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SuitSat's Successor

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Inside:

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Official Journal of ARRL The national association for AMATEUR RADIO™

ARRL June VHF Contest

New 6M Records Set in 2010!

Joel Harrison at his 6M station, represents team W5ZN's achievement of the 6M Grid Square Record in the Limited Multi-Operator Category.

Ted Saba, KN5O, with his IC-756PROIII achieved the top Total 6M Score in the Limited Multi-Operator Category in the June 2010 VHF Contest!

"Most HF equipment manufacturers build their radios and add 6 meters simply as a novelty add-on, relying on preamplifiers and filtering designed for HF. Icom chose to take the initiative to engineer and implement components specifically for 50MHz in the IC-7700 making it a clear choice for HF and VHF operators alike."

— Joel Harrison, W5ZN

Congratulations on a job well done!

Icom shares your commitment to contesting excellence.

IC-7700 HF + 6M

2010 ARRL DX Contest

Team K3LR Both Modes #1

From left: N3SD, N2NC, N2NT, DK9TN, K1AR, K3UA, VE3EJ, K3LR, N3GJ, K1DG, KM3T, WM2H

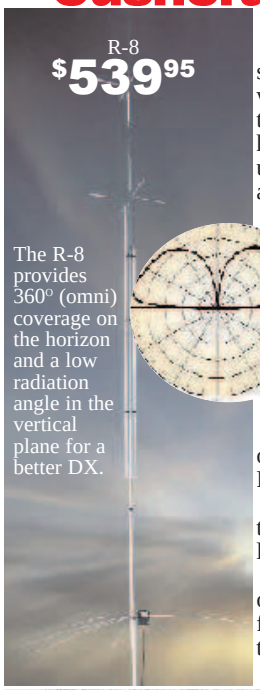
Phenomenal Station. Phenomenal Ops. Phenomenal Radios.

Using 9 IC-7800s, 3 IC-7700s, and 1 IC-7600, Team K3LR is 100% Icom all the time.

IC-7800 HF + 6M

ICOM®

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!

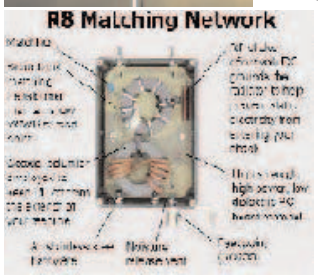
Rugged Construction: Thick fiberglass insulators, all-stainless hardware, and 6063 aircraft-aluminum tubing that is double or triple walled at key stress points handle anything Mother Nature can dish out.

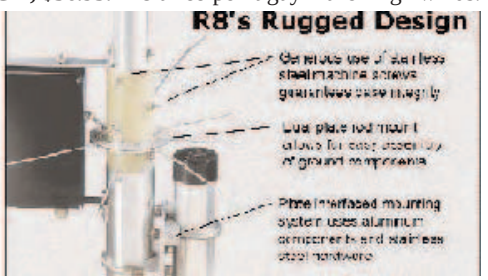
Compact Footprint: Installs in an area about the size of a child's sandbox -- no ground radials to bury and all RF-energized surfaces safely out of reach.

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!

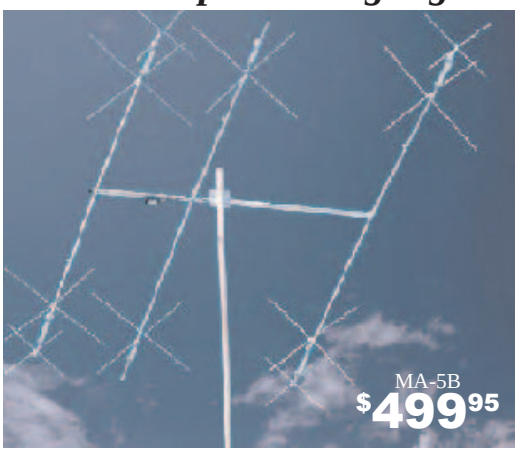
R-8GK, $56.95. R-8 three-point guy kit for high winds.





MA-5B *5-Band* Beam

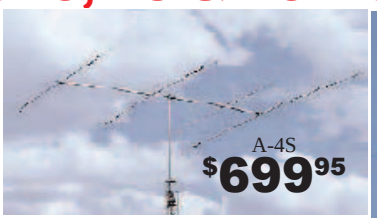
Small Footprint -- Big Signal



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.

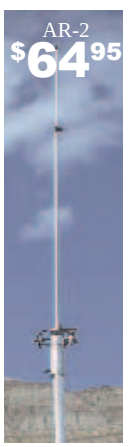
The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS**, **$499.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

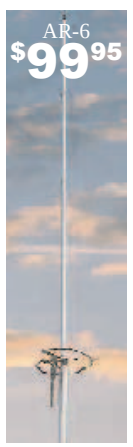
Cushcraft Dual Band Yagis

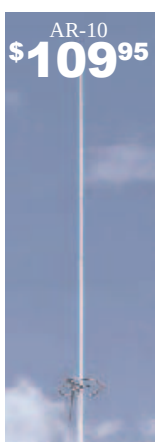
One Yagi for Dual-Band FM Radios

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 *Ringos* Compact FM Verticals







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

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

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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.
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This Month in QST

February 2011 ■ Volume 95 Number 2

Technical

News and Features

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Radiosport

Our Cover
Get ready for a new bird in the sky as ARISSat-1/RadioSkaf-V is set to be launched this month from the International Space Station. Four members of the ARISSat team (from left to right) — ARISS US Hardware Manager and member of AMSAT's Board of Directors Lou McFadin, W5DID; ARISSat-1 Project and member of AMSAT's Board of Directors Gould Smith, WA4SXM; Mechanical Engineer (hidden from view) Bob Davis, KF4KSS, and ARISSat-1 Project Team Member David Jordan, AA4KN — place ARISSat-1 onto an expansion plate for its vibration test this past September in Orlando, Florida. Photo by David Jordan, AA4KN. Turn to page 30 for more on ARISSat-1.

Departments

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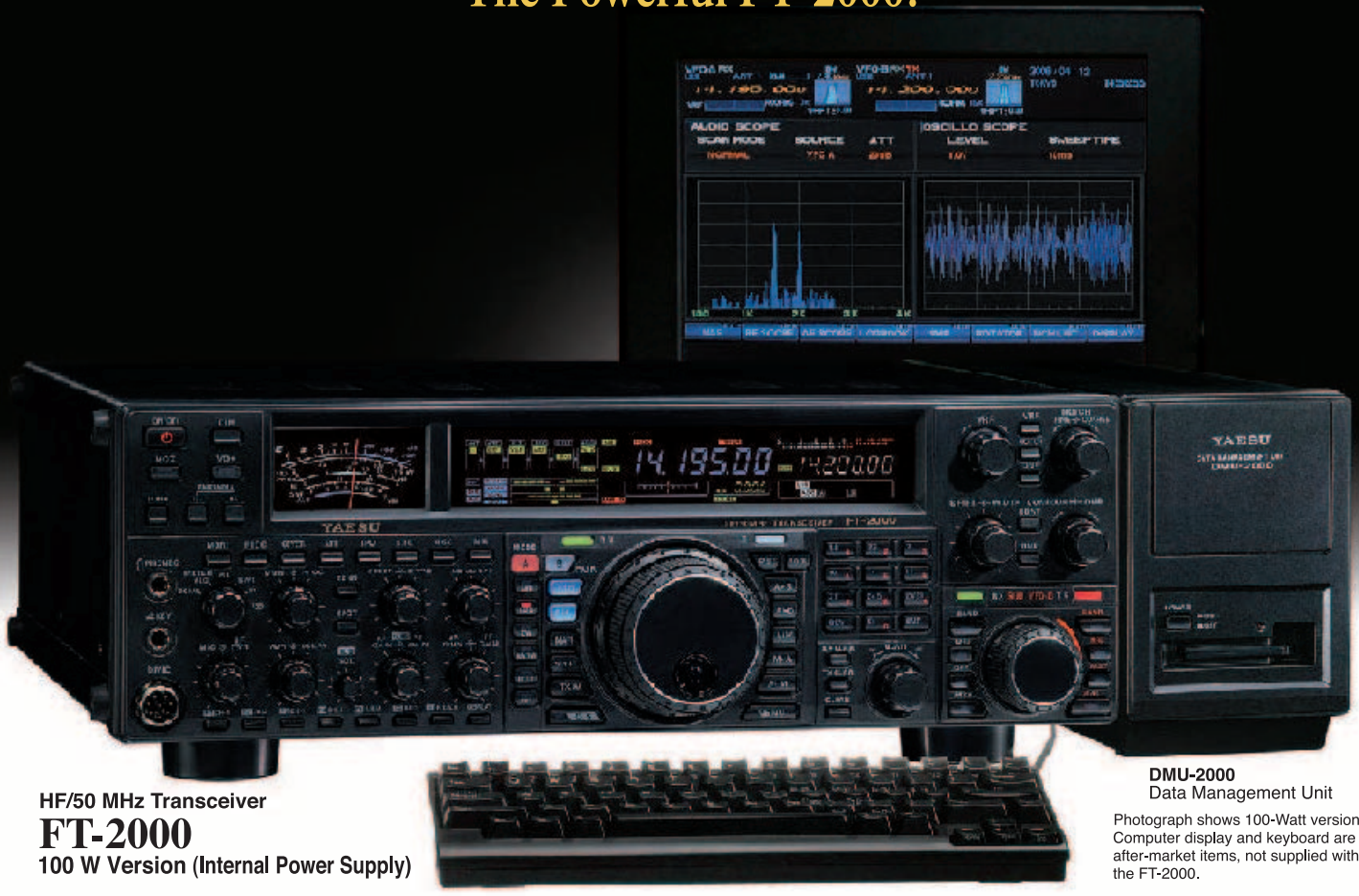
Choice of the World's top DX'ers

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



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

DMU-2000
Data Management Unit

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

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

Options

SP-2000
External Speaker
with Audio filters

RF μ-Tune Kits

160m Band	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

For the latest Yaesu news, visit us on the Internet:
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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:
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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

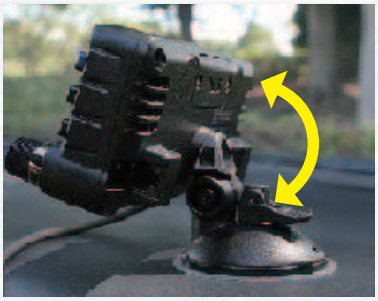
FTM-350AR NEW

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.



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- 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

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*SmartBeaconing™ from HamHUD Nichetronix

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Public Service
Advocacy
Education
Technology
Membership

"It Seems to Us"

A Good Year to Upgrade!

"Any time is a good time to upgrade your knowledge and (if you're not already Amateur Extra) your class of license, but for Technicians 2011 is an especially good year to go for at least the General."

If you hold a Technician license you have credit for Element 2 of the current written examinations for an FCC amateur license. (Element 1 encompassed the Morse telegraphy exams that are no longer part of the license requirements.) To earn a General license you must pass an exam on Element 3. On July 1, 2011 a new Element 3 question pool will be put into service by the volunteer examiners who administer FCC amateur license exams. So, if you want to use current study material to prepare for your General license you should plan to pass the exam by June 30.

Not that a door will close forever if you miss that date. The Element 3 syllabus will not change very much on July 1. The Question Pool Committee — a group representing several Volunteer Examiner Coordinators, including the ARRL — only made minor adjustments. There is a new group of questions on station operation and setup, and new questions on sideband operation near band edges — a subject that a lot of already-licensed Generals and Extras need to brush up on! Still, most of us tend to focus more attentively when a deadline looms — something I experience every month when it comes time to write this page.

If you're already enjoying Amateur Radio operation within the privileges of a Technician license you might wonder why you should upgrade. As a Tech you already have a lot to explore. You have full privileges above 50 MHz. You can operate SSB in the most popular part of the 10 meter band, 28.3-28.5 MHz, and CW, RTTY and data in the entire lower part of the band, 28.0-28.3 MHz. You can operate CW in generous portions of 80, 40 and 15 meters. That might be enough to keep you busy, and fully engaged in Amateur Radio. But there's so much more you could be doing. If the prospect of exchanging greetings and making friends by radio in other parts of the world is enticing, you want at least a General license.

While some portions of the 80, 40, 20 and 15 meter bands are reserved for Advanced and Extra licensees, Generals have operating privileges at the full legal power limit in every amateur band. Even if you're already enjoying 10 meters, once there are more sunspots the lower part of the phone band is going to become very crowded and the wider spaces above 28.5 MHz will become very important. And yes, more sunspots *are* on the way. According to SpaceWeather.com, there were 260 spotless days in 2009 but only about 50 in 2010 (the year hasn't quite ended as this is being written). So far we have had just a small taste of what's to come on 10 meters as we get farther into Solar Cycle 24, but already there have been some very exciting days on 15 and 12 meters.

Studying for and passing the Technician exam may have been hard work for you. It certainly can be for people who are long out of school and are without a technology background. That shouldn't discourage you from going for the General. As you review the Element 3 syllabus and question pool — either the current version or the revised pool that will take effect on July 1 — you will see a lot of familiar topics. The emphasis is on HF rather than on VHF and UHF operation, but the material is just a little different and is not much more difficult than what you already have studied. Building on what you already have learned in order to pass Element 2 will be easier than starting from scratch, and the sooner you start the less you will have forgotten.

As always, the ARRL is here to help. Our *General Class License Manual* has just been revised to include a CD-ROM with newly developed exam review software. A new edition based on the new question pool will be coming out later in the year, but there's no need to wait — July 1 is still months away. If you learn more easily from an instructor and as part of a group, a visit to **www.arrl.org/find-an-amateur-radio-license-class** may help you locate a training class in your area.

Of course, there's no need to stop at General. The Element 4 exam for an Amateur Extra license *is* more difficult, as it should be for full privileges. While the details have changed over the decades, the FCC rules have always encouraged amateurs to advance their skills and to expand the reservoir of trained operators, technicians, and electronics experts in our ranks.

If your ultimate goal is an Amateur Extra license, whether for the additional frequency privileges, the opportunity to choose a call sign from a wider selection, or simply "because it is there," you must pass Element 3 before you tackle Element 4. If you wish you can pass both (or all three elements for that matter) on the same day, but most take it a step at a time.

Why not make 2011 the year you upgrade? There's nothing to lose, and a wider world to gain.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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HAM-IV

HAM-IV $649.95

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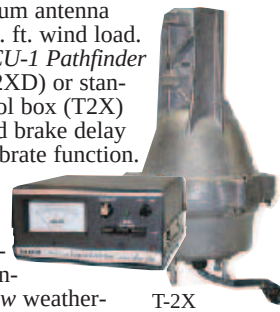
HAM IV and HAM V Rotator Specifications	
Wind Load capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs.**

TAILTWISTER SERIES II



For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, $2^{1}/_{16}$ inch max. mast.

T-2X $799.95

T-2XD $1229.95 with DCU-1

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000** in.-lbs.
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs.**

CD-45II

CD-45II $449.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs.**

HAM-V

HAM-V $1099.95 with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

AR-40

AR-40 $349.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs.**

HDR-300A

HDR-300A $1499.95

King-sized antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power	5000 in.-lbs.
Brake Power	**7500 in.-lbs.**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight	61 lbs.
Effective Moment (in tower)	**5000 ft.-lbs.**

ROTATOR OPTIONS

MSHD, $109.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $49.95. Light duty mast support for CD-45II and AR-40.
TSP-1, $34.95. Lower spacer plate for HAM-IV and HAM-V.

Digital Automatic Controller

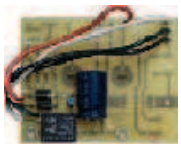
DCU-1 $749.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1° accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

AR-35 Rotator/Controller

AR-35 $89.95

For UHF, VHF, 6-Meter, TV/FM antennas. Includes automatic controller, rotator, mounting clamps, mounting hardware. 110 VAC. One Year Warranty.



RBD-5 $29.95

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Provides automatic 5-second brake delay -- insures your rotator is fully stopped before brake is engaged. Prevents accidentally engaging brake while rotator is moving. Use with HAM II, III, IV, V, T2Xs. Easy-to-install. Includes pre-assembled PCB, hardware.

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- A secondary allocation to the Amateur Radio Service at 461-469 and 471-478 kHz has gained inter-American support in a WRC-12 preparatory meeting. Details appear in Happenings, elsewhere in this issue.
- The ARRL has filed an *ex parte* submission with the FCC, providing additional support for its position that the FCC should require mandatory notching of the amateur bands by Broadband over Power Line (BPL) systems.
- SKYWARN and ARES® were activated as a series of tornadoes swept across several southeastern states in late November.
- The winners of the *QST* Cover Plaque Award for November 2010 are Joe Taylor, K1JT, and Bruce Walker, W1BW, for their article "WSPRing Around the World."
- After more than 160 days in space, ISS Expedition 25 Commander Doug Wheelock, KF5BOC, has returned to Earth from the International Space Station.
- On November 23, the FCC issued a Citation to Hobby Lobby International for marketing non-compliant radio frequency devices.
- The Question Pool Committee of the National Conference of Volunteer Examiner Coordinators released the new General class (Element 3) question pool in early December. It will be effective July 1, 2011.
- Five research satellites were carried to orbit in November aboard a Minotaur V rocket launched from Kodiak Island, Alaska. All the satellites use Amateur Radio frequencies.
- Two operations — the 2009 H4ØHP (Temotu Province) operation and the 2007-present 7Z1HB (Saudi Arabia) operation — have been approved for DXCC credit, as have eight operations in Africa.
- February 28 is the deadline for the First ARRL Video Contest. Details are in January 2011 *QST*, page 20.

Media Hits

Allen Pitts, W1AGP
Media & Public Relations Manager

- Without a doubt, the biggest Amateur Radio news in the end of 2010 was the activity of Colonel Doug Wheelock aboard the International Space Station. While other astronauts have made flurries of contacts using the famous NA1SS call, Expedition 25 Commander Doug, KF5BOC, even televised some of his contacts.

NASA Television released and also published the video tapes on YouTube where they were picked up by many outlets. Colonel Wheelock took us on a tour through the ISS and ended up making a series of Amateur Radio contacts while passing over the West Coast and down through Texas. You can see the video at **tinyurl.com/3yep54f**.

- Meanwhile, on the ground, hams were not only enjoying the contacts but were busily telling their local news reporters about it. There were many stories on television, in newspapers and all over the Web.

The *Louisville Courier-Journal* for southern Indiana told how "an avid ham radio operator, Mark Williams [K9GX] recently got a thrill of a lifetime when he communicated with astronaut Commander Doug "Wheels" Wheelock..." and the *Cape Gazette* (DE) reported how Terry Hastings, W3TRY, of Milford, was the first Sussex Amateur Radio Association member to speak to the space station. "It was absolutely great to hear Col. Wheelock return my call," he said. "I felt the enthusiasm of a child again." Del Palmer, K3AXR, also made contact as did Jerry Martin, KB3NZJ, and his wife Paula, KB3TCH, as well as Joe Stormer, W3TL. All of these were reported in the news along with 400 schoolchildren at the Holy Family Catholic School who made contact, reported in *The Daily Sentinel* (CO) and on KJCT television.

"Local ham-radio operator communicates with astronauts" were headlines from *The Evening Sun* (PA) to TMC.net. Wheelock's "enthusiastic greeting is something Hanover's Randy Schriver [KG3N] has heard three times recently…But it's rare to have one as talkative as Wheelock."
Indeed — he is very special and has done both NASA and Amateur Radio proud. Thank you, Doug!

- Also in the news were stories about the National Weather Service's SKYWARN Appreciation Day. One of the TV stations reporting on that was KATV in Arkansas: "According to the NWS, amateur radio operators, known as HAMs, provide a vital public service by passing on emergency information during severe weather outbreaks."
- Finally, we like the "ham radio know-how" promoted in Kathy Berkowitz's story "Ham speaks for itself" in the *Lake Wales News* (FL). She wrote of Judson Bracewell, KJ4RMC, "All he needs…is two trees and a wire, and a car battery to hook up his ham radio."

JOEL P. KLEINMAN, N1BKE

Bob Heil Donates Mike for Visitor Use at W1AW

In December, Bob Heil, K9EID, of Heil Sound, visited ARRL HQ to donate a newly designed microphone for use at W1AW. The supercardioid dynamic mike, model PR-31BW, is now in use with the Yaesu FTDX9000D transceiver in Studio One.

In Studio One: **Bob Heil, K9EID (left), and ARRL COO Harold Kramer, WJ1B, admire the new mike that Heil donated to W1AW. Visitors can operate weekdays (except holidays) from 10 AM-12 PM and 1 PM-3:45 PM Eastern Time.**

ALAN GAUZENS, WA4ATF

ARRL official family friends reunite: **Former long-time Southeastern Division Director Frank Butler, W4RH, former Southeastern Division Vice Director Evelyn Gauzens, W4WYR, and former ARRL President Larry Price, W4RA, met up in early December at the Tampa Bay Hamfest in Palmetto, Florida. Gauzens and Butler are ARRL Honorary Vice Presidents, while Price has also served as Southeastern Division Director and IARU President.**

Hudson Division Names Its Amateur of the Year

ARRL President Kay Craigie, N3KN, was on hand as Nancy Rosner, N2TKA, of W Sayville, New York, was honored in November as 2010 Hudson Division Amateur of the Year. Other honorees included Julius Jones, W2IHY, of Staatsburg, New York, who was awarded the Technical Achievement Award and Jerry Jankowitz, NO2T, of Hillsdale, New Jersey, who was named the Grand Ole Ham.

In addition to the Division awards, two ARRL Board Awards for 2010 were presented to hams in the Hudson Division. The ARRL Technical Service Award was given to Richard Knadle, K2RIW, of Dix Hills, New York, and the ARRL George Hart Distinguished Service Award was presented to David Struebel, WB2FTX, of Butler, New Jersey. — *tnx Diane Ortiz, K2DO, and Frank Fallon, N2FF*

GEORGE TRANOS, N2GA

At the Hudson Division Awards luncheon: **Front — Nancy Rosner, N2TKA, and Vice Director Joyce Birmingham, KA2ANF. Back — Director Frank Fallon, N2FF, Julius Jones, W2IHY, ARRL President Kay Craigie, N3KN, and Jerry Jankowitz, NO2T.**

Inside HQ

Looking for News? Subscribe to an E-Newsletter

Where can you find the latest news and information about Amateur Radio? Depending on your particular interests, it's available in any or all of the ARRL's electronic newsletters that are all available at no charge to our members.

For the timeliest information, subscribe to the weekly *ARRL Letter.* Now in its 30th year, the *Letter* includes Amateur Radio news, regulatory updates, solar forecasts and information about upcoming ARRL Section, State and Division Conventions. *The ARRL Letter* is e-mailed to its 80,000 subscribers every Thursday, except for a few holidays. It is edited by S. Khrystyne Keane, K1SFA, and it is published in an HTML format. This lets us add pictures, videos and other multimedia features. We also post a copy on the ARRL Web site, at **www.arrl.org/arrlletter**. An audio version is available at **www.arrl.org/arrl-audio-news**.

The *Contest Update Newsletter* is an enlightening, and occasionally irreverent, biweekly compendium of interest to any active operator. Started in 2002, its more than 25,000 readers now enjoy news on subjects ranging from on-the-air events to new products and stories of scientific and technical interest.

"Technical items are packed into every issue as well, covering towers, antennas, electronics, construction techniques, and more," according to Editor Ward Silver, NØAX. "Along with operating tips, editorial content in the Conversation section may be a sermon or a surprise. You can use the newsletter's calendar sections to keep tabs on upcoming events and submission dates for logs and scores, too. The intent of the *Contest Update* newsletter is to compile items of interest to all active hams, whatever their operating preference, while spicing up the mix with photos, audio and video elements. There is so much information flying by on the Internet these days that collections such as the *Contest Update* are a welcome way to increase the 'signal-to-noise' ratio of what we choose to take in."

Whether or not you have a go-kit, if you are interested in Amateur Radio Public Service and Emergency Communications, you should subscribe to the monthly *ARES E-Letter*. Edited by Rick Palm, K1CE, it is devoted to news about ARES, RACES, training programs, simulation exercises and served agencies. It is loaded with informative, practical and relevant information including the latest emergency communications gear. The popular *Letters to the Editor* section is your chance to be heard by a wide audience of amateurs with similar interests.

Here's how you can subscribe to any or all of these newsletters:

1) Log in to the ARRL Web site, **www.arrl.org**.

2) Click "Edit Your Profile" located under the "Your Favorites" box at the top of the screen.

3) Click the "Edit Email Subscriptions" tab

4) Check the boxes of the newsletters you wish to receive.

You can also call or e-mail us to sign up. Contact information is on page 16.

73,

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

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

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

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

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

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

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

- **ARRL "Special Risk" Ham Radio Equipment Insurance Plan**
  Insurance is available to protect you from loss or damage to your station, antennas and mobile equipment by lightning, theft, accident, fire, flood, tornado, and other natural disasters.
- **The ARRL Visa Signature® Card**
  Every purchase supports ARRL programs and services.
- **MetLife® Auto, Home, Renters, Boaters, Fire Insurance and Banking Products**
  ARRL members may qualify for up to a 10% discount on home or auto insurance.

* ARRL Group Benefit Programs are offered by third parties through contractual arrangements with ARRL. The programs and coverage are available in the US only. Other restrictions may apply.

ARRL Programs

Public Service — www.arrl.org/public-service

Amateur Radio Emergency Service® – **www.arrl.org/ares**
Emergency Communications Training – **www.arrl.org/emcomm-training**

Radiosport

Awards – **www.arrl.org/awards**
Contests – **www.arrl.org/contests**
QSL Service – **www.arrl.org/qsl**
Logbook of the World – **www.arrl.org/lotw**

Community

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

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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

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

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

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

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

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

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

Officers, Division Directors and Staff

As an ARRL member, you elect the director and vice director who represent your division on ARRL policy matters. If you have a question or comment about ARRL policies, contact your representatives at the addresses shown.

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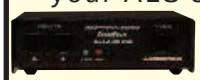

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Programmable Screwdriver Antenna Controller

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Suggested Retail

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Ameritron's exclusive *StallProtector*™ feature prevents your expensive motor from burning out. Automatically detects motor stall and completely shuts off power to motor.

Monitor motor current on LEDs for signs of trouble and to determine stall current.

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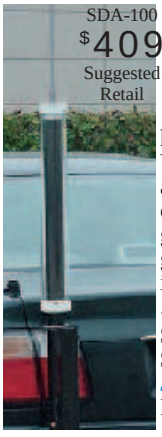

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The Silver Panthers are Loose

Ralph Holberg, N4RX

The Silver Panthers ARC, from the left: Terry Young, K4KJP; Grover "Ike" Durant, N4FF; Jim Reaves, W4SGP; Ron Vincent, KF4D; Ralph Holberg, N4RX, and Jim Younce, K4ZM.

Fifty years is a long time, especially for the members of the Murphy High School class of 1958, who had not seen or heard from each other in all that time. In the early days of the Novice license many were middle schoolers whose fathers and uncles, returning from military service, introduced them to ham radio. Together again in high school in Mobile, Alabama, we organized the Murphy High ARC.

We were given a place in the movie projection room for our station and upper classman Howard Smith, W4YHS, became the license trustee. The club call was K4BDS. We borrowed some equipment, put an antenna on the roof and were on the air.

In 2008 it was 50 years later and plans for a reunion were taking shape. Wouldn't it be great if we could get the old radio guys together and put a station on the air with our old call? We set about locating as many alumni members as possible. But how do we reorganize the club, considering that the members were all across the US and some overseas?

We decided to meet by e-mail. We set up a station, wrote a constitution, elected Jim Younce, K4ZM, as our president and chief operator and designated Ralph, N4RX, as our license trustee. We then applied for our old call. We named ourselves the Silver Panthers Alumni Radio Club, which gave us a nice acronym (SPARCs).

We had done it. Time for the 50th anniversary came. The club reassembled, we talked old times and put "the Voice of Murphy High" back on the air — right? *Wrong*. With all the activity planned for the milestone reunion, there just wasn't enough time. No station was set up nor any meeting convened (except by e-mail) until the class held a 52nd "mini-reunion," in June 2010. It was then that the seven Silver Panthers put K4BDS on the air.

We operated Field Day from the home of Tom Walker, KG4JWD, class of 1960. Plenty of heat, humidity, ants, a generator, a beam on a 32 foot ladder, sandwiches, watermelons, cold 807s (remember them?), plenty of stories, laughs and lies, and even an occasional (how 'bout that!) contact — CW only, of course. But we had fun and we're ready for the next time we put the old club call on the air.

Photos by Jim Younce, K4ZM.

Our antenna was an old TH-3JR on top of a 32 foot ladder.

Terry Young, K4KJP (left), and Ron Vincent, KF4D, open up the event.

PAUL CHOMINSKI, WA6PY

Paul Chominski, WA6PY, of San Diego, California used this single 26 element SMØPYP Yagi to complete what is believed to be the first single-Yagi 70 cm Worked All Continents on CW. See this month's The World Above 50 MHz column.

JAKE LAUSER, K3UAZ

I caught a recent fall sunset at my home in Lancaster, Pennsylvania behind my 7 element GØKSC LFA 2 meter Yagi. — *Jake Lauser, K3UAZ*

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CORRESPONDENCE

REMEMBERING A FATHER'S LAST WORDS

I had some concrete work to do, so I stopped in at my local big-box hardware store. I told the young lady at the counter what I needed and she called over a middle-aged man to assist me. After he loaded the concrete in the back of my jeep, he noticed my license plate, which has my call sign on it. He asked if I was a ham, and I told him that I was. He started crying. We both stood there for what seemed the longest time and then he apologized. He explained that he was in the Vietnam War and was able to call home and talk with his dad via Amateur Radio, two days before he passed away. "I'll never forget those wonderful hams who patched me through to my dad," he said. "Every time I think of it, even though it was 40 years ago, I remember my dad's last words to me over the radio and I cry."

Thanks to all the radio amateurs who help our service men and women stay in touch with their homes and families.

JOHN HAMILTON, W8JNK
Springfield, Ohio

TO THE *LETTER*

I want to take this opportunity to say "thanks" for the ongoing great job with *The ARRL Letter*. The *Letter* is informative, with a good, broad spectrum of information. It helps keep hams current in ways that just aren't possible with the monthly *QST* publication schedule. I can't recall ever seeing a typo or other mistake. Good job!

CURT HOLSOPPLE, K9CH
ARRL Life Member
Hopewell, Virginia

[Editor's note: For more on *The ARRL Letter*, as well as our other electronic publications, check out "Inside HQ" by ARRL Chief Operating Officer Harold Kramer, WJ1B, on page 13.]

TRYING TOP BAND

Since I was first licensed in 1965, I've always wanted to work 160 meters, but I never got around to it. So after reading an article on the ARRL's Web site — with an appeal to try the ARRL's 160 Meter Contest — I decided to make 2010 my year to get on 160. Owning a townhouse outside Chicago with all the usual CC&Rs left me relegated through the 1980s and '90s to VHF/UHF FM/repeaters — until the summer of 2007 when my kids were out and on their own and I had room for a desk with my limited equipment.

This included an old 25 W 10 meter transceiver and a 4.5 foot base-loaded telescoping antenna that I installed right at the connector on the back. I learned quickly that I could make contacts with an indoor antenna and limited power. A 160-10 HF rig, antenna analyzer, an accurate SWR/power meter and other "necessary" gear followed. But I had never worked lower than 40 meters — I just never had enough room for the indoor wire. To top it off, I was always under the impression that 160 was a band strictly for big signals and big antennas. Perhaps for ragchewing it is, but at the suggestion to try the contest, I ran a wire out the window to a driven copper stake, grounded the HF rig, loaded it with a long-wire tuner and got ready for my first contact on 160.

Tuning was extremely sharp, but the marginal SWR was "cleaned up" by the rig's internal tuner. Though very inefficient due to the heavy loading — the wire was only ⅛ wave at 160 meters — I managed to work eight states and a Canadian province, with only limited time on the air. It only took 45 years to meet this long-term goal! Don't let apparent restrictions keep you off the air or limit your ambitions — there is always a way!

DEAN LEWIS, W9WGV
Palatine, Illinois

DIGITALLY SPEAKING

Just recently, I had a conversation on a digital mode with a fellow ham about signal reporting. It is obvious that the time-honored Readability/Signal/Tone (RST) has no valid application in digital modes. Considering that some of the conversations can take place below the noise floor but are perfectly readable on your screen, I would question the validity of continuing to be required to use RST especially in contest operations. As for contesting, 599 is embedded in most logging and contest software. We don't give or receive honest reports during contests, so what is the value? When I'm in digital modes, my speaker is off so I rely on the garble factor on the screen to determine a report. But for simplicity's sake, it is 599 — I doubt the accuracy of any report I'm given so the numbers are a wasted formality. I'm not sure if our computers could generate a valid report based on signal quality, but pretty much all of my software is locked on 599.

STEVE LENAGHAN, VE6VS
ARRL Life Member
Red Deer, Alberta, Canada

HAVING FUN ON HF

As a new radio amateur — I passed Technician and General on the same day in June 2010 — I was disappointed to read the letter from Randy Hamud, KJ6JAJ ["Correspondence," Dec 2010, page 24]. I was also glad that my experiences so far have been quite the opposite. During a recent ARRL contest that included a year-first-licensed check, I made several contacts with serious competitors, based on the very high serial numbers they were sending. Several took the time to congratulate me on my new license and welcomed me to the hobby. I am running barefoot with 100 W and a dipole in my backyard trees. Several other contacts hung with me and had me give the exchange a couple more times so they could work me. I ended the day delighted with the warm welcome I had received on the air.

MATTHEW MILLER, KF7LKB
Wilsonville, Oregon

KEY NOTE

I read the letter from Ray Grob, NN8R ["Correspondence," Dec 2010, page 24], who doesn't like sloppy CW. Like many of the old-timers who Grob refers to, I am just now getting back into CW and my sending sometimes isn't great. I need encouragement, not rebuke from senior hams who should be setting an example and encouraging others.

Randy Hamud, KJ6JAJ, made an excellent comment in his letter on the same page, about receiving boorish treatment on 75 meters: "It is just plain arrogant not to talk constructively to anyone you can hear who is trying to make a contact. Instead of giving them a lecture, give them a QSL and a signal report — make them feel welcome." Grob said that if you can't handle a paddle, use a straight key; failing that, use a keyboard. With all due respect, pounding a straight key well is not easy. Frankly, if I have to revert to a keyboard because my sending isn't up to some nebulous standard I'll drop CW entirely and go to a superior keyboard mode like PSK31.

BOB ABBOTT, AIØS
Evergreen, Colorado

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

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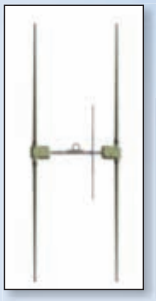
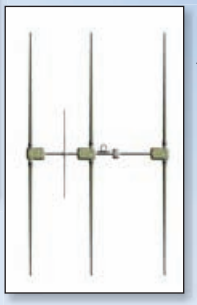
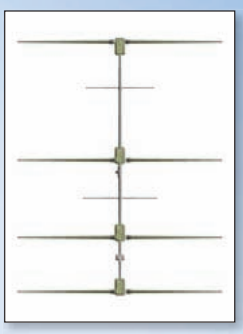


2 Element 20m-6m Yagi
2 element Yagi, 20m-6m continuous coverage; 57" boom, 36 ft longest element, 18.2 ft turning radius, 6 sq ft wind load, 30 lb; SDA 100 controller included.



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



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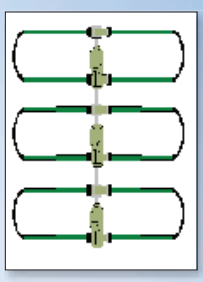
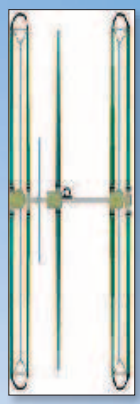
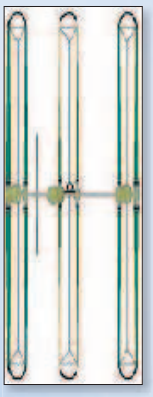


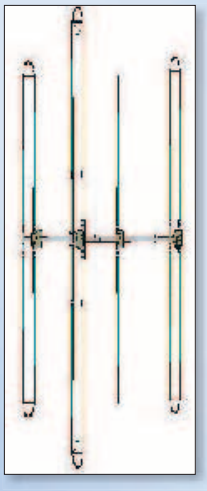
DB11 Yagi Antenna
DB11 Yagi, 18.5 ft element length, 11 ft boom, 10.8 ft turning radius, 61 lb, 5.9 sq ft wind load; 2 active elements on 20m; 3 active elements on 17, 15, 12, 10, 6m.

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



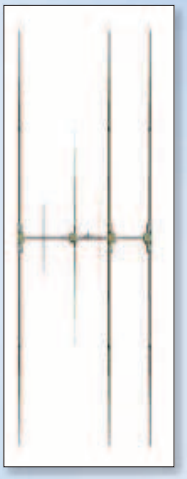


DB18E YAGI
Dreambeam DB18E, 3 el 30m-6m, 2 el 40m, three looped elements, does not include optional 6m passive element kit, 18 foot boom; Includes SDA 100 controller.



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

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



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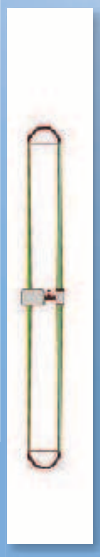
20m-6m Dipole
20m-6m continuous coverage dipole; 36 ft element length; Comes with SDA 100 controller.



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David Jordan, AA4KN, for the ARISSat-1 Team

Several years ago, an idea surfaced out of the Russian space program of turning a retired Russian Orlan spacesuit stored on board the International Space Station (ISS) into an Amateur Radio satellite. The suit would be filled with Amateur Radio equipment, connected to a battery and an antenna mounted on the helmet, and then released into orbit during an extra-vehicular activity (EVA). Sergey Samburov, RV3DR, of RSC-Energia introduced the idea at the 2004 AMSAT Symposium in Washington, DC. At this meeting, Lou McFadin, W5DID, of AMSAT-NA introduced the name *SuitSat* for the project and the name stuck.

This idea came to fruition when, on February 3, 2006, cosmonaut Valery Tokarey quite literally shoved the spacesuit into orbit from the ISS with the parting words, "Goodbye…Mr Smith." And with that, SuitSat-1 began its journey, sailing on a slow descent as it orbited Earth. For a couple of weeks it transmitted a collection of stored messages and other data until its final transmission was heard on February 18, 2006.

Unfortunately, due to a still unexplained problem, SuitSat-1 was extremely hard to hear on the ground for all but the most sophisticated stations. But, nevertheless, the "successful failure" of SuitSat-1 piqued the interest of millions, not to mention energizing its innovative experimenters into building a follow-on project they tentatively called *SuitSat-II*.

In November 2006, discussions began with the idea of creating a new and improved SuitSat. Again, the plan was to use a retired Orlan suit, but with some significant improvements. For example, SuitSat-1 contained only a battery for supplying power. This new "satellite in uniform" would have solar panels attached to its legs for recharging its onboard battery along with modular subsystems that, once designed, could be easily replicated for future SuitSats. And to really push the envelope, the spacesuit turned satellite would also contain a software defined transponder (SDX), a first for any ham satellite up to that time.

Things were going well and excitement was building until July 2009 when, out of necessity to make room on the ISS for some new orbital occupants, the Orlan suit tagged for SuitSat-II had to be discarded. The good news was that the Amateur Radio on the International Space Station (ARISS) team would still be given the opportunity to fly the radio gear up to the ISS and have it deployed during an EVA. But there was the lingering problem of what would house all the radio gear, solar panels and batteries.

For many years, AMSAT had been toying with the idea of building a small satellite that could be tossed overboard from the space shuttle. The idea took on many forms, most of which were later discarded. One "half-baked" idea even included mounting some Amateur Radio gear and batteries inside a pizza box, sticking a few antennas on the outside and tossing it overboard…an idea that, for obvious reasons, came to be unceremoniously dubbed "pizza sat."

So, once again the ARISS team drew on a similar concept and came to the conclusion that, since they no longer had a spacesuit available for the project, how about using a space frame instead? And, sure enough, almost, immediately after the announcement that an Orlan suit was unavailable, work began in earnest to reconfigure SuitSat-II's components to both fit and operate inside a new housing. But, there was another issue to resolve. Since there would no longer be a spacesuit involved, the name needed to change. ARISS-International later decided that the craft would now be called *ARISSat-1* with its full official name being *ARISSat-1/Radioskaf V*.

By the time you read this, ARISSat-1 will have been shipped to Russia for integration of the Kursk Student Experiment as well as testing with the Russian battery installed. It was to have then been shipped to Kazakhstan in December where it was due to be loaded onto the Russian Progress supply vehicle 41P and launched to the ISS in January 2011. Deployment of this Amateur Radio experiment to the ISS is scheduled for February 2011 during EVA #28 and, if all goes as planned the craft will be in full operation 15 minutes after its release.

So…What's in the ARISSat-1 Space Frame?

Well…quite a lot! ARISSat-1 is basically an aluminum frame with modules inside (Figure 1). The overall size of the unit was determined by the solar panels that measure 19 × 10.5 inches and are

mounted on all four sides and the top and bottom plates of the craft. The modules contain the various subsystem circuits. The circuits interconnect allowing the satellite to carry out its on-orbit functions. Let's take a look at the subsystems on board.

First of all, there are a total of six solar panels — one on each of the four sides plus on the top and bottom. Each panel can generate 50 V and more than 19 W of power. The output of each panel connects to its own circuit in the Maximum Power Point Tracker module (or MPPT) where the power from each panel is optimized. Power from the solar panels is used to run the satellite and recharge its battery. Having a charged battery is especially important for supplying power to the spacecraft when it's in darkness ("eclipse"). The battery is the same type used on the Russian Orlan spacesuits and was donated by RSC-Energia. There is an RF module containing a 2 meter communications transmitter that connects to a whip antenna mounted on the satellite's top panel and a 70 cm receiver with a whip on the bottom panel. The module also houses an SSB/CW transponder that will (hopefully) be easily accessible in orbit by users running less than 5 W.

All Earth-orbiting satellites must have a means of being controlled from Earth as necessary. So, a 70 cm command receiver, always listening for commands from hams serving as ground control stations is also contained within the RF module.

As a safety precaution, it is important that ARISSat-1's transmitter and solar panel power system remain inactive until after its deployment. The control panel made up of three toggle switches is mounted on the top plate of the satellite. Just before ARISSat-1 is released into space, a space-walking crewmember will turn on all three switches. This starts a timing sequence that delays activation of the transmitter and generation of power by the spacecraft for 15 minutes to insure there will be no RF interference with the crew member's spacesuit electronics until ARISSat-1 is well on its way.

In addition to the radio gear carried aboard, the satellite also has a total of four cameras mounted on the top and bottom of the spacecraft. These cameras will receive power just prior to release and are designed to capture images of the deployment for later transmission. They will also continue to operate while in orbit, supplying views of the Earth and space via slow scan television (SSTV) to those stations so equipped.

Protruding from the top plate and resembling a silver colored "top hat" is the Kursk science experiment. This is an experiment developed by students at the Kursk State Technical University in Russia. Its purpose is to take periodic measurements of vacuum as ARISSat-1 continues its gradual descent into the Earth's atmosphere.

The Internal Housekeeping Unit (or IHU) is the processing center for the satellite. It is here where all analog and digital signals from the modules are routed and converted to a usable form to do particular tasks. The main "brains" of this unit is a PIC32MX processor that provides the overall control of the satellite's systems and generates telemetry to report the health of the spacecraft. A second PIC32MX is the first software-defined transponder (SDX) ever to fly on a ham satellite.

What Happens after ARISSat-1 is Switched On?

Just prior to ARISSat-1's EVA, clear Lexan solar panel covers will be carefully removed from all sides of the satellite frame and replaced by protective soft covers. These soft covers will be removed before deployment. One of the EVA crewmembers will slowly guide the craft through the open hatch and then engage the three control panel switches beginning from left to right. Flashing yellow LEDs on the panel will begin their slow cadence indicating that the 15 minute "countdown to power up" sequence has begun. The crewmember will then grasp the space frame's large corner handles, carefully angle the craft and push ARISSat-1 into a gradual rearward separation from the ISS.

ARISSat-1 is initially expected to orbit at a height around 350 km while exhibiting a very gradual decline in altitude over time. Hopefully, it will remain functional and in orbit for two to six months. The "best estimate" is approximately 3.5 months based upon an analysis conducted by NASA's ISS and Trajectory Planning Team as part of their review of how ARISSat-1 should be deployed by the International Space Station.

How Do I "Work" the New Bird?

ARISSat-1 is a unique Amateur Radio experiment and offers many new and exciting features. Among them, the on-board SDX system allows hams to speak with one another via satellite using CW and SSB. And unlike FM repeater satellites that can only support one conversation at a time, the

NASA

SuitSat-1 all dressed up for its flight into space.

TONY MONTEIRO, AA2TX

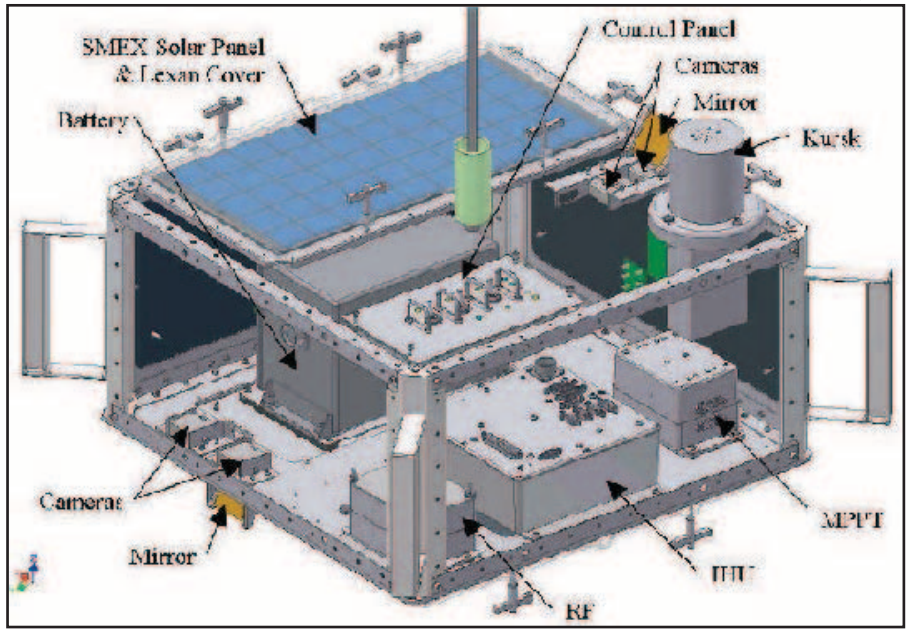


Figure 1 — An internal view of the ARISSat-1 modules housed in a space frame.

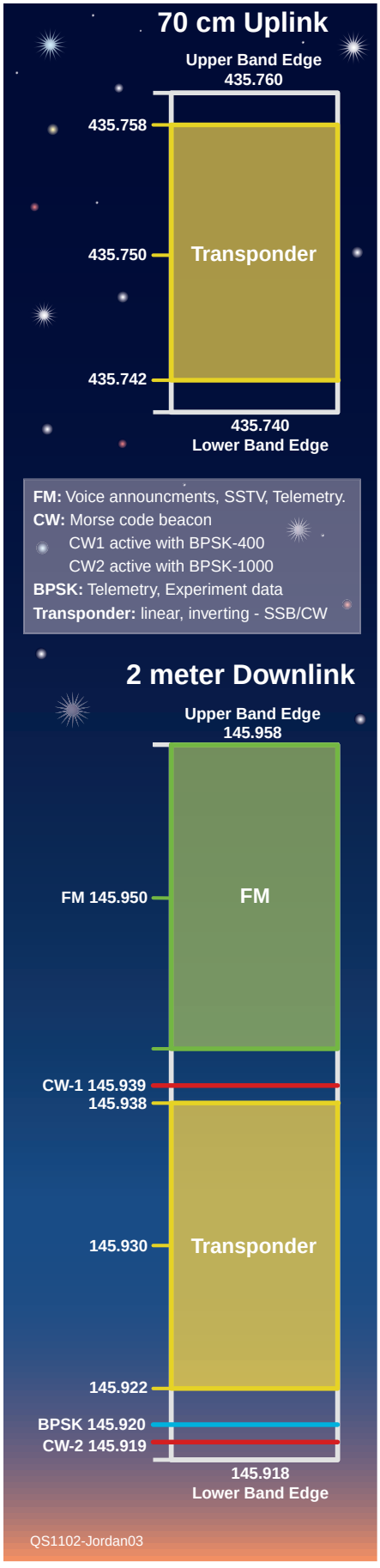


Figure 2 — The ARISSat-1 uplink and downlink bandplan.

Classroom Applications for ARISSat-1

Innovative teachers can find many ways to integrate communication with ARISSat into their Science, Technology, Engineering and Mathematics (STEM) curriculum. Topics might include the satellite's characteristics, capabilities and transmitted information. Whether it's constructing a classroom ground station to receive and track ARISSat-1, demonstrating RF frequency shift due to the Doppler effect, creating a project to track the daily changes in the health of the satellite by recording and decoding telemetry, or the opportunity to introduce students to Morse code through collecting call signs in the CW contest, the only limit is the teacher's imagination.

ARISSat-1 transponder can relay several conversations *simultaneously*.

Digital enthusiasts will enjoy the challenge of receiving BPSK-1000 telemetry. This will be an exciting application of a digital mode that is entirely new to Amateur Radio.

All transmissions from ARISSat-1 will be sent within the 2 meter satellite band using various modes of operation (see Figure 2). All stored voice transmissions will use FM at 145.950 MHz. This includes a female voice ID, female voice telemetry (subset) and 24 greeting messages in 15 different languages from students and other individuals from around the world. Many of these messages end with a "secret word." If listeners successfully collect and identify all the secret words, they can submit them and receive a special certificate. Details for the contest will be announced via the AMSAT and ARISSat-1 Web pages as well as the AMSAT News Service before deployment. To add even more variety, SSTV ID images and images acquired by the on-board cameras are slated to be part of the transmission sequence. The SSTV signals will be sent in Robot 36 protocol and can be displayed in real time on a computer using free downloadable software from the Internet. The freely available *MMSSTV* program was used during testing and works well.

