to easily disconnect your inside rotator control box and substitute another rotator control box outside, where you can see the antenna and communicate with the guy up on the tower.

I used a commonly available rigid PVC ½ inch conduit access fitting, a Kraloy type LB05, that has a removable cover with gasket. A plastic wine bottle cork cut in half served as a plug for the unused ½ inch port. The cork, with two ¼ inch holes drilled into the center also acts as a weatherproof lead-in plug for the rotator wire, as shown.

I used the simple "bullet" style connectors for the controller wires. Note that the controller wires can have 30 V ac on them. To use, simply disconnect the inside rotator control box at the break-out box by pulling the bullet connectors apart and plug in the rotator control box to be used outside, which can be the one from inside the house, if you don't have a spare. Obviously, any weatherproof plastic box could be used and with whatever type of rotator you have (three or four wire, etc). — *73, Don Dorward, VA3DDN, 1363 Brands Ct, Pickering, ON L1V 2T2, Canada,* **ddorward@sympatico.ca**

"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.

Hang Gliding with Ham Radio

Airborne hams use radio to overcome the challenges and enhance the enjoyment of soaring through the air.

Bill Schell, W4UHE

Hang gliding is the sport you've probably seen on TV where people launch themselves off of a mountain, hill or even a sand dune while suspended below a kite-like wing (see Figure 1). The thrill of soaring through the air using your skill and the power of thermal currents is not easily described. As you watch the earth falling away below you it's like being a photon leaping away from an antenna destined for some remote part of the globe.

Being airborne, upheld by rising currents of air is a thrill, but just as important is the eventual landing. Part of the excitement of hang gliding is its inherent danger. Here is where ham radio comes in.

The safe operation of hang gliders requires a system of communication between the glider pilot, other glider pilots in the area and the pilot's team on the ground. Ham radio provides a solution that is effective in cost, size and weight.

Hang gliding typically requires four main pieces of equipment: the glider, a harness, a set of instruments and communications.

SARAH WISEMAN

Figure 1 — John Wiseman, KE3QG (now WT3J), takes off from Jack's Mountain, Pennsylvania while Jeff Harper, N3VJG, stays in touch on 2 meter FM simplex.

Hang Gliding Gear

There are several types of gliders. The "flex-wing" type uses the pilot's weight-shifting movements to control its flight. The "rigid wing" type uses spoilers, manipulated by the pilot's movements for control. The SWIFT type (Swept Wind with Inboard Flap Trim) is designed so the pilot sits in a seat and uses a stick to control the glider rather than weight shifting.

The harness, used to hold the pilot to the frame, is available in two types: cocoon and pod. The cocoon is typically less expensive and here in south Florida they are a good deal cooler. The pod harness is significantly more aerodynamic so it is used almost exclusively in competitions.

For instruments, most people carry, at minimum, a "vario," which is short for variometer. This instrument measures the glider's rate of climb or descent using a repeating tone. The pilot understands the tones so she does not need to constantly look at the instrument. Most pilots also carry a GPS unit to display a map of the area together with stored waypoints (preset positions along a route the traveler passes by on the way to the destination).

A Shack in the Air

When it comes to communications, ham radio is a perfect fit. The pilot and his flying companions use 2 meters to share information about air currents when aloft. This is an important point since properly using air currents is essential to flying. Ham radio gives pilots the ability to share information on flying conditions that makes everyone's flight more fun.

Though there is some slight variation, virtually everyone in the hang gliding community sets up their radios identically. Though there is a lot of variation in language, there are few variations in how we connect everything together and use it (see Figure 2).

To keep in touch with other pilots and your friends on the ground, installed in your helmet (required in hang gliding) are both speakers and a microphone. The speakers are mounted between the helmet shell and liner (near the pilot's ears). The microphone is typically placed right in front of the pilot's mouth, in a closed-front helmet, which is the type most people wear. To transmit, everyone uses a PTT (push-to-talk) switch that is wired (typically inside a clothing sleeve) to a finger position. Wind noise makes VOX operation impractical. Pilots use helmet components that are typically manufactured in kits for the motorcycle communications industry.

After an on-the-ground, prelaunch radio check, the 2 meter handheld transceiver keypad is typically locked so settings don't change once the pilot is airborne. Once in the air most pilots will *not* take their attention off flying their glider to change any radio settings. The radio is then zipped into a side pocket of the pilot's harness.

Some pilots have a small switch mounted on their helmet to mute the speaker(s) so they can concentrate on flying the glider, staying aloft, looking for landing spots and, in general, paying attention to the flight. After all, in hang gliding ham radio is a tool to enhance the safety and enjoyment of the flight, but it shouldn't take the pilot's attention away from the important task of flying the glider.

Pilots always try to use the 2 meter simplex subbands (146.400-146.580 MHz, 147.520-147.570 MHz). We use simplex to keep our traffic off the repeaters and to keep the repeater traffic from interfering with our conversations about staying aloft or getting to the destination.

The Antenna — A Case of Compromise

Another critical factor in the set up of the 2 meter transceiver for flying is the antenna. When you are hanging up in the air, hundreds of feet above the ground, you need to rethink your ideas about antennas. Almost all ham antennas are designed to be operated at or near

BILL SCHELL, W4UHE

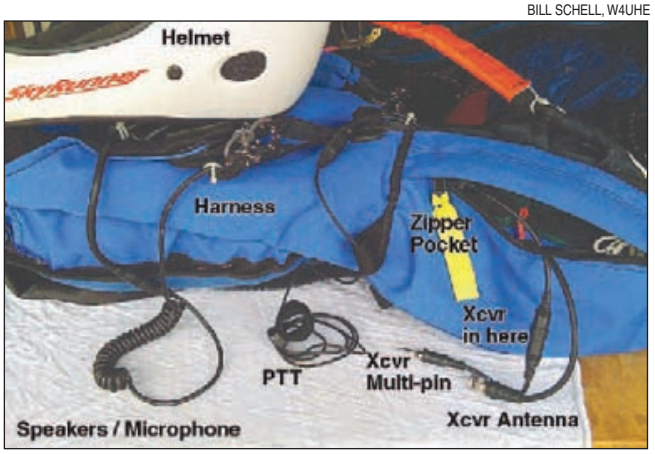


Figure 2 — The communications and gliding gear are integrated so as to provide the best communications with the least amount of weight and drag on the glider.

BILL SCHELL, W4UHE

Figure 3 — This photo shows how the 2 meter dipole is integrated into the harness.

the ground, radiating *up* (vertically). Flying a hang glider, we want something to radiate *down* (to the ground) or horizontally to another pilot. On top of that, the antenna must be *simple, lightweight* and *durable* so that it won't break easily or overwhelm the glider.

Some people use the flexible antenna that comes with the handheld transceiver, but this approach has some problems. Typically, the transceiver is zippered into a compartment in the harness. Some of these compartments have a metal zipper, which can interfere with the radiation pattern of the antenna. Still, these can be effective even though a glider pilot might be 5-10 miles from a receiving station. Remember that, with the glider in the air, virtually all communications are line of sight, with *no* obstructions at all. A 50-100 mile communication range is not uncommon.

Some pilots use a 2 meter dipole that they can buy or make with a piece of coax. RadioShack sells a 6 foot coax cable with a BNC on each end. About half of the pilots buy one of these, cut it in half, then remove the outer shield for about 19 inches and use it as a dipole antenna.

I use an inverted-inverted V — where the V is right-side-up so it radiates downward (toward the apex of the V). It is sewn into the harness between myself and the wing (see Figure 3). This configuration works quite well. There is the usual null when the plane of the V is pointed at the receiving station, which is a quirk that the pilot has to consider when transmitting to a ground station or another glider in the air. The flexible antennas have similar null problems but are more effective, omnidirectionally, at close range (less than 1 mile) to other gliders in the air nearby.

One of the interesting notes about antennas used in hang gliders is that there is basically no groundplane in a hang glider. A hang glider is about 80% sailcloth, about 5% stainless cable and about 15% aluminum (or carbon) tubing. The hang glider has little to act as a groundplane. The one thing that compensates for poor antenna design and placement is altitude. As height increases the distance to the radio horizon also increases according to the formula: Distance (miles) = $\sqrt{1.5*\text{Height (feet)}}$. What does that mean in the air? Well, let's say you are soaring at 1000 feet. That puts the VHF horizon about 39 miles away — 13 times the range you get standing on the ground watching the show overhead.

So given their small size, light weight, low cost and simplicity of operation, 2 meter handheld transceivers are the key to communications from the hang glider, both air-to-air and air-to-ground.

Hang Glider Communications

Hang gliders use 2 meters for three basic purposes:

- To communicate between pilots in the air about where the lift is the best ("Over here. See that dark field. Great lift here."). Radio is also used for training purposes, for an experienced pilot to guide a student through the flight.
- To communicate with the retrieval driver who will pick up the pilot and glider when they land, typically not at the location they launched from. It is not uncommon for gliders to travel 50 or 100 miles from their launch point. Once a pilot is on the ground almost all communications is via cell phone, due to the limits of simplex VHF at ground level.
- If someone goes down and is hurt, the downed pilot can contact someone in the air. That pilot (in the air) can then relay the message to someone on the ground (say a retrieval-car driver).

Communication with other hams is a low priority item. Though it does happen, it is not typical for several reasons.

First, coordination of simplex frequencies is required before the flight and it is very difficult, if not dangerous, to try to change frequencies in flight.

Second, pilots are exceedingly busy attempting to stay aloft, so communications is a luxury. *Very* rarely does one have enough time to listen and then communicate with other amateurs. Making a contact in the air would require a "change of mental focus" from the job of flying (attempting to stay in the air) to the job of communicating with other amateurs.

Third, the use of simplex frequencies also complicates matters, since simplex frequencies are not static. They can be changed right before a flight happens, with little time to communicate the change with another amateur who *may* not be reachable with the radio while the pilot is on the ground. After launch, a pilot is not able to change frequencies or other radio settings either, which also makes using a repeater to coordinate a simplex frequency with a ground-based ham impossible.

I've actually had good luck with both simplex and duplex (to my repeater) from as far away as 75 miles (line of sight) and from as low as 1500 feet — obviously the higher one goes the farther you can reach.

Bill Schell, W4UHE, an ARRL member, obtained his Amateur Extra class license after accepting a challenge from his father, William, AA4AY, an Amateur Extra class operator for 40-plus years, to pass the Amateur Extra class exam. Bill also holds an FCC-GROL license. His Amateur Radio interests are mostly in all-bands listening, 2 meter hang gliding and EmComm.

Bill is semiretired from a previous life as a computer network security and assessment guru, mostly in Asia for Motorola. His alternative time-wasting is primarily spent in windsports (board-sailing, sailing, kiteboarding, etc) with his wife of 15 years. They live (with their cat) in southeastern Florida. He also volunteers a lot of his time in helping run sailing regattas and teaching computer security in and around the Florida area. He can be reached at **bill@vikingasia.org**.

YI9PSE Iraq 2010 — An Extreme Adventure

A DXpedition team braves the challenges of activating a war zone.

David Collingham, K3LP, and Paul Ewing, N6PSE

My son, Nathan Collingham, KC7NKN, had just finished serving two 12-14 month tours in Iraq when I (K3LP) saw the announcement by N6PSE that he was looking for YI9PSE team members. Thinking, "Ah — another Tom Clancy adventure, which best describes my lifestyle." It didn't take me a minute to fire off an e-mail and request to be part of this unique challenge.

So what type of person jumps at the opportunity to go to Iraq during a time of unrest? I imagine very few would take the risk. After explaining my reasoning to my wife and family on why I would even consider this venture, the only reply was a blank stare. The only interpretation of this stare was an obvious, "Why?" So I did the right thing, I took out a million dollar life insurance policy and immediately purchased my airline ticket.

About Erbil, Iraq

We would be operating from Erbil (also known as Arbil or Irbil) a city of over 500,000 located in an area known as Kurdistan (see Figure 1). Erbil is a commercial, agricultural and administrative center with a predominantly Kurdish population; it is one of the world's oldest continually settled towns.

The fourth largest city in Iraq after Baghdad, Basra and Mosul, Erbil lies 50 miles east of Mosul and is the capital of the Kurdistan Autonomous Region.

In April the average maximum daytime temperature is a warm 76°F, with little chance of discomfort from heat and humidity. This made our trip quite comfortable. Erbil lies between 1300 and 1725 feet above sea level. The area we operated from was about 1700 feet above sea level.

Getting the License and Permission

The team came together as a result of persistence and the willingness of our Team Leader, Paul Ewing, N6PSE, to overcome many different obstacles (see Figure 2). His efforts led to the issuance of the YI9PSE license and the success of our DXpedition. The licensing effort took about 7 months. Support from NCDXF, INDEXA, NCDXC, ICOM, ACOM (K1LZ) and SteppIR were key in enabling the trip's success.

Getting Started

At the beginning, the team started as a four to five person effort with three radios, then transitioned to a team of 12 uniquely qualified and skilled operators representing the USA, France, Japan, Martinique and Serbia and another ham from Iraq named Heathem Sabah, YI1UNH.

Figure 1 — Map of Kurdistan, Iraq showing Erbil (Arbil), our operating location, near the center.

Contacts by Continent

Continent	*Total*
Europe	35,773
Asia	6,801
North America	6,706
South America	515
Africa	396
Oceania	210
Totals	50,401

Figure 2 — The YI9PSE team. Front row (from left) Paul, N6PSE — Team Leader; Krassimir, K1LZ; Al, K3VN; Bob, N6OX; Jack, WØUCE; David, AH6HY, and Wayne, W5KDJ. Rear row (from left) Heathem Sabah, YI1UNH; Bill Beyer, N2WB; Jun Tanaka, JH4RHF; David Collingham, K3LP; Michel Brunelle, FM5CD, and Hranislav Milosevic, YT1AD.

Making Memories — Programming Your Local Repeaters

Store repeaters in your radio using these simple steps.

Sumner Weisman, W1VIV

Figure 1 — A new ham's first radio is often a handheld transceiver. This 5 W unit has had the original rubber flex antenna replaced with a more efficient one. The palm-sized T-90A has 500 memory channels available for storing repeaters.

Figure 2 — The ICOM IC-208H can be used as either a mobile rig or base station. This radio is capable of 55 W output and can store 512 memory channels.

Our radios seem to get more and more complicated as time goes on — with more capabilities and more tiny buttons. When members of our radio club are ready to purchase a new radio, they are often dismayed at the challenge of selecting the right one and then getting it set up and operational. After answering many related questions, I have attempted to document and simplify the steps to select the best one and get it on the air. No written article can help you program all radios, since each is different, but I can give you some hints that will help you to get started. This information may be helpful not only to new hams but to old-timers as well.

First, Which Radio?

The first question new Technician class hams ask is, "What should I buy for my first radio?" I usually tell them that it should be a battery-operated handheld transceiver (see Figure 1). A 5 W output is typical and that is a good compromise between battery life and adequate power. If you can afford it, get a dual-band radio, with both 144 and 440 MHz. Some come with a third band, 220 or 50 MHz, as well.

If you have money left over for accessories, replace the standard rubber flex antenna with a more efficient one. It's also good to have a remote speaker/microphone, so you can keep the radio on your belt. Finally, you should have several spare batteries kept fully charged at all times, so you are prepared in case of emergencies. (AA battery packs are best for EmComm use.) Later, you may wish to also own a larger, 12 V powered unit that can be used as a mobile radio or for a base station. These typically provide 50 or 55 W output (see Figure 2).

As you advance to General or Amateur Extra class, you will never outgrow these radios. They will remain useful for making contacts through repeaters, including EchoLink and IRLP (Internet radio linking project), checking into local nets or working simplex with your friends. In addition, you can listen to many frequencies such as aircraft, police, fire and weather.

Toning Up

One of the most common areas of confusion is in the use of tones. Not so many years ago, there were no such things as audio tones on repeaters. As more and more repeaters were built, especially in major metropolitan areas, interference between them increased rapidly. That caused major headaches to operators and potentially serious problems in emergencies. To solve the problem, CTCSS (Continuous Tone-Coded Squelch System) tones were developed. CTCSS is also called PL, a Motorola trademark for Private Line, or simply "tone."

CTCSS places a low frequency subaudible tone on your radio's transmission. If a repeater is programmed to that tone, the signal from your radio will key the repeater and allow access. If the tone is not the repeater's tone, even if you are transmitting on the correct frequency, you can't get into the repeater. Most modern repeaters use a tone to

block undesired signals.

In addition, some repeaters also include a tone on their transmitted output signal. Programming in this tone and using tone squelch operation can eliminate much annoying interference to your radio. With your tone squelch activated only signals with the correct tone will open the squelch on your radio. An interfering signal at the repeater's output frequency will not break the squelch and you won't hear it. Your manual squelch control is disabled and the radio will be silent until a signal with the tone is received. It's a good idea to go to the extra step of programming this feature.

Getting Started

When I get a new radio, I enjoy the challenge of trying to operate it intuitively without opening the manual; that doesn't always work these days — radios are simply too complicated. Using the manual, on the other hand, often leaves me frustrated. The chapters are seldom written in the sequence I need. I usually have to insert four or five bookmarks and then jump around between chapters to complete the programming.

There are alternatives to programming by hand. You can usually buy a software package and special cable to program the radio with your computer, but that's an additional expense. Also, this option may not be available in emergencies, so it's always a good idea to know your radio. Another option is *cloning*. If you have two identical radios, one often may be "cloned" to the other by connecting them with a cable. Cloning copies all the programming of one radio to the other, resulting in identical programming for both.

Get with the Program

To begin, let's review a logical sequence of programming. The nomenclature used is typical but may be different for your radio. In addition, some of these steps may not be needed. Information for your local repeaters can be found in *The ARRL Repeater Directory*, which includes all the programming information for each repeater.[1] Additional directories may be found on the Internet.

1) *Frequency offset and polarity*: For use with a repeater, most new radios automatically set both the correct frequency offset and the offset polarity for you, depending on the repeater's frequency. Some repeaters may not follow the standard convention and you may have to program older radios manually. First, set the offset, or difference, between the transmit and receive frequencies. Look for the section in the manual on duplex or repeater operation. For example, for the 2 meter band the frequency offset is normally 600 kHz. When an offset is programmed, DUP is shown on my radio's display.

Next, you have to program the direction of the frequency offset, either positive or negative. This will vary depending upon the operating frequency of the repeater and must be set for each one. For simplex operation (simplex is used to communicate radio to radio without going through a repeater), where the same frequency is used for both transmit and receive, no offset is needed. Therefore, three options are available, "+", "−" and "none." The "+" and "−"options are often shown on the display.

2) *Frequency*: Here, you set your radio's receive frequency to the repeater's transmit frequency. A repeater is usually known by its transmit frequency. For example, if it transmits on 147.150 MHz, it is called "the 147.150 repeater." Often you will have a choice of keying it in with the keypad or dialing it in with a knob.

No written article can help you program all radios, since each is different, but I can give you some hints that will help you to get started.

3) *CTCSS*: Now it's time to set the two separate subaudible tone modes we have discussed. The first may be required by the repeater. The second is optional, but may be advantageous. The same frequency is often, but not always, used for both.

a) First determine the receive tone needed to access the repeater using a repeater directory. Then open your radio's tone feature. On my radio I set it for rt. Then select the correct tone frequency.

b) If the directory indicates the repeater transmits a tone, you can take advantage of it to quiet your radio by enabling the tone squelch feature, which on my radio is ct. Then select the repeater's transmit tone frequency.

4) Step 3 will not work unless you remember to perform one more step. You must select "Tone" or Tone Squelch" on your radio. For step a, select "Tone" so that the letter T shows on your display. For step b, select "Tone Squelch" so that T-SQL is displayed.

5) *Programming DTMF tones*: DTMF stands for dual-tone multi-frequency signaling. You may be more familiar with it as the touch-tone system. Two simultaneous audio tones are provided that may be used for autopatching (a system allowing you to place a landline telephone call through the repeater) or for controlling other equipment. Your radio may have special DTMF memory channels for storing often-used codes.

6) *Digital-coded squelch (DCS)*, also called DTCS, is another way to communicate with a group of radios. A digital data stream is superimposed on the transmitted signal, similar to the way CTCSS audio tones are used. If your radio is set to the same code, the squelch opens. If your radio has this feature, it is programmed just like the CTCSS.

7) *Storing the information*: Now that you have carefully programmed all the above information into your radio, you need to store it all into your radio's memory. Read the memory chapter in your manual. You'll discover that you probably have hundreds of memory channels available (all the information you have stored — repeater frequency, offset, CTCSS and DMTF — are collectively referred to as a channel).

In most modern handheld transceivers you can assign any stored information to any channel and you can even automatically scan these memory channels. Study the part on selecting a channel and saving all of your programmed parameters to it. When you understand the channel-saving process, save your repeater's information. You may find that you can even give the channel an alphanumeric name — for example, CLUB 1 — to make it easier to recognize.

Repeater Ready

Congratulations — the job is done. You can now quickly go to that repeater anytime you wish by selecting the memory channel number (or name if you gave it one). All the information will remain in memory until you decide to change it. Of course, you probably will now want to do the same for all of the other nearby repeaters. You will assign each its own memory channel, which can be easily selected at any time.

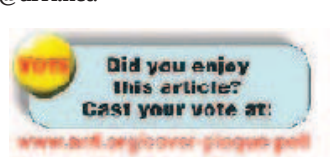
When going on a road trip, some hams like to preprogram the repeaters they will pass along the way. The ARRL has a product to help with this called *TravelPlus for Repeaters*.[2] If you do that, please drive carefully and have fun.

[1]Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order nos. 0854 or 0861. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

[2]Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order no. 0878. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Photos by Sumner Weisman, W1VIV.

Sumner Weisman, W1VIV, an ARRL member, has been licensed with the same call since 1952. He is a retired electronics engineer. The major part of his career was in design and development of electronic instrumentation products with the last 15 years in the sales and marketing of those products. Sumner has authored many technical papers on the use of humidity measurement instrumentation and has lectured nationally on this topic. He enjoys ham radio, computers, photography and sports cars. Sumner can be reached at 43 Agnes Dr, Framingham, MA 01701-3815, **w1viv@arrl.net**.



Focused Frequencies

Focusing frequencies on specific activities helps make room for everyone's interests.

Steve Sant Andrea, AG1YK

As ham radio operators we are fortunate to have a wide range of frequency allocations. Most other services are limited to one band. Amateur Radio stretches from 1.8 MHz all the way up to light — literally.

Most activity takes place between 160 meters and 23 cm, which all together constitute 136 MHz of spectrum. Into this wide expanse ham activities have grown to include CW, AM, SSB, RTTY, PSK31, ATV, contesting, DXing, moonbounce, satellite, ARISS, foxhunting, repeaters, traffic handling, emergency communications, SKYWARN and ragchewing to name a few. It would be impossible for all of us to enjoy all these activities without giving some structure to our bands beyond the FCC requirements.

ODILE ROMANICK, KB1GKS

Selecting the right frequency on the right band can help you get the most out of your operating hours.

The Bands Divided

Our basic subbands are determined by the Part 97 regulations. These subbands are allocated according to license class and emission type. For example, on 10 meters, any license class can use any data mode (CW, RTTY, digital modes) from 28.0 to 28.3 MHz. From 28.3 to 28.5 MHz, Novice and Technician licensees can use SSB. All other licensees can use any type of phone or image modulation from 28.3 to 29.7 MHz. A handy chart of the subbands can be found at **www.arrl.org/files/file/Hambands_color.pdf**.

Beyond the legal requirements there are frequencies and subbands where certain types of activity are concentrated. The most notable of these are the repeater subbands that are defined on the 10 meter band and above. Repeaters use subband pairs, one for the repeater input frequencies and the other for the output frequencies. For example, we find the repeater inputs subband from 29.51-29.59 MHz and the outputs subband from 29.61-29.69 MHz.

Windows

Relax — Bill Gates hasn't taken over the ham bands. A window in the ham bands refers to a small frequency range where, by mutual agreement, a certain type of activity takes place. The most notable is the DX window found at 3.79-3.8 MHz. If you are looking for 80 meter DX, this is where you listen or call CQ. When you connect with a DX station, try to keep your contact short. If you want to chew the rag it is best to move the contact out of the DX window.

Calling Frequencies

Calling frequencies are specific frequencies on each band where certain activities are concentrated. For example, 14.285 MHz is the low-power SSB calling frequency. If you are operating SSB under 10 W, use this frequency to contact other low-power enthusiasts. If you prefer low-power CW, use 14.060 MHz. Interested in AM? Try 3.885 or 7.29 MHz to contact other hams who like the "big" sound of AM. Interested in SSTV? Try 7.171 or 14.230 MHz. PSK31? Try 14.070 or 7.035 MHz.

As with the DX window, the calling frequencies are only meant to let hams with similar interests connect with one another. The calling frequency should not be used for an extended contact. Once you connect with another ham move the contact off the calling frequency. No ham should "hog" the frequency for an extended period.

Band Plan Resources

Want to know more? The ARRL has a number of resources available to help you find the best frequency for your operating interests.

■ For specific band information go to **www.arrl.org/band-plan-1**. Here you will find a band-by-band list of the various subbands from 1.8 MHz up to 10.5 GHz.

■ For more detailed information on your favorite band, check out the Considerate Operators Frequency Guide (**www.arrl.org/considerate-operator**). The Guide lists the focus of activity for various frequencies and subbands from 160-10 meters. For bands above 10 meters *The ARRL Repeater Directory* has tables listing calling frequency and subband information from 28 MHz up to 10.5 GHz.[1]

■ Another useful hardcopy resource is *The ARRL Operating Manual*. In "Chapter 1 Operating Amateur Radio" you will find a wealth of information about the ham bands that includes not only frequency and subband data but general descriptions of the bands explaining their propagation characteristics and the predominate type of activity you will find there.[2]

■ Still can't find a frequency that suits your style? You might want to try the frequency lists available on the AC6V web page. For band plans and operating frequencies, try **www.ac6v.com/frequencies.htm** where you will find links to both ham and nonham frequency assignments. If you really just want to focus on ham radio, **ac6v.com/callfreq.htm** has tables listing calling frequencies for a wide range of activities over just as wide a range of bands.

■ The National Frequency Coordinators Council (NFCC) is an organization of various state groups. These groups work within their own states to coordinate frequencies. The NFCC is a union of these organizations that works on frequency coordination on a national scale. Go to **www.arrl.org/nfcc-coordinators** to locate the group for your state.

So the next time you find yourself wondering where to tune your transmitter, have a look at any of these references to find just the right place to set the big knob.

[1]Available from your local ARRL dealer, or from the ARRL Bookstore, ARRL order nos. 0854 or 0861. Telephone toll-free in the US 888-277-5289 or 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.
[2]ARRL order no 1093 (see Note 1).

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ARRL Shows IBEC BPL Systems Interfere, Violate FCC Rules

On December 29, the ARRL filed a complaint with the FCC, documenting ongoing harmful interference and egregious rules violations by Broadband over Power Lines (BPL) systems installed by IBEC, Inc in Virginia, Pennsylvania and Indiana. In its filing, the ARRL requested that the FCC "initiate immediately an enforcement proceeding regarding these BPL systems, and cause them to cease operation until such time as they are each in full compliance with the Commission's Rules."

Contrary to earlier representations — both to the ARRL and in statements in the online BPL database — IBEC's systems in these locations are not universally notching the amateur bands as is necessary in order to avoid emissions at levels that are likely to cause harmful interference to licensed Amateur Radio stations. In fact, measurements by ARRL staff that were independently confirmed show that IBEC systems are not even notching the aeronautical bands. The FCC rules require BPL systems to avoid these bands, but IBEC is operating at power levels that cause radiation well in excess of the FCC limits.

IBEC systems were observed operating in Somerset, Pennsylvania and Fairfield, Virginia well above permitted radiated emission levels. The ARRL discovered that these IBEC BPL systems in operation were not even listed in the online BPL database — another clear violation of the FCC rules, which require listing 30 days prior to initiation of service.

"While IBEC was cooperative in the early stages of their BPL system development and appeared to understand what was necessary to avoid harmful interference, it appears that corners have been cut in the course of deployment," observed ARRL Chief Executive Officer David Sumner, K1ZZ. "We can only speculate as to the reasons why they have taken this path, but the fact is that IBEC is not playing by the rules and their systems must cease operation until they are brought into compliance."

ARRL General Counsel Christopher D. Imlay, W3KD observed that "the information supplied to the FCC in support of this complaint amply justifies the modifications of the BPL rules urged by ARRL in ET Docket No 04-37, including the mandatory, full-time notching of all Amateur Radio allocations by BPL systems, to a notch depth of at least 30 to 35dB." This rulemaking proceeding was reopened by the FCC as a belated response to an April 2008 order by the United States Court of Appeals for the District of Columbia Circuit, which ruled in favor of the ARRL in finding that the FCC had failed to comply with the Administrative Procedure Act and had not provided a reasoned justification for some of its decisions in adopting rules for BPL systems.

NEW AMATEUR RADIO BILL INTRODUCED IN CONGRESS

The *Amateur Radio Emergency Communications Enhancement Act*, which died at the end of the 111th Congress, has been reintroduced in the 112th Congress as HR 81. The sponsor is Representative Sheila Jackson Lee (D-TX-18). The new bill — which was introduced on January 5 — has been referred to the House Committee on Energy and Commerce. "We are hopeful that this early start will lead to success in the new Congress," commented ARRL Chief Executive Officer David Sumner, K1ZZ.

Rep Jackson Lee first introduced the bill — HR 2160 — in the 111th Congress in April 2009. It gained an additional 41 cosponsors but did not progress out of the committee of jurisdiction. A similar bill introduced in the Senate — S 1755 — made it all the way through that body in December 2009, but likewise was not taken up by the House. The objective of the bill — which is supported by the ARRL — is for the Secretary of Homeland Security to study the uses and capabilities of Amateur Radio communications in emergencies and disaster relief and to identify and make recommendations regarding impediments to Amateur Radio communications, such as the effects of private land use regulations on residential antenna installations.

You can view the bill at **www.gpo.gov/fdsys/pkg/BILLS-112hr81ih/pdf/BILLS-112hr81ih.pdf**.

ARRL RECEIVES $1.4 MILLION GIFT TO THE ARRL ENDOWMENT

In October 2010, the ARRL received word that it is a beneficiary of the Charles and Iona Mathias Joint Trust. Dr Mathias, W8KGD, became a Silent Key in 2008 at the age of 93; Iona, his wife of 62 years, passed away in June 2010. The ARRL is one of five beneficiaries of the Trust that has an estimated value in excess of $8 million. Each beneficiary is scheduled to receive a 20 percent share of the residual after other distributions are completed. The ARRL first learned of the Trust upon Dr Mathias' passing in 2008.

Dr Mathias joined the ARRL in 1942 and later became a Life Member. He made additional contributions to various programs, beginning with his support of the W1AW renovation campaign in 1988. He also made numerous gifts since then to the Spectrum Defense Fund, W1AW Endowment Fund and the Education & Technology Fund. He became part of the ARRL Diamond Club in 2003.

"The generosity of Dr and Mrs. Mathias is a shining example of how individuals can make a continuing impact on the organizations that influenced their lives," said ARRL Chief Development Officer Mary Hobart, K1MMH. "The Mathias' generosity to the ARRL during their lifetime — and through the Charles and Iona Mathias Joint Trust — is an example of commitment to the work of the ARRL, even after their passing."

The $1.4 million partial distribution from the Charles and Iona Mathias Joint Trust has been added to the ARRL Endowment, as will

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

additional distributions. Hobart explained that the ARRL Endowment is the repository for all estate gifts. The Mathias' gift will generate earnings each year to help the ARRL achieve its goals on behalf of Amateur Radio.

"Charles and Iona Mathias have left a strong and enduring legacy to ARRL," Hobart said. "Radio amateurs are encouraged to consider how they might support the ARRL by including the ARRL in their estate plans. For some, a legacy to ARRL as part of a trust or bequest, or as the beneficiary of an insurance policy or 401(k) provides an avenue to giving over and above annual dues and contributions to other ARRL funds."