Satellite telemetry will also be available on 2 meters on 145.920 MHz using a new BPSK transmission mode (BPSK-1000) specifically developed for ARISSat-1 by Phil Karn, KA9Q. There is a Phase 3, 400 bps BPSK telemetry downlink on board for use only as a backup system. Only the BPSK-1000 system is slated for activation. Even though the satellite will *not* be spin stabilized, the BPSK-1000 mode should provide an error-free signal allowing the use of simple antennas on the ground even during deep fades. Free decoding software for BPSK-1000 will also be made available before deployment. In addition, a downlink telemetry subset will be transmitted using CW (Morse code). If CW is transmitting on 145.919 MHz, then BPSK-1000 is active on 145.920 MHz. If CW is transmitting on 145.939 MHz, the BPSK-400 backup mode is active on 145.920 MHz.

To encourage an interest in using Morse code, the CW beacons will also host a CW contest, transmitting the call signs of hams that have contributed to Amateur Radio in space. Received call signs may be submitted for a special CW certificate. Again, specific details for the contest will be announced before deployment.

As noted earlier, for those so equipped, ARISSat-1 will feature the first software defined transponder (SDX) to fly on board an Amateur Radio satellite. A software-defined transponder creates the modulation schemes (FM, CW, USB, LSB) used by the uplink and downlinks in software through digital signal

Funding for ARISSat-1 — You Can Help!

Even though the spacecraft was built by volunteers, the ARISSat project has cost AMSAT about $180,000. That money has come from AMSAT's financial reserves that now must be replenished. AMSAT also needs funding to provide seed money for work on future space projects.

You can support AMSAT by going online and making a donation at **www.amsat-na.com/store/donation.php**. You can also send donations by mail to AMSAT Headquarters, 850 Sligo Ave, Ste 600, Silver Spring, MD 20910. Donations can also be accepted via telephone with a credit card from the USA and Canada at 888-322-6728 or 301-589-6062 from all other locations.

ARISSat-1 is the result of hard work from a large group of talented individuals from around the world. These people have freely volunteered their time and talents with the goal of creating an Amateur Radio satellite that demonstrates the latest technology while at the same time acting as an educational tool for teachers to inspire students considering careers in science, technology, math and engineering. We hope you enjoy it!

What Do I Need to Work or Hear ARISSat-1?

The only radio you need to receive the voice ID, voice telemetry, SSTV and voice messages is a 2 meter FM transceiver (even a handheld radio), or a scanner that covers 2 meters.

If you are fortunate enough to own a multiband or multimode 2 meter/70 cm rig such as the Yaseu FT-817, Kenwood TS-2000, ICOM IC-910 or an older Yaesu FT-847 or FT-736R, you already have what you need to monitor and/or access ARISSat-1. If this isn't the case, here are some options to consider.

Since ARISSat-1 is a multimode satellite, it would be best to have a single radio that covers 2 meters and can receive SSB, CW and FM modes. The Yaseu FT-817 is a good choice since it also features digital and packet modes and has positions for narrower CW filters to improve reception. This rig, while being a good performer, can be expensive if purchased new, however.

Another approach is to use one of several multiband/multimode scanners available that cover the 2 meter band. Pricing for these units starts at around $300 to $500. Hamfests (or online auction sites such as eBay) are also good sources for used radios such as the ICOM R-10 and Yaesu VR-500. With a little searching, these radios can often be found in good condition and at bargain prices.

If you only plan to listen to the FM audio, a common "scanner" should be adequate provided it covers the 2 meter band and you have a decent outside antenna. By that, I'm suggesting that you at least use a ¼ wave vertical or circularly polarized antenna. This is discussed in more detail in the section on antennas. Of course, you'll only be able to tap into the downlinked voice and SSTV signals with these rigs.

The RF output of ARISSat-1 varies according to the mode in use…

250 mW: FM audio (including SSTV)
100 mW: BPSK-1000 beacon
25 mW: CW beacon
125 mW: SDX transponder

This may not seem like much power, but consider the height of the antenna!

The multimode receivers I've discussed will also allow you to receive downlink signals from the SSB/CW SDX transponder. If you want to uplink to the transponder, however, you will need a 70 cm SSB transmitter.

Antennas

When it comes to antennas, a ¼ wave vertical antenna should work well even without a preamp as long as you minimize your coax cable loss by keeping its length less than 25 feet. If a longer cable run is necessary, you might want to move up to the lower loss, LMR-400 solid center conductor coax. A ⅝ wave or larger "gain" vertical will be worse since all the gain is toward the horizon. Because the orbiting satellite will be in a slow, random tumble, the listener will probably experience some fading caused by *spin modulation*.

To minimize this problem, you may want to consider building a simple circularly polarized antenna such as the K5OE "Texas Potato Masher." You'll find instructions on the Web at **victrolla.homeip.net/wo5s/junkpile/432/tpm2.pdf**. Another approach is to purchase and install the 2 meter Eggbeater, model EB144, from M^2 Antenna Systems (**www.m2inc.com**). The popular handheld Arrow beam antennas (**www.arrowantennas.com**) should also work well. Note that the 70 cm versions of all of the antennas I've mentioned here will also allow you to uplink to the SDX transponder. I recommend the 70 cm antenna be separated from the receive antenna by at least 8 feet to avoid crosstalk.

Computers and Software

As I've said, free software for demodulating and decoding the BPSK-1000 via a computer sound card will be made available before ARISSat-1's deployment. You'll also need software to receive and display the SSTV images from ARISSat-1. *MMSSTV* performed well for this purpose during the craft's development. *MMSSTV* can be downloaded free of charge at **mmhamsoft.amateur-radio.ca/pages/mmsstv.php**. Mac users have several options to decode SSTV signals. The Mac SSTV program *Multiscan* is available free at **web.me.com/kd6cji/MacSSTV/MultiScan.html**. Another option is to download *Coca Modem*, which is also a free at **homepage.mac.com/chen/w7ay/cocoaModem/index.html**.

To know when ARISSat-1 passes over your location, you'll need to track it. You'll find tracking software such as *SATPC32* available from AMSAT at **www.amsat.org** (all proceeds from the sales are donated to AMSAT). The AMSAT Web site also hosts a satellite pass prediction program for your convenience (**www.amsat.org/amsat-new/tools/predict/**). Mac users can purchase the *MacDoppler* tracking program at **www.dogparksoftware.com/Macintosh_Amateur_Radio_Pr.html**.

processing rather than analog circuits. Using a linear, inverting SSB/CW transponder in U/V mode (UHF uplink/VHF downlink) sporting a 16 kHz bandwidth, hams will be able to chat with each other whenever the satellite is within range. The uplink window is from 435.742 MHz to 435.758 MHz with a downlink window of 145.922 MHz to 145.938 MHz.

Another exciting aspect of the ARISSat-1 mission is called "Fly a File." The ARISS team has accepted digitized submissions of space and science related images as well as information about various science projects from students worldwide. These have all been loaded onto a memory chip that was attached to the inside of the spacecraft prior to shipment and will now be flown as part of the mission. The submissions will not be accessible from space, but rather, are posted for viewing at the ARISS Europe Web site at **www.ariss-eu.org/arissat-1.htm**.

As you can see, ARISSat-1 is a satellite that offers something for everyone. It will offer various modes of operation for individual hams as well as providing many "hands-on" opportunities for educational applications.

DAVID JORDAN, AA4KN

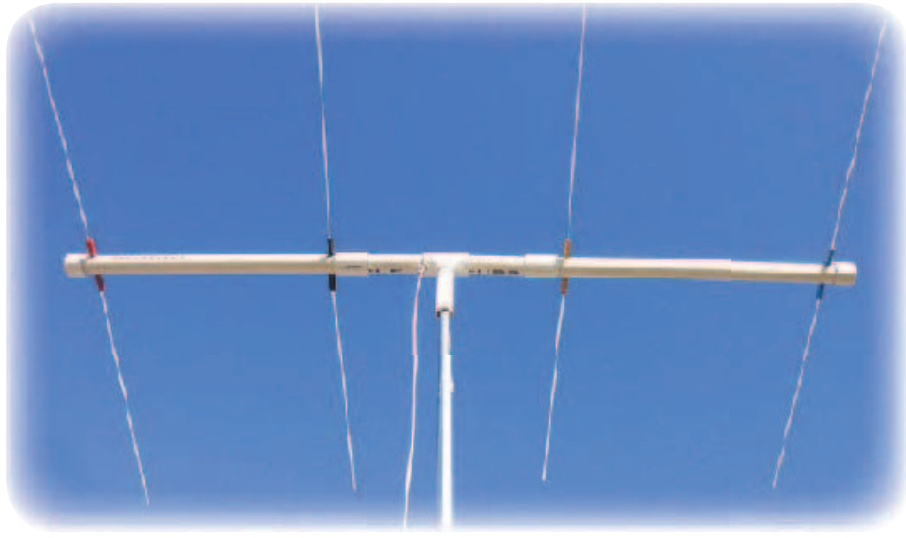
A simple handheld setup like this will be more than sufficient to receive ARISSat-1.

David Jordan, AA4KN, is an Amateur Extra Class operator and has been a licensed ham for 37 years. He attended the University of Central Florida where he earned a BS in Engineering Technology and worked as a design engineer for a local Orlando firm. David spends much of his time promoting Amateur Radio in local schools and is heavily involved in both AMSAT and the ARISS program. Most recently, David served as a member of the ARISSat-1 Project Team playing a role in its development and integration. He also serves as Education Chair for the Lake Monroe Amateur Radio Society (LMARS). You can contact David at 825 Hickory Hill Ct, Orlando, FL 32828 or by e-mail at **aa4kn@amsat.org**.

A Portable 2 Meter Yagi

This antenna provides gain and bandwidth and it stows in the corner of your trunk or in a backpack.

Richard F. Gillette, W9PE



I had a flashback as I came upon some various colored banana plugs and jacks at a recent hamfest. In 1998, the ARRL published my "Fox-Hunting DF Twin 'Tenna" article and since then I have received a number of requests for a simple portable 2 meter antenna.[1] When George Holada, K9GLJ, looked at my design he suggested that I use fixed length elements with banana plugs and a PVC boom, and that I store the elements inside the boom when not being used. I added his suggestion as a sidebar to the Twin 'Tenna article, but I have never seen it applied.

I purchased some colored banana plugs and jacks with the idea of building a portable Yagi using boom storage and color coding of the elements to assure their proper placement. Then came the "how to do it." That is the part I would like to share.

Making My Portable Yagi

I found that the pipe had to be at least 1 inch inside diameter to clear the jacks if the elements were not going to be offset. I started to go with offset elements to be able to use a smaller diameter boom. The clearance needed to stow the banana plug tipped elements also required clearance in the order of 1 inch, hence a 1 inch inside diameter schedule 40 PVC pipe was chosen.

The first thing I learned was that soldering to banana jacks inside PVC pipe required the jacks to be close to an open end of the pipe. I can't solder anything way down a small diameter pipe especially in a plastic pipe that can melt! I wrapped solder wick around the jacks. The soldering iron touched the pipe a few times and the joint has a lot of solder, but it is a good, even if not pretty, connection as shown in Figure 1.

Mechanical Design

Having the jacks near the PVC end required that the boom separate near each element to allow for soldering. If the elements are to be stowed in the boom, the separated boom must be long enough to hold them. For a three element Yagi, the part of the boom used to stow the elements would have to be longer than one half of the boom length. That requirement and my desire to have the mast at the center of the antenna boom led me to a four element design.

Plugs and Jacks

The neat idea of color coding the elements started this project. Although I found jacks in 4 colors, I found plugs in only two colors. I also found plugs with no back shell. To solve the missing color problem I painted red jacks yellow and blue. The plugs without back shells could also be painted. By the time I finished the antenna I found that the color coding can be eliminated as each pair of elements is a different length. Just bundle them and press against a flat surface. The longest two mount as reflector, the next as driven, etc. By using non color coded plugs and jacks it will be easier to find low cost parts.

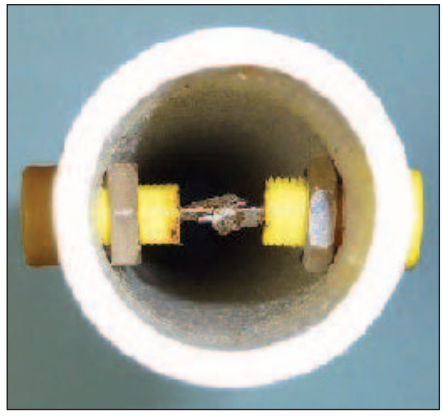


Figure 1 — Banana jacks soldered inside plastic boom.

I also found that banana plugs come in many materials with various spring tension between them and the jacks. All seem to work (add low RF impedance) but those with the high spring tension will hold the elements in their plane best. I suspect that the banana plugs would not be a good choice for elements that were permanent. They work fine for the portable beam as they are a wiping contact upon insertion, assuming there is no visible corrosion. The banana plug with the best spring that I found had no back shell. It has three facets (springs) while the one with a back shell has four. Any banana plug that has a way of mounting the elements can be used, but a number of plugs I found lack this ability as they do not have axial threading, wires connect radially not axially.

Boom to Mast Connection

A PVC T at the center provides for connection to the mast. I used a reducing T allowing the mast PVC pipe to be a short length of 1 inch PVC as ½ inch electrical thin wall fits it well.

I quickly found that the elements would

[1]Notes appear on page 36.

be too heavy for banana jacks and plugs if they were brass or copper. Aluminum ⅛ inch diameter rods were used. I purchased ten 3 foot rods for $2.85 at the local welding supply shop. They are also easy to thread 6/32 so as to screw them into the banana plugs as shown in Figure 2.

Feed Line Connection

To use coax, an unbalanced transmission line, to feed a balanced dipole fed Yagi driven element, a balun is required. I used eight ferrite beads between the driven element and the antenna connector as a common mode choke acting as a current balun.[2,3] The goal of the ferrite choke is to eliminate any RF current from flowing on the outside of the coaxial cable.

How much ferrite is required? A simple view would be a current generator feeding two parallel loads. One load is the 25 Ω of the half dipole, the other is the unknown impedance of the outside of the coax, a function of wire length, frequency and termination. By adding ferrite beads at the antenna we force this load to increase in impedance. If we add more than 250 Ω (10 times the load impedance) to the outside of the coax, the current on the outside of the coax typically will be small. Changes in the coaxial cable's length will have negligible effect on VSWR. I used 8 beads (4½ inches) for about 900 Ω. Both type 61 and 43 ferrite beads 0.25 inch outside diameter and a 0.125 inch inside diameter have about 200 Ω impedance per inch of length at 150 MHz.

I mounted the choke before I remembered to photograph it. A duplicate is shown in Figure 3. The heat shrink tubing at one end is shown before shrinking. The first of the three layers has a hole to allow it to slip over the shield wires and isolate them from the center conductor. By using three layers, the beads are captured at the cable center, and can not slide to the coax ends.

The connector end of the balun feed line is shown in Figure 4. The antenna connector used was a screw in BNC type. Any coax connector you can mount will work, or just pass the coax through a hole in the boom.

Assembly

To drill the holes for the jacks in the boom I set up a drill press vise at 45°. I then added some ¾ inch thick wood scraps to both upward facing vise faces. The vise was clamped to the drill press so that the drill bit came down at the apex of the V. See Figure 5. This ensured that any hole drilled in round PVC placed in the V would pass through the center of the PVC. To be sure that elements were in the same plane, after drilling one through-hole I mounted one jack and added one element. With the PVC in place for the next drilling it was rotated until the element was vertical using a string and a plum bob as reference. Note the elements were not cut to length at this point, so it was easy to see any angular error at the end of a three foot radius.

I was going to pin the boom sections together after assembly, but I found that the PVC pipe was a friction fit and no pinning was required. Just push them together and they will stay. In fact I had to add a little taper to the pipe ends to fully seat them in

Calculation of Element Dimensions

All calculations shown were made on scientific calculator and rounded to two places.

Free space wavelength inches = 300 × 39.37 / F (MHz)
= 11811.02 / 145.7 = 81.06 inches.
Driven element = 0.95 × free space wavelength / 2
= 0.95 × 81.06 / 2 = 38.51.
Reflector = 1.05 × driven element; 1.05 × 38.51 = 40.43 inches.
First director = 95 × driven element; 0.95 × 38.51 = 36.58 inches.
Second director = 94 × driven element; 0.94 × 38.51 = 36.2 inches.
Spacing driven to reflector and first director
= 0.2 wavelength = 0.2 * 81.06 = 16.21 inches.
Spacing first to second director 1.1 × 0.2 wavelength
= 1.1 × 16.21 = 17.83 inches.

Hamspeak

Balun — A *bal*anced-to-*un*balanced transformer. Generally used to couple from a balanced antenna such as a dipole to an unbalanced (with respect to ground) transmission line, such as coaxial cable.

Fox hunt — A competitive Amateur Radio activity in which hams track down a transmitted signal. Usually directive antennas and triangulation are used.

VSWR — Voltage standing wave ratio, often called SWR. 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.

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

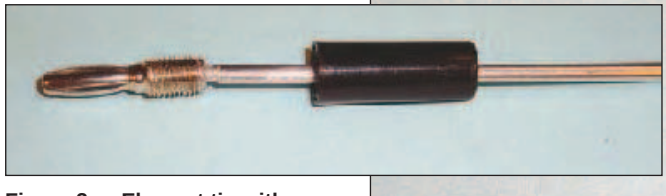


Figure 2 — Element tip with cap unscrewed. The threaded aluminum rod is shown.

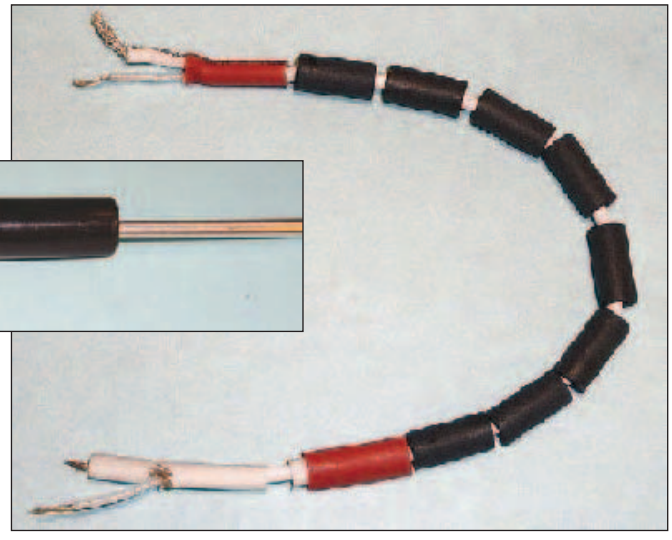


Figure 3 — Ferrite balun used to connect the driven element to the BNC connector.

Figure 4 — Balun as attached to the BNC antenna connector.

Figure 5 — Setup to drill a round boom at its center.

the unions. As the antenna is assembled, it is easy to rotate a section to align the elements. It is also easy to rotate the center T to change polarization from horizontal to vertical.

You can find Yagi dimensions in the *The ARRL Antenna Book* and at many locations on the Internet.[4] I used 145.7 MHz as the design point to be sure that the antenna would have a good match at the low end of the band. This design rules I used were from WN1Z and are shown in the sidebar.[5]

Figures 6 and 7 show how easy it is to pack up the antenna for storage in a back pack or a corner of you vehicle trunk.

Putting It on the Air

If using the antenna in the vertical mode use at least a half wavelength of PVC mast between any metallic support and the antenna to eliminate a conductive mast from messing up the gain, pattern and VSWR. Also run the coax along the boom and well behind the reflector before it is brought down. The coax is a conductor and will interfere with the antenna's gain, pattern and VSWR if it is allowed parallel to and between the elements.

The highest in-band VSWR measured was 1.2:1 at both ends of the band, increasing to 1.3:1 at 143 MHz and 1.5:1 at 149 MHz. Measurements were made with 7 feet of RG-174A/U and an MFJ-249 antenna analyzer with the antenna mounted 10 foot above a flat field. The cable provided about ¾ dB insertion loss, typical of actual use. If you are going to require a longer cable a larger diameter lower loss feed line cable is suggested.

I hope I gave you some ideas and tips on making a very low cost easy to make portable antenna. Also note that the predicted 8 dB antenna gain turns a 5 W handheld transceiver into a 32 W effective isotropic radiated power (EIRP) machine. If this is compared to a short flexible antenna, the range of communication increases significantly.

Notes

[1]R. Gillette, W9PE, "A Fox-Hunting DF Twin 'Tenna," *QST*, Oct 1998, pp 41-44.

[2]Suitable beads are available from a number of sources. For example, see **www.amidon-corp.com/items/44**. Select one with an inside diameter that will fit over your coax.

[3]W. Maxwell, W2DU, *Reflections: Transmission Lines and Antennas*, see **www.w2du.com**.

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

[5]The design rules were taken from the GeoCities Web site of Orrin Winton, WN1Z. Yahoo has since closed this free Web hosting service.

Figure 6 — The antenna elements inserted in the boom section ready to button up for travel.

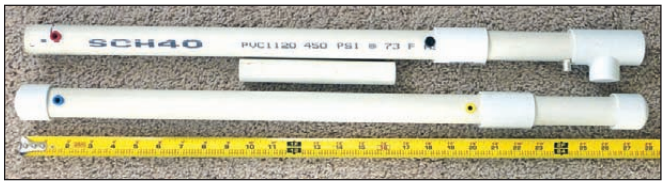


Figure 7 — Antenna ready to go. The elements are secured in the section with the end caps.

Richard Gillette was first licensed as WN9RSU in 1952, during his senior year of high school. This came about as his radio lab instructor at St Rita High School, Rev John Galloway, W9RMS (SK), made obtaining the then new Novice license a graduation requirement. As a new ham he built many radio projects. He credits those home brew projects and Amateur Radio with making him a better engineer.

Richard holds a BSEE degree from the Illinois Institute of Technology and an MBA from Loyola University of Chicago. He is retired from Northrop Grumman and works part time as a consulting engineer. He is active in the IEEE Consultants' Networks (Chicago and Houston) and in helping others to get into Amateur Radio. He has given his Ham Cram *course to over 800 students. The course is available free at* **www.w9pe.us** *as is a Morse code course.*

Richard is a Licensed Professional Engineer, hence he could not resist giving up W9RSU after 43 years and obtaining W9PE when vanity calls became available. You can reach ARRL member Richard Gillette at 131 W Kentwick Pl, The Woodlands, Conroe, TX 77384-5133 or at **rf.gillette@ieee.org**.

New Products

AUDIO PEAKING FILTER FOR THE ELECRAFT K3

♢The Elecraft K3 now provides an APF (audio peaking filter) function for weak signal CW work. K3 users testing the feature have reported that signals buried in noise become solid copy with APF. This is said to be due to the filter's characteristics, which boost the desired signal without emphasizing noise. The filter's center frequency can be fine tuned using the SHIFT control, allowing the operator to focus on selected weak stations without changing the receive VFO frequency. Patterned after classic analog APF circuits, the APF function is implemented in the K3's 32-bit IF DSP and is said to provide virtually ideal passband shaping. It is available in firmware revision 4.17 or later (there is no charge for K3 firmware upgrades). For details, visit **www.elecraft.com**.

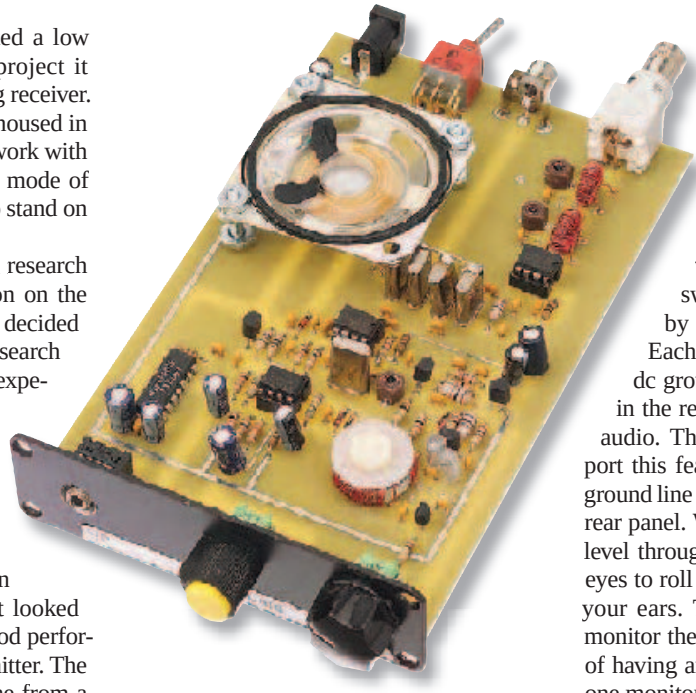
A Compact 40 Meter Receiver

This compact receiver makes a good companion for a low power transmitter.

Lou Burke, W7JI

After I successfully completed a low power (QRP) transmitter project it was time to build a matching receiver. I wanted to build one that could be housed in the same enclosure and that would work with the transmitter in a transceiver-like mode of operation but still have the ability to stand on its own as a separate receiver.

Early in my library and Internet research I was faced with making a decision on the type of receiver I wanted to build. I decided on a superhet, which narrowed the search considerably. I do not have much experience building receivers so I started teaching myself about the design criteria used in the various schematics I reviewed.



The completed PC board. Note the clean layout made possible by the double sided board.

Design Process

The design process was begun by choosing a receiver circuit that looked easy to build and would provide good performance as a companion to my transmitter. The circuit I started with originally came from a Dave Benson transceiver described in a *QST* article, and then was updated slightly in a now out of print book.[1,2] I contacted Dave with some questions about the receiver and found him extremely helpful with information and some suggestions.

In studying the circuit I began to see some areas in which I wanted to make changes. To begin with, I decided to use a double rather than single tuned band-pass filter on the input. Next I thought a little sharper filter would be nice, so I settled on a four rather than two-crystal filter. The product detector and limiter amplifier looked pretty standard so these circuits were used without any modification. Since the audio limiting amplifier uses half of an NE5532, I decided to use the second half of the '5532 as a preamp to the final audio power amplifier stage. Since I had so much success with the stable and drift free VFO circuit in my QRP transmitter, I incorporated the same circuit in the receiver. Using this combination of circuits would create a complete stand-alone receiver that can be used in conjunction with my QRP transmitter in a transceiver-like mode of operation.

The pairing is made possible by the muting, or more accurately, the attenuating of the audio path on transmit prior to the pre-amp by inserting a 4.7 MΩ resistor in series with the audio. I used an FET switch activated at the keying rate by a key line from the transmitter. Each time the transmitter is keyed, a dc ground is applied to the FET switch in the receiver, which then attenuates the audio. The transmitter is designed to support this feature by providing the necessary ground line through an RCA connector on the rear panel. Without the attenuation the audio level through headphones would cause your eyes to roll around and smoke to come from your ears. This feature also allows you to monitor the actual transmitted signal instead of having an audio oscillator used as a sidetone monitor.

I feel compelled to mention that I was at a complete loss when it came to designing the crystal filter. One of my many reference books is *Experimental Methods in RF Design*.[3] This book comes with a CD packed full of some great software. I found I needed some help with how to use the software, so I contacted author, Wes Hayward, W7ZOI. I had many questions about filter design and the software, and this man demonstrated patience beyond anything I expected. Simply saying thank you does not seem adequate.

Readers should know that not only does this final design reflect many hours of my time, but countless hours of others who have traveled these roads before me and made my trip possible. Figure 1 is the first page of the schematic drawing set.

PC Board Layout

With the completed schematic, I could now begin the PC board layout. I used *ExpressPCB* software for all the PC board layouts. The software is easy to learn, easy to use and best of all it's free, although they would like you have them fabricate the boards and that's not free. You can download a copy at **www.expresspcb.com**. The

Hamspeak

FET — Field effect transistor. A transistor in which the current flow is regulated based on an electric field instead of a current, as in the usual bipolar transistor. See www.arrl.org/Hands-On-Radio/ — look for Experiment #12.

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

RCA connector — Inexpensive coaxial connector type often encountered in home audio equipment. Sometimes pressed into service as a low power RF connector.

[1]Notes appear on page 40.

PC board layout is provided on the QST-in-Depth Web site.[4]

After finishing the board layout you simply upload the file to ExpressPCB and in a few days you will receive your professionally manufactured circuit boards with plated through holes and tinned backplane, ready to build. I do not use the manual assist routing built into *ExpressPCB* software. I prefer doing the PC board layout and wiring myself to allow me the opportunity to avoid circuit-caused coupling and layout problems. Of course this preference may be due to my inexperience with more sophisticated software employing auto routers.

I have found through experience that it is much easier to design the circuit board to a specific size that will fit a readymade enclosure rather than to try to fabricate an enclosure for the completed board. With this in mind I used the same board size as my QRP transmitter so the same size enclosure could be used. I also like to design the PC boards so that there is no external wiring necessary after all the parts are mounted. This makes it much easier to work on the boards since there are no wires running all over the workbench to switches, pots and connectors.

In order to keep the cost of manufacturing the PC boards as low as possible, I never get silk-screened parts legends stenciled to the top side of the boards. Instead, I use the hole patterns to determine parts locations. I print a full-page copy of the PC board layout with parts and pads on the drawing. It is simple to establish the proper mounting holes to use for various parts.

I always begin by mounting all the resistors on the board, then mount all the

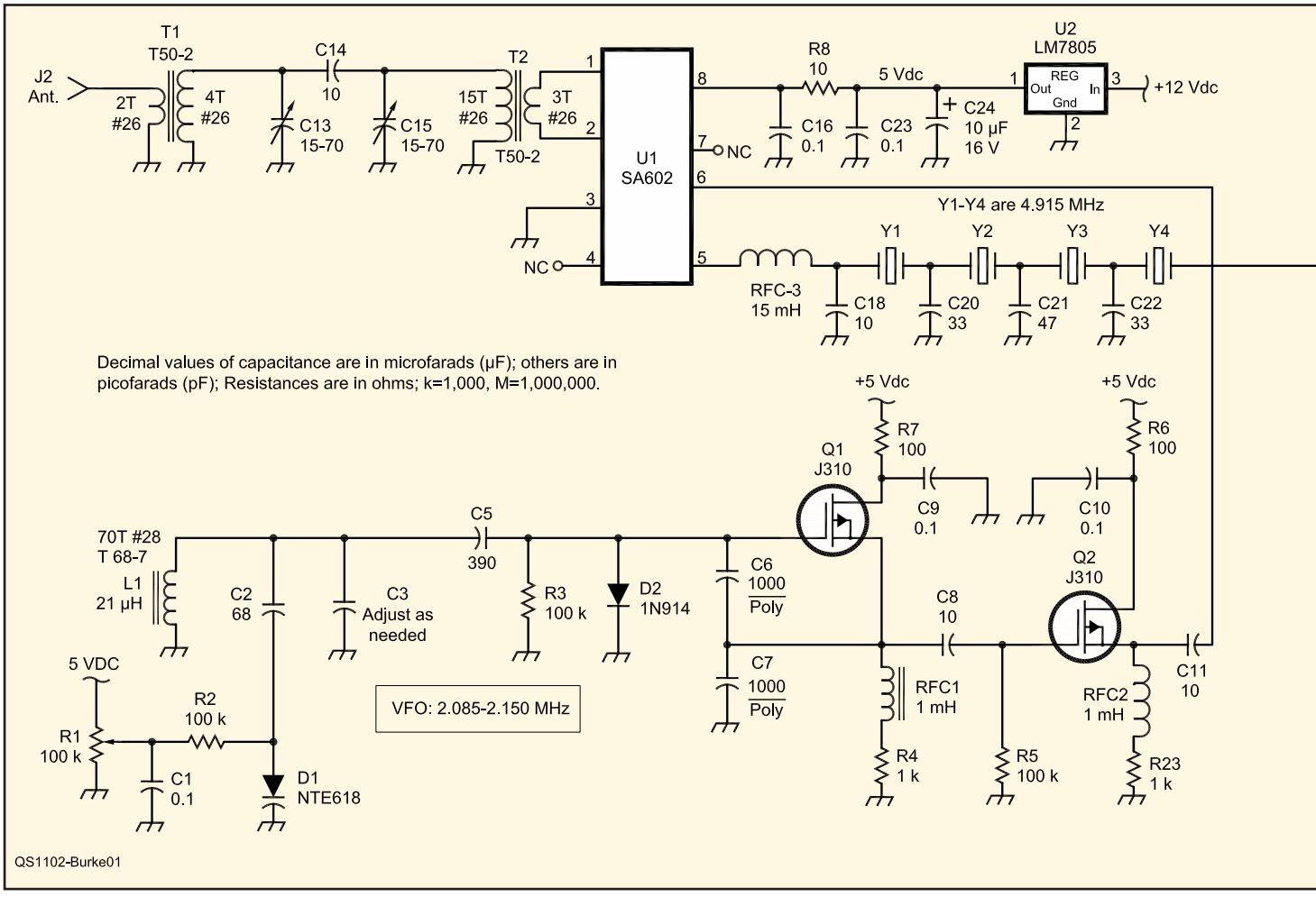


Figure 1 — Schematic diagram of RF and IF stages of receiver with complete parts list. Although parts are available from most dealers, Mouser Electronics (www.mouser.com) part numbers are provided to aid in gathering parts. Missing part numbers were not used in final version. With values shown the IF filter bandwidth is approximately 500 Hz and the tuning range is 7.0 to 7.065 MHz. On the right, schematic diagram of detector and AF stages of receiver.

C1, C9, C10, C16, C23, C26, C32, C36, C38, C41, C43 — 0.1 µF disc ceramic capacitor (80-C320C104 k5RCA7301).
C2 — 68 pF disc ceramic capacitor (80-C315C680J1G).
C5 — 390 pF disc ceramic capacitor (80-C315C391J1G).
C6, C7 — 1000 pF polystyrene capacitor, vertical (23PW102).
C8, C11, C14 — 10 pF disc ceramic capacitor (80-C315C100J1G).
C13, C15, C29 — 15-70 pF variable capacitor (659-G kG70015).
C17, C27, C28 — 47 pF disc ceramic capacitors (80-C315C470J1G).
C18 — 10 pF disc ceramic capacitor (80-C315C10J1G).
C20-C22 — 33 pF disc ceramic capacitor (80-C315C15330J1).
C21 — 47 pF disc ceramic capacitor (80-315C470J1G).
C24, C37 — 10 µF electrolytic capacitor (647-UVR1E100MDD).
C25 — 0.01 µF disc ceramic capacitor (SR151C103 kAR).
C30 — 0.033 µF disc ceramic capacitor (80-C315C333 k5R).
C33, C35 — 150 pF disc ceramic capacitor (80-C315C151J1G).
C34, C39, C42 — 100 µF electrolytic capacitor (647-UVR1E101MED).
C44 — 4.7 µF electrolytic capacitor (647-UVR1E470MDD).
D1 — Tuning diode, 20-430 pF (526-NTE618).
D2-D5 — 1N4148 diode (621-1N4148T).
J1 — Headphone jack (161-MJ2735-3-E).
J2 — BNC connector, RA-PCB (571-522716101).
L1 — VFO inductor 70 turns #28 AWG — Palomar Engineers — T68-7 (www.palomar-engineers.com/Iron_Powder/iron_powder.html).

disc ceramic capacitors. After the caps are mounted, the remaining parts are installed.

I usually build equipment one stage at a time then get that stage working before moving onto the next. Doing it this way eliminates a lot of troubleshooting when you power up the finished receiver and nothing works. This receiver can be built with minimal test equipment. The only test equipment I own are a 'scope and a frequency counter. Not having a signal generator makes it difficult to test each stage of a receiver while it's being built, but the simplistic straightforward design of my receiver makes it simple to troubleshoot — either you hear signals or you don't!

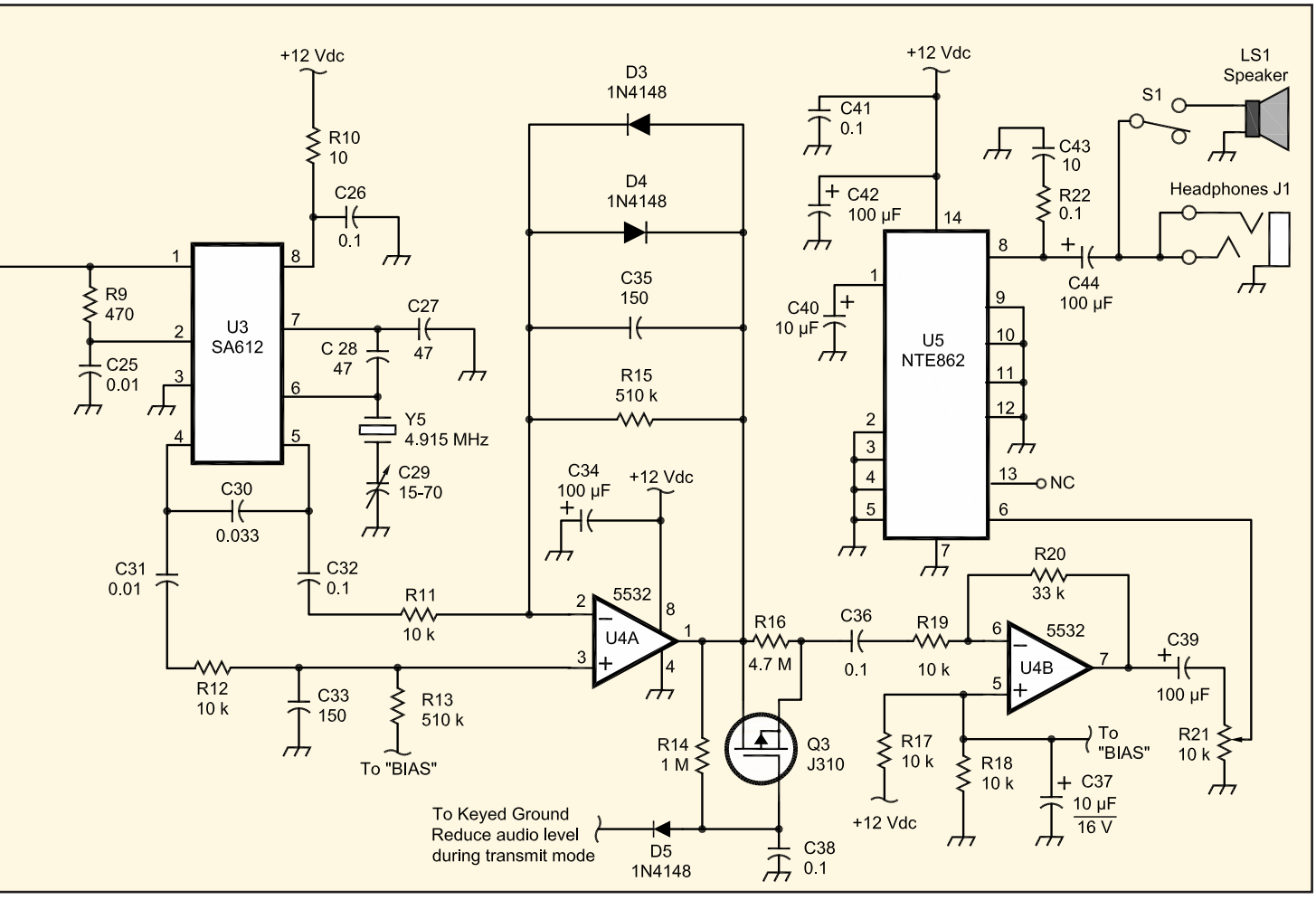
Physical Plant

The enclosure I chose at the beginning of this project provides a nice looking, low profile piece of equipment. To finalize the receiver it's a simple matter of drilling holes in the front and rear panels at the proper locations to fit the connectors and controls. Figures 2 and 3 show the front and rear of my receiver.

Controls on the front panel are, left to right, HEADPHONE jack, VOLUME control and TUNING. On the rear panel, left to right are ANTENNA connector, audio MUTE from transmitter, SPEAKER switch and dc POWER.

Testing and Alignment

Upon completion, apply power and connect a 40 meter antenna. Tune C13 and C16 for a peak in background noise. If you hear background noise chances are that you will be able to tune across the band and hear signals. Once you hear a signal, tune C29 for the tone frequency you find most pleasing



Q1-Q3 — J310 FET (512-J310).
R1 — 100 kΩ, ½ W potentiometer (317-2091F-100k).
R2, R3, R5 — 100 kΩ, ¼ W resistor (660-CF1/4CT52R104J).
R4, R23 — 1 kΩ, ¼ W resistor (660-CF1/4CT52R103J).
R6, R7 — 100 Ω, ¼ W resistor (660-CF1/4CT52R101J).
R8, R10, R22 — 10 Ω, ¼ W resistor (660-CF1/4CT52R100J).
R9 — 470 Ω, ¼ W resistor (660-CF1/4CT52R471J).
R11, R12, R17-R19 — 10 kΩ, ¼ W resistor (660-CF1/4CT52R102J).
R13, R15 — 510 kΩ, ¼ W resistor (660-CF1/4CT52R514J).
R14 — 1 MΩ, ¼ W resistor (660-CF1/4CT52R105J).
R16 — 4.7 MΩ, ¼ W resistor (660-CF1/4CT52R475J).
R20 — 33 kΩ, ¼ W resistor (660-CF1/4CT52R333J).
R21 — 10 kΩ ½ W potentiometer (317-2091F-10 k).
RFC1, RFC2 — 1000 µH choke (434-23-102).
RFC3 — 15 µH choke (434-23-150).
S1 — Push button switch (107-3025-EVX).
T1, T2 — Primary 4 turns. secondary, 15 turns #26 enameled wire on T50-2 or Palomar Engineers T37-2 toroid core.
U1, U3 — SA612 mixer/oscillator IC (771-SA612AN/01).
U2 — 5 V dc regulator IC (512-LM78L05).
U4 — NE5532 dual low noise amplifier IC (863-NE5532ANG).
U5 — NTE862 power amplifier IC (526-NTE862).
Y1-Y5 — 4.915 MHz crystal (695-HC49US-5-U).
Socket, 8 pin DIP (571-26404634).
Washer for BNC connector (571-13296322).
Jam nut for BNC connector (571-13296312).
Enclosure (546-1455L1601BK).
Speaker, 8 Ω (Mouser 665-AS05008MSR).

Figure 2 — Front view of receiver. Note the clean control layout.

Figure 3 — Rear view of receiver. See text regarding use of the MUTE jack.

and easy to copy. That's it — you're ready to begin using your new receiver.

On the Air

If you're going to use this receiver with a transmitter that does not provide a ground during the transmit mode, please manually turn down the audio level prior to transmitting. Failure to do so will present a bone chilling blast through your headset that you won't soon forget. A future article will provide the details of my transmitter, which provides the required ground.

I really enjoy using my QRP twins and hope you enjoy the project as much as I have. There's nothing like the feeling you get from making a contact with a rig that you built yourself.

Notes

[1]D. Benson, NN1G (now K1SWL), "A Single-Board Superhet QRP Transceiver for 40 or 30 Meters," *QST*, Nov 1994, pp 37-41.

[2]*QRP Power,* M. Lee, KB6FPW and D. Monticelli, AE6C, "Revisiting the 40-40," pp 3-6 to 3-25. Newington, CT. ARRL, 1996. Out of print but available at **www.amazon.com**.

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

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

Amateur Extra class operator Lou Burke, W7JI, was first licensed as a Novice in 1954 as WN8QJH and later as a General class operator as W8QJH, in Hamilton, Ohio. An intense interest in ham radio and electronics led to a career spanning 42 years as a broadcast engineer in Phoenix, Arizona. Now retired, Lou is an ARRL member and is very active in ham radio. He recently became interested in CW contesting. His son Randy is licensed as KE7AZM and lives in Phoenix. You can reach Lou at 30163 Hillcrest Dr, Arkansas City, KS 67005 or at **w7ji@wildblue.net**.

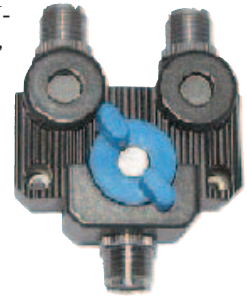
New Products

WEST MOUNTAIN RADIO RIGBLASTER PLUS II SOUND CARD INTERFACE

♢The RIGblaster Plus II sound card interface from West Mountain Radio incorporates several user requested enhancements. The plug-and-play USB port eliminates the need for special USB-to-serial cables and also provides power for the RIGblaster Plus II. Microsoft certified USB drivers are provided. Pre-wired microphone jumper blocks called Instant Setup Connectors (ISCs) let users match different transceiver wiring schemes. Six ISCs are provided to cover the most popular radios. The rig control interface may be used with any CAT or CI-V controlled radio that requires an RS-232 to TTL level converter, including most ICOM, Ten-Tec (CI-V) and smaller or older Yaesu (CAT) radios. Price: $159 including microphone and USB cables, audio cables and a CD with free sound card software. For more details, visit your favorite dealer or **www.westmountainradio.com**.

MFJ RHINO COAX SWITCHES

♢MFJ Rhino 2, 3 and 4 position antenna switches are available with a variety of connectors. They have gold plated flanges and connector contacts designed to provide low SWR and low insertion loss, and isolation is rated up to 70 dB. These switches are built in a diecast case and rated to handle up to 2 kW at dc up to 3 GHz depending on model. MFJ-2702, $32.95, 1 GHz, 2 positions, SO-239 connectors. MFJ-2702N, $42.95, 3 GHz, 2 positions, N-type connectors. MFJ-2703, $64.95, 800 MHz, 3 positions, SO-239 connectors. MFJ-2703N, $74.95, 1.5 GHz, 3 positions, N-type connectors. MFJ-2704, $89.95, 900 MHz, 4 positions, SO-239 connectors. MFJ-2704N, $99.95, 1.5 GHz, 4 positions, N-type connectors. MFJ-2704M2, $99.95, 900 MHz, 4 positions, Inputs are SO-239 connectors, outputs are two of each: SO-239 and N-type connectors. MFJ-2704N2, $99.95, 1.5 GHz, 4 positions, Inputs are N-type connectors, outputs are two of each: SO-239 and N-type connectors. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.



ENGRAVED CALL SIGN PLAQUES FROM JIM'S ENGRAVING

♢Jim's Engraving offers etched and lighted glass call sign plaques that can include your name, call sign and ARRL diamond or other logo. These plaques are available in a variety of sizes and styles. Bases can be made from hand finished oak, walnut, mahogany or cherry. Prices start at $85. For more information, or to order, visit **www.jimsengraving.com**.

Building a Modern Signal Tracer

Add this versatile tool to your test bench and hear what you've been missing.

Curt Terwilliger, W6XJ

A few years ago I was developing a speech compressor/clipper, and needed to test its audio quality. That's when I realized that something was missing from my workbench. If you want to measure voltage or current, a multimeter works fine. If you have a scope, you can see waveforms displayed graphically. But if you want to make a subjective measurement — such as audio quality — those tools aren't enough.

I wanted to know how my speech processor output sounded, not how it looked. Did it have hum on the output? Did it make the microphone sound tinny or add too much distortion? Meters and a scope weren't very helpful — I needed an easy way to make signals audible. In short, I needed a *signal tracer*.

Signal Tracing

A signal tracer is basically an audio amplifier and speaker, with a very high, but adjustable, gain. The name comes from its original application — tracking a test signal from one stage to the next in a defective receiver. With its high gain and the help of a "detector probe," the signal tracer could hear even some radio frequency signals at the first stage of a receiver. By tracing from stage to stage until the signals vanished, you could quickly determine where the problem lay.

In days gone by, signal tracers were popular kits available from Heath, Knight, Eico and the like.[1] While not quite boat anchors, they were nevertheless heavy, bulky and power hungry by today's standards. They also offered some features that are not useful today — such as the ability to apply 100 V or more to a suspect circuit. In the old days, that might have been a good way to check for noisy parts or solder joints. With modern solid state rigs, though, that is just a good way to generate smoke. So rather than pick up an old signal tracer at a hamfest or auction site, I decided to build a modern version. Table 1 gives a summary of goals for my design.

Design Overview

The core of my design is a low noise amplification block with switchable gain of 1, 10, 100 or 1000. In front of this is a selectable 40 dB attenuator, to prevent overloading on large input signals. In addition, there needs to be a selectable detector to allow tracing RF and IF signals in a receiver. Following the amplification block is a VOLUME control, and a 1 W power amplifier driving a small speaker.

Older instruments usually had just one input connector. I didn't find this convenient if I wanted to switch from, say, a test probe with a BNC connector to a shielded cable with an RCA plug. No one likes to be hunting for adapter plugs all the time. So my design has a BNC jack that accepts a 'scope probe, a phono jack that accepts an ordinary audio cable and a mini phone jack that accepts a stereo plug from a computer sound card or other source. Oh yes, there's also a second BNC jack on the rear panel. More on that shortly.

For convenience, there are also two output connections for headphones — accepting either ⅛ or ¼ inch plugs. So no adapter plugs are needed here, either.

Table 1

Design Goals

- Amplification range to 4000 times
- High input impedance (1 MΩ)
- Full audio bandwidth response
- Low internal noise and distortion
- Built-in RF detector
- Versatile input selection
- Speaker or headphone output

Input Section

As you can see in Figure 1, the front panel inputs are wired in parallel. The mini phone jack is wired to accept stereo signals — the two channels are mixed with a resistor network. If you insert a mono plug, the signal will make it through, but its amplitude will be cut in half.

A blocking capacitor, C3, keeps dc away from the active circuits. But you shouldn't trace circuits where more than 150 V is present.

I mentioned that there is a second BNC input on the rear panel. This goes to the "vertical amplification output" of my oscilloscope. If this BNC input is selected, I can

Hamspeak

BNC — RF coaxial connector with good performance through the UHF region. It is of a size convenient to smaller coax cables such as RG-58, 59 or 8X and features a twist lock bayonet attached back shell.

CTCSS — Abbreviation for continuous tone-controlled squelch system, a series of subaudible tones that some repeaters use to restrict access.

Dead bug — Term for an electronic circuit construction technique in which components are placed on a circuit board with their leads up and then wired with point-to-point wiring. The name comes from the appearance of multilead integrated circuits, which look reminiscent of expired insects with their legs up.

Operational Amplifier (op-amp) — Integrated circuit that contains a symmetrical circuit of transistors and resistors with highly improved characteristics over other forms of analog amplifiers.

Wall wart — Small power supply unit for low power equipment with integral plug for standard ac wall socket. Colloquially named due to its appearance as a protrusion from a wall socket.

[1]Notes appear on page 44.

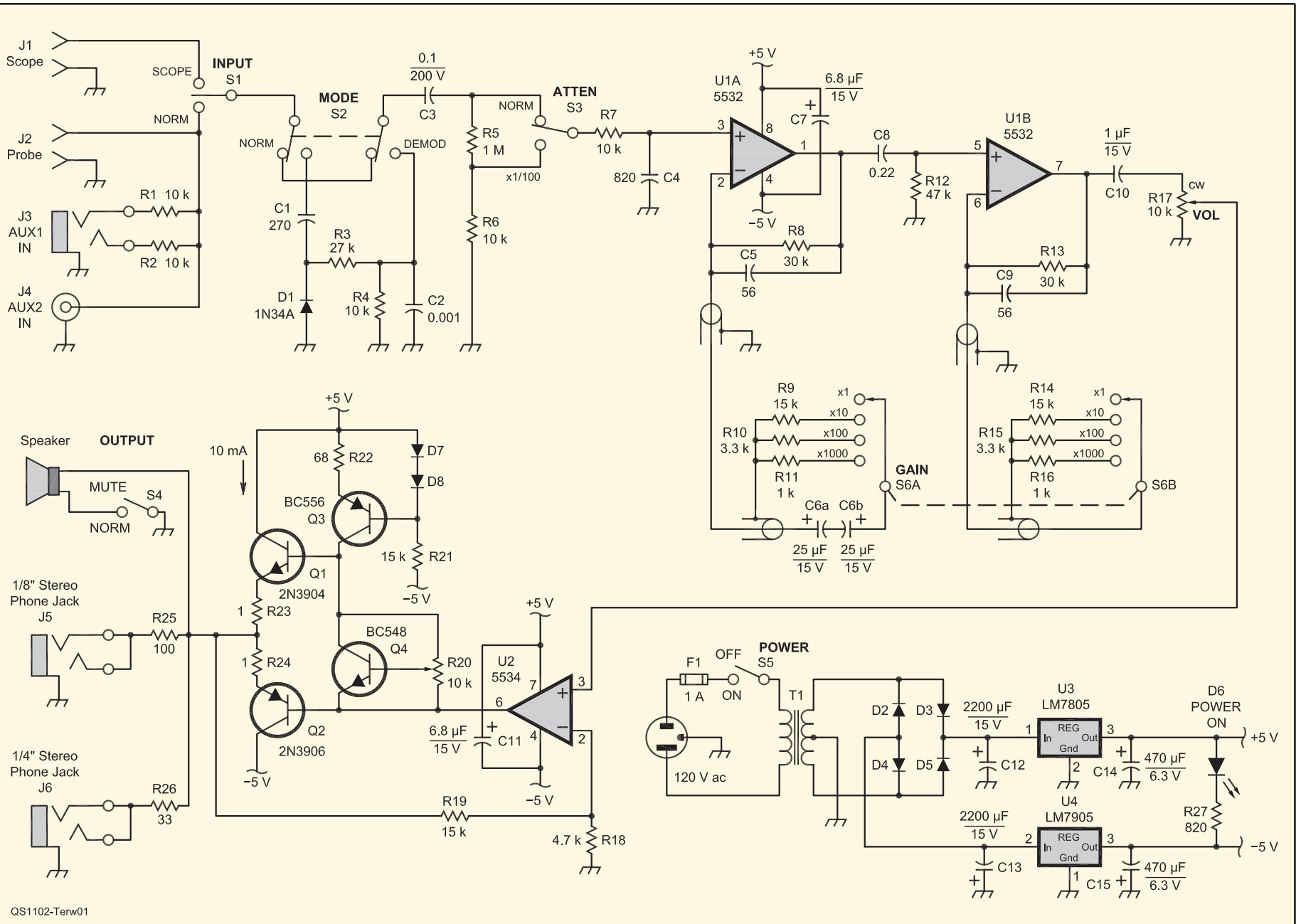

J1
Scope
SCOPE
INPUT
S1
NORM
J2
Probe
R1 10 k
J3
AUX1
IN
R2 10 k
J4
AUX2
IN
MODE
S2
NORM
DEMOD
0.1
200 V
C3
C1
270
R3
27 k
D1
1N34A
R4
10 k
C2
0.001
NORM
R5
1 M
x1/100
R6
10 k
ATTEN
S3
R7
10 k
820
C4
+5 V
U1A
5532
6.8 µF
15 V
C7
−5 V
C8
0.22
R12
47 k
U1B
5532
1 µF
15 V
C10
R17
10 k
CW
VOL
R8
30 k
C5
56
R13
30 k
C9
56
R9
15 k
R10
3.3 k
R11
1 k
x1
x10
x100
x1000
GAIN
S6A
C6a
C6b
25 µF
15 V
25 µF
15 V
R14
15 k
R15
3.3 k
R16
1 k
S6B
Speaker
OUTPUT
MUTE
S4
NORM
10 mA
+5 V
68
R22
D7
D8
BC556
Q3
Q1
2N3904
15 k
R21
−5 V
1/8" Stereo
Phone Jack
J5
R25
100
R23
R24
BC548
Q4
R20
10 k
Q2
2N3906
U2
5534
6.8 µF
15 V
C11
−5 V
1/4" Stereo
Phone Jack
J6
R26
33
R19
15 k
4.7 k
R18
F1
1 A
OFF
ON
POWER
S5
T1
120 V ac
D2
D3
D4
D5
2200 µF
15 V
C12
U3
LM7805
REG
In
Out
Gnd
470 µF
6.3 V
C14
D6
POWER
ON
+5 V
R27
820
−5 V
2200 µF
15 V
C13
U4
LM7905
470 µF
6.3 V
C15
QS1102-Terw01

Figure 1—Schematic diagram and parts list for the signal tracer. All capacitors 15 V or greater unless otherwise specified; all resistors ¼ watt, 5%.

C1 — 270 pF ceramic capacitor.
C2 — 0.001 µF ceramic capacitor.
C3 — 0.1 µF, 200 V film capacitor.
C4 — 820 pF ceramic capacitor.
C5, C9 — 56 pF ceramic capacitor.
C6a, C6b — 25 µF electrolytic capacitor.
C7, C11 — 6.8 µF electrolytic capacitor.
C8 — 0.22 µF ceramic capacitor.
C10 — 1 µF film capacitor.
C12, C13 — 2200 µF electrolytic capacitor.
C14, C15 — 470 µF, 6.3 V electrolytic capacitor.
D1 — 1N34A germanium diode (Mouser 833-1N34A-TP).
D2-D5 — 1N4001 (Mouser 512-1N4001).
D6 — LED
D7, D8 — 1N4148A silicon diode (Mouser 512-1N4148).
F1 — 1 A in-line fuse.
J1, J2 — BNC jack.
J3, J5 — ⅛ inch stereo phone jack.
J4 — Phono jack.
J6 — ¼ inch stereo phone jack.
Q1 — 2N3904 transistor (Mouser 863-2N3904G).
Q2 — 2N3906 transistor (Mouser 863-2N3906G).
Q3 — BC556 transistor (Mouser 512-BC556).
Q4 — BC548 transistor (Mouser 512-BC548A).
R1, R2, R4, R6, R7 — 10 kΩ resistor.
R3 — 27 kΩ resistor.
R5 — 1 MΩ resistor.
R8, R13 — 30 kΩ resistor.
R9, R14, R19, R21 — 15 kΩ resistor.
R10, R15 — 3.3 kΩ resistor.
R11, R16 — 1 kΩ resistor.
R12 — 47 kΩ resistor.
R17 — 10 kΩ audio taper potentiometer.
R18 — 4.7 kΩ resistor.
R20 — 10 kΩ linear taper trimpot.
R22 — 68 Ω resistor.
R23, R24 — 1 Ω resistor.
R25 — 100 Ω resistor.
R26 — 33 Ω resistor.
R27 — 820 Ω resistor.
S1, S3 — SPDT toggle switch.
S2 — DPDT toggle switch.
S4, S5 — SPST toggle switch.
S6 — 2 pole, 4 position rotary switch.
SP — Speaker, 8 Ω, 1 W.
T1 — Transformer, 12.6 V, 1 A center tapped.
U1 — 5532 IC (Mouser 512-NE5532N).
U2 — 5534 IC.
U3 — LM7805 IC (Mouser 512-LM7805ACT).
U4 — LM7905 IC (Mouser 512-LM7905CT).

Figure 2 — Signal tracer front panel. The legend was designed using Microsoft *PowerPoint*.

Figure 3 — Signal tracer rear panel. This legend was also prepared on clear film using Microsoft *PowerPoint*.

listen to the waveform that the scope is displaying.[2] It's a convenient way to have the scope probe do double duty providing simultaneous audio and video.

The Detector

The RF detector is a simple rectifier — your basic crystal set. I used the traditional 1N34A germanium diode, but you could substitute a Schottky diode such as the 1N5711, or even a general purpose switching diode like the 1N4148A.[3]

If you plan to use the signal tracer to trace RF signals in a high impedance environment (such as in a vacuum tube set), you might find that this built-in detector loads the circuit too much due to cable capacitance. In that case, you could build an outboard detector, such as the RF probe shown in *The ARRL Handbook* for so many years.[4]

Low Noise Amplifier

The low noise amplifier module is built around the venerable but still hard-to-beat 553X series of low noise operational amplifiers. The variable gain part of the circuit is made from a 5532 dual section op-amp. Each section forms an amplifier with switch-selected gain of 1, 3, 10 or 31. Changing resistors in the feedback loop controls the gain. Since the two sections are in series, and the switches are ganged, the stage gains multiply, giving an overall gain of approximately 1, 10, 100 or 1000.

Limiting the gain of a single stage to 31 or less has several advantages: it makes self-oscillation less likely, it reduces the dc offset at the output and it ensures that the op-amp doesn't run out of steam at high frequencies because high gain takes its toll on the gain-bandwidth product of the chip.

The input has a 1 MΩ resistance. While this makes for a nice high impedance input, it also causes a dc offset problem in the first stage. The input bias current of the op-amp (up to 800 nA) flowing through 1 MΩ creates an offset voltage of several hundred millivolts. Clearly, you don't want to then amplify that by 31, or even 10 — the output will hit the power supply rail. So the first stage uses capacitors, C6a and C6b, to lift the feedback leg above ground and limit the dc gain to 1.

The second stage is ac coupled to the first stage, so it doesn't try to amplify whatever dc offset remains. While we don't have to worry about the second stage output offset hitting the output rail, it can still be significant (nearly 1 V). So its output is ac coupled to the power amplifier to prevent dc from being sent to the speaker.

Both op-amp stages were tamed with 56 pF capacitors between their respective outputs and inverting inputs. These were needed in order to kill a high frequency oscillation that showed up in the prototype when gains of 10 or greater were selected.

The Output Amplifier

The usual choice for a small audio power amplifier would be the LM386 chip. I've never liked them — they sound harsh to my ears. A few years ago I stumbled across the excellent Web site of XQ6FOD, who shares my feelings about the 386.[5] He designed several low power, discrete amps that are great substitutes for the 386. I lifted one of his circuits, and found that it made an outstanding amplifier. It contributes an additional gain of 4, while adding very little noise or distortion, one of my key objectives.

A 5534 single-section op-amp is used to drive a complementary set of output transistors, Q1 and Q2. Those are biased by a V_{BE}

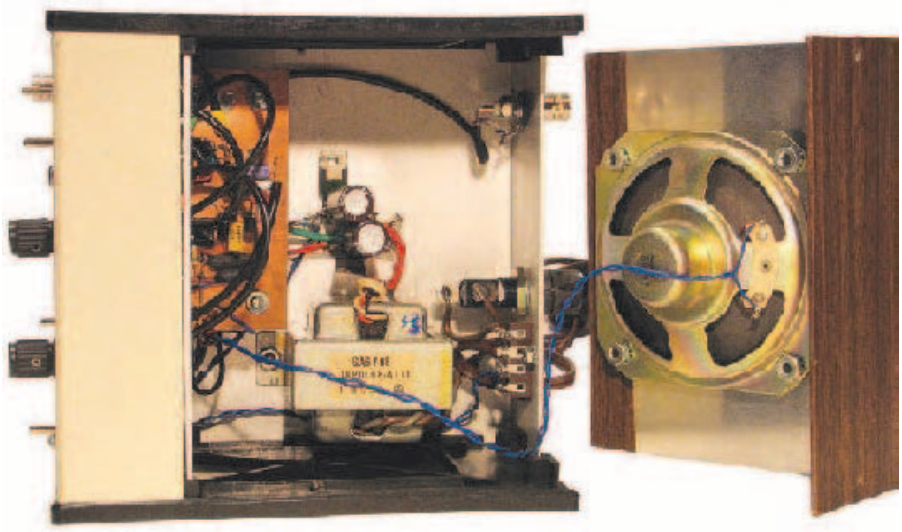


Figure 4 — View of the circuit using dead bug style of construction on a piece of copper clad board. The wiring method is not critical — just avoid ground loops.

(voltage between transistor base and emitter) multiplier, Q4, driven by a current source, Q3. Just set the trimpot for about 10 mA of idle current in the output transistors and you are good to go.

Why go to so much trouble to get high quality audio for this simple signal tracer, you might ask. Well, you want to know for sure that any noise or distortion you hear is due to the signal under examination — not an artifact introduced by the test rig. Otherwise, you couldn't use this signal tracer to work on high quality audio circuits.[6]

Speakers and Headphones

The internal speaker is adequate for many tasks. But it is not big enough to reproduce low frequencies, including power line hum or CTCSS tones. For such tasks, you will want to use high fidelity headphones. I put in jacks for both standard and mini phone plugs. Since all modern phones are wired for stereo, so are the jacks. I adjusted the size of the series resistors so the sound level was about the same whether I used the speaker, a large set of phones on the big jack, or a set of ear buds on the mini jack. A switch disconnects the speaker for headphone-only use.

Power Supply

I decided to use a conventional transformer rather than a wall wart. I don't like the constant current drain of wall warts, so I wanted to be able to switch off power completely. That meant an internal transformer, with fuse and power switch. A shielded power transformer helps prevent magnetically coupled hum. Mine was liberated from an old CD player, but they are widely available from electronics suppliers.

Construction Tips

I built this unit in a Ten-Tec enclosure that had been bouncing around in my junk box for a few years — you can see a few scuff marks in the photos. It has an aluminum half frame, surrounded by plastic end panels. You might want to find a full metal enclosure if you want to minimize RF interference.

The front panel legend (see Figure 2) was designed using Microsoft *PowerPoint*, then printed on a transparent sheet. That sheet was then cut to size, holes punched for the connectors and controls, and it was then glued to the front panel. A similar technique was used for the rear panel (see Figure 3).

Wiring style is not critical. I used the dead bug style of construction on a piece of copper clad board, as shown in Figure 4. Do take care to avoid ground loops. Make sure all the input and output connectors are isolated from the metal panel, then connect their ground tabs with separate wires to a central grounding point in the power supply.

Applications

The original use for this signal tracer was analyzing noise and distortion in my speech processor. In another project, I used it to listen to white noise generated by various voltage regulators. Did you know that Zener diodes are sometimes noisier than three terminal regulators (unless you bias the Zener heavily)? I had no idea about that until the signal tracer revealed the truth.

I've also used this tracer to find an open connection in my living room audio setup, to test radio headphone outputs and to listen for dial tones while tracing telephone wiring problems.

Some of the classic literature on signal tracing that can be found online offers useful tips.[7] For instance: many amplifiers use an electrolytic bypass capacitor across the emitter (or cathode) bias resistor — and these sometimes dry out and lose capacitance with age. If you suspect that has happened, try listening to the signal at the top of the capacitor. You should hear little or nothing if the bypass cap is doing its job. But if the cap is no good, you'll hear plenty of unwanted signal. Neat trick, eh?

Conclusion

Yogi Berra once said: "You can observe a lot just by watching." To that we might add: "And you can hear a lot just by listening." It's nice to have a set of ears on the test bench. After I finished this project, my only regret was that I hadn't built it long ago.

Notes

[1]See, for example, the old signal tracers pictured at **oak.cats.ohiou.edu/~postr/bapix/SigTrac2.htm**.

[2]The vertical amplification output is also useful when fed to a frequency counter, which then can show the frequency of the waveform under observation. In my shack, I leave a counter and the signal tracer permanently connected to the scope.

[3]J. Smith, K8ZOA, published a nice comparison of diode types used in RF detectors. See **www.cliftonlaboratories.com/diodes_for_rf_probes.htm**.

[4]*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**.

[5]Manfred's article at **ludens.cl/Electron/audioamps/AudioAmps.html** gives a very readable discussion of the issues with the LM386.

[6]For those who think this output amplifier is overkill, a simpler version with about half the parts is provided on **www.arrl.org/qst-in-depth**.

[7]Such as "Principles of Signal Tracing," reproduced from *Radio News*, Nov 1944, available on-line at **www.nostalgiaair.org/references/Articles/post/post01.htm**.

ARRL member and Amateur Extra class operator Curt Terwilliger, W6XJ, has been a homebrewer since he was first licensed at age 13. Among his favorite ham related milestones — receiving a Science Fair prize ribbon in high school for a balanced modulator speech clipper for his Johnson Ranger transmitter — and building a slow scan television receiver for an engineering lab course in college.

Before embarking on a technology career in California's Silicon Valley, Curt wrote an article for QST *on computer control of an ICOM radio. Published in 1981, it ran with the editor's prophetic subheading* "Ready for the computer age in Amateur Radio? It won't be long before many hams tie their computers to their radios. Here is an example of what we all may be doing one of these days." *Curt can be reached at 372 Darrell Rd, Hillsborough, CA 94010, or at* **qstdew6xj@gmail.com**.

Making Better Homebrew Traps from Coax

Improving the mechanical design of coax traps built on a PVC coil form. The benefits: greater bandwidth, lighter weight, lower cost and easier fabrication.

John Portune, W6NBC

In recent years antenna traps made from coaxial cable have become popular for use in homebrew antennas. The traditional coax trap is made from a few turns of coax wound solenoid fashion on a hardware store PVC form to eliminate the coil and capacitor of a discrete component antenna trap. It relies on the natural distributed capacitance and inductance of a short length of coax.

To make this style of trap, all one needs is a length of coax, a PVC pipe form and a little hardware. These are readily available at local electronics or hardware stores. Discrete coils and capacitors are more difficult to find and to make into traps. These factors, as well as the reduced cost, are no doubt the main reasons for the popularity of coax traps.

Figure 1 is a simplified drawing of the traditional homebrew coax trap built on a PVC form. Figure 2 compares it to the version that will be presented in this article, a no-form scramble-wound trap.

Figure 2 — Common PVC form trap compared to the 40 meter version described in this article.

Another Approach

I do not propose in this article to reinvent the wheel. The theory and practice of traps made from coax are well documented in many ham articles.[1,2] Here I merely offer two mechanical improvements to the common PVC form design, along with step-by-step instructions on how to make such a trap.

Both these modifications are applicable to other configurations and bands. The first increases the resultant trapped antenna bandwidth by using higher impedance coax for the traps. The second makes coax traps easier to construct and lower in cost by eliminating the PVC coil form completely. I evolved both methods simply because the familiar configuration has always seemed lacking in these ways.

The magic of a coax trap happens because of a crossover connection at the ends of the coil of coax. We connect the center conductor at one end to the braid of the other. The remaining ends then go to the antenna. See Figure 3.

The reason for the crossover connection is clever. It causes RF in the antenna to traverse the trap twice. On the outside it encounters inductance. On the second pass, on the inside of the coax, it encounters distributed capacitance. These two reactances are in parallel, forming a parallel tuned circuit. They replace the coil and capacitor of a discrete trap.

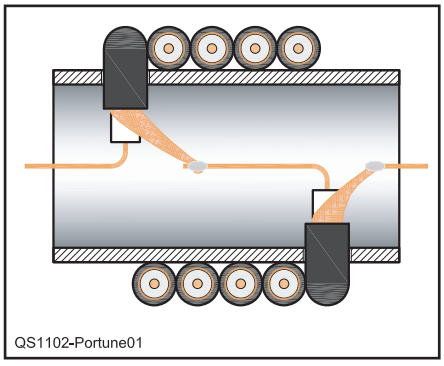


Figure 1 — Traditional configuration of a solenoid wound coax trap.

Trap Bandwidth

As attractive as this style of trap may be for ease of construction and economy, it does have a small drawback — lower Q than discrete LC traps. Many articles point this out. This is why some home builders still prefer separate coils and capacitors, for they do produce higher Q. Here's why. With discrete components one can choose optimum values. We are free to select an LC ratio that will achieve high Q.

In a coax trap we can't. There's just one length of each coax type and coil configuration on a specific frequency that will make a trap. That fixed length unfortunately has too much capacitance and too little inductance to yield the Q of a discrete LC trap. It's just the basic physics of coax traps. Very roughly, the typical discrete LC trap has twice to three times the inductance and only a third to a half the capacitance of a coax trap — a higher LC ratio.

The Downside of Low Q

Low Q is not ideal simply because a trap with a higher Q affords a higher working bandwidth to the antenna. I realize that common wisdom might suggest the opposite. For haven't we always heard: *The higher the Q, the narrower the bandwidth*? Yes, that is true for antennas, but not for traps.

Traps present a high impedance at resonance, which prevents RF from passing through to the ends of the antenna. At the resonant frequency they are efficient. But off resonance, their trapping action rapidly decreases as the overall impedance of the parallel tuned circuit diminishes. In any case though, a higher Q trap will maintain a higher impedance off the resonant frequency than will a low Q trap.

So what do we do about the low Q of a

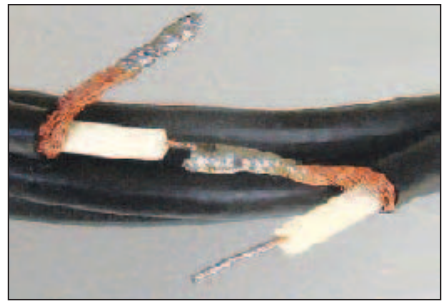


Figure 3 — Coax ends at the crossover connection.

[1]Notes appear on page 48.

Figure 4 — Test traps: RG-62 (left), RG-59 (top) and RG-58 (bottom). Two of each type were used for testing.

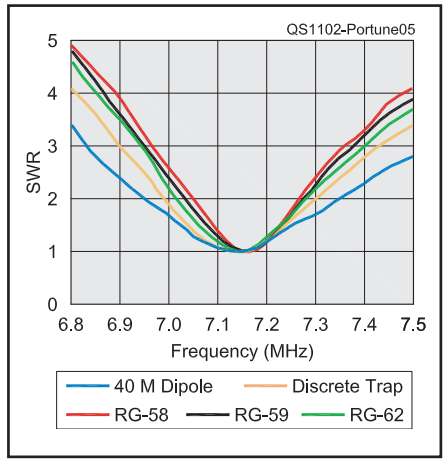


Figure 5 — Bandwidth of 40 and 80 meter trapped dipole with traps made from different impedance coax types, compared to a basic dipole without traps. Also shown is the same dipole with discrete commercial traps.

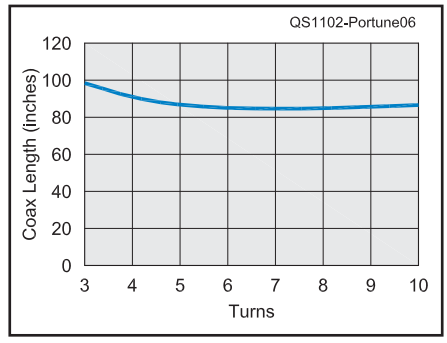


Figure 6 — The number of turns on a trap is almost irrelevant for the fixed length of coax required for the trap.

coax trap? The first improvement of this article is to use coax with less natural distributed capacity, that is, with a higher characteristic impedance (Z_0). 50 Ω coax, such as RG-58, as many articles suggest, is not the optimum choice for coax traps. RG-59, a 75 Ω coax, is better. Still better is RG-62. This not so common coax has a Z_0 of 93 Ω. It was promoted some years ago by IBM for use in their computer networks. While it has generally fallen out of fashion for that use, it is still commonly available. Table 1 compares the important properties of the most common coax types.

Lower capacitance will of course now require more inductance in the trap — a longer piece of coax — to produce resonance. But that's exactly what we want, a higher LC ratio — higher Q — greater operating bandwidth.

To verify how great the benefit is, I made three 40 meter trap sets of the modified design of this article from RG-58, RG-59 and RG-62. See Figure 4. I also tested the antenna with some commercial discrete LC traps I had on hand. I did it one evening as an outdoor club project that everyone enjoyed. Many had never seen home made antenna traps.

I took a reading on each pair in a two band 40-80 meter dipole at a height of 24 feet. All traps had five turns, only the coil diameter was different. I also measured the basic 40 meter dipole without traps. Additionally, I tested the antenna with a pair of commercial discrete LC traps I had on hand as well as a home-brew trap of the common PVC form configuration.

With the traps installed one pair at a time, I plotted the SWR across the 40 meter band using an MFJ-259 antenna analyzer. See Figure 5. The data were normalized to an SWR of 1:1 and a frequency of 7.15 MHz to make the comparisons more evident. The actual traps were very close, though. I fed the antenna through an electrical half wavelength of LMR-400 low loss coax and a choke balun. These precautions essentially eliminated the feed line from the tests.

Here are my conclusions. As I discovered, and you can see, much of the bandwidth of a trapped antenna is not based on trap characteristics but on the antenna itself. Yes, it is evident that a higher impedance coax does improve the bandwidth. It is also clear that a discrete LC trap is a little better. But after my tests it was evident to me that trap bandwidth is really not a major concern. That's why lower Q coax traps perform quite favorably compared to discrete LC traps. And higher impedance coax is still the best idea, though the difference is only modest.

Trap Mechanical Design

Here's the second mechanical improvement of this article. It to me this one is a much more significant improvement. To eliminate calculations while you're making coax traps I recommend a freeware computer program by VE6YP available at **www.qsl.net/ve6yp/index.html**. It quickly computes all the parameters for traps made from common coax. I discovered the improvement while learning to navigate the program. I was surprised to find that one can completely eliminate the need for the PVC coil form.

Once you're familiar with the program, calculate the parameters for several traps on the same frequency using the same coax type. Change only the coil diameter. You will probably be surprised to observe that the length of coax hardly changes for a wide range of diameters, and therefore turns. The effect is evident in Figure 6. The reason is simple. For the fixed length required to make a trap from a given coax and coil configuration, as the diameter goes up the number of turns goes down. It's just simple trigonometry. This made me realize that it is the length of the coax in a trap that primar-

Table 1

Comparison of the Key Characteristics of Common Coaxial Cables

Type	*LMR-400*	*RG-58*	*RG-8*	*RG-59*	*RG-6*	*RG-11*	*RG-62*
Z_0 (Ω)	50	50	50	75	75	75	93
Capacitance (pF/foot)	23.9	28.3	30.8	20.5	18.6	20.6	13.5
Diameter (inches)	0.41	0.19	0.40	0.24	0.27	0.40	0.24

Figure 7 — A no-form coax antenna trap No-form traps have four very real advantages: They are easy to make with a whole number of turns, they are lighter in weight, lower in cost and simpler to fabricate.

ily determines the trap's resonant frequency, not the number of turns or the coil diameter.

So if turns and coil diameter do not matter, why then even bother with a coil form? The PVC form is actually doing nothing but adding weight, cost and construction difficulty. Therefore, the second improvement of this article is to wind coax traps as no-form bundles and secure them with tie wraps. Many will recognize that this is like using a bundle of coax to form a balun. [Note that in the balun case, the form actually improves the bandwidth by reducing the distributed capacitance between the turns. — *Ed.*]

To me these are significant improvements compared to the common PVC form design. Expanding a little, with a rigid coil form you'll often end up needing a fractional number of turns. With a no-form coil you can always achieve a whole number of turns. This is very convenient, for the end connections will now be close together. This permits a much easier crossover connection than on a PVC form trap. See Figure 3.

Second, the savings in weight are substantial. This is desirable with respect to the stress on an antenna. For example, an RG-58 PVC form 40 meter trap on a 2¼ inch form weighs 5 ounces. Its no-form equivalent only weighs 2 ounces with pigtails attached. Similar weight savings exist for RG-59 and RG-62.

Cost reduction isn't as great, but is still significant, in that many builders finish their PVC form traps with stainless steel or brass screws, nuts and washers, plus wire terminals. The add-ons for a no-form trap are only two crimp butt splices, some small tie wraps and two short wire pigtails.

Lastly, fabricating a no-form trap is much easier. Just solder the ends together, form a tight bundle, add some tie wraps and two pigtails, and you're done.

Let's Make a No-Form Trap Antenna

Here is the step-by-step procedure to fabricate RG-62 no-form traps and make a dual band 40 and 80 meter dipole.

Input the coax data from Figure 3 into the trap design program. See Figure 8. For RG-62 do not specify a coax type. Just enter the listed diameter of 0.24 inches and the capacitance of 13.5 pF per foot. If you wish you may add this data to the configuration file of the program for later use.

Cut the specified length of RG-62. The program value will typically be a few inches too long. This is due to the shorter physical length of the no-form trap coil. My initial resonant frequency was roughly 6.8 MHz. This is handy, though, as it permits pruning.

Remove 1 inch of the jacket from both ends of the coax. Separate and twist together the shield strands to expose the center conductor and dielectric. Note the direction that the coax naturally tends to bend and twist both strand sets together outward in the same direction. This makes the crossover connection a little easier.

Remove ⅝ inch of the dielectric to fully expose the center conductor. Form a tightly spaced five turn bundle of the coax. Ignore the number of turns and the diameter of the trap specified by the program. Remember, they are essentially irrelevant. Position the ends of coax to the outside of the bundle as shown in Figure 3.

Solder the center conductor of one end of the coax directly to the braid of the other as shown in Figure 3. Lightly secure the bundle with about four temporary tie wraps. Now, before connecting anything to the trap, measure the resonant frequency. Suspend it with a non-metallic cord at least a foot from any nearby object. Use a dip meter or an MFJ-

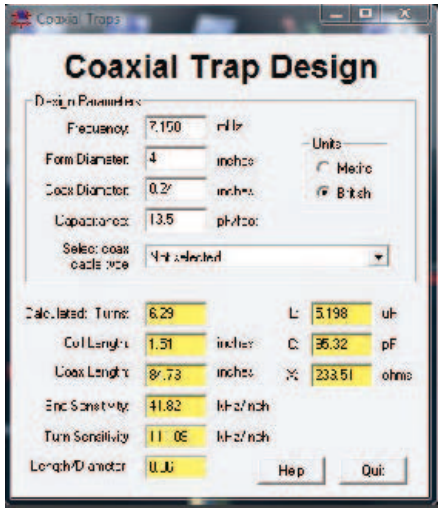


Figure 8 — Sample display of the output of the VE6YP trap design program with data for RG-62 at 7.15 MHz.

Give it a Try

Here is a suggestion for an experiment. The characteristic impedance of coax is a logarithmic function of the ratio of outer to inner conductor diameter and the properties of the dielectric between them. For a given shield diameter, the smaller the inner conductor, the higher the Z_0. See Figure A.

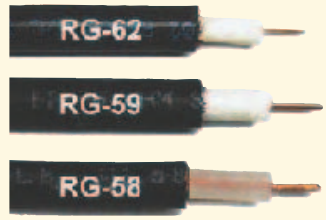


Figure A — Center conductor sizes. Outer diameter is scaled to equal size.

Since the amount of coax needed to make a trap is not large, one could remove the outer jacket and braid from a length of RG-62 and add some additional dielectric, perhaps in the form of flexible plastic tubing. Then replace the outer conductor with the braid from a larger coax type and then the jacket with heat shrink tubing. You'd then likely need to experimentally determine the length required for a trap from this coax, in that you would not now easily know the characteristic impedance. The length of coax will be significantly longer than for unmodified RG-62. The author would appreciate hearing about your experiences.

Hamspeak

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. Some cable types, the outer conductor is covered by a protective insulating jacket.

Resonant frequency — The frequency at which a circuit of a resistor, capacitor and inductor has an impedance that is only resistive. The inductive and capacitive reactances are equal and opposite.

Trap — Parallel resonant circuit used to electrically isolate sections of an antenna to provide resonant operation on more than one frequency range.

259/269 with optional dip coils.

Do not attempt to dip a trap with anything connected to it, or with it installed in an antenna. Once installed in the antenna, make frequency adjustment by changing the antenna wire lengths, not the traps

Progressively now, shorten the coax an inch or two at a time until the trap is resonant at the center of the band (7.15 MHz). One inch equals roughly 100 kHz in this case. Keep the trap bundle secured with temporary tie wraps while dipping.

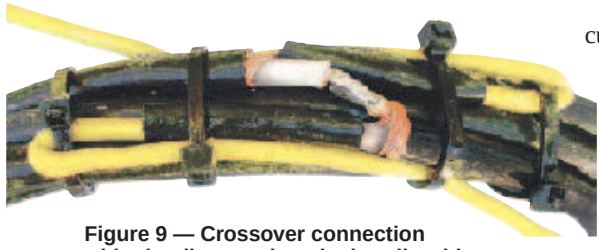


Figure 9 — Crossover connection with pigtails complete the bundle with permanent tie wraps. Remove any temporary tie wraps. Finally, weather proof the trap as described in the text.

Cut two pigtails of single-conductor stranded insulated hook-up wire of the same gauge as the antenna wire roughly 8 to 12 inches in length. Strip ¼ inch from the ends and solder these to the remaining coax ends. Insulate these connections with small pieces of heat-shrink tubing. Now install two tight permanent tie wraps roughly 2 inches from the crossover connection on both sides.

Permanent tie wraps should be the black UV stabilized type, specified for outdoor use. White or colored tie wraps deteriorate quickly in sunlight.

Fold back the pigtails and secure them on the opposite side of the crossover connection with two more tight permanent tie wraps. See Figure 9. This provides strain relief for the traps in the antenna. It is more than adequately strong. Some may wish to add additional strain relief using a short piece of plastic or PVC pipe.

Weatherproofing the Traps.

It is essential to protect the crossover connection from the weather to keep the coax from wicking up moisture and degrading. I coat the entire trap. Clear hardware store RTV 100% silicone sealant is completely satisfactory, though it is messy to apply.

To keep things tidy I employ a trick suggested on an artist's Web Site for making flexible molds. 100% silicone sealant can be thinned to brushing consistency with ordinary paint thinner or turpentine. A 50/50 mix paints on easily. It does take longer to cure if thinned, but it eventually does. Curing time is really not a problem though up on an antenna. Make up only the amount you need; it does not store well.

Inserting Traps Into an Antenna

At first I was perplexed about how to insert no-form traps into an antenna. For a PVC form trap, by using two loops of heavy solid wire, some screws and a couple of crimp type ring terminals, one easily accomplishes this. But it is also easy with no-form traps. Simply use crimp butt splices between the pigtails and the antenna wires. I have had many in service for extended periods with no weatherproofing whatsoever. Or you may coat them with silicone sealant. You can also strain-relief the butt splices by tying a small loop of the antenna wire around them. This isn't necessary, though.

For determining the lengths of your antenna wires, refer to the many published articles on trapped antennas in the ham literature. Again, it has not been the object of this article to reiterate coax trap design and practice, but merely to offer two simple mechanical improvements to their physical design.

However, the basic idea is this. Start by cutting the innermost dipole according to the classical 468/f MHz formula. Add the traps and then also add about 80% of the remaining wire that would have been required for a single band (lower frequency) outer dipole. Because of the resulting inductance of the traps on the lower frequency, the outer dipole will need to be somewhat shorter. Adjust first the length of the highest frequency dipole and then work outward.

Overall, no-form coax traps are easier to make, less expensive and lighter. Also, if made from higher characteristic impedance coax, namely RG-62, coax traps have moderately better bandwidth than other kinds of traps.

Notes

[1]A Buxton, W8NX "Two New Multiband Trap Dipoles," *QST,* Aug 1994, pp 26-29.
[2]A Buxton, W8NX "An Improved Multiband Trap Dipole Antenna," *QST,* Jul 1996, p 32.

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

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

New Products

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◊ Powerex IMEDION batteries are now available in a variety of sizes: AAA, 800 mAh; AA, 2400 mAh; C, 5000 mAh; D, 9500 mAh; 9 V (8.4 V), 250 mAh and 9 V (9.6 V), 230 mAh. Unlike some rechargeable batteries that lose their charge if stored for long periods, IMEDION batteries are said to retain up to 85% of their charge after one year of storage (at a room temperature of 20°C). The IMEDION batteries are compatible with all Powerex chargers. Prices range from $12.95 for a package of four AAA cells to $37.95 for two D cells. For more information, visit **www.mahaenergy.com**.

COAXIAL CONNECTORS FROM CENTERPIN TECHNOLOGY

◊ Centerpin Technology offers a line of solderless coaxial cable connectors that can be installed with simple hand tools. A variety of connector styles are available including PL-259, BNC, N and TNC for RG-58, RG-8X and RG-8 size cables. For more information, visit **www.centerpin.com**.

Selecting the Best Coax for Your Next Antenna

Once you've decided to use coax, you are just starting to make decisions.

Joel R. Hallas, W1ZR

It seems as if I've spent a lot of ink explaining why low loss, balanced, open wire or window line works better in many applications. Under some conditions, however, coax is the obvious transmission line choice. In this article, we'll introduce the conditions under which coax makes sense and then discuss the available options.

So What's Coax, Anyway?

Coaxial cable consists of a center conductor completely surrounded by insulation and then surrounded again by a shield, usually of wire mesh. The shield is then surrounded by an outer jacket, often of polyethylene or polyvinyl chloride (PVC). Coaxial cable is intended to work between unbalanced terminations in which one side, generally connected to the shield, is at ground potential.

Coax has a number of advantages over other line types. If connected to an unbalanced load (so currents stay inside), the signal exists entirely between the outside surface of the inner conductor and the inner surface of the outer conductor. Thus the coax is not affected by its surroundings and it can be run through conduit, near metal or lossy objects and even coiled (within reason) without any operational problems.

Some special coaxial cables have outer jackets that are rated for direct burial. These can be safely used underground while others should only be used above ground.

Then What's the Problem?

The usual issue with coaxial transmission line is line loss — not all of what you put in one end comes out the other. While this is true of any transmission line, coax has a bit more loss to start with than the other line types. This can result in very high loss if the line is mismatched, as we've discussed previously.[1] If the line is matched, typically with an SWR of 2:1 or less, the loss is usually manageable — see Table 1. As can be seen, the matched loss goes up with frequency and with length, so coax is a great choice for short lengths at lower frequencies. Longer lengths of coax at higher frequencies require a careful assessment.

We tend to get accustomed to not worrying about the occasional decibel — after all, one S-unit on a calibrated receiver equals 6 dB, and that's not too important — or is it? Well a loss of 6 dB means that you are wasting 75% of your power heating up your transmission line. A loss of 3 dB means you are leaving 50% of your power on the table, while even 1 dB means 20% left behind. Whether or not that's important depends on how much more signal you have than you need, your other alternatives and how much they will cost — in both dollars and convenience.

[1] J. Hallas, W1ZR, "Getting on the Air — Selecting Your Transmission Line," *QST*, Jan 2009, pp 71-72.

Table 1

Key Parameters of Common Coaxial Transmission Lines

50 Ω Line Type	*Diameter (inches)*	*Matched Attenuation (dB/100')* 1 MHz	10 MHz	100 MHz	1000 MHz
RG-174	0.174	1.9	3.3	8.4	34
RG-58/223	0.195	0.4	1.4	4.9	21.5
LMR200	0.200	0.3	1.0	3.3	10.7
RG-8X	0.242	0.3	0.9	3.1	11.2
LMR240	0.240	0.2	0.7	2.4	8.1
RG-8/213	0.405	0.2	0.5	1.5	4.8
LMR400	0.400	0.1	0.4	1.3	4.2
CATV hardline	0.5	0.05	0.2	0.8	3.2
75 Ω Line Type	*Diameter (inches)*	*Matched Attenuation (dB/100')* 1 MHz	10 MHz	100 MHz	1000 MHz
RG-59	0.242	0.6	1.1	3.4	12.0
RG-6	0.275	0.2	0.7	1.8	5.9
RG-11/216	0.405	0.2	0.7	2.0	7.1
CATV hardline	0.5	0.1	0.2	0.8	3.2

Differences Between Types

Characteristic Impedance

Table 1 lists the most commonly available types of coax with 50 and 75 Ω characteristic impedance (Z_0). If the line is terminated with a load equal to its characteristic impedance, it is said to be *matched* and the SWR is 1:1. That same impedance will then be at the other end of the line, for any length. Thus, the first selection criterion is usually Z_0. If you have a 50 Ω antenna system and a radio designed to drive a 50 Ω load, then coax with a Z_0 of 50 Ω would be a very good choice to go between them. If you have a high dipole with a feed point closer to 75 Ω, and a 50 Ω radio, the 75 Ω cable may be a better choice — at least in terms of the match while transmitting. It generally doesn't matter too much; both are reasonable choices. There are also lines of other Z_0, including 93 and 35 Ω, but they are not often encountered in amateur circles.

Dielectric Material

The insulating material between inner and outer conductors has significant impact on Z_0, loss and propagation velocity. In the beginning, coax cable almost universally had a polyethylene dielectric, although I've also seen early rigid, air dielectric coax made with copper pipe and occasional ceramic insulating disks — very low loss, but out of reach for most amateurs.

Now we have an additional choice — foamed polyethylene. This has air embedded in the insulating material resulting in properties in between pure plastic and air. It has somewhat less loss than solid dielectric for a given set of dimensions. This is to the good. On the down side — the foam is not quite as physically robust.

Size, Weight and Flexibility

In some applications, these parameters are very important. In general, smaller coax cables are less expensive and the most flexible, but have higher attenuation than larger ones. Larger ones tend to be harder to handle. Very low loss coax tends to be less flexible than other cables of the same size.

If flexibility is important, look for cables with stranded inner conductors — they are available in many types of cable. Some manufacturers, make cables specially designed to be flexible for use around rotators, for example.

Each manufacturer's series includes lower loss types with special part numbers — TW&C's LMR is one and Belden's 9913 is another lower loss version of RG-8. These can be good choices for long fairly straight runs, but they may require special care in connector attachment.

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

A Flexible Audio Limiter Using a Shunt Diode String

Preserve your ears from that very strong unexpected signal with this easy to build limiter.

Tom "HN" Hamblin, VA3HN, VE3TMH, VE3HIE

Anyone who has ever ripped off his earphones in agony when hit by an S9+40 dB CW signal on top of the S5 signal he was copying knows why an audio limiter is a must while using a receiver that does not have good AGC on CW.

Double Trouble

Ear pain is even more likely while using a direct conversion (DC) receiver without a limiter, because the painful interference can be on either the actual operating frequency or (more frequently) be on its audio image frequency. Even more vexing is accidentally blasting your ears by not following the correct steps when spotting your boat anchor transmitter. This flexible limiter will protect your hearing against all of these dangers.

Flexibility

The three levels of limiting provided by the shunt diode string, combined with an output level potentiometer (see Figure 1), allow the use of both high and low impedance headphones or even a small speaker. I have used my limiter with my vintage vacuum tube Eddystone 830/4 and Heath HR-10 receivers, as well as with my more modern DC receivers, a Ten-Tec Century 21 and a Heath HW-8.

Adjusting the Limiter — Easier Done Than Said

Set the limiter output level at ¾ of full rotation. Select the voltage limiting level to be 1.8 V peak over 0. Set the receiver audio gain to ¾ of full. Then tune in a medium strength CW signal. Adjust the receiver RF gain for a comfortable listening level.

Change the voltage limiting level to 0.6 V peak over 0. You should hear a tinny sound on the signal caused by the harmonics generated by the clipping (limiting) action of the first pair of back-to-back silicon rectifiers. Adjust the output level potentiometer to restore the original volume level. Use the RF gain to adjust the clipping level based on how tinny a CW signal sounds when you tune it in. Heavy clipping sounds very tinny. To hear the signal with little or no clipping, change the voltage clipping toggle switch to 1.8 V over zero. Then turn it back to 0.6 V over zero and listen without fear.

Now that you have set the clipping level to match the sensitivity of your headphones, you won't need to ride the receiver RF gain as much as you previously did when tuning around. If you have less sensitive headphones or a small speaker, you may find it more satisfactory to increase the receiver RF gain and to use the 1.2 V limiting level.

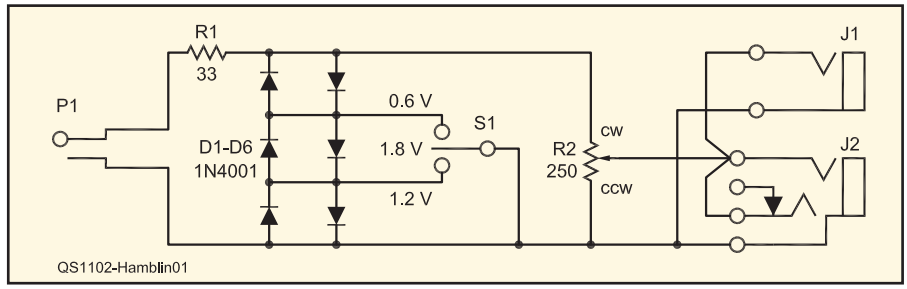


Figure 1 — Schematic diagram and parts list of the simple limiter.
D1-D6 — Silicon power diode, 1N4001 or equivalent.
J1 — Phone jack, ¼ inch mono.
J2 — Phone jack, ⅛ inch stereo.
P1 — Phone plug, ¼ inch mono.
R1 — 33 Ω, 1 W resistor.
R2 — 250 Ω, potentiometer.
S1 — SP3T center off toggle switch.

Put It in a Small Box and Fasten It to the Table

The limiter was installed in a small plastic box (1.125 × 2.125 × 3.25 inches) with the components wired in point-to-point style. After having the box flop around for a while, I drilled one mounting hole in the top of my antique radio and low power desk (VE3TMH) and another in the top of my Ten-Tec desk (VA3HN). A single wood screw fastens the limiter box to the top of either desk between my all caps *mill* (typewriter) and my keys.[1,2] In Figure 2, you can see the limiter box between the edge of the well for my IBM Selectric mill on the left (mill not visible) and my Bunnell double speed key (DSK or sideswiper) plus my Vibroplex Blue Racer Deluxe bug on the right. This location

Hamspeak

Bug — Trade name for semi-automatic telegraph key with horizontal motion of a lever arm. Pushing the arm to the right results in a stream of dots generated by a weight and spring. Dashes are made manually by pushing the arm to the left. Originally developed to relieve muscle stress of wire line telegraph operators in the early 20th century.

Direct conversion receiver — Receiver architecture in which signals are mixed directly to audio. The local oscillator is at the receive frequency and thus there are no intermediate frequency (IF) amplifier stages, just audio amplifier stages. Essentially a "crystal set" with an oscillator for SSB and CW reception.

DSK or sideswiper — Bunnell brought their DSK or sideswiper to market in 1904 as a cure for carpal tunnel syndrome (glass arm) brought on by high speed hand sending. The operator swipes his hand continuously from left to right to left to right, making dots on either side and making dashes on either side as well.

[1]Notes appear on page 51.

Figure 2 — The completed limiter installed on the operating desk.

keeps the headphone cord out of the way while I am copying on the mill.

Most of my headphones have a 600 Ω or higher impedance and plug into the 0.25 inch mono phone jack. Small stereo headphones can be used by plugging them all the way into the 0.125 inch stereo jack. Small mono headphones can be used by inserting their plug only half way into the stereo jack. Note that if the small mono plug is inserted all the way, it will short the limiter audio output. The 33 Ω input resistor combined with the series portion of the 250 Ω potentiometer will protect the receiver output stage from seeing a short circuit. Nevertheless, the small mono plug should not be left fully inserted.

The labels for the switch, the potentiometer and the output jacks were all printed on Avery address labels (#05267). The wording for each label was placed inside an MS *Word* 1 × 1 table that was centered on the label. After a label was trimmed and applied to the box, it was covered with a strip of transparent tape.

Hear Today and Hear Tomorrow As Well

This flexible limiter is a quick and easy project that will pay big dividends by protecting your hearing for your entire CW operating career. I wouldn't listen to my boat anchor receivers or my DC receivers without it.

Notes

[1]T. Hamblin, VA3HN, "Up Front — Nothing Beats Copying CW on an ALL CAPS Mill," *QST*, Jan 2009, p 20.

[2]See the January 8, 2009 ARRL Web site *News and Features* article, Putting It Down at **www.arrl.org/news/**. Type "PUTTING IT DOWN" in the Web site search box.

Thomas M. Hamblin, known by his personal sine HN from his line telegraph days, was first licensed in 1958 as VE6TM. During the summers of 1961 and 1962 he followed the family trade working as an American Morse telegrapher on the Canadian Pacific Railway. HN is the president of the Maple Leaf Chapter of the Morse Telegraph Club and a member of the ARRL. He has B Eng and M Eng degrees in electrical engineering from McGill University and retired in May 2008. HN's sole operating modes are CW and Morse, always preferring to copy on his ALL CAPS mill. Interests include rag chewing and reading the mail, low power operation, operating antique boat anchor radios, FD with VE3QDR, Moxon wire beams and making little modifications to the eight CW rigs on his two operating desks. His current call signs are VE3HIE, VE3TMH, and VA3HN. He can be reached at 9798 Trew Rd, RR 1, Campbellcroft, ON L0A 1B0, Canada or at **ve3hie@arrl.net**.

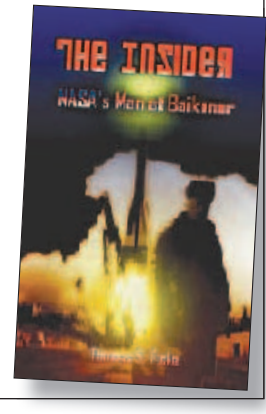
New Products

THE INSIDER BY TOM FISKE, AA6TF

◊Thomas S. Fiske, AA6TF, has just released his tenth book, *The Insider*. Said to be based on real events and required by international politics to hide the real name of his characters, Fiske tells the story of how a radio amateur and his new wife unravel the mystery surrounding the life of a dead friend, Tad Benson, MD. On his deathbed, Benson told the ham (Stokely Towles) about his career in the USSR and the US as a space medicine scientist working for NASA and then ostensibly the National Science Foundation (NSF).