Radio amateurs who advise the ARRL that they have included the ARRL in their estate plans will be recognized as members of the ARRL Legacy Circle. For more information on leaving a legacy to ARRL, contact Mary Hobart, K1MMH, Chief Development Officer by phone at 860-594-0397, via e-mail at **k1mmh@arrl.org** or by mail at 225 Main St, Newington, CT 06111.

ARRL FILES *PETITION FOR PARTIAL RECONSIDERATION* WITH FCC REGARDING VANITY, CLUB CALL SIGNS

In October 2010, the FCC released a *Report and Order* (*R&O*), detailing rules changes to the vanity call sign system and call signs for Amateur Radio clubs. These new rules are scheduled to go into effect on February 14. The ARRL found that most changes made by the *R&O* are "reasonable codifications and clarifications of existing policies." But several amended Sections of Part 97 — including §§97.5 and 97.19 — are unclear. As such, the ARRL filed a *Petition for Partial Reconsideration* on January 13, 2011, urging the FCC to reconsider and modify these portions "in order to reflect the intent of the *Report and Order*."

In the *R&O*, the FCC took into consideration some of the ARRL's comments, but not all. The ARRL found it "disappointing" that the Commission refused to consider in this proceeding "a series of reasonable proposals aimed at increasing the available pools of Group A call signs." The ARRL, in its comments, asked the FCC to consider several changes that could be made "that would increase the number of desirable call signs available for assignment, both sequentially and in the vanity call sign program, and which would provide greater flexibility in the temporary assignment of special-event call signs in the Amateur Service."

While the ARRL did not seek reconsideration of this refusal, it noted that the Commission's "tersely stated dismissal of these proposals" should be reevaluated in the near term in a separate proceeding. As such, the ARRL urged the FCC to remain open to "future, near-term proposals to address improvements to the sequential, vanity and special event call sign systems; to preclude abuses of the vanity call sign assignment system; and to remedy the serious shortage of available Group A call sign permutations."

The ARRL maintained that the FCC, with this *R&O*, has "missed an opportunity to make available new call signs in preferred formats; to preclude abuses in the assignment of Group A call signs, and to address the root problem which gave rise to some of the rule changes accomplished by the *R&O*, which is the scarcity of such preferred call sign formats." The ARRL's *Petition*, if adopted, will close a loophole that would have allowed a club with multiple trustees to obtain more than one vanity call sign.

As such, the ARRL asks that the FCC take "the timely opportunity to comprehensively update the call sign assignment system for the Amateur Service and thereby provide for the continued, steady growth of the Service. Without substantial administrative burden, such an updating will help to enhance the pride and satisfaction of licensees in their personal achievements in the radio art and their dedication to public service."

FCC News

♦**FCC Sends License Renewal for K1MAN to Administrative Law Judge**: The FCC has issued a *Hearing Designation Order* to determine, among other things, if the Amateur Radio license of Glenn A. Baxter, K1MAN, of Belgrade Lakes, Maine, should be renewed. According to the *Order*, "Baxter has apparently willfully and repeatedly engaged in unlawful Commission-related activities, including causing interference to ongoing communications of other amateur stations, transmitting communications in which he had a pecuniary interest, failing to file requested information pursuant to an Enforcement Bureau (Bureau) directive, engaging in broadcasting without communicating with any particular station and failing to exercise control of his station."

Baxter filed a timely renewal on July 22, 2005; his license expired on October 17, 2005. Because of the timely renewal, Baxter's license remained in effect past its expiration date. The FCC said it "believe[s] that Baxter's apparent continuing course of misconduct raises a substantial and material question of fact as to whether he possesses the requisite character qualifications to be and remain a Commission licensee."

♦ **FCC Cites Retailer for Marketing Amateur Radios as CB Radios**: In October 2010, an agent from the FCC's Enforcement Office visited Monroe, Michigan-based Doctor Radio's CB Shop to find that the store was selling, among other items, a radio that was described as "an Amateur Radio that could operate on CB frequencies" that was modified to operate above the approved power limits. As such, the FCC issued a *Citation* to the store on January 4 for marketing unauthorized radio frequency devices in the United States in violation of Section 302(b) of the Communications Act and Section 2.803(a)(1) of the Commission's rules.

The equipment in question includes a Cobra 150 GTL DX. A store employee explained to an FCC agent that the transceiver had been modified to generate 170 W of power. The store employee further explained that the Cobra 150 GTL DX was an Amateur Radio transceiver that could operate on CB frequencies. If legally operated, the 150 GTL DX operates from 28-29.7 MHz; the CB frequencies are 26.965-27.405 MHz. Section 95.655(a) of the FCC rules prohibit radios that can transmit on both the amateur and CB bands. According to the *Citation*, the Cobra 150 GTL DX "offered for sale at Doctor Radio had both CB and Amateur Radio capability and therefore cannot be sold in the United States."

The FCC advised Doctor Radio's CB Shop that if after receipt of the *Citation*, it violates the Communications Act or the Rules by continuing these sorts of sales, the FCC may impose monetary forfeitures of up to $16,000 for each such violation or each day of a continuing violation, and up to $112,500 for any single act or failure to act. In addition, violations of the Communications Act or the Rules can result in seizure of equipment through *in rem* forfeiture actions as well as criminal sanctions, including imprisonment.

Doctor Radio's CB Shop had until February 4 to respond to the *Citation*, either through a personal interview at the FCC's Farmington Hills, Michigan office, or via a written statement.

LOGBOOK OF THE WORLD NOW SUPPORTS VUCC

ARRL's Logbook of the World (LoTW) — an online system for amateurs to confirm two-way contacts that can be used for various ARRL awards — has been upgraded. Along with DXCC and the Worked All States (WAS) awards, it now supports awards based on Maidenhead grid squares, such as VUCC and the Fred Fish Memorial Award.

To take advantage of the new features, you need to log in to your LoTW account. (Don't have an LoTW account? Go to **www.arrl.org/instructions** to get started.) VUCC is an open-ended award in that hams can work on throughout their lifetime, just like

DXCC. But, like the WAS award, the VUCC rules require all the contacts to be made from a defined area. For VHF and UHF QSOs on 1296 MHz and below, this distance must be within 200 km on 1296 MHz and below. For SHF awards, contacts must be made from a single location, defined as within a 300 meter diameter circle. As such, the VUCC support in LoTW allows you to make the rule — or rules — necessary to find the QSOs in LoTW that satisfy the VUCC rules.

Getting Started with VUCC on LoTW

When you log in to LoTW, click on the "Awards" tab. Besides finding the buttons for DXCC and WAS, you will also find a VUCC button. If you wish to use LoTW for VUCC, click on "Create New VUCC Award Account." When you do, you'll see a box where you can name your account. You also have the opportunity to make this your default VUCC account. Click "Save account changes."

At this point, you can manually add QSOs by clicking on "Add a QSO Set to this VUCC account." If you click on "Add rule to QSO Set," this will add a rule that will select current and future QSOs to this VUCC LoTW account. You do not need to create separate accounts for each band which was used from any geographic location; LoTW will manage your band awards in each account for you. For example, your "home" location is grid square FN31, but you also operated portable from EL97. You will have to create two separate VUCC accounts so that the QSOs you made from EL97 are not credited to FN31.

Beyond these set-up procedures, the VUCC support functions operate much the way the WAS support in LoTW works: You are allowed to have multiple VUCCs, as long as they are from areas too far apart to be counted as one area. Most people will likely have one "home" or "primary" VUCC area.

What is Different?

■ ***No "hybrid" applications***: You can make as many LoTW applications as you want and you can make separate applications with paper QSLs. We will keep track. It is not necessary to have 100 grids confirmed in order to make an application, but of course, it is necessary to have 100 grids confirmed and applied in order to be awarded a certificate for 6 or 2 meters.

■ ***Payment rate structure***: Paper applications will cost more than LoTW applications. There are lower prices for ARRL members, but US stations must be ARRL members. There is no "range of prices" for LoTW credits (what you pay to use a QSL inside LoTW). The LoTW per-QSO fee is 16 cents for members and 20 cents for non-members. You will see all the prices when you go to apply for an award.

■ ***Credit for adjoining grid squares***: It is possible to give credit for up to four different grids using LoTW. This option is available for those who operate from "grid lines" and follow the rules for this set forth in VUCC and the Fred Fish Award.

It is possible to "link" your ARRL-affirmed list of grids — those grids that have already been accredited to your VUCC award. This means that you have already received a VUCC award and want that data to appear in LoTW. This is very similar to what you can do with DXCC in LoTW. Unfortunately, some of the older VUCC applications exist only on paper and will need to be entered into the system by ARRL staff. If you have not made a VUCC application since 2000, you may be in that group; please have patience as staff will not be able to enter that data for a while. Daily automated listings of VUCC standings by band — similar to the DXCC standings — will be online soon.

We invite you to take your time and enjoy the new tools. If you see matched QSOs and they are showing grids that you do not believe are correct, please let us know. We do check submitted grid data for accuracy, but there may be errors. You have final control over which of your confirmations you apply to your VUCC. If you believe someone has submitted QSO data with an incorrect grid square, please let both us and that station know. The originating station can fix his geographic data and resubmit the logs. Please have patience with our rollout of VUCC support. Questions can always be sent via e-mail to **lotw-help@arrl.org**.

ARRL AUDIO NEWS ONCE AGAIN AVAILABLE FROM ITUNES

The *ARRL Audio News* is once again available through iTunes. To download and subscribe to the *Audio News* at iTunes, log into your iTunes account and go to the ADVANCED pull-down menu. Click on SUBSCRIBE TO PODCAST, insert **http://www.arrl.org/arrlletter/audio/aan.rss** in the dialogue box and click OKAY. You are now subscribed!

If you had previously subscribed to the *ARRL Audio News* via iTunes, you should not have to redo these steps; episodes should appear in your podcast folder once you sync your device.

Of course, the *ARRL Audio News* is also available on the ARRL website at **www.arrl.org/arrl-audio-news** and via telephone at 860-594-0384. The *ARRL Audio News* is compiled, edited and produced in conjunction with each *ARRL Letter*, except during the Dayton Hamvention, Thanksgiving and other times as announced.

GENERAL MOTORS TURNS TO AMATEUR TO SOLVE ANTENNA PROBLEM

When General Motors — the world's second largest auto maker — encountered a problem with the AM/FM antenna on its 2011 Chevrolet Camaro convertible, it was at a loss as to what to do. Spy photographs showed a pre-production version of the car with a long whip-style antenna on its rear fender. After what GM called "an outcry among Camaro enthusiasts," the company decided to rethink the antenna. But how?

On hardtop Camaros, the antenna is integrated into the rear windshield, but given the disappearing nature of this car's roof, that wasn't possible on the convertible. So GM turned to two antenna engineers — Don Hibbard, W8DBH, and Gregg Kittinger — who were tasked with doing what some thought was impossible: concealing the AM/FM antenna without sacrificing radio reception, while not putting it inside the Camaro's windows.

Hibbard and Kittinger managed to find a way to bury the AM/FM antenna inside the spoiler perched on the car's rear deck lid. All that is visible is a shark fin antenna (used for satellite radio, OnStar and cellular signals), while the separate whip antenna — built into the spoiler — is used to receive AM and FM radio signals. Hibbard and Kittinger knew they had to find a way to preserve the vertical polarization of an AM/FM antenna, so they tried a few possibilities before coming up with the idea of placing the half-wavelength horizontal antenna in the spoiler. According to GM, this is a first.

A ham since 1977, Hibbard — the holder of an Advanced class license — is a self-described antenna nut, crediting his Amateur Radio background as a precursor for his love for antennas. He was first licensed when he attended Lansing Community College where he was studying electrical engineering. "One of my professors asked us in class if we would be interested in getting licensed," he told the ARRL. "We already knew the technical stuff from our college courses, but we settled in to learn Morse code, the FCC regulations

COURTESY GM

GM Antenna Validation Engineers Don Hibbard, W8DBH (see photo), and Gregg Kittinger came up with the idea to place the antenna in the rear spoiler, something that had never successfully been done before.

COURTESY GENERAL MOTORS

The 2011 Chevrolet Camaro convertible features its AM/FM radio antenna inside the spoiler, thanks to some ham ingenuity. The "shark fin" antenna is for satellite radio, OnStar and cellular signals.

and everything else you needed to know to become a ham."

After graduating, Hibbard went to work for General Motors in the electromagnetic compatibility (EMC) lab. A few years ago when a position in the antenna validation department opened, he jumped at the chance. "Through ham radio, I've always loved playing with antennas," he told the ARRL. "As hams, we are always building and experimenting. Sometimes at work, when I'm confronted with a problem, I say, 'I did such-and-such on an antenna for a ham band. I wonder if it will work here.' So my amateur experience with antennas has definitely come into play here at work."

The spoiler AM/FM antenna is an active antenna module that does all its impedance matching and amplification before the signal is sent back to the receiver. But when asked about the possibility of an amateur antenna in the spoiler, Hibbard just chuckled. "This antenna just receives, it doesn't transmit," he told the ARRL. "We can get away with a receive-only antenna in the spoiler. I'm not so sure about a ham antenna."

Hibbard said that the unorthodox placement of the antenna within the body of the vehicle created a number of technical challenges, such as balancing form by preserving the car's styling and maintaining unimpeded audio reception. "Where other automakers have tried and failed, Chevy succeeded," said Hibbard. "We hope to take what we've learned with the Camaro convertible, build on it and apply it to future vehicles."

Hibbard said that with work and kids in college, he has not found as much time as he would like to be active once again on the air; he counts 15 meters as his favorite band and SSB his mode of choice. "I really enjoy contesting, ARRL Field Day and the ARRL Sweepstakes," he said. "I also love experimenting and seeing what I can do. After all, I'm a ham."

In Brief

● **US Rep Greg Walden, W7EQI, Tweets News of His New Subcommittee Chairmanship**: When US Representative Greg Walden, W7EQI (R-OR), learned on December 16 that he will be chairing the House Subcommittee on Communications, Technology and the Internet when the 112th Congress convened in January, he let the world know about it by "tweeting" the news in Morse code. "Just the ham radio operator in me having fun," he posted to his official web page. The subcommittee has jurisdiction over interstate and foreign telecommunications including, but not limited, to all telecommunication and information transmission by broadcast, radio, wire, microwave, satellite or other mode.

US Representative Greg Walden, W7EQI (R-OR), was named Chairman of the House Subcommittee on Communications, Technology and the Internet for the 112th Congress.

ARRL Chief Executive Officer David Sumner, K1ZZ, was pleased to hear the news: "We're delighted that the subcommittee is in the hands of such a well-qualified chairman. Greg was an early cosponsor of HR2160, and while he may not always be able to agree with every ARRL position, we know his door will always be open to us."

● **ARRL Executive Committee Approves Grant for Five Schools**: In December 2010, the ARRL Executive Committee reviewed grant applications for the ARRL's Education & Technology Program (ETP), awarding equipment valued at nearly $5000 to five schools: Basehor-Linwood High School in Basehor, Kansas, Crenshaw Middle School in Canton, Ohio, Edward Bain School of Language and Art in Kenosha, Wisconsin, Old Towne Middle School in Ridgeland, Mississippi and Samsula Academy in New Smyrna Beach, Florida. More than 525 schools across the country have received support from the ETP in the form of grants for equipment, curriculum and resources, as well as teacher in-service training through the Teachers Institute on Wireless Technology. Applications for equipment and resource grants are accepted twice each year; application deadlines are May 1 and November 1.

A central goal of the ETP is to develop a foundation of wireless technology literacy among America's teachers and students. It employs Amateur Radio to explore radio science and electronics and provide hands-on activities that engage students' minds and imaginations, opening doorways into math, science and technology curriculum topics, as well as other core curriculum areas such as geography and language arts.

● **Former ARRL Canadian Director George Spencer, VE3AGS (SK)**: A. George Spencer, VE3AGS, passed away December 21, 2010. He was 90. Spencer served as ARRL Canadian Division Vice Director from January 1970-January 1974. In 1974 — upon the election of Canadian Director Noel Eaton, VE3CJ, as ARRL Vice President — Spencer moved up to the Director position and served one term. An engineer by training and profession, Spencer lived all across Canada. While on the ARRL Board of Directors, he was VE2MS and then VE4IM; he later became VE6AW before moving to Ontario.

● **Former Western Massachusetts Section Manager Bill Voedisch, W1UD (SK)**: William Voedisch, W1UD, of Leominster, Massachusetts, became a Silent Key on January 1. He was 78. Voedisch was an avid CW operator who especially enjoyed operating in the CW National Traffic System nets. In recent years, he was the Manager of the NTS First Region CW net and almost nightly represented the First Region in the Eastern Area Net. He was also active in the Transcontinental Corps, relaying messages to other regional nets around the country. Voedisch served several terms as ARRL Western Massachusetts Section Manager: from 1987 through 1989, in 1992 and 1993, and again from 1996 through 2005. An ARRL Life Member, he was the former president of the Montachusett Amateur Radio Association and remained active before his death.

Handheld Transceiver Go-kit

Scott R. Gothard, W6SRG, El Dorado County Amateur Radio Club and El Dorado County Amateur Radio Emergency Service
srgothard@yahoo.com

As an Amateur Radio operator who's serious enough to be an active part of a club, most of us (maybe all of us) have a handheld transceiver. This may have been the first radio you started with when you got your license. This is a more-than-adequate communications device, especially when access to repeaters is available. But performance and usability can always be improved (see Figure 1).

COURTESY SCOTT GOTHARD, W6SRG

Figure 1 — This is my entire handheld radio kit. Clockwise from top left: Mirage BD-35 dual-band amplifier, plastic storage box (1 of 2 to hold everything), rolled up "Slim Jim" J-pole antenna, parachute cord for mounting of J-pole antenna, extendable whip antenna, coax adaptors for radio, zip ties for mounting of J-pole antennas, belt pouch for handheld transceiver, pigtail coax adaptors, plug in speaker-microphone, cigarette lighter recharging chord for handheld radio and extension cable for amplifier. My handheld transceiver is shown in the center.

One of the first places to start is with an aftermarket antenna. While the flexible antenna that comes with handheld transceivers is certainly adequate to the job when operating relatively close to repeaters or within a short distance of others operating on simplex, a "whip" antenna can extend the range of communications. As an example, Comet Antenna provides a good product, with models having both BNC and SMA connectors.[1] While somewhat longer than the stubby flexible antenna your radio came with, these whip antennas are still of a workable length while the radio hangs on your belt. A bit of wire clipped to the bare base of the antenna can complete the dipole, assuming your antenna allows for such an arrangement.

I also carry two other antennas in my kit. One is a telescoping Diamond RH789 with an SMA-to-BNC adaptor that gives my handheld an antenna equivalent to the mobile antenna on my vehicle.[2] This can be really handy if you're in an isolated area and need to access a distant repeater. The other antenna I carry, which gives me an antenna loosely equivalent to a base station antenna, is a dual band "Slim Jim" antenna, a custom made J-pole made out of common ladder line, which the manufacturer will outfit with the appropriate connector for you.[3] This unit rolls up into a conveniently small package and, when unfolded, can be suspended from a nail or by a section of parachute cord tossed over a branch.

A plug-in speaker-microphone is also very useful. This way, you get to keep your radio on your belt, rather than having to take it out each time you transmit. Make sure you don't "ground out" your antenna with your body. In addition, if you mount your handheld transceiver on some kind of desktop cradle that allows it to sit up, you can use the speaker-microphone to turn it into a miniature "base station" radio, especially if you combine your handheld with an external amplifier.[4, 5]

In addition to the wall wart charging unit, I also have a vehicle recharger for my radio. You never know how long you'll be out in the field and away from a wall plug, so having the ability to recharge your radio in your vehicle is a virtual must.[6]

Another set of useful items to have along are a set of adaptors and a short "pigtail" extender that would allow you to attach your handheld transceiver to various types of transmission lines or antennas with connectors other than the style your radio uses. For instance, I use a handheld transceiver with an SMA connector that the antenna attaches to, so I have adaptors that include SMA-to-BNC and SMA-to-PL-259, as well as a "pigtail," a short section of RG-6 or RG-8 with a BNC connector on one end and a PL-259 connector on the other. This allows me to connect my handheld transceiver, by using an SMA-to-BNC adaptor and a "pigtail," to my Mirage BD-35 dual-band amplifier and use it as an alternate mobile or base station.

[1] **www.cometantenna.com**
[2] **www.hamcity.com/store/pc/viewPrd.asp?idcategory=306&idproduct=114**
[3] **www.n9tax.com/Slim%20Jim%20Info.html**
[4] **www.nifty-accessories.com** puts out a nice little unit for about $35.
[5] A good example would be the Mirage BD-35 dual band amplifier that boosts the 5 W signal from your handheld to approximately that of a mobile radio, 45 W on 2 meters and 35 W on 70 cm.
[6] This assumes you don't have some kind of inverter mounted in your vehicle or one that can insert into a lighter plug.

One last item to add to the list is some kind of small container to keep all of these items together in one place, as well as making it easy to pitch everything in your bug-out bag when you need to go somewhere quick.

AMATEUR RADIO SUPPORTS 2010 BANK OF AMERICA CHICAGO MARATHON

Rob Orr, K9RST
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At the 2010 Bank of America Chicago Marathon on October 10, more than 38,000 runners participated and thousands volunteered, including more than 100 volunteer Amateur Radio operators who provided communication support for the field medical teams.

The Bank of America Chicago Marathon is one of five marathons in the World Marathon Majors series, setting the standard for global marathon competitions. Runners from all 50 states and more than 100 countries set out each fall to achieve their personal goals.

A dozen local radio clubs provided over 105 volunteer ham radio operators to assist the Bank of America Chicago Marathon organizers at the 2010 event, providing critical communication services for medical and medical transport functions. Working with medical personnel at 21 aid stations (see Figure 2) along the 26.2 mile course, hams provided information to assist emergency dispatch (see Figure 3) and medical logistic information, helping coordinate transportation for runners who may have become ill or dropped out prior to reaching the finish line (see Figure 4).

During large scale public events, such as a marathon, runners as well as spectators may experience medical issues. In order to provide timely aid at the Marathon, medical tents are located every 1-2 miles along the route. Each tent has a licensed physician, multiple nurses and other medical staff present, including ambulance service. Participants in need are either treated in the on-course medical tents or are transported by ambulance to the Marathon's central medical location, or to a local hospital.

Hams are seated immediately adjacent to ambulance dispatchers and are paired with medical staff in and outside the tents. The hams communicate requests and status reports to the central medical location in Grant Park using up to seven different radio networks (see Figure 5) to ensure complete course coverage and redundancy in case of equipment problems. Hams also report on the status of runners who drop out of the event and require transportation back to Grant Park. *Photos by Don Motz, N9NYX.*

Figure 2 — Matt Mason, N2ZQO, and Dan Elekman, AA9NK, worked at Aid Station #5.

Figure 4 — Mark Klocksin, WA9IVH, operated as the net control station for the medical net.

Figure 3 — Craig Dieckman, KC9HWK, set up as the Ham Liaison to the Chicago Fire and Police Department.

Figure 5 — Don Whiteman, KK9H, is shown setting up the 220 MHz link to net control.

SOUTHEASTERN NEVADA FLOODING AND POWER OUTAGE

Glenn Hale, KB7REO, Southern Nevada DEC and Bill Smith, W7HMV, Clark County ARES/RACES EC

The weekend before Christmas saw southern Nevada and southwestern Utah inundated with record snow and rainfall for 3 straight days. The threat of severe flooding to cities and towns near the Virgin River in northeast Clark County, along with a power outage to Kyle Canyon on Mt Charleston, northwest of Las Vegas, on Tuesday evening, December 21, led the Clark County Office of Emergency Management to declare a state of emergency.

The Clark County Emergency Management Director, Irene Navis, requested activation of the Clark County ARES/RACES team, led by Bill Smith, W7HMV. Bill reported to the EOC, normally used as a training room, with his go-kit. The challenge presented was to establish viable communications with hams in Mesquite, Nevada, which is about 90 miles northeast of Las Vegas, and at the same time recruit members to bring their rigs to a police substation near Mt Charleston. Approximately 300 homes, one school and a restaurant/lodge were impacted by the power outage. Additionally, an imminent risk of avalanches was determined for a portion of the canyon, causing a delay in the power restoration efforts in that portion of the canyon. At the time of the activation, there was no estimated date for resolution of either incident.

On the evening of December 21, 2010, Ken Johnson, W7BES, ARES/MARS member received a call from Ed "Otto" Tune, KV7J, from Nevada State Department of Emergency Management (NvDEM) inquiring about amateur and/or MARS operators in the Mesquite area. This request was strictly for information and the gathering of situation reports from the affected area. Ken told Otto that there was an IRLP node in the Mesquite area and he would contact Nevada ARES Technical Coordinator Kent Johnson, W7AOR, about establishing communications circuits.

Kent reported, "My involvement was simply to assure we had an operator in Mesquite and to maintain operability of the IRLP/EchoLink servers (VoIP) that connect the State of Nevada from Mesquite to Carson City (Ophir Peak 441.650 repeater)."

The operator in Mesquite was Steve Hoff, K7AMP, who gave reports of sand bagging

Aiken Hams Support Anniversary Parade

On September 18, 2010, Aiken, South Carolina, had a city-wide celebration to honor the 175th anniversary of transportation in Aiken and for the grand opening of the Aiken Railroad Depot.

Amateur Radio operators (and ARES members) throughout the Aiken area were on hand to provide communications support for the festivities that included a parade. Mike Newland, K4NOP, helped to organize this public service event and the radio amateurs made extensive use of APRS to follow this moving event. Radio amateurs accompanied officials for the start of the parade lineup and they monitored the parade along its entire route. The net control station for the event was set up at the Emergency Operations Center's trailer located just north of the railroad depot. — *Kent Hufford, KQ4KK,* **kq4kk@arrl.net**

KENT HUFFORD, KQ4KK

Aiken County Amateur Radio operators provided communications support for Aiken's citywide celebration on September 18, 2010, which included the grand opening of the Aiken Railroad Depot. Notice their emergency communications trailer on the right.

activities on the Virgin River. Also, the Las Vegas Repeater Association, through the cooperation of Ralph Decker, N7TND, allowed ARES to access their closed system, which had a linked repeater in Mesquite.

A resource net was established by Dave Blankenburg, AK7DB, an ARES member, from his home, within 15 minutes of receipt of notice of activation by Clark County OEM on December 21, 2010, at 1900 hours local. Within an hour of notification, Bill Smith, W7HMV, Emergency Coordinator (EC), had his station operational at the EOC. At the request of the Incident Command Staff COM-L, another member, Jeff Green, KC7PK, was en route to the Emergency Communications Center (ECC) to act as a relief net control station.

Our county EOC is located in a classroom that has to be configured as an EOC. There is no permanent Amateur Radio station there, so we need to bring our own radios, power supply and antenna. The ECC is located in a separate building about a mile from the EOC and does have a permanent ham station with generator backup. That night we were released at 2100 and asked to return at 0730 the next day, Wednesday, December 22.

In the morning, it was still raining on and off and concerns grew about floods in Mesquite and Overton, Nevada. Jay Peskin, KE7EGO, manned the ECC all day on Wednesday. Unfortunately, we had only two hams, Charlie Lum Kee, KH6AB, and Steve Hoff, K7AMP, located in Mesquite, who were able to provide the EOC with intermittent reports. There was no ham radio presence within the Mesquite EOC.

Also, on Wednesday morning at the request of our COM-L, we provided an operator to a police substation located on the approach to Mt Charleston for the duration of that incident, to serve as a relay station in the event that power-company crews could not communicate with their dispatch center within the canyon. We were able to provide an operator, namely, Vern Garman, KØEGA, who volunteered and brought his own gear to that facility and stayed all day Wednesday until sundown.

Adding to the complexity of restoring power to the mountain was the risk of avalanches, particularly in the Echo Canyon subdivision. On Wednesday afternoon, the OEM issued an avalanche warning and a voluntary evacuation advisory. This resulted in search and rescue team members going door-to-door in Echo Canyon recommending that occupants evacuate.

"Our primary task at that location was to provide cache radios to the NV Energy crews working multiple line breaks in the Kyle Canyon area. Once the radios were distributed, I was to forward any necessary traffic to the appropriate people," according to Vern.

It was too dangerous for the NV Energy crews to work at night due to the adverse weather and huge amount of snow. We were released at 1800 because of a lack of activity on the mountain and because the river level was not as high as originally forecast and the flooding conditions were under control.

Vern, KØEGA, returned to the substation on Thursday morning (December 23) and found that the crews were trying to get a revised assessment of the avalanche danger. Forestry department people went to Echo Canyon to check out the avalanche situation. It was determined that some minor sliding had occurred and that the possibility for more was there.

At 0800 on Thursday, Bill, W7HMV, reconvened in the EOC and was greeted with the good news that we had clear, sunny skies, the flood threat had diminished significantly and the road crews had cleared a lot of roads overnight enabling good access for the power company crews on the mountain in all areas except Echo Canyon, where a risk of avalanche still remained, albeit to a lesser degree.

Mountain residents were not heavily utilizing the shelter at a nearby school. Additionally, the OEM was advised that the avalanche risk had subsided to the point that the prior avalanche warning was downgraded to a lesser status. With respect to the NV Energy crews, "It was determined that calls from the field would have to be made on the mutual aid repeater to be heard from the Echo Canyon area. Since the mutual aid repeater can be heard all over the valley it was decided that our service there could be terminated and calls on mutual aid handled from other locations," according to Vern, KØEGA.

All signs were good and we were released at noon on Thursday, when the EOC went to a Level One status.

With acknowledgment and thanks to: Ken Johnson, W7BES, FEMA DAE, MARS AFA9KJ; Kent Johnson, W7AOR, Nevada Section TC; Bill Smith, W7HMV, Clark County ARES/RACES EC; Jay Peskin, KE7EGO, ADEC, AEC City of Henderson; Charlie Lum Kee, KH6AB, ARES and CERT Mesquite, Nevada; Steve Hoff, K7AMP, ARES Member, Mesquite, Nevada; Vern Garman, KØEGA, ARES member Las Vegas, Nevada.

OP-ED

Preserving What We Have

Bruce Filbeck, N5ASU

Have you recently stopped to think what a many-faceted hobby we enjoy? Compared to other hobbies, Amateur Radio allows us to each find our own "niche" — sometimes to the exclusion of nearly everything else related to radio. The only truly common thread can be loosely described as involving some sort of wireless communication with others who are beyond the range of our sight and voice.

This "many-hobbies-in-one" situation gives each of us the chance to concentrate on the portions of radio communication that we find most interesting and enjoyable. One of the nicest things about it is how well we get along with each other. Oh, sure, sometimes the ragchewers and the contesters get on each other's nerves. And, occasionally a new or uninformed ham messes up a satellite pass for someone in one of the OSCAR sub-bands. For the most part, however, we are a group of gentlefolk who try our best to see that we do not tread on someone else's toes.

It is this feeling that we all share something that separates us from those who are "non-hams" In fact, this attitude of seeing other hams as "family" is rare among enthusiasts of other hobbies. Even though most other hobbyists share a common interest, they don't seem to share the common bond that Amateur Radio operators share with one another.

I recently returned to Amateur Radio after a hiatus of several years and found that, as expected, technology had progressed considerably, and many new aspects of the hobby were available for my investigation. But the closeness of the fraternity had not diminished at all.

Perhaps the epitome of this feeling is found on the many ragchew nets that meet daily. A couple of years ago, I became active in a 2 meter traffic/ragchew net that meets on the air six days a week. Most sessions last a half hour or so. Who, beyond your immediate family, do you spend actively communicating with for three hours a week? Perhaps your coworkers, but at work the topics of discussion are generally limited to business rather than personal chats. On ragchew nets, the information that is passed back and forth is frequently mundane — weather, daily activities and Amateur Radio top the list. However, after you listen to your friends (and these folks truly become your friends) sharing their daily lives with you every day, you find they are really sharing their hopes, their dreams and their philosophy of life.

"In a world society that seems to overflow with contention, conflict and division, it is refreshing to have our little on-the-air oasis of peace, friendship and calm."