Benson actually worked for two US intelligence agencies. Since conventional wisdom has it that President Kennedy and Premier Khrushchev did *not* agree to swap information on space medicine, many "experts" were caught flat-footed by the revelation that they did. Also both the Russian and the American governments will not admit to this day that such an agreement took place. Stoke, and his wife, Ari, spent several months seeking information under the Freedom of Information Act to get actual dates and methods that were used to keep the entire operation secret from Congress and the American people — and especially from the Russian people.

A shroud of secrecy still hangs over the project in several countries even though Stoke and Ari found sources in the US and the former USSR that supported Tad's story. Published by Star Publish LLC, *The Insider* is 285 pages in length. For more information on this or other books by the author, visit **www.fiskefamily.com**.



A Farmer-Rancher's 2 kW HF Dummy Load

You don't need to exceed the legal limit to want a dummy load that doesn't spew oil at high power.

Robert J. Zavrel Jr, W7SX

This article describes a quick and easy solution for construction of a 2 kW HF dummy load. I have completed and am constantly modifying and experimenting with a new homebrew full power 160-10 meter amplifier using the Soviet era Russian GS35b tube. I am experimenting with some novel approaches to using this fascinating triode. For this project I needed a reliable high power dummy load. Even surplus 2 kW dummy loads can be more expensive than the parts cost of the amplifier.

I had an old 1 kW dummy load using the traditional 1 gallon paint can and a single 50 Ω noninductive carbon resistor immersed in transformer oil. As usual, I pushed the equipment to the limit. First, the shack was filled with the fumes of burning transformer oil. After letting the load cool down, the next set of tests destroyed the resistor. Amplifier development came to an abrupt halt.

I managed to borrow a very heavy duty dummy load from a good friend, Richard Ewing, KO7N, but I needed my own reliable dummy load that would not burn up after a minute of full power operation. I decided to build my own rather than wait for a surplus bargain that might take a few years.

The Long Term Solution

Three critical component problems needed to be solved: load resistors, oil and the container.

Load Resistors

MGS Systems sells noninductive carborundum resistors for $20 each plus a few dollars more for the clip-mounts.[1] I decided to buy four 50 Ω resistors and wire them in a series-parallel arrangement to yield a 50 Ω load using four of their 90 W resistors as shown in Figure 1. The power dissipation is rated in still air, so immersing them in oil greatly improves the power capability.

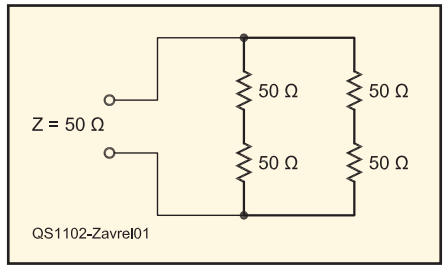


Figure 1 — Four 50 Ω carborundum resistors connected in series-parallel to yield a 50 Ω load.

Figure 2 — The label says it all. This brand is offered by Equine America, www.absorbine.com.

Figure 3 — The 2 gallon fount shown next to a traditional 1 gallon paint can dummy load. Little Giant double walled fount, Miller Mfg Co, Model 9832, www.hotshotproducts.com.

I then began to research the other two critical issues: oil and the container. Both came from an unlikely source for Amateur Radio supplies — my local farm and ranch supplier.

Oil

After spending about 30 hours researching oils used for transformers and dummy loads, I reached a few conclusions. Although I make no claim for expertise on this subject, I offer my conclusions. There is a great deal of work being done on new oils. Long gone are the days of PCBs in transformer oil. Many suppliers to electric utilities are now offering vegetable oil as a "green" alternative to petrochemical based oils. The main advantage of vegetable oils is that they are biodegradable and, since edible, inherently nontoxic. This advantage, however, is also their main disadvantage. You don't want your oil biodegrading (rotting) inside your transformer or dummy load. So you might think twice about simply using rape, olive, soy or flaxseed oil in your dummy load.

I then returned to petrochemical based oils as the best solution, at least for the near term. You can purchase mineral oil at your local drug store in 1 pint containers. This is neither cost effective nor convenient if you need 2 gallons or more. Many online sources offer 55 gallon drums. It took some work to find an intermediate alternative. Mineral oil is also used for horse care. I really don't want to know how it's used, but the horse pictured on the bottle (see Figure 2) seems quite fit. It is offered in 1 gallon plastic containers for about $10 and available at many farm and ranch supply distributors.

There are many forms of mineral oil. The two usual variables are viscosity and additives. If you have a choice, choose the lowest viscosity possible (usually 70). Lower

[1]Carborundum type 886 SP 500K, CESIWID, Inc. model 886 SP 500J, or equivalent, 50 Ω, noninductive resistors, 10% tolerance. From Max Gain Systems, see **www.mgs4u.com/RF-Microwave/dummy-loads.htm**: "We believe these to be rated at 90 W continuous dissipation in still air. Much higher if immersed in oil or cooled with blown air."

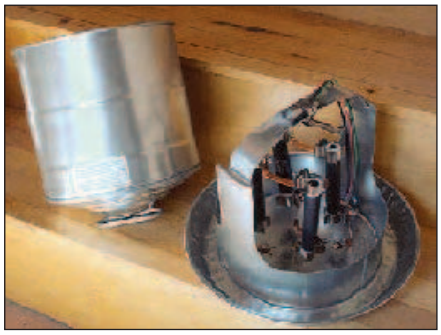


Figure 4 — The dummy load is constructed from the two parts of the fount. The inner container's side walls are cut away with a saber saw permitting oil to freely contact the outer (left) container but leaving two strips and the handle. The entire unit is then turned upside-down. The 2 gallon water container (left) is filled with oil, and the right half is now the lid, complete with the resistors, clamps and UHF female coaxial connector.

Figure 5 — The completed dummy load. Since what is now the bottom of the oil reservoir is a convex shape, a coffee can is used as a temporary pedestal mount. Two holes drilled into the top, as well as the grommet for the three temperature sensor leads, permit air to escape when placing the top on the oil reservoir bottom. For a more stable arrangement, a bucket is less precarious.

viscosity provides for better heat dissipation from immersed resistors, since the lower viscosity oil circulates more freely. A frequent additive is Vitamin E, used as a biodegrading retardant, since mineral oil will degrade over time, although much more slowly than vegetable oil.

Container

The most common inexpensive 1 kW dummy loads for amateur use are built into 1 gallon paint cans and use a single noninductive 50 Ω resistor. They actually can dissipate 1 kW, but not for long. Most manufacturers provide derating graphs indicating 1 kW can be dissipated for a few seconds, then you have to let the load cool down.

After some crude calculations, I decided four resistors instead of one and 2 gallons of oil instead of 1 would offer far better dissipation and perhaps provide minutes of safe dissipation at 2 kW.

The obvious first question was, are 2 gallon paint cans available? The answer is yes, but they are plastic, an unacceptable material. The next size for metal cans is 5 gallons — way too big. I investigated trash cans, food containers and other options, including sheet metal fabrication. Then I found the fount pictured in Figure 3, used as a water fountain for poultry.

This container costs about $25 retail, holds 2 gallons and is made of tin. The tin construction makes soldering easy, so copper or brass strips used to connect the resistor clamps can be soldered directly to the tin container for grounding. Even the UHF connector soldered rather than fastened with screws to the lid. Figures 4 and 5 show how it all goes together.

Results

The dissipation capability far exceeds the 1 gallon dummy load for a bit more cost and some extra work. The cost is, however, far less than that for a professional dummy load. I took no special effort to calculate and build metal runners for impedance matching inside the load, since I only intend to use this load for HF. The maximum VSWR, not surprisingly, is highest at 28 MHz, 1.3:1. Up to 10 MHz, the VSWR is 1:1. Even at 6 meters, the VSWR is only 1.6:1. If more care were taken with internal layout, I believe this basic design could work well into the VHF and even UHF regions.

Temperature Sensor

As an added feature, I added a temperature sensor. The PVS temperature sensor is very easy to use. A +12 V supply is needed for power. The temperature at the sensor is read as a voltage between the signal and ground leads. The voltage varies linearly with respect to temperature. For example, if the sensor temperature is 125°, the voltage is 1.25 V, or 10 mV/°. Therefore, you need only the sensor, a dc power source (5-20 V) and a digital or analog voltmeter to monitor temperature. They are available in either Fahrenheit or Celsius. See **pvsoregon.com**.

ARRL Life Member, Technical Advisor and Amateur Extra class licensee Bob Zavrel, W7SX, has been licensed since 1966. His primary interest in Amateur Radio is low band DXing and designing and building antennas, tuners and amplifiers. Bob holds 5BDXCC, 5BWAZ (200), has 334 mixed, 324 CW, 110 on 160 m, 210 on 80 m and 299 entities confirmed on 40 meters. Previous call signs include WN9RAT, WA9RAT, WA9RAT/HR2 and SV1/W7SX.

Bob has a BS in Physics from the University of Oregon and has worked in RF engineering for 30 years. He has five patents, and has published over 50 papers in professional and amateur publications, including the first block diagram of an SDR receiver in 1987. He was involved with the first generation of RF integrated circuits for cellular phones, and worked extensively with DDS, WLAN and passive mixer development. Bob currently works as an independent RF engineering consultant. You can reach Bob at PO Box 91, Elmira, OR 97437 or at **w7sx@live.com**.

Hamspeak

Dummy load — Sometimes called dummy antenna. Device designed to accept and dissipate the power, usually as heat, from a transmitter without radiating it. Generally used for transmitter testing to avoid interfering with other spectrum users.

HF — High frequency. That portion of the radio spectrum between 3 and 30 MHz. Often called short waves, these frequencies are characterized by long range propagation via ionospheric refraction.

UHF (ultra high frequencies) — Radio frequencies from 300 to 3000 MHz.

VHF (very high frequency) — Radio frequencies from 30 to 300 MHz.

VSWR — Voltage standing wave ratio, often called SWR. 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.

Strays

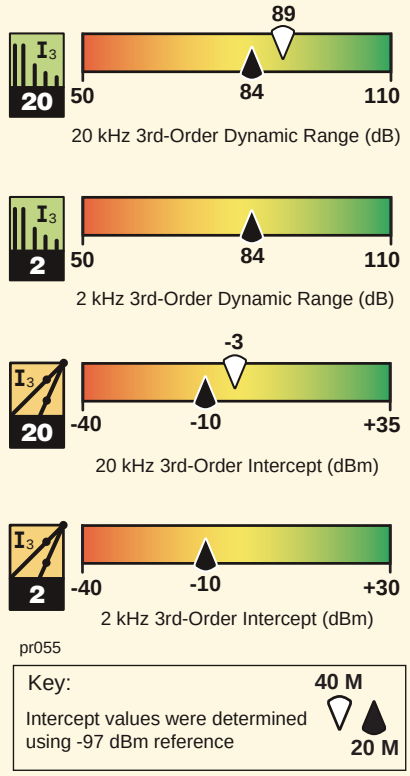
QST congratulates…

◊Haney Howell, K2XN, an ARRL member from Rock Hill, South Carolina, who has been awarded the South Carolina Broadcasters Association's Honorary Lifetime Membership Award. An associate professor of mass communication at Winthrop University, Howell is a former CBS-TV news producer and Vietnam correspondent. — *tnx Pat Hensley, N4ROS*

PRODUCT REVIEW

Ten-Tec R4020 Two Band CW QRP Transceiver

Key Measurements Summary



Reviewed by Chuck Skolaut, KØBOG
ARRL Field and Regulatory Correspondent

Ten-Tec has introduced two new transceivers in their line-up for low power (QRP) operators. Each model covers two bands. The Model R4020 includes full coverage of the 40 and 20 meter bands, while the R4030 covers 40 and 30 meters. Both radios are designed primarily for CW operation but can also receive SSB.

These radios are the result of a design by BD4RG from China who first introduced the model HB-1 with several revisions soon following. It originally was a kit but later was offered as an assembled unit. That design covered three bands — 40, 30 and 20 meters. These two band versions are manufactured to Ten-Tec's specifications, but are not made by Ten-Tec at their factory in Tennessee. In their introduction of these radios, Ten-Tec stated that they were offering these radios as a service to the QRP community.

We received the R4020 40/20 meter version of the radio to check out and try on the bands. This radio is sophisticated and offers quite a few features for the QRP operator. It's a long way from the simple QRP gear many of us enjoyed years ago, such as the classic Tuna Tin 2 transmitter. The ARRL also tested an R4030 (40/30 meter) with results similar to those shown in Table 1.

Sturdy Construction

The first thing you notice when handling the radio is that it features a sturdy steel case. It should hold up well to physical abuse. The transceiver weighs in at slightly less than a pound without internal batteries and is classified as a trail friendly radio (TFR) designed to lay flat on your operating position. It sports a bright blue, easy to read LCD that shows the frequency, mode, power supply voltage, S-meter level, RIT setting and power output when transmitting.

The top (front) panel includes the MAIN TUNING dial, VOLUME control and four push button switches plus a separate slide power switch. The MAIN TUNING dial and the four push buttons have multiple uses to enable selection of the various modes and functions.

One of the side benefits of using a frequency synthesizer is that in addition to the full coverage of the two specific amateur bands it also allows 5 to 16 MHz continuous general coverage in the receive mode for shortwave listening. So while the 40/20 version won't transmit on 30 meters, you can still tune around the band in the receive mode. If you try to transmit on 30 meters (or anywhere outside the 40 and 20 meter ham bands), there is no output and the display will show a flashing TX ERROR message.

The radios have 20 memories to store your favorite frequencies and modes to allow quick changes. The main tuning steps can be changed by pressing the tuning knob to switch between 100 Hz or 1 kHz. For quick excursions, press and hold the tuning knob for 2 seconds to change the tuning step to 100 kHz.

The MAIN TUNING knob is also used to control the RIT. To enter the RIT mode, simply press the RIT/MOD button (a dash will be displayed) and turn the MAIN TUNING knob for your desired offset. An up or down arrow will be displayed to show the direction. This

Bottom Line

The Ten-Tec R4020 is a QRP CW transceiver with a variety of convenience features. It can operate from internal batteries, so add a paddle, headphones and antenna and head for your favorite portable location.

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

Table 1
Ten-Tec R4020

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 5-16 MHz; transmit, 7.0-7-3, 14.0-14.35 MHz.	Receive, as specified; transmit, 6.9953-7.3042, 13.9967-14.3550 MHz.
Current drain: Transmit, 550-950 mA (depending on supply voltage); receive, 55 mA (no signal), 9-14 V dc (internal 8 AA batteries or external supply).	With 13.8 V dc external power: receive, max audio, no signal, 50 mA; transmit, 740 mA. With battery power: receive max audio, no signal, 50 mA; transmit 620 mA at 12 V dc. Minimum operating voltage, 7.3 V dc at 1.5 W output.
Modes of operation: transmit, CW; receive, SSB and CW.	As specified.
Receiver	**Receiver Dynamic Testing**
Sensitivity: Not specified.	Noise floor (MDS), 500 Hz filter 7 and 14 MHz, –130 dBm
Noise figure: Not specified.	17 dB
Blocking gain compression: Not specified.	Not measured.*

ARRL Lab Two-Tone IMD Testing (500 Hz bandwidth)

Band	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
7 MHz	20 kHz	–41 dBm	–130 dBm	89 dB	+4 dBm
		–34 dBm	–97 dBm		–3 dBm
14 MHz	20 kHz	–46 dBm	–130 dBm	84 dB	–4 dBm
		–39 dBm	–97 dBm		–10 dBm
		0 dBm	–1 dBm		–1 dBm
14 MHz	5 kHz	–46 dBm	–130 dBm	84 dB	–4 dBm
		–39 dBm	–97 dBm		–10 dBm
		0 dBm	–1 dBm		–1 dBm
14 MHz	2 kHz	–46 dBm	–130 dBm	84 dB	–4 dBm
		–39 dBm	–97 dBm		–10 dBm
		0 dBm	–1 dBm		–1 dBm

Second-order intercept point: Not specified.	14 MHz, +19 dBm.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: 3.05 µV.
Receiver audio output: 100 mW into 8 Ω.	100 mW maximum at 1.6% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth): CW (500 Hz filter): 741-1252 Hz (511 Hz); Equivalent Rectangular BW: 521 Hz; USB: 746-1805 Hz (1059 Hz); LSB: 735-1814 Hz (1079 Hz).
Spurious and image rejection: Not specified.	First IF rejection, 14 MHz, 53 dB; image rejection, 40 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output: 13.8 V dc external supply, 5 W; 12 V dc (internal AA batteries), 4 W.	13.8 V dc external supply, 7 MHz, 5.0 W, 14 MHz, 4.5 W; 12 V dc (internal AA batteries), 7 MHz, 3.4 W, 14 MHz, 3.2 W.
Spurious-signal and harmonic suppression: Not specified.	>53 dB. Meets FCC requirements.
CW keyer speed range: Not specified.	6 to 36 WPM.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Receive-transmit turnaround time (tx delay): Not specified.	116 ms.
Composite transmitted noise: Not specified.	Not measured.†
Size (height, width, depth): 2.2 × 5.5 × 4.2 inches, including extrusions.	
Weight: 15.8 ounces (without batteries); 1.5 pounds, including batteries.	
Price: $249	

*The AGC could not be turned off. Blocking gain compression and reciprocal mixing measurements must be made with the AGC off.
**ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.
†Composite noise test not completed. Transmit frequency changed more than the 1 Hz during testing, causing a PLL unlock on the test fixture.

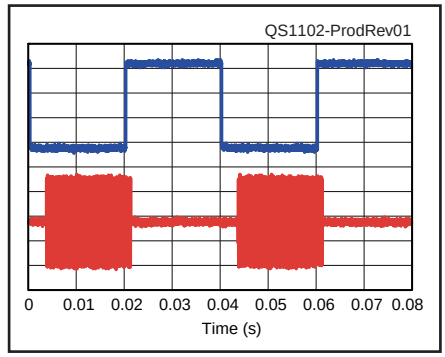


Figure 1 — CW keying waveform for the R4020 showing the first two dits in full break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 5 W output on the 7 MHz band.

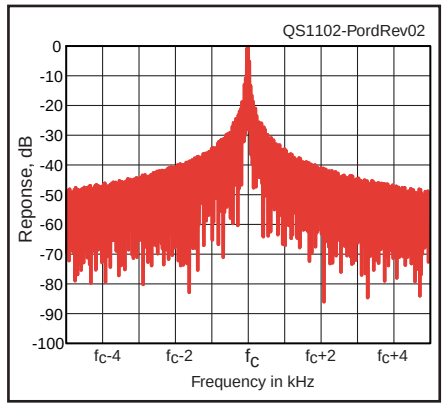


Figure 2 — Spectral display of the R4020 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 5 W PEP output on the 7 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

feature also allows split frequency operation. In the RIT mode, the tuning ranges are 10 Hz and 100 Hz.

To change modes, press and hold the RIT/MOD button for 2 seconds. The radio cycles through CW to USB to LSB.

The ATT/IF button permits turning the attenuator off and on. When on, the S in the S-meter portion of the display will change to A. Pressing ATT/IF for 2 seconds will enable you to enter the IF bandwidth change mode. Once in this mode, click the button to switch among the various widths provided — 400, 500, 700 or 900 Hz for CW and 1.6, 1.8, 2.0 or 2.2 kHz for SSB. The audio bandpass on CW is shifted higher than on most radios, about

750 to 1250 Hz for the 500 Hz filter. There is no adjustment to the IF, other than bandwidth. The sidetone is fixed at about 700 Hz.

While transmitting, the R4020 will display the approximate power output. The letter S on the dial will change to P followed with a series of vertical bars. Each three bars represents approximately 1 W of output power.

Internal Keyer

Either a straight key or paddles can be used with this transceiver. It has an automatic function that determines which type of key is connected. At power-up, you will hear the keyer send the letter A if a paddle is connected or the letter M if a straight key is connected.

The built in keyer has a range of approximately 6 to 36 WPM. To set the speed, press the CQ/SET button for approximately 2 seconds and the letter S will be heard, then release the button. Within 5 seconds, push the paddle to the dot side to increase the keyer speed or to the dash side to decrease the keyer speed. When finished, again press the CQ/SET button quickly to exit. The letter E will be heard.

The R4020 keyer has just one memory, which is preset to call CQ. To activate it, press the CQ/SET button quickly causing it to send CQ CQ CQ DE (your call sign three times) PSE K. Hitting the CQ/SET button for 1 second at any time during the CQ cancels it. To enter your call sign, press the CQ/SET button for about 2 seconds, you will hear the letter S. Continue to hold down the button until you hear the letter I, then release it and send your call sign with the paddle as usual. When done, a short click of the button will exit the setup, confirmed by hearing the letter E, or it will automatically exit. The PSE K format may be a bit different than many are used to, but it indicates the polite culture the designer comes from.

To turn off or cancel the automatic call CQ function, simply press the CQ/SET button and hold for about two seconds, you will hear the letter S. Continue to hold down the button until your hear the letter I, then continue to hold it down until you hear the letter C, and then release the button. Push the paddle to the dash side to cancel the automatic call CQ function; OFF will be heard. If you want to restore this function, after reentering, push the paddle to the dot side to turn it back on.

This automatic CQ function is operational while using paddles but not during straight key use. A tune feature is also available while using paddles.

On the Air

As shipped, the radio arrives with the two battery packs enclosed within the radio. The user is required to wire up the packs. It is highly recommended that you remove the packs before plugging in an external power supply to ensure that no damage to components occurs. While using the internal battery pack, our lab measured 3.4 W out on 40 meters and 3.2 W out on 20 meters. The output is closer to 5 W with an external 13.8 V supply.

How does it work in the shack? I was very favorably impressed with its operation and had no trouble making contacts with North Carolina, Pennsylvania, Florida, Oklahoma, Kentucky, Indiana, Ohio and Georgia among others in a leisurely operating timeframe in the evenings on 40 meters. This was with a basic 40 meter dipole only about 20 feet high. (There is no built-in antenna tuner, so you'll need to arrange for one if you use a nonresonant antenna.) The full break-in (QSK) was smooth with few thumps.

The tuning dial is of the mechanical indent style and there is a bit of play in the shaft/bearing arrangement. I wish that the tuning dial operation were smoother.

It is certainly nice to be able to monitor the supply voltage, especially while using the internal pack. I opted to go to an external 12 V battery when the internal pack dropped to 10 V, although the lab test indicated 1.5 W out with the supply down to 7.3.

A plus with the LCD frequency display is being able to know exactly where you are on the band, unlike some other QRP transceivers with imprecise frequency displays. While monitoring LSB activity on 40 meters, I wished phone transmitting capabilities were available on this model as copy was so good. Note that the Lab measured SSB bandwidths significantly narrower than the 2.2 kHz filter setting would indicate.

Audio and sidetone volumes were adequate with my headphones. There is no built in speaker, but it would be no trick to use amplified computer speakers to supply plenty of audio. One of the cautions is not to use a mono audio plug.

I found that putting a small spacer under the rear of the unit and tilting it up made for better viewing of the display in the home shack atmosphere. In the field many operators prefer the horizontal position. An accessory tilt bail might be a good addition. [Ten-Tec now offers an oak easel stand for these radios. — *Ed.*]

The radio comes with a six page instruction manual plus schematic diagram. A slightly more comprehensive manual would be a nice touch.

The QRP world is very exciting. The enthusiasm of the QRP group is remarkable, resulting in a lot of experimentation and plain tinkering. Changes and revisions to the various radios available happen frequently and new designs appear often.

I would urge those who say "life is too short for QRP" to take another look at what's available now and give it a try. The R4020 is a good way to get started. Overall it's a very nice performing radio. Since it comes assembled, tested and with a warranty, it should prove to be a winner.

Manufacturer: Ten-Tec Inc, 1185 Dolly Parton Parkway, Sevierville, TN 37862, 800-833-7373; **www.tentec.com**; **sales@tentec.com**.

Mini-Circuits PWR-6GHS+ USB Power Sensor

Reviewed by Phil Salas, AD5X
QST Contributing Editor

Bottom Line

The Mini-Circuits PWR-6GHS+ USB power sensor is a reasonably priced, highly accurate, very broad range power meter that is equally useful in a commercial lab or home experimenter's workshop.

For much of my homebrew work I need to accurately measure RF power. And I need quite a large range — from low levels such as the output of an oscillator, mixer or coupler, to the much higher output of typical amateur transceivers from HF through UHF. Most available ham type power meters aren't precision instruments, and those that are accurate don't satisfy my low level measuring requirements. So what to do?

Enter the Mini-Circuits PWR-6GHS+

While doing an Internet search on RF power sensors, I stumbled across the Mini-Circuits PWR-6GHS+. This USB powered

RF power sensor measures average signal power levels from –30 dBm to +20 dBm in the 1 MHz to 6 GHz frequency range. It's calibrated, and it uses your computer and supplied software for the display. While it may seem pricey at $795, it is lower in cost than a used, calibrated commercial power meter. The PWR-6GHS+ comes with a one year warranty and can be recalibrated by Mini-Circuits for $99 if desired.

The PWR-6GHS+ measuring system consists of the power sensor, a male type N connector, an N-to-SMA adapter, a USB interface cable, the installation software CD and the user manual. The basic specifications are shown in Table 2, along with results of some ARRL Lab testing.

Mini-Circuits offers two other versions of the USB power sensor: the PWR-6G+ and the PWR-8GHS+. The PWR-6G+ has a slightly slower sampling speed and is limited to *Windows* 32 bit operating systems (*XP*, *Vista* and *Windows 7*) — no *Linux* or 64-bit *Windows* support. The PWR-8GHS+ has the same specifications as the PWR-6GHS+ except the frequency range is extended to 8 GHz. At $695, the PWR-6G+ is $100 less expensive than the PWR-6GHS+; the PWR-8GHS+ is $869.

Using the PWR-6GHS+

The latest software is available on the Mini-Circuits Web site for easy download and installation. In addition to reading and displaying RF power, the software also provides text file and *Excel* spreadsheet file outputs, maximum/minimum measurement limits, and time scheduled measurements with a power output versus time graph. You can even add additional power sensors to other USB ports, and the software will read and record the data from all sensors simultaneously.

For maximum accuracy the measuring frequency is entered in the display window. You don't need to change the frequency input unless you move more than 100 MHz. An internal temperature sensor in the PWR-6GHS+ also provides for temperature variation compensation to keep the readings accurate. Now let's look at some power sensor applications.

Calibrating Attenuators

With an input power range from –30 dBm to +20 dBm, you will require attenuators for power levels above 100 mW (+20 dBm). All attenuators I've looked at have well-controlled return loss and attenuation across the bandwidth I need (1.8 to 450 MHz). The attenuator specifications, however, are typically ±0.3 to ±0.5 dB about their nominal attenuation value. This sounds good, but ±0.5 dB corresponds to about a 12% error, and ±0.3 dB corresponds to about a 7% error. So a transceiver that puts out exactly 100 W could measure as little as 88 W or as much as 112 W with a ±0.5 dB attenuator specification. If you cascade attenuators, you can cascade the attenuator errors making them much worse (or much better) than this. Of course, the PWR-6GHS+ has a typical measurement uncertainty of ±0.1 dB. But with a little care, you can calibrate your attenuators so that your total uncertainty is no more than this.

For attenuator calibration you need a stable low level signal source. Most antenna analyzers have output levels that can be used. For attenuator calibration you need a stable low level signal source such as is available from most antenna analyzers. As examples, the nominal output levels of the Array Solutions AIM 4170C and VNA 2180 are –18 dBm and +7 dBm, respectively. The nominal output levels of the RigExperts AA-200/230 and the MFJ-259B are +10 dBm. The actual measurement frequency is usually not important, as most attenuators you buy are specified into the microwave range and the attenuation is usually very consistent across the full range. For most amateur applications, a test frequency of 50 or 100 MHz works very well.

Calibration Procedure

For high power applications, I use a 20 dB, 150 W attenuator and a 20 dB, 2 W attenuator for typical 100 W transceiver measurements. I also have a variety of 10, 6 and 3 dB attenuators for flexibility in measuring various power levels.

Because of the "relative" measuring capability of the PWR-6GHS+, the actual output power of the signal source is unimportant — as long as you don't exceed the maximum input power. Simply connect the PWR-6GHS+ directly to your low level frequency source and check the RELATIVE and dB boxes on the display. Now anything connected between the PWR-6GHS+ and the signal source reads out exactly in dB.

To illustrate the calibration process, I wanted to accurately measure the output power level of my Jetstream JT220M 222 MHz transceiver. While I used my RigExperts AA-230 with a 10 dB attenuator as the signal source for calibration. Figure 3 shows the actual measured attenuation of my high power attenuator.

Using the same procedure, I measured my 20 dB, 2 W attenuator at –19.872 dB, giving a total attenuation of 39.8 dB. Now enter the 39.8 dB total attenuation in the OFFSET

Figure 3 — PWR-6GHS+ screen showing the actual measured attenuation of the author's surplus 150 W, 20 dB attenuator.

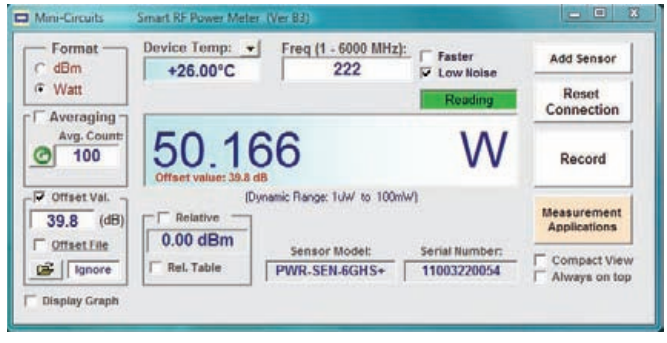


Figure 4 — Measured output power of the author's Jetstream 222 MHz transceiver.

Table 2
Mini-Circuits PWR-6GHS+

Manufacturer's Specifications

Frequency range:	1 MHz to 6 GHz.
Signal type:	CW, continuous.
Dynamic range:	50 dB, from –30 to +20 dBm.
Absolute maximum input:	+27 dBm RF level, 15 V dc.
Power reading uncertainty:	±0.15 dB typical, ±0.4 dB max.
Linearity:	±3% typical.
Display resolution:	0.01 dB.
Measurement speed:	100 ms in Low Noise mode, 30 ms in Faster mode.
Supported operating systems:	*Windows*/*Linux* 32 and 64-bit operating systems.

Price: PWR-6GHS+, $795; recalibration, $99.

Tested in the ARRL Lab

This table compares power measurements with the PWR-6GHS+ to measurements with the ARRL Lab's calibrated HP-437B microwattmeter. Input signal from the Lab's calibrated Marconi 2041 signal generator.

Marconi 2041	*HP 437B*	*Mini-Circuits PWR-6GHS+*	*Marconi 2041*	*HP 437B*	*Mini-Circuits PWR-6GHS+*
Input Frequency = 1 MHz			*Input Frequency = 1000 MHz*		
–30 dBm	–30.00 dBm	–29.70 dBm	–30 dBm	–30.00 dBm	–29.75 dBm
–20 dBm	–19.76 dBm	–19.73 dBm	–20 dBm	–19.78 dBm	–19.68 dBm
–10 dBm	–9.77 dBm	–9.75 dBm	–10 dBm	–9.77 dBm	–9.67 dBm
0 dBm	+0.31 dBm	+0.23 dBm	0 dBm	+0.22 dBm	+0.43 dBm
+10 dBm	+10.22 dBm	+10.27 dBm	+10 dBm	+10.18 dBm	+10.46 dBm
Input Frequency = 10 MHz			*Input frequency = 2000 MHz*		
–30 dBm	–29.90 dBm	–29.77 dBm	–30 dBm	–30.02 dBm	–29.98 dBm
–20 dBm	–19.85 dBm	–19.77 dBm	–20 dBm	–20.02 dBm	–19.95 dBm
–10 dBm	–9.83 dBm	–9.77 dBm	–10 dBm	–9.97 dBm	–9.90 dBm
0 dBm	+0.17 dBm	+0.28 dBm	0 dBm	+0.06 dBm	+0.13 dBm
+10 dBm	+10.16 dBm	+10.25 dBm	+10 dBm	+10.04 dBm	+10.07 dBm
Input Frequency = 100 MHz					
–30 dBm	–29.90 dBm	–29.65 dBm			
–20 dBm	–19.72 dBm	–19.64 dBm			
–10 dBm	–9.72 dBm	–9.67 dBm			
0 dBm	+0.35 dBm	+0.17 dBm			
+10 dBm	+10.23 dBm	+10.32 dBm			

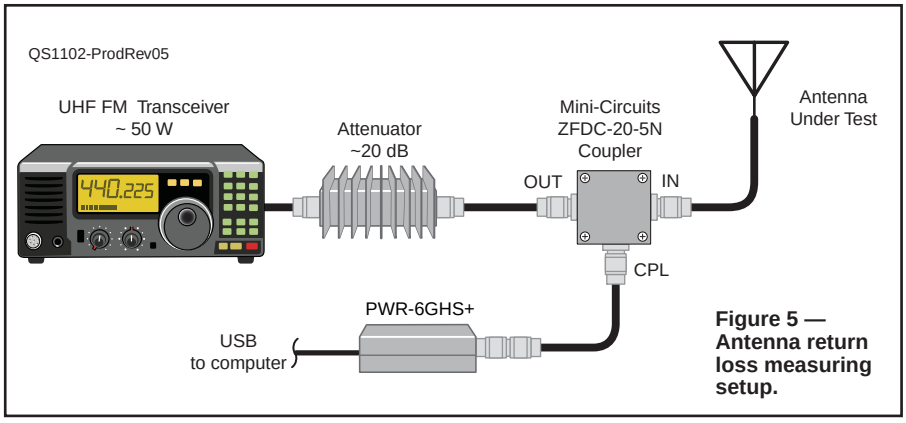


Figure 5 — Antenna return loss measuring setup.

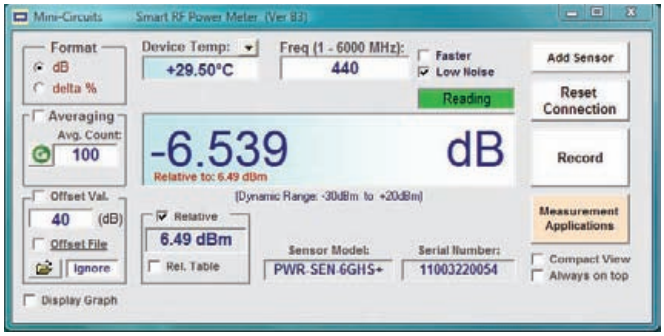


Figure 6 — Return loss of the 147 MHz antenna measured at 445 MHz.

VALUE box. You can now read the output of the transceiver directly in watts as you can see in Fig-ure 4. The measured output power of 50.166 W is very close to the JT220M specified typical output power of 50 W. Incidentally, I was able to mount the attenuators and PWR-6GHS+ directly to the JT220M RF output connector. If you use an interface cable, you may need to add in 0.1 to 0.2 dB additional cable losses for best accuracy.

Measuring Return Loss

Many hams have an antenna analyzer that permits measurement of SWR up to about 170 to 200 MHz. Measuring above this frequency range normally means investing in much more expensive equipment. Of course, the reason you'd need to measure SWR above 2 meters is because you have a 222 or 440 MHz radio, so you do have a signal source — your transceiver. With that signal source, you can measure return loss using a broadband directional coupler. I found that the relatively inexpensive Mini-Circuits ZFDC-20-5N coupler ($90) is perfect for virtually all of these applications. This coupler is specified from 100 kHz to 2 GHz with a maximum input power of about 2 W, so you do need to size your attenuators appropriately.

To illustrate, I wanted to see how well a ¼ wave 147 MHz antenna might work at 445 MHz, at which point the antenna is a little less than 3/4 wavelengths. I measured a 1.5:1 SWR at 147 MHz using my antenna analyzer, which corresponds to a 14 dB return loss. To measure return loss at 445 MHz, I used the test setup shown in Figure 5. Note that we're feeding the signal into the *output* (OUT) port of the directional coupler. This is correct, as we want only the reflected signal from the unit under test to couple out to the PWR-6GHS+. In other words, the reflected signal becomes the input to the directional coupler, as we're measuring the "loss" of the "return" signal — *return loss*!

The 20 dB attenuator limits the signal into the coupler to about 0.5 W. First I left the IN port of the coupler open so all power is reflected, resulting in a measured reflected power level of +6.49 dBm. Precise measurement of the attenuators, coupler, transmitter output power and cable loss is not necessary as we only need relative readings for the return loss measurement. However, the numbers make sense: 50 W = +47 dBm. Less 20 dB attenuator = +27 dBm. Less 20 dB coupling of the reflected signal = +7 dBm (close to the measured +6.49 dBm). This is well above the –30 dBm threshold of the PWR-6GHS+, which gives us a good return loss measurement range.

Now check the RELATIVE and dB boxes on the PWR-6GHS+ display to set this as the reference reflected power level and then connect the antenna to the IN port of the coupler. As you can see in Figure 6,

the return loss of the 147 MHz antenna at 445 MHz is 6.6 dB, or about a 2.8:1 SWR. This is not great, but it is within the load range of many UHF transceivers.

Final Thoughts

I've described some basic measurements that are easily accomplished with the Mini-Circuits PWR-6GHS+ USB power sensor. I'm sure other applications will come to mind as you work with this instrument. Obviously you can measure coupler directivity (OUT to CPL with IN terminated on the Mini-Circuits ZFDC-20-5N). And because of its wide and linear dynamic range, you could use the PWR-6GHS+ and a low level variable frequency source to measure filter performance (insertion loss, shape factor, in-band ripple, ultimate rejection and return loss). It's a very flexible instrument indeed!

Because your laptop takes care of all display information, no other external equipment is required other than the power sensor head — even if you need multiple sensors and data recording. You can view detailed documentation for these power sensors on the Mini-Circuits Web site.

Manufacturer: Mini-Circuits, PO Box 350166, Brooklyn, NY 11235; tel 718-934-4500; **www.minicircuits.com**.

Array Solutions AS-43A Digital Upgrade Kit for Bird 43 Wattmeter

Reviewed by Joel R. Hallas, W1ZR
Technical Editor, QST

It is likely that the Bird 43 Thruline is one of the most popular wattmeters that has ever been. I first used one as part time mobile and marine radio serviceman in the early 1960s and would guess that there isn't a mobile radio shop without at least one. The Bird 43 includes a coaxial line section into which the user plugs "slugs" (elements) designed for various frequency ranges and power levels. By rotating the slug in its housing, you can read either forward or reflected power in the nominal 50 Ω system.

New Bird 43 wattmeters are still available, along with a wide array of other measurement and RF products from Bird Technologies Group (see **birdtechnologies.thomasnet.com**). Many amateur equipment dealers offer Bird meters and accessories. By selecting the appropriate element they can cover the frequency range of 450 kHz to 2.7 GHz, at power levels from 100 mW to 10 kW depending on the plug-in element selected. They are priced for the commercial market and it is likely that many amateurs with Birds purchased theirs from a ham radio classified ad or Internet auction site, as I did mine.

The '43 is a portable device designed for rough handling and there's a good chance that any used one you buy has received hard usage over the years (see Figure 7). About the only component that can fail is the well dampened and rugged shock-mounted meter movement. That was the case with mine, and after only about 10 years with me, my meter started sticking. I looked into replacement meter movements and found that, while available, either new or used ones cost more than what I paid for the whole meter.

Enter the AS-43A Digital Upgrade Kit

Another alternative is the Array Solutions AS-43A digital upgrade kit (see Figure 8). While called a kit, it really is just a one-for-one replacement for the analog meter. The AS-43A can be installed in the wattmeter very easily in a few minutes — just remove the six bottom cover screws, the bottom cover then the two screws holding the meter. Later, the digital display could be removed and the meter returned to original condition just as easily, if desired.

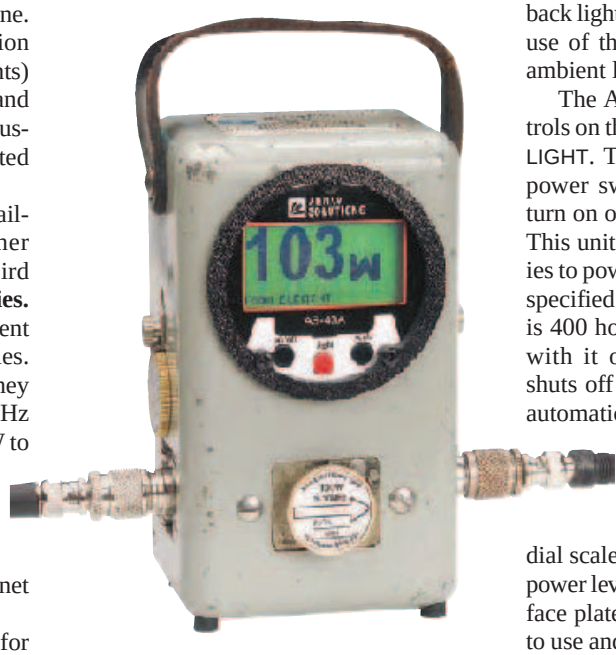


Figure 7 — The author's auction-acquired Bird 43 wattmeter shows signs of heavy use in a previous life. The AS-43A is a direct replacement for the defunct analog meter movement.

Bottom Line

The Array Solutions AS-43A Digital Upgrade Kit provides a three digit digital readout for your tired old Bird wattmeter. While the accuracy is limited by the wattmeter slugs, a calibration adjustment is described that can improve accuracy.

Not Just a Pretty Face

The AS-43A provides some benefits in comparison to the original analog display. It offers three digits of precision, much improved over the analog meter. It also offers a back lighted liquid crystal display that allows use of the instrument in locations without ambient lighting.

The AS-43A has three push button controls on the meter face: ON-OFF, SCALE and LIGHT. The original Bird 43 didn't need a power switch, since there was nothing to turn on or off, an advantage to the original. This unit uses four AA size alkaline batteries to power the electronics and display. The specified battery life, with alkaline batteries, is 400 hours with the backlight off, and 50 with it on. The backlight automatically shuts off after 90 seconds, while the meter automatically turns off after 90 minutes to preserve the battery.

Using the AS-43A

The analog meter has multiple dial scales that can be used with the various power level slugs. You just have to look at the face plate of the slug to decide which scale to use and keep track of the full scale power. The AS-43A has a SCALE switch that can cycle through all the available power levels: 1, 2.5, 5, 10, 25, 50, 100, 250 and 500 W or 1, 2.5, 5, 10 and 25 kW. You don't have to keep track, just remember to check the scale setting whenever you change slugs.

Operation is simple. Just turn it on, select the appropriate scale and it's ready to go. As with the original, turn the slug 180° to select forward or reflected power. One aspect of the digital display that you will notice immediately is the time it takes to reach the final reading, about 1 second, as we could best estimate. While the heavily damped analog meter takes almost as long to reach full scale, it responds much more quickly near

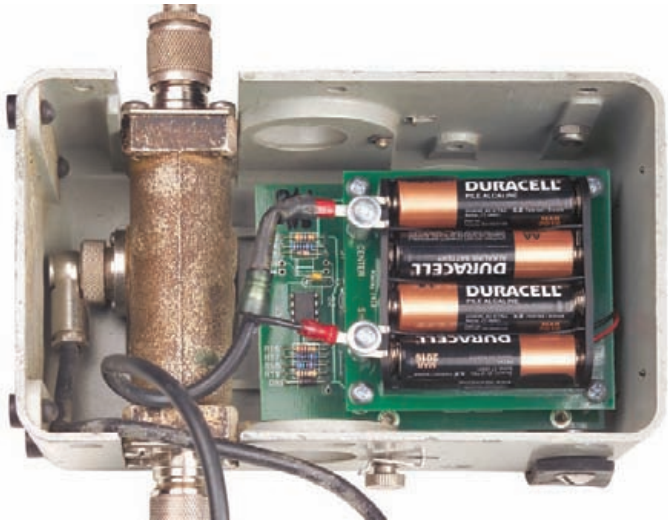


Figure 8 — The AS-43A circuit board and battery holder mounted in place of the analog meter.

the bottom of its range. I found the original analog display more useful for adjusting an antenna tuner for minimum reflected power while watching the meter.

Note that while the AS-43A provides three digits of resolution, actual accuracy of measurement is limited by the accuracy of the individual slugs. Array Solutions offers instructions for the addition of a calibration potentiometer on their PC board to permit compensating for a slug's error. The adjustment can be made while an accurate reference wattmeter is in the line. Note that the adjustment may only be completely valid at the particular frequency and power level adjusted to, although checking at other levels and frequencies may indicate a wider calibration range. Another option is to calibrate each slug individually, as described in a recent *QST* article.[1]

Documentation

The AS-43A comes with an excellent 12 page assembly and instruction manual. Each step required is concisely described, along with a clear photo of the required action. It's hard to imagine going wrong!

Manufacturer: Array Solutions, 2611 North Beltline Rd, Ste 109, Sunnyvale, TX 75182; tel 214-954-7140; **www.arraysolutions.com**. Price: $189.

[1]F. Glenn, K9SO, "Repair and Calibrate Those Wattmeter 'Slugs' with Confidence," *QST*, Nov 2009, pp 50-52. QST

In The January/February 2011 Issue:

- A discussion of an innovative design for "An All-Digital Transceiver for HF," by James Ahlstrom, N2ADR
- "A Two Diode Frequency Doubler" project by John Pivnichny, N2DCH
- "An All Purpose High Gain Antenna for 2400 MHz" by Roger Paskavan, WAØIUJ
- "Loop Antennas — The Factor 'N'," an intriguing technique to improve loop performance by Virgil Leenerts, WØINK.
- How to enjoy better filter performance with "Seventh-Order Unequal-Ripple SVC Low-Pass Filters with Improved Second Harmonic Attenuation" by Dave Gordon-Smith, G3UUR
- A novel approach to "Simulating Tapped Coupled Inductors" by Oleg Sergin, DL2IPU
- "A Driverless Ethernet Sound Card" project by Sivan Toledo, 4X6IZ

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New Products

PERMANENTLY BONDED POWERPOLE SETS FROM POWERWERX

◊Powerwerx now offers red/black Anderson Powerpole sets that have been ultrasonically welded together, creating a permanent bond between the red and black housings. This can save assembly time, guarantee correct RACES/ARES configuration, eliminate the need for a roll pin and enable the use of Powerpole accessories such as retaining clips or clamps. Bagged quantities of 10, 25, 50, 100, 250 and 500 sets are available. A 10 set bag contains 10 red/black housings and 20 contacts (the same as 5 mated connector pairs). Prices start at $11.99 for a bag of 10 sets of 15 A connectors. For more information, or to order, visit **www.powerwerx.com**.

MFJ GIANT CROSS-NEEDLE SWR/WATTMETERS

◊ These MFJ SWR/wattmeters have 3⅝ inch cross needle meters with a three color scale for improved readability. They simultaneously display forward/reflected power and SWR and have meter scales for each power range for increased reading accuracy. A peak-reading circuit is included for SSB operation (MFJ-891 only). LED backlighting provides illumination for night viewing. Meter accuracy is rated at ±10 % of full scale or better. Each unit has a lighted meter on/off switch and SO-239 connectors. Models available include: MFJ-891, $109.95, 1.6 to 60 MHz with 20/200/2000 W ranges and PEP circuit for SSB operation. MFJ-892, $109.95, 1.6 to 200 MHz with 2/20/200W ranges. MFJ-893, $109.95, 125-525 MHz with 2/20/200W ranges. MFJ-894, $129.95, 1.6 to 60 MHz and 125-525 MHz with 2/20/200 W ranges (incorporates separate RF sensors for HF or VHF/UHF operation). To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

W1ZR

THE DOCTOR IS IN

Q Don, AB2IF, is planning on operating 2 meter SSB from his mobile station. He is aware that most SSB operation uses horizontal polarization and wonders what antenna choices he has.

A This is not a new problem. In the days before 2 meter FM became popular (late 1960s), most 2 meter operation used full carrier AM. The popular radios of the time were WW2 surplus aircraft radios (SCR-522, VHF ARC-5 and others designed for the AM aircraft band) as well as the ubiquitous Gonset Communicator and later the Heathkit Twoer. In most parts of the country AM also used horizontal polarization and a number of antenna types were popular. A 1956 *QST* article (**www.arrl.org/arrl-periodicals-archive-search**) shared the results of a study of cross polarization effects on VHF and concluded that in most terrain the difference is significant.[1]

Probably the two most popular horizontal mobile antennas were the halo — basically a ½ wave dipole, often gamma matched, bent in not quite a circle (see Figure 1) and a turnstile — two straight horizontal dipoles mounted at right angles and fed 90° out of phase to form an omnidirectional pattern (see Figure 2). The turnstile had more gain but a much wider wingspan — and more potential to poke an unsuspecting pedestrian in a parking lot. In use the turnstile was a better fit for the center of a roof or deck lid, while a halo could fit on a corner. Although back in "the day," most major antenna manufacturers offered horizontal 2 meter antennas, most now seem to be focused on the vertical. An exception is M[2], which offers some halo-like options — see **www.m2inc.com**. In poking around the Web, I also found a few niche marketers that offer such products. One candidate was at **www.ku4ab.com/2m-horiz.html**,

Unfortunately, the horizontal antenna is as bad as working into vertical FM systems as the vertical antenna is in the other direction. Even so, you may get through to nearby repeaters just because of their height — I can hit all mine with my 10 W multimode radio and a horizontal Yagi from home. If FM operation is also desired, and you want to use a single antenna, there are some circularly polarized (CP) options. CP antennas will have a 3 dB reduction toward either horizontal or vertical antennas. The Lindenblad antenna comes to mind.[2] While it has twice as many dipoles as the turnstile, it actually has a narrower width and is less likely to cause injury to bystanders due to the element angles.

Q Schley, W4AMW, asks: I'm headed to see the cardiologist next week about a pacemaker. I have already started researching their use around RF. I'm happy to go all low power (QRP), if that's what's called for. I might also be able to operate my rig remotely — perhaps 20 feet away. My biggest question is how to measure stray RF in the shack itself.

A I haven't received actual reports of any pacemaker problems and that seems to go along with the current info on the ARRL Web site at **www.arrl.org/pacemaker**. One maker that I'm aware of, Medtronics, has published the safe levels for their current pacemakers (new standards have been in place for some time). They, based on the Medronics data, indicate that at RF power levels of 1000 to 2000 W, being 30 or more feet away from the radiating antenna will result in safe levels. Click on EXPERT OPINION,

[1]E. Tilton, W1HDQ, "Polarization Effects in V.H.F. Mobile," *QST*, Dec 1956, pp 11-14.

[2]A. Monteiro, AA2TX, "An EZ-Lindenblad Antenna for 2 Meters," *QST*, Aug 2007, pp 37-40.

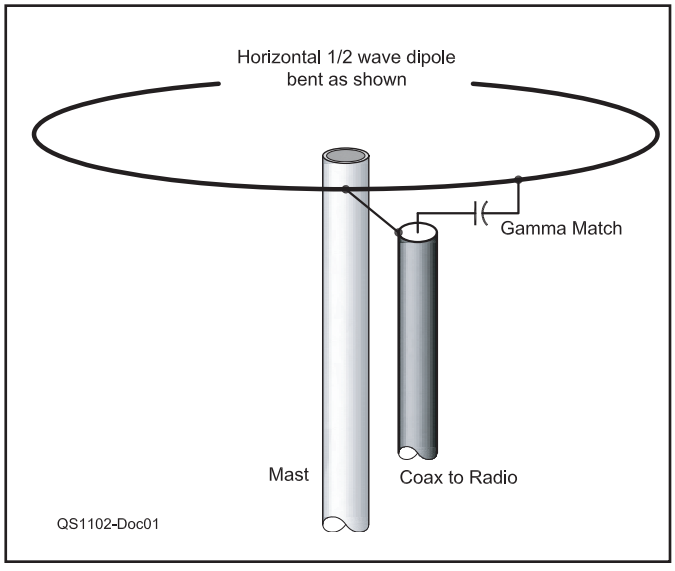


Figure 1 — Typical 1950s vintage 2 meter halo antenna.

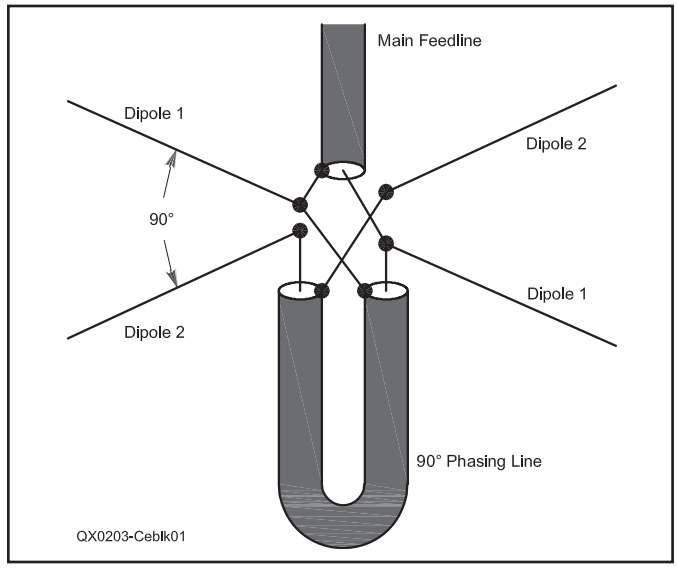


Figure 2 — Turnstile antenna. While used for horizontal polarization in this context, it also provides circular polarization perpendicular to the antenna elements and is thus popular for satellite communications.

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

then RADIO TRANSMISSION to see the details from Medtronics in their paper of February 16, 2009. Note that the devices are still quite subject to static and low frequency magnetic fields. Thus, advisories about arc welders and MRI scanners should still be closely adhered to. If in doubt, ask your physician.

I would start with a careful RF safety evaluation, as required by the FCC anyway. While the FCC guidelines were not based on pacemaker interference, they should result in a reasonably safe environment. If your station is properly set up — without common mode feed line current bringing radiation into the shack, for example — most radiation should surround the antenna and there should not be much RF at your operating position. If the RF follows the coax back into the shack, however, you may have higher levels than you think.

If it were me, I would start by talking to my physician. She will at best be able to give you power limits from your device manufacturer, but more importantly, could indicate symptoms to watch for while on the air so you could take appropriate action quickly if called for.

Calibrated RF field strength meters are available, but are quite expensive. Relative measurement is pretty easy — there have been many *QST* articles.[3] If you had a simple field strength meter running at all times in the station (I'm thinking the diode and microampmeter type that doesn't require power), you could see if anything changed in your antenna system to increase shack radiation. Then diagnose and repair as needed.

Q Bob, W6PYO, notes that in looking at vacuum tube transmitter circuits in old *ARRL Handbooks*, he sees that it is common practice for a bandswitch to short out inductor turns of plate circuits to change operation to higher frequency bands. He would expect that such a practice would result in reduction of circuit Q and higher loss than leaving the unused portion open. He wonders if that is true and why it is done that way.

A Perhaps the most electrically efficient way of changing bands, short of separate radios, is to use individual plug-in coils for each band. Most hams got tired of this approach by 1950, and with all our current bands, we'd now have to add a room onto the house for all the needed coils! Shorting the turns is not the best alternative; neither is leaving the unused turns open, however. The two choices are shown in Figure 3, for the case of a link coupled tank circuit. First, note that the tank circuit is not operated in isolation, but is coupled to a 50 Ω load through the link. The resulting loaded Q is much lower than that of either type of switched connection.

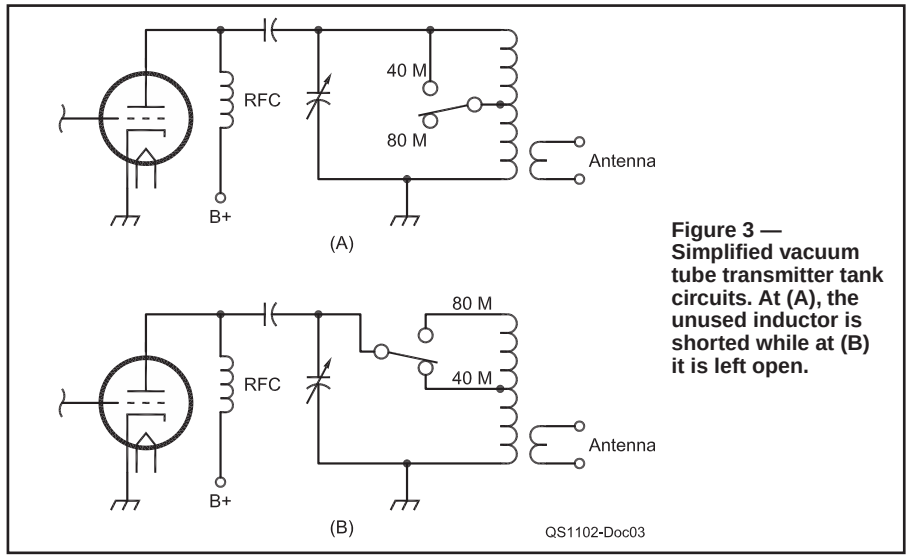


Figure 3 — Simplified vacuum tube transmitter tank circuits. At (A), the unused inductor is shorted while at (B) it is left open.

Table 1
Measured Data of Simulated Amplifier Tank Inductor

Configuration	*Inductance (µH)*	*Capacitance (pF)*	*Resonant Frequency (MHz)*	*Q*
Full coil	19.5	205	2.59	
Half coil	8.2	49	7.9	
Open half coil	8.2	63	7.0	748
Shorted half coil	8.2	66	7.0	713
Shorted with switch	8.2	66	7.0	710
Open half coil	8.2	270	3.5	590
Shorted half coil	8.2	278	3.5	550
Shorted with switch*	8.2	275	3.5	78
Shorted with switch	8.2	274	3.5	509

*The switch was not making good contact; wiggling the switch resulted in the higher Q shown in the next row.

Senior ARRL Lab Engineer Zack Lau, W1VT, dusted off the lab's Hewlett Packard 4342A Q Meter, found a piece of coil stock as used for such circuits and took data. The coil was 31.5 turns of #17 AWG with a length of 3.5 inches and an inside diameter of 1.75 inches. The insulation is four thin strips of polystyrene. A 4.5 inch piece of #16 AWG PVC insulated wire was used to connect a center tap. A similar piece was used to provide connections to the Q meter. Zack found a phenolic switch wafer with a shorting contact to simulate the switch — it shorted everything except the desired contact.

Zack found that the Q of the coil with shorted turns was lower, but not much lower, than the open case (see Table 1). In either case, the link coupled load would reduce it to the point that the difference wouldn't matter. Zack noted that if the shorting switch had poorly cleaned contacts and did not make a solid connection, the contact resistance would further reduce the Q and result in loss.

The problem with leaving the turns open is that you effectively have made a Tesla coil type autotransformer. With high RF voltage on the coil on 10 meters, for example, there will be a *very* high voltage on the full 80 meter section of coil, likely resulting in fireworks and component breakdown in the amplifier compartment.

♦Dave, W7KFO, provided an interesting and potentially helpful comment regarding my discussion of interference from Ethernet routers. 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.*

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. QST

[3]J. Noakes, VE7NI, "The No Fibbin' RF Field Strength Meter," *QST*, Aug 2002, pp 28-29.

SHORT TAKES

microHAM DigiKeyer II

This 6.5 × 1.75 × 4.38-inch box is about as close to an all-in-one station accessory as you're likely to see. The microHAM DigiKeyer II is a plug-and-play USB interface that will put you on the air within minutes running RTTY, PSK31, MFSK, Olivia, Packet and just about every other digital mode existing today. You don't have to worry about wiring the Digi Keyer II to your computer sound card. The Digi Keyer II has its own sound chipset built in. When you insert the USB plug into your PC, the computer recognizes the Digi Keyer II as a "sound device" just like your current sound card or motherboard sound chipset.

The rear panel of the DigiKeyer II.

But the DigiKeyer II isn't just about digital operating. The DigiKeyer allows your computer to "talk" directly to your radio for the ultimate in smooth rig control. This feature is critical for contest and DX logging software as well as Internet remote control applications.

The DigiKeyer can work with your CW software to key your radio, and it works directly with virtually all RTTY programs to provide "true" FSK keying, if your radio supports it.

Inspection and Setup

Before you can use the DigiKeyer II you have to open its enclosure and set a couple of small jumpers according to the type of data format your transceiver accepts for communication. Since I was doing this review with a Kenwood TS-2000, I chose good old RS-232. As you look around inside, the construction quality is evident. I noticed audio isolation transformers on both the inbound and outbound audio lines. I also spotted the integrated K1EL CW keyer chip, which is a nice touch! The speed control for the K1EL keyer is on the front panel. So, you have the option of using software to send CW, or you can plug a set of paddles directly into the Digi Keyer II back panel and go from there.

The price of the DigiKeyer II includes a custom-made interfacing cable for your radio. The cable has a male DB-15 connector that plugs directly into the DigiKeyer II; the opposite end plugs into your radio. This is extremely convenient and furthers the plug-and-play nature of the device. Since my Kenwood TS-2000 has a second receiver, I was happy to see that the DigiKeyer II cable was pre-wired to tap its audio as well. By manipulating the controls on the Digi Keyer II front panel, I could easily monitor the main and sub receiver audio simultaneously.

With all the wiring installed and ready, I booted up the microHAM "router" software. This is the application that allows you to fully control and configure the Digi Keyer II. You can set transmit and receive audio levels and assign "virtual" ports for your programs to use. For instance, my PSK31 software wanted to key my radio through serial port COM 5. Not a problem. I configured the microHAM software to emulate COM 5 as the Push-to-Talk line to the transceiver. My PSK31 software never knew the difference.

Taking the DigiKeyer II for a Spin

Being a casual RTTY contester, I couldn't resist taking the DigiKeyer II out for a "drive" during CQ WW RTTY and the JARTS RTTY contests late last year. The DigiKeyer II never failed me despite being bombarded with RF from my nearby antenna. FSK keying was smooth and accurate to say the least.

Switching to CW for the ARRL November Sweepstakes, I could best describe the DigiKeyer II performance as intense. And I operated both ways — computer generated CW and direct through the K1EL internal keyer.

Even casual PSK31 operating was a breeze. I couldn't help but notice the outstanding dynamic range characteristics of the DigiKeyer II sound chipset. The noise level was remarkably low, too.

A Top-of-the-Line Interface

High quality and a respected name demand a substantial price. You may find less expensive interfaces on the market, but if you are careful to weigh the features and benefits, along with construction quality, the price of a microHAM DigiKeyer II suddenly looks like a bargain.

Manufacturer: microHAM s.r.o. of Slovakia and distributed by microHAM America, LLC, PO Box 1257, Geneva, FL 32732; **www.microham-usa.com**. *$339 (includes interface cable for your transceiver)*

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

NØAX

HANDS-ON RADIO

Experiment 97

Programmable Frequency Reference

A recent article in the NZART *Break-In* magazine reminded me that a frequency reference was once part of every ham's shack, using a stable oscillator based on a 100 kHz (or 1 MHz) crystal.[1] The oscillator's fundamental and harmonics were used to identify the various band and segment edges. Although modern commercial gear may not need a frequency reference, what of the homebrew rig? With that in mind, this month's experiment uses a multistage counter to create a programmable reference for calibration or alignment or for generating a digital clock signal.

The Ripple Counter

Ripple counters were introduced in Hands-On Radio Experiment #36 — The Up-Down Counter.[2] Because they are asynchronous, the ripple counter isn't a very good choice for keeping a consistent count of input events because the change of state propagates (or ripples) through the chain of flip-flops. As a result it takes some time for the counter to stabilize after each count.

In our application, asynchronous operation is not an issue. It's only important that the counter has enough stages to divide the input signal by a large enough number. (There is one caveat we'll discuss at the end.)

We're going to use the 74HC4040 12 stage ripple counter. Enter 74HC4040 DATA SHEET into an Internet search engine and download a copy for reference. The internal circuit of the IC consists of *toggle flip-flops* that change the state of their Q and $\overline{Q}$ outputs whenever the T input changes from low to high. Figure 1 shows the logic diagram. The *truth table* for the counter is shown in Table 1.

The data sheet should also provide a *timing diagram* of the relationship between the control, input and output signals. The 74HC4040 has one control input — the master reset at pin 11 connected to the R_D input of each flip-flop — and one signal input — the clock pulse at pin 10. (MR and CP on the Philips data sheet, respectively.) If MR is high, all of the flip-flops are forced to the state in which Q is low and $\overline{Q}$ is high, regardless of what $\overline{CP}$ is doing. You can see this in the timing diagram because no flip-flop changes state until MR is low.

Once MR is *released*, the next high to low transition of the $\overline{CP}$ signal causes the first flip-flop's Q output to go high and the $\overline{Q}$ output to go low. Each successive high to low $\overline{CP}$ transition causes the first flip-flop's Q and $\overline{Q}$ outputs to change state. No action occurs if the $\overline{CP}$ input changes from low to high. Since the $\overline{Q}$ output of one stage is the input to the following stage, each flip-flop changes state at ½ the rate of the preceding flip-flop.

The counter's outputs Q_0 to Q_{11} produce a square wave with a frequency of the input divided by powers of 2 from $2^1 = 2$ to $2^{12} = 4096$, respectively. The counter advances from 0 (all Q outputs low) to 4095 (all Q outputs high) and then returns to 0 for a total of 4096 states.

If our objective were to divide the input signal by any integer power of 2, our work would be done — use the output corresponding to that ratio. Generally we want some other divisor than a power of two and that's where the fun begins.

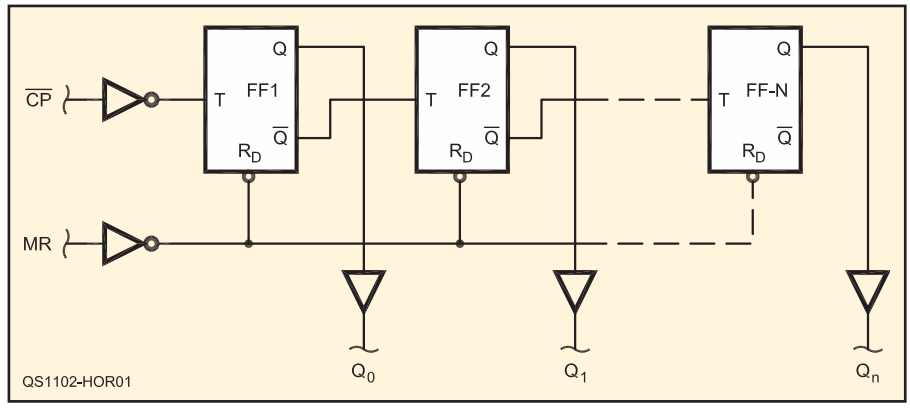


Figure 1 — The internal logic diagram of the 74HC4040 counter IC.

Table 1

Function Table of 74HC4040 Counter IC

Inputs		Outputs
CP	*MR*	Q_n
⇧	L	No Change
⇩	L	Count
×	H	L

Notes:
H = High voltage level.
L = Low voltage level.
× = Don't care.
⇧ = Low to high voltage transition.
⇩ = High to low voltage transition.

Getting Wired

The function of the row of diodes and the JK flip-flop labeled U2A in Figure 2 is to detect that the counter has reached a specific count (N) and reset the counter to zero. Imagine that the shorting jumpers labeled J0 to J11 are all installed. Thus, all of the diode anodes share a common connection to the 4.7 kΩ pull-up resistor. Since each cathode is connected to a Q output, if *any* Q output is low the current through that diode will pull the anode connection low. For the anode connection to be high, *all* of the Q outputs must also be high. This is a wired-AND connection — all of the inputs to the wired-AND (the counter outputs) must be high for the output (the anode connection) to be high. (If the diodes were turned around, exchanging

[1]A. Woodfield, ZL2PD, "Programmable CMOS Clock Generator," *Break-In*, New Zealand Association of Radio Transmitters, Sep/Oct 2009, pp 6-7.

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

H. Ward Silver, NØAX ♦ 712 Jefferson St, St Charles, MO 63301 ♦ n0ax@arrl.org

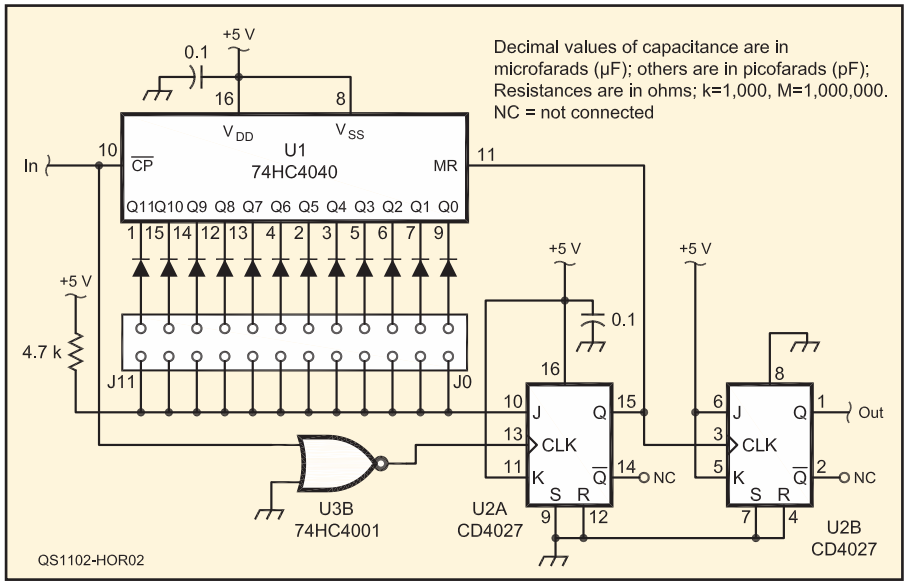


Figure 2 — The counter U1 and wired-AND circuit divide the input signal frequency by up to 4096. The output of U2A is a reset pulse at the frequency of the counter output. U2B divides the reset pulse frequency by two, creating a symmetrical square wave. J0 to J11 can be wire jumpers, a header strip with removable jumpers or DIP switch arrays.

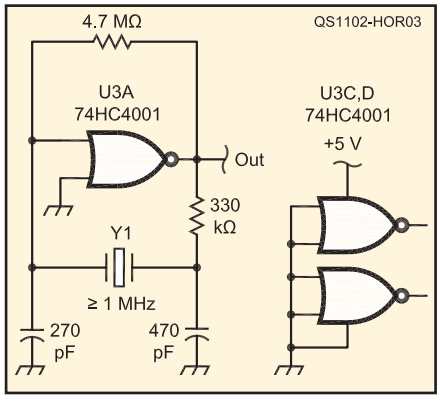


Figure 3 — A crystal oscillator circuit for high frequency and tuning fork crystals. For tuning fork crystals, replace 270 pF with 10 pF and 470 pF with 47 pF.

the anode and cathode, that would be a wired-OR connection for which the output would be high if *any* of the inputs were high.)

The wired-AND connection forms our *count detector* used to reset the counter and control the ratio of frequency division. We can make the wired-AND output go high after the desired count is reached by using the jumpers to select which counter outputs are connected to the wired-AND. Here's how it works: Say that we want U1 to divide the counter's input clock by 35. First, convert 35 to a 12 bit binary number with one digit for each counter output: 000000100011B (the right-most B denotes a binary number) with Q_{11} corresponding to the *most significant bit* (MSB) on the left and Q_0 to the *least significant bit* (LSB) on the right. This describes the counter outputs after 35 low to high transitions of the input signal: Q_0, Q_1 and Q_5 are high and all the rest are low.

If these three jumpers (J0, J1 and J5) are connected and the other jumpers disconnected, the wired-AND will go high as the count of 35 is reached. The other jumpers are not connected because we don't want the wired-AND to go high at any other count but 35. When 35 is reached that is the first time the combination of counter outputs will cause the wired-AND to go high. It doesn't matter if any higher count causes Q_0, Q_1 and Q_5 to be high (such as 37, 39, etc) because the counter will not reach those values.

The wired-AND output is the J input to the flip-flop U2A, so the Q output of U2A will go high at the following low to high transition of the input signal at U2A's clock input. (The input signal is inverted by U3B, a NOR gate wired as an inverter, so that it acts at the same time as the ripple counter's clock.) U2A's $\overline{Q}$ output is also connected to U1's reset input, causing all of the flip-flop Q outputs, the wired-AND output, and U2A's J input to go low. At the next input signal low to high transition, one input cycle later, U2A's Q output returns to low, creating a pulse one input signal cycle long. The pulse occurs every 35 counts, so the input frequency has been divided by 35!

Squaring the Cycle

We could stop here, but if we are going to use the circuit as a frequency reference, it would be preferable to have a symmetrical output. That is the function of U2B, the other half of the 74HC4027. This flip-flop divides its input signal frequency by two, producing a square wave. So, if the jumpers are set to divide the input frequency, f_{in}, by N, the circuit's output frequency will be f_{in} / 2N. The sharp edges of the 74HC series logic signals are rich in harmonics, making an especially good *marker generator* for a homebrew receiver. If you do intend to use the circuit as a receiver calibrator use a metal enclosure, filter the input power well, and connect only the output signal to a short antenna.

The caveat regarding the ripple counter's asynchronous operation involves propagation delay through the counter as compared to the shortest input cycle period. For the circuit of U2A to function properly, its J input must be high *before* its clock input signal's low to high transition. Since the J input won't be high until the most significant ripple counter output connected to the wired-AND goes high, the total propagation delay through the ripple counter must be *less* than input signal period or a reset pulse won't be generated. Using typical values for propagation delay from the CLOCK input to Q_n at power supply voltages of 4.5 V, it takes 17 + 11 × 10 = 127 ns from the input for Q_{11} to change. That puts an upper limit of 1 / 127 ns = 7.87 MHz on the input signal if the Q_{11} output is to be used, although the limit is higher with lower values of N.

Figure 3 shows an oscillator circuit that can be used for crystals above a few hundred kHz and for tuning fork crystals that operate at 32 kHz or lower. You can use any input signal as long as it meets the 74HC4040 requirements for logic high and low levels. Crystal manufacturers usually publish application notes showing how to make an oscillator at any frequency.

Parts List

74HC4001 — quad NOR gate IC.
CD4027 IC — dual D type flip-flop IC.
74HC4040 — 12 stage ripple counter IC.
12 — 1N4148 signal diodes.
2 — 100 nF capacitor.
270 pF and 470 pF capacitors (assuming high-frequency crystal).
4.7 kΩ, 330 kΩ and 4.7 MΩ resistors.

Recommended Reading

The ARRL Handbook's updated "Digital Basics" chapter has a good discussion of counters and other digital concepts.[3] Your library may have the terrific *CMOS Cookbook* on the shelves, as well, with many other great counter circuits.[4]

[3]*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**.

[4]D. Lancaster, rev by H. Berlin, *CMOS Cookbook*, Howard W. Sams & Company, 1988.

Velleman SOL8 Solar Panel and SOL4UCN2 Charge Controller

Reviewed by Joel R. Hallas, W1ZR, QST Technical Editor, **w1zr@arrl.org**

The 13 W Velleman SOL8 portable solar panel is actually two separate panels that fold in half to become a 20.5 × 13.5 inch "suitcase" (plus handle), making it handy for use on a picnic table or ARRL Field Day location. The SOL8 includes built-in elevation supports that orient the panels at a fixed 58° from vertical, a good compromise for operation in mid latitudes.

The panel is held in the folded position by strong magnets, as I figured out while trying to get it open. Once open, a blue LED indicates that it is generating voltage. The panel, designed with battery charging in mind, comes equipped with adapter cables to allow plugging into a vehicle "cigar lighter" type connector, as well as battery clips and a cigar lighter type socket designed to power accessories. The panel has a built-in polarity protection diode to prevent the battery from discharging through the panel. (A solar panel doesn't work in reverse; it will not emit light if driven backwards, although smoke is a possibility!)

The panel instructions say that the panel will not overcharge a battery. That may be true, but the specified maximum 17.5 V (measured by the ARRL Lab at up to 23 V in full sunlight) output could certainly "overcharge" a radio. Many transceiver POWER switches do not turn off the entire radio. They allow the amplifier stages to stay powered on, but without forward bias so they don't draw current, making for maximum voltage. While having a rechargeable battery in shunt with the panel and a radio would likely keep the voltage within bounds, a loose battery connection could result in radio damage.

Enter the Charge Controller

The optional SOL4UCN2 Charge Controller interconnects one or two solar panels, a battery and the load. It manages the battery charging process and also limits the dc output toward the load to a nominal 12 V (3 and 6 V dc jacks are also provided). The charge controller also protects the battery by not delivering power if the battery voltage drops below 10.5 and limits the charging voltage to 15 V. The controller's LOAD output is about 0.5-0.75 V below the battery voltage, depending on load current.

I personally would not consider connecting a radio to the system without having a charge controller in line. Since I'm a belt and suspenders kind of guy, I would further protect the radio from high voltage (from any source) with a high voltage protector, as described in a recent *QST* article.[1]

N1BKE

ARRL Lab Test Engineer Bob Allison, WB1GCM, taking data on the SOL8 outside ARRL Headquarters.

The compact controller is designed to interconnect one or two panels to a 10 to 40 Ah battery and deliver a maximum charge current of 4 A (more than two of these panels can provide).

On the Air with a Solar Station

We did our testing with a compact sealed 12 Ah battery, a nice size for this setup. The Velleman panel and charge controller proved to be highly reliable. The panel provided more than enough power to keep the battery charged, even under overcast skies.

A typical rule of thumb is that to avoid battery damage, do not discharge to less than 50% of capacity. If we operate at less than the 0.75 A charge level, that provides a useful capacity of up to 6 Ah, meaning that during periods of darkness, about 8 hours of operation would be feasible.

The actual operation time will depend on the particular radio used, the fraction of time in transmit mode and the duty cycle of the mode used. The combination battery, panel and controller easily ran a 5 W HF (QRP) rig all day. Lab data from some typical recent reviews of QRP sets indicate receiver current at about 0.05 A and transmit peak at 0.8 A. CW tends to have a transmit duty cycle of 50%, SSB a bit less. For CW, that would average 0.5 × (0.8 + 0.05) = 0.43 A while transmitting. Thus a contest operator who listens half the time would draw an average current of about 0.5 × (0.43 + 0.05) or about 0.24 A, giving a comfortable margin. Another possibility would be a 5 W FM VHF handheld transceiver. It draws full transmit current, generally more than 0.75 A, the whole time it's transmitting, however. Still, it should work well in the usual transmit-receive mix of an EmComm net, for example.

A heavier duty transceiver could also be used, if not used as much. Check the *QST* Product Review archives for the radio you're considering and look at the measured transmit and receive current requirements.[2] Note that while the QRP HF radios can often operate down to 11 V or less, other radios generally can't. If you expect to need to operate down to the controller's 10.5 V minimum output, consider adding a boost regulator to your solar go-kit.

Manufacturer: Velleman Inc, 7354 Tower St, Fort Worth, TX 76118; tel 817-284-7785; **www.vellemanusa.com**. *Price: SOL8, $199.95: SOL4UCN2, $39.95. Lower prices are available from some dealers.*

[1] P. Salas, AD5X, "A Compact Voltage Protector and Fuse Assembly for 100 W Transceivers," *QST*, Apr 2010, pp 30-32.

[2] **www.arrl.org/reviews**

AG1YK

HINTS & KINKS

MOBILE LOGBOOK

◊At Dayton 2008 I kept seeing call sign tags and thinking, "I think I worked that guy at some point in time." Wouldn't it be nice to have a logbook on one of the new handheld phone devices where I could search the call quickly? If a call was found it would allow me to strike up a conversation showing him the contact in the log and possibly filling out a QSL for him if he wanted one.

After coming home from Dayton I approached all my techie friends and posed the problem to them with the following requirements:

- Have a mobile handheld logbook that would hold at least 50,000 contacts with time, date, band, mode and call.
- Have a search time of less than 10 seconds so that if I saw someone and entered the call, I could find them in the log before they disappeared.

We started out with a friend's Palm Pilot, but could not find any available programs that would meet the requirements. Most of the year passed with no progress. Then a coworker's cousin who was upgrading his phone let me have his old T-Mobile Wing. The nice thing about it is that when connected to a computer via a USB cable it acts like a thumb drive and you can transfer files back and forth between the Wing and the main computer. The Wing also has *Windows Mobile* and *Excel Mobile* installed.

I use *DX4WIN* as a normal record keeping program on my main computer. Mack, N4SS, suggested that I export the *DX4WIN* file as a .CSV file, which *DX4WIN* will generate. Then, still on the main computer, open the .CSV file with *Excel*, which accepts .CSV files. After cleaning up the *Excel* version of the *DX4WIN* file, export it to the Wing's *Excel Mobile*. It worked easily but we did have a few minor things to contend with.

We discovered that my version of *Excel Mobile* would only accept 16,384 contacts of the 41,000 we exported to it. The next suggestion was to divide the 41,000 into individual sheets, which would be set up in alphanumeric order so I could select the sheet I wanted to search from. The first try was with three sheets, 1-J, K-R and S-Z. This made each sheet cover about 13,000 contacts. The worst case search time on each sheet was around 10 seconds so, to reduce the search time, my plans are to divide it up even more.

During these tests the thought was to expand the Wing's memory with an 8 GB SD memory card. Unfortunately, we found that the Wing only stores data in the external memory card and does not actually run programs in that area. The Wing does have a fixed amount of onboard memory so the data being used by *Excel Mobile* had to be kept within certain limits. All manipulation of the *Excel* file is done on the main computer before exporting to the Wing.

Even a computing novice like me found *Mobile Excel* fairly easy to use. You can even do a zoom on the log page to improve readability. I am sure other devices out there will do the same thing but the Wing makes it easy. With technology moving at a high rate I am sure this solution will be outdated soon but the price of used Wings on eBay will come down, making them more available.

Maybe I will see you at Dayton this year and find you in my logbook, which has 21 years of contacts so far. My thanks go to Mack, N4SS, and Larry Griffie for all their help, and to Roark Jones for supplying the Wing. — *73, Mike Greenway, K4PI, 4055 Kings Hwy, Douglasville, GA 30135-3763,* **k4pi@arrl.net**

YAESU FT-530 ALKALINE BATTERY PACK REPAIR

◊The FT-530 is a wonderful dual-band handheld transceiver that I have had for years. The NiCd pack finally died and I tried to keep it alive by breaking open the NiCd pack and recharging each cell individually. After doing this for over 3 years, it is now ready for replacement.

Thankfully, I had the foresight to buy the alkaline battery pack when I purchased the FT-530. Unfortunately, the original design of the pack had three batteries on each half of the plastic shell and, to make a connection between the two halves, there was a spring-tab that was pressed against the docking tab on the other half-shell.

This design never worked well. It never made a good solid electrical connection and, while six fully charged NiMH batteries should have shown close to 8.4 V (1.4 V per cell), it never did. I was always attaching the pack to the FT-530 only to find absolutely no voltage at all. I'd have to take it apart and try cleaning the tabs, then bend the spring-tab so it would sit with a bit more force. After two or more tries it would eventually work — but not well.

I figured that someday I'd come up with a real connection between the two halves. The day came when I wanted to use the rig but found that, once again, the tab was not making a good enough connection even though the batteries were just fine.

I pulled out both battery connection sections and tried to solder a length of desoldering braid size 4 (60-4-5) onto both the spring-tab and docking-tab, only to find that while it soldered with no problem to the docking tab (the one with the battery spring) it refused to solder to the spring tab from the other battery pack half. While the metal used was not aluminum, it acted like it and refused to accept any solder. [The spring-tab is probably nickel plated. Some careful filing should remove the plating. With the plating removed you should be able to solder to the spring-tab. — *Ed.*]

Since I had already cut off part of the spring tab there was no going back. A solu-

PHIL KARRAS, KE3FL

Figure 1 — The alkaline battery pack opened and with two batteries removed to show the desoldering braid jumper.

tion had to be found. The original design of the pack was a simple press fit. The problem with the original design was that it was never able to apply enough force or surface area to insure a good electrical connection. In looking at the situation, I noticed that I could probably fit some of the desoldering braid behind the positive battery plate connected to the spring-tab (see Figure 1). With the battery tip pushing on the plate, there should be more than enough force to insure a good electrical connection and, in fact, there was. — *73, Phil Karras, KE3FL, e-mail via* **cs.yrex.com/ke3fl**

KEEPING THE CRITTERS OUT

♢I have been putting a new M² KT34M triband beam together and wanted to make sure my neighborhood birds did not build a nest in the boom. I looked around for a solution and found that a rain gutter downspout strainer, found in any lumber store, worked perfectly. I drilled a small hole in the boom and used a stainless steel key ring to make sure the screen stayed in place (see Figure 2). I also sprayed the gutter screen with a clear spray just to add some extra weather protection. — *73, Ron Toyne, WAØAJF, 1220 Hertz Dr SE, Cedar Rapids, IA 52403,* **wa0ajf@aol.com**

RON TOYNE, WAØAJF

Figure 2 — The downspout strainer secured in the end of the boom will keep the critters out.

SOLVING AN EMI PROBLEM

♢Shortly after having my new combo Internet/telephone/television system installed, I discovered RF from my transceiver was scrambling the residential gateway (modem). As little as 25 W was enough to cause havoc. The detective work began by determining how the RF was getting into the modem. It was either entering via the power source, the CAT 6 input cable, the RG-6 feeding the televisions, the USB cable to my computer or via direct radiation.

One at a time I disconnected the RG-6 cables, the USB cable and the CAT 6 cable with no success. Since the modem had a battery backup, I then disconnected the 120 V ac power supply to the modem and let it run on battery backup. Now the modem was naked with no input or output wiring and running on the battery; a quick transmission on 80 meters still scrambled the modem. I therefore verified the modem was sensitive to direct radiation.

Since the modem was housed in a plastic case and there was no direct attachment available for an earth ground, I decided to construct a Faraday shield to surround the modem. I remembered I had saved some scrap aluminum window screen so I made a pattern and cut and folded the screen to form a box for the modem.

I attached two AWG 12 flexible pigtails to the screen box and attached the other end of each pigtail to the cover screw of a nearby 240 V ac junction box providing power to my linear amplifier. The neutral for the 240 V ac cable coming from the main breaker box is somewhere around an AWG 6, only about 15 feet long and is tied to earth ground. [*Warning* — The neutral wire in your home's electrical system, while grounded by the power company, is *not an electrical safety ground* but an active part of the ac power circuit. A safety ground should be wired directly to the green safety ground wire in the outlet box or directly to the earth ground point with a separate piece of wire. If you are unsure about proper safety grounding, contact a licensed electrician. — *Ed.*]

I slid the modem into the screen box, reconnected all the leads and was ready for an RF test. I incremented the RF power from 25 W to the legal limit and from 160 meters to 6 meters and the modem never missed a lick — problem solved. I used an available convenient earth ground, but depending on your individual situation, experimentation is the key to finding a safe and effective ground. I later made a more permanent shield using some aluminum sheet metal I had lying around. This solution will not only make you happy but also a nearby neighbor whose TV or Internet suddenly drops out when you transmit and he doesn't know why. — *73, Joe Vlk, W8DCQ, 3967 Shoshone Ct, Oxford, MI 48370-2933,* **w8dcq@arrl.net**

TUNE-UP FOR THE TEN-TEC 238B TUNER

♢The very popular Ten-Tec 238 series of antenna tuners utilize a very efficient L network, with wide ranging antenna-matching capabilities. This tuner was reviewed in the February 2003 issue of *QST*.[1] Now into their third generation, the latest "C" version offers improvements in metering.

[1]J. Parise, W1UK, "*QST* Reviews Five High-Power Antenna Tuners," *QST*, Feb 2003, pp 69-75.

I personally own the model "B" and have achieved excellent results with it. Here are two simple modifications that can improve the 238's operation. The changes involve the addition of a switch to control the meter lamp and installation of two electrolytic capacitors to damp the response of the SWR meter.

The switch, a miniature SPST toggle variety, is mounted in a hole drilled in the rear of the chassis, directly above the 13.5 V dc meter light connector. The wire from the power connector is disconnected and soldered to one terminal of the switch. An added wire is soldered from the remaining switch terminal to the vacant terminal of the power connector. (I also replaced the RCA-style phono connector with a coaxial power connector, which seems to be more conventional these days.) [It is a good idea to replace an RCA power connector on any unit so equipped with a coaxial one. This avoids the risk of accidently shorting the 12 V on the center pin to the chassis while plugging it on. If the 12 V source is a wall wart this is probably not that important. If the source is the accessory 12 V output of some radios, it can destroy a PC board trace. — *Ed.*]

The meter response damping is achieved by the installation of two parallel capacitors (220 µF and 470 µF) directly across the meter terminals (see Figure 3). Be sure to observe

STEVE VANSICKLE, WB2HPR

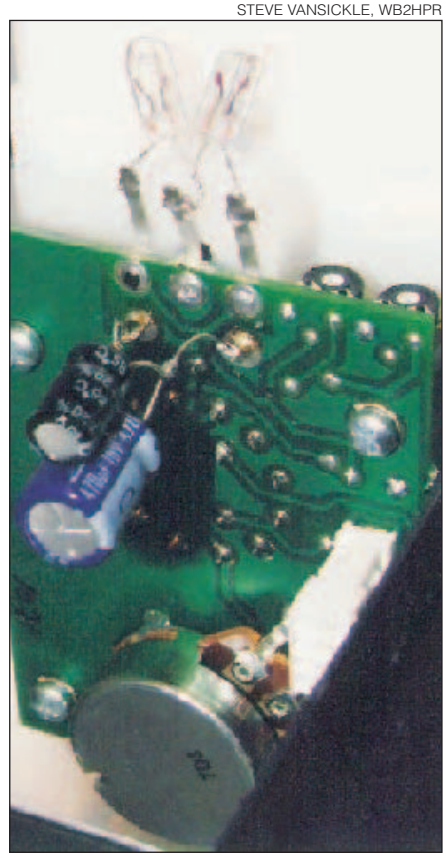


Figure 3 — The two capacitors soldered in parallel to the meter board.

the correct polarity. Their combined value is 690 µF, with a voltage rating of 16 V. This value was arrived at by trial and error and "tames" the jerky response of the meter indicator very nicely. Since the detector portion of the metering circuit is not involved, there is no difference in meter reading, other than the time required for the meter's needle to settle. Also, there is no more pointer slap when using CW.

Now, tuning is much easier, with a smooth meter response and I no longer have to unplug the wall wart power supply when I've finished operating. — *73, Steve VanSickle, WB2HPR, 3010 Tibbits Ave, Troy, NY 12180,* **wb2hpr@arrl.net**

GEL CELL MAINTENANCE

◊Being in the commercial fire alarm industry, I deal with a *lot* of gel-cell batteries, the most common size being the 7 Ah. Having been in the industry since 1982, I speak from experience when I tell you that the "expected" life of these batteries is around 3 to 4 years in average service. As a matter of fact, our fire codes *require* they be changed at 4 year intervals. Now, you may get more life from them, but you can only *depend upon them* for 3.5 to 4 years. Considering that the name of the game is emergency preparedness, I'd paraphrase my Uncle Bill's admonition about motor oil and motors, this way: "Batteries are cheap, lives aren't!"

I'd also comment on testing them — nothing works as well as a *real load*. Old automobile headlights draw about 3-4 A at 12 V dc making them a great test load (plus you can *see* the rate of change). I made my test load from seven 47 Ω, 10 W resistors in parallel (that's 6.7 Ω), which at 12 V dc yields a current draw of 1.79 A and at 24 V dc (typical fire alarm control panel voltage) gives you a drain of 3.6 A. All the new testers I've tried have been outshined by this tried-and-true method, which provides "real life" information. Lastly, *do not* keep those batteries on charge, all the time. You *must* cycle them (some chargers do a pretty good job of this).

As we learned in the Navy — never depend upon something that you haven't maintained *and* tested, properly! — *73, Tom Dailey, WØEAJ, 270 S Lafayette St, Denver, CO 80209-2524,* **daileyservices@qwest.net**

TRI-BAND LAMP ANTENNA

◊Need to get a little more range from your handheld transceiver for the weekly net? This is a simple arrangement that can turn any household lamp into an antenna to help those 5 W along (see Figure 4). To build the "lamptenna" you will need a 1/16 × 1½ inch aluminum strip, an SO-239 with threaded stud and a telescopic rod antenna with

BOB EVANS, WBØSVS

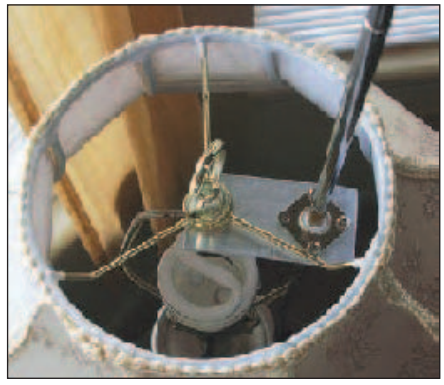


Figure 4 — The business end of the "lamptenna" connected and ready to get on the air.

3 mm female thread. The SO-239 and antenna are available from the author. To build the antenna:

1. Saw the aluminum strip to a 3 inch length to form the support bracket
2. Layout and drill two ¼ inch diameter holes, ½ inch from each end.
3. Punch a 5/8 inch diameter hole at one end
4. Place the SO-239 in the hole. Mark the four mounting holes, drill 1/8 inch holes and mount the connector.
5. Install the telescopic rod antenna onto the SO-239.

To use the antenna, find a medium size table lamp, remove the finial and shade. Next, place the bracket onto the lamp's hoop stud and replace shade and finial. Route the coax alongside the hoop using a wire bag tie. Note that conical shaped lamp shades seem to work the best. Extend telescopic rod to 19¼ inches for 2 meters, 12½ inches for 1.25 meters or 6¼ inches for 70 cm.

For a single band version use a common SO-239 and solder a 5/32 inch OD brass tube to the center conductor. Use a 6¼ inch length of tubing for 70 cm. For lower frequencies use a 12 inch length of 5/32 inch tube with a 1/8 inch tube telescoped inside. For 2 meters extend the tube to 19¼ inches or 12½ inches for 1.25 meters. Add a brass round head machine screw at top to finish it off. [The "lamptenna" should only be used for low power — 5 W or less — transceivers and it should be used with coax long enough to allow yourself to sit a few feet away from the antenna when operating. — *Ed.*] — *73, Bob Evans, WBØSVS, 2253 Norwegian Dr, Apt 25, Clearwater, FL 33763-2904,* **beach_bob@msn.com**

SILVER SHARPIES

◊Over the years, I've seen various methods of tagging wall wart type power supplies, those annoyingly prolific little black cubes that seem to fill up drawers and boxes as the devices they power become damaged and discarded or lost. Sometimes they get mixed together with others and you have to use a magnifying glass to read the voltage and amperage in an attempt to join the power cubes with their respective devices.

I discovered that a silver-colored Sharpie pen is ideal for marking directly on the exterior surface of these devices. You can write the name of the device the cube belongs to, the voltage and amperage rating, polarity information and whether it's an ac or dc device. Unlike attaching tags on the wire, the permanent Sharpie markings are difficult to remove once dry. You can also highlight the information molded into the device housing to make it easier to read by lightly rubbing the edge of the Sharpie point across the surface of embossed lettering.

Silver Sharpie markers are also ideal for restoring raised silver lettering and numbering on the faces of radios where the color has been rubbed off. I used one to color the MIC, PH and CW legends on the front of my Ten-Tec Orion II because the black background made the black embossed lettering difficult to read. Some radios have silver trim rings and the Sharpie is ideal for hiding small scratches and dings in these rings. Sharpie markers are also available in gold and other colors for custom applications. — *73, Webster Williams, WY3X, 4305 Fernwood Rd, Myrtle Beach, SC 29579,* **wy3x@arrl.net**

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

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

Feedback

◊In Table 1 of "Product Review — Yaesu FTDX5000D HF and 6 Meter Transceiver" [Dec 2010, pp 42-47], we reported the serial number as 0**0**020034. Upon closer examination, the actual serial number turned out to be 0**D**020034.

In the same review, the heading "Receiver Dynamic Testing, Receiver B" on the top of page 45 should actually be just above the table entry "SSB/CW sensitivity" — that's where receiver B starts. The heading on the top of page 45 should read "Receiver Dynamic Testing, Receiver A — Continued."

LoTW – A Modern Tool for Awards-Hunting

Logbook of The World is a paper free and fast way to get that DX contact confirmed.

Parke Slater, N4KFT

Rosy government reports of the "end" of the US recession notwithstanding, I am timidly watching where I spend my money. That goes for QSLing, too. Want to confirm a DX contact? Altogether that will cost you just under 3 US dollars. The bank envelope of dollar bills I keep on my desk is growing thin these days.

I am often dismayed when I look up the QSL route for DX entities, only to find that they want two, three, or even 5 US dollars to confirm a contact. Yes, I know the dollar isn't as strong as it once was and that foreign postage rates have also risen. But adding international postage rates to the money requested to offset the DX station's costs can quickly add up if you're an active DXer chasing an award.

Why Do I Need a QSL Card?

One might ask, "Why do you need QSL confirmation when you can just say you've worked North Korea?"

A friend gave me some options for making and printing my own awards. I mulled the idea before dismissing it. Be they for recreation or professional purposes, our world is filled with recognitions, awards, certifications and degrees that are meaningful only because they are conferred by outside bodies. The doctorate degree I could create using my color laser printer would be just as hollow as the log entry and self-made certificate claiming I had bagged North Korea (ever-doubting hams aside).

Who would know? I would. What pride would I really have in making such a bogus claim?

An Accrediting Body

In the scholastic world universities are able to award diplomas themselves, but they go the additional step of subjecting their courses and policies to an accrediting body. Higher standards mean tougher requirements. Tougher requirements mean recognition of one's perseverance toward the award. In short, I could claim to have worked the world's number 1 most wanted DX entity. But it's quite another thing to have an accrediting body to certify my claim.

A Problem and a Solution

Problems in obtaining QSLs remain, such as ever-rising postal costs, confirmation timelags often measured in years, some postal authorities removing "compensation" from envelopes and outright lost mail. Is there a way to overcome these obstacles? Yes.

Enter Logbook of the World (LoTW). I was more than a little dubious when LoTW was introduced and ham radio caught up to technology in this regard, partly because I still like paper. I feel like it's Christmas when I see a bureau envelope arrive in the mail. I recently stopped on my visit to Tortola, British Virgin Islands to exchange QSL cards with George Collingston, VP2VQ. It's priceless to meet a ham with whom you have spoken, shake hands and exchange paper but that does not happen every day. Given that impracticality, the economy and other factors, I vowed to upload my log regularly.

Parke, N4KFT, and George, VP2VQ, exchange traditional QSL cards on the author's visit to Tortola, British Virgin Islands.

Roy Davis, WK4Y, was not a member of the DX Century Club until he uploaded 50 years' worth of contacts. Here Roy poses with his 5-band DXCC earned entirely through LoTW.

Although only modestly DXing at the time I began participating, I followed the instructions and obtained my LoTW certificate (**www.arrl.org/logbook-of-the-world**). In the beginning the process seemed mechanical and awkward. But now I find that within 2 minutes I can export, authenticate and convert my log for uploading to LoTW. By e-mailing the signed file, I often receive a reply within minutes, telling me I have new countries confirmed. The process has become effortless and the rewards often instantaneous.

Proving It

Dominion DX Group (DDXG) club member Bruce, WD4LBR, challenged fellow member Roy, WK4Y, to upload his log. Licensed in 1957 as KN4QIT, Roy characterized his activity with ham radio as "playing," until he began contesting in 1982. "I would have tried to get DXCC before, but I always had trouble getting contacts confirmed," he said. Others share that frustration.

Bruce was fearful that the 42,000 contacts Roy had logged in his

52 years of Amateur Radio might be problematic to upload at one time, so he broke the file into four equal parts. Minutes after the upload, Roy went from having no award of record, to having an instant 5-band DXCC. [While LoTW is free, a fee may be required before an award can be issued. — *Ed.*]

One day Bruce said in passing, "Wouldn't that be something if the club could get DXCC under its own call, K4VAC?" That sounded like a challenge to me. But as a young club of only 6 years and with a limited membership, the contact count was lean. A check of the club's uploaded log further revealed that only a very small number of LoTW contacts had been confirmed.

Wrestling with the costs and effort that manual QSLing with cards would entail, the project was almost abandoned as a pipe dream. So we agreed we should consider making our DXCC quest strictly a LoTW effort. That would eliminate needing club funds to confirm the entities, but require more effort because not all hams participate. Conversely, we realized that by using LoTW, we would greatly shorten the time required to confirm the contacts. The club concurred and several of the members went to work.