Ragchew nets are found on many bands but the nature of the 2 meter band with its FM repeaters is such that most of the net members are within an area of two or three counties. Furthermore, within the footprint of the repeater, it is generally noise free. These conditions tend to make these nets more "intimate" than HF nets. It is like chatting with someone in your living room — no concerns about static and propagation.

This past March, one of our longtime net members, Frank Warsalla, K8MFK, was diagnosed with lung cancer and within a few short weeks became a silent key. Many net members and other hams, some of whom had never met Frank in person, attended memorial services and his funeral. In November another local ham, Hank Kohl, K8DD, passed away after a lengthy hospital stay. The outpouring of concern for his daily condition and the widespread sorrow over his passing demonstrated that the connections of our ham radio family are national and even international in scope.

Losing each of them felt, to me, more like the passing of a family member than a friend. Both will be long remembered by their Amateur Radio family — many of whom they had met only on the air.

In a world society that seems to overflow with contention, conflict and division, it is refreshing to have our little on-the-air oasis of peace, friendship and calm. Ours is often a world where another's race, religion and politics are unknown, and therefore do not even have a chance to get in the way of us enjoying each other's conversation.

Let us frequently remind ourselves of this fine thing we have and each do our individual best to preserve it.

Bruce Filbeck, N5ASU, an Extra class licensee and ARRL member, was first licensed as a Technician in Texas in 1977. His amateur interests are varied but he is particularly interested in traffic handling, rag chewing and learning new operating modes. He is a Volunteer Examiner and enjoys finding ways to interest newcomers in Amateur Radio. He can be reached at **n5asu@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

ON ETHICS

Part of my job is to look for contesters who decide to break the rules and gain an unfair advantage over the competition. This is nothing new, of course; seeking an edge has been going on since time immemorial. During the Civil War, members of one Confederate company would have louse races by placing them on two plates, and whichever louse jumped off their plate first would win. One gent kept winning; after a perplexingly long winning streak, it was discovered he was heating his plate before competition.

I would prefer even to fail with honor than to win by cheating." — Sophocles

Each event has entry categories for you to declare your style of operating. When you choose your category, you make an agreement to abide by the limitations set forth in the entry category. For example, if you choose to enter the ARRL DX Contest as Single Operator Low Power, you agree that you will keep your transmit power under 150 watts and you will not use spotting assistance, such as DX Summit or other sources of info on the Internet that tell you where other stations are currently transmitting. If you don't wish to agree to those terms, there are other entry categories for you to choose that will accommodate your operating style, such as Single Operator Assisted. Read the rules for each event so you understand the entry categories and choose your category based on your preferred style of operation.

"Dilemmas, Dilemmas…"

It's Sunday afternoon of ARRL Sweepstakes. You've been working your tail off as a Single Operator entrant with no spotting assistance allowed. Despite your best efforts, you are stuck with 79 of 80 sections, just one away from the elusive Clean Sweep. You simply have not been able to find that last multiplier. The thought enters your mind to check DX Summit to see if that last section you need has been spotted recently…

I hear from several operators every year after Sweepstakes that find themselves in this predicament. What to do? If you don't look up the last section on the Internet, you might not get the Clean Sweep; if you do; you've just broken the rules of your category to not use spotting assistance. If you decide to use spotting, understand that you're changing your entry category as a result.

"But Nobody will Know…"

The worst thing you could do in the situation above is to use spotting assistance and submit a log in a non-assisted category. This is wrong on so many levels:

A) You're lying to yourself and other competitors about your efforts.

B) If you win a certificate as a result, you've denied a legitimate competitor your ill-gotten victory.

C) You will be caught…this can lead to various penalties, up to and including disqualification from the event. Most contest organizers publish the calls of disqualified stations for all to read.

What does "Assistance" mean, anyway? Assistance means you received call signs, frequencies, or information sent in the contest exchange from a source other than yourself using the bands and modes on which the contest is conducted. This includes having a friend tell you over the air where a needed multiplier is or getting the information via email from your club's reflector. Assistance does *not* include your spouse bringing you a sandwich while you're running stations on 20 meters.

Be sure that you understand what Single Operator means, too. If you have a friend that logs while you make the QSOs, you're a Multi-Operator entrant, not Single-Operator.

"Should I Not Have Done That?"

Cheating can take on various forms. Using spotting assistance when you claim you didn't, using more than one operator when claiming you are a single operator, transmitting with more power than you claim, adjusting the times of your QSOs in your submitted log to comply with band changes or off-time restrictions (known as "rubber clocking"), and a host of other methods. Thanks to modern computer technology (and the eyes of some amazing log checkers), cheating is detectable.

"There is No Honor Among Thieves"

The largest consequence of cheating is that, once caught, you will be branded a Cheater. That reputation will stay with you long after the event is over. This will affect who will operate with you, what stations you may (or may not) be asked to operate from, and who will buy you a frosty malt at the next club meeting. When tempted to stray over to the Dark Side, ask yourself if the award certificate, plaque or "bragging rights" is worth sullying your reputation for the remainder of your time as an Amateur Radio Operator.

There are numerous gray areas that I don't have the column space to cover. For me, my conscience keeps me in check when nobody else is around. I will know when I cross the line, and I would be reminded of that every time I looked at my award certificate for my efforts.

Randy Thompson, K5ZD, participates in Contest University (**www.contestuniversity.com**) at Dayton every year. His presentation on Contest Ethics is nothing short of amazing. If you're serious about contesting, attend Contest University; Randy's talk on ethics is worth the price of admission alone.

Contesting is a sport, just like many other competitive events. There will always be people that try to game the system; don't become one of those people. Develop your skills, improve your station as your budget allows and earn your victories justly. Remember: Victory, like good food, tastes much better when not filled with artificial ingredients.

Read "HF Contesting – Good Practices, Interpretations & Suggestions" at www.arrl.org/hf-operating-guidelines.

Sean's Picks

- **State QSO Parties this month**: Idaho, New Mexico, North Dakota, Oklahoma, Virginia, Wisconsin
- **ARRL International DX Contest, Phone (Mar 5-6):** 48 hours of SSB DX goodness. Send a signal report and your state or province; DX stations send a signal report and output power. DXCC in a weekend? You bet!
- **QRP ARCI HF Grid Square Sprint (Mar 12):** A 3 hour contest for the low-low-power buffs. Send your Maidenhead grid square and your ARCI member number, or power output if not a member. The lower your power, the bigger your score multiplier!
- **North American Sprint, RTTY (Mar 13):** 4 hours of RTTY fun. Make no more than 2 QSOs on the same frequency, then you must QSY. This one is really growing in popularity!
- **BARTG HF RTTY Contest (Mar 19-21):** More RTTY fun! Everybody works everybody in this excellent event. Are you on the digital modes yet? If not, why not?
- **CQ WPX Contest — SSB (Mar 26-27):** Prefixes are the thing to chase in this worldwide contest. Exchange is a signal report and a sequential serial number. Visit **www.cqwpx.com** for complete info.

CONTEST CORRAL

in association with the *National Contest Journal*

MARCH 2011

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site or Contact
Mar 1, 1900Z - Mar 1, 2100Z	3.5		YL CW Party		✘		RST, serial, if YL "YL," name	www.agcw.org
Mar 4, 0230Z - Mar 4, 0300Z	1.8-14		NS Weekly Sprint		✘		Serial, name, and S/P/C	www.ncccsprint.com/rules.html
Mar 5, 0000Z - Mar 6, 2400Z	**1.8-28**		**ARRL Int'l Phone DX Contest**	✘			**RS and state, province, or power**	www.arrl.org/contests
Mar 5, 2200Z - Mar 6, 1200Z	1.8-28		Open Ukraine RTTY Championship			✘	Regional abbreviation and serial	www.urdxc.org
Mar 8, 0200Z - Mar 8, 0400Z	3.5-28		ARS Spartan Sprint		✘		RST, S/P/C, and power	www.arsqrp.blogspot.com
Mar 9, 1100Z - See website	3.5-14		CWops Monthly Mini-CWT Test		✘		Name and member number or S/P/C	www.cwops.org/onair.html
Mar 9, 2300Z - See website	7,14		John Rollins Memorial DX Contest		✘		RS, name, and S/P/C	www.antiquewireless.org
Mar 12 , 0000Z - Mar 13, 2400Z		144, 10G+	Worldwide EME Contest	✘	✘		TMO/RS(T) and "R"	www.dubus.org
Mar 12, 1000Z - Mar 13, 1000Z	3.5-28		RSGB Commonwealth Contest		✘		RST and serial (Commonwealth only)	www.rsgbcc.org/hf/calendar10.shtml
Mar 12, 1400Z - Mar 12, 2000Z	3.5-28		AGCW QRP Contest		✘		RST, serial, class, AGCW number or NM	www.agcw.org
Mar 12, 1500Z - Mar 12, 1800Z	3.5-28		QRP ARCI HF Grid Square Sprint		✘		RST, 4-digit grid square, QRP ARCI number	www.qrparci.org
Mar 12, 1600Z - Mar 13, 1600Z	3.5-28		EA PSK31 Contest			✘	RST + serial or EA province	www.ure.es
Mar 12, 1900Z - Mar 13, 1900Z	1.8-28	50-440	Idaho QSO Party	✘	✘	✘	RS(T) and S/P/C	www.nx7tt.com
Mar 13, 0000Z - Mar 13, 0400Z	**3.5-14**		**North American RTTY Sprint**			✘	**Both call signs, serial, name, and S/P/C**	www.ncjweb.com
Mar 13, 1800Z - Mar 14, 0100Z	3.5-28	50+	Wisconsin QSO Party	✘	✘	✘	WI county or S/P/C	www.warac.org
Mar 15, 1700Z - See website	3.5-28		CLARA and Family HF Contest	✘	✘		RS(T), name, QTH, and CLARA	www.claranet.ca
Mar 17, 0030Z - Mar 17, 0230Z	3.5-14		NAQCC Monthly QRP Sprint		✘		RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
Mar 19, 12 PM - Mar 19, 2 PM	1.8-28		Feld-Hell Rolling Sprint			✘	RST, QTH, Feld-Hell number	www.feldhellclub.org
Mar 19, 0001Z - Mar 19, 2359Z	28		10-10 Mobile QSO Party	✘	✘	✘	Call, name, county & S/P/C, 10-10 number	www.ten-ten.org
Mar 19, 0200Z - Mar 21, 0200Z	3.5-28		BARTG HF RTTY Contest			✘	3-digit serial and 4-digit time	www.bartg.org.uk
Mar 19, 0500Z - Mar 19, 0800Z	1.8 - 7		OK1WC Memorial Contest	✘	✘		RS(T) and serial	www.hamradio.cz/ok1wc/
Mar 19, 1200Z - Mar 20, 1200Z	1.8-28		Russian DX Contest	✘	✘		RS(T), serial or oblast abbr	www.rdxc.org
Mar 19, 1300Z - See website	3.5-28	50	Oklahoma QSO Party	✘	✘	✘	RS(T) and OK county or S/P/"DX"	www.okdxa.org
Mar 19, 1800Z - Mar 20, 1800Z	1.8-28	50,144	North Dakota QSO Party	✘	✘		RST and ND county or S/P/C	www.w0cq.com
Mar 19, 1800Z - Mar 21, 0100Z	1.8-28	50-440	Virginia QSO Party	✘	✘	✘	Serial and VA county/city or S/P/C	www.qsl.net/sterling
Mar 26, 0000Z - Mar 27, 2400Z	1.8-28		CQ WPX SSB Contest	✘			RS and serial	www.cqwpx.com

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

In the March/April "Contesting 101"

Kirk, K4RO, goes over the basics of antennas and propagation for contesting. Contesting 101 can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

On-Air Skills — Technical Knowledge
Understanding Propagation
Worldwide Friendship
Amateur Radio Contesting

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March 2011 W1AW QUALIFYING RUNS

W1AW Qualifying Runs are 10 PM EST Friday, March 4 (0300Z March 5) (10-40 WPM) and 7 PM EDT (2300Z) Tuesday, March 15. The West Coast Qualifying Run will be transmitted by station K6KPH on 3581.5, 7047.5, 14047.5, 18097.5, 21067.5 kHz at 2 PM PST (2200Z) Saturday, March 12. Unless indicated otherwise, speeds are from 10-35 WPM.

2010 ARRL September VHF QSO Party Results

Lots of competition, fun and some exciting moments.

Jeff Klein, K1TEO
wa2teo@aol.com

ARRL VHF+ contesting for 2010 is now in the history books. The January contest saw a nice uptick in log submissions while June was an all-time record breaker with 6 meters wide open for extended periods across much of North America. Amazing QSO and grid totals indicated that when band conditions cooperate there is plenty of VHF+ contest activity.

Would the September contest (September 11-13) keep the trend going? In general, band conditions were not all that great with the exception of some nice "tropo" (tropospheric enhancement) in the Midwest. As it turned out it, activity decreased in virtually all operating categories with 488 log submissions this year versus 595 in 2009. Most importantly, the number of Rover logs was down significantly with a major impact on the number of contacts and grids available to all operators.

Tropospheric Enhancement

One challenge with VHF+ contesting is that many operators are fairly casual about their efforts. They often get on at the beginning to give out points and then either stop operating or only listen in from time to time. An opening like the one on Sunday morning in this past September's contest, though, may be over before the casual operators get on to check the band.

Sharp operators know how to find the brief tropo enhancements even under average conditions. Record-setting QRP Portable op N6NB was frustrated early, but late in the contest there was a little bit of lift that allowed him to achieve his high score. Likewise, Multioperator winner K1WHS found the briefest of enhancement periods to work some long-haul microwave contacts from Maryland, helping them to just squeak by W2SZ.

Many contesters use the Hepburn Tropo maps from **www.dxinfocentre.com** to predict tropo conditions during contests. The Hepburn prediction for Saturday was for enhancement from Kansas and Oklahoma east to Illinois and as far as western Tennessee. Sunday morning's map looked even better. Sure enough, N4QWZ in Tennessee noted working into Oklahoma and up to K2DRH in Illinois through 1296 MHz.

Single-Operator, Low Power

K1TR	178,715
K2DRH	169,740
W3SZ	119,301
W3PAW	102,810
K1KG	66,780
N4QWZ	60,941
AF1T	60,200
W3IP	47,047
N3RN	43,461
K2KIB	41,664

Single-Operator, High Power

K1TEO	388,080
WA2FGK (K2LNS, op)	325,208
K1RZ	246,688
W8ZN	100,497
K8TQK	90,134
K3CB	77,674
N3HBX	61,476
VE3ZV	60,759
K3TUF	50,949
W2SJ	42,738

QRP Portable

N6NB	266,192
KA1LMR	41,400
K9GY	12,740
NØJK	4,361
KB5WIA	900
W7RDP	896
KC8KSK	528
K6BSR	490
AB1MI	242
KX9X	200

Limited Multioperator

W3SO	188,232
W4NH	112,504
W4IY	110,600
KA2LIM	91,256
W2LV	81,812
AA4ZZ	75,504
K2BAR	57,672
W1QK	21,830
WO9S	20,175
VA7ISL	16,422

Multioperator

K1WHS	1,159,924
W2SZ	1,141,254
KBØHH	140,430
K5QE	124,320
W2EA	81,548
N9UHF	27,825
K4EJQ	25,912
K3EOD	25,359
W4MYA	21,804
WY3P	18,900

Rover

KK6KK/R	252,195
W6XD/R	248,178
N6HC/R	244,608
W6TE/R	238,260
WB6BFG/R	236,640
N6HD/R	228,900
N6VI/R	221,367
KJ6CNO/R	202,950
VE3SMA/R	109,440
VE3OIL/R	98,736

Limited Rover

K9JK/R	11,592
AF6AV/R	10,368
N6ZE/R	4,968
K4AMK/R	4,485
N6ORB/R	4,230
K8MAD/R	3,630
WR8W/R	3,450
AB1GF/R	2,640
K7TM/R	2,047
ABØYM/R	1,975

Unlimited Rover

W1RT/R	85,028
WA3PTV/R	67,609
NV6C/R	4,158
KRØVER/R	4,154
KCØP/R	2,640
N4GER/R	2,016
AA5JG/R	836
K1MAP/R	578
NØHZO/R	510

KBØHH in Oklahoma managed to work as far east as Alabama on Sunday, as far west as central Colorado, and up to K2DRH in Illinois. QRP station NØJK found the opening and managed to work many contacts beyond normal coverage range.

Fun, Fun, Fun

We all operate contests to have fun. There are many ways to have fun and September is often a time when the weather is great for heading outdoors. Quite a few participants had their fun combining a good hike with contesting. KD7WPJ hiked up an 11,800 foot mountain carrying equipment for three bands. Five hours operating on the summit followed by a three-hour descent made for a great day. In Washington, W7RDP headed up to a fire lookout to operate. With a fantastic view of Mt Rainier it was hard to focus on the operating while enjoying the view. The ARRL's Contest Manager, Sean, KX9X, took a nice hike Saturday afternoon to a Connecticut high point, too.

Another way to have fun is to make station improvements and give them a workout during a contest. The KA2LIM group in New York added omnidirectional antennas this time to better search for stations and had fun trying them out in the contest. KD5IKG/R added a new band before the contest (432 MHz) and another one during the contest (222 MHz). He did not find great activity overall but still had lots of fun handing out contacts and trying out the new bands. AB1GF/R decided to build a bigger setup after his first-ever rove in the June contest. He added a 28 foot tower to his rover setup.

When the band conditions do not cooperate there are other modes available to help the score and increase the fun. With the availability of *WSJT*, EME operation has become much easier for smaller stations. The

Regional Leaders

A = Single Operator, Low Power; B = Single Operator, High Power; Q = Single Operator, QRP Portable; L = Limited Multioperator; M = Multioperator; L = Limited Multioperator; R = Rover; RL = Limited Rover; RU = Unlimited Rover

Northeast Region
(New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

K1TR	178,715	A
W3SZ	119,301	A
W3PAW	102,810	A
K1KG	66,780	A
AF1T	60,200	A
K1TEO	388,080	B
WA2FGK (K2LNS, op)	325,208	B
K1RZ	246,688	B
K3CB	77,674	B
N3HBX	61,476	B
KA1LMR	41,400	Q
AB1MI	242	Q
KX9X	200	Q
KC2JRQ	55	Q
W3SO	188,232	L
KA2LIM	91,256	L
W2LV	81,812	L
K2BAR	57,672	L
W1QK	21,830	L
K1WHS	1,159,924	M
W2SZ	1,141,254	M
W2EA	81,548	M
K3EOD	25,359	M
NE1B	10,374	M
NN3Q/R	62,522	R
K2QO/R	62,127	R
KB1EKZ/R	45,780	R
WA2IID/R	31,348	R
W1AUV/R	29,946	R
K9JK/R	11,592	RL
AB1GF/R	2,640	RL
W1RT/R	85,028	RU
WA3PTV/R	67,609	RU
K1MAP/R	578	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

N4QWZ	60,941	A
W3IP	47,047	A
WB8TFV	13,130	A
K4FJW	8,008	A
W4XP	4,720	A
W8ZN	100,497	B
W4WA	40,656	B
KE2N	36,696	B
K4QI	30,302	B
KG5MD	12,720	B
K9GY	12,740	Q
KC8KSK	528	Q
W4NH	112,504	L
W4IY	110,600	L
AA4ZZ	75,504	L
K1KC	3,367	L
K4EJQ	25,912	M
W4MYA	21,804	M
WY3P	18,900	M
N4JQQ	13,050	M
W4YCC	3,300	M
AG4V/R	23,236	R
N4OFA/R	20,679	R
W4WNT/R	78	R
K4AMK/R	4,485	RL
AD4IE/R	864	RL

Central Region
(Central and Great Lakes Divisions; Ontario Section)

K2DRH	169,740	A
WZ8T	15,714	A
KC9BQA	14,076	A
K8MR	10,850	A
N9LB	9,333	A
K8TQK	90,134	B
VE3ZV	60,759	B
K9EA	42,237	B
K8MD	41,418	B
WØUC	32,118	B
K9PLS	78	Q
W9LGP	50	Q
WO9S	20,175	L
N2BJ	3,810	L
N9TF	3,094	L
KA9RSL	143	L
KI4OIP	16	L
N9UHF	27,825	M
KB8O	17,940	M
VA3WLD	4,608	M
W8RU	2,856	M
VE3SMA/R	109,440	R
VE3OIL/R	98,736	R
W9SNR/R	48,594	R
W3USA/R (K8MR, op)	924	R
K8MAD/R	3,630	RL
WR8W/R	3,450	RL
K8DOG/R	1,280	RL
VE3RKS/R	648	RL
N4GER/R	2,016	RU

Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

NØLL	38,090	A
W6ZI	29,606	A
ABØRX	7,936	A
WAØARM	4,794	A
K5YM	3,325	A
WQØP	37,932	B
K5LLL	26,572	B
WØLGQ	13,275	B
WØRT	10,640	B
WØEEA	7,810	B
NØJK	4,361	Q
N7QF/7	117	Q
KD7WPJ	77	Q
KØSIX	10,780	L
NØLD	4,094	L
WD5IYF	3,219	L
KBØHH	140,430	M
K5QE	124,320	M
NR5M	6,780	M
W9FZ/R	97,519	R
K5GJ/R	22,880	R
KAØKCI/R	14,352	R
WRØI/R	13,970	R
WBØLJC/R	294	R
ABØYM/R	1,975	RL
KD5IKG/R	1,850	RL
KK6MC/R	1,550	RL
AF5Q/R	1,197	RL
K5MRA/R	1,166	RL
KRØVER/R	4,154	RU
KCØP/R	2,640	RU
AA5JG/R	836	RU
NØHZO/R	510	RU

West Coast Region
(Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

W6AQ	10,745	A
K6TSK	8,865	A
AF6RR	6,697	A
K6XN	6,660	A
W6YLZ	3,116	A
N7EPD	17,280	B
KC6ZWT	13,988	B
W7MEM	5,408	B
W7FI	5,304	B
KB7ME	5,000	B
N6NB	266,192	Q
KB5WIA	900	Q
W7RDP	896	Q
K6BSR	490	Q
VA7ISL	16,422	L
N7CKJ	2,100	L
KE6GFF	715	L
WB6CZG	312	L
WB6W	10,824	M
WA6KLK	6,552	M
WA1PMA	126	M
KK6KK/R	252,195	R
W6XD/R	248,178	R
N6HC/R	244,608	R
W6TE/R	238,260	R
WB6BFG/R	236,640	R
AF6AV/R	10,368	RL
N6ZE/R	4,968	RL
N6ORB/R	4,230	RL
K7TM	2,047	RL
K6JRA/R	1,083	RL
NV6C/R	4,158	RU

K5QE group managed to work 95 grids on 2 meters, many obtained by EME. Single-Op WA2FGK also made use of the Moon to help his score and have some fun when terrestrial activity was slow.

Single-Operator Categories

A total of 250 stations submitted logs in the Single-Operator, Low Power (SOLP) category, while 106 entered the High Power (SOHP) competition. SOLP has seen some great competitions between Ed, K1TR and Bob, K2DRH over the last several years. This year 'TR narrowly edged out 'DRH, with 178k to 169k points. Bob used a combination of the enhanced conditions in the Midwest on Sunday morning and a terrific station to work 91 more grids than Ed. Operating portable from Mount Wachusetts in Massachusetts, 'TR countered with much higher QSO totals (681 versus 429) and benefited from having two bands — 5 and 10 GHz — that Bob does not have. Ed worked more stations than other Single-Operator, high or low power, on 6 meters and was near the top in QSOs on most other bands. Congratulations to both ops for some great results!

In SOHP category, despite a slightly lower score in 2010, WA2FGK finished a good deal closer to the leader, K1TEO. Herb, 'FGK, added to his excellent grid totals with effective use of *WSJT* (Weak Dignal Software by K1JT) for scatter contacts on 6 and 2 meters, and added some on EME as well. Dave, K1RZ was third with a very good score of 246k.

Affiliated Club Competition

Medium Club Category

Southern California Contest Club	17	2,172,895
Potomac Valley Radio Club	23	899,786
North East Weak Signal Group	18	640,712
Mt Airy VHF Radio Club	15	407,084
Contest Club Ontario	11	305,021
Yankee Clipper Contest Club	10	234,431
Society of Midwest Contesters	15	231,629
Nacogdoches ARC	3	126,702
Rochester VHF Group	3	93,977
Carolina DX Association	5	81,018
Pacific Northwest VHF Society	22	64,636
Tennessee Contest Group	3	60,977
Roadrunners Microwave Group	3	52,138
Northern Lights Radio Society	7	50,639
Mad River Radio Club	7	22,899
Northern California Contest Club	8	21,606
Frankford Radio Club	3	18,904
North Texas Microwave Society	4	4,147
CTRI Contest Group	3	3,146
Arizona Outlaws Contest Club	5	1,436
Alaska VHF-UP Group	5	413

Local Club Category

Murgas ARC	4	375,949
Badger Contesters	9	116,651
Bristol (TN) ARC	5	38,558
Stoned Monkey VHF ARC	3	27,953
Florida Weak Signal Society	7	17,667
Eastern Connecticut ARA	3	15,934
Portage County Amateur Radio Service	4	558

QRP Portable Operation

Wayne, N6NB lapped the field of 15 entries as he broke K9PW's long-standing category record with 266k points, operating from a mountaintop location at 6800 feet in DM05. An associated group of pack rovers provided the majority of his QSOs and grids as they worked him on as many as 10 bands each from each grid. Clearly this was a very effective strategy as even with QRP power Wayne's score was higher than all but two Single-Operator scores.

Placing second was KA1LMR with a fine 41k, followed by K9GY with 12k. Eric showed that even a simple setup in a good location can do quite well as he ran an FT-817 into 4 elements on 2 meters, 3 elements on 432, and a Hamstick on 6 meters. Of course it helps to be on Skyline Drive in Virginia at 3500 feet!

Multioperator Categories

Despite a drop in score, the W3SO team

Top Ten Band-By-Band Breakdown by Entry Category

Numbers in each column show total QSOs/total mults

Single-Op High Power

Call	50	144	222	432	902	1296	2304+	TOTAL
K1TEO	171/40	290/51	99/35	126/37	49/18	62/19	85/45	882/245
WA2FGK	150/43	157/51	85/31	89/31	48/17	40/15	108/48	686/236
K1RZ	175/44	164/40	62/26	82/29	34/14	43/16	82/39	642/208
W8ZN	65/21	123/21	45/22	67/22	17/7	24/11	47/24	388/139
K8TQK	60/38	108/51	49/32	46/32	15/13	21/17	4/4	303/187
K3CB	56/25	69/24	35/21	46/24	22/13	22/15	32/20	282/142
N3HBX	165/29	139/30	45/20	64/24	0/0	14/6	0/0	427/109
VE3ZV	36/16	65/33	42/25	50/24	18/13	12/6	24/12	247/129
K3TUF	57/20	72/23	41/18	48/20	10/7	26/13	11/10	265/111
W2SJ	28/13	45/17	31/14	32/15	18/10	22/12	25/21	201/102

Single-Op Low Power

K1TR	208/28	176/27	67/21	104/22	32/21	45/13	49/30	681/155
K2DRH	103/52	134/60	53/37	80/44	22/21	27/22	10/10	429/246
W3SZ	82/20	92/19	55/17	69/19	26/11	31/10	76/37	431/133
W3PAW	115/30	88/29	44/21	52/23	23/12	22/12	40/22	384/149
K1KG	72/18	99/21	38/15	51/14	19/9	28/8	35/21	342/106
N4QWZ	56/25	90/41	40/28	54/31	12/12	14/12	0/0	265/149
AF1T	101/15	115/18	45/12	56/10	20/7	26/7	36/17	399/86
W3IP	90/18	125/23	32/14	62/21	18/7	20/8	0/0	347/91
N3RN	87/23	78/25	46/20	52/20	0/0	26/11	0/0	289/99
K2KIB	41/16	83/21	28/12	34/15	12/6	20/9	26/14	244/93

Single-Op QRP Portable

N6NB	90/16	123/19	86/13	95/16	64/11	83/13	270/39	811/127
KA1LMR	115/16	109/18	43/12	64/15	18/7	20/7	0/0	369/75
K9GY	79/19	76/18	0/0	45/15	0/0	0/0	0/0	200/52
NØJK	9/9	32/20	0/0	24/20	0/0	0/0	0/0	65/49
KB5WIA	8/6	17/8	0/0	10/6	0/0	0/0	0/0	35/20
W7RDP	20/4	22/7	0/0	11/3	0/0	0/0	0/0	53/14
KC8KSK	8/3	14/5	3/2	8/2	0/0	0/0	0/0	33/12
K6BSR	10/5	9/5	0/0	8/4	0/0	0/0	0/0	27/14
AB1MI	10/6	8/4	0/0	2/1	0/0	0/0	0/0	20/11
KX9X	10/5	10/5	0/0	0/0	0/0	0/0	0/0	20/10

Limited Multiop

Call	50	144	222	432	902	1296	2304+	TOTAL
W3SO	246/46	306/58	85/38	145/44	0/0	0/0	0/0	782/186
W4NH	222/52	171/49	60/30	85/32	0/0	0/0	0/0	539/164
W4IY	240/50	190/48	57/30	78/30	0/0	0/0	0/0	565/158
KA2LIM	174/36	221/43	66/27	72/30	0/0	0/0	0/0	533/136
W2LV	226/36	200/31	63/23	86/23	0/0	0/0	0/0	575/113
AA4ZZ	110/29	178/53	51/21	91/29	0/0	0/0	0/0	430/132
K2BAR	229/28	215/28	38/16	64/17	0/0	0/0	0/0	546/89
W1QK	162/21	110/18	28/10	21/10	0/0	0/0	0/0	321/59
WO9S	71/24	72/23	26/14	37/14	0/0	0/0	0/0	206/75
VA7ISL	66/11	86/20	32/9	53/11	0/0	0/0	0/0	237/51

Multiop

K1WHS	390/75	360/69	139/42	200/44	71/35	89/35	232/109	1481/409
W2SZ	456/45	395/55	173/42	266/43	87/35	101/34	261/88	1739/342
KBØHH	78/27	168/48	78/33	105/38	12/12	21/17	11/11	473/186
K5QE	93/48	187/95	46/30	68/33	7/7	9/8	1/1	411/222
W2EA	211/30	202/35	45/16	55/18	12/6	14/9	3/2	542/116
N9UHF	74/16	79/19	29/12	37/11	9/7	13/8	5/2	246/75
K4EJQ	13/6	56/19	24/14	35/17	8/6	15/9	15/11	166/82
K3EOD	56/15	40/15	24/13	29/13	12/6	13/7	11/10	185/79
W4MYA	137/35	87/30	0/0	26/14	0/0	0/0	0/0	250/79
WY3P	95/24	54/21	22/12	22/14	4/3	1/1	0/0	198/75

repeated as top dog for September. They had excellent grid totals on all four bands, including tying for top results with 44 grids on 432 MHz, a good deal ahead of the 2nd and 3rd place groups, W4NH and W4IY who were separated by less than 2000 points in a tight finish.

The stiffest competition in the contest was in the Multioperator category, pitting perennial leader W2SZ against the K1WHS team from "Down East." Year after year the "Sugar Zebra" team does an amazing amount of work before and after the contest to set up a huge station from one of the best operating locations in the Northeast, Mt Greylock in Massachusetts. K1WHS is located in southwestern Maine in a good location, though further from the higher density operating areas than the 'SZ location. The 'WHS team does have the advantage of operating from a fixed station and Dave, the station owner, has built an impressive array of antennas to maximize the team's capabilities. Both groups scored over 1.1 million points with 'WHS finishing a slim 19k ahead of 'SZ.

In the Midwest, the KBØHH group enjoyed some good propagation and made use of their outstanding setup to place third, up from 6th in 2009. K5QE continued their run of Top 10 results repeating in the 4th position.

DAVE OLEAN, K1WHS

The winning K1WHS Multioperator team included (back to front) Steve, N2CEI on 222 MHz, Sandra, K4SME on 432 with HØUND in her lap. Joel, W5ZN is on 903 through 3456, and Al, WA1T is at the 5 and 10 GHz position.