They were instructed on how to submit contacts on behalf of the club to the trustee and to make sure they operated within their own license privileges. Periodically the trustee uploaded the logs and slowly the numbers began to climb. Members were encouraged to log contacts for K4VAC when they worked a station for themselves and all were kept abreast of the progress. The LoTW DXCC award page became marked in members' "favorites" URL list, and regular checks and e-mails of the country count helped keep the momentum. Finally, the 100th contact was TX3A, the Chesterfield Islands DXpedition, which was confirmed via LoTW within 24 hours of the contact. The club has since attained DXCC on 20 meters with a phone endorsement.

A Growing Trend

While some hams decline to participate in LoTW, it has become obvious that the numbers are growing. DDXG member Marcus, WV4Y, reported confirming Djibouti within 24 hours and I have seen relatively rare entities like Glorioso Island, West Malaysia and Cambodia confirmed for DXCC credit in less than a week.

Many of the Dominion DX Group's members noticed interesting trends with regard to LoTW. When I participated with the club in the January 2009 RTTY Roundup, I made my first ever RTTY contacts. In the 11 months that followed I logged 1100 contacts in that mode, with 35 percent QSLing via LoTW so far. Marcus, WV4Y, agrees that RTTY and LoTW seem to have a common denominator. "I called CQ DX on RTTY for 2 hours one afternoon, and 1 week later over 15 percent of those contacts were confirmed (by LoTW)." Those numbers continue to climb. I participated in the OK RTTY contest and again had 40 percent LoTW confirmation within 24 hours. Yes, the technological nexus between RTTY and Internet use seems to contribute to a higher-than-normal LoTW QSLing rate.

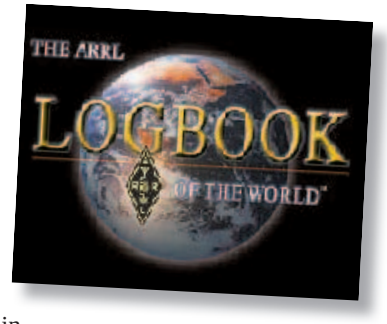
Members of the Dominion DX Group pose with their Club DXCC award, earned exclusively through LoTW. The club presented all participants with a miniaturized copy of the certificate.

"Just because someone's QRZ.com profile does not indicate they use LoTW, that may not be true," Marcus said. He worked a station who said, "QSL buro or direct." A few days later he found that contact confirmed online. Indeed, as today's hams gradually discover the benefits of LoTW, you'll be surprised as you confirm old contacts in the future.

Are there downsides to LoTW? I've identified two.

First, the safeguards the ARRL uses to ensure the integrity of the QSL process make LoTW cumbersome to initially set up. But once you are up and running, exporting and uploading quickly become second nature.

Second, in 2009 I worked the Desecheo Island DXpedition in several band slots. Like most hams who QSLed the K5D team, I included sufficient cash in the envelope to cover the QSL reply and also help offset the operation's expenses. Hams who benefit from DXpedition uploads to LoTW must still remain aware of the need to help these efforts. Sending a donation is a great way to not only support the effort, but to say "thanks" for confirming the entity quickly. Ways to contribute to an operation can usually be found on the DXpedition's Web page.



Now my elation over bureau envelopes in the mail has been largely replaced with anticipation of checking my LoTW QSLs online. The savings in time and money make Logbook of the World a wise choice in the electronic age. As more and more hams become LoTW users, our awards will come more quickly for us all and at an increased savings. Good economy or bad, I never have been one to throw money away. LoTW provides a way to acquire the awards you may be seeking, allowing you to save your cash, or spend it on more radio gear.

Get registered and upload, and you'll also reap a savings in the time you'd otherwise spend QSLing paper — and that's more time you'll have for DXing.

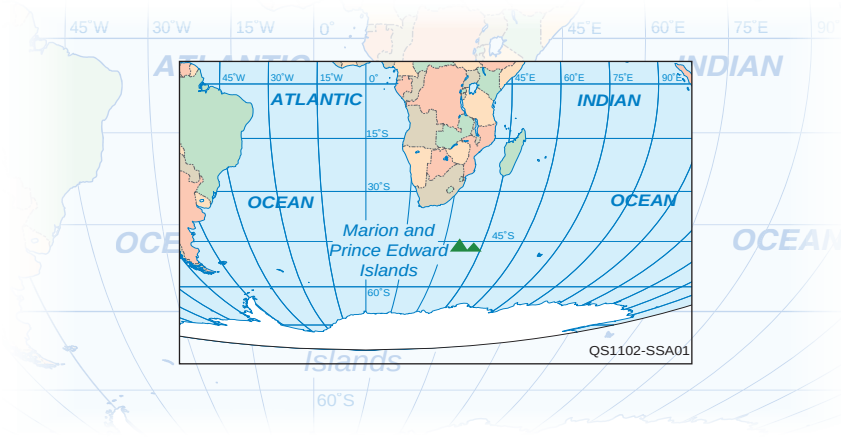
Photos courtesy Parke Slater, N4KFT.

Parke Slater, N4KFT, an ARRL member, is an Amateur Extra class licensee and a police sergeant in Henrico County Virginia. He has attained DXCC on 20, 40 and 15 meters. He has DXCC endorsements for Mixed, Phone, CW and RTTY and is a charter member of the Dominion DX Group (DDXG). Both his son Andrew, K4PUF, and daughter Amanda, KG4NBF, are also licensed. Parke can be contacted at **n4kft@arrl.net**.

Where in the World is Marion Island?

Geographic resources add color to the countries you contact.

Steve Sant Andrea, AG1YK



You finish typing and look at the monitor to admire your log entry. Marion Island, ZS8, the third most wanted DX country and you snagged it before it got up on the cluster and the pileup began. Your contact was brief but the operator at the other end said he was working at a research station studying Antarctic wildlife.

"I guess he is in Antarctica somewhere," you think. "I wonder where exactly?"

Ham radio is an international hobby. When you turn on the rig you never know who is going to come back to your CQ. The other ham may be in the center of a bustling European metropolis or in some small remote outpost. Through the magic of radio we can learn about far-off places and get the inside story from a native. Still, in some situations, as with Marion Island a very desirable DX location, the operator at the other end may not have the time to chew the rag about why he's there and what it's like.

The World on Your Monitor

So how do you find out about a country, city or island that you have in your log? Well, first you need to determine the country. If you had been 5 minutes later finding Marion Island you would have had to work him through the pileup and might only have gotten his call and a signal report. What then?

The ARRL Operating Manual has a detailed listing of all the prefixes along with their assigned countries. Another useful work is the *Radio Amateurs World Atlas*, which provides a two way cross reference to prefixes and countries plus locator maps.[1]

Once you have converted the prefix into a country, the next stop is the Internet.

For a remote entity like Marion Island, **Wikipedia.org**, the online encyclopedia is a great place to start. Typing in Marion Island gives you an overview including information on its geology, climate, wildlife and history. Wikipedia even includes an aerial map and a global projection showing you that — surprise! — Marion Island isn't in Antarctica but in the Indian Ocean about halfway between South Africa and Antarctica. The Wikipedia entry even includes a note that identifies it as the third most wanted DX entity!

What about a place like Kyrgyzstan? The November 2010 issue of *QST* included a story about an EMExpediton there but where exactly is there?[2] You can also try Wikipedia and get quite a bit of information, but since Kyrgyzstan is a country in the political sense other sources are available.

A good stop for country information is the CIA. Yes, *that* CIA. If you go to **www.cia.gov** and click on World Factbook you will open the CIA's world information archive. Click SELECT A COUNTRY OR LOCATION to open a list. Select Kyrgyzstan, or any other country you may have in your log, and you will find a concise snapshot of your country of interest.

The World Factbook includes a general introduction to the country as well as information on its geography, people, government, economy, communications, transportation, military and "transnational issues." You'll also find a map of the country, a locator map showing its location, a picture of its flag and photographs of the country.

What about that LX call sign you have in your log — he said he was in Luxembourg, not a country often in the news. Well, the previous two resources can certainly provide you with information but **news.bbc.co.uk/2/hi/country_profiles** will give you a European perspective. Once there, in the EUROPE area, click on Choose a country and select Luxembourg to open a snapshot that includes links to Luxembourg's newspapers, television and radio stations. Want more information?

Next try **www.state.gov**. The US State Department's Web site has links to all the world's countries. Each link gives a detailed summary of the country's geography, people, economy, political structure and travel information. Most important, the State Department Web site provides a link to the Luxembourg Embassy Web site where you can learn about the country "from the horse's mouth," so to speak.

Hold the World in Your Hands

"That's all well and good," you might respond, "but I have a hard time getting the computer away from the kids. What's a good resource I can hold in my hands?"

Many different atlases are available. Good ones are published by National Geographic, the World Book Encyclopedia and Hammond. The best way to decide on which you should have in your shack is to visit your local library. There you can look them over, page through them and see what information they have to offer, how readable they are and how easy they are to use.

Bring along the names of one or two countries from your log for research. Atlases provide background information. The library's map section will have a collection of large scale maps of various areas of the world. For real detail, you might try an encyclopedia or wander over to the stacks and look for the 900 series books. There you will find individual books on everything to do with the world and the places in it — perhaps including Marion Island!

Steve Sant Andrea is an Assistant Editor at QST. *He can be reached at* **ag1yk@arrl.org**.

[1]Available from your local ARRL dealer, or from the ARRL Bookstore. 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]M.Chirkov, UN8GC, and O. Ivin, EX8MLT, "Working Ultra Long Path from the Eye of the World," *QST*, Nov 2010, pp 69-71.

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.

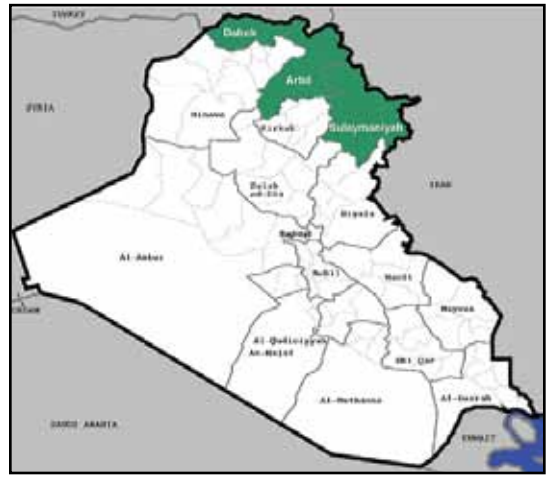


Figure 1 — Map of Kurdistan, Iraq showing Erbil (Arbil), our operating location, near the center.

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.

The core team arrived between March 31 and April 2, 2010. With Bill Beyer, N2WB, and Bob Grimmick, N6OX, arriving on March 31 and Krassimir Petkov, K1LZ, and Hranislav Milosevic, YT1AD, joining the team on the evening of April 9 to participate in the last 2 days of the trip.

Our primary contact in Iraq was Heathem, YI1UNH, who proved to be very valuable in coordinating resources. He also provided tourism support for our team members during off-operating hours.

Bill, N2WB, proved to be valuable in soliciting for donations while Bob, N6OX, and George Williams, N6NKT, provided much needed support during beam antenna and computer checkout in California prior to shipping the equipment to Iraq in early March.

Figure 3 — Jun Tanaka, JH4RHF, racking up RTTY contacts.

Band and Mode Breakdown

Band	*SSB*	*CW*	*RTTY*	*Total*
160	270	1713	0	1,983
80	1605	2193	1	3,799
40	4004	3690	260	7,954
30	—	3256	891	4,147
20	8244	8004	1079	17,327
17	5478	2896	1015	9,389
15	3007	2387	210	5,604
12	143	15	1	159
10	12	27	0	39
Totals	22,763	24,181	3,457	50,401

Planning the Trip

The Station and Antenna Installation Plan was revised numerous times prior to our departure. We had to make a lot of tough decisions that took into account the availability of team contributions and donations. Sometimes what you want to bring and what you end up with are clearly not the same.

We were blessed to have ICOM providing us with five IC-7600 HF rigs and ACOM (K1LZ) who loaned us four amplifiers (two ACOM 1000s and two ACOM 1010s) that performed exceptionally well. In addition, SteppIR loaned us two Big IR verticals and two 2 element SteppIR beams that also performed well.

Paul, N6PSE, purchased six new laptops and configured them with the donated *WriteLog* software in advance for our team's use. Jun, JH4RHF, prepared the 240 V ac power cables for the amplifiers and radios plus set up the RTTY effort. I provided two USB WinKeyers (**k1el.tripod.com**) for use at the CW stations.

Assembling the Core Team

Our team was divided into three camps (SSB, RTTY and CW) with Bill, N2WB, leading SSB; Jun, JH4RHF, leading RTTY and myself, K3LP, leading the CW efforts along with 160 meter CW/SSB. Al, K3VN, Bob, N6OX, and the remaining team members participated in the development of the Station and Antenna Installation Plan including site installation and operating.

Traveling to Iraq

Our trip to Iraq ended up being pretty routine. Each of us flew from our own respective locations and arrived in Vienna, Austria. From there, we would fly to Erbil, Iraq.

Because of the war in Iraq, the secured hotel location was expensive, running about $275 USD per night per room. Team members paid for the hotel and airline ticket expenses. The donation money was used for equipment transportation, and purchasing needed supplies and materials. On average, each team member contributed $5000 to $6000 toward the trip.

Locating the Equipment

Our plan was to have the equipment clear customs prior to our arrival on Friday, April 2 and have it sitting at the hotel ready for installation. Our advanced team, Bill and Bob, were unable to get the equipment released on the previous Wednesday or Thursday prior to the local scheduled weekend. Since we arrived on Friday, it was a non-working day and also the Easter Holiday weekend.

The next day, Saturday at 7:30 AM, Paul, N6PSE; Bob, N6OX; Heathem, YI1UNH, and I, K3LP, went to the warehouse. We found that Iraq customs had opened all of the crates and inventoried our equipment. There was just one big problem. Only one of the five ICOM IC-7600 radios was there.

More panic set in. How can we have a successful DXpedition with only one radio? We asked the shipper about our other equipment. More confusion and more pandemonium set in. The shipper did some checking and after about a half an hour, the shipper told us that part of our shipment was still in Dubai, United Arab Emirates.

As we stood around, trying to figure out what to do, we were told that a cargo plane from Dubai had just landed. We waited anxiously as the cargo plane was unloaded. The giant skid was brought to the warehouse and we helped tear the packaging off. We were so glad to see the four large black ICOM Pelican cases.

The shipper sensed our frustration and relief. He agreed to have his truck immediately loaded and deliver our equipment to the hotel on April 3. All of our equipment arrived safely at our hotel around 11:30 AM.

Getting on the Air

Anytime you want to operate SSB, RTTY and CW in close proximity with multiple transmitters for each mode, you are going to have a little stress, okay, sometimes a lot. Beyond the station design (filters, antennas, radios, amplifiers), a little understanding goes a long way. Let's face it, every mode wants to be on the same band at the same time and it's just not possible.

A couple of issues that need to be managed on a DXpedition are the following:

- SSB — keep the HF rig RF power output around 75 W (approximately 11 o'clock) to reduce overdriving the amplifier and interfering with the CW camp (especially when there is no ALC jack on the amp or when you have no ALC cable)
- RTTY — avoid being on the same band as the CW camp and keep the output power as low as possible but keep operating by finding unique placements and opportunities no matter how much negative feedback you get from the other camps
- 160 meters — operate both CW and SSB from the CW camp and move to SSB on the hour for 10 minutes and return to CW
- Gray line map — have open the gray line map and properly manage workable regions. This may mean putting others in timeout, as Jack, WØUCE, calls it, in order to manage the pileup and hear the weak ones.

SSB Camp Activities

Paul, N6PSE, made the first YI9PSE team and SSB contact to kick off our DXpedition

effort. The SSB camp focused on 10 through 80 meters SSB. Bill, N2WB; Al, K3VN; Bob, N6OX; Paul, N6PSE; David, AH6HY; Michel, FM5CD, and Heathem, YI1UNH, did a nice job handing out needed contacts for the next 8½ days.

The antennas used at the SSB camp included a C3S Force 12 Beam, one SteppIR BigIR vertical, a 2 element SteppIR beam and a ¼ wave aluminum vertical for 80 meters.

RTTY Camp Activities

At the RTTY camp, Jun Tanaka, JH4RHF, handed out all the RTTY contacts (see Figure 3). He did a great job minimizing interference issues and exceeded our expected RTTY effort. He is simply a fantastic operator, technically smart and overall a great person. The antenna used at the RTTY camp was a SteppIR vertical with the 80 meter coil.

CW Camp Activities

Initially, Jack, WØUCE, made the first CW contact on 20 meters and quickly exhibited his command of CW by working the pileup with ease over the next 6 hours. Both Jack, WØUCE, and Wayne, W5KDJ, were relentless in keeping CW alive from 0600 until 1800 each day for 10 days.

This allowed me (David, K3LP) time to work on antenna enhancements during the day and operate from 1800 to 0600 on 40 and 80 meter CW and 160 meter SSB and CW each evening to early morning. It was wonderful installing the 160 meter ¼ wave vertical antenna and operating 160 meter CW and SSB as well as 30-80 meters.

The antennas at the CW camp included one 2-element SteppIR Beam, one SteppIR BigIR vertical, a 2 element 40 meter homebrew K3LP wire beam and ¼ wave wire verticals for both 160 and 80 meters supported by the Spider Beam telescoping poles.

Michel, FM5CD, provided CW support during the evening when available from working SSB. It was nice to see Krassy, K1LZ, and Hrane, YT1AD, arrive on the last 2 days of the trip providing additional CW manpower (see Figure 4).

Trip Results

After about 8½ days on the air, we were able to make 50,401 contacts after removing all busted call signs and duplicate contacts from the log. Actual contact total was about 55,000. The operating time started on April 3, 2010 at 15:09 UTC with the last contact occurring on April 12, 2010 at 03:21 UTC. A total of 50,401 contacts (with duplicate and busted call signs removed) and 19,396 unique call signs were made on this DXpedition. Refer to the tables for a breakdown of the numbers.

Figure 4 — Krassy, K1LZ, adding some extra man-power to the CW effort.

DXCC by Band and Mode

Band	*SSB*	*CW*	*RTTY*	*Total*
160	37	63	0	63
80	72	79	1	92
40	101	94	38	116
30	—	86	55	93
20	110	100	61	122
17	110	86	58	118
15	88	83	24	102
12	30	12	1	33
10	6	15	0	19
Totals	145	133	74	165

A Change in Propagation

Toward the middle of the week on April 5, we noticed that propagation really dropped off. A check of **www.spaceweather.com** reported a very strong geomagnetic storm. While we could still work into Europe, the JA stations were much weaker and working North America became quite difficult. This lasted for several days before things improved again. During our last weekend, propagation was again very good. We enjoyed working many West Coast/Zone 3 stations, including many members of the Northern California DX Foundation.

The high point was when Paul, N6PSE, was able to work Reg, K6SSJ, on SSB in his mobile station at his "hot spot" and also worked a big rig trucker who was driving down Highway 80 in Cheyenne, Wyoming. He was very surprised when he found out we were in Iraq.

There was limited activity and no real band openings on 12 and 10 meters. We did not include 6 meters, 2 meters and VHF/UHF/Satellite activities on this trip.

Thanks for the Support

We want to thank the Iraqi Amateur Radio Society (IARS), President Diya N. Al-Asadi, YI1DZ, and staff members for a job well done by issuing our YI9PSE license in a timely manner.

We also want to thank Zerro Sherwani, our hotel general manager, the Ministry of Security in Kurdistan and the Kurd people for being very kind, supportive and great hosts to our DXpedition team.

Where Do We Go Next?

In January 2011, our team members will join the Spratly Island (DXØ) DXpedition, and then in May 2011 we'll head to Afghanistan (YA). We hope to see you on the bands from these exotic locations.

Photos courtesy of David Collingham, K3LP, and Paul Ewing, N6PSE.

David Collingham, K3LP, an ARRL member, was first licensed as a WN6KTF in 1975 at the age of 15 and currently holds an Amateur Extra class license. He is very active in DXpeditions and contesting.

David is the Founder and Executive VP of AQCES International Corporation and International Quality Registrars. He has visited 60 different DXCC entities and operated from 36. He enjoys contesting and is a member of the Potomac Valley Radio Club (PVRC). He is also a life member of the National Capital DX Association (NCDXA). David has published numerous articles in QST *and the* DXCC Year Book *and enjoys youth development. He can be reached at 12410 Glissans Mill Rd, Mt Airy, MD 21771,* **k3lp@yahoo.com**.

Paul Ewing, N6PSE, operates from San Jose, California. He is a member of AMSAT, The Northern California DX Foundation, the Northern California DX Club and a Life member of both the ARRL and INDEXA. He is very active on SSB on 10, 15, 17 and 20 meters and really enjoys chasing new DXCC entities.

In addition to operating as N6PSE, he has operated from the following entities: The UK, Italy, France, Alaska, Hawaii, BVI, US Virgin Islands, Puerto Rico, Jamaica, St Lucia, Barbados, Grand Cayman, Mexico, Italy, Turkey, Egypt, Dodecanese (Rhodes) Greece, Japan and Vietnam.

Paul works in the Information Technology industry in Silicon Valley. In his spare time he likes to tinker with and drive his 1924 Brockway LaFrance Torpedo-Chemical Fire Truck and SCUBA dive. He also volunteers his services to the Doctors Without Borders organization. Paul can be reached at 3052 Wetmore Dr, San Jose, CA 95148, **paul@n6pse.com**.

The Sun Shines on the Granite Bay Montessori Shack

Two young hams design and build a solar power system for their school's shack.

Sylvie Fournier, KI6WZB, Frankie Moirao, KI6QYS, and Brian Lloyd, WB6RQN

During Field Day 2009 our school station used solar power for its operation. After Field Day, when we were back in school, our Science and Technology teacher, Brian Lloyd, WB6RQN, challenged us to design a solar power system for our club station.

You probably thought that you could go out, buy a solar (PV) panel, hook it up to your station and then your station would run off of solar energy. Well, we hate to break it to you, but it is a bit more complicated than that if you want good results. There are many things that you have to do before you convert your station to solar power. Our school applied for and received a grant from the ARRL Education & Technology Program to convert our station to solar power. This article explains how we did it.

Power and Energy Budget

The first step is to create a power and energy budget for the equipment. To do so, follow these steps to find out how much power your equipment uses throughout the day.

1. Find the average current drawn by each radio. To calculate this multiply current used in receive by the average amount of time spent receiving (in percent). Perform the same calculation for transmit and add them together. That will give you your average current in amperes (A_A). For example, if the radio uses 0.2 A on receive, 10 A on transmit and receives 90% of the time, the calculation would be:

$0.2 \text{ A} \times 0.9 = 0.18 \text{ A}_A$
$10 \text{ A} \times 0.1 = 1 \text{ A}_A$

2. To get power, you multiply the average current by the voltage ($A_A \times V$) for each radio. If the average current was 0.5 A at 12 V, the power is 6 W.

3. Now it's time to calculate ampere-hours (Ah) so we can determine the battery capacity. Multiply the total A_A by the hours per day the radio is used to find your Ah requirement. If A_A is 0.5 A and the hours per day is 5, then your radio requires 2.5 Ah per day.

4. Next find the total watt-hours (Wh) by multiplying your power by the hours per day that you use your radios. So, if the power is 6 W and you use that radio 5 hours per day, then the radio requires 30 Wh per day. Do this for each radio then add the individual Ah and Wh values together to determine the total for the whole station. At our school we built a spreadsheet to do the calculations (see Table 1).

Calculating Battery Capacity

The next step is to determine the battery capacity required to run the station without being charged by the PV panel. Take the number of days you want to run without the solar panel (sunless days) and multiply that by how many Ah your station consumes each day to get the required battery Ah capacity.

We wanted to run without solar energy for 3 days. We took the average Ah per day (30 Ah), multiplied it by 3 days and determined we need 90 Ah of storage. The nearest battery capacity available is 98 Ah, which means we can run without solar energy for 3⅓ days.

Calculating PV Panel Capacity

To determine PV panel capacity, you need to know the power and energy budget from step 1. First, take the Wh value and divide it by the minimum hours of sunlight per day (in winter, usually). That will give you the minimum PV panel wattage.

We determined we needed about 365 Wh per day to run our station (see Table 1) and estimated that we get about 8 hours of sunlight each day in the winter. Dividing 8 into 365 means we need a 45 W panel. Since PV panels only produce about half their rated power in real life, we multiply our minimum PV panel wattage by two. This gives us 90 W, which is the minimum PV panel wattage needed for our installation.

We got a really good deal on a 120 W panel on eBay.

Figure 1 — The solar panel attached to the side of the school building adjusted for an angle of 60° to get the most sunlight regardless of the time of year.

Table 1
Power/Energy Budget (12 V)

Device	*Receive A*	*Receive Percent*	*Transmit A*	*Transmit Percent*	*Average A*	*Hours/ Day*	*Ah*	*Wh*
2 m transceiver	0.29	90	11	10	1.36	4	5.44	65.33
HF transceiver	0.54	90	15	10	1.99	4	7.94	95.33
Satellite receiver	0.1	100	—	0	0.1	8	0.8	9.6
440 MHz repeater	0.46	95	4.8	5	0.68	24	16.25	194.98
						Totals	*30.44*	*365.23*

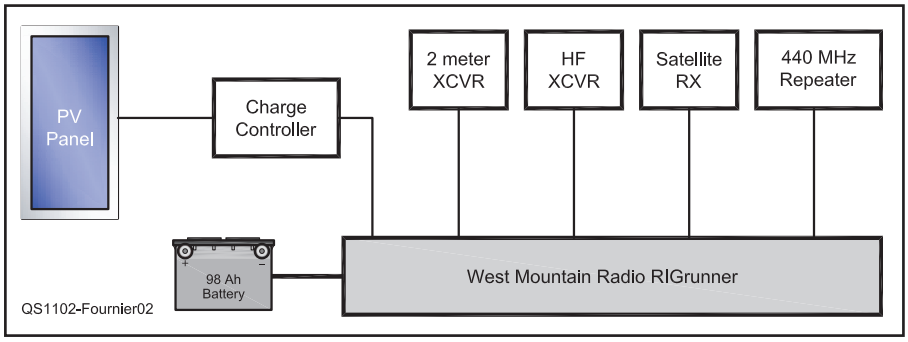


Figure 2 — Block diagram showing how the entire PV system is connected.

Figure 3 — Frankie Moirao, KI6QYS, and Sylvie Fournier, KI6WZB, operate their solar powered station.

Components

With all the design calculations done, the next step is to collect the parts needed to complete the project:

- PV panel
- Charge controller
- Power strip with Powerpole connectors (RIGrunner)
- Battery (meeting the Ah capacity previously calculated)
- Miscellaneous wires and connectors

Picking a Charge Controller

If you connect a PV panel directly to a battery it will overcharge and damage the battery. To prevent damage you need a charge controller. There are basically two kinds of charge controllers, pulse-width modulated (PWM) and maximum power-point (MPP).

The PWM charge controller is simpler and cheaper. It monitors the battery voltage and switches the current from the panel on and off to keep the voltage on the battery from rising above normal charging voltage.

The bad thing with a PWM controller is that it does not let you get the most power out of a panel since most are meant for charging 12 V batteries and put out up to 18 V. This means that you are wasting as much as 30 percent of the capacity of the panel when using a PWM controller.

The MPP charge controller is a special kind of switching power supply that varies the load on the PV panel in order to get the most power out of it. It steps down the panel voltage to that of the battery allowing you to get more current from an MPP controller than from a PWM. The problem with the MPP controller is that it costs more than a PWM unit, but it will allow you to use a smaller, less costly PV panel.

You have to consider how much smaller your PV panels can be if you use an MPP controller and decide if you will save money buying smaller PV panels with an MPP controller. At our school it ended up being about the same cost to use a smaller PV panel with a MPP so that's what we did. After getting our MPP controller, we discovered that it emits RFI that sometimes causes a problem when we operate on HF.

Orienting and Mounting the PV Panel

You'll want to orient your panel to receive maximum sunlight. Here in the Northern Hemisphere, we need to face our panel to the south and adjust it for latitude. On average the mounting angle is the same as your latitude, but because the sun is 22° lower in the winter you add 22° to your latitude to get the final angle. Our latitude is about 38° and adding 22° gives us our mounting angle of 60° (see Figure 1). One of the parents at our school, Andy Brophy, built a mount designed to have the solar panel tilted at the 60° angle we calculated.

Wiring It All Up

Finally we were ready to wire everything together. Since we use Powerpole connectors on all our radios we decided to use a West Mountain Radio RIGrunner to connect everything together (**www.westmountainradio.com**). The only thing that didn't connect to the RIGrunner was the PV panel, which connected directly to the charge controller (see Figure 2). Since the PV panel was outside and about 6 meters from the shack, we used solid #12 AWG wire to connect them. We used grounded flexible conduit to run the wire from the panel to where the wire went through the wall with the coax to our antennas. Everything is grounded for protection.

Since we also plan to use the PV panel and charge controller for Field Day we put Powerpole connectors on the wire between them. Now we can take the PV panel off the wall and move everything to our Field Day site while leaving the permanent wire in place.

Testing

The PV panel certainly produced more than enough power to keep the battery fully charged in the spring, summer and fall. The big test came during the winter. Only once did we have to hook up a battery charger and that was because we had more than a week with no sun. We tried to stretch the battery charge by using the station less but the repeater is always using some power and the battery charge got pretty low. Even so we have decided that it really did work out pretty close to how we planned it so we have decided that our solar power system was a success.

Conclusion

This was a fun and interesting project. We now know that, no matter what, our station will be on the air (see Figure 3). It also helped us learn what we need to know to plan for running our Field Day station. We hope that this article helps you to build your own solar powered ham shack.

Help and Support

We would like to thank our Science and Technology Teacher Brian Lloyd, WB6RQN, for his support during this project. He provided technical guidance that helped us through the design process and also provided constructive feedback on the technical content of this article. We also want to thank our Language Teacher Teri Brown, who helped us in preparing this article for publication.

Photos courtesy Brian Lloyd, WB6RQN.

Sylvie Fournier, KI6WZB, is a 7th grader at Granite Bay Montessori School. Sylvie likes PSK31, competitive swimming and playing with her dog, Achilles.

Frankie Moirao, KI6QYS, is an 8th grader at Granite Bay Montessori School. He likes singing, photography, cooking and playing soccer and basketball.

Brian Lloyd, WB6RQN, an ARRL member, has been a ham since 1976 and holds an Amateur Extra class license. Brian ran several successful Internet companies before coming to Granite Bay Montessori school 4 years ago as a science and technology instructor.

Sylvie and Frankie can be contacted care of Brian Lloyd, WB6RQN, Granite Bay Montessori School, 9330 Sierra College Blvd, Roseville, CA 95661, **brian@lloyd.com**.

"Science is a Blast Again!"

Again this past year, the Teachers Institutes provided teachers with exciting ways of bringing wireless technology to their classrooms.

Debra Johnson, K1DMJ

This comment from one of the participants in ARRL's 2010 Teachers Institute on Wireless Technology (TI) sums up the reactions from many of the 89 participants. They found ways to renew their teaching and left with exciting ideas on how to bring wireless technology topics to their classroom.

Sessions were held in held in Arizona, California, South Carolina, New Mexico, Ohio and at ARRL Headquarters in Connecticut, attracting participants from 27 states. The instructors included Miguel Enriquez, KD7RPP; Nathan McCray, K9CPO, and Mark Spencer, WA8SME. 2010 was the second year for the advanced TI-2 session, Space in the Classroom, and the first offering of a TI-2 on Basic Electronics. TI-2s are "graduate level" opportunities for teachers who have already taken part in a TI session.

The Teachers Institute is a 4 day, intensive, expenses paid in-service training opportunity for classroom teachers in basic electronics, the science of radio, bringing space technology into the classroom, microcontroller programming and basic robotics. Last year was the 7th year we have been able to offer these professional development workshops as a result of donor support for ARRL's Education & Technology Program. The TI program is one component of the grant offerings within the ETP portfolio of resources made available to schools and school teachers. The goal is to advance the integration of wireless technology literacy and ham radio into school curricula.

What Teachers are Saying about the Program

Here are some representative comments from 2010 participants:

"The sessions were "plum-full" of things to accomplish. I see how students can be motivated by the curriculum to explore the concepts of wireless through the materials."

"This was the best institute that I have attended in 27 years of teaching.… It was the kind of experience that changed the way I teach."

"Good combination of integrating hardware and software. I like the oscilloscope to show the sine waves in real life form which will help my trig class. The robotics will be used to reinforce mathematical concepts and to determine what kind of function formulas to use.… The hands-on experience with all of this equipment was great!"

"This program is amazing! This provided me with so many technical possibilities to expand in all of my classes. I can't wait for the school year to start! I especially love how so many of these projects are cross-curricular so we can all do this together in my school."

"This is an excellent course with tremendous possibilities for standards based application in math, science and engineering classrooms.… I was blown away with how much we covered and how much more I still wanted to investigate that we did not have time for!...I am so excited to now take this material and create projects that align to my units so that my sometimes dry math topics become interesting, relevant and hands-on."

SAM GRAY, KG4WRM

Teachers at the 2010 TI in Walhalla, South Carolina get some hands-on robotics experience.

TI-2 Space in the Classroom a Hit

The 2010 TI-2 on Space in the Classroom was sponsored by Dayton Amateur Radio Association (DARA) with generous support from Yaesu and Ham Radio Outlet. The eight participants received a basic satellite ground station, which they learned how to set up and operate. They learned how to locate and access ham radio satellites, making voice contacts and SSTV contacts and receiving satellite telemetry. The International Space Station was operational for APRS packet, which allowed the teachers to experience as closely as possible what is involved in making an ISS voice contact with the ARISS program.

If you are a teacher, or you know a teacher who would like to explore wireless technology or who is looking for hands-on learning tools to engage students in science, technology, engineering and mathematics (STEM) topics, check into the Teachers Institute. The dates, locations, requirements and application for this year's TIs can be found on the ARRL Web page at **www.arrl.org/teachers-institute-on-wireless-technology**.

Debra Johnson, K1DMJ, is ARRL Education Services Manager. You can reach her at **djohnson@arrl.org**.

Want to Help us Bring Wireless Technology Literacy to America's Classrooms?

The success of the Education & Technology Program is a tribute to the generosity of ARRL donors. You can make your contribution to the Education and Technology Fund by mail to ARRL, 225 Main St, Newington, CT 06111, by phone to the Development Office at 860-594-0397 or via the secure ARRL Web site (**www.arrl.org/arrl-donation-form/**).

Teachers Institute Calendar for 2011

Date	*Location*	*Application Deadline*
June 13-16, 2011	Albuquerque Unified School District, Albuquerque, NM	April 15, 2011
June 20-23, 2011	Parallax Inc, Rocklin, CA	April 15, 2011
July 11-14, 2011	Mohawk Valley Community College, Utica, NY	May 15, 2011
July 18-21, 2011	ARRL Headquarters, Newington, CT	May 15, 2011
*TI-2 Space in the Classroom**		
July 11-14, 2011	Dayton Amateur Radio Assn, Dayton, OH	May 15, 2011

*Though participants need not hold an Amateur Radio license to enroll in all other sessions of the TI, to be considered for a seat in TI-2 Space in the Classroom, participants must possess at least a Technician class license at the time of application.

The Philip J. McGan Memorial Silver Antenna Award

Allen Pitts, W1AGP

Have you seen a good article about Amateur Radio on your TV or in the newspapers? Who made that happen? Who has been spending the time and effort to not only ***say*** that we need more publicity, but to actually go *do* something about it?

Throughout the year hundreds of ARRL PICs, PIOs and other public relations volunteers keep Amateur Radio visible in their communities by publicizing special events, writing press releases, creating media for radio, Web sites and television, and so much more. If you know of someone who achieved public relations success on behalf of Amateur Radio, nominating him or her for the McGan Award is the perfect way to recognize their efforts and say thank you.

Public Relations activities for which the McGan Award is presented include efforts specifically directed at bringing Amateur Radio to the public's attention (and most often the media's) in a positive light. These may include traditional methods such as news stories, articles and broadcasts, or non-traditional methods such as hosting a radio show or being an active public speaker.

Philip J. McGan, WA2MBQ (SK), served as the first chairman of the ARRL's Public Relations Committee. In honor of Phil, his friends in the New Hampshire Amateur Radio Association joined with the ARRL Board of Directors to pay a lasting tribute to the important contributions he made on behalf of Amateur Radio. The 2011 McGan Award will go to that ham who has demonstrated success in Amateur Radio public relations and best exemplifies the great volunteer spirit of Phil McGan.

The ARRL Public Relations Committee will review all nominations and send a recommended winner to the ARRL Board of Directors for approval at the July meeting.

Call for Nominations

1) The award is given to an individual (not a group), who must be a full ARRL member in good standing at the time of nomination. The nominee must not be compensated for any public relations work involving Amateur Radio (including payment for articles) and may not be a current officer, director, vice director or paid staff member, or member of the ARRL Public Relations Committee.

2) The winner of the Philip J. McGan Memorial Silver Antenna Award will demonstrate volunteer public relations success on behalf of Amateur Radio at the local, state or national level, and will live up to the high standard of achievement exemplified by Philip J. McGan.

"Who dun it?"

Previous Winners of the McGan Award

1992	*McGan Award first announced*
1992	James Heil, KB5AWM
1993	Gary Pearce, KN4AQ
1994	Joe Phillips, K8QOE, and Michael Karp, AF2L
1995	Len Winkler, KB7LPW
1996	Bob Josuweit, WA3PZO
1997	James Biddle, WB3DCL, and Beverly Priest, N8VZV
1998	Stephan Anderman, K2SMA
1999	Peter Coffee, AC6EN
2000	Diane Ortiz, K2DO
2001	Bill Morine, N2COP
2002	Sherri Brower, W4STB
2003	Tim Lewallen, KD5ING
2004	Mike Duff, KG4SLH
2005	Jerry Martin, KC9BDA
2006	Dee Logan, W1HEO
2007	Dan McMonigle, N3IXQ
2008	Walt J. Palmer, W4ALT
2009	Nate Brightman, K6OSC
2010	Norm Lauterette, WA4HYJ

3) *Anyone* may make a nomination.

4) Deadline: *Nominations must be received at ARRL HQ in Newington by 5 PM May 20, 2011*. Nominations arriving after the deadline or without an entry form cannot be considered.

5) Eligible nominations will be screened by a committee of Amateur Radio operators knowledgeable about public relations, which will forward its recommendation to the Programs and Services Committee of the ARRL Board of Directors. The Board will make a final determination at its July meeting and the winner will be notified shortly thereafter.

6) Nominations must be on an official entry form, available from ARRL Headquarters. The nomination will include a written summary whenever possible.

To obtain the required entry form, go to **www.arrl.org/phil-mcgan-award** or e-mail **apitts@arrl.org**. Ask for an official 2011 Philip J. McGan Memorial Silver Antenna Award entry form.

7) Return the completed entry form and supporting materials to Philip J. McGan Memorial Silver Antenna Award, c/o Allen Pitts, W1AGP, ARRL, 225 Main St, Newington, CT 06111. QST

Strays

HOMEBREW CHALLENGE WEB PAGE: CHECK IT OUT

◊Looking for information about the ARRL Homebrew Challenge? The place to find it is **www.arrl.org/homebrew-challenge**. You'll find everything we've published about the three challenges: the announcements, any clarifications, the winning articles and a Q&A section.

Why not take part yourself? Homebrew Challenge III is under way. This time there's a challenge to build a transceiver in celebration of the (slow) return of sunspots. It's in two parts, and readers can enter into either or both:

- A single band, 25 W, SSB and CW transceiver for 10 or 6 meters (Option 1), prize $200, and
- A 25 W, SSB and CW transceiver that can be switched between 10 and 6 meters, using one or two switches (Option 2), prize $300.

For details, see November 2010 *QST*, page 47 — or the brand-new HBC Web page.

ARRL Award Nominations Open

Here are five ways to honor a ham radio innovator or educator.

Each year the ARRL Board of Directors has the opportunity to select recipients for a number of awards in various categories that honor Amateur Radio operators.

The nomination period is now open for the ARRL awards that are designed to recognize educational and technological pursuits in Amateur Radio. There is also an award to honor a young Amateur Radio operator. Please log onto **www.arrl.org/arrl-award-nominations** for specific award details and information on how to nominate or submit supporting endorsements.

The ARRL Herb S. Brier Instructor of the Year Award will be awarded to an ARRL volunteer Amateur Radio instructor or to an ARRL professional classroom teacher who demonstrates commitment to licensing instruction and uses resourceful instructional approaches resulting in successful outcomes, while modeling the highest values of the Amateur Radio community. Nominations must be received by March 15, 2011 to be considered this year. For more information about the criteria and documentation needed for the nomination, see **www.arrl.org/herb-s-brier-award**.

The **Hiram Percy Maxim Award** is for a licensed radio amateur under age 21 (and an ARRL member) whose accomplishments and contributions are of the most exemplary nature within the framework of Amateur Radio activities. Nominations for this award need to be made through your Section Manager (see page 16), who will then forward the nomination to ARRL Headquarters by March 31, 2011. For more information, see **www.arrl.org/hiram-percy-maxim-award**.

The ARRL Microwave Development Award is presented to a licensed radio amateur or to individuals who are licensed radio amateurs who contribute to the development of the Amateur Radio microwave bands. The nomination deadline is March 31, 2011.

The ARRL Technical Service Award recognizes a licensed radio amateur or individuals who are licensed radio amateurs who provide Amateur Radio technical assistance or training to others. The nomination deadline is March 31, 2011.

The ARRL Technical Innovation Award is granted to a licensed radio amateur or to individuals who are licensed radio amateurs who develop and apply new technical ideas or techniques in Amateur Radio. The nomination deadline is March 31, 2011.

More information on the Microwave Development Award, the Technical Service Award and the Technical Innovation Award can be found at **www.arrl.org/nominations-for-technical-awards**.

If you have questions about any of these awards, contact Steve Ewald, WV1X, at **wv1x@arrl.org** or 860-594-0265 at ARRL Headquarters.

ARRL the national association for AMATEUR RADIO

Strays

WEDDING OR HAMFEST?

◊On July 31, Maggie MacDonald, KC2CYC, and Jon Andrews, K1IMD, were wed in Riverhead, New York. In attendance were bridesmaid Chelsea Andrews, KC2GSZ, and best man Paul Alberghini, W1IMD. As you can see from the photo, the ham guest list didn't stop there. — *Jon Andrews, K1IMD*

BILL TOEDTER

At the Andrews-MacDonald wedding: back row, left to right — N2NEI, N2NFI, W1GHW, W1IMD, WA2KQD, W1HHO, WB2CIK, KB2AKE and WB2UKA. Front row — N2VBW, KC2GSZ, K1IMD, KC2CYC, KG2IQ and K1LGO. Present but missing from the photo — N2XJR.

FEBRUARY 2011 W1AW QUALIFYING RUNS

W1AW Qualifying Runs are 7 PM EST Wednesday, February 2 (0000Z February 3) and 4 PM EST (2100Z) Thursday, February 17. The West Coast Qualifying Run will be transmitted by station K9JM on 3590 and 7047.5 kHz at 9 PM PST Wednesday, February 9 (0500Z February 10). Unless indicated otherwise, speeds are from 10-35 WPM.

Amateur Allocation at Lower MF Gains Formal Support in the Americas

A secondary allocation to the Amateur Radio Service at 461-469 and 471-478 kHz gained inter-American support in meetings held in December in Bogota, Colombia, with the Permanent Consultative Committee II of the Inter-American Telecommunication Commission (CITEL) adopting the US position for the MF allocation. World Radiocommunication Conference 2012 (WRC-12) Agenda Item 1.23 calls on participants "to consider an allocation of about 15 kHz in parts of the band 415-526.5 kHz to the Amateur Service on a secondary basis, taking into account the need to protect existing services."

Canada — which had previously supported a secondary allocation at 472-487 kHz — withdrew that support and aligned itself with the US at the meeting in Bogota. Over the course of the meeting, Argentina, Brazil, Colombia, the Dominican Republic, Uruguay and Venezuela signed on to have CITEL present the proposal at WRC-12 as an Inter-American Proposal (IAP). The support of six countries is required for a proposal to gain IAP status. The US agreed to support the allocation earlier this year, despite initial opposition by maritime interests.

As a member of the US delegation, ARRL Technical Relations Specialist Jon Siverling, WB3ERA, attended the meeting, serving as Rapporteur for the agenda item. IARU Region 2 President Reinaldo Leandro, YV5AMH, was also in attendance on behalf of the IARU. The adoption of an affirmative IAP on Agenda Item 1.23 represents an important milestone in the ARRL's and the IARU's international advocacy efforts.

ARRL Chief Executive Officer David Sumner, K1ZZ, explained that while the milestone is important, there is still difficult work to be done on the agenda item to maximize success at WRC-12: "While we still face an uphill battle internationally, gaining the support of one of the major regional telecommunications organizations this early in the process improves our chances for achieving an allocation at WRC-12."

CITEL is one of six regional telecommunications organizations whose formal positions carry significant weight during deliberations at a WRC. WRC-12 is scheduled for January 23-February 17, 2012 in Geneva.

ARES®, SKYWARN ACTIVATED AS TORNADOES SWING THROUGH THE SOUTH

On the evening of November 29, a series of severe storms swept through Louisiana, Mississippi and Alabama, with hams providing support from the National Weather Service (NWS) office in Jackson, Mississippi. According to the NWS, seven tornadoes were embedded in the storm system, with at least six counties reporting damage. There were no deaths, though 15 people were hurt in Mississippi and buildings were badly damaged there and in Louisiana. Schools were closed in Alabama and tornado watches were posted in Tennessee and parts of North and South Carolina as the storms moved east.

In Central Mississippi, the NWS office in Jackson activated SKWARN in advance of the storm. "This provided NWS personnel with numerous reports that assisted in making preliminary damage assessments and short term storm predictions," ARRL Mississippi Section Manager Malcolm Keown, W5XX, told the ARRL. "These reports related to structural damage, power outages, trees down and roads blocked. Hams at the Jackson office using the call sign WX5JAN were on the air until sunrise the next morning. Word that hams were providing information to the NWS filtered to the local TV stations, resulting in some nice public relations for Amateur Radio."

Keown said that emergency ARES® nets were also activated in Jasper and Yazoo Counties, as was the Northeast Mississippi SKYWARN net.

Yazoo County Emergency Coordinator Glenn Patterson, KE5YES, said that there was significant damage in the Yazoo City downtown area, but overall, the total damage was not nearly as bad as that caused by the tornadoes this past April. Mississippi Emergency Management Agency spokesman Greg Flynn told the Associated Press that the damage included "a lot of windows blown out, some roof damage and very little power in the downtown area" of Yazoo City.

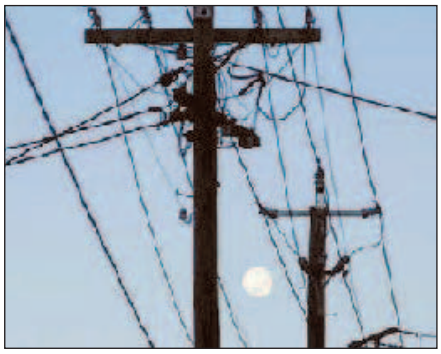
One of the hardest hit places in Mississippi was the town of Starkville, home to MFJ. An employee told the ARRL that even though the tornado destroyed a mobile home park across the street from their building, they escaped relatively unscathed. No one was injured, as everyone had gone home for the day, but the metal shop building suffered minor damage, with some of the tin roof coming off in the strong winds.

ARRL MAKES THE CASE FOR MANDATORY BPL NOTCHING

On November 30, the ARRL filed an *ex parte* submission with the FCC, providing additional support for its position that the FCC should require mandatory notching of the amateur bands by Broadband over Power Line (BPL). The ARRL's filing stated such devices can cause harmful interference to Amateur Radio operators, and requested that the FCC "establish rules that are appropriate for unlicensed BPL systems and which minimize the interference potential."

"It has been painfully apparent that the present rules permit the deployment of BPL in configurations which cause severe, ongoing harmful interference if operated on radio spectrum that is in use locally," the ARRL asserted in its filing. In its numerous filings on this issue, the ARRL has "strenuously urged" the FCC to require full time, mandatory notching of all amateur allocations to at least 35 dB notch depths: "This level of notching is both achievable by present BPL systems and

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



is typically, but not universally, implemented by the BPL industry." The ARRL maintains that mandatory, full time 35 dB notch depth requirements can be implemented in the FCC's BPL rules without adverse impact on the BPL industry; most BPL systems are already notched at this level.

The ARRL pointed out that it has been 18 months since the FCC released its *Further Notice*, more than two and a half years since the Court of Appeals remanded the case to the Commission for further proceedings and more than six years since the Commission first adopted the inadequate and insufficient Part 15 Rules governing BPL systems: "There is no reason why the BPL rules should not be amended immediately to impose a mandatory, full-time, 35 dB notching requirement for all BPL equipment in all amateur allocations. If that is done, the fundamental incompatibility is effectively eliminated, and BPL can, going forward, avoid the stigma of the Amateur Radio spectrum polluter that it has been shown to be in deployments throughout the United States and elsewhere in the world." In May 2008, the US Court of Appeals for the District of Columbia Circuit found that the FCC violated the Administrative Procedure Act and failed to provide a reasoned explanation for its choice of the extrapolation factor.

The ARRL attached seven documents to its *ex parte* submission. *Exhibit A*, written by ARRL Laboratory Manager and BPL expert Ed Hare, W1RFI, thoroughly reviewed cooperative industry efforts to design broadband systems in such a way as to, where necessary, utilize notching or spectral masks in order to avoid fundamental incompatibility in the use of the radio spectrum allocated to the Amateur Service.

Hare pointed out that in some, but not all, cases, these efforts are not adhered to on a voluntary basis and the regulations must therefore mandate the industry "best practices." Hare cited experiences with Home Phone Networking Alliance (HPNA) standards, Very High Speed Digital Subscriber Lines (VDSL) systems, and Home Plug in-Premise BPL as evidence that full time notching of Amateur Radio allocations is a standard procedure that has worked well on a cooperative basis. *Exhibit A* also cited the IEEE standard on BPL protocols and specifications that established the need for BPL systems to completely avoid the use of spectrum allocated to the Amateur Radio Service.

International Support for BPL Notching

A June 2010 report by the United Kingdom's Office of Communications (OFCOM) was also offered as part of the filing. This report concluded "that BPL systems will result in widespread harmful interference to amateur, international broadcast, FM narrowband and FM broadcast operations *unless existing practices of notching and adaptive power control are incorporated in formal regulations.*" Specifically, the report concluded that "our results show that users of sensitive radio systems may increasingly suffer interference from [BPL] devices." OFCOM recommends that notching of amateur allocations be "formalized" in regulations "to ensure that their introduction can be relied upon." The report specifies the notch depth of the UPA specification — the BPL technology most common in the UK — as 40 dB.

Hare cited multiple reports from the International Telecommunication Union (ITU) that support the ARRL's position on notching. Report ITU-R SM-2158 — *Impact of Power Line Telecommunication Systems on Radiocommunication Systems Operating in the LF, MF, HF and VHF bands Below 80 MHz* — from September 2009 concluded that because electrical power lines are not designed for the transmission of high data rate signals, BPL signals on electrical power lines have the potential of causing interference to radiocommunication services.

In its filing, the ARRL said that the ITU-R SM-2158 report provides a good basis on which to set BPL limits: "BPL emits at a relatively uniform level across a wide frequency range. Some BPL systems operate on a near-continuous basis. For access BPL deployed on overhead power lines, BPL emits at or near the emissions limits for long distances down lines on which it is deployed. Therefore, it is clear that the ubiquitous deployment of BPL, especially access BPL on medium-voltage distribution lines, would result in interference levels that exceed the protection criteria anywhere

ARRL Lab Manager Ed Hare, W1RFI, takes a BPL measurement out in the field.

FCC News

♦**New Rules Governing Vanity, Club Station Call Signs to Take Effect February 14, 2011**: On December 15, new rules affecting vanity and club station call signs within the Amateur Radio Service were published in the *Federal Register*. These new rules will go into effect on February 14, 2011. In November 2009, the FCC announced its intention to modify Part 97 as it applies to the vanity call sign system and club station call signs, aligning the rules to prior Commission decisions. In November 2010, the Commission released a *Report and Order* (*R&O*), outlining its decision. Along with the changes to the call sign rules, the FCC made "certain minor, non-substantive amendments" to portions of Part 97. For more details on the new rules, please see **www.arrl.org/news/fcc-issues-em-report-and-order-em-on-vanity-and-club-station-call-signs**.

♦**FCC Issues Retailer Second Citation in 18 Months for Marketing Non-Compliant RF Devices**: On November 23, the FCC issued a *Citation* to Hobby Lobby International (HLI) for marketing non-compliant radio frequency devices. According to the Commission, these devices were in violation of Section 302(b) of the *Communications Act of 1934, as Amended* and Section 2.803(a)(1) of the Commission's Rules. In July 2009, HLI was also issued a *Citation* for the same reason. This time, HLI was found to be selling an unauthorized radio frequency device, specifically, the JETI Duplex 2.4 GHz System for radio-controlled models; this system consists of a transmitter and receiver used for remote control of model aircraft, boats and cars. The FCC *Citation* warned that if, after receipt of the *Citation*, HLI violates the *Communications Act* or the Rules "by engaging in conduct of the type described herein, the Commission may impose monetary forfeitures...as well as criminal sanctions, including imprisonment." HLI had 30 days to respond to the *Citation*, either through a personal interview at the FCC office in Atlanta or via a written statement.

that BPL is deployed."

As amateur stations can be fixed or mobile, the ARRL said that the only practical way to implement required interference protection "is to have spectral masks applied to BPL for the spectrum allocated to the Amateur Radio Service. The ARRL maintained that a "notch depth at or near 35 dB is easily achievable, with 40 dB or more being typical in the most robust designs." Most of the present Access BPL deployments in the United States, though not all, are using the improved technology of 40 dB notching or are using HomePlug technology with fixed notches in the amateur bands. Studies of measured field strength and notch depth of BPL devices conducted by a number of authoritative sources show that a...mandated notch depth of 35 to 40 dB provides the required protection criteria shown to be necessary in the SM-2158 report."

HAMS INVITED TO LISTEN FOR NEW SATELLITES

Five research satellites were carried to orbit on November 19 aboard a Minotaur V rocket from Kodiak Island, Alaska. All the satellites use Amateur Radio frequencies and hams have been invited to participate in their missions by monitoring and collecting data.

The FASTRACs — Formation Autonomy Spacecraft with Thrust, Relnav, Attitude and Crosslink — are two small "nanosatellites" built by students at the University of Texas-Austin. They entered orbit as a single spacecraft, but then separated into FASTRAC 1, known as "Sara Lily," and FASTRAC 2, referred to as "Emma." Both satellites use 1200 or 9600 baud AX.25 digital communication and transmit at 1 W output, so amateurs should be able to receive their signals using omnidirectional VHF or UHF antennas and decode them by ordinary packet radio hardware and software. After their scientific missions are complete — approximately six months after launch — the satellites will be reconfigured to function as digipeater relays for Amateur Radio use as part of the Automatic Packet Reporting System (APRS). Mission status information is also available via the FASTRAC Facebook page at **www.facebook.com/fastracsats**.

The third satellite in the group is the University of Michigan's Radio Aurora Explorer (RAX) CubeSat. RAX was designed and built by University of Michigan students and faculty in cooperation with SRI International. The primary objective of the mission is to use an onboard radar receiver in conjunction with a powerful radar station in Alaska to study the formation of a plasma anomaly known for causing the scintillation of radio signals in the UHF and higher bands. RAX carries a 9600 baud UHF digital transceiver. Using the call sign RAX-1, the satellite sends telemetry at 437.505 MHz. Amateurs are invited to download the free telemetry decoding software (for *Windows*, *Mac OS X* or *Linux)* and submit reports at the mission Web site at **rax.engin.umich.edu/?page_id=311**.

The Organism/Organic Exposure to Orbital Stresses satellite, better known as O/OREOS, is a nanosatellite designed to study the growth, activity, health and ability of microorganisms to adapt to the stresses of space. It will also monitor changes in four classes of organic molecules as they are exposed to space conditions. O/OREOS transmits digital telemetry 437.305 MHz and hams are invited to submit raw telemetry data at the O/OREOS Web site at **beacon.engr.scu.edu/Submission.aspx**.

Table 1
FASTRAC Satellite Information

	FASTRAC 1	*FASTRAC 2*
Downlink (1200/9600 baud)	437.345 MHz	145.825 MHz
Beacon (1200 baud)	437.345 MHz	145.825 MHz
Uplink (1200 baud)	145.980 MHz	435.025 MHz
Uplink (9600 baud)	145.825 MHz	437.345 MHz
Satellite call sign	FAST1	FAST2

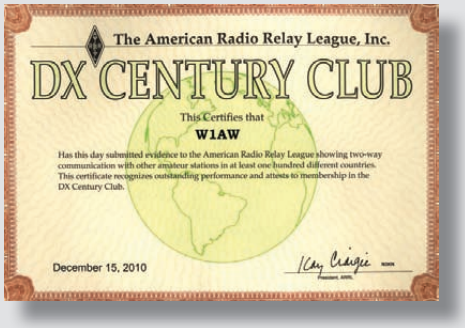
If you wish to listen for the FASTRAC satellites, be sure to make a note of their uplink and downlink information.

UNIVERSITY OF TEXAS

An artist's conception of the FASTRAC satellites in orbit.

In Brief

● **DXCC News**: ARRL DXCC Manager Bill Moore, NC1L, reports that the following operations have been approved for DXCC credit: 9Q/DK3MO (Democratic Republic of the Congo), 3CØC (Annobon), 3C9B (Equatorial Guinea), 3V9A (Tunisia), 3VØA (Tunisia), TS7TI (Tunisia, also includes /p operation), TS8P (Tunisia, also includes /p operation), TS9A (Tunisia), 5XØCW (Uganda), D2QV (Angola), H4ØHP (Temotu Province) and 7Z1HB (Saudi Arabia). All operations — with the exception of 9Q/DK3MO (2007-present), H4ØHP (2007) and 7Z1HB (2007-present) — are 2010 events. "If you had these operations rejected in a recent application, please send an e-mail to **dxcc@arrl.org**," Moore said. "Results will appear in Logbook of The World (LoTW) accounts, as well as online in the daily listings at **www.arrl.org/dxcc**."



● **New General Class Question Pool Released**: The Question Pool Committee of the National Conference of Volunteer Examiner Coordinators (NCVEC) released the new General class (Element 3) question pool on December 7. This new question pool — including graphics and diagrams — will become effective for all General class examinations administered on or after July 1, 2011; it will remain valid until June 30, 2015. The current General question pool that became effective July 1, 2007 will expire June 30, 2011. The new General pool contains 457 questions, from which 35 are selected for an Element 3 examination. The current Technician class question pool that was effective July 1, 2010 is valid through June 30, 2014. The current Amateur Extra class pool that was effective July 1, 2008 is valid until June 30, 2012.

● **Let Your Voice Be Heard**: Each month, the ARRL publishes poll questions on the QuickStats page, located at **www.arrl.org/quickstats**. Visit the QuickStats page and give us your input. Be sure to bookmark the page in your browser! Results from each QuickStats poll will be published in upcoming issues of *QST* on the QuickStats page, located in the rear advertising section of the magazine. Along with monthly poll results, *QST* QuickStats offers colorful charts and graphs that highlight interesting Amateur Radio statistics.

NanoSail-D2 is a solar sail experiment with an expected lifetime of about 100 days. It carries a data beacon transmitting at 437.275 MHz. Although NanoSail-D2 was developed by NASA, mission control for this satellite, as well as O/ORES, is being handled by students at Santa Clara University.

BRITISH MAN CONVICTED FOR DELIBERATE INTERFERENCE, OPERATING WITHOUT A LICENSE

Clive McMurray of the British town of Hull (located about 45 miles southwest of York) was convicted and sentenced on November 22 for causing deliberate interference to Amateur Radio users and unlawfully using radio equipment without a license. According to the Radio Society of Great Britain (RSGB) — that country's IARU Member-Society — McMurray caused interference to operators in the Hull region of Humberside between June-November 2009.

Ofcom — the British equivalent of the FCC — charged that McMurray kept his radio equipment in his van and would drive all over the region and park outside homes, jamming signals — and even broadcasting his own material — in an effort to interfere with those amateurs who were operating legally. He was sentenced to four months' imprisonment (suspended for 18 months) and a 12 hour curfew, as well as forfeiture of his van and radio transmitters to Ofcom.

RSGB General Manager Peter Kirby, GØTWW, said that RSGB volunteers "cooperated closely with Ofcom in gathering evidence for this case. This conviction shows that deliberate interference will not be tolerated and can have serious consequences for the perpetrator."

Ofcom Head of Enforcement Paul Mercer concurred: "There are around 900 Amateur Radio users in and around the Hull area who have been deliberately disrupted for more than four years. Ofcom is very pleased with this result, which will hopefully give these users some welcome relief, as well as sending a very strong signal to those that abuse the airwaves."

2010 A BANNER YEAR FOR DXCC, INCOMING/OUTGOING QSL BUREAUS

With the coming of more sunspots comes more DX. And when more amateurs are working DX, that means the ARRL's Membership and Volunteer Programs Department — especially the DXCC desk and the ARRL Incoming and Outgoing QSL Bureaus — goes into high gear.

"Compared to 2009, 2010 saw a dramatic increase in the number of cards we received from ARRL members that were sent to foreign QSL bureaus, as well as the number of cards we sent out to the bureaus," said DXCC Manager Bill Moore, NC1L. "In addition, the number of DXCC applications — including those for initial awards and endorsements — also increased."

Through December 14, the ARRL Outgoing QSL Bureau had received 709,800 cards destined for foreign QSL bureaus from ARRL members in the US. This represents an increase of 16 percent over the 2009 number of about 612,000 cards. In 2009, the ARRL shipped 673,500 cards — or close to 4500 pounds of cards — to foreign bureaus. "We have processed nearly 660,000 cards in 2010, and the year isn't even over yet," said MVP Administrative Manager Sharon Taratula. "I would not be surprised if we surpassed 750,000 cards by the end of the year."

While ARRL membership is required to take advantage of the Outgoing QSL Bureau, membership is not required to receive cards from the Incoming QSL Service.

As the number of QSL cards has increased, so have the number of DXCC applications. In 2009, the DXCC Desk processed 7134 applications for initial awards and endorsements; these 2009 applications included almost 762,500 QSOs. So far in 2010, the DXCC Desk has processed 6895 applications, containing almost 860,000 QSOs, for an increase of 13 percent over 2009. "With all of the year's applications not yet fully processed, we've seen the number of QSOs increase in 2010 over 2009, even though the number of applications is a tad lower," Moore said. "Come the end of the year, I expect the 2010 application total to surpass the 2009 number."

S. KHRYSTYNE KEANE

The Outgoing QSL Bureau at ARRL HQ. More than 1 million QSL cards passed through the ARRL Incoming and Outgoing QSL Bureaus in 2010.

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Maryland/DC, Nevada, New Hampshire, Northern New Jersey, Rhode Island, San Joaquin Valley, Utah and West Texas sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms FSD-129 are available on request from ARRL Headquarters but are not required. A sample nomination form is available on the ARRL Web site at **www.arrl.org/section-terms-nomination-information**.

We suggest the following format:

(Place and Date)

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

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

(Signature___ Call Sign___ City__ ZIP___)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on March 4, 2011. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before April 1, 2011, to full members of record as of March 4, 2011, which is the closing date for nominations. Returns will be counted May 24, 2011. Section Managers elected as a result of the above procedure will take office July 1, 2011.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning July 1, 2011. If no petitions are received from a section by the specified closing date, such section will be resolicited in the July 2011 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager. — *David Patton, NN1N, Membership and Volunteer Programs Manager* QST

911 Special Event Station at Battery Park, New York City

Vincent Mattera, KB2PSI
President, Kings County Repeater Association
kb2psi@arrl.net

VINCENT MATTERA, KB2PSI

We sectioned off the area where we had the generator and telescoping 30 foot mast with the end fed 20 meter dipole. The ARRL flag, tied to the mast, was spotted by other amateurs in the area who dropped in to say hello.

Those of you who were listening on 40 meter SSB on September 10 for the 911 special event station, KC2RA, transmitting from near the World Trade Center site may have heard the recorded announcement my father made: CQ CQ CQ This is KC2RA, the Kings County Repeater Association is honoring the memory of the 911 tragedy which occurred on 9/11/2001. This horrible attack on America should never be forgotten. 'WE WILL NEVER FORGET'…" — *Vincent Mattera Sr, WB2AAP/SK, 9/5/09*

The Kings County Repeater Association has been doing this annual memorial event around the yearly anniversary of 9/11 since 2002. We do this to remember one of America's worst tragedies and to honor the memories of the lives that were lost on that day. The 2010 event was made even more solemn for our group being near the site because many of us had witnessed the tragedy firsthand.

Battery Park at the southern tip of Manhattan was deserted and very quiet 6 AM when we arrived. The Parks Department permit allowed us to set up on the blacktop area in the front of Castle Clinton National Monument. We had arrived before the vendors, so that we could pick the prime spot directly in front of the Castle, one of the major tourist destinations in NYC. This is where you can purchase tickets to see the Statue of Liberty and Ellis Island. Nearby is the Staten Island Ferry terminal entrance, Museum of Jewish Heritage, Smithsonian National Museum of the American Indian and the South Street Seaport Museum. It was a good central location with a lot of pedestrian traffic and food vendors — a great spot to set up the radios.

We brought the essential equipment needed for the event: tables; chairs; canopy tent; ice chest with water; generator; several lengths of coax; two 30 foot telescoping poles; 20 meter end fed dipole; Buddipole set up for 40 meters; 2 meters and 70 cm, vertical mag mount and various radios. The four of us, Gary, KB2BSL, Joe, N2TEE, Jan, W2KMA and I had the equipment set up and tested by 8 AM. The antenna set-up was not easy because of the rules of the Parks Department. We could not tie off antennas to park property, use tent stakes or string up anything into the trees. We had to be inventive. The telescoping masts were weighted down by batteries, which could double as a power source.

We also set up an Amateur Radio information table. Documents, flyers, pens and club business cards were given out to every visitor who stopped by to talk to us. ARRL material was donated to us by our section manager, Mike Lisenco, N2YBB. Many hams from around the world stopped by when they spotted our League flag hanging on the canopy.

I was running an ICOM IC-756 ProII my dad had given to me when I passed my General exam. It still had his recorded message from the 9/11 special events station he participated in with the club years ago. The reassuring voice from my past set the serious mood I was in for the day. I hooked the radio up to a 40 meter Buddipole on a tripod 10 feet off the ground. In most cases this would do okay, but today the propagation on 40 was not very good — lots of interference and the noise level was a S9. I operated SSB and made only a few contacts. Later that day, my friend Bob, WA2VMO, stopped by and tried CW, but did not do any better on 40. He was receiving some stations, but they did not hear our small signal.

Gary had an ICOM IC-7200 transceiver with LDG tuner, used for SSB, CW and digital modes (PSK31, Feld-Hell) on the 20 meter end fed dipole. The 20 meter dipole was strung between two 30 foot telescoping masts held in place with weights. This setup worked well, but again the interference was high and the noise level was S9. We made some voice contacts, one or two with Morse code, and struck out with Feld-Hell. Due to the interference, PSK31 was our miracle mode and the bulk of our contacts were made using it. Our micro PC server was used for the digital modes (DM780) and for logging our contacts. We have learned from past events that paper logs just don't work well when translating someone else's hand writing after the event.

The other side of the table had mobile D-Star equipment, an IC-880H, small and compact. It's a great radio — very easy to use. It was connected to REF020B via the

WG2MSK NI-Star repeater. The antenna used was a JetStream 2 m/70 cm vertical connected to a diplexer and shared with an Alinco DR-135. It was tuned to the club's 2 meter repeater with EchoLink access (node 643000). Many hams participated using the EchoLink node. Most were using RF, but some even checked using their iPhones or Droids.

We decided not to use band-pass filters due to the approximate 2 dB insertion loss, and poor band conditions. We had operated without filters in the past in close quarters with good success, but today was not the case. Although the 40 meter station was not experiencing any interference from our 20 meter setup, the reverse was not true. It was either due to the more extensive filters on the IC-756 or the location of the 40 meter dipole being parallel with the 20 meter dipole. I tried moving the 40 meter antenna to a different location and making it perpendicular to the 20 meter dipole. The results were not any better, so for the rest of the day we transmitted intermittently, trying not to interfere with one another's contacts.

Throughout the day local Amateur Radio operators and visitors from other countries who were in the area stopped by to talk, and operated the radios with us. We had visiting radio amateurs from Russia, who had read about the special event in *QST* and asked if they could operate with us for the day. We didn't advertise Morse code, but were pleased to find that some of our guests were very good at using the Bencher key. Other visiting hams were kind enough to take pictures of the event and later e-mailed them to us. We were grateful for this as we were too preoccupied to use our cameras.

It was a very long day for us on the air. We talked to many old friends, made many new friends and hopefully some new hams in the process! Activating a station in a downtown Manhattan park is very different from Brooklyn's historic Owl's Head Park where we previously held the event. Both have a unique view of the city, but being downtown was a different experience. There were food and souvenir vendors, caricature artists and the thousands of visitors passing by, including a local turkey that lived in the park.

Many of the KCRA members are active ARES® participants. During this event we operated our equipment under simulated emergency conditions, utilized no commercial power and operated in an urban canyon surrounded by skyscrapers filled with millions of people. In the midst of this we were able to maintain constant communication with other hams around the globe via the HF/VHF/UHF bands.

For more information, videos and pictures on this and our other special events please visit the Web site **www.kc2ra.org** or contact the club at Kings County Repeater Association, PO Box 280288, Brooklyn, NY 11228.

HALL COUNTY ARES® A PART OF READYFEST

Michael V. Crowder, AA4BA
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On September 20, Hall County ARES (in Georgia) participated in ReadyFest sponsored by the Georgia Emergency Management Agency and the Hall County Emergency Management Agency. We set up a display and answered questions as the attendees came through the facility. Our goal was to inform them of the role of Amateur Radio in disaster preparedness.

MICHAEL CROWDER, AA4BA

Marcus Shockley, KJ4EZQ, of the Hall County ARES, was among several members of the group that promoted Amateur Radio and ARES on September 20.

Hall County ARES is making regular appearances at public events to promote emergency communications along with the ARES and ARRL. This public preparedness event at Georgia Mountains Center featured emergency preparedness experts such as a local television station's chief meteorologist and representatives from National Weather Service, American Red Cross, Georgia Emergency Management Agency, Hall County EMA and CERT, as well as others.

One of the main purposes of holding ReadyFest during September's National Preparedness Month was to help community members get together with experts to learn how to prepare for any disaster.

DUAL POLARIZATION RADAR UPGRADE FROM THE NWS

Beginning in late 2010, the National Weather Service will begin upgrading their WSR-88D radar system to the new Dual Polarization Radar (DPR). Currently the WSR-88D system emits a radar beam polarized horizontally to measure weather data. The new system will allow the radar to emit both vertically and horizontally polarized beams. The upgrade will begin in 2011 with five beta test sites: Wichita (KS), Phoenix (AZ), Chicago (IL), Morehead City (NC) and Fort Polk (LA). The remainder of the WSR-88D sites will be upgraded by the end of 2012.

There are several benefits to the new system that SKYWARN storm spotters may find useful. First is better measurement of precipitation. Currently NWS radar measures the size of precipitation. DPR will be able to measure the size, shape and variety of precipitation. Users will also be able to better determine the type and amounts of precipitaion in an area.

The NWS has already made training on the new system available online. There are two training courses available, one for non-NWS meteorologists and one for non-meteorologists. These courses can be found on the Warning Decision Training Branch Web site, **www.wdtb.noaa.gov/courses/dualpol/Outreach/index.html**.

It is important to keep in mind that this is an upgrade to an existing system, not a completely new system. The features available on the current WSR-88D radar will still be available, but enhanced by the upgrade. And the limitations such as range and angle of the beam will still be there.

This Month in Contesting

Sean Kutzko, KX9X
ARRL Contest Branch Manager, kx9x@arrl.org

DEBUNKING THE "SIMPLE STATION" MYTH

"Is it possible to operate in contests with only 100 watts and a dipole?" This question has been asked many times over the years, and the answer remains the same: Certainly! Read on to dispel one of the biggest myths in Amateur Radio as I recount my adventures with a mere 5 W during November's CW weekend of the CQ Worldwide DX contest!

It was the Wednesday before CQ Worldwide DX CW contest over Thanksgiving weekend. The contesters here at HQ were discussing their plans for the world's largest CW event. I knew I would be in Vermont that weekend, and as I listened, I decided to use the weekend to practice what I preach about simple stations in contests. I announced that I would attempt to make DXCC (working 100 different countries) in a weekend with a 5-watt station, no spotting assistance and a single-wire antenna. We all left for the Thanksgiving holiday and my colleagues wished me good luck.

If ever there was an average station, my QTH in VT is it: a single, G5RV-style open-wire-fed dipole at about 45 feet. There is also a noise source near the house that produces QRN on 40 and 80 meters, rendering those bands all but useless.

When the event kicked off, I didn't hear much on 20 meters, so I went to 40. The noise source was louder than most of the stations I was trying to work, so I decided to focus my time on the high bands during daylight hours and ignore the low bands entirely. At least I would get a decent amount of sleep.

I awoke with the sun on Saturday morning, grabbed a cup of coffee, and went straight to 20 meters. After one hour, I had 37 QSOs in the log from 29 DXCC entities. By 1500 UTC, I was switching between 20 and 15 meters about twice an hour in constant quest of new stations. This went on all afternoon and into the early evening. I heard some great DX during those times. There were plenty of African stations on 15 meters: 5R8WW in Madagascar was unbelievably loud on 15 meters all afternoon, but I simply couldn't break the pileup on him. New Zealand and Hawaii were also loud on 15.

As the sun set, I wanted to see if there was any opening to Asia over the North Pole on 20 Meters. Indeed there was: I heard several Japanese stations weakly, kept trying to work them, with no luck. As I worked South Americans on 15 and 20 meters, I kept tuning around, and eventually found a UA9 in Asiatic Russia on 20 meters in Zone 18, right over the Pole. His signal was fluttery and warbly as is common with the polar path. It took a few calls, but eventually I bagged the UA9 at 2211 UTC. That was exciting! I finally worked my first "JA" at 2300 UTC Saturday; my first JA QRP QSO ever.

Saturday evening, I had 148 QSOs with 70 DXCC countries in my log. I'd worked most of the big-gun stations from Europe and the Caribbean. There were some nice surprises in the mix as well, such as C5 (Guinea-Bissau), the JA, the UA9, San Andres (HKØ), and Morocco (CN). However, finding 30 more would be difficult.

Fifteen meters was in better shape Sunday than Saturday and I worked 34 stations in my first 90 minutes. With 15 in good shape, I wondered how 10 meters was doing and snagged a ZF and an EA8 in 3 minutes after the band change. The rest of Sunday found me searching 20, 15 and 10 meters.

Sunday afternoon in a contest can provide some nice opportunities for the smaller station. Big Gun stations have worked a lot of the louder stations, which gives the smaller guys a chance to get in the log. Such circumstances arose for me this year, as I was able to make it into the logs of both 5R8WW and ZM4M on Sunday, stations I couldn't work on Saturday. Working these two stations with such a simple setup were thrills I won't forget.

By 3:30 PM, it was time to pack it up so I could leave by 4 pm and make my appointment for Sunday evening. I added up my totals…exactly 250 QSOs in the log. Although I worked only 86 DXCC countries, 14 short of my goal, I worked over 60 countries on both 15 and 20 meters and achieved Worked All Continents on both those bands.

The bottom line is that, even with a simple station with a simple antenna and local noise issues, I was on the air for most of the weekend, enjoyed some sleep, worked plenty of stations and had a great time. If I can do it, so can you. To reiterate what has been said numerous times, if you don't think you can work lots of stations with 100 watts and a dipole, you're selling your station short. Dedicate yourself to the effort, keep working stations, and keep yourself in the chair in front of the rig. You'll work more stations and see your scores and fun factor increase as a result.

Sean's Picks

- **State QSO Parties this month:** Delaware, New Mexico, Vermont, Louisiana, Minnesota, New Hampshire. In Canada: British Columbia
- **Ten-Ten Winter Phone QSO Party (Feb 5-6):** 10 meters has been acting up this year. This contest, sponsored by Ten-Ten International, is a fun way to spend time on the band and collect 10-10 numbers. Novices and Technicians can get in on the action, too.
- **FYBO Winter QRP Field Day (Feb 5):** A one-day QRP event that includes the air temperature as part of the exchange. The colder it is at your QTH, the higher you multiply your score.
- **North American Sprint, CW (Feb 6):** Four hours of intense CW action, with a mandatory QSY rule after two QSOs. One of the purest CW contests on the calendar.
- **North American Sprint, SSB (Feb 13):** The same intense frenzy of activity as the CW Sprint, but on SSB instead.
- **ARRL International DX Contest, CW (Feb 19-20):** The oldest Amateur Radio contest returns in 2011! DX works W/VE, W/VE only works DX. There will be plenty of good DX on for this one.
- **CQ WW 160 Meter Contest, SSB (Feb 25-27):** DX on 1.8 MHz? Certainly! Load up whatever wire you can and discover the fun you've been missing on Top Band.

In the January/February "Contesting 101"

"Contest Management." We hear from guest author Doug Smith, W9WI, on all the things you have to keep track of for a contest. Contesting 101 can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

CONTEST CORRAL

in association with the *National Contest Journal*

FEBRUARY 2011

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site or Contact
Jan 31, 1400Z - Feb 1 0800Z	1.8-28	50, 144	Classic Exchange		✘		RST, QTH, model of rcvr and xmtr	www.classicexchange.org
Feb 4, 0230Z - Feb 4 0300Z	1.8-14		NS Weekly Sprint		✘		Serial, name, and S/P/C	www.ncccsprint.com/rules.html
Feb 5, 0000Z - Feb 6 0000Z	1.8-28		YLISSB QSO Party		✘		Call sign, RS(T), ISSB number	www.ylsystem.org
Feb 5, 0001Z - Feb 6 2359Z	28		Ten-Ten Winter Phone QSO Party	✘			Call sign, name, QTH, 10-10 number	www.ten-ten.org
Feb 5, 1200Z - Feb 6 1200Z	1.8-28		Black Sea Cup International	✘	✘		RS(T) and org'n ID, member nr or ITU zone	www.bscc.ucoz.ru
Feb 5, 1200Z - Feb 6 1200Z	3.5-28		EPC WW PSK Contest			✘	RST and serial	www.epcwwdx.srars.org/index.php/contest-rules.html
Feb 5, 1300Z - Feb 7, 0300Z	1.8-28		Vermont QSO Party	✘	✘	✘	RS(T) and VT county or S/P/C	vtqsoparty.westriverradio.org
Feb 5, 1400Z - Feb 5 2400Z	1.8-28	50+	Minnesota QSO Party	✘	✘	✘	Name and MN county or S/P/C	www.w0aa.org
Feb 5, 1400Z - Feb 5 2400Z	1.8-28		FYBO Winter QRP Field Day	✘	✘		RS(T), S/P/C, name, power, temp in deg F	www.azscqrpions.org
Feb 5, 1600Z - Feb 5 1900Z	3.5		Straight Key Party		✘		RST, serial, category, name, age	www.agcw.org
Feb 5, 1600Z - Feb 6 0800Z	1.8-28		British Columbia QSO Party	✘	✘	✘	RST and BC district or S/P/Territory or DX	www.deltaamateurradio.com
Feb 5, 1700Z - Feb 6 2359Z	1.8-28	50+	Delaware QSO Party	✘	✘	✘	RS(T) and DE county or S/P/C	www.fsarc.org
Feb 5, 1800Z - Feb 6 1759Z	3.5-28		XE Int'l RTTY Contest			✘	RST and XE state/district or serial	www.fmre.org.mx
Feb 6, 0000Z - Feb 6 0400Z	**3.5-14**		**North American Sprint**		✘		**Both call signs, serial, name, and S/P/C**	www.ncjweb.com
Feb 6, 1500Z - Feb 7 0300Z	1.8-28	50	New Mexico QSO Party	✘	✘	✘	Call sign, name, and NM county or S/P/C	www.swcp.com/~n5zgt
Feb 6, 2000Z - Feb 6 2359Z	3.5-28		QRP Winter Fireside SSB Sprint	✘			RS, S/P/C, QRP ARCI number or power	www.qrparci.org
Feb 8, 0200Z - Feb 8 0400Z	3.5-28		ARS Spartan Sprint		✘		RST, S/P/C, and power	www.arsqrp.blogspot.com
Feb 9, 0130Z - Feb 9 0330Z	3.5-14		NAQCC Monthly QRP Sprint		✘		RST, S/P/C, and NAQCC mbr nr or power	naqcc.info
Feb 9, 1100Z - , See Web site	3.5-14		CWops Mini-CWT Test		✘		Name and member number or S/P/C	www.cwops.org/onair.html
Feb 11, 8 PM - Feb 12 2 AM	1.8-7		Valentine Sprint			✘	Name, OM or YL, S/P/C	www.podxs070.com
Feb 11, 1400Z - Feb 13 0200Z	1.8-28		YL-OM Contest	✘	✘	✘	Call sign, RST, serial and S/P/C	www.ylrl.org
Feb 12, 0000Z - Feb 13 2400Z	3.5-28		CQ WW RTTY WPX			✘	RST and serial	www.cqwpxrtty.com
Feb 12, 0001Z - Feb 13 0001Z	1.8-28	50-1296	New Hampshire QSO Party	✘	✘	✘	RS(T) and NH county or S/P/C	www.w1fz.org
Feb 12, 1100Z - Feb 12 1300Z	7,14		Asia-Pacific Sprint		✘		RST, serial	jsfc.org/apsprint/aprule.txt
Feb 12, 1200Z - Feb 13 1200Z	1.8-28		WW Peace Messenger Cities	✘	✘		RS(T), serial, PMC ref number or CQ zone	www.s59dcd.si
Feb 12, 1200Z - Feb 13 1200Z	1.8-28		Dutch PACC Contest	✘	✘		RS(T) and Dutch province or serial	www.dutchpacc.com
Feb 12, 1500Z - Feb 13 0300Z	3.5-28		Louisiana QSO Party	✘	✘	✘	Call sign, RS(T), LA parish or S/P/C	laqso.w5yl.org
Feb 12, 1500Z - Feb 13 1500Z	3.5-28		OMISS QSO Party	✘			RS, S/P/C and OMISS nr or "DX"	www.omiss.info
Feb 12, 1700Z - Feb 12 2100Z	3.5-28		FISTS CW Winter Sprint		✘		RST, S/P/C, first name, FISTS nr or power	www.FISTS.org
Feb 12, 2100Z - Feb 13 0100Z	1.8		RSGB - First 1.8 MHz Contest		✘		RST, serial, UK district	www.rsgbcc.org
Feb 13, 0000Z - Feb 13 0400Z	**3.5-14**		**North American Sprint**	✘			**Both call signs, serial, name, and S/P/C**	www.ncjweb.com
Feb 13, 1400Z - Feb 14 0800Z	1.8-28	50,144	Classic Exchange	✘			RST, QTH, model of rcvr and xmtr	www.classicexchange.org
Feb 13, 1900Z - Feb 13 2300Z		144	Maine FM Simplex Challenge	✘			Call sign, QTH, power	www.qsl.net/ws1sm/contest.html
Feb 14, 1300Z - Feb 18 2400Z	**1.8-28**	**50+**	**School Club Roundup**	✘	✘	✘	**RS(T), Class, S/P/C**	www.arrl.org/school-club-roundup
Feb 16, 1900Z - Feb 16 2030Z	3.5		Semi-Automatic Key Evening		✘		RST, serial, first year of bug use	www.agcw.org
Feb 18, 2100Z - Feb 19 2100Z	1.8-28		Russian WW PSK Contest			✘	RST and oblast code or serial	www.qrz.ru/contest/detail/384.html
Feb 19, 0000Z - Feb 20 2400Z	**1.8-28**		**ARRL International DX**		✘		**RST, state/province or power**	www.arrl.org/contests
Feb 19, 2000Z - Feb 19 2200Z	1.8-28		Feld-Hell Annual WAS Sprint			✘	RST, QTH, Feld-Hell number	www.feldhellclub.org
Feb 19, 2300Z - Feb 20 2300Z	3.5-14		AM QSO Party	✘			RS, name, and S/P/C	www.antiquewireless.org
Feb 20, 1900Z - Feb 20 2130Z		50-440	FM Simplex Contest	✘			Call sign and grid square	www.w9rh.org
Feb 25, 2200Z - Feb 27 2200Z	1.8		CQ WW 160 Meter SSB	✘			RST and state/province or CQ zone	www.cq160.com
Feb 26, 7 PM - Feb 26 11 PM		50-440	Pennsylvania FM Sprint	✘			Call sign, serial, and 5-digit Zip code	harcnet.org
Feb 26, 0600Z - Feb 27 1800Z	3.5-28		REF Contest	✘			RS and French dept or serial	www.ref-union.org/concours
Feb 26, 1300Z - Feb 27 1300Z	3.5-28		UBA Contest		✘		RS, serial, and ON province	www.uba.be/en/hf/contest-rules
Feb 26, 1500Z - Feb 27 0300Z	3.5-28	50-432	Mississippi QSO Party	✘	✘		RS(T) and MS county or S/P/C	www.arrlmiss.org
Feb 26, 1800Z - Feb 27 0600Z	**3.5-28**		**North American QSO Party**			✘	**Name and S/P/C**	www.ncjweb.com
Feb 27, 1700Z - Feb 28 0300Z	3.5-28		North Carolina QSO Party	✘	✘		RS(T) and NC county or S/P/C	www.w4nc.com
Feb 28, 0100Z - Feb 28 0259Z	3.5-14		CQC Winter QSO Party	✘	✘		RS(T), S/P/C, name, CQC nr or power	www.cqc.org

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates.
Refer to the contest Web sites for full rules, scoring information, operating periods or time limits, and log submission information.
No contest activity occurs on 60, 30, 17, 12 meters. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity. XE = Mexican state.
Publication deadline for Contest Corral listings is the first day of the second month prior to publication.

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

W3UR

HOW'S DX?

The PJ6A Story… A New DXCC Entity Born on 10-10-10

Bob Allphin, K4UEE

Background

The first time I got a glimpse of Saba was from the porch of Ottley's Estate on St Kitts. (Old timers may remember that this was the property owned by "Kit" Carson, VP2KC.) The year was 1979 and members of the Southeastern DX Club were at Ottley's to try to break the CQWW Phone Multi/Multi World Record. We did…with what was then an amazing score of 29,000,000 points and 17,000+ QSOs.

Looking north on a clear day we could see several islands in the distance. Closest was St Eustatius, and beyond that was this triangle-like island jutting out of the Caribbean Sea. That was Saba! And beyond Saba, on a really clear day you could see a sliver of land just above the horizon. That was St Maarten.

Saba Island with Mt Scenery in the clouds. Our locations are above the airport on the lower left.

Reconnaissance Visit

Thirty-one years later, I finally got to visit that triangle of an island. Gregg, W6IZT; George, N4GRN, and I flew there in March 2010 to do a reconnaissance visit in preparation for a DXpedition scheduled for October 10, 2010. (10-10-10 is the date the Netherlands Antilles would be dissolved, two existing DXCC entities would be deleted and as many as four new entities would likely be created.) As we approached the island on the short 15 minute flight from St Maarten, we saw that the triangle shape was really the top of a volcano. This mountaintop referred to as Mt Scenery dominates the entire island. There is only one flat place on the island; it was produced by a giant landslide coming off the NE side of the volcano. It happened millions of years ago but today is the location of one of the shortest runways in the world. At only 1300 feet long, it is ranked as the world's 9th most dangerous airport. It was some comfort that WinAir makes the round trip from St Maarten five times each day when the weather permits. Those pilots, despite their lack of gray hair, were quite experienced at getting the Twin Otter in and out again. Still, our landing in March was a thrill as we battled a stiff crosswind.

Saba is an interesting location with friendly people and beautiful scenery. It has an area of only 5 square miles, and a population of about 1500. The economy is primarily based on eco-tourism. The major attractions are hiking, climbing and scuba diving. It is often listed as one of the top diving destinations in the world. As a result, one of the names by which Saba is known is "The Unspoiled Queen."

We spent four days on Saba and quickly found that the volcano was an obstacle that blocked propagation to the North except at only one location, just above the airport. This community, named Hells Gate, has a clear shot to the main population areas of the world, that is, JA, NA and EU. We located two rental houses in the area and began negotiations to rent them for two weeks in October. We set up in one and operated for a couple of days. Because we were 500 feet

Team 1, from the left: KØIR, W4GKF, N4NX, K4SSU, W6IZT, K4UEE, VE7CT, N4HH (missing K8EAB).

Team 2: K4ZLE, N4LR, K5AC, K4UEE, KU4V, K8EAB, VE7XF, N4GG and VE7CT.

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PJ6A QTH 1 housed station one with a perfect view to Europe, North America and Japan.

above the sea with nothing between our pileups and us, we found that 100 W and a wire antenna provided strong signals everywhere.

We made a quick 3000 contacts and headed home with the knowledge that we could mount a very successful DXpedition to Saba with little effort, minimal equipment and cost — certainly as compared to recent Mega DXpeditions such as 3YØX and K5D. Wow, we could easily activate what would likely be a brand new DXCC entity. We could fly in, fly out, use rental cars, enjoy restaurants, warm beds and need only basic equipment and antennas — that were provided by the operators themselves. Also, there was no reason to mount a fundraising campaign, as the costs involved were no more than what would ordinarily be paid by a DXpedition participant.

The Planning Begins

On the Desecheo DXpedition (K5D) in February 2009, we rotated two teams of operators on and off the island at the midway point. This provided fresh operators for the second week and gave more people an opportunity to have the DXpedition experience. I decided to do the same thing on Saba. In order to man three radios, the simple math suggested that nine people on each weekly team was the right number. An operator could have 3 hours on and 6 hours off — a pretty leisurely pace for most DXpeditioners.

Most of us involved in planning this DXpedition live in the Atlanta area and are members of the Southeastern DX Club (SEDXC). Several of us had been doing some Caribbean contesting (TI5ØDX and PJ2T) together for the last few years and we became the core of the team. I sprinkled in a few of my friends from previous DXpeditions and we were fully staffed. Because I would hold the PJ6A call sign, it was necessary for me to stay for the duration…but that was certainly okay with me!

The teams consisted of operators that most DXers will recognize. Three of us stayed for the full 2 weeks — Bob, K4UEE; Steve, VE7CT, and Wey, K8EAB. The rest of the team for week one was Dave, K4SSU; Ralph, KØIR; Don, N4HH; Bill, N4NX; Chaz, W4GKF, and Gregg, W6IZT. For the second week the six replacements were Jay, K4ZLE; Tim, K5AC; Wayne, KU4V; Hal, N4GG; Gordon, N4LR, and Ralph, VE7XF.

The planning responsibilities were spread around. Don, N4HH, was the "rig wrangler" responsible for three fully functioning, complete stations and two backup radios. Hal, N4GG, was in charge of antennas and along with Gregg, W6IZT, devised a plan that was genius in its simplicity. Multiband doublets (40-10 meters) as the prime antennas with a separate 160 meter "L" and 80 meter dipole for the low bands. We also planned high power for the low bands for extra oomph!

Gregg was the IT guy. He borrowed and configured a number of our personal laptops for the DXpedition. My buddy Chaz, W4GKF, put together a beautiful Web site (**www.pj6a.com**) just as he did for 3YØX and K5D. Bill, N4NX, volunteered to handle the QSLing and LoTW uploads. Everybody else had a role of some kind and of course contributed equipment to the team.

Three Main Concerns

So now, with the team all set and the equipment/antenna decisions made, the only remaining concerns were (1) Would the dissolution actually take place as planned on 10-10-10, and (2) What exactly would the ARRL do? Would there be two new DXCC entities or…three or four (my best guess) or five? Obviously we had no control over these first two variables but we did have some control over my final concern.

If four new DXCC entities all come on the air at once, and there were multiple operations on some of the islands, how would we all be able to coexist, share the limited bandwidth and keep our split pileups from causing total mayhem. I felt that as responsible DXpedition leaders we had an obligation to try to minimize interference. This was for our benefit as well as for the benefit of those DXers trying to work us. Fortunately, several of the leaders of the other groups agreed and over a period of 2 weeks we hammered out a PJ Operations Band Plan and published it. Looking back, I am convinced that more DXers are in our collective logs as a result of that band plan.

As the big day approached it became more and more apparent that the Netherlands Antilles would indeed be dissolved on 10-10-10. And the ARRL announced that the two Netherlands Antilles DXCC entities would immediately be deleted from the DXCC list on 10-10-10 and hinted that some new DXCC entities countries would be created. That was all we needed….

The Plan Comes Together

Team 1 arrived on Saba on the 5:05 PM flight on Saturday, October 9. Because we hand-carried three complete rigs and wire antennas, we were easily on the air at 0401Z on 10/10/10…the effective date for Saba (and nearby St Eustatius) to become a new DXCC entity.

As mentioned earlier, our operation was

The famously short/dangerous runway at Saba!

PJ6A QTH 2 with stations 2 and 3 were located at a house under construction.

Jay, K4ZLE (foreground) and Tim, K5AC, operating from stations 2 and 3.

spread between two physical locations. Also, we rented two cottages designated for sleeping and showers at yet a third location. We needed three rental cars to move people around. Station 1 was located in a private home about 550 feet above the sea. It was primarily the low band station for operations on 160 and 80 meters. During the first week it was the only station that had access to a linear amplifier. During the day this station was used on the higher bands and we coordinated bands and modes with the other two stations by using 2 meter handhelds.

Stations 2 and 3 were located in a villa still under construction. It was farther west of Station 1 and another 400 feet up on the volcano. This location was about a 5 minute drive from Station 1 along the one road on Saba appropriately named "the road that could never be built." Both stations had direct views of the airport and could clearly see six DXCC entities simultaneously.[1] For the second week we had a 500 W linear available at this second location and alternated using it between 40 and 80 meters. All three stations used Elecraft K3s and wire antennas. All the equipment was furnished by the operators themselves or borrowed from their friends. No external support was, nor is being sought for this operation. It was totally financed by the individual participants — our gift to the DX community.

The following Saturday, October 16, Team 2 flew in and took over the radios. Operations continued until shut down at approximately 2100Z on the 22nd. We changed our game plan for week two and assigned three men to each station, gave them a rental car and let them work out their own operating schedule. My only request was that they keep their radio on the air 24/7, coordinate bands and modes with the other stations and maximize contacts. Decentralizing the operator scheduling was something I had never tried before. It was tremendously successful.

Wrap-up

So what was the final result for PJ6A? We made a total of 57,515 contacts with 16,988 unique call signs. CW accounted for 59%, Phone was 35% and RTTY was 5% even though we only operated RTTY during the second week. European contacts were 28,331, North America 26,429 and Asia 1,175.

All this was accomplished with only 100 W on most bands and simple wire antennas on all bands.

Thank You

I would like to thank DXers worldwide for their courtesy and self-control exhibited in the huge pileups that we experienced. It was only during the second week of operation that we saw a limited amount of poor operating techniques. I suspect those operators were newer and less experienced…give them a little Elmering and some time!

What's Next?

So what now? Here is a hint. We left some equipment and antennas on Saba. It is such a neat, friendly place that we must go back. And I suspect demand for contacts will be strong for several years. Look for us during some of the contests in the coming year.

For QSL information, see **www.pj6a.com**. Logs were expected to have been uploaded to LoTW prior to January 1, 2011. QST

[1]Saba (PJ6) and St Eustatius (PJ5); Nevis and St Kitts (V4); Montserrat (VP2M); St Barts (FJ); St Martin (FS); and St Maarten (PJ7).

VHF/UHF Century Club Awards

Compiled by Sharon Taratula, Administrative Manager

The ARRL VUCC numbered certificate is earned by amateurs who submit written confirmation for contacts with the minimum number of Maidenhead grid locators (indicated in italics) for each band listing. The numbers preceding call signs indicate total grid locators claimed. The numbers following the call signs indicate claimed endorsement levels. The totals shown are for credits given from October 1, 2010 to November 30, 2010.

The VUCC application form, field sheets and complete list of VHF Awards Managers can be found on the VUCC Web site at **www.arrl.org/vucc**. An SASE to ARRL is required if you cannot download these forms. Send questions relating to VUCC to **vucc@arrl.org**.

50 MHz

100

1744 K9YC
1745 WB8BPU
1746 W5ODD
1747 K6JRA
1748 VE6SH
1749 KI5FJ
1750 W2ZDP
K6JRA 150
N9KO 150
KI5FJ 200
AA4FL 250
NQ7R 275
WB8BPU 275
NW6R 300
KF7CQ 325
K3FN 525
K6QG 525
W9VHF 625
N6JV 700
K4PI 825
WD5K 1,175

144 MHz

100

707 K6HLH
708 VE7DXG
709 KI7JA
N9OBB 125
KC6ZWT 300

222 MHz

50

146 K5VH

432 MHz

50

N9LR 140

1296 MHz

25

N9LR 65

5.7 GHz

5

62 N1GJ

10 GHz

5

195 NA4N
196 WA3TTS
WA3TTS 10

Satellite

100

203 AJ5C
204 KD8KSN
205 KI4OTG
206 N9KQQ
207 KE4KOL
AA4FL 150
KI4OTG 150
XE1AO 175
KE4KOL 200
K8ZZU 325
WA8SME 325
N5AFV 700

W3ZZ

THE WORLD ABOVE 50 MHz

Magic Days on "The Magic Band" Long Path on 50 MHz — *Part 2*

Last month Bob Cooper, ZL4AAA, began a "forensic" study of exceptional long-haul 50 MHz two-way contacts involving one or more forms of F-layer propagation that provide evidence for "some path" other than great-circle "short path." With distances exceeding 31,000 km in the extreme, crossing 18 time zones, existing propagation knowledge fails to provide an explanation. We continue the two-part series by considering long path oddities and eventually returning to the first week in April 2001 and the operation of W7XU and his spouse NØQJM on Easter Island (CEØY) (see Figure 1).

More 50 MHz Long Path

The examples given in Part 1 of this series emphasize some of the oddities experienced via long path. The first challenge is to substantiate that the signal path was not direct/short path. This is difficult at 7 MHz and even more so at 3.5 MHz where few at both ends of a contact have accurate directional capability.

Carl, K9LA explores some of these challenges (see "Long Path Propagation" by Bill, W4ZV (then WØZV) in **users.vnet.net/btippett/w4zv.pdf**) in a well documented article that focuses on our "lower" bands. While these skewed paths are quite well known to operators with directional low frequency arrays, at 50 MHz, where any F layer propagation is rare, something coming on the reverse (long) path is very unusual. As Jim Kennedy, KH6/K6MIO, documents (see **www.bobcooper.tv**), the related cousin, "*skew path*," is much more common and has been from the first day a JA discovered an LU on 6 meters back in 1956.

Skewing makes "proofing" a "long path" murky and difficult to calibrate or justify. For example; in March/April 2001 W7XU operating from CEØY "discovered" what he interpreted to be a 6 meter "polar path" (north he believed) to Raj, VU2ZAP (Bengaluru, southern India) and Raj would later report he heard Easter Island continuously for as long as 5 hours. That works out to be 18,278 km; not quite antipodal but an amazing bit of VHF propagation none the less.

As a point of reference, the *short path* direct heading for Raj would be 157° while for W7XU/CEØY it should have been 205°; in neither case even close to 0/360° (north). Here were two skilled, experienced 6 meter operators who certainly knew enough to point their antennas where the signal was strongest. It was 2 AM local time in Bengaluru when Easter Island finally faded out. And it happened several days in a row, centered on April 5, 2001.

ARLISS THOMPSON, W7XU

Figure 1 — Holly, NØQJM, operating at Easter Island CEØY with Arliss, W7XU.

An additional oddity was 9M2TO/B copied first on April 3 at 1820Z from Penang, western Malaysia. While it sounds impressive, the Easter Isle to Penang path is nearly 1500 km shorter than the path to Indonesia. Of greater forensic interest, just *prior* to hearing the Malaysian beacon (at 1813Z) Arliss noted the end of the path to VU2ZAP, "*Path fading out*" and then immediately after first hearing 9M2TO/B, "*I now hear V29JKV.*" Jimmy's Caribbean signal would be pervasive throughout the Easter Island DXpedition.