Rovers

A total of 64 rovers submitted logs, down almost 25% which of course has an impact on all stations operating the contest. In the Traditional category as has been the case the last several years, pack rovers from southern California worked together, sweeping the top eight places and scoring between 202k and 252k — in order KK6KK, W6XD, N6HC, W6TE, WB6BFG, N6HD, N6VI and KJ6CNO.

Regionally, there were many fine efforts worth noting in the traditional Rover category including NN3Q who led the Northeast ahead

ERIC HALL, K9GY

Eric, K9GY entered the QRP Portable category from this picturesque location on Thorofare Mountain, VA in FM08. An operating position at 3500 ft ASL (above sea level) certainly helps!

of K2QO, KB1EKZ, WA2IID and W1AUV. In the Southeast AG4V and N4OFA livened the contest up for many others handing out lots of QSOs on their roves. In the Central region W9SNR was third after VE3SMA and VE3OIL, while in the Midwest W9FZ just missed a Top 10 finish by 1k points while leading the region.

The RL category saw a very close finish with K9JK driving more than 1000 miles and just getting by AF6AV, 11k to 10k! The rest of the top scorers had a very tight contest with N6ZE who went roving in the Pacific Northwest and placed 3rd.

The number of RU entries tripled to nine this contest. Last year's 9th place traditional Rover, W1RT, moved to the Unlimited Rover category this time and finished in first with 85k. John operated 10 bands from 6 grids with his partner Andy, K1RA to edge out WA3PTV's 2nd place effort. Joe ended up with 67k operating from 4 grids, also with 10 bands.

Club Competition

Twenty-eight clubs submitted scores for the September contest with roughly half of the participants crediting their score to a club. Finishing on top in the Medium category was the Southern California Contest Club. Swapping places from the prior year were the Potomac Valley Radio Club (PVRC) in 2nd and the Northeast Weak Signal Group (NEWS) in 3rd.

Repeating as Local Club winner was the Murgas Amateur Radio Club from Pennsylvania in a significant jump from 2009. The Badger Contesters moved from the Medium category to Limited and took 2nd with over 100k points. Next in line were the Bristol Amateur Radio Club out of Tennessee and the Stoned Monkey VHF Amateur Radio Club.

In Closing

The 2010 September contest is in the books as we head toward a new year for VHF+ contesting. We hope that conditions will be great to enhance the fun. But if not, there is still a lot of fun to be had. Let's all get on the air and have some fun September 10-11, 2011.

Online Version

You won't have to wait for sporadic-E to get more photos and information about the contest and Midwest Mania. Read the expanded version of the results online at **www.arrl.org/contests/results**.

Frequency Measuring Test — April 2011

KIM HAGAR

The Frequency Measuring Test (FMT) adds a couple of new wrinkles to the format when it takes to the airwaves on April 12. The first change is that the FMT will be held on Tuesday evening instead of Wednesday. If weeknight schedules have prevented you from participating in past FMTs, this change is for you. The second change is in the sequence of stations transmitting. The new format will mimic a round-table QSO in which all of the stations are *close* to the same frequency but not *exactly* on the same frequency!

Here's how the new format works: K5CM will lead off with a call-up followed by a key-down period. He will then hand off the frequency to W8KSE who leads with a call-up and then performs a key-down transmission before handing it off to the next station and so forth. Your job is to measure and report the frequencies of all the stations.[1]

The test will begin on 40 meters near 7055 kHz at 10:15 PM EDST. That is on Tuesday evening in North America and all times are listed in EDST in the accompanying table. (For our friends in Europe, that is 0215 UTC on the morning of April 13.) There will be four stations in the 40 meter round-table: K5CM (OK), W8KSE (OH), W6OQI (CA) and WA6ZTY (CA). The test will then move to 80 meters near 3575 kHz beginning at 10:45 PM. The 80 meter stations will be K5CM, W8KSE and W6OQI. All stations will be within ±200 Hz of the initial frequency for K5CM. While the start time on 80 meters is a little early for the West Coast, this was felt to be a reasonable compromise without beginning too late on the East Coast.

For more information and any updates in procedure, tune in to the ARRL's Frequency Measuring Test web page at **www.arrl.org/frequency-measuring-test**. Results will be reported using the regular web page format provided by WA7BNM. More information on frequency measuring techniques and exercises can be found on K5CM's website at **www.k5cm.com**.

[1]*QST* articles from 2005 and before on FMT techniques are available to ARRL members at **www.arrl.org/arrl-periodicals-archive-search**.

April 2011 FMT Schedule in Eastern Daylight Saving Time

40 Meter Sequence (near 7055 kHz)

K5CM	10:15 PM	call up (3 mins)
K5CM	10:18	key down (2 mins)
K5CM	10:20	turnover to W8KSE (1 min)
W8KSE	10:21	call up (2 mins)
W8KSE	10:23	key down (2 mins)
W8KSE	10:25	turnover to W6OQI (1 min)
W6OQI	10:26	call up (2 mins)
W6OQI	10:28	key down (2) mins)
W6OQI	10:30	turnover to WA6ZTY (1 min)
WA6ZTY	10:31	call up (2 mins)
WA6ZTY	10:33	key down (2 mins)
WA6ZTY	10:35	end and announce FMT move to 80 meters

80 Meter Sequence (near 3575 kHz)

K5CM	10:45 PM	call up (3)
K5CM	10:48	key down (2)
K5CM	10:50	turnover to W8KSE (1)
W8KSE	10:51	call up (2)
W8KSE	10:53	key down (2)
W8KSE	10:55	turnover to W6OQI (1)
W6OQI	10:56	call up (2)
W6OQI	10:58	key down (2)
W6OQI	11:00	end FMT announcement

2010 ARRL 10 GHz and Up Contest Results

Silver Anniversary event yields thrilling "Tropo" for the Midwest.

Bruce Richardson, W9FZ
w9fz@w9fz.com

W9FZ

Jim, KØKFC, operates in eastern South Dakota from the I-29 Summit rest area in EN15lj. Here he is beaming north to Winnipeg and Barry, VE4MA, in EN19lu.

The ARRL 10 GHz and Up contest, held August 21-22 and September 18-19, 2010, yielded fun and adventure for many who participated. On the microwave bands thrills come from conquering challenges that should make a contact impossible. Tight antenna beamwidths, low transmit power levels and obstructing terrain and foliage make completing microwave contacts difficult. When an operator considers the significant barriers to making a contact — yet there is the signal in the rig — the reward is the "zing" of success.

2010 Contest Highlights

Some areas of the nation had below average conditions while the Midwest enjoyed a rare tropospheric ducting event. On the September weekend, John, W3HMS and Joe, WA3PTV visited their favorite site in FN00wc but experienced the worst conditions they've yet seen in five years of 10 GHz activity. At the other extreme, the Upper Midwest experienced the finest tropo opening yet seen during a 10 GHz contest. Winnipeg, Manitoba, the eastern edge of the Dakotas, Minnesota, Iowa, and Illinois enjoyed a real thrill as frontal boundaries spun through the area on Sunday morning of the August weekend. Several overland contacts were made in the 700km range. The longest one reported was between Barry, VE4MA (EN19lu) and Steve, N4PZ (EN52gb) at a whopping 1046 km!

During the September weekend, Lake Michigan had activity along both shores. Bob, K2YAZ near Glen Arbor, MI hosted a group of operators who explored many of the shoreline locations in the northwest corner of Michigan's Lower Peninsula and worked other groups along Lake Michigan's western shore. The August weekend found Lake Erie particularly hopping as a group activated several locations on the northern shore and worked stations along the southern shore and well inland.

The Red River Valley was busy for the August weekend. First, a portable group set up both days as a portable operation in eastern South Dakota at the "Summit" rest area along I-29. Also, a rover group operated from many locations between Fargo and Grand Forks, ND. Fixed stations in the region worked the rover group at as many of their stops as possible.

Top 10 Scores

10 GHz Only	*Score*	*10 GHz and Up*	*Score*
KK6MK	58,803	AA6IW	57,919
WØZQ	55,769	N6RMJ	54,215
WBØLJC	55,130	W6BY	45,481
KCØIYT	53,933	KI6TWT	43,302
NØKP	50,938	N9JIM	35,020
WA2VOI	47,054	N1JEZ	30,372
KE6HPZ	44,107	W6QIW	27,629
W6SR	37,530	KC6QHP	23,328
AF1T	36,369	W1GHZ	23,144
KØKFC	33,811	AD6FP	23,133

Top 10 QSOs Completed

10 GHz Only	*QSOs*	*10 GHz and Up*	*QSOs*
KCØIYT	280	AA6IW	287
WBØLJC	249	N6RMJ	283
WØZQ	247	W6BY	213
KK6MK	238	KI6TWT	189
KE6HPZ	230	N9JIM	175
WA2VOI	222	WA6CGR	133
NØKP	194	W6QIW	130
KØMHC	168	KC6QHP	120
WB6JDH	155	KA1OJ	112
KØKFC	151	N1JEZ	109

Participation by Call Area

Call Area	*Call Entries*	*Area*	*Entries*
6	37	9	5
Ø	21	5	4
1	16	2	3
VE	11	3	3
8	10	DX	1
4	7	7	0

Expanded Report on Website

Be sure to check out the expanded web version report at **www.arrl.org/contests** with more reporting, analysis, and graphics. — look for the 2010 10 GHz and Up listing.

10 GHz Only

In the 10 GHz Only category, Rex, KK6MK led all 88 operators in this class with a score of 58,803. Rex topped Jon, WØZQ in second place with 55,769, by having more unique call signs (59) worked despite Jon's slightly greater distance point total. Third, fourth, and sixth places went to WBØLJC, KCØIYT and WA2VOI who traveled with WØZQ in eastern ND on the first weekend and southern MN on the second weekend. In fifth place was Dave, NØKP.

Longest DX in the 10 GHz Only category goes to VE4MA and N4PZ with their 1046 km shot mentioned earlier. Between Virginia and New England's Mount Washington, Larry, K1LPS and Gary, NA4N completed an excellent DX contact of 845 km.

10 GHz and Up Category

Just like last year, the "And Up" category received 31 logs. Topping this category in points is Lars, AA6IW with 57,919 points. Of the logs submitted in this category, all made contacts on 10 GHz and 24 GHz. Five operators submitted contacts on the 47 GHz band. In the 10 GHz and Up category, N1JEZ had the longest 10 GHz distance with 845 km. Gary, AD6FP had the longest distances on 24 GHz at 526 km and also on 47 GHz at 181 km. No activity was submitted for 78 GHz and above this year.

Looking Ahead — The Next Quarter Century

Congratulations to the 119 microwave operators who met the challenges for the 2010 contest. For 2011, make a point to get on the air for this event. Put it on your calendar for August 20-21, 2011 and September 17-18, 2011. Plan a new adventure different from past years. Also, include new operators in your plans to expand the fun. QST

W3UR

HOW'S DX?

Most Wanted Entities

As I write this month's column winter has officially begun and Christmas was just last week with 2011 just around the corner. *The DX Magazine* came yesterday with their annual results of the "Most Wanted Countries" survey of DXers around the world. The 2010 analysis was taken between September 1 and October 15, hence the title "2010 Most Wanted Countries." This month let's talk about the top 20 most wanted DXCC entities with some candid comments for each one.

Top 20 Most Wanted Entities, 2009 and 2010

Rank 2010	*Prefix*	*Country*	*Rank 2009*
1	P5	North Korea	1
2	KP1	Navassa	2
3	3Y/B	Bouvet	4
4	7O	Yemen	5
5	VKØ/H	Heard Island	6
6	FT5Z	Amsterdam	9
7	ZS8	Marion Island	3
8	VP8/S	South Sandwich	10
9	FT5W	Crozet	7
10	BS7	Scarborough	11
11	VP8/O	South Orkney	12
12	HKØ/M	Malpelo	14
13	VKØ/M	Macquarie	15
14	SV/A	Mount Athos	13
15	FT/T	Tromelin	16
16	ZL9	Auckland & Campbell	17
17	KH5K	Kingman Reef	18
18	PYØS	St Peter & Paul Rocks	19
19	KH5	Palmyra/Jarvis	20
20	FT/J&E	Juan de Nova & Europa	2

The Top 20

There were very few changes to the top 20 DXCC entities between 2009 and 2010, as you can see from the Table. It shouldn't be any surprise that P5 — North Korea is #1. This one was last activated by Ed, P5/4L4FN, from late 2001 late 2002. He worked 12,170 unique stations on SSB and RTTY. To be honest the likelihood of another P5 operation is not real high given the current political situation.

I'm kind of surprised we have not heard any news on the #2 most wanted, KP1 — Navassa Island, as the K5Desecheo DXpedition of February 2009 was very successful and the US FWS seemed to be pleased with the results. The last KP1 DXpedition was in 1993, making Navassa the longest time period of being off the air — 18 years!

Bouvet Island ranks #3 and has not had a major DXpedition group there since January 1990. Chuck, 3YØC, was there in early 2001 and Petrus, 3YØE, was there in late 2007 and early 2008. Coming in at #4 was, believe it or not 7O — Yemen. This surprises me as 7O1YGF, although it took several years for it to meet DXCC criteria, made some 35,000 QSOs back in 2000. This is probably the most dangerous of locations for a DXpedition and I suspect not many would be willing to go there under the current circumstances. An operation from the airport might be safe.

The uninhabited VKØ/H — Heard Island is in position #5, with the last operation being a huge success by VKØIR in January 1997 at the bottom of cycle 22. Many DXers worked this one on 1.8 through 21 MHz but few made it on the high bands. A group from Australia is working on this rare one for February 2013. That should be the right time for the high bands for the top (or close to it) of cycle 24.

FT5Z — Amsterdam and St Paul Islands was #6. The last operations took place during 1998 and 1999, although the last DXpedition was FT5ZH by two Frenchmen in 1998. They managed to make just over 32k QSOs of which about 14k were uniques.

ZS8 — Prince Edward and Marion Islands is #7, going down four positions possibly because of Pierre, ZS8M, who is on Marion Island until late April 2011. Over the past decade there have been a few minor operations from this one and there continue to be rumors of a DXpedition here.

2002 was the last time #8 VP8/S — South Sandwich Islands was QRV and that was the VP8THU DXpedition. This was the first "micro-lite" DXpedition running barefoot and from 40 meters and up. Ten years earlier VP8SSI was QRV. And going farther back LU3ZY was on in the early '80s. The Sandwich Islands are not an easy place to get to and a long way from any departing points. It could be a few more years before we see any activity from this one.

The Crozet Islands (FT5W) is another French sub-Antarctic Island DXCC counter with a somewhat permanent population of researchers and scientists. This one is #9 on the list and there have been some minor operations during 1998, 1999, 2000, 2005, 2008 and 2009. There has never been a major DXpedition to this rare one.

Rounding out the top 10 most wanted is everyone's favorite DXCC Entity — BS7H — Scarborough Reef. Actually I am amazed it is as high as it is given there have only been three DXpeditions to this one, with about 69k QSOs and only 7065 confirmations (as of January 2011) in the ARRL DXCC records. That is, only 7065 people have confirmed this one and submitted it to the DXCC Desk in Newington. It ranks #4 on the ARRL list. This one also ranks high on the RTTY most wanted list.

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By the time you read this you will have had the chance to work VP8ORK on South Orkney in late January or early February. This one ranked #11 in last year's most wanted survey. If you missed this one, you might be able to work the Argentine club station LU1ZA, which occasionally is QRV on the high end of the 20 meter phone band.

Malpelo Island (HKØ/M) was the 12th most wanted. HKØTU used to be QRV by the members of the Liga Colombiana de Radioaficionados (LCRA) just about every 7 or so years. The multiop team has not been there since 1990, although they have supported at least one DXpedition since then. The last operation from this one was by two Japanese ops in 2001. When the next one goes, serious effort should be considered on RTTY, the low bands and 6 meters.

VKØ — Macquarie Island has a semi-permanent population with scientists and researchers usually stationed here for 12 months at a time. Occasionally the radio technician is an Amateur Radio operator and can get on the air in their spare time, but you can see why this one is coming in at #13.

Monk Apollo, SV2ASP/A, is the only active Amateur Radio operator from Mount Athos, which was #14. Like the scientists and researchers he too is only QRV in his spare time and can usually be found semi-active during the Christmas holidays and shortly thereafter. Apollo is not the only Amateur Radio operator who is a monk and working on Mount Athos. There are others who either don't have equipment or have VHF-only licenses.

Number 15 was Tromelin Island, which used to use the FR prefix but any future operations will use the FT#Txx call sign block. The last operation from here was by FR5ZU/T in mid 2002. Jacques used to work for Reunion's meteorological department and would go around to each of the old FR (Europa, Glorioso, Juan de Nova, Tromelin) islands. There are rumors that one or two groups are seriously considering going to Tromelin in the future.

Auckland and Campbell Islands (ZL9) was #16 and the last operation from this rare one was an unannounced a half a day operation by ZL2BSJ as ZL9BSJ in September 2006. The last big operation was by ZL9CI in January 1999 made just over 96k QSOs.

Number 17 is KH5 — Kingman Reef, which has not been on the air since K5K in October 2000.

St Peter and St Paul Rocks, #18, has not been QRV since the 2006 PYØS/PS7JN operation. In fact Joca was there during 2003, 4, 5 and 6 for short stints.

Palmyra and Jarvis rank #19 and a DXpedition is in the works for Jarvis in November of this year thanks to the efforts of Radio Expeditions, Inc. This is the same group that gave us VP6DX, so it there are high expectations here!

And, finally, rounding out the top 20 was Juan de Nova and Europa, which now will use the FT#Jxx and FT#Exx call signs. The last operation was in 2003 by TO4E on Europa.

DX NEWS FROM AROUND THE GLOBE

3D2 — FIJI ISLANDS

Eddie, VK4AN, Kenneth, OZ1IKY, and possibly others will be operating as 3D2A from Nadi, Fiji Islands between March 15 and April 2. This will also include the BARTG RTTY and CQ WPX SSB contests. Focus will be made on 80, 40 and 30 meters and to some degree Topband. They will have an Emtron DX-1d amplifier. Both ops enjoy CW and the digital modes. Online logs will be posted to **www.hamlog.eu/3d2a**. They will not be posting their logs to LoTW.

9L — SIERRA LEONE

Four Dutch and one Liberian radio amateurs will cooperate with the Mercy ships organization in a Sierra Leone operation March 15-April 4, call sign 9L5MS. They will operate from Freetown. Operators are PA3A, PA8AD, EL2DT, PDØCAV and PA3AN. They plan to raise awareness of the work of Mercy Ships, raise funds for the ships' Charity Project and activate Sierra Leone on the HF bands. **www.sierraleone2011.com**.

CYØ — SABLE ISLAND

An American three man team is planning to be QRV from Sable Island during early March. This will be their third attempt as the last two were scrubbed due to bad weather. Team members include NØTG/CYØ, AI5P/CYØ and VE1RGB/CYØ. The exact dates were not known as of press time so watch your favorite DX publication and their website at **www.cy0dxpedition.com**.

PJ2 — CURAÇAO

A group of women are planning a DXpedition to Curaçao Island (PJ2). They include Gayle, K6GO; Rusty, AF6WF; Michelle, W5NYV; Ellen, N6UWW; Georgia, KI6LAV; Cathy, K6VC; Marilyn, KJ6YL, and Margie, KG6TBR. Plans are to have three or four stations and to be QRV on as many bands as possible. This one looks like it will be from March 17 to 21, 2011. They have a website at **yldxpeditions.com/**.

T3Ø — WEST KIRIBATI

SP5EAQ and SP5DRH are planning to head to T3Ø, West Kiribati, for their 2011 Pacific trip. Both are named Jacek. They will be on Tarawa with call signs T3ØAQ and T3ØRH, March 1-17. They'll be on 160-10 CW, SSB and RTTY. 'DRH, will focus on 160 and 30 RTTY with some 80. `EAQ will specialize in SSB on the other bands. They will each have a K3 rig and 600 W amp. For antennas, it's an 18 meter high Spiderbeam pole and GP5 antenna by SP7GXP. SP5EWY will act as pilot station back home. QSL to home calls. **www.sp5drh.com/t30**.

V3 — BELIZE

Jim, WB2REM; Paul, W4PGM, and Glenn, KD2JA, will be operating from Placentia, Belize from March 23 through March 30. They will be active during the CQ WPX SSB Contest. They will be on both SSB and CW on 160-6 meters with a concentration on 30, 17, 12 and 6 meters. When QSLing please supply a self-addressed, stamped envelope (SASE) from stateside stations or self-addressed envelope (SAE) for stations overseas, with the appropriate US Air Mail Postage Rate or an IRC. This will ensure you will receive a response to your QSL request. QSL direct only to each of the operators' call signs. QSL to V31MM via WB2REM, V31GB via KD2JA and V31PM via W4PGM.

VK9Y — COCOS (KEELING) ISLANDS

The Cocos (Keeling) Islands is the destination of DXpeditioners Phil, G3SWH, and Jim, G3RTE. The two plan to be QRV from the West Island as VK9C/G6AY on 3.5 through 28 MHz on CW only from February 22 to March 5. There will be no 160 or 6 meter or EME activity. The Cocos (Keeling) Islands (OC-003) ranks #76 worldwide. "Propagation permitting, we plan to have two stations on the air for as many hours every day as is possible," says Phil. Their focus will be on Europe, North America and ROTW (rest of the world) and they have a goal of 15,000 QSOs. Phil says "This will be a very expensive DXpedition. We are happy to meet the costs of transport to and from the islands, but are seeking sponsorship and donations from individuals, DX clubs and organisations towards our living expenses on the island, printing QSLs and the like." They have a web page with more details at **www.g3swh.org.uk/vk9c-g6ay.html**. QSL VK9C/G6AY via G3SWH either direct with SAE and "adequate return postage," via Phil's website for a bureau reply or via the bureau.

XU — CAMBODIA

XU7AFU will be Eddy's, ON4AFU, call sign from Cambodia March 5-15. He will be in Kampong Som. He hopes to also get to AS-133, Koh Russei, with the XU7KOH call sign. He plans to take a super light DXpedition version of a Hexbeam for 20 through 10.

WRAP-UP

That's it for this month. Thanks to G3SWH, NØTG, WB2REM, *The DX Magazine*, KE3Q and *The Daily DX* for making this month's column possible. Until next month, see you in the pileups! — *Bernie, W3UR*

W3ZZ

THE WORLD ABOVE 50 MHz

Maintaining Your Station

If you look out the window as you read this column, you may see snow and ice. If you listen to the VHF+ bands you may hear absolutely nothing. But in a few short weeks the weather will turn warmer and with the warmer weather comes better conditions — tropospheric ducting and the start of the summer E_S season. So now is the time to prepare your station for these improved circumstances. This month we will discuss how you assess your station performance and what you need to do to keep it running in top notch form. What we won't do is give you much detail about how to fix problems that you may find. Let's take a look.

Test Equipment

One important requirement for this tune-up involves test equipment. Some every reasonable VHF+ station should have; others can be rather expensive but may be available from friends. Every VHF operator needs an accurate power meter that will measure output power and VSWR. The easiest but not cheapest way to do this is a professional meter like those made by Bird or Coaxial Dynamics. A less expensive system such as the one made by Daiwa can be used particularly if it has been calibrated against a professional meter. If you do the latter, once a year it is a good idea to recalibrate the less expensive system.

What is important is to know the power output compared to the accurate professional meter at a variety of power levels. The nominal accuracy of the professional meter is ±10 percent. Thus if an output of 200 W on your meter reads 150 W on a Bird meter, then you know that if your B2516 Mirage brick amplifier is reading 200 W its real output is 150 W, which is probably fairly close to its published ratings. You also want to test the meter's SWR function against a professional meter. Most I have used match up pretty accurately.

Secondly, you want an accurate dummy load. Although these can be expensive if bought new, they are relatively inexpensive buys at a hamfest. I own two such commercial 50 Ω loads — one good to 12 GHz rated at 20 W and the other good to 18 GHz rated at 5 W. To a first approximation you can trust your antenna to be a decent testing load so long as the SWR is low, that is ≤1.5:1.

If you belong to a VHF+ club, one of its members may have some of the more exotic and expensive test equipment. Since you need these only rarely, you may be able to borrow them. Here are a few such useful test instruments:

- Nothing makes testing a feed line easier than a time domain reflectometer (TDR). Briefly what the TDR does is to inject a broadband pulse into the transmission line and measure the magnitude of the returning pulse and the time it takes to return. It is thus possible to determine if the transmission line is defective in any way and if there are any problems with any of the connectors in the feed line. (For more information about TDRs, see the *QST* articles by Warren Jochem, WB2IPF, and Tom King, KD5HM.)[1,2]
- An independent test of receiver sensitivity is possible by using a noise figure meter such as those made by Hewlett Packard. Even old ones cost more than you might want to pay but again a club member may have one that you can borrow.
- Need a higher power dummy load? One at power levels up to the legal limit may be available from one of your friends. Just make sure the dummy load has a reasonable impedance at the frequency you want to use.
- Microwave performance measurements require expensive test equipment. Even the usual professional power meter does not go above 2.3 GHz. Here also there may be a VHF+ operator not so far away who has such equipment and would be willing to let you borrow it.

[1]W. Jochem, WB2IPF, "An Inexpensive Time-Domain Reflectometer," *QST*, Mar 1973, pp 19-21.
[2]T. King, KD5HM, "A Practical Time-Domain Reflectometer," *QST*, May 1989, pp 22-24.

This Month

March 20	Excellent EME conditions*

*Moon data from F5SE/DL7APV

Station Performance

Station performance basically means how well your station transmits and receives. It involves all station aspects from the exciter and receiver to the antenna. The best way to do this is to have performance records. If you don't have them yet, now is a good time to start. A simple but powerful tool is to keep a maintenance notebook including updates on every bit of preventative work you have done. You can thus determine when something needs work before it needs work. Nothing like fixing the guy wire before it breaks.

Receiver. Remember our friends, the VHF+ propagation beacons? They are an excellent way to judge overall station receiving performance. First you need to find suitable beacons. At least one should be relatively close — no more than 50-75 km from you. Preferably the path to this beacon should be clear of obstructions like intervening hills. Beacons farther away can also be used. If possible, a beacon that is normally just audible above the noise floor should be chosen. This gives you a minimal signal to test your system. Measurements should be made under flat, unenhanced conditions such as those you will likely encounter if you do this as soon as you receive this magazine. Late February and March are usually about as unenhanced as you can get.

If you don't know your local beacons, you can find beacon frequencies on the Internet. The G3USF list at **www.keele.ac.uk/depts/por/50.htm** provides the best worldwide 6 meter list including the US. Concentrate on those beacons that are within tropospheric range (not more than 200-300 km away) and not those that are heard by ionospheric reflection. WZ1V's list at **www.newsvhf.com/beacons2.html** is a good place to look for domestic beacons on frequencies 2 meters and above.

As an example, a sampling of beacons at

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 ♦ w3zz@arrl.org; (301-948-2594)

Table 1

Typical Beacons at Different Distances from W3ZZ

Weak beacons are normally at or just above the background noise.

Band	*Local*	*Medium*	*Weak*
50	W3APL (29 km)	W3CCX (193 km)	KD4NMI (387 km)
144	W3APL (29 km)	W3CCX (193 km)	K2DLL (726 km)
222	N4MW (174 km)	W3CCX (193 km)	
432	W3APL (29 km)	W3CCX (193 km)	WA3PGI (268 km)
903	W3APL (29 km)		
1296	W3APL (29 km)		
2304	W3UO (116 km)		
3456	W3UO (116 km)		
5760	W3UO (116 km)*		
10G	W3UO (116 km)*		

*Not normally copiable here

W3ZZ is presented in Table 1. Particularly, K2DLL on 2 meters and WA4PGI on 70 cm are a good test of my system performance. Neither of them was audible here until I improved my antennas and feed lines, and if there is any degradation I cannot hear them. The weak beacons even provide evidence that mast mounted preamps are important. The WA4PGI beacon is extremely weak but becomes comfortable copy with such a preamp.

Now that we know how well the receiver hears, we need to check its other performance parameters. The best test here is a very strong line of sight neighbor. I use Terry, W8ZN, who is on Bull Run Mountain (FM18dv) some 51 km from me and whose location is visible from the top of my tower. Terry has antennas similar to mine and runs the legal limit on all four of the lower V/UHF bands. To say that he lights all my S meter segments is a clear understatement. The test is entirely qualitative. How close can I get to Terry before he blows my receiver away? In my case, I have a native Elecraft K3 on 6 meters and DEM transverters feeding the K3 on the other three V/UHF bands. If my system is working I should be able to get within 5 kHz of Terry and still copy quite a weak station.

Transmitter. What about transmitter performance? Here you need to trot out your power meter and a suitable dummy load if you have one of sufficient power handling capability. Lacking the right dummy load, check the antenna for an SWR of 1.5:1 or less. If so, you can use the antenna as a reasonable substitute. Run the transmitter and amplifier at full power. Find the input power by measuring the plate current and plate voltage if it is a vacuum tube final or measure the current draw and power supply voltage if it is solid state. Measure the output power. Calculate the efficiency (eff = P_{input}/P_{output}). How does the output compare with your previous tests? What is the efficiency (it should be at least 50 percent)?

Transmission line. All my feed lines are ~55 meters long and some form of hardline ranging from ½ inch copper similar to Andrew LDF4 to Andrew LDF6. Some are fairly new and some are approaching 50 years old. All the drip loops are 5-10 meters of Belden 9913F7. You can do one very simple ohmmeter check a few times a year by measuring the resistance between the center conductor of your antenna feed and the shield inside the station. If you have a bad connection, that measurement will change. It might get lower or higher in either case you know something is wrong.

The key quantitative measurement is to determine the loss and compare that with the published coax loss. Once a year I get someone to take the 20 W precision dummy load to the top of the tower with a Bird wattmeter, disconnect each drip-loop from the hardline at the top of the tower, insert the dummy load at the end, inject 10 W into bottom end of the coax (as measured by a Bird slug that has been checked against the slugs used on top of the tower) and measure the power at the top of the tower. The loss ought to range between 1-2 dB maximum. If it is double that or more I suspect a problem in the transmission line. Of course I cannot check the drip loop directly (but see mechanical inspection below).

Once every 3 years or so I borrow a TDR and sweep the entire transmission line including the drip loop. This can confirm any suspected problems. Recently I measured the loss in my 2 meter feed line. It should have been ~1 dB but it measured more like 10 dB. Sure enough, when I tested it with the TDR I saw an unexpected and serious bump at one end of the line. Such a bump is often indicative of water intrusion. Needless to say that piece of coax is no longer in use!

Mechanical Inspection

A once-a-year visual inspection of the entire station is a very good preventive maintenance idea. Go up to the top of the tower and start with the antennas. You can't do much with the bird guano but you can see whether everything looks intact. Check the transmission lines — are they cable tied properly to the tower? Every few years it pays to go up the tower, check for any rust and check the tightness of all the hardware. Look at the guys and check their tension (a tensionometer is a good instrument for that although with some experience you can tell whether the guys are too tight or too loose). Follow the transmission lines into the shack. Is there any sign of abrasion or a place where water could enter? Are all the connectors properly waterproofed?

If the station appears to work you should still check all the station interconnecting cables. Put a little pressure on each of the connectors. Do they feel solid? If not, fix them. Dust is a killer of electronic equipment. Take the covers off all you amplifiers and remove all the dust. While they are open, oil all the fans. Dust kills computers just as readily. Take off the case and remove the dust. Oil all those fans too. Speaking of computers, do all the pieces of software you are likely to use work? You should update all your contest software as new versions appear. But if not, do it now.

You have less than 2 months before the warm weather propagation begins. You want to know your station is working and working right. There is no time like the present to get started!

ON THE BANDS

6 meters. No one would argue that the solar flux is too low to support F2 propagation. Yet this winter has once again produced what Bob Cooper, ZL4AAA, calls the "Christmas Bonus." On a few days between about Dec 10 and early January propagation often exists between North (and South) America and VK/ZL. Here on Dec 9 Bob, K6QXY (CM88ql), heard ZL video. On the 11th Bob worked ZL3NW (RE66ho) and then Bob, ZL1RS (RF64vs) (see Figure 1). At the same time ZL1RS heard K6QG (CM98nc) and VK4CZ (QG62lp) heard K6QXY. On Dec 12 ZL2TPY (RF70cw) heard K6FV/B (CM87ul). Dec 13 VK4CZ and VK4DDC heard K6MYC (DM07db). On Dec 14 K6QXY worked ZL1RS again. K6QXY heard ZL video Dec 15, 16, 19, 21 and 22. Bob, K6QXY, notes that when he hears 48.250 video from the south island he can only work ZL3NW; when he hears 48.240 or 48.260, he can work ZL1RS or ZL2DX. The ZL video appears to display two diurnal peaks, one at 1930Z and the other ~2330Z; ZLs have been worked only around the later peak.

The days around Christmas produced some exciting propagation. ZL1RS worked OA4TT on the geomagnetic equator on

BOB SUTTON, ZL1RS

Figure 1 — The antenna system of Bob, ZL1RS, is a pair of stacked 6 element GØKSC LFA Yagis. Bob is located on New Zealand's north island and has an excellent horizon toward the Pacific Ocean.

Dec 24. Peter, VK6KXW, notes that an f0F2 of 11 MHz existed at the midpoint of that path in the mid Pacific. On Christmas day K6QXY worked ZL1RS and Ed, N5JEH (DM65rd) worked ZL1RS on an E_s/F2 link. On Dec 26 the E_s/F2 link recurred leading to welcome Qs to ZL from N5JEH; Pat, W5OZI (EM00cl), and John, AE5B (EM-02kl). ZL1RS also reports working N5TSP (EM10af), K5RLA (EM02kl) and N5BLH (EM92gg). K6QXY reports ZL video Dec 28, 29 and 31 and that ZL1RS heard him with no contact on the 28th.

A few domestic openings enlivened the minor E_s season. During the 10 Meter Contest Dec 13 NØJK (EM28) worked FL, TX, CO, AZ, NM and CA. Joey, W5TFW (EM41), worked MO, IA and AZ. Dec 14 Pete, N6ZE (DM04), worked into AZ, CO and UT while Mike, WB6FFC (CN82), worked down into southern CA and Mexico. Dave, N7DB, reports short openings from his area in CN85 to the south. Brett, WØBLD (EM37), had a good week starting Dec 13 into the southeast and later NM, AZ and CA. Propagation to the southeast continued the 18th and 20th and to the west on the 14th and 15th. NØJK reports contacts into TN on the 27th and as part of a solid E_s opening into and along the northern tier to FN07 and FN25. Dave, W6OAL (DM79), found stations along the northeastern seaboard on the 27th and then a few W6s on the 29th. Finally N7DB reports AZ and NM on the 27th and southern California again on the 29th from his Pacific Northwest location.

EME. Lance, W7GJ, reports that he worked Al, CE/K7CA, Dec 15 for the first 6 meter EME contact with Chile. On Dec 24 Lance worked TA2AD for the first 6 meter EME contact with Turkey. Lance now has 111 entities worked on 6 meter EME.

Meteor scatter. Your editor received no reports from the Geminid meteor shower in mid December. Nothing unusual was reported by visual observers and meteor activity during the ARRL 10 Meter Contest appears to have been somewhat below normal.

Earth-Moon-Earth Annual Standings

Published Earth-Moon-Earth annual standings include stations with a minimum number of unique initial contacts as of January 1. For a complete list of all reporting stations check the EME Standings Report at **www.arrl.org/wa50-standings**. To ensure that the Standings tables reflect recent activity, submit reports at least every 2 years by e-mail to **standings@arrl.org**. For printed reporting forms, send a request with SASE to Standings, ARRL, 225 Main St, Newington, CT 06111.

6 Meters (50-54 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W7GJ	MT	2	107	158
K6QXY	CA	15	45	95
ZS6NK		18	27	71
K2ZD	NY	14	25	55
KR7O	CA	5	15	21
K7CW	WA	5	9	15
K2BLA	FL	4	8	11
K1SIX	NH	3	7	13
W7MEM	ID	—	7	2
W5LUA	TX	2	3	4
W7EME	ID	3	3	2
ZF2ZD		2	3	3
KD3UY	MD	1	2	2
K4MM	FL	2	2	4
W5UWB	TX	—	—	20

2 Meters (144-148 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
IK1UWL		44	128	781
PA3CEE		33	118	497
W7GJ	MT	50	112	152
W7MEM	ID	50	80	553
K2BLA	FL	39	77	525
W8WN	KY	50	76	503
K1JT	NJ	47	73	476
KD3UY	MD	42	70	479
AA9MY	IL	49	69	382
K5DNL	OK	29	68	286
W5UWB	TX	35	65	446
W3CMP	PA	50	64	242
K6AAW	CA	49	63	409
XE2AT		39	60	350
W4SW	VA	5	55	164
N9LR	IL	50	50	160
K8BHZ	MI	32	44	195
W3TWX	VT	38	42	40
K6PF	CA	47	41	219

1.25 Meters (222-225 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
WØSD	SD	24	6	5
W5LUA	TX	35	4	31
WD5AGO	OK	1	1	2

70 cm (420-450 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
KØRZ	CO	43	50	342
W5LUA	TX	46	33	201
WD5AGO	OK	25	23	101
W7EME	ID	16	15	43
W7MEM	ID	17	12	47
K2OVS	NY	—	4	4
KD3UY	MD	1	3	3
KC6ZWT	CA	4	3	10
WA8RJF	OH	22	3	30
AA9MY	IL	25	3	2
W5UWB	TX	—	2	6
KR7O	CA	0	2	2

33 cm (902-928 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
WA8RJF	OH	14	2	25
W5LUA	TX	6	2	9

23 cm (1240-1300 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W5LUA	TX	44	57	282
WD5AGO	OK	33	36	170
N6CA	CA	—	11	—
WA8RJF	OH	18	6	20
KØRZ	CO	0	2	3

13 cm (2300-2310, 2390-2450 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
WD5AGO	OK	14	23	61
W5LUA	TX	27	21	83
WA8RJF	OH	13	4	20

9 cm (3300-3500 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W5LUA	TX	3	8	12
WD5AGO	OK	1	2	3

5 cm (5650-5925 MHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W5LUA	TX	3	16	27
WD5AGO	OK	1	10	15

3 cm (10-10.5 GHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W5LUA	TX	7	21	64
WA5VJB	TX	7	11	19

1.25 cm (24-24.5 GHz)

Call Sign	State	States Worked	DXCC	Initials Worked
W5LUA	TX	—	5	5

— Not given

AT THE FOUNDATION

CW Operators Club Grants Available!

Amateur Radio organizations, school radio clubs and youth organizations that are interested in activities that promote the teaching of Morse code are invited to apply for grants funded by the CW Operators Club.

The CW Operators Club is a new organization of over 700 CW enthusiasts that will provide small grants for materials needed to teach Morse code to new hams, including scouts. Education materials covered under the grant include oscillators, keys, software, audio tapes or CDs and other written materials.

Proposals will be accepted only in February and August of each year and should be filed electronically using the forms on the ARRL website at **www.arrl.org/grant-application**. The ARRL Foundation Board of Directors will review proposals and award grants.

The ARRL Foundation offers grant opportunities for a variety of Amateur Radio activities. The Foundation is most interested in licensing and operating by young hams and does not usually fund equipment for emergency operations. Information on grant opportunities is available on the ARRL website at **www.arrl.org**. QST

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Feb 14, 0001Z-2359Z, K6EAG, Hayward, CA. Hayward Radio Club. Valentine's Day. 14.084. Certificate. Richard Sauneuf, 28216 Armour St, Hayward, CA 94545. **www.qsl.net/k6eag**

Feb 21-Feb 23, 0001Z-0400Z, WS7G, Moses Lake, WA. Columbia Basin DX Club. George Washington's Birthday. 18.135 14.250 3.880 7.230. QSL. Brian Nielson, 11650 Road 1 SE, Moses Lake, WA 98837. Celebrating George Washington's birthday near the town of George in the state of Washington. **w7bjn@nwi.net**

Feb 25-Mar 7, 0000Z-2359Z, W4F/K4O/N4S, St Petersburg, FL. St Petersburg Amateur Radio Club. 90th Anniversary of The Festival of States. 28.450 14.250 7.080 3.050. Certificate & QSL. St Petersburg Amateur Radio Club, PO Box 2217, St Petersburg, FL 33731. **www.sparc-club.org**

Mar 1-Mar 5, 1600Z-2100Z, KA9NLX, Arlington Heights, IL. Peace Corps Amateur Radio Club and returned PC volunteers throughout the US. Peace Corps 50 Year Anniversary. 21.375 14.325 7.283 10.133 Olivia possible 2 m. Certificate & QSL. John Paskevicz, 1423 N Ridge Ave, Arlington Heights, IL 60004. Honoring all Peace Corps Volunteers; promoting understanding of other people. **ka9nlx@arrl.net**

Mar 3-Mar 5, 1600Z-2300Z, W9SSB, Centralia, IL. 80th Anniversary of the Adoption of the *Star-Spangled Banner* as the National Anthem. 145.520 14.250 14.050 7.200. QSL. Joe McNelly, 529 S Sycamore, Centralia, IL 62801. *The Star-Spangled Banner* was recognized for official use by the Navy in 1889 and the President in 1916, and was made the national anthem by a congressional resolution on March 3, 1931.

Mar 4-Mar 8, 0001Z-0600Z, WØC, Fulton, MO. Callaway Amateur Radio League LLC. 65th Anniversary of Winston Churchill's "Iron Curtain" Speech at Westminster College, Fulton, MO. 14.275 14.040. Certificate & QSL. Richard White, 826 Evergreen Dr, Fulton, MO 65251. **dmueller55@sbcglobal.net**

Mar 8-Mar 10, 1400Z-2100Z, W4LX, Ft Myers, FL. Ft Myers Amateur Radio Club. Commemorating Buckingham Air Field/Lee County Mosquito Control. 28.340 21.350 14.240. Certificate. FMARC, PO Box 61183, Ft Myers, FL 33906. **fmarc.net**

Mar 11-Mar 12, 1700Z-2300Z daily, W8NVY, Muskegon, MI. American Red Cross Serving Muskegon Oceana and Newaygo Counties. American Red Cross Month Special Event Station.14.260 7.245 147.420 Simplex EchoLink: W8NVY, Node # 349350. Certificate & QSL. Karen Strait, KD8DHJ, 1479 Sullivan Rd, Ravenna, MI 49451. **dstlead@arcmon.org** or **www.arcmon.org**

Mar 12, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. Navy Seabees Birthday, Girl Scouts of America Founded 1912, Centennial of Naval Aviation.SSB 14.320 7.250 PSK31 14.070 D-STAR 012C and 2 m/70 cm SOCAL rptrs. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Mar 13, 1300Z-2100Z, W1GZ, Leominster, MA. Montachusett Amateur Radio Association. 60th Anniversary of Montachusett ARA. 21.250 14.250 7.250 3.900. QSL. MARA, PO Box 95, Leominster, MA 01453. Digital operation in digital subbands. **www.w1gz.org**

Mar 18-Mar 20, 1500Z-2200Z, W5G, Goliad, TX. Goliad County Amateur Radio Operators. 262nd Anniversary of the Founding of Goliad. SSB 21.320 14.270 7.215 CW 21.050 14.050 7.050. QSL. Skip Stem, WB4DAD, 655 N Loop 337 #405, New Braunfels, TX 78130. Goliad is the second oldest town in Texas. Operating in conjunction with the Goliad County Fair.

Mar 19, 1400Z-2000Z, W4BKM, Macon, GA. Macon Amateur Radio Club. 29th Annual Cherry Blossom Festival. 14.240 7.225 145.37. Certificate. MARC, PO Box 4862, Macon, GA 31208. **www.members.cox.net/w4bkm**

Mar 19, 1400Z-2100Z, W4OT, Vero Beach, FL. Vero Beach Amateur Radio Club. Celebrating the Start of the National Wildlife Refuge System and the 108th Birthday of Pelican Island National Wildlife Refuge. 28.450 21.350 14.240 7.255. Certificate. VBARC, PO Box 2082, Vero Beach, FL 32961. Pelican Island National Wildlife Refuge was the first. **www.vbarc.net**

Mar 19-Mar 20, 1300Z-0100Z, W8FT, Findlay, OH. Findlay Radio Club. Findlay Radio Club Celebrates 90 Years of Existence. 21.285 21.055 14.255 14.055 7.260 7.055 3.855 3.555. QSL. Findlay Radio Club, PO Box 587, Findlay, OH 45839. **www.w8ft.org**

Mar 27, 1000Z-2300Z, K5B, Las Cruces, NM. Mesilla Valley Radio Club. Bataan Memorial Death March Marathon. 21.337 14.330 7.225 3.893. QSL. Special Events Station K5B, c/o Mesilla Valley Radio Club, PO Box 1443, Las Cruces, NM 88004. **www.n5bl.org/bataan**

Mar 28-Apr 2, 0001Z-2359Z, KØR, Boone, IA. Tall Corn Amateur Radio Club. Boone Speedway Annual Frost Buster Race. 21.310 14.260 7.250 3.980. Certificate. Jim Moreland, 109 S Underhill St, Boone, IA 50036. **w0bnw@yahoo.com**

Mar 29-Mar 30, 1500Z-0000Z, K7GST, Prescott, AZ. Yavapai Amateur Radio Club. Celebration of the 100th Anniversary of the Creation of the M1911 Pistol. 21.335 14.250 14.055 7.250. QSL. Yavapai Amateur Radio Club, PO Box 11994, Prescott, AZ 86304. Operating from Gunsite Academy. **www.w7yrc.org**

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 **May** *QST* would have to be received by **Mar 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 January 10. You can view all received Special Events at **www.arrl.org/special-event-stations**.

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Colorado (Longmont) — Apr 2 D F H R V
8 AM-2 PM. *Spr:* Longmont ARC. Boulder County Fairgrounds, 9595 Nelson Rd. *Tl:* 147.27. (100 Hz). *Adm:* $5. Tables: $10. Gerald Schmidt, NØOUW, 1541 Judson Dr, Longmont, CO 80501; 720-341-8751; fax 303-772-6736; **n0ouw@arrl.net**; **w0eno.org**.

Connecticut (Dayville) — Mar 19 D F H R V
8 AM-noon. *Spr:* Eastern Connecticut ARA. St Joseph's Church Hall, 350 Hartford Pike (Rte 101). *Tl:* 147.225 (156.7 Hz). *Adm:* $3. Tables: $10. Paul Rollinson, KE1LI, 182 Wrights Crossing Rd, Pomfret Center, CT 06259; 860-928-2456; fax 860-928-3844; **ke1li@arrl.net**; **www.qsl.net/k1muj/**.

Connecticut (Southington) — Mar 20
D F H Q R V
8 AM-noon. *Spr:* Southington ARA. Southington High School, 720 Pleasant St. 28th Annual Hamfest, ARES meeting. *Tl:* 147.345, 145.49 DV (both 77 Hz). *Adm:* $5. Tables: advance $15, door $20. Norm Fusaro, W3IZ, 586 King St, Bristol, CT 06010; 860-584-1403; **w3iz@sbcglobal.net**; **www.chetbacon.com/sara.htm**.

Florida (Fort Walton Beach) — Mar 25-26
D F H Q R S V
Friday 5-9 PM; Saturday 8 AM-3 PM. *Spr:* Playground ARC. C. H. "Bull" Rigdon Fairgrounds, 1958 Lewis Turner Blvd. *Tl:* 146.79 (100 Hz). *Adm:* $5. Tables: $10. Scott Morgan, AC5LT, Box 873, Fort Walton Beach, FL 32549; 850-496-1819; **parcfest@w4zbb.org**; **w4zbb.org**.

Florida (New Port Richey) — Mar 26 R T V
8 AM. *Spr:* Gulf Coast ARC. Ridgewood High School Gym Parking Lot, 7650 Orchid Lake Rd. *Tl:* 146.67. *Adm:* $6. Tables: Included in admission. Jerry Patterson, K4JHK, Box 595, New Port Richey, FL 34656; 727-946-5186; **k4jhk@verizon.net**; **www.gulfcoastarc.org**.

Florida (Punta Gorda) — Mar 12
D F H R T V
8 AM-3 PM. *Spr:* Peace River Radio Assn. Tropical Gulf Acres Clubhouse, 28272 Pasadena Dr. *Tl:* 147.255 (136.5 Hz). *Adm:* $5. Tables: $10 (tailgate space $5). Tom Lambie, N4XJQ, c/o PRRA, Box 510943, Punta Gorda, FL 33951; 941-639-3670 or 941-661-2547 (cell); **n4xjq@comcast.net**; **www.w4dux.net**.

Florida (Stuart) — Mar 19 D F H Q R S T V
8 AM-5 PM. *Spr:* Martin County ARA. Martin County Fairgrounds, 2616 SE Dixie Hwy. *Tl:* 147.06. *Adm:* Free. Tables: $20 (inside swap), $50 (commercial vendors). Doug Shields, W4DAS, Box 1901, Stuart, FL 34995; 772-349-7820; **w4das@arrl.net**; **www.stuarthamfest.com**.

Florida (West Palm Beach) — Mar 12
D H Q R S T V
8 AM-3 PM. *Spr:* Palms West ARC. Family Services Center, 5841 Corporate Way. *Tl:* 147.045 (110.9 Hz). *Adm:* $2. Tables: $5. Rob Pease, KS4EC, 5841 Corporate Way, West Palm Beach, FL 33407; 561-358-9999; **ks4ec@arrl.net**; **www.palmbeachradiofest.com**.

Georgia (Marietta) — Mar 19
D F H Q R S T V
8 AM-3 PM. *Spr:* Kennehoochee ARC. Jim Miller Park, 2245 Callaway Rd. 58th Annual Hamfest. *Tl:* 146.88 (100 Hz). *Adm:* advance $5, door $6. Tables: $20. Don Heppe, W5LGK, 1425 Ridgeway Dr NW, Acworth, GA 30102; 404-630-1249; **w5lgk@bellsouth.net**; **w4bti.org**.

Indiana (Columbus) — Mar 26 D F H R T V
8 AM-2 PM. *Spr:* Columbus ARC. Community Building, 750 W County Rd 200 S. 28th Annual Hamfest. *Tl:* 146.79 (100 Hz). *Adm:* advance $4.50, door $5. Tables: $8. Russ Holderness, KA9MZV, 2654 Hawpatch Dr, Columbus, IN 47203; 812-372-7422 or 317-691-3345 (cell); **rholder433@live.com**; **www.qsl.net/carc**.

Indiana (Terre Haute) — Mar 12
D F H R S T V
8 AM-1 PM. *Spr:* Wabash Valley ARA. Terre Haute National Guard Armory, 3614 Maple Ave. *Tl:* 146.685 (151.4 Hz). *Adm:* $5. Tables: Free. Nick Vinardi, N9WG, Box 172, New Goshen, IN 47863; 812-870-9459; **n9wg@hotmail.com**; **www.w9uuu.org**.

Kentucky (Cave City) — Mar 5 D F H R T V
7:30 AM-3 PM. *Spr:* Mammoth Cave ARC. Cave City Convention Center, 502 Mammoth Cave St. 35th Annual Cave City Hamfest. *Tl:* 146.94. *Adm:* $6. Tables: $8. Larry Brumett, KN4IV, 108 Withers Dr, Glasgow, KY 42141; 270-651-2363; **lbrumett@glasgow-ky.com**.

Louisiana (Rayne) — Mar 11-12
D F H Q R S V
Friday 5-8 PM, Saturday 8 AM-2 PM. *Spr:* Acadiana ARA. Rayne Civic Center, 300 Frog Festival Dr. *Tl:* 146.82. *Adm:* advance $4, door $5. Tables: $10. Irma Bookter, KE5UPK, 301 Cheyenne Cir, Scott, LA 70583; 337-235-5653; **ilafle@hotmail.com**; **w5ddl.org/hamfest/index.htm**.

Coming ARRL Conventions

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*

March 11-12
Oklahoma Section, Claremore

March 12-13
North Carolina Section, Concord

March 19
Nebraska State, Lincoln
West Texas Section, Midland

March 25-26
Maine State, Lewiston

March 26-27
Maryland State, Timonium

April 2-3
New Jersey State, Ewing

April 15-17
International DX, Visalia CA

April 16-17
Communications Academy, Seattle, WA

April 22-23
Southeastern VHF, Huntsville, AL

April 22-24
Idaho State, Boise

April 23
Louisiana State, Monroe
North Carolina State, Raleigh

May 6-8
EMCOMMWEST, Reno, NV

May 7
South Carolina State, Spartanburg

*See February *QST* for details.

MAINE STATE CONVENTION

March 25-26, Lewiston
D F H R S V
The Maine State Convention (33rd Annual "Andy" Hamfest and Computer Fair), sponsored by the Androscoggin ARC, will be held at the Ramada Conference and Convention Center, 490 Pleasant St. Doors are open Friday 7-9 PM, Saturday 8 AM-noon. Features include exhibitors, vendors, new and used radio and electronics gear, computers, forums, VE sessions, handicapped accessible, refreshments. Talk-in on 146.61. Admission is $7 in advance, $8 at the door. Tables are $8. Contact Ivan Lazure, N1OXA, 440 Webber Ave, Lewiston, ME 04240; 207-577-5152; **n1oxa@arrl.net**; **www.w1npp.org**.

MARYLAND STATE CONVENTION

March 26-27, Timonium
D F H Q R S T V
The Maryland State Convention (42nd Annual Greater Baltimore Hamboree and Computerfest), sponsored by the Baltimore ARC, will be held at the Maryland State Fairgrounds, 2200 York Rd. Doors are open Saturday 8 AM-4 PM, Sunday 8 AM-2 PM. Features include giant indoor and outdoor show and sales areas, flea market, dealers, tailgating, forums, QSL card checking (Saturday, 9 AM-1 PM), free VE exams (Saturday only, 9 AM, Crowne Plaza Hotel; pre-registration requested, John Creel, 301-572-5124; **creewb3gxw@aol.com**). Talk in on 146.67 (107.2 Hz). Admission is $6 per day ($10 for the weekend if paid in advance). For table prices, see web site. Contact Keon Hayes, KE3HAY, Box 120, Reisterstown, MD 21136; 410-499-7117 or 443-590-1444; fax 410-256-1130; **w3ft67@yahoo.com** or **gbhc@w3ft.com**; **www.gbhc.org**.

Michigan (Lowell) — Apr 2 D F H R V
8 AM-noon. *Spr:* AR Group of Youth in Lowell. Lowell High School, 11700 Vergennes St. *Tl:* 145.27, 146.62 (both 94.8 Hz). *Adm:* $5. Tables: See web site. Al Eckman, WW8WW, 725 Bowes Rd, Apt K6, Lowell, MI 49331; 616-450-4332; **al.eckman@comcast.net**; **www.argyl.org**.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

Michigan (Marshall) — Mar 19 D H R V
8 AM-noon. *Spr:* Southern Michigan ARS. Marshall Activity Center, 15325 W Michigan Ave. 51st Annual Michigan Crossroads Hamfest. *TI:* 146.66 (94.8 Hz). *Adm:* $5. Tables: $10. John Davidson, W8JRD, 30 Mill Rd, Battle Creek, MI 49014; 269-339-1908; **crossroadshamfest@gmail.com**; **www.w8df.com/hamfest.html**.

Minnesota (Buffalo) — Mar 26 D F H R V
8 AM-1 PM. *Spr:* Robbinsdale ARC. Buffalo Civic Center, 1306 County Rd 134. 30th Annual Midwinter Madness Hobby Electronics Show. *TI:* 147.0. *Adm:* $8. Tables: $20. Jerry Dorf, NØFWG, Box 22613, Robbinsdale, MN 55422; 763-537-1722; **k0ltc@k0ltc.org**; **www.k0ltc.org**.

Missouri (Mount Vernon) — Apr 9
D F H Q R V
Set up Friday after 4 PM; public Saturday 8 AM-4 PM. *Spr:* Ozarks ARS. Mount Vernon Middle School, 731 Landrum St. *TI:* 146.97. *Adm:* advance $4, door $5. Tables: advance $8, door $10. Mike Sanders, KØAZ, 18169 Hwy 174, Mount Vernon, MO 65712; 417-205-6000; **k0az@arrl.net**; **www.w0oar.com**.

NEBRASKA STATE CONVENTION

March 19, Lincoln
D F H Q R S V
The Nebraska State Convention, sponsored by the Lincoln ARC, will be held at the Lancaster Event Center, 84th and Havelock Ave. Doors are open 8 AM-4 PM. Features include flea market; vendors; forums; special guest from ARRL Hq Steve Ewald, WV1X, ARRL Field Organization Supervisor; QSL card checking; VE sessions; handicapped accessible; refreshments. Talk-in on 146.76. Admission is $5 in advance, $8 at the door. Tables are $10. Contact Reynolds Davis, KØGND, 3901 S 42nd St, Lincoln, NE 68506; 402-488-3706; **reynoldsd1@aol.com**; **www.lincolnhamfest.org**.

New Hampshire (Henniker) — Mar 27
D F H R S V
8 AM-2 PM. *Spr:* Contoocook Valley RC. Henniker Community School, 51 Western Ave. *TI:* 146.895 (100 Hz). *Adm:* $3. Tables: $10. Donald Curtis, N1ZIH, 353 N State St, Apt 1, Concord, NH 03301; 603-651-8000; **n1zih@comcast.net**; **www.k1bke.org**.

New Jersey (Clinton) — Mar 19
D F H Q R S V
8 AM-4 PM. *Spr:* Cherryville Repeater Assn II. North Hunterdon Regional High School, Rte 31. *TI:* 147.375 (151.4 Hz). *Adm:* $7. Tables: $25. Mike Varas, N1MNV, 7 Decatur Ct, Ringoes, NJ 08551, 908-806-3998; **mvaras@comcast.net**; **www.qsl.net/w2cra/**.

NEW JERSEY STATE CONVENTION

April 2-3, Ewing
D F H R S V
The New Jersey State Convention, sponsored by the Delaware Valley Radio Assn, will be held at The College of New Jersey, 2000 Pennington Rd (held in conjunction with the 2011 Trenton Computer Festival). Doors are open Saturday 9 AM-5 PM, Sunday 9 AM-3 PM; sellers at 8 AM. Features include a huge indoor flea market (non-commercial sellers, $15 per day or $25 for two days, plus admission), commercial dealers, fifty technical forums, one-day Technician Boot Camp Course (Saturday, preregistration required, **aa2f@arrl.net**; textbook $16), VE sessions (both days, 2 PM; $15 fee), handicapped accessible, refreshments. Talk-in on 146.67 (131.8 Hz). Admission is $13 in advance, $15 at the door (one-day admission on Sunday is $10 at the door); under 10 free. Contact Henry Castiglione, N2HEM, Box 7852, West Trenton, NJ 08628; 800-426-6736; **HenryLion@aol.com**; **www.tcf-nj.org/**.

New Jersey (Toms River) — Apr 10
D F H R T V
7 AM-noon. *Spr:* Jersey Shore ARS. Riverwood Park, Riverwood Rd. *TI:* 146.91 (127.3 Hz). *Adm:* $5. Tables: $15. Don McGlaughlin, K2HCW, Box 811, Ocean Gate, NJ 08740; 732-237-9448; **k2hcw@comcast.net**; **jsars.org**.

New Jersey (Township of Washington) — Mar 6
D H R **(Auction)**
12 noon. *Spr:* Bergen ARA. Westwood Regional High School, 701 Ridgewood Rd. *TI:* 146.79 (141.3 Hz). *Adm:* Free. James Joyce, K2ZO, 286 Ridgewood Blvd N, Township of Washington, NJ 07676; 201-664-6725; **k2zo@arrl.net**; **www.bara.org**.

New York (LaGrangeville) — Apr 10
D F H R T V
8 AM-2 PM. *Spr:* Mt. Beacon ARC. Tymor Park, 249 Duncan Rd. *TI:* 146.97 (100 Hz). *Adm:* $7. Tables: $15 (tailgating $9 per space). David Ruth, KC2AFK, 48 Hoof Print Rd, Millbrook, NY 12545; 845-677-5079; **kc2afk@optimum.net**; **www.wr2abb.org**.

New York (Middletown) — Mar 26
D F H Q R T V
8 AM-2 PM. *Spr:* Orange County ARC. Town of Wallkill Community Center, 2 Wes Warren Dr. *TI:* 146.76 (100 Hz). *Adm:* $6. Tables: $12. Neil Shubert, AC2O, 16 Pioneer Tr, Monroe, NY 10950; 914-490-2001; **carmic7@gmail.com**; **ocarc-ny.org**.

New York (West Seneca) — Mar 12
D F H R V
8 AM-2 PM. *Spr:* Lancaster ARC. Ismailia Shrine Center, 1600 Southwestern Blvd. Greater Buffalo Spring Hamfest. *TI:* 147.255 (107.2 Hz). *Adm:* $7. Tables: $7. Luke Calianno, N2GDU, 1105 Ransom Rd, Lancaster, NY 14086; 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net**.

NORTH CAROLINA SECTION CONVENTION

March 12-13, Concord
D F H Q R S V
The North Carolina Section Convention (Charlotte Hamfest), sponsored by the Mecklenburg ARS, will be held at the Cabarrus Arena and Events Center, 4751 Hwy 49 N. Doors are open Saturday 8:30 AM-5 PM; Sunday 9 AM-1 PM. Features include commercial dealers, manufacturers, exhibitor booths, flea market, QSL card checking, forums, VE sessions (all classes; registration 12:30 PM, testing at 1 PM; $10 fee), on-site camping, handicapped accessible, refreshments. Talk-in on 146.655, 146.94. Admission is $7 in advance, $10 at the door (good both days); under 12 free when accompanied by a paying adult. Tables are $20 (electricity $40, chairs $1). Contact Charlotte Hamfest Info, W4BFB, 16007 Wynfield Creek Pkwy, Huntersville, NC 28078; 704-948-7373; **HamfestInfo2011@w4bfb.org**; **www.w4bfb.org/hamfest**.

Ohio (Cuyahoga Falls) — Apr 9 D H R
8 AM-1:30 PM. *Spr:* Cuyahoga Falls ARC. Emidio & Sons Party Center, 48 E Bath Rd. 57th Annual Hamfest, Electronics, and Computer Show. *TI:* 147.27. *Adm:* $6. Tables: $15. Ted Sarah, W8TTS, 239 Bermont Ave, Munroe Falls, OH 44262; 330-688-2013; **www.cfarc.org/hamfest2011.html**.

Ohio (Gallipolis) — Mar 12 F H R S V
9 AM-1 PM. *Spr:* Mid-Ohio Valley ARC. Gallipolis Christian Church, 4486 State Route 588. *TI:* 147.06 (74.4 Hz). *Adm:* advance $4, door $5. Tables: $5. Steven Little, WD8NUY, 402 LeGrande Blvd., Gallipolis, OH 45631; 740-441-5007; **slittle@zoomnet.net**.

Ohio (Perrysburg/Toledo) — Mar 20
D F H R S V
8 AM-2 PM. *Spr:* Toledo Mobile Radio Assn. Owens Community College (Student Health and Activity Center), 30335 Oregon Rd. 56th Toledo Hamfest and Computer Fair. *TI:* 147.27 (103.5 Hz). *Adm:* $6. Tables: $20 (non-wall), $25 (wall). Brian Harrington, WD8MXR, 4463 Holly Hill Dr, Toledo, OH 43614; 419-385-5624; fax 419-383-5880; **wd8mxr@gmail.com**; **www.tmrahamradio.org**.

OKLAHOMA SECTION CONVENTION

March 11-12, Claremore
D F H S V
The Oklahoma Section Convention, sponsored by the Green Country Hamfest, Inc, will be held at the Claremore Expo Center, 400 Veterans Pkwy. Doors are open for setup on Friday at noon and Saturday at 7 AM; public Friday 5-9 PM, Saturday 8 AM-3 PM. Features include radio, electronics and computer show; large indoor flea market; commercial vendors and dealers; fantastic free forums; free test table (check it before you buy it); VE sessions (Friday and Saturday); handicapped accessible. Talk-in on 147.09. Admission is $8 in advance, $10 at the door. Tables are $10 in advance, $15 at the door (electricity is $20; cords not provided). Contact Merlin Griffin, WB5OSM, Box 470132, Tulsa, OK 74147-0132; 918-520-7668; **wb5osm@sbcglobal.net**; **www.greencountryhamfest.org**.