The VU fadeout lasted as long as the 9M2 beacon persisted (not very long) but by 1840Z the VU path returned at full strength until past 1957Z; beyond the brief interruption, Arliss noted, "*The band was open to VU today from at least 1538 to 1957 hours.*" Given the 18,500 km distance here, the use of power levels as low as 0.125 W (to a 4 element beam) or 1 W to a 12 foot dipole, 4+ hours of continuous propagation seems mind-boggling. "*Magic*" indeed and for slightly more than a week, W7XU was magician-in-charge.

Although this has been our focus, these conditions were not restricted to April in 2001. VK3OT says that other Aprils (1989, 1991, 2000 and 2002) produced record long path contacts. The evidence suggests if you want to be on one end of a 50 MHz long path contact, you are well advised to be in the South Pacific — from Easter Island to Australia. *All* of the six record VK contacts are Southern Hemisphere to Southern Hemisphere (as well as being in the month of April). This makes the 2140-2200Z JG3IFX (et al) contacts with the eastern Mediterranean stand out. Why? Because both ends were Northern Hemisphere although all logic suggests it would not have happened without traversing at least a portion of Southern Hemisphere (see K6MIO's "50 MHz Long-Path Propagation" at **www.bobcooper.tv**). K6MIO's rules for long path are presented in the sidebar.

The Japanese Magic Band

At 2140Z it is 0640 LST (local standard time) in Japan and 2340 LST for 4X1RF. Thus this would be a dawn opening for Yutaka while in Israel and nearby the local time was exiting the evening TEP (transequatorial propagation) window; *only* there had been virtually no TEP for those working JG3IFX/2 that night. Yutaka recalls: "*The opening on long path (on this morning) seems to be unusual for 3 points. First, the season is too late (the peak LP season should be March); second, the time is too early; normally it starts around 0800 JST (2300 UTC). Finally, this was to a most unusual area; frequently when this path opens it is to CT, EA, EH8, and perhaps I and 9H1. From Japan, the Middle East is very far for LP.*"

That's one of the marvels of the Japanese "Magic Band" conditions: from the JG3IFX location to, say, EH7KW, long path, is still

This Month

*February 19-20	*Excellent* EME conditions

*Moon data from F5SE/DL7APV

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Rules of TPL/TEL (Long Path Extended)

[courtesy of KH6/K6MIO]

Refer to Jim Kennedy's, KH6/K6MIO, series of seven in-depth papers reprinted at **www.bobcooper.tv**. *2003's "50 MHz Long-Path Propagation" is essential reading.* Some of Jim's rules follow:

1. If the signal path crosses the equator twice on anything like a Great Circle, the path must be long path (eg, VK3OT to 9Q5EE).
2. The possible exception for point 1 is if both stations are close to the equator and beaming essentially east or west, long path is possible with a singular equatorial crossing (eg, OA4TT to YB).
3. TPL (Transpolar Long Path) over the south-polar region has headings ~160° for the daytime station (~1100 LST) and headings of ~200° (~0000 LST) for the nighttime station (eg, EH to KH6).
4. TPL over the north-polar region has headings of ~20° for the daytime station (~1100 LST) and headings of ~340° (~0000 LST) for the nighttime station (eg, FO to S79).
5. TEL (Transequatorial Long Path) goes east from a daytime station (~0730 LST) in the *northern* magnetic hemisphere with headings of ~120°, with the nighttime station (~2030 LST) in southern magnetic hemisphere having a heading of ~300° (eg, FY to VK).
6. TEL goes east from a daytime station (~0730 LST) in the *southern* magnetic hemisphere with headings of ~60°, with the nighttime station (~2030 LST) in the northern hemisphere having a heading of ~240° (eg, KH8 to JY).
7. Trans-"Anything" time of year: is typically September-November, February-April.
8. For K Index and Solar Flux requirements see **www.bobcooper.tv** (under KH6/K6MIO).

Note that for both TPL and TEL, the daytime station is on the west end of the circuit. In the case of TEL, it appears the reason is that the path starts in the morning looking east into daylight nF2; by the time it reaches the afternoon longitudes the ionosphere's "afternoon fountain" [a bulging of the F-layer that occurs over the geomagnetic equator after sunset — *Ed*.] is beginning to establish TEP layers, which then provide an F2 to TEP link into the late evening east-end station

an amazing 28,887 km distance but the JAs (at least a cycle ago) considered this *standard stuff*. But the extra distance to 4X1RF (31,063 km) caught Yutaka's attention (setting aside the "wrong month" and "wrong time"). Perhaps this is one of the reasons why, by country, there may be more 50 MHz JA DXCCs than any other region.

In a sense, given the near or total lack of "other signals" at *either end* when a *single* signal pops out of the background noise at 20,000-31,000 km on 50 MHz, we have a forensic mystery of significant proportions. Moving away from this class of event there are instances when during a major F layer opening in the 12,000-14,000 km range a lone signal at *twice* the distance pops through. VK3OT was working a string of 5th call district (US) stations on April 6, 1991 when he copied "5EE." Asking for a repeat to get the prefix correct in his log, the station repeated three times "Q5EE." Steve was hearing only W5s and the signal levels were not spectacular:

"I first copied the caller as WQ5S; I called him back and no answer. Next I thought, 'maybe it is PJ9EE' and tried that. No response but thinking it a PJ9 had moved the beam off of W5 to Aruba. The noise floor dropped and returning the beam to W5 now heard the caller again."

9Q5EE was the *correct* call and Steve had been savvy enough to try to repeak the beam. Democratic Republic of the Congo and Texas from suburban Melbourne do not share a common heading (the short path to Houston, eg, is 14,720 km while the 9Q5EE "longer path" works out to 27,207 km). KB5LIU (and others) stood by — enchanted. The contact required only 30 seconds and 9Q5EE went on to also work VK2 and FK8. Nobody in the States heard *any* sign of the 9Q5. "*It was midnight at 9Q5 and just ahead of 10 AM here.*"

An F-layer First

Research unearths dozens of contacts that fit this genre; a "much farther" away single station busting through during a more moderate F-layer opening at 50 MHz. A 6 meter path from 9Q5 to W5/Texas is not only uncommon, it has apparently *never* happened. But for 10 minutes on April (that month again!) 6 (and that year — 1991) VK3OT (plus VK2, VK5, FK8) found the long-path 9Q5 struggling against the W5-land competition; 14 "time zones" on the "Magic Band."

Logic here suggests a "forensic coincidence" between the month of April (a few weeks past the Northern Hemisphere "spring equinox") and antipode-plus 50 MHz links, at least during moderate to high sunspot years. Setting aside the very brief October 2001 period when OD5/OK1MU and JG3IFX/3 heard each other a second time (and within the "predictable" 2300-2400Z time frame; see last month's column), virtually all of the beyond-antipode 50 MHz contacts occurred within what IØWTN labels "*the magic month.*"

Returning to the January 2011 column, there is one more highly unusual circumstance, which involves W7XU's presence on Easter Island. That would be the four 28,709 km contacts in 3 days between ZL4AAA and VU2ZAP. In April, 2001 I did not hear (or work) CEØY/W7XU although he was a mere 7224 km to my east. In fact, Arliss worked only a single VK (VK4) and no ZLs. But, April 6 at 1946Z while ignoring some EAs and CN8s near my Antipodean 20,000 km zone plus the potent signal of V29JKV, I worked VU2ZAP. His signal peaked at 150° and we exchanged reports. Raj would also work two other ZLs neither quite as far "west" as this reporter.

Raj asked, "*Is this a world record?*" on his QSL card. But given that world records do not apparently recognize LP paths longer than 20,000 km this would not count. We repeated the contact at 1950Z the next day; April 7. What is important here is the "coincidence" between this "LPE" distance and the VK3OT-9Q5EE contact *also* on April 6 (2001) approximately 4 hours later; one is an almost mirror-image of the other as if an F-layer "tunnel" was *hanging* up there connecting points 14-16 time zones apart.

A review of solar events and HF conditions for the period April 1-10 provides few clues. A (minor) SID (Sudden Ionospheric Disturbance) did occur on April 6 around 1915 UTC; it knocked out all 14-28 MHz HF signals *at ZL4AAA* for around 45 minutes and in the midst of this VU2ZAP appeared from 28,709 km away (on 50 MHz). The SID may have had an influence on April 6; it does not explain the same path also being open on April 7 or the consistency of the 18,500 km 50 MHz path from VU to CEØY from April 3 until Arliss left CEØY April 8.

Clearly whether we ever see sunspot numbers well over 100 again in the foreseeable future, there are locations on this globe where 6 meters is not only "magic" but beyond explanation. The antipode is of special interest because it is "as far as you can go" on any band without reverting to a different beam heading and a shorter distance.

The ZL4AAA antipode is a rural desert location in Morocco, Sidi Yahya du Rhab. During the 1991 ARRL 10 Meter Contest a Moroccan multioperator station was not only worked "early" but stayed "in" for the *full* length of the contest (although the beam heading for peaking the CN8 signal did of course vary as would be expected). Ten meters is not 6 meters but it is instructive; at no time during the contest period did this antipode signal drop below S9; even at 4 AM local (ZL) time. If the

LUF (lowest usable frequency) were >28 MHz for the full contest weekend at whatever beam heading, what might the daylight-enhanced MUF (maximum usable frequency) have been to the same "Antipodean" location?

More Mysteries

What we do *not* know (understand) about antipode propagation is perhaps far more than what we do know. For the bulk of the North American readers, your antipode falls someplace in the water between Western Australia and Africa and this obviously reduces your opportunity to create similar observations (on *any* band).

The K1ZZ *QST* editorial of August 2010, "*Anomalies: Is the ionosphere changing in ways we do not yet understand?*" perhaps lays down the gauntlet.[1] Amateur Radio has always been largely about discovery ("*we*" did indeed first discover the benefits of HF via the ionosphere and have contributed significantly to what is known about E skip, auroral propagation, TEP, etc). K1ZZ again described it well: "*For more than a century Amateur Radio has provided an outlet for curiosity — people who seek a better understanding of the natural forces that shape life on our planet.*" And the "Magic Band" remains our best *anomaly* resource.

[1]D. Sumner, K1ZZ, "Anomalies," *QST*, Aug 2010, p 9.

ON THE BANDS

One expects a dearth of reports in mid-winter but this November has been perhaps the least interesting in many years. Let's take a look at the lack of activity.

6 meters. The minor winter E-skip (E_s) season is off to a slow start this year. Jon, NØJK (EM17), worked southern CA and reports contacts from CA into the Rockies November 13. Dave, N7DB (CN85), worked AZ the same day. Bob, K6QXY (CM88), notes E_s to AZ and OK on the 16th. DX Sherlock reports widely scattered contacts from TX/OK into PA, OH, GA and AL on the 26th. NØJK worked into GA and then southern CA and nearby Mexico on November 29. He reports that southern CA worked into GA on double hop E_s. Let's hope that conditions improve in December and early January. Meanwhile K6QXY notes weak ZL video on November 17 and 18.

Tropospheric ducting. Many Novembers have some excellent tropo. A warm spell around Thanksgiving time or earlier has produced some outstanding openings including some rare east/west enhancement over the Appalachian Mountains including the East Coast and even trans-Gulf ducts from Texas to Florida. Not so this year. Not one single tropo report this November. Since 2002 only in 2002 and 2008 were there no instances of tropo reported.

Aurora. The best guestimate of smoothed sunspot numbers puts the value at around 25 for November 2010 [we won't know final numbers for sure for another year]. Solar flux is only at 80. Aurora producing events like CMEs [coronal mass ejections] and >M class flares with associated high solar wind have not yet occurred in Cycle 24. So aurora reports have been essentially nonexistent.

Meteor scatter. Not a single report reached me concerning this year's Leonids. Data indicates a sharp, narrow peak zenith hourly rate of only 32 at 0140Z November 18. There was no obvious increase in the steady state digital WSJT meteor scatter activity at that time. Thus one can be relatively assured that little if any interesting meteor scatter happened during Leonids 2010.

EME. Al, K2UYH, notes that Paul, WA6PY (ex-SMØPYP), recently completed with PY1KK for what is believed to be the first 432 MHz single Yagi WAC on CW. Paul was running 1.5 kW to a 26 element manually elevated SMØPYP Yagi. This amazing feat attests to Paul's exceptional operating abilities. Congratulations Paul! Herb, K2LNS, thanks Jeremy, W7EME/KH6, for state #50 on 144 MHz on November 30 via JT65B. Jeremy was running only a single 5 λ Yagi. Congratulations Herb!

HERE AND THERE

New DXCC entities on 6 meters. The dissolution of the Netherlands Antilles has caused the deletion of two DXCC entities, Leeward Netherlands Antilles PJ2, 4 and Windward Netherlands Antilles PJ5, 6, 7 and the concomitant formation of four new DXCC entities: Curacao PJ2, Bonaire PJ4, St Eustatius/Saba PJ5/6 and Sint Maarten PJ7. Plans are being made to activate each of these new entities on 6 meters during the summer E_s season. Stand by.

Microwave Standings

Published Microwave Standings include only regional leaders as of December 1. For a complete listing of all stations, check the VHF/UHF/Microwave Standings boxes at **www.arrl.org/wa50-standings**. To ensure that the Standings Boxes reflect recent activity, submit reports at least every 2 years by e-mail to **standings@arrl.org**. Printed reporting forms are available by sending a request with an SASE to Standings, ARRL, 225 Main St, Newington, CT 06111. Stations are grouped into regions based on call area.

33 cm (902-928 MHz)
Minimum Terrestrial DX = 1000 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K1WHS	ME	18	2	48	1,212
W1AIM	VT	9	2	25	1,078
KØVXM	FL	7	1	29	1,747
K4RF	GA	2	1	10	1,045
W5LUA*	TX	22	2	70	1,725
K5LLL	TX	9	1	32	1,608
N6CA	CA	4	—	19	3,978
K6QXY	CA	4	3	24	3,794
WA8RJF*	OH	14	2	37	1,306
K3SIW/9	IL	19	2	62	1,265

23 cm (1240-1300 MHz)
Minimum Terrestrial DX = 1000 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K1WHS	ME	20	2	55	1,688
W1AIM	VT	12	2	34	1,103
W1ZC	NH	12	2	19	1,116
WA2FGK	PA	21	2	55	1,571
WA4NJP*	GA	28	25	82	1,696
K4RF	GA	17	1	32	1,067
AA4ZZ	NC	13	1	26	1,201
KØVXM	FL	9	1	36	1,698
W4WA	GA	7	1	35	1,506
N4QWZ	TN	18	—	30	1,040
W5LUA*	TX	50	65	300	2,060
WD5AGO*	OK	39	36	210	1,705
K5UR	AR	18	1	92	1,102
K5SW	OK	17	1	60	1,570
K5YPV	MS	12	1	26	1,198
K5LLL	TX	10	1	40	1,608
W5UWB	TX	7	1	14	1,664
W5HNK	TX	7	1	—	1,272
WA5VJB	TX	14	—	29	1,980
N6CA	CA	11	—	44	3,978
K6QXY	CA	4	3	24	3,794
WA8RJF*	OH	19	10	60	1,306
K2YAZ	MI	18	2	58	1,300
K3SIW/9	IL	23	2	80	1,265
N9LR	IL	19	2	61	1,151
NØLL	KS	13	1	54	1,321
WØRT	KS	8	1	10	1,065

13 cm (2300-2310, 2390-2450 MHz)
Minimum Terrestrial DX = 1000 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K1WHS	ME	18	2	45	1,212
KØVXM	FL	6	1	19	1,698
W5LUA*	TX	33	33	124	1,533
K5LLL	TX	5	1	22	1,608
N6CA	CA	5	—	20	3,798
WA8RJF*	OH	10	10	39	1,306
K3SIW/9	IL	14	1	53	1,109

9 cm (3300-3500 MHz)
Minimum Terrestrial Distance = 600 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K1WHS	ME	16	2	43	1,212
KØVXM	FL	3	1	15	1,802
W5LUA*	TX	16	17	52	1,353
K5LLL	TX	5	1	11	1,608
N6CA	CA	5	—	20	3,978
WA8RJF	OH	6	2	14	1,306
K2YAZ	MI	4	1	7	843
K3SIW/9	IL	11	1	44	936
WØLD	CO	3	1	6	828

5 cm (5650-5925 MHz Standings)
Minimum Terrestrial Distance = 600 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K1WHS	ME	16	2	39	1,212
W5LUA*	TX	9	19	49	1,187
N6CA	CA	5	—	20	3,978
K3SIW/9	IL	9	1	36	930

3 cm (10-10.5 GHz)
Minimum Terrestrial DX = 800 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
W1AIM/1	RI	11	2	19	1,008
K1WHS	ME	14	1	33	1,212
WA2FGK	PA	12	2	21	1,086
W4DEX	NC	17	1	28	1,214
W5LUA*	TX	15	22	83	918
W6OYJ	CA	5	2	21	1,020
KJ6HZ	CA	2	2	19	808
N6CA	CA	4	—	18	3,978
K2YAZ	MI	7	1	21	924

12 mm (24-24.5 GHz)
Minimum Terrestrial DX = 250 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
W5LUA*	TX	3	8	17	542
W6HCC	CO	3	1	5	259

6 mm (47-47.2 GHz)
Minimum Terrestrial DX = 100 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
K2DH	NY	1	2	6	134
W4SW	VA	1	1	1	174
WA1ZMS/4	VA	2	1	7	114
KØRZ	CO	2	1	6	125
W6HCC	CO	2	1	5	217

4 mm (75.5-81 GHz)
Minimum Terrestrial DX = 10 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
WA1ZMS/4	VA	2	1	5	114

2.5 mm (119.98-120.6 GHz)
Minimum Terrestrial DX = 5 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
WA1ZMS/4	VA	2	1	5	114

2 mm (142-149 GHz)
Minimum Terrestrial DX = 5 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
WA1ZMS/4	VA	2	1	5	114

1.25 mm (241- 250 GHz)
Minimum Terrestrial DX = 5 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
WA1ZMS/4	VA	2	1	5	79

1 mm and Above (300+ GHz)
Minimum Terrestrial DX = 1 km

Call Sign	QTH	States	DXCC	Grids	Best DX (km)
WA1ZMS/4	VA	1	1	1	7.3

*Includes EME contacts
— Not given

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jan 22, 1400Z-2100Z, WX4MC, Stuart, FL. Martin County ARES/RACES. Road to Victory WWII Museum Open House. 14.280 14.255 EchoLink 315546. Certificate. Ron Tagg, KD4PQQ, 8629 SW Tropical Ave, Stuart, FL 34997. *Also visit roadtovictorymilitary museum.org*. **www.wx4mc.org**

Jan 23-Jan 29, 0800Z-2359Z, N7Q, Quartzsite, AZ. Quartzfest Hams. Quartzfest. All bands. QSL. QSL info not needed; all contacts will receive a QSL. *Will operate various time throughout the event*. **www.quartzfest.org**

Jan 29-Feb 6, 1500Z-0400Z, W5B, Lubbock, TX. Buddy Holly Memorial. 52nd anniversary of the death of Buddy Holly 18.150 14.260 7.260 3.860. QSL. W5B, 109 N Pontiac Ave, Lubbock, TX 79416. **www.amcrc.com/w5b**

Feb 3-Feb 6, 1200Z-1800Z, W3C, Washington, PA. Washington Amateur Communications Inc. Washington County Sportsmen Show. 14.250 7.225. QSL. Ed Oelschlager, 60 Carl Ave B2, Eighty Four, PA 15330. *Help us show the general public that Amateur Radio is fun. This is our 11th year at this special event.* **www.wacomarc.org**

Feb 5, 1400Z-2100Z, K3HWJ, Punxsutawney, PA. Punxsutawney Area Amateur Radio Club. Commemorating Groundhog Day. 14.240 7.245 147.390 146.715. Certificate. Mike Miller, N3HBH, 1097 Wishaw Rd, Reynoldsville, PA 15851.

Feb 5, 1500Z-2100Z, W5NAC, Nacogdoches, TX. Nacogdoches Amateur Radio Club. Columbia Special Event Station. 21.350 14.250 7.250. QSL. Nacogdoches Amateur Radio Club, 167 County Rd 2093, Nacogdoches, TX 75965. **www.w5nac.com**

Feb 5-Feb 6, 1500Z-2100Z, W3B, Baltimore, MD. Baltimore City RACES. 107th Anniversary of the Great Baltimore Fire. 14.270 7.280 3.865. QSL. Baltimore City RACES, 1201 E Cold Spring Ln, Baltimore, MD 21239. **bcraces.org**

Feb 5-Feb 6, 1500Z-2100Z, NI8G, Milan, OH. Thomas Edison Memorial Radio Club. Thomas Edison's Birthday. 28.370 21.270 14.270 7.270. QSL. Jack Hubbard, 13113 River Rd, Milan, OH 44846. **ni8n1@yahoo.com**

Feb 7-Mar 7, 1600Z-2300Z, W1AFV/W4, Dauphin Island, AL. Estey Family Amateur Radio Club. Dauphin Island, AL, IOTA NA-213. 18.140 21.355 14.255. QSL. Carl Estey, 10021 Drew Ave S, Minneapolis, MN 55431. *Will be operating with a Buddipole Antenna System. QSOs with everyone are welcome, particularly QRP and stations running mobile or portable*. **wa0cqg@arrl.net**

Feb 12, 1700Z-2359Z, NI6IW, San Diego, CA. USS *Midway* (CV-41) Museum Radio Operations Room. Women Marines Birthday, Lincoln's Birthday and Boy Scouts of America Founded 1910. 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**

Feb 17-Feb 19, 1700Z-2359Z, W6F, Petaluma, CA. Sonoma Mountain Repeater Society. Centennial celebration of the first US Air Mail flight. 21.290 14.280 146.91R. QSL. SCHS, PO Box 1373, Santa Rosa, CA 95402. *Flight by Fred J. Wiseman from Petaluma, CA to Santa Rosa, CA on February 17-18, 1911. Co-sponsors: The Salvation Army and Auxiliary Communications Service.* **fredwiseman.org**

Feb 19, 1400Z-2200Z, WØEBB, Leavenworth, KS. Kickapoo QRP Amateur Radio Club. 7th Annual Freeze Your Keys Winter Operating Event. 14.285 14.060 7.285 7.040. QSL. Gary Auchard, 34058 167th St, Leavenworth, KS 66048. **w0ebb@juno.com**

Feb 19, 1500Z-2300Z, K8BF, Kent, OH. Portage County Amateur Radio Service. 6th Annual Freeze Your Acorns Off. 21.315 14.315 7.215 3.815 EchoLink KC8RKV node. Certificate. Al Atkins, KB8VJL, 12433 Chamberlain Rd, Aurora, OH 44202. **www.portcars.org**

Feb 19-Feb 20, 1500Z-2200Z, WØFSB, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club. Commemoration of the 66th anniversary of the Battle for Iwo Jima and the Flag Raisings. 21.240 14.240 7.240. Certificate & QSL. Five Sullivan Brothers ARC, 4015 Independence Ave, Waterloo, IA 50703. **www.qrz.com/db/w0fsb**

Feb 19-Feb 20, 1600Z-2100, K4US, Alexandria, VA. Mount Vernon Amateur Radio Club. George Washington Special Event. 14.240 7.240 7.038. Certificate. Mount Vernon ARC, PO Box 7234, Alexandria, VA 22306. **k4us@mvarc.com**

Feb 23, 1400Z-2000Z, W7Z, Red Mountain Park, AZ. The Sunlife and Venture Out Amateur Radio Clubs. Third Annual Snowbird Field Day. 28.490 24.980 21.440 18.158 14.340 7.290. QSL. Earl Palmer, 560 S Rosemont, Mesa, AZ 85206. *Our goals are to operate SSB on all open HF bands between 40 and 10 m, to have fun, to work as many contacts as possible, not to keep score and to involve as many inactive senior citizen hams as possible*. **www.sunlifearc.webs.com**

Feb 23-Feb 24, 1800Z-2359Z daily, WØG, Palm Springs, CA. QCWA, Leo Meyerson, Chapter 154, Greater Palm Springs Area. Leo Meyerson (WØGFQ) special event station. 14.265. Certificate. QSL to operator contacted. *Honoring Mr Leo Meyerson, WØGFQ, who is celebrating his 100th birthday. Leo is founder/owner of W R L (World Radio Laboratories) of Council Bluffs, Iowa. He is famous for the GLOBE line of Amateur Radio equipment*. **popeye67@msn.com**

Feb 23-Mar 6, WA5DTK, San Antonio, TX. Central Texas Contest Group. Siege Days at the Alamo. 14.250 14.050 7.240 7.040. QSL. Barry Brewer, 601 Wagon Wheel Tr, Pflugerville, TX 78660. *For times of operation see* **www.ctdxcc.org**

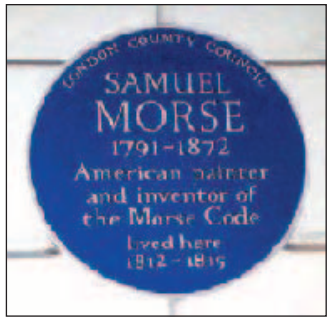
Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9 × 12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's Web site.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain text version of the form is also available at that site. You can also request a copy by e-mail or send a self-addressed, stamped envelope (SASE) (Special Requests, ARRL, 225 Main St, Newington, CT 06111; write "Special Events Form" in the lower left-hand corner.) Off-line completed forms can be mailed, faxed (Attn: Special Events) or e-mailed.

Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **Apr** *QST* would have to be received by **Feb 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 December 10. You can view all received Special Events at **www.arrl.org/special-event-stations**. QST

STEVEN C. GOLDFARB, AA3AE



Strays

Morse in London: **Steve Goldfarb, AA3AE, happened across this plaque while on business in London recently. It's one of a series commemorating famous people who have lived in and around London. Among the other scientists and inventors who have earned a blue plaque: Michael Faraday, Alan Turing, Sigmund Freud and Aldous Huxley.**

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

OP-ED

Evolve or Die

Randy Ross, KI4ZJI

Fifty years ago, Amateur Radio meant learning CW and twiddling with the knobs on something that glowed in the dark (tubes) and warmed the room. Today, Amateur Radio is, to many, something quite different. Fifty years ago, knowledge of tube technology was critical to society and Amateur Radio was a natural hobby for many. For the TV repairman, Amateur Radio was an enjoyable extension to his job. Or, perhaps, his job grew out of his passion for Amateur Radio. In fact, I've been told that if you needed your TV fixed, you could look to the Amateur Radio operator down the street for help.

Any way you look at it, there was a close tie between Amateur Radio and society. Fifty years ago, if a wife wanted to quickly send a message to a loved one at a foreign military installation, she relied upon the Military Auxiliary Radio System. Twenty years ago, phone patch through a 2 meter repeater was used to help someone in distress on the side of the road. Today, international communications can be easily accomplished in an instant at the computer keyboard and a motorist in distress can call for help with their own cell phone.

Some of our fellow Amateur Radio operators point to the computer, the Internet and the cellular telephone as the competition. Forgive me for being bold but this thinking is wrong. These are not the competition; they are the product of evolving technology. Knowledge of computers and the Internet should be embraced and incorporated into the newest evolutions of Amateur Radio.

The general public does not understand the technology they hold in their hand. When dad calls mom as he is driving home from work, does he give a thought about how that cell phone works? When a teen is sitting on the couch, looking at her friend's wall on Facebook, how is she connected? We, as Amateur Radio operators, need to understand that cell phones and the Internet are not passing fads. They are here to stay. In fact, their integration into society will only continue to expand. With that realization, we also need to understand that the hobby of Amateur Radio faces two choices: evolve or die.

Consider the Options

The evolving technology, whatever it may be, should be quickly embraced and integrated into the existing tool bag of the Amateur Radio operator. If you are interested in incorporating youth into your Amateur Radio club,

the club better use e-mail, text messaging, Facebook, Twitter and the other social media outlets, or it will never reach the youth.

DX clusters via packet radio are great if you have a packet modem and an extra radio. If you don't have the cash for that investment (like me), you could use Internet connected DX cluster software and the PC you already own. Perhaps another option would be using Twitter. What if your followers on Twitter were able to follow as you contacted strange and foreign countries in real time. Might it raise their interest? Suppose your Twitter friends watched as you noted your Russian contact, your Bulgarian contact, etc, then read about your club's upcoming Technician licensing class. Would they be more likely to attend? If you are interested in publicizing your club, build an active, attractive, dynamic Web site. Even better, publicize your Web site on social networking sites such as Twitter.

Publicity aside, if you want to be an effective, truly equipped operator, you better have a working, modern laptop computer in your go-kit, the requisite hardware to connect it to your radio and the skill to use it. You need to understand the emerging technology and develop a plan to integrate it into your existing skill set. We know the world relies upon e-mail. In fact, the US Postal Service and manufacturers of facsimile machines have suffered because, as many believe, they have not adapted to the changing technology.

Suppose for a moment there were a telecommunications outage in your area. Could you use your computer and radio as a bridge to the Internet to re-establish the e-mail connectivity your served agencies are accustomed to, or will you force them to go back to 30 year old technology? Are you even willing to embrace the idea or will you force them to use radiograms?

While there will always be a place for the straight key and while CW will work when nothing else will, we must, as a group, embrace the emerging technology and integrate it into Amateur Radio. If we fail to do this, our hobby will die in the face of the "competition." After all, is Amateur Radio about forcing one mode of communication upon the entire world or is it about using the best means of communicating for any given circumstance?

ARRL member Randy Ross, KI4ZJI, is a Public Information Officer in the North Carolina section and is also an Official Relay Station. Randy started and currently is the coordinator for the Foothills Weather Net (**foothillswx.net**)*, the new SKYWARN net in North Carolina. He is interested in contesting and enjoys working DX including stretching the limits of 2 meter FM simplex.*

Happily married since 1994 to his wife, Kellie, he has two children, Laurel and Benjamin. He earns an income providing information technology support for small businesses. Randy can be reached at PO Box 131, Shelby, NC 28151-0131, **ki4zji@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).

WB8IMY

ECLECTIC TECHNOLOGY

Windows 7 – Taking the Plunge

I finally took the plunge a few months ago, tearing apart my trusty station PC and rebuilding it with a new motherboard, video graphics card, hard drives and…*Windows 7*.

I must admit to having some concerns about how *Windows 7* would play with my favorite Amateur Radio applications, which include *WriteLog*, *Ham Radio Deluxe*, *DigiPan*, *WSPR*, *WSJT*, *PowerSDR*, *UIView*, *MixW* and *ACLog*. Since I was installing an entirely new operating system and hard drive, I had to reinstall each one. The good news is that *Windows 7* accepted each program with little more than a raised eyebrow from time to time (courtesy of its User Account Control system). Once I had all the applications fully installed and had assured *Window 7* that, yes, the programs were safe to run on my PC, everything was fine.

One aspect of *Windows 7* I noticed right away is its ability to quickly adapt to whatever situation I happened to throw at it. If it encounters a problem with a device you've attached or a program you have installed, *Windows 7* doesn't just immediately throw up its hands and say, "I give up." It seems to be designed to take the initiative and resolve conflicts on its own. For example, I deliberately plugged in a USB device that required an odd driver. I didn't have the original driver on CD, so I knew this would present a challenge. As soon as *Windows 7* "realized" that the driver was nowhere to be found on the hard drive, it immediately accessed my Internet connection, tracked down the driver from a site in Taiwan and installed it (after it asked for my approval).

So far I've been impressed with *Windows 7*. It appears to be smooth and well designed (at least from a user perspective). After four months of use I've yet to encounter strange hiccups or Blue Screens of Death.

My motherboard CPU is an Intel quad core, but I think at least part of the secret to enjoying a good experience with *Windows 7* is packing in lots of memory. I have 4 GB of fast RAM and may someday bump that up to 8 GB. Memory is relatively cheap, so it is a worthwhile investment. If you're buying a new station computer from an outfit such as Dell that allows you to customize the contents, insist on as much memory as your budget will allow.

A Different "Spin" on Oscillator Design

Researchers at the National Institute of Standards and Technology have found theoretical evidence of a new way to generate RF. Keep in mind that this is just theory at the moment, but if the experiments support the theory (early results are encouraging) we could be looking at a new generation of wireless technology that would be more secure and resistant to interference than conventional devices.

The team's findings point toward an oscillator that would harness the spin of electrons to generate microwaves. The theory predicts that a special type of stationary wave called a "soliton" can be created in a layer of a multilayered magnetic "sandwich." Solitons are shape-preserving waves that have been seen in a variety of media. Creating the soliton requires that one of the sandwich layers be magnetized perpendicular to the plane of the other sandwiched layers. Then, an electric current is forced through a small channel in the sandwich. Once the soliton is established, the magnetic orientation oscillates at more than 1 GHz — sometimes much more.

According to NIST physicist Thomas Silva, "You might use this effect to create an oscillator that uses much less energy than those in use today. And the military could use them in secure communications as well. In theory, you could change the frequency of these devices quite rapidly, making the signals very hard for enemies to intercept or jam." In other words, Spread Spectrum with ultra-fast frequency hopping.

Silva adds that the oscillator is predicted to be highly stable. Its frequency would remain constant even with variations in current. That's a distinct practical advantage since it would reduce unwanted noise in the system. It also appears to create an output signal that would be both steady and strong.

The research was published in the August 30, 2010 issue of *Physical Review*.

Triple-Mode Transistors

Triple-mode, single-transistor amplifiers based on graphene — the one-atom-thick form of carbon that recently won its discoverers a Nobel Prize — could become key components in future electronic circuits.

There has been a great deal of buzz about graphene in the engineering community. In case you're unfamiliar, graphene is strong, is nearly transparent and conducts electricity very well. But another key property is *ambipolarity*, graphene's ability to switch between using positive and negative carriers on the fly depending on the input signal.

A three-terminal single-transistor amplifier made of graphene can be changed during operation to any of three modes at any time using carriers that are positive, negative or both. According to Kartik Mohanram, an assistant professor of electrical and computer engineering at Rice University, the new transistor would behave like a water tap. "Turn it on and the water flows," he said. "Turn it off and the water stops. That's what a traditional transistor does. It's a unipolar device — it only opens and closes in one direction.

"But if you close a tap too much, it opens again and water flows. That's what ambipolarity is. Current can flow when you open the transistor in either direction around a point of minimum conduction."

That means a graphene transistor can be "n-type" (negative) or "p-type" (positive), depending on whether the carrier originates from the source or drain terminals. A third function appears when the input from each carrier is equal. In that configuration the transistor instantly becomes a frequency multiplier! QST

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org

K2TQN

VINTAGE RADIO

Joseph Koenig, W2BZM

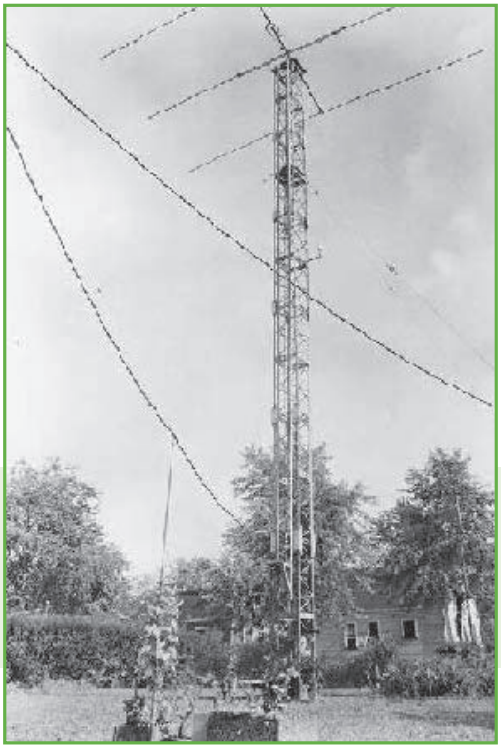
Joseph's first license was dated February 22, 1930, but his introduction to ham radio came much earlier. During 1922 he was listening to ham radio operators on the air and called himself a shortwave listener or SWL. He first joined the ARRL on February 23, 1922 and started receiving *QST* magazine. In 1923, after high school, he got a job working for DeForest in Jersey City, New Jersey. Then on George Washington's Birthday in 1930 his 35 years as a ham began.

Joe was a bachelor his entire life, spending his time working and dividing the rest between family, friends (mostly other hams) and operating on the air. He went to work for Con Ed (Consolidated Edison Company, the company that supplies electricity, gas and steam to most of New York City.) He started working there as a meter reader in the mid 1930s and returned after he came back from the war.

He was in the US Naval Reserve as a Seaman 1st Class from 1930 until 1934 and again as a Radioman 2nd Class from 1936 until he left the reserves in 1940, thinking his service to our country was done. After the US entered WWII, he enlisted in the US Army in 1942 at the age of 37 and was on active duty until August 1945. Stationed in the South Philippines, he was a sergeant and a Communications Chief. His superiors

W2BZM's 1950 beam mounted on an old cedar pole in his back yard. This was a typical installation of the time.

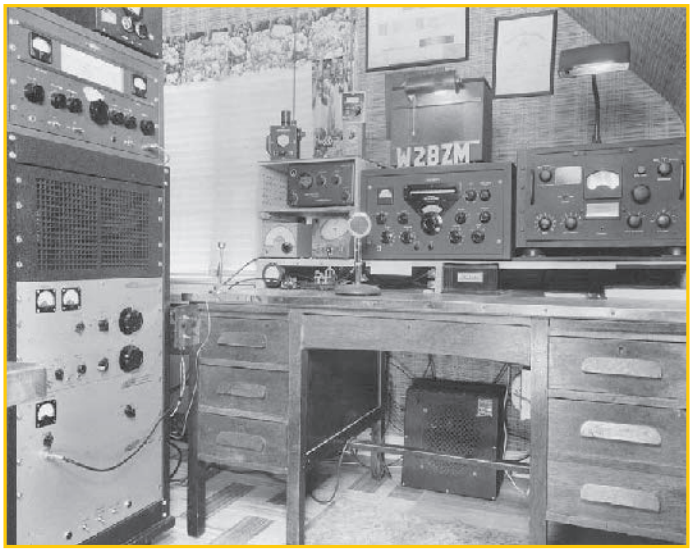
Joseph Koenig, W2BZM, in his 1950 shack. Equipment from the left: unknown, Collins 32V-2 transmitter, rotator indicator, Triplet modulation monitor (top), Collins 75A-1 receiver, field strength meters, BC-221 frequency meter (top), and an RCH CZC-46209 Scott Radio Labs receiver.



W2BZM's 1954 steel tower and beam. This is a four leg straight tower, compared to today's modern three leg tapered designs.

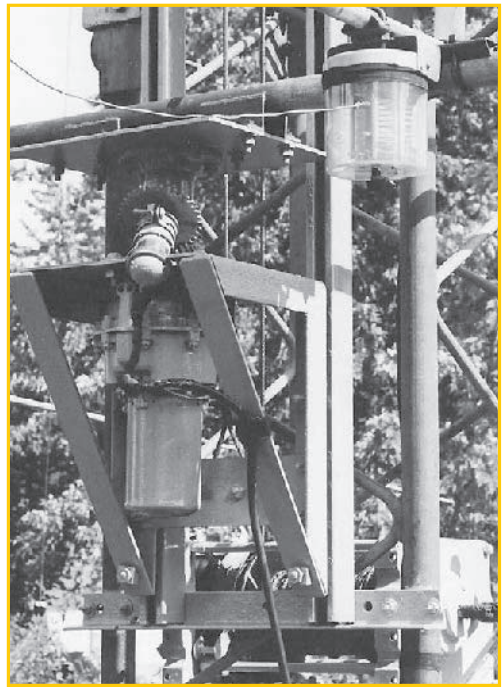
Joseph Koenig, W2BZM, in his 1954 shack. Equipment from the left: Collins 32V-2 in the rack — shielded for TVI, field strength meter, Hallicrafters SP-44 panadapter (top), unknown below, Collins 75A-3 receiver, Handy field strength meter (top) and the Scott Radio Labs receiver.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org



W2BZM's 1958 shack. Equipment from the left: rack-top unknown, Collins 32V-2 transmitter, Eldico TR-1-TV AM transmitter (rare), desktop field strength meters, Hallicrafters SP-44 panadapter, Eldico VFO, rotator indicator, Collins 75A-3 receiver and the Scott Radio Labs receiver.

Details of his beefy tower and antenna rotator. Note the geared unit. It is the selsyn motor that controls the rotator indicator in the shack.



valued him because of his radio knowledge and experience as he was able to keep them in touch with their superiors.

His discharge papers said he supervised a communication section in the installation, operation and maintenance of radio and wire communication. He instructed and trained personnel in techniques of field communication. It also mentioned that he would improvise and repair parts as necessary.

Attic Treasures

His family found a large box of mementos of his ham activities stored in an attic. These had been saved after he became a Silent Key. The box included his log books from 1957 through 1965; his 1950s photos; his collection of hamfest buttons, badges and program books; his ARRL membership certificates and awards; his 1932 Royal Order of the Wouff Hong certificate, and a few homemade 78 r/min records of his contacts. His family contacted me to see if I would be interested.

For a period of time, 1950 to 1958, he had a lot of photographs taken of his station and printed 8 × 10 inch photos. These outstanding photos immediately caught my attention. The box also included a printer's "tear sheet" showing two of the photos of his station, leading me to believe they were printed in a magazine or newspaper at one time. Going through his album I noticed he rubber stamped the date on an upper corner of the photos indicating when they were taken. (He made liberal use of this stamp in his logbook as well.) This helped me piece together a portion of his life.

His log book is a treasure. He made extensive notes and comments on the back of his log pages about his station and much of the work he performed on it. And there are a lot of pages, as it seems he was on the air almost every day talking to his friends. Through the notes, and his log entries, it was easy to figure what rig and mode he was using on almost any contact.

His Station

I guess one big benefit of being a bachelor is you don't have to get permission when you want to buy a new piece of gear or an antenna tower. Joe was always upgrading his shack with something new and as a collector today I envy the list of radios he had to play with over the years. I'll run through the list of what I found in his log book, things he added later and what the 1950s photos show.

Late 1950s: he was using a WRL Globe King 500A transmitter, with a July 9, 1958 note saying, "Last call w/GK500A and VFO." He replaced it with a WRL Globe King 500B transmitter; 1960: he added a Johnson Ranger transmitter, which he used with a Collins 75A-3 receiver on 75 meter AM phone; he bought a Hallicrafters HT-37 transmitter and started operating SSB. In early 1961 he added a Hallicrafters SX-101 receiver and a Collins 75A-4 receiver; July 1961 he added a Hallicrafters HT-33 linear amplifier to the HT-37. Then in February 1962 he purchased a Collins S-Line station and the matching 30L-1 linear amplifier. These replaced the WRL GK 500B, which was used up to this time on 20 meter AM phone. And finally going 100% SSB in October 1964, he purchased a Galaxy III transceiver replacing the faithful Ranger he had used up to this time on 75 meter AM phone.

Conclusion

Because of a common interest in ham radio he became friends with someone much higher up in the company. He had become an electrical technician for Con Ed.

In the 1940s and '50s, he had a regular routine of going to the movies every Thursday night at Radio City Music Hall in New York City. Thursday was the day they changed the movie they were playing.

Joe went to many hamfests and conventions from 1931 through 1965. He traveled and visited his ham friends around the country and they visited him. His log book had many notes mentioning his visitors, including some from other countries.

He was active on the New Jersey traffic nets and was good friends with Ed Raser, W2ZI, and attended Ed's Old Timer's nights. He also ran phone patches with his Collins station.

On Sunday March 14, 1965 his logbook shows he worked the following stations: W4TCO, W2MM, W2FGV, K4RLO, W2ZQ, WØYZK, W7GX, KØHCX and W6EHR.

Joe became a Silent Key on March 15, 1965 at the age of 60. He died at work at Con Ed. In the mornings he was usually the first person in the office. That day would be no exception. The second person in found him dead on the floor.

Please visit my Web site (**www.k2tqn.com)** for more photos of Joe Koenig's 1950 station and his hamfest button collection. I purchased a USB record turntable. If I can extract his contacts from the 78 r/min records, I'll post them as well.

Photos by K2TQN.

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

ALABAMA SECTION CONVENTION
March 5-6, Birmingham
D F H Q R S T V

The Alabama Section Convention, sponsored by the Birmingham ARC, will be held at the Zamora Shrine Temple, 3521 Ratliff Rd (Irondale). Doors are open 9 AM-4 PM. Features include flea market, dealers, tailgating, QSL card checking, forums, VE sessions, handicapped accessible, refreshments. Talk-in on 146.88 (88.5 Hz). Admission is $8 (includes both days). Tables are $24 for 6-ft, $32 for 8-ft. Contact Marvin Cook, KK4TC, 56 Valleydale Ct, Birmingham, AL 35244; 205-613-8298; **kk4tc@hotmail.com**; **w4cue.com**.

ARIZONA STATE CONVENTION
February 18-19, Yuma
D F H Q R S T V

The Arizona State Convention (7th Annual Yuma Hamfest and Emergency Preparedness Show), sponsored by the Yuma AR Hamfest Organization, will be held at the Yuma County Fairgrounds, 2520 E 32nd St. Doors are open Friday noon-5 PM, Saturday 8 AM-5 PM. Features include swapmeet; commercial vendors; tailgating; AR equipment; seminars; special guest from ARRL HQ Bob Allison, WB1GCM, Lab Test Engineer; DXCC card checking; VE sessions (Saturday, 9 AM; $15 fee); hospitality area; Country Store consignment sales; Buzzard BBQ dinner (Saturday, 6-8 PM, $10); on-site RV camping ($15 per night in advance, $20 per night at the event). Talk-in on 146.84 (88.5 Hz). Admission is $1 (under 13 free). Tailgating spots are $15 in advance, $20 at the door. Contact Roger Hunt, K7MEX, Box 1843, Yuma, AZ 85366; 928-305-1034; **info@yumahamfest.org**; **www.yumahamfest.org**.

Arkansas (Russellville) — Mar 5
D F H Q R S T V

8 AM-4 PM. *Spr:* Arkansas River Valley AR Foundation. Hughes Center, 1000 E Parkway. *TI:* 146.82 (131.8 Hz). *Adm:* $6. Tables: $10. John Evans, WB5BHS, Box 582, Russellville, AR 72811; 479-498-6205; **k5pxp@suddenlink.net**; **www.arvarf.com**.

Colorado (Brighton) — Feb 13 D F H R V

9 AM-1 PM. *Spr:* Aurora Repeater Assn. Adams County Fairgrounds, 9755 Henderson Rd. *TI:* 147.15 (88.5 Hz). *Adm:* $5. Tables: $10. Wayne Heinen, NØPOH, c/o ARA, Box 471802, Aurora, CO 80013; 303-699-6335; **n0poh@arrl.net**; **www.n0ara.org**.

Florida (Brooksville) — Feb 19 D F H R T

8 AM-2 PM. *Spr:* Hernando County ARA. Sand Hill Scout Reservation, State Road 50. *TI:* 146.715. *Adm:* $6. Tables: $10. John Nejedlo, WB4NOD, 15430 Waxweed Ave, Spring Hill, FL 34610; 813-838-5432; **wb4nod@tampabay.rr.com**; **hcara.org**.

SOUTHEASTERN DIVISION CONVENTION
February 11-13, Orlando, FL
D F H Q R S T V

The Southeastern Division Convention (65th Orlando HamCation and Computer Show), sponsored by the Orlando ARC, will be held at the Central Florida Fairgrounds, 4603 W Colonial Dr (SR 50). Doors are open Friday noon-6 PM; Saturday 9 AM-5 PM; Sunday 9 AM-2 PM. The theme for the 2011 Orlando HamCation is "Ham Radio Brings Communities Together." Features include swap tables, commercial booths ($300), major vendors, tailgating ($35 for the weekend, plus admission), RV camping with water and limited electricity ($25 per night, no reserved spaces), VE sessions (two sessions on Saturday, 9 AM and 1 PM, pre-registered only; Joe, N4UMB, **hamcationtesting@cfl.rr.com**), forums on various subjects of interest, foxhunt, Special Event Station, QSL card checking, handicapped parking, free parking. Talk-in on 146.76, 147.015. Admission is $10 in advance (by Jan 22), $12 at the door (good for the entire 3 days); under 12 free with paid adult. Swap tables are $45 (per 8-ft table for the entire weekend). Contact Orlando HamCation, Box 547811, Orlando, FL 32854-7811; 407-841-0874 or 800-214-7541; **info@hamcation.com**; **www.hamcation.com**.

Florida (Sebring) — Feb 19 D F H R T

7 AM-2 PM. *Spr:* Highlands County ARC. Bert J Harris Agra Civic Center, 4509 George Blvd. 18th Annual Hamfest. *TI:* 147.045 (100 Hz). *Adm:* $5. Tables: $10. John Bliss, KF4IZT, 615 N Roberts Rd, Avon Park, FL 33825; 863-452-6600; **kf4izt124@gmail.com**; **www.strato.net/~hamradio**.

Coming ARRL Conventions

January 15
Southern Florida Section, Fort Myers*

January 28-29
Mississippi State, Jackson*

February 5
South Carolina Section, Ladson*
Virginia State, Richmond*

February 11-13
Southeastern Division, Orlando, FL

February 18-19
Arizona State, Yuma

February 26
Vermont State, Colchester

March 5
South Texas Section, Rosenberg

March 5-6
Alabama Section, Birmingham

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

*See January *QST* for details.

Georgia (Dalton) — Feb 26 D F H R S T V

7 AM-2:30 PM. *Spr:* Dalton ARC. North Georgia Fairgrounds, 500 Legion Dr. 29th Annual Hamfest. *TI:* 145.23. *Adm:* $5. Tables: $5. Harold Jones, N4BD, 3033 Davis Rd SW, Rocky Face, GA 30740; 706-673-2291 (9 AM-9 PM); fax 706-673-2436; **n4bd@windstream.net**; **www.w4drc.net**.

Illinois (Sterling) — Mar 6 D F H R V

7:30 AM. *Spr:* Sterling-Rock Falls ARS. Challand Middle School, 1700 6th Ave. 51st Annual Hamfest. *TI:* 146.85 (114.8 Hz). *Adm:* advance $5, door $6. Tables: $7. Paula Portner, KC9FQK, 1302 W 2nd St, Dixon, IL 61021; 815-284-5650; **pportner@comcast.net**; **www.sterlinghamfest.com**.

Indiana (Dugger