Ontario (Brampton) — Mar 26. Don McPhee, VE3REO, 647-233-8817; fax 905-791-1974; **donmcphee@rogers.com**; **www.ham-ex.ca**.

Pennsylvania (Spring Grove) — Apr 9
D F H Q R S T V
8 AM-2 PM. *Spr:* York Hamfest Foundation. Porters Community Fire Hall, 1199 Porters Rd. 56th Annual York Hamfest. *TI:* 147.33 (123 Hz), 147.495 backup. *Adm:* $5. Tables: advance $15, door $20 (outdoor tailgate space $5). Tabitha Zier, N3TOH, 3 Cardinal Dr, Hanover, PA 17331; 717-632-6719; **tazier@embarqmail.com**; **www.yorkhamfest.org**.

Tennessee (Bartlett) — Apr 9
F H Q R S T V
Set up 7-9 AM; public 9 AM-3 PM. *Spr:* Mid-South ARA. Bartlett Station Municipal Center, 5868 Stage Rd. MARS Meeting. *TI:* 147.03 (107.2 Hz). *Adm:* Free. Tables: Free (reservations strongly recommended). Tony Brignole, WA4KHN, 2444 Lacosta Dr, Bartlett, TN 38134; 901-372-2738; **abrigno@comcast.net**; **maraonline.org**.

Tennessee (Tullahoma) — Mar 19
D F H R S T V
8 AM-2 PM. *Spr:* Middle Tennessee ARS. First Methodist Church, 208 W Lauderdale St. *TI:* 146.7 (114.8 Hz). *Adm:* $5. Tables: $10 (6-ft), $15 (8-ft). Michael Glennon,KB4JHU, 302 Twelve Oaks Rd, Tullahoma, TN 37388; 931-461-3037; **kb4jhu@arrl.net**; **www.qsl.net/mtars**.

Tennessee (Union City) — Mar 19
D F H Q R S T V
7 AM-2 PM. *Spr:* Reelfoot ARC. Tennessee National Guard Armory, 2017 E Reelfoot Ave. *TI:* 146.7 (100 Hz). *Adm:* $5. Bob Miles, K9IL, 113 Greenacres Dr, Martin, TN 38237; 731-588-2840; **greenacres113@charter.net**; **www.reelfootarc.com**.

Texas (Belton) — Apr 2 D F H R T V
7 AM-2 PM. *Spr:* Temple ARC. Bell County

Expo Center, 301 W Loop 121. "HamEXPO." *TI:* 146.82 (123 Hz). *Adm:* $5. Tables $15-$25. Mike LeFan, WA5EQQ, 1802 S 13th St, Temple, TX 76504; 254-773-3590; fax 254-231-4128; **expo@tarc.org**; **www.beltonhamexpo.org**.

Texas (Irving) — Mar 12 D F H R V
8 AM-2 PM. *Spr:* Irving ARC. Betcha Bingo Hall #1, 2420 W Irving Blvd, #125. 9th Annual Hamfest. *TI:* 146.72 (110.9 Hz). *Adm:* advance $3, door $4. Tables: advance $8, door $10. Coleta Taylor, KD5QFH, 107 E 7th St, Irving, TX 75060; 972-579-9089; **coleta.mt@verizon.net**; **www.irvingarc.org/iarchamfest.html**.

WEST TEXAS SECTION CONVENTION

March 19, Midland
D F H Q R S T V

The West Texas Section Convention (56th Annual St Patrick's Day Hamfest), sponsored by the Midland ARC, will be held at the Midland Lions Club, 200 Plaza Ave. Doors are open 8 AM-2 PM. Features include large indoor flea market, dealers and exhibitors, ARRL Forum, VE sessions (1 PM, $15 fee), QSL card checking, handicapped accessible, limited RV parking, snack bar. Talk-in on 147.3. Registration is $8 in advance, $9 at the door. Tables are $10 each (online registration available). Contact Joe Coldewey, KK5ZG, 4510 Fairbanks Dr, Midland, TX 79707; 432-697-7846; **kk5zg@grandecom.net**; **hamfest.w5qgg.org**.

Texas (Weatherford) — Mar 26 D F H R T V
7 AM-noon. ARC of Parker County. Couts Memorial United Methodist Church Gym, 802 N Elm St. *TI:* 147.04 (110.9 Hz). *Adm:* advance $4, door $5. Tables: $10 (8-ft). Jerry Thompson, W7JT, 302 E 6th St, Weatherford, TX 76086; 817-594-8091; **w7jt@arrl.net**; **www.w5pc.org**.

Washington (Puyallup) — Mar 12 D F H R V
9 AM-3 PM. *Spr:* Mike and Key ARC. Western Washington Fairgrounds Pavilion Exhibition Hall, 110 9th Ave SW. 30th Annual Electronics Show and Fleamarket, club info, consignment store. *TI:* 146.82 (103.5 Hz). *Adm:* $8. Tables: $32. Michael Dinkelman, N7WA, 22222 148th Ave SE, Kent, WA 98042; 253-631-3756; **n7wa@arrl.net**; **www.mikeandkey.org/flea.htm**.

West Virginia (Charleston) — Mar 19
D F H Q R V
9 AM-2 PM. *Spr:* Charleston Hamfest Committee. Coonskin Armory, 1707 Coonskin Dr. 27th Annual Charleston Area Hamfest and Computer Show. *TI:* 145.35 (95.5 Hz). *Adm:* $5. Tables: $5. David Ellis, WA8WV, 610 Hillsdale Dr, Charleston, WV 25302; 304-344-4488; **wa8wv@aol.com**; **www.w8gk.org/docs/HamfestFlyer2011.pdf**.

Wisconsin (Eau Claire) — Mar 12 D H R
8 AM. *Spr:* Eau Claire ARC. Grace Lutheran Church, 202 W Grand Ave. 23rd Annual AR Equipment Auction. *TI:* 146.91 (110.9 Hz). *Adm:* $5. Rolf Nestingen, KGØKM, 202 W Grand Ave, Eau Claire, WI 54703; 715-832-7913; **bignorsk@hotmail.com**; **www.ecarc.org**.

Wisconsin (Jefferson) — Mar 20 D H R V
8 AM-1 PM. *Spr:* Tri-County ARC. Jefferson County Fairgrounds Activity Center, 503 N Jackson Ave. *TI:* 145.49 (123 Hz). *Adm:* $5. Tables: $8 (until Mar 16), $10 (after Mar 16). Paul Marowsky, KD9PM, Box 411, Johnson Creek, WI 53038; 920-674-4968; **hamfest@w9mqb.org**; **w9mqb.org**.

Wisconsin (Milwaukee) — Apr 1-2
D H Q R S V
Friday 2-6 PM; Saturday 8:30 AM-3 PM. *Spr:* Amateur Electronic Supply. AES Milwaukee, 5710 W Good Hope Rd. "AES Superfest 2011"; foxhunt; area clubs and organizations; Gordon West; special guest ARRL President Kay Craigie, N3KN. *TI:* N9LKH 145.130/144.530 (127.3 Hz); D-Star KC9LKZ 442.46875 (Port B), 145.425 (Port A). *Adm:* Free. Tables: Free. Ray Grenier, K9KHW, 5710 W Good Hope Rd, Milwaukee, WI 53223; 414-358-4088; fax 414-358-3337; **rayk9khw@aol.com**; **www.aesham.com**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **March 1** to be listed in the **May** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL Web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

ARRL VEC Volunteer Examiner Honor Roll

The ARRL VEC Honor Roll recognizes the top 25 Volunteer Examiners according to the total number of exam sessions they have participated in since their accreditations. Since each session requires an average time commitment of 2-4 hours or more, the thousands of hours these VEs have invested in extraordinary! Whether you are one of our VE Teams that test once a week, once a month or once a year, we want to express our warmest appreciation to all volunteers for their generous contribution to the ARRL VEC program.

If you are an ARRL VE, you can see your session stats online at **www.arrl.org/ve-session-counts**.

If you're not a VE, become one! See **www.arrl.org/become-an-arrl-ve**.

Examiner Call	*Sessions*	*Accreditation Date*	*Examiner Call*	*Sessions*	*Accreditation Date*
Sammy Neal, N5AF	506	20-Nov-84	John Hauner, KØIH	292	11-Jan-85
Harry Nordman, ABØSX	440	9-Jan-02	David Fanelli, KB5PGY	289	1-Oct-91
Royal Metzger, K6VIP	368	29-Apr-85	Daniel Calabrese, AA2HX	284	1-Nov-91
Karen Schultz, KAØCDN	358	6-Sep-84	Gary Mangels, AD6CD	282	30-Jul-97
Kevin Naumann, NØWDG	357	17-Nov-02	Frankie Mangels, AD6DC	278	14-Oct-97
Franz Laugermann, K3FL	349	1-Dec-91	Michael Faucheaux, N5KBW	275	15-Jul-96
David Bartholomew, ABØTO	348	22-Mar-02	Robert Hamilton, NØRN	270	19-May-87
John Moore III, KK5NU	332	21-May-95	Loren Hole, KK7M	269	6-Sep-84
John Mackey Jr, KSØF	324	1-Oct-90	Richard Morgan, KD7GIE	269	11-Aug-00
Paul Maytan, AC2T	320	6-Sep-84	Leslie Dale, NI5S	268	6-Sep-84
Victor Madera, KP4PQ	308	1-Mar-92	Adolph Chris Koehler, K5VCR	267	29-Sep-95
Gerald Grant, WB5R	297	4-Jan-85	Roy Johnson, N1IKM	267	24-Jul-95
William Martin, AIØD	294	1-Nov-84			

WB8IMY

ECLECTIC TECHNOLOGY

Keeping Sounds "On the Level"

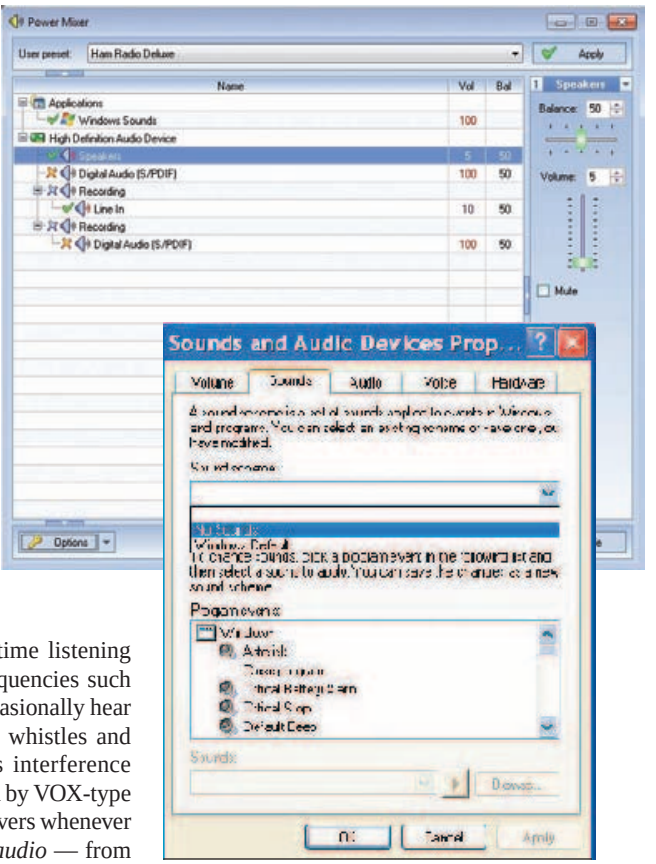
Back in the day, that day being a few years ago, if you wanted to enjoy digital Amateur Radio using one of the many modes that rely on sound-card-based software, your only option was to wire your computer sound card (or sound chipset) directly to your transceiver. That usually entailed an interface with isolation transformers in the transmit and/or receive audio lines.

In 2011 there is a strong trend favoring USB interfaces with sound devices already built in. See my "Short Takes" review of the microHAM DigiKeyer II in last month's *QST*. I expect this trend to continue and eventually arrive at the point where these types of interfaces utterly dominate the market. Until that happens, however, many of us will continue using our computer sound circuitry to do the work.

I'm among the holdouts. Not that I dislike interfaces with built-in sound hardware. On the contrary, I think they are terrific. I just enjoy playing around with homebrew designs. I recently built an interface around a CW, FSK and PTT keying board created by Bob Peterson, W3YY (**www.w3yy.com/fsk.htm**). But with my station computer running several types of Amateur Radio digital software, and with the family using it as well, keeping track of audio settings is a challenge. Transmit/receive sound levels that are appropriate for my *WSJT* software, for instance, are totally wrong for *Digital Master 780*. If my teenage daughter decides she wants to listen to music on the PC, all bets are off!

QuickMix (**www.ptpart.co.uk/quickmix/**) has been a popular solution for *Windows XP* users for years. It allows you to set up audio configurations you can enable with a single mouse click. After switching to *Windows 7*, however, I discovered that *QuickMix* was incompatible. (It doesn't work with *Vista*, either.) Fortunately, I tracked down *Power Mixer* by Actual Solution. This is a well-designed piece of software that allows you to set up elaborate "presets" that adjust sound levels and even select different sound devices in a heartbeat. With a mouse click or a hot key I can instantly configure the correct audio levels for whatever software I intend to use.

You can download the free 14 day trial version at **www.actualsolution.com/download.htm**. A few hours after installing *Power Mixer*, however, I was more than ready to part with $17.95 to get the fully registered version.



Power Mixer **software at www.actualsolution.com/download.htm.**

In this example from *Windows XP*, you can use the Sound and Audio Devices window to disable *Windows* sounds.

Speaking of Sounds...

If you spend enough time listening to the popular PSK31 frequencies such as 14.070 MHz, you'll occasionally hear beeps, boops, locomotive whistles and even music. Most of this interference isn't deliberate. It is caused by VOX-type interfaces that key transceivers whenever they detect audio — *any audio* — from the computers. I'm willing to bet the operators aren't even aware that their computers are guilty of this obnoxious behavior.

The solution, at least in *Windows*, is simple: Turn off "*Windows* sounds" before you get on the air. In the *Power Mixer* presets you have an option to automatically disable all *Windows* sounds. You can also do this manually by opening *Windows* Control Panel and double clicking the Sound and Audio Devices icon. Click the Sound tab and under Sound Schemes select NO SOUNDS. (Depending on the *Windows* version in question, the labels may differ.) Your fellow hams will thank you!

Repurpose a Hard Drive and Make it *Fast*

Many columns ago I discussed the debut of ultra-fast USB 3.0 technology. Today you can purchase computers and motherboards with USB 3.0 capability. You can also buy $30 USB 3.0 cards to add to your existing machine if it has an empty PCI-Express slot.

One excellent use of USB 3.0 is for making regular backups of your station computer. USB 3.0 can move enormous amounts of data in a fraction of the time required by USB 2.0.

With USB 3.0 backups in mind, many of us have cast-off SATA hard drives that we've pulled from other machines. These drives also turn up on eBay at absurdly low prices. I had a 75 GB SATA drive in my junk pile, but no easy means to put it to work as a backup drive (USB 3.0 or otherwise) unless I installed it within the computer itself. I preferred something portable.

Then along came the new AZiO SuperSpeed USB 3.0 drive enclosures. I got my hands on one of these the other day and they are genuinely clever devices. The AZiO enclosures make creating a portable backup drive a "snap" — literally; the old drive just snaps into place in the enclosure case. Installing the 75 GB drive took all of about 60 seconds and soon after I was making massive backups at lightning speeds. In addition to the rugged aluminum case, the AZiO model I selected featured a power supply, status LEDs and even a cooling fan. You'll find AZiO enclosures selling at $30 to $40 from retailers such as Newegg (**www.newegg.com**). QST

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

K2TQN

VINTAGE RADIO

The Mighty Purple Pajama No 3

Henry P. Broughton, K2AE (SK), loved to claim he was the first ham, stating he started in ham radio in 1893. Known to his friends in later years as the "Dean of Amateur Radio," he truly was one of ham radio's earliest pioneers.

Now before you think too deeply, let me explain how this came about. 1893 is extremely early and ham radio wasn't generally known until after 1910 and not licensed until 1912. So let's liken this to the first person who built a boat. There weren't any boat builders, so he did it and became the first one. Later many followed but someone had to be first.

Henry was born July 7, 1865, attended Cornell University and graduated in 1890 as an electrical engineer. He went to work for the Municipal Electric Light & Power Company in St Louis and was the assistant to Mr James I. Ayer, general manager. The company and Mr Ayer were members of the National Electric Light Association, which was scheduled to have a meeting in St Louis. Mr Ayer persuaded Nikola Tesla to attend and put on a demonstration.

Tesla's London Lecture

Arriving on February 28, 1893, Henry Broughton was assigned by his boss as an aide to Tesla during this visit and to "render him all possible help in preparing for the lecture, as well as during the lecture itself." The lecture would become known as the "London Lecture." It was delivered on the night of March 1, 1893.

During the lecture experiments Tesla and Broughton demonstrated wireless communication using electromagnetic waves across the auditorium stage, a distance of several yards. Unfortunately, those in the audience were unable to realize the significance of what they just witnessed. Later, others would receive credit for accomplishing the same thing.

On the day of Tesla's departure, March 4, Henry dined at the Southern Hotel with Nikola Tesla, Mr Ayer, Mr Porter Bragg and Miss Billings.

A short time later, on March 11, the *St Louis Dispatch* printed an account of the meeting of the Electric Club of St Louis where Henry gave a talk on his experience with Tesla.

THE ELECTRIC CLUB.

A Balance Left to Start a Library—Tesla's Lecture.

The first general meeting of the Electric Club since the National Convention was held last night. President Robert McCullough reported that the funds provided by the people of St. Louis for entertaining that body was $3,610, and he had great pleasure in announcing that the expenditures had been kept within that sum with a few dollars to spare. He thought that the contributors would have no objection if the balance were to be applied in starting an electrical library for the club. The President also stated that the lunch-counter was paying expenses.

By invitation Mr. Harry Broughton gave his impressions of Tesla, and explained at length, and interestingly, the apparatus which he employed in his lecture in St. Louis. Mr. Broughton assisted Tesla in preparing for the lecture, and was therefore able to describe the conditions under which he performed his great experiments. Mr. Wagner, who was present at Dr. Wellington Adams' dinner to Tesla, spoke of Tesla's fascinating powers of conversation, not only in electricity, but in whatever subject was broached.

Prof. Nipher discussed the salient scientific significance of some of Tesla's experiments, especially those in which phosphorescent effects were the feature. The problem is to produce a great amount of light with little energy—conditions that are found to perfection in the firefly—and Tesla seemed to be working along in that direction. The firefly's light is certainly produced in atmospheric air, and Tesla's idea of producing a similar light is not at all visionary.

A discussion then ensued over Tesla's receiving as he does, without injury, such enormous voltage of electricity, and various theories were proposed. Prof. Nipher suggested that the current did not pass through the lecturer's body; in fact, with such rapid alterations, the current was diffused over the surface. It was a well understood law that the greater the frequency the greater the resistance.

About a dozen applications for membership were approved.

The March 11, 1893 *St Louis Dispatch* article about the meeting of the Electric Club of St Louis.

Tesla's letter thanking Henry Broughton for assisting him during the "London Lecture."

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

Here is Henry, K2AE, at his microphone for an early morning session of the "Pyjama Club."

On April 10, 1893 Tesla wrote a letter to Henry from his residence at the Gerlach Hotel in New York:

> My dear Mr Broughton,
> I need not [amuse] you that I feel much indebted to you for your valuable help at the occasion of my lecture in St Louis.
> I beg you to accept the photo which I enclose as a proof of my friendly feelings toward you.
> Yours sincerely,
> N Tesla

Family Life

Henry moved on and married Jane Tinkham and on February 22, 1902 a son, William, was born. During 1903, according to Cornell's alumni news, Henry was employed as assistant sales manager by the Fort Wayne Electric Works of Fort Wayne, Indiana.

William G. Broughton, W2IR (SK)

It would be William who brought Henry into ham radio. William first became interested in "wireless" during the summer of 1914, at the age of 12. He wrote a letter to his father about his new hobby. In the letter he said,

> Dear Father: — John Allman and I became interested in a phamphlet [sic] that showed how to make a 'Wireless' without any expense. Well, we put up a 'Wireless' that was much better than this phamphate [sic] told how to make, however, this pamphlet is guilty for our sets. The sets we have are so much better than this phamplet [sic] described that we think we have might good stations. We have been pretty busy lately so we haven't had time to talk much but the fever is not dying by any means and am hearing Lake Boats all the time and pretty soon I expect to be able to read the messages they send out. I think my station's a little better than John's but we both have a good amount of fun. Yours truly, Bill.

At the beginning of the next summer, William received his Amateur Radio Operator's License, Second Class and his First Class license by the end of the summer — the first of many radio licenses he'd receive as time went on, such as 9SD, W9SD, 9JM, 8NJ and W2IR.

It would be years before Henry would be licensed by the FCC due to his being born in a rural area in 1865 and his birth was not documented. (FCC licensing required proof of citizenship.) But Henry was involved in ham radio with his son from the beginning, helping design and build homebrew equipment.

After college William went to work for General Electric in Schenectady, New York and Henry moved there and perhaps also worked for General Electric. (Henry's letterhead proudly proclaimed he was a "Self-Employed Independent Contractor since 1893 in home modernization.")

William and his father had a very close relationship with each other and with ham radio to the point that when they corresponded they referred to each other by call sign. This would continue by William even after his father became an SK in 1959.

An interesting online document titled *William G. Broughton: One Radio Ham* by Joseph "Jofish" Kaye was prepared while a student at Cornell University in 2004. Look for a link from my web page **www.k2tqn.com**. "Jofish" digs into William's documents located in Cornell's library and examines his life, his family relationship and his ham radio logbook entries. I will leave it to the reader to examine this 52 page document for more information.

The Mighty Purple Pajama No 3

Henry, well-known for his purple pajamas, was the head of "The Pyjama Club" [sic] and could be frequently found operating on the 75 meter band in the very early hours of the morning. He was also an active member of the Old-Old-Timers-Club (OOTC), the Professional Loafers Club and the Schenectady Amateur Radio Association. Henry and William were the first father-son team who were members of the Old-Old-Timers-Club.

Silent Keys

Henry became an SK in 1959 at the age of 93 and his call sign, K2AE, was transferred to the Schenectady Amateur Radio Association **(www.k2ae.org)** per his wishes.

William became an SK in 1994 and his call sign, W2IR, was donated to the Schenectady Museum Amateur Radio Association **(www.smara.com)**. His Collins radio equipment was also donated to the Schenectady Museum in memory of his father. The station is known as the Henry Primm Broughton Memorial Station. It is manned by the members of SMARA and is located inside the Schenectady Museum & Suits-Bueche Planetarium. The station can be visited by appointment.

William also set up a trust fund for a scholarship administered by the ARRL. The Henry Broughton, K2AE, Memorial Scholarship, presents a $1000 scholarship to any ham having a General class license or above, who lives within 70 miles of Schenectady, New York and is in a baccalaureate or higher course of study in engineering, sciences or a similar field at an accredited 4 year college or university. See **www.arrl.org/scholarship-descriptions** for more information**.**

For those wishing more information on Tesla and his experiments, I will post a PDF document on my website, **www.k2tqn.com** containing William's letter to the OOTC requesting proper recognition for his father. The letter is in great detail with exhibits and references to books written about Tesla. — *K2TQN*

Photos by John Dilks, K2TQN, unless otherwise noted.

JAMES MAC MURRAY, N2UZQ

William's Collins equipment in the Schenectady Museum Amateur Radio Association station, W2IR.

75, 50 AND 25 YEARS AGO

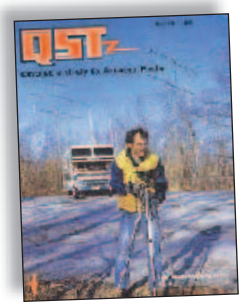
March 1936

- The cover photo shows the Morse code "fists" it has recorded with ink on paper tape.
- The editorial discusses the art of conversation, as applied to ham radio.
- George Grammer, W1DF, provides practical suggestions for "Operating Noise-Silencing Units."
- W1DF also writes about "Transmitter Band-Switching Systems," surveying the various techniques that are available.
- Vernon Chambers, W1JEQ, describes "A Low-Cost Crystal Transmitter" that's simple and which uses inexpensive receiving tubes.
- The "Results — 3500 Kc. Transoceanic Tests" reports that many transatlantic contacts were made during the December 80-meter test, but that a few careless U.S. operators were sending when they should have been listening, making it difficult for other U.S. ops to hear Europeans.
- F. H. Schnell, W9UZ, writes about "'Fists' I have Seen," and shows some of his paper-tape records (as shown on the cover) to make his points about good sending.
- Keith Williams, W6DTY, writes a fine tongue-in-cheek report of a high-power DX contester and his neighbors, in "Peace on Earth."
- Henry Keen, W2CTK, discusses "Transmission-Line Loading for Short Antennas." An accompanying graphic clearly illustrates the proverbial "Sky Hook."
- Perennial BPL traffic man Benton White, W4PL, asks, "Winter Brings Emergencies! QRV?" The photo of Ben surrounded by ice damage in his central Georgia QTH shows that hams need to be ready for anything, anywhere, anytime.

March 1961

- The cover photograph shows W2YM's great-looking homebrew transmitter and V.F.O., described in this issue.
- The editorial discusses self-policing in the ham bands, a practice that began in the earliest days of radio.
- George Hanchett, W2YM, tells about his 6146 rig with band-switching, a built-in power supply, and V.F.O., in "Complete Packaging for the 6146 Transmitter."
- Lew McCoy, W1ICP, uses parts from a discarded TV set to build a rig that will provide "65 Watts at Low Cost."
- Robert McFarland tells us how to build "A Pulsed, Crystal-Controlled Signal Generator" to check the performance of V.H.F. and U.H.F. receivers.
- Cal Hadlock, W1CTW, describes his "Wide-Band F.M. Gear for 220 Mc." The transmitter will provide up to 120 watts input with only two tubes, and the receiver is a revamped broadcast F.M. unit.
- Ed Fehrenbach, KZ5EG, tells about his "All-Metal Quad for 15 Meters," which he puts to good use in the Panama Canal Zone.
- G. M. Krivohlavek, K6AXN, presents "A 1296 Mc. Converter without Complications."
- Robert Karl, W8QFH, discusses "De Luxe Transistor Power Converters" that provide high and low voltages for a 50 watt mobile station.

March 1986



- The cover photograph shows WB1DNL, of the W1XX crew, at their mountaintop QTH.
- The editorial, "Spirituality," examines humankind's ongoing quest for knowledge, and the occasional missteps and stumbles along the path, such as the recent space shuttle *Challenger* disaster.
- Keith Sueker, W3VF, tells us how to get "Real-Time HF WEFAX Maps on a Dot-Matrix Printer."
- Ralph Taggart, WB8DQT, describes an SSTV imager that he calls "The Romscanner," which is easy to build, at low cost.
- Paul Shuch, N6TX, tutors us on logarithmic power ratios, in "Gaining on the Decibel."
- Donald Hillard, WØPW, presents an easy-to- build project, "A CW Transmitter for 902 MHz."
- Doug DeMaw, W1FB, tells us about his "Field Tester for Antennas," which enables us to avoid having to provide ac power and carry heavy test gear to the antenna site.
- John Lindholm, W1XX, explains how to have a big signal at contest time, in "VHF Mountaintopping in the '80s."

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

DECEMBER 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**.

555
W7TVA

410
KØIBS

345
KT2D

331
W2MTA

330
KA2ZNZ

310
AK2Z
K2DYB

295
WB9YBI

285
K2HAT

281
KI4KWR

268
NC4VA

232
K8OLY

218
W4CAC

215
W4DNA

200
WA2BSS
WB9JSR

186
WB8RCR

176
KB2ETO

173
KC2SFU

170
KT5SR
K2HJ

165
KE5HYW

164
K2ABX

160
KGØGG
N9VC
K6HTN
WM2C

155
WD9FLJ

150
KB5SDU

145
KB2BAA

WB9FHP

140
W5DY
WØLAW
KB2RTZ
N7CM
K7BFL
KK3F
K8RDN
WD8USA

135
W3YVQ
KA8ZGY
N2JBA
WE2G

132
KF2GC

130
W4OTN
NX9K
WB2FTX
K6JT
N1UMJ
K7EAJ
K4IWW

129
W7JSW
KB2CCD

128
N9DVL

127
KB5PGY

125
NN7H
N2GJ

120
KA4FZI
AG9G
K9LGU
N2GS
N8IO
WB8HHZ
W1GMF
KW1U
N1LKJ
WB8WKQ

115
N1IQI
KD1LE

114
N3RB

110
KE4CB
KA3OCS
W5GKH
K4BG
K4GK
W2DWR
N9MN

K1REV
K3RC
W8UL
KC5OZT
KF5CRX
NM1K
K1HEJ
KB1NMO
K1YCQ
WB6OTS
N7XG
N7YSS
W7GB
WI2G
W2EAG
WA5LOU
NS7K
N5NVP
KB8RCR

109
N2VC

105
KK5NU
K4BEH
K7OAH
K2TV
KC2ODN
NX8A

103
K2GW
KØLQB

102
N2DW

100
KCØM
WØCLS
NIØI
NØMEA
WAØVKC
N4ABM
N5OUJ
N1JX
KS3Z
N3SW
W3TWV
NR2F
WA3EZN
N8OD
WD8Q
WG8Z
N1QLN
KC2UVQ
K4SCL
W4TTO
W9LW
WB4FDT
AA3SB
W8CPG
K5MC
K8VFZ
KB8GT
AC8AL

99
WA4UJC
W3SB

98
WS6P

93
KO6V
KK7DEB

92
NA7G
K8AE

91
AL7N

90
K4MSG
N9VT
WB4BIK
W4WNE
W3GQJ
KA1G
W8IM
K4JGA
K1JPG
NU8K
KZ8Q
KT4YA
W8DJG
N8CJS
KC8WH
WB8SIQ
N8DD
KA5AZK
WA2CUW
AA2SV
WA2NDA
N3KB
KI4YV
WK4P
K3IN
N3ZOC
KB3LNM
WB6UZX

89
W9WXN

88
NA9L

87
W2CC

85
KB9KEG
N9WLW

84
KE5YTA
W7ELI
KØBXF

82
N2VQA
AD8BC

KK1A
N7IE
KBØDTI

81
K6RAU

80
W5CU
KB5KKT
KCØZDA
KA3NZR
KI4AAN
N4ELI
KJ4HGH
K8KV
WB8VNV
KJ7NO
N2YJZ
N5ASU
KD8CYK
W8QZ

79
WDØGUF

78
W5ESE
N8SY
KK7TN
W5XX
W1PLW

77
KB1KRS

75
KA8NSG
KC5MMH
WD8DHC

74
WB4GHU
KD7OED
KD8LZB

72
W1PLK
AC5CW

71
KB1RGQ

70
KØDEU
NØDLK
NØDUW
NØDUX
NUØF
KAØFUI
KBØJKO
NØMHJ
N3NTV
KØOR
KØRXC
NØUKO
KD7ZUP
W9RSX

The following stations qualified for PSHR in previous months, but were not properly recognized in this column: (Nov) K7BFL 140, W7GB 110, W5CU 91. (Oct) K2HJ 205, K4BEH 172, K4GK 150, WA4UJC 123, K4BG 110, KJ4DRW 90, W4WNE 90, WB4BIK 90. (Aug) WD8USA 230. (Jul) WD8USA 162. (Apr) WD8USA 209, WB8WKQ 110.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AZ, CT, CO, EB, EMA, ENY, EPA, EWA, GA, IL, IN, KS, LA, LAX, MDC, ME, MI, MN, MO, MS, NC, NFL, NLI, NNJ, NNY, NTX, OH, OK, OR, ORG, SD, SFL, SNJ, STX, SJV, TN, UT, VA, WCF, WI, WMA, WNY, WPA, WV, WWA, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, GA, IA, IN, KS, MDC, MI, MN, MO, MT, NC, NLI, NM, SD, SFL, STX, SV, TN, 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.

KK3F 5033, W5KAV 2546, W1GMF 2296, N1IQI 1959, W8UL 1648, WB5NKD 1462, KA9EKG 1445, WB2FTX 1290, KW1U 1261, WB9JSR 1118, W7TVA 934, N8IXF 739, W4WNE 728, K1JPG 722, N1UMJ 721, NX9K 672, WB8WKQ 645, N1LKJ 642,WB5NKC 620, K1JGA 653, N1JX 564, W7QM 543, N9VC 515, K4IWW 510, KA8AZK 501.

Stations earning BPL by Originations plus Deliveries: KB2RTZ 150.

The following station qualified for BPL in previous months, but were not properly recognized in this column: (Nov) NX9K 672, K8CQF 101 [Originations + Deliveries]. (Oct) W4WNE 614.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

K1DAP **McCollor**, Frederick J., Waterville, ME
W1DIT **Dunn**, Cletus M., Waterford, CT
W1FEX **Syriac**, Leonel, Vernon, CT
W1IQX **Spada**, George "Joe," Brewster, MA
KB1OVN **Pimental**, Russell "Russ," Riverside, RI
W1RMR **Marshall**, Walter E., Seminole, FL
N1SWB **Renault**, Cary L., Lowell, MA
W1SXN **Nese**, Richard A. Sr, Hingham, MA
♦W1UD **Voedisch**, William C. Jr, Leominster, MA
WA1URB **Lambert**, Paul A., Lake Placid, FL
W1WU **Schwartz**, Alfred J., Dedham, MA
KB2BU **Taylor**, Donald E., Canandaigua, NY
N2BW **Warren**, Barrett, Kingston, NY
KG2CK **Armstrong**, Harold T., East Randolph, NY
N2CPD **Walker**, Thomas P., Livonia, NY
K2CQV **Sousa**, David, New Bern, NC
KC2DI **Castellano**, Frank A., Massapequa Park, NY
WA2HPF **Snyder**, Melvin "Mel," Cherry Hill, NJ
K2IAV **Bower**, James M., Webster, NY
W2IBK **Chance**, Britton, Philadelphia, PA
W2KS **Seil**, Kenneth F., Rochester, NY
N2MUE **Tracy**, John E., Farmington, NY
ex-K2RGX **Glende**, Walter R., Palmyra, NY
♦KF2WH **Lavelle**, Michael J., Rochester, NY
AA2XG **Parker**, William E., Newark, NY
WA2ZKI **Bates**, James L., Rochester, NY
K3CKY **Cramer**, Ralph "Rusty," Huntingdon, PA
♦KA3EET **Horanic**, Frederick S., Marysville, PA
W3JKX **Lewis**, Earle H. Jr, Pottstown, PA
N3KKM **All**, Billy R., Winterville, NC
W3SEI **Keyes**, Richard, Germantown, MD
KA3WJJ **Saylor**, Melvin "Bill," Knox, PA
W3ZRS **Zengerle**, James "Zip," Lebanon, PA
KD4ATW **Carmichael**, Fredrick G., Jasper, TN
W4BFX **Harris**, Ernest, Selma, AL
WD4BGU **Moriarty**, Joseph A., Kingsport, TN
WD4BKF **Starkey**, Leonard R., Morrow, GA
W4BXN **Parmer**, Hugh K., Fort Walton Beach, FL
KF4CVD **Davis**, Jack, Spartanburg, SC
N4DZJ **Carnright**, Marshall W., Blairsville, GA
KG4GEZ **Eberwine**, Galen "Blink," Saint Petersburg, FL
N4IKJ **Peterson**, Guy, Watauga, TN
KF4JFM **Britt**, Charles L., Kingsport, TN
KB4KGL **Maiden**, Doug E., Bristol, VA
K4KSF **Cox**, William R., Stafford, VA
N4MQR **Alger**, Ralph J., Broadway, VA
KJ4MTC **Boling**, James W., Midlothian, VA
N4NUQ **Bright**, Willard C., Spartanburg, SC
K4OD **Rowe**, John Gordon., Macon, GA
K4OKK **White**, David L., Pensacola, FL
WA4OTA **Alexander**, Thomas W., Raleigh, NC
K4RUP **Wilson**, Paul A., High Point, NC
KC4SPB **Hall**, Howard B., Saint Petersburg, FL
KD4UVD **Ryan**, Glenn, Albertville, AL
NO4V **Burousas**, Jimmie, Barnesville, GA
W4WQD **Rowe**, Herbert E., Charlestown, IN
♦KC4X **Johnston**, Herbert R., Council, ID
KG4YKJ **Parsley**, Hiram, Inez, KY
KB5BWK **Greenshields**, David H., Sugar Land, TX
W5HAE **Nash**, William "Bill," Aubrey, TX
W5HTW **Brooks**, Emmett E., McIntosh, NM
♦W5JIZ **Pully**, Luther S. Jr, Dallas, TX
K5QWD **Corpier**, Bing R., Marshall, TX
N5WSM **Newman**, Betty B., Fort Smith, AR
NV5Y **Smith**, Eldred "Bud," Bonham, TX
W6CJG **Saylor**, Richard "Dick," Brentwood, CA
KB6DJ **Smith**, Jim T., Merlin, OR
K6FAS **Stawitcke**, Frederick A., Sunnyvale, CA
♦ex-K6NK **Nordstrom**, Gordon J., La Habra, CA
N6QHO **Steinberg**, Elliot, Martinez, CA
KB6QIO **Sullivan**, James M., Westminster, CA
WA6RF **Frampton**, Richard K., Indio, CA
KE6UOL **Britton**, Bennicha M., Fresno, CA
WA6VML **Damiano**, John F., Madera, CA
N7CXG **Bergum**, Irene L., Lynnwood, WA
W7KOP **Woodward**, Leonard "Woody," Provo, UT
W7KS **Crawfis**, Earl D. Jr, Houston, TX
KD7KTM **Smith**, Marilynn D., Orem, UT
AC7RK **Kennedy**, Robert "Bob," Port Angeles, WA
KC7TZO **Twadell**, Thomas R., Rialto, CA
KB7UB **Piedfort**, Robert D., Mena, AR
KD7WHJ **Roper**, Glen A., West Valley, UT
W7WWU **Larsen**, Gareld R., Rexburg, ID
K7WYC **Ranney**, Jay A., Sparks, NV
WA7YNN **Berkey**, Ray R., Eugene, OR
N7YYA **Yost**, Gerald G., Bosque, NM
W8BCI **Harger**, Daniel G., Lansing, MI
KB8CV **Ilas**, Robert, Amherst, OH
W8DAT **Brais**, Alfred H., Ashtabula, OH
W8GCF **Wood**, Richard J., Bluefield, WV
AA8JS **Runkle**, James H., Piqua, OH
♦W8KOX **Feeny**, Thomas M., Wolverine Lake, MI
WB8MCQ **Lewandowski**, Thomas G., Harbor View, OH
W8WIG **Chittenden**, Robert M., Green Forest, AR
WA8YGR **Marang**, Samuel L., Massillon, OH
KC8ZKA **Augustyniak**, Ralph D., Novi, MI
NG9B **Bowman**, John R., Chesterton, IN
K9CIL **Workman**, Errol, Chatham, IL
W9DYO **Smith**, Edgar J., West Allis, WI
KC9HVF **Davis**, Benjamin H., Gary, IN
♦N9HZ **Zook**, Robert B., Goshen, IN
KA9NEC **Caesar**, David E., Mishawaka, IN
K9PPT **Kittel**, Emil A., Alton, IL
N9RTX **Hobbs**, Shirley L. Jr, Chicago, IL
W9SPN **March**, Willard B., Albuquerque, NM
KA9TTW **Walker**, William L., Winona Lake, IN
W9WAR **Shoemaker**, Everett L., Winona Lake, IN
WØBUN **Hatch**, Bonnie C., Burlington, KS
NØDLV **Storey**, Jannie A., Howard, CO
WØEBG **Hargesheimer**, Frederic G., Grass Valley, CA
KCØPGX **Ozburn**, Marvin R., Marion, IA
KZØT **Linde**, Thomas F., Sheboygan, WI
WØUKI **Mattson**, Robert W., Virginia, MN
KBØVEP **Palmberg**, Eric A., Topeka, KS
♦NØVV **Kolter**, Richard A., Winona, MN
♦VE3AGS **Spencer**, A. George, Jordan, ON, Canada
DL1CR **Fritz**, Kurt, Bargteheide, Germany

♦ 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

Strays

AWARD-WINNING ROSE PARADE FLOAT HAD A CALL SIGN

♢The Cal Polytechnic State University Rose Float had a radio tracking device on board for real-time location monitoring during the 2011 Tournament of Roses Parade on New Year's Day. After a joint effort by the Amateur Radio clubs from both Cal Poly San Luis Obispo and Pomona, this year's float had an Automatic Position Reporting System (APRS) enhanced radio on board. The device received GPS data and then beaconed its position to local digipeaters and iGates to put its location online. The tracker operated using the N6CP call sign, held jointly by the Cal Poly SLO and Pomona ARCs. — *Marcel Stieber, KI6QDJ, President, Cal Poly ARCs*

TOM ZASADZINSKI/CAL POLY STATE UNIVERSITY

The Cal Poly Rose Float, aka N6CP, won the 2011 Rose Parade "Viewers' Choice" Award for the third year in a row. The float, "Galactic Expedition," also won the Tournament of Roses "Fantasy Trophy" in pre-parade judging for most outstanding display of fantasy and imagination.

QST congratulates...

♢ARRL member Barry Ernest, KB3MCK, whose first book, *The Girl on the Stairs*, has been published by Amazon.com at Kindle e-books. It involves the author's 35 year search for a missing witness to the JFK assassination.

♢ARRL member James M. Coleman ENP, AI5B, of Franklinton, Louisiana, who has been appointed by FCC Chairman Julius Genachowski to the Emergency Access Advisory Committee (EAAC). Mandated by the Twenty-first Century Communications and Video Accessibility Act of 2010, the EAAC is charged with determining the most effective and efficient technologies and methods by which to provide individuals with disabilities access to Next Generation 911 emergency services.

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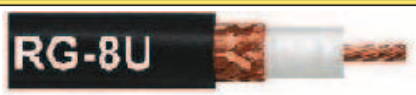

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DXE-MBV-ATU-1	Multi-Band 43 ft. Vertical Automatic Tuner Add-on Kit	$399.00
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DXE-A0K-DCF	SO-239 Add-On Kit for BTV Base	$22.95
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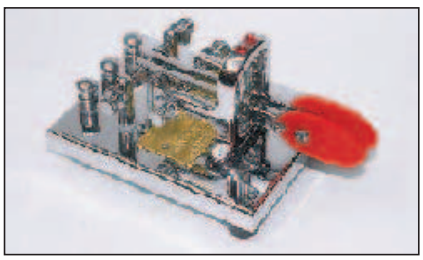
DXE-AOK-60M	60m Add-On Kit for BTV	$74.95



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RG-213/U JSC-3780 Cable Assemblies with PL-259 Connectors

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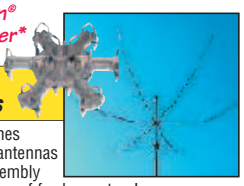
*Complete 5-Band Kit with NEW Stainless/Teflon® Balanced RIGID Feeder**



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- Good results at 20 to 30 feet above ground

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  7 Strands of 21 AWG Bare Copper

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HEI-PROSET-5	Boom Mic/Headset, HC5	$125.00
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See the many sizes at DXEngineering.com
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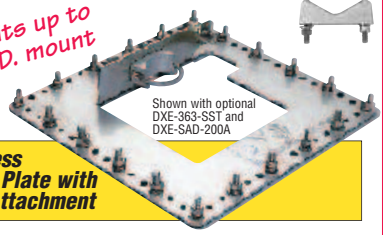
Now fits up to 3" O.D. mount



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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

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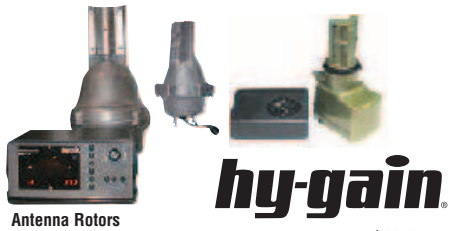

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HYG-T-2X	20 Sq. ft. Rating	$689.95
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Heavy Duty Tripod Roof Mount

- 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 Incl.

RON-1011 ..... $149.95

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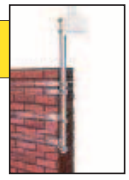

- Ideal for medium size antennas with rotors like the DX Engineering HEXX Beam or small HF and VHF Yagi or tri-band antennas
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- Shipped partially assembled

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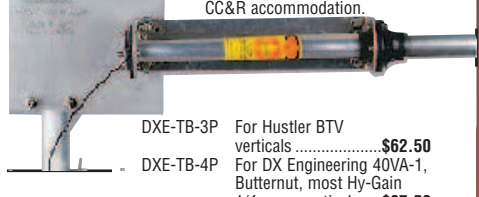
Thick, Laser Cut Stainless Steel Tilt Base

- 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
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DXE-CNL-911	Coax Cable Cutters	$23.75
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Now available in cost-saving tool kits with carrying case

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- ***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.

Did you know that we have tuner that will work for you?

Some people don't know that we make tuners that will work with any transceiver. Don't know which one is right for you? Give us a call or see the Tuner Comparison Chart on our web site for more selection help!

radio not included

AT-897Plus for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price$199.99***

AT-600Pro

The AT-600Pro handles up to 600 watts SSB and CW, 300 on RTTY (1.8 – 30 MHz), and 250 watts on 54 MHz. Matches virtually any kind of coax-fed antenna and will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use it with longwires, random wires and antennas fed with ladder line just by adding a balun. Two antenna ports with a front-panel indicator, and separate memory banks for each antenna. LED bar-graph meters shows RF power, SWR and tuner status, tactile feedback control buttons and an LED bypass indicator. Operates from 11 – 16 volts DC at 750 mA. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $359.99***

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes Icom interface cable, DC power cable and coax jumper.
Suggested Price $159.99

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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.

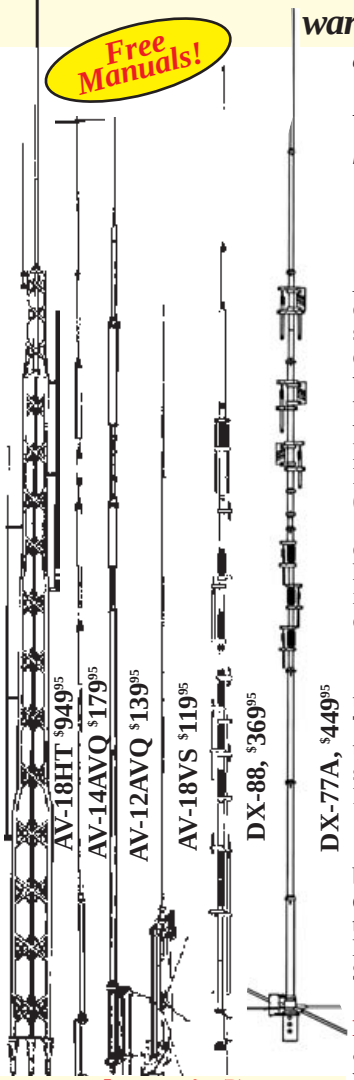
Call or visit your favorite dealer today! ***www.ldgelectronics.com***

LDG

hy-gain® HF VERTICALS

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

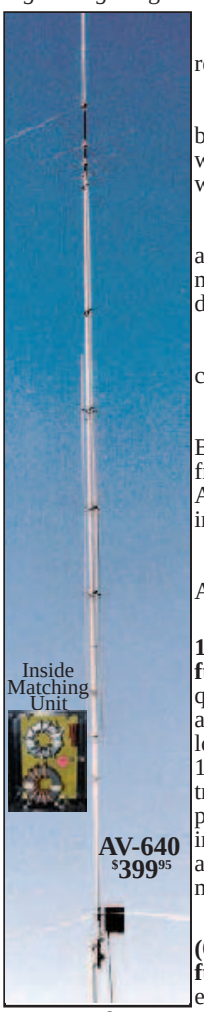
DX-77A, $449.95. (10, 12, 15, 17, 20, 30, 40 Meters). 29 ft., 25 lbs.

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

hy-gain® PATRIOT

Hy-Gain's new PATRIOT HF verticals are the best built, best performing and best priced multiband verticals available today. For exciting DX make full use of your sunspot cycle with the PATRIOT's *low 17 degree angle* signal.



No ground or radials needed

Effective counterpoise replaces radials and ground.

Automatic bandswitching

Single coax cable feed. Each band is individually tunable. Extra wide VSWR bandwidth. End fed with broadband matching unit.

Sleek and low-profile

Low 2.5 sq. ft. wind surface area. Small area required for mounting. Mounts easily on decks, roofs and patios.

Full legal limit

Handles 1500 Watts key down continuous for two minutes.

Built-to-last

High wind survival of 80 mph. Broadband matching unit made from all *Teflon*® insulated wire. Aircraft quality aluminum tubing, stainless steel hardware.

hy-gain® warranty

Two year limited warranty. All replacement parts in stock.

AV-640, $399.95. (6,10,12, 15,17,20,30,40 Meters). 25.5 ft., 17.5 lbs. The AV-640 uses quarter wave stubs on 6, 10, 12 and 17 meters and efficient end loading coil and capacity hats on 15, 20, 30 and 40 meters -- no traps. Resonators are placed in parallel not in series. End loading of the lower HF bands allows efficient operation with a manageable antenna height.

AV-620, $299.95. (6,10,12,15,17,20 Meters). 22.5 ft., 10.5 lbs. The AV-620 covers all bands 6 through 20 Meters with no traps, no coils, no radials yielding an uncompromised signal across all bands.

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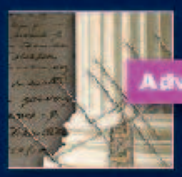

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Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
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IC-V80/SPORT

RX-7-05

IC-V80 2M FM Handheld

- TX: 144-148 MHz • RX: 136-174 MHz
- Power: 5.5/2.5/0.5W • Memories: 207
- Comes with NiMH Battery and Wall Charger

IC-V80 SPORT 2M FM Handheld

- No NiMH Battery and Charger • Has AA Battery Case

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

IC-7000 Multimode HF/VHF/UHF Mobile

- TX: HF/6M/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 2-100W (HF/6M), 2-50W (2M), 2-35W (440)
- Memories: 503 • 41 band-widths with sharp or soft filter shape • RMK-7000 included!

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

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

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-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-7800 Multimode HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen • Two receivers
- Four 32-bit floating DSPs • Power supply built-in
- Three roofing filters • External VGA connector
- Automatic antenna tuner

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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
• GPS unit and antenna is built-in for APRS® data

FT-2900R 2M FM Mobile

• TX: 144-148 MHz • RX: 136-174 MHz
• Power: 75/30/10/5W • Memories: 221

FT-7900R 2M/440 FM Mobile

• TX: 144-148, 430-450 MHz
• RX: 108-520, 700-999 MHz (cell blocked)
• Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
• Memories: 1055 • YSK-7800 included!

FT-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
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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 December 10 through January 10.
Get on the web and vote today at **www.arrl.org/quickstats**!

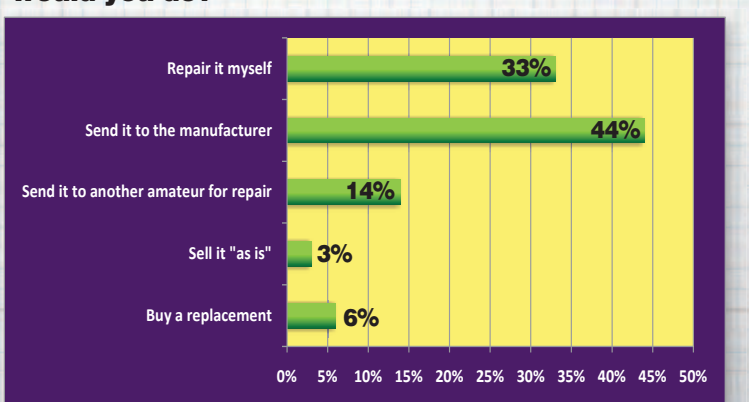
Does your ARES group use the ARRL Public Service Activity Report form to document SKYWARN activity?

Yes: 7%
No: 10%
Don't know: 36%
My ARES group isn't involved with SKYWARN: 8%
I don't participate in ARES: 39%

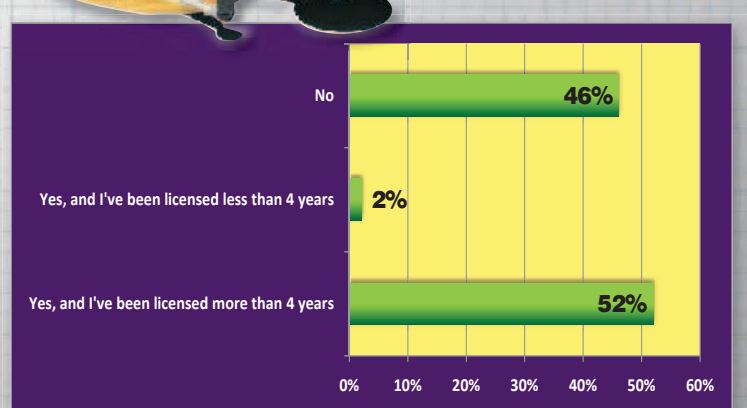
Do you own a tablet computer?

No	83%
Yes, an Apple (iPad)	8%
Yes, an HP	3%
Yes, a Lenovo	1%
Yes, an Archos	1%
Yes, a Samsung	1%
Yes, Other	3%

If your out-of-warranty transceiver failed, what would you do?



Do you use CW on a regular basis?



1.8-170 MHz *plus* 415-470 MHz
MFJ HF/VHF/UHF Antenna Analyzer

All-in-one handheld antenna test lab lets you quickly check and tune HF, VHF, UHF antennas anywhere. Covers 1.8-170 MHz and 415-470 MHz

Measures: SWR…Return Loss…Reflection Coefficient…Antenna Resistance(R), Reactance(X), Impedance(Z) and Phase Angle(degrees) . . . Coax cable loss(dB) . . . Coax cable length . . . Distance to short or open in coax … Inductance . . . Capacitance . . . Resonant Frequency . . . Bandwidth . . . Q . . . Velocity Factor . . . Attenuation . . . Has: LCD readout . . . frequency counter . . . side-by-side meters . . . Ni-MH/Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . . One year No Matter What™ warranty . . .

You can instantly get a complete picture, check and tune any antenna from 1.8 to 170 MHz and 415 to 470 MHz -- an MFJ-269 exclusive -- with this rugged easy-to-use hand-held antenna test lab! You can measure virtually every antenna parameter.

You won't believe its capability and versatility. This rugged handheld unit literally replaces a workbench full of expensive delicate test equipment.

MFJ-269
$389.95

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

SWR Analyzer

You can read SWR, return loss, reflection coefficient and match efficiency at any frequency simultaneously at a single glance.

Complex Impedance Analyzer

Read Complex Impedance (1.8 to 170 MHz)as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp) -- *an MFJ-269 exclusive!*

Coax Analyzer

You can determine velocity factor, coax loss in dB, length of coax and *distance to short or open in feet (it's like a built-in TDR).*

CoaxCalculator™ lets you calculate coax line length in feet given electrical degrees and vice versa for any frequency and any velocity factor -- *an MFJ-269 exclusive!*

Use any Characteristic Impedance

You can measure SWR and loss of coax with *any* characteristic impedance (1.8 to 170 MHz) from 10 to over 600 Ohms, including 50, 51, 52, 53, 73, 75, 93, 95, 300, 450 Ohms -- *an MFJ-269 exclusive!*

Inductance/Capacitance Meter

Measures inductance in uH and capacitance in pF at RF frequencies, 1.8-170 MHz.

Frequency Counter/Signal Source

You can also use it as a handy frequency counter up to 170 MHz and as a signal source for testing and alignment.

Digital and Analog displays

Just plug in your UHF antenna coax, set frequency and read SWR, return loss and reflection coefficient simultaneously. You can read coax cable loss in dB and match efficiency.

415 to 470 MHz Range features

You can adjust UHF dipoles, verticals, yagis, quads and others and determine their SWR, resonant frequency and bandwidth.

You can test and tune stubs and coax lines. You can manually determine velocity factor and impedances of transmission lines.

You can adjust/test RF matching networks and RF amplifiers without applying power.

Has easy-to-read LCD *logarithmic* SWR bargraph and SWR meter for quick tuning.

Much Better Accuracy

New 12-bit A/D converter gives much better accuracy and resolution than common 8-bit A/D converters -- *an MFJ-269 exclusive!*

Super Easy-to-Use

Select a band and mode. Set frequency. Your measurements are instantly displayed! Smooth reduction drive tuning makes setting frequency easy.

Take it anywhere

Take it anywhere - to remote sites, up towers, in cramp places. Fully portable -- battery operated, compact 4Wx2Dx6¾ in., weighs 2 lbs. *Free* "N" to SO-239 adapter.

Has battery saver, low battery warning and built-in charging circuit for rechargeables.

Use 10 AA Ni-MH or Ni-Cad or alkaline batteries (not incl.) or 110VAC with MFJ-1312D, $15.95.

MFJ SWR Analyzer Accessories

MFJ-39C, $24.95.

Tote your MFJ-269 anywhere with this *genuine* MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric, the MFJ-39C cushions blows, deflects scrapes, and protects knobs, meters and displays from harm. Wear it around your waist, over your shoulder, or clip it onto the tower while you work -- the fully-adjustable webbed-fabric carrying strap has snap hooks on both ends. Has clear protective window for frequency display and cutouts for knobs and connectors.

MFJ-66, $24.95.

Plug these MFJ dip meter coupling coils into your MFJ *SWR Analyzer™* and turn it into a sensitive and accurate *band switched* dip meter. Set of two coils cover 1.8-170 MHz depending on your MFJ-269 *SWR Analyzer™*.

MFJ-99C, $40.90.

SWR** Analyzer Power Pack.* 10 Pack MFJ *SuperCell™* Ni-MH batteries, and power supply for SWR analyzers. ***Save $5!

MFJ-98, $60.85.

MFJ-269** Accessory Pack.* MFJ-39C *custom* Carrying Pouch, MFJ-66 dip coils, power supply for MFJ-269. ***Save $5!

MFJ-98B, $88.90.

MFJ-269** Deluxe Accessory Pack.* Complete accessory pack! MFJ-39C Pouch, 10 Ni-MH batteries, dip coils, power supply. ***Save $7!

MFJ-269*PRO™* Analyzer

Like MFJ-269, but has extended coverage in UHF range ***(430 to 520 MHz)*** and ruggedized cabinet that protects LCD display, knobs, meters and connectors from damage.

MFJ-269*PRO*
$419.95

MFJ-259B HF/VHF Antenna *SWRAnalyzer™*

MFJ-259B
$289.95

The world's most popular antenna analyzer gives you a complete picture of your antenna performance 1.8 to 170 MHz.

It's Super easy-to-use -- makes tuning your antennas quick, painless and easy.

Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to short or open in feet. Read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Free MFJ Catalog

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http://www.mfjenterprises.com *for instruction manuals, catalog, info*

MFJ 160-6 Meter Antenna

Self-supporting 43 foot vertical -- no guy wires required . . . 1500 Watts . . . exceptional performance . . . low-profile . . . includes base mount and legal limit balun . . . assembles in an hour . . .

MFJ-2990
$359.95

New!

Operate all bands 160 through 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 from across the street.

Exceptional Performance

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

With an automatic antenna tuner there's no fuss -- just talk!

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 M with good quality, low-loss coax).

Fully self-supporting, Extremely low wind loading, Very low visibility . . .

With just 2 square feet wind load, the fully self-supporting MFJ-2990 -- *no guy wires needed* -- 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 -- it'll stay up!

Weighs just 20 pounds -- you can easily put it up by yourself because its corrosion resistant *6063 aircraft aluminum* tubing and stainless steel construction make it light *and* super-strong.

Assembles in an hour

You can easily assemble it in an hour! Ground mounting lets you completely hide its antenna base in shrubbery. Includes ATB-65 high-strength antenna mount. Requires ground system -- at least one radial. More extensive ground system will give much better performance.

Great for Stealth Operation in antenna restricted areas

This very low-profile antenna is perfect for stealth operation in antenna restricted areas. Hide it behind trees, fences, buildings, bushes. Use it as a flagpole. Telescope it down during the day. Put it up at night and take it down in the morning before the neighbors even notice!

Quick and easy installation makes it great for DXpeditions, field day and other portable and temporary operations.

MFJ *Automatic* Tuners

MFJ-998
$699.95

For legal limit 1500 Watt SSB/CW amplifiers. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, amp bypass, matches 12-1600 Ohms, 1.8-30 MHz.

MFJ-993B
$259.95

Dual power range -- 300 Watt range matches 6-1600 Ohms. 150 Watt/6-3200 Ohms. Auto-ranging LCD and Cross-Needle SWR/Wattmeter, antenna switch, 1.8-30 MHz.

MFJ *Manual* Tuners

MFJ-989D
$389.95

1500 Watts SSB/CW, 1.8-30 MHz. Active peak-reading Cross-Needle SWR/Wattmeter, balun, dummy load, antenna switch, aircore roller inductor.

MFJ-949E
$179.95

World's most popular tuner! 300 Watts, 1.8-30 MHz. Peak/Average Cross-Needle SWR/Wattmeter, 8 pos. antenna switch, dummy load, 1kV capacitors.

Window Feedthru

MFJ-4602
$69.95

Bring 3 coaxes, balanced line, random wire, ground thru window. Connectors mounted on *stainless steel* panel. ¾" thick *pressure-treated* weather-proof wood.

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10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

MFJ-1798
$299.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

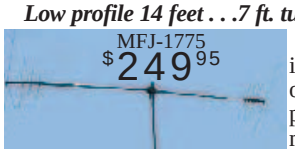
MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters ***Rotatable*** Mini-Dipole

Low profile 14 feet . . .7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .



MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter ***Rotatable*** Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ Antennas

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 M as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

Dealer/Catalog/Manuals

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MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

The famous G5RV *antenna is the most popular ham radio antenna in the world!* You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size,* 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed.

MFJ-17754, $59.95. Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A
$69.95
160M, 265 ft.

MFJ-1779B
$49.95
80-40M, 135 ft.

MFJ-1779C
$29.95
20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*(R) coax and *Teflon*(R) coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz.

MFJ-919, $59.95. 4:1 current balun,1.5 kW.

MFJ-913, $29.95. 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D in.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators.

MFJ-16B01, $19.95. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole.

MFJ-18G100, $24.95. 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire.

MFJ-58100X, $49.95. 100 ft. 50-Ohm RG-8X with PL-259s on each end.

MFJ-18H100, $34.95. 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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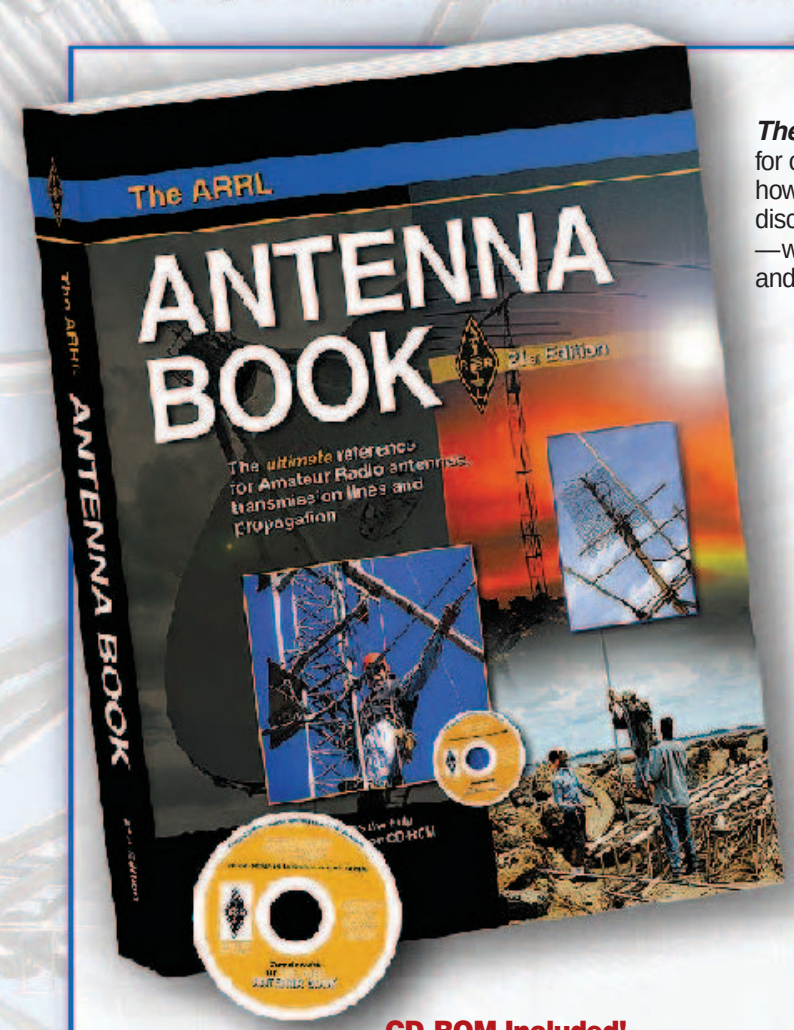

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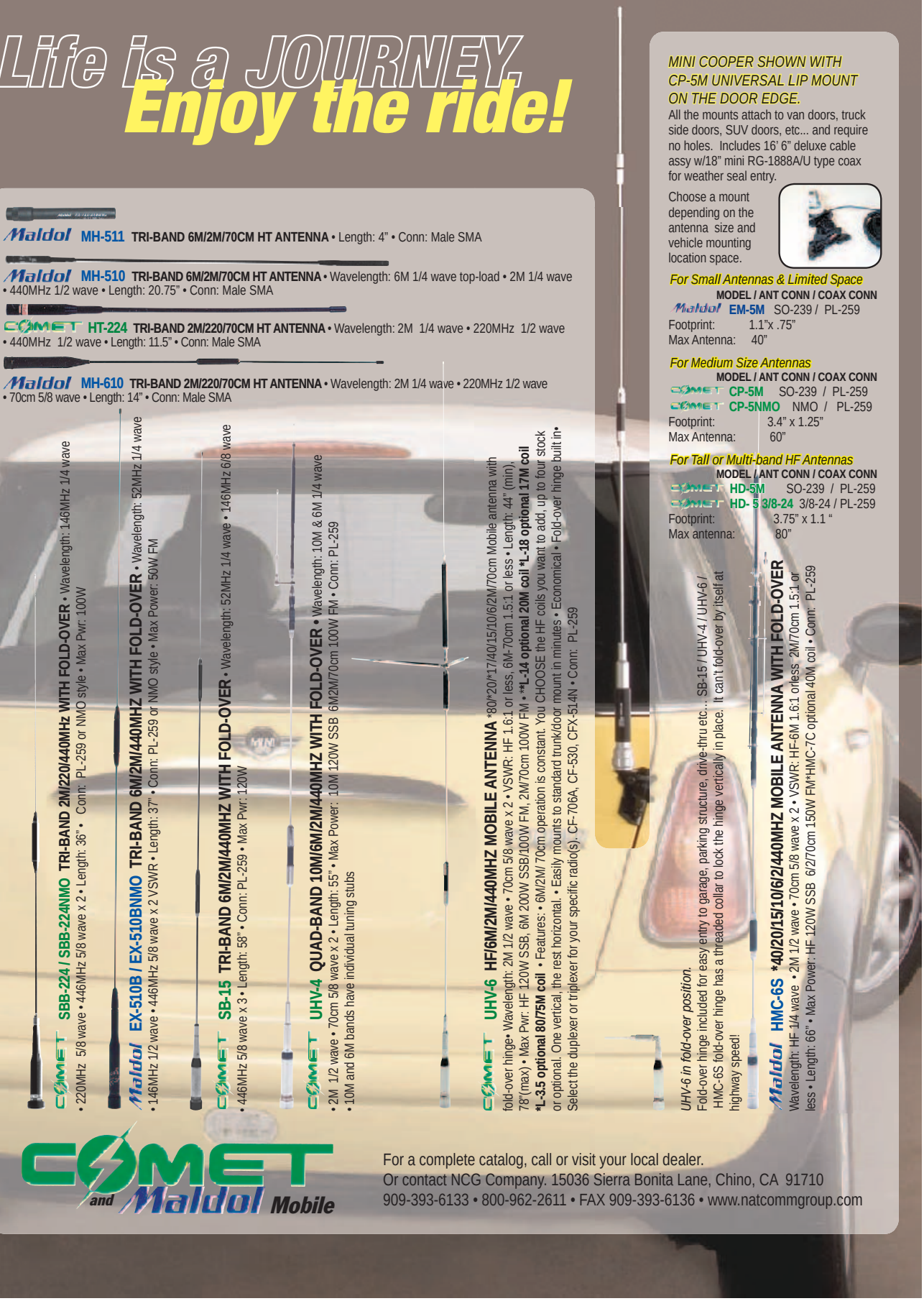


Maldol MH-511 **TRI-BAND 6M/2M/70CM HT ANTENNA** • Length: 4" • Conn: Male SMA

Maldol MH-510 **TRI-BAND 6M/2M/70CM HT ANTENNA** • Wavelength: 6M 1/4 wave top-load • 2M 1/4 wave • 440MHz 1/2 wave • Length: 20.75" • Conn: Male SMA

COMET HT-224 **TRI-BAND 2M/220/70CM HT ANTENNA** • Wavelength: 2M 1/4 wave • 220MHz 1/2 wave • 440MHz 1/2 wave • Length: 11.5" • Conn: Male SMA

Maldol MH-610 **TRI-BAND 2M/220/70CM HT ANTENNA** • Wavelength: 2M 1/4 wave • 220MHz 1/2 wave • 70cm 5/8 wave • Length: 14" • Conn: Male SMA

COMET SBB-224 / SBB-224NMO TRI-BAND 2M/220/440MHz WITH FOLD-OVER • Wavelength: 146MHz 1/4 wave • 220MHz 5/8 wave • 446MHz 5/8 wave x 2 • Length: 36" • Conn: PL-259 or NMO style • Max Pwr: 100W

Maldol EX-510B / EX-510BNMO TRI-BAND 6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 52MHz 1/4 wave • 146MHz 1/2 wave • 446MHz 5/8 wave x 2 VSWR • Length: 37" • Conn: PL-259 or NMO style • Max Power: 50W FM

COMET SB-15 TRI-BAND 6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 52MHz 1/4 wave • 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W

COMET UHV-4 QUAD-BAND 10M/6M/2M/440MHZ WITH FOLD-OVER • Wavelength: 10M & 6M 1/4 wave • 2M 1/2 wave • 70cm 5/8 wave x 2 • Length: 55" • Max Power: 10M 120W SSB 6M2M/70cm 100W FM • Conn: PL-259 • 10M and 6M bands have individual tuning stubs

COMET UHV-6 HF/6M/2M/440MHZ MOBILE ANTENNA *80/*20/*17/40/15/10/6/2M/70cm Mobile antenna with fold-over hinge• Wavelength: 2M 1/2 wave • 70cm 5/8 wave x 2 • VSWR: HF 1.6:1 or less. 6M-70cm 1.5:1 or less • Length: 44" (min). 78"(max) • Max Pwr: HF 120W SSB, 6M 200W SSB/100W FM, 2M/70cm 100W FM • ***L-14 optional 20M coil *L-18 optional 17M coil *L-3.5 optional 80/75M coil** • Features: • 6M/2M/ 70cm operation is constant. You CHOOSE the HF coils you want to add, up to four stock or optional. One vertical, the rest horizontal. • Easily mounts to standard trunk/door mount in minutes • Economical • Fold-over hinge built in • Select the duplexer or triplexer for your specific radio(s). CF-706A, CF-530, CFX-514N • Conn: PL-259

UHV-6 in fold-over position.
Fold-over hinge included for easy entry to garage, parking structure, drive-thru etc... SB-15 / UHV-4 / UHV-6 / HMC-6S fold-over hinge has a threaded collar to lock the hinge vertically in place. It can't fold-over by itself at highway speed!

Maldol HMC-6S *40/20/15/10/6/2/440MHZ MOBILE ANTENNA WITH FOLD-OVER Wavelength: HF 1/4 wave • 2M 1/2 wave • 70cm 5/8 wave x 2 • VSWR: HF-6M 1.6:1 orless 2M/70cm 1.5:1 or less • Length: 66" • Max Power: HF 120W SSB 6/2/70cm 150W FM*HMC-7C optional 40M coil • Conn: PL-259

MINI COOPER SHOWN WITH CP-5M UNIVERSAL LIP MOUNT ON THE DOOR EDGE.
All the mounts attach to van doors, truck side doors, SUV doors, etc... and require no holes. Includes 16' 6" deluxe cable assy w/18" mini RG-1888A/U type coax for weather seal entry.

Choose a mount depending on the antenna size and vehicle mounting location space.

For Small Antennas & Limited Space

MODEL	ANT CONN / COAX CONN
Maldol EM-5M	SO-239 / PL-259

Footprint: 1.1"x .75"
Max Antenna: 40"

For Medium Size Antennas

MODEL	ANT CONN / COAX CONN
COMET CP-5M	SO-239 / PL-259
COMET CP-5NMO	NMO / PL-259

Footprint: 3.4" x 1.25"
Max Antenna: 60"

For Tall or Multi-band HF Antennas

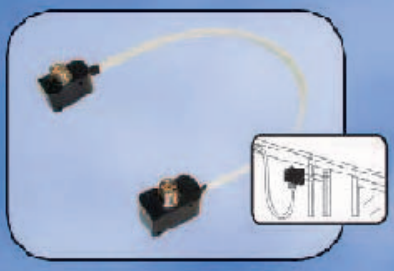
MODEL	ANT CONN / COAX CONN
COMET HD-5M	SO-239 / PL-259
COMET HD- 5 3/8-24	3/8-24 / PL-259

Footprint: 3.75" x 1.1 "
Max antenna: 80"

COMET and Maldol Mobile

For a complete catalog, call or visit your local dealer.
Or contact NCG Company. 15036 Sierra Bonita Lane, Chino, CA 91710
909-393-6133 • 800-962-2611 • FAX 909-393-6136 • www.natcommgroup.com

Life is a JOURNEY. Enjoy the ride!



NEW! COMET CTC-50M
Window Gap Adapter!

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

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

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

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

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

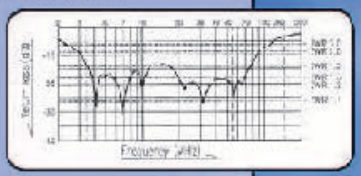
COMET CHA-250B
Broadband HF Vertical!

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

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

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

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



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

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

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

COMET and Maldol

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

Or contact NCG Company, 15036 Sierra Bonita Lane, Chino, CA 91710
909-393-6133 • 800-962-2611 • FAX 909-393-6136 • www.ratcommgroup.com

MFJ Weather-Proof *Window Feedthrough Panels*

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof *Window Feedthrough Panels* mount in your window sill. Lets you bring all your antenna connections into your hamshack *without* drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, 3 1/2 inch high, 3/4 inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603
$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1 1/4X1 5/8 in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.

3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$69.95

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$59.95

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New! MFJ-4600
$79.95

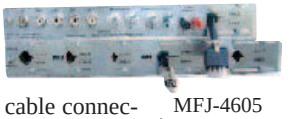
5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1 1/4x1 5/8 inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604
$99.95

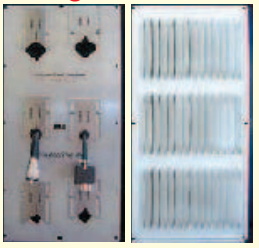
All-Purpose FeedThru/CableThru™

***Stacks** MFJ-4603 **and** MFJ-4604!* Gives you every possible cable connection you'll ever need through your window without drilling holes in wall -- including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.



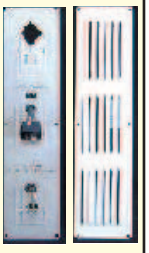
MFJ-4605
$159.95
New!

Bring cables thru eave of your house



MFJ-4616
shown with standard full-size vent (not included) it replaces. For *6 Cables*
$26.95

MFJ-4613
shown with standard half-size vent (not included) it replaces. For *3 Cables*
$14.95



Replace your standard air vents on the eave/sofitt of your house with these *MFJ AdaptiveCable*™ *Air Vent Plates* and…

Bring in coax, rotator, antenna switch, power cables, etc. *with connectors* up to 1 1/4x1 5/8 inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ *Wall Plates*

MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1 1/4x1 5/8 inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

Free MFJ Catalog
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

http://www.mfjenterprises.com for more info, catalog, manuals, dealers

MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B $259.95

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

MFJ-994B $359.95

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.

***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

MFJ-998 $699.95

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.

300 Watt...*Extra*...Wide Range

SWR/Wattmeter, 10000 VA Memories

MFJ-991B $219.95

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

MFJ-929 $219.95

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.

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

MFJ-928 $199.95

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.

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

MFJ-925 $179.95

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!

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/feed-point 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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or call toll-free 800-647-1800

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http://www.mfjenterprises.com for instruction manuals, catalog, info

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

MFJ-969
$219.95

Superb *AirCore™* Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune™*, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$Wx$3^{1}/_{2}$Hx$9^{1}/_{2}$D inches.

MFJ-941E ***super value*** Tuner

MFJ-941E
$139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M ***mobile*** Tuner

MFJ-945E
$129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 ***portable/QRP*** Tuner

MFJ-971
$119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B ***smallest*** Versa Tuner

MFJ-901B
$99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

MFJ-902
$99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

MFJ-16010
$69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906
$99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB.

MFJ-903, $69.95, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931
$109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig.

MFJ-934, $209.95, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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Exam: 35-question Technician test (Element 2)
NEW! **The ARRL Ham Radio License Manual—Revised 2nd Edition.** Ham radio's most popular license manual! Organized in easy-to-understand "bite-sized" sections, this is all you need to become an Amateur Radio operator. **Now including practice exam software on CD-ROM.**
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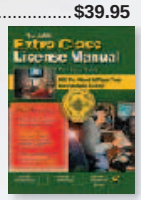

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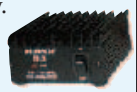

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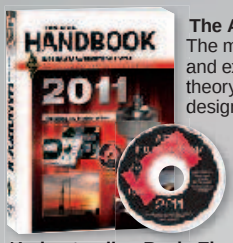

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www.arrl.org/expo www.hamcom.org

PROGRAM HIGHLIGHTS

Ham-Com – "The BIGGEST Hamfest in Texas," will feature equipment dealers, manufacturers, forums, license examinations, transmitter hunts and more. Tailgate Market opens at 7 AM each day!

ARRL EXPO 2011 – A special exhibit area including ARRL program representatives, activities and a huge ARRL bookstore.

DXCC Card Checking – and other ARRL operating awards.

W5DXCC Dinner – Friday evening, sponsored by the Lone Star DX Association.

ARRL Youth Activities and Youth Lounge

Boy Scout One-day Radio Merit Badge Program – sponsored by Ham-Com.

W1AW/5 Special Event Station

ARRL Wouff Hong Ceremony

...and much more!

See **www.arrl.org/expo** for lodging options and links to travel information.

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The national association for
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Photo by Loudoun Amateur Radio Group - K4LRG.ORG

TICKETS

www.hamcom.org
Purchase advance tickets online by May 31.

General admission
in advance $8
at the door $10

Additional family members
in advance $6
at the door $8

Children 12 and under and uniformed Scouts are FREE.

Visit hamcom.org for exhibit booth reservations.

Tailgaters $8 per space per day, first-come, first-served.

ARRL SPECIAL GUEST

Riley Hollingsworth, K4ZDH

Before his retirement from the Federal Communications Commission in 2008, Riley Hollingsworth was recognized as the man who embodied Amateur Radio Enforcement. Today, he continues to champion good amateur practice, responsibility for our radio spectrum privileges, and respect for the Amateur Radio Service as part of the American heritage.

Riley, K4ZDH, will give the ARRL National Convention keynote address.

NEARBY

Historic downtown Plano

Interurban Railway Museum

The Shops at Legacy

Bring your family & friends!

Southfork Ranch

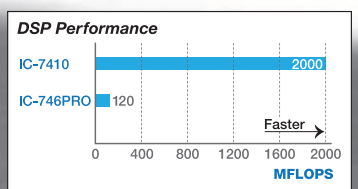
Bringing the latest in DSP technology

NEW IC-7410
HF/50MHz Transceiver

Icom continues to lead in high performance digital technology. The IC-7410 is a familiar-looking yet new HF/50MHz rig for everyday use that takes advantage of our digital know-how. A high grade DSP unit and double conversion super-heterodyne system developed for our higher grade IC-7800/7700/7600 series are used. In addition, the IC-7410 comes with a built-in 15kHz 1st IF Filter and can accept up to two optional filters (3kHz/6kHz). When used with these 1st IF Filters, narrow mode signals such as the CW and SSB modes are protected from adjacent strong signals. Experience the latest tech in your everyday use!

AD/DA Converter
ADC Signal (Noise+Distortion): 100dB
ADC Dynamic Range, S/N: 113dB
DAC Signal (Noise+Distortion): 97dB
DAC Dynamic Range, S/N: 115dB

DSP Unit
ADSP-21369
Internal Clock Speed: 333MHz
32-bit Floating Point DSP
Max. Performance: 2000MFLOPS



Features:

+30dBm 3rd Order Intercept Point (144MHz)

Double Conversion Superheterodyne System

32-bit Floating Point DSP Unit

Built-in 15kHz 1st IF Filter (Optional 3kHz/6kHz)

Large Monochrome LCD Display

±0.5ppm Frequency Stability

Built-in Simple Band Scope

Built-in Automatic Antenna Tuner

All Mode (SSB, CW, RTTY, AM, FM)

Optional RS-BA1 for IP Remote Control

Icom's HF Family

IC-7800
The Ultimate Rig

IC-7700
The Contester's Rig

IC-7600
The DX'ers Choice

to your everyday communications.

Large heat sink
Even during long hours of heavy duty use, the IC-7410 provides stable output power.

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Control and Audio

USB connector for PC control
A standard type B USB connector is located on the back panel. Use it to control your IC-7410 via PC.

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IC-718
The "Get-into-HF" Rig

IC-7000
The "Go Anywhere" Rig

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LDG ELECTRONICS

AT-200PRO

250 Watt Automatic Tuner

$229.95

The AT-200 will handle up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz. It features LDG's state-of-the-art, processor-controlled Switched-L tuner. It will match virtually any kind of coax-fed antenna, including Yagis, dipoles, inverted Vs, slopers, loops, just about anything. It will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use the AT-200 with longwires, random wires and antennas fed with ladder line with the optional LDG balun. The AT-200 is the latest in a long line of innovative LDG tuners. Get the most out of your Kenwood, Yaesu, Ten-Tec or Icom radios that operate at higher power.

Z-100Plus

125 Watt Economy Tuner

$139.95

LDG's popular Z-100 economy tuner is now the Z-100Plus. Still 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. With all these enhancements, you'd expect to pay more, but once again leading the industry.

TS-590S

High Performance HF Transceiver

The TS-590S marks a bold new chapter in Kenwood's proud history of manufacturing high-performance transceivers. Featuring a narrow-band Roofing Filter the TS-590S significantly reduces interference from unwanted signals that would be hidden to lesser rigs. With IF AGC based on advanced DSP technology, Kenwood has essentially redefined HF performance. Built to satisfy the most demanding DX'er, this high-performance HF transceiver takes Amateur Radio to the next level continuing the Kenwood tradition of operating ease and rugged reliability.

SP23	External Speaker	84.95
MB430M2	Mobile Mount	49.95
MC60A	Desk top mic	149.95
MC90	Desk top mic	249.95
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SO3	TCXO	109.95
SP50B	External Mobile Speaker	54.95
VGS1	Voice Guide & Storage Unit	65.95

KENWOOD

TH-D72A

144/440 MHz FM Dual Bander

Featuring the SiRFstar III high-performance GPS receiver, Kenwood's TH-D72A dual-band transceiver is compatible with APRS® data communications. Built-in high-performance GPS receiver, APRS® firmware equipped as standard, USB (Mini-B) port, Built-in 1200/9600 bps TNC compliant with AX.25 protocol, Stand-alone digipeater, Simple node access with EchoLink® memory, Enhanced operating ease and visibility, MIL-STD810 & IP54 weatherproofing, Long operating hours (high-capacity battery included), Kenwood Sy Command System II, Weather Alert/RX.

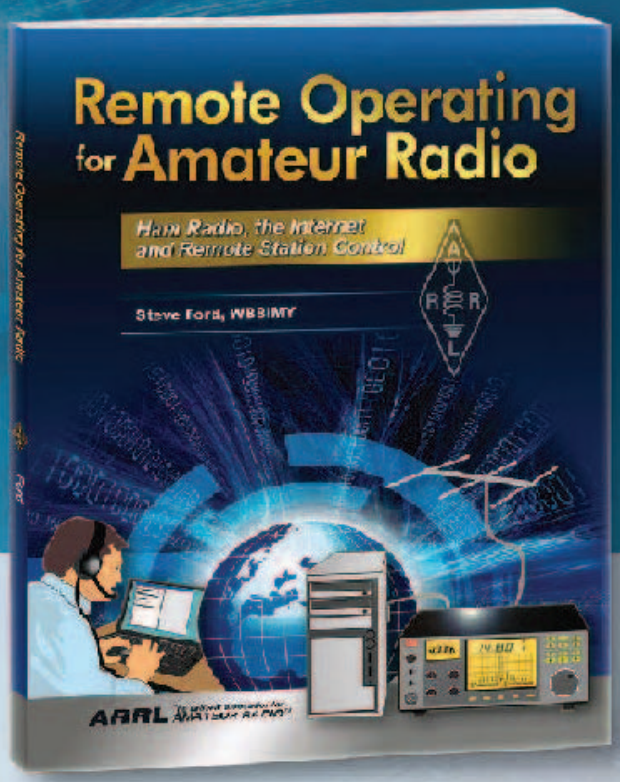
BT15	AAA x 6 Battery Case	34.95
KHS22	Behind the Head Headset w/Flexible Boom	32.95
KHS26	Clip Mic	23.95
KSC32	Desktop Rapid Charger	52.95
PB45L	1800 mAh Li-Ion Battery Pack	73.95
PG2W	DC Power Cable w/Fuses	18.95
PG3J	Filtered Cigarette Lighter Cable	36.95
SMC34	Speaker Mic w/Remote Buttons & Volume Control	32.95

Publications from ARRL!

Remote Operating for Amateur Radio

Ham Radio, the Internet and Remote Station Control

By Steve Ford, WB8IMY



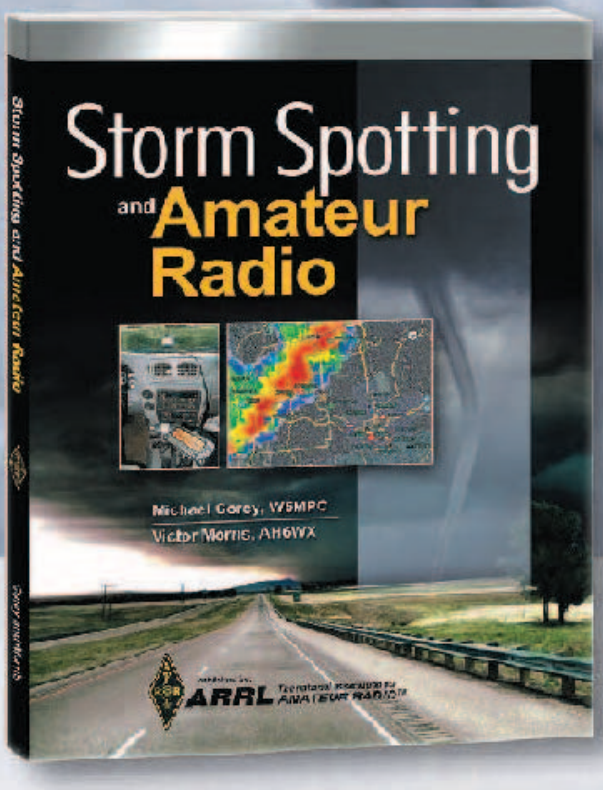
Get on the air from anywhere!

Remote Operating for Amateur Radio guides you through the process of establishing your own Internet-controlled station. You'll learn the basics of how the Internet works, how home networks operate and how to interconnect Amateur Radio hardware and software for remote Internet control. You'll find station diagrams, software tips, legal aspects of remote station control, and unique issues of remote operating as it applies to activities such as DXing and contesting.

ARRL Order No. 0922
Only $22.95*

Storm Spotting and Amateur Radio

By Michael Corey, W5MPC and Victor Morris, AH6WX



Storm Spotting and Amateur Radio is a resource for the Amateur Radio operator who volunteers as a trained storm spotter. This handy guide includes information on resources, training, equipment, safety, storm spotter activation procedures, reportable weather criteria, developing a local storm spotter manual, and the experiences of storm spotters from around the country. It also provides some meteorological information about severe weather such as hurricanes, tornadoes, hail, floods, damaging wind, and winter weather.

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QS6/2010

MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $59.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ 1500 Watt ***Fully Balanced*** Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get superb 10 Meter performance due to MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

Ladder line, Twin lead, Insulators, Copper wire . . .

Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at mid-point with SO-239, quadruple weave-through ladder line stress relief.

MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead

20 gauge stranded copper wire. Black polyethylene. MFJ-18T050, **50 Ft.**, $24.95. MFJ-18T100, **100 Ft.**, $44.95. MFJ-18T250, **250 Ft.**, $99.95.

Copper Antenna Wire

Flexible, 7-strand, 14 gauge, hard solid-copper wire. Strong/long-lasting. MFJ-18G100, **100 Ft.**, $24.95. MFJ-18G250, **250 Ft.**, $59.95.

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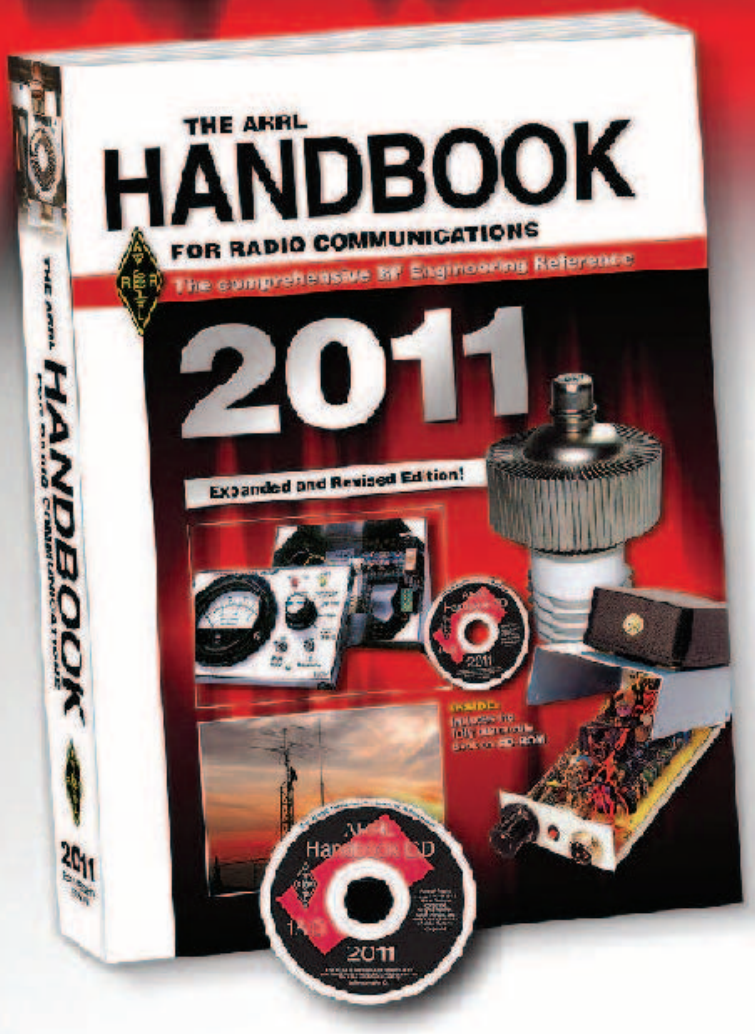

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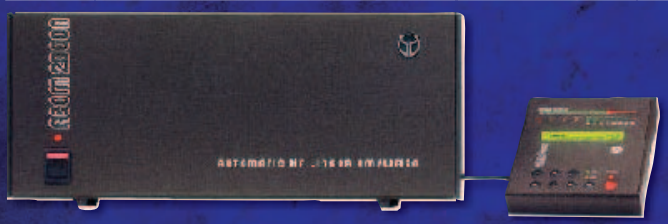

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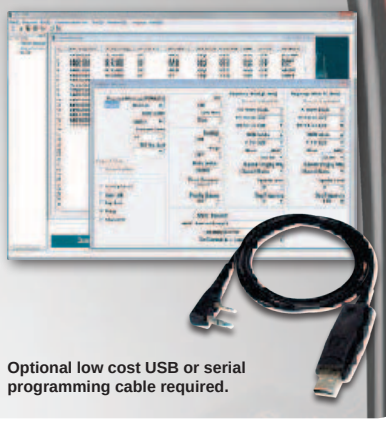

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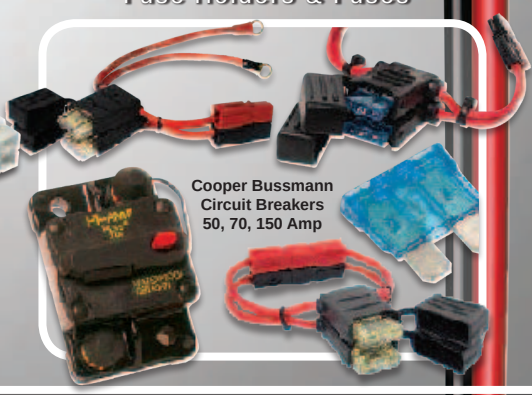

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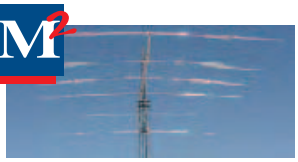

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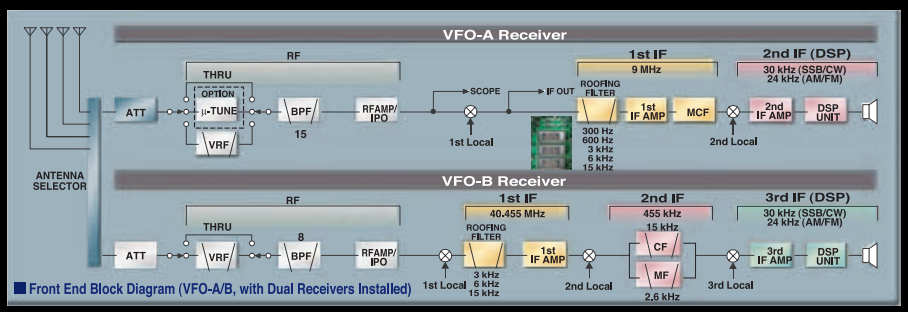
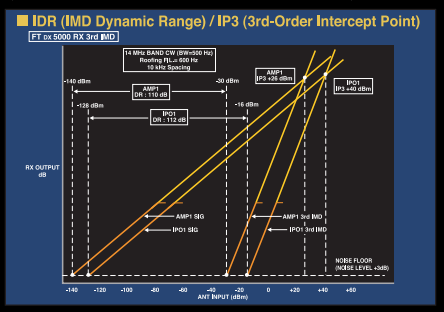


■ Front End Block Diagram (VFO-A/B, with Dual Receivers Installed)



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*** For 1.8/3.5/7/14/21 MHz Amateur bands, when receiving in CW/FSK/SSB modes, down conversion is automatically selected if the final passband is 2.7KHz or less.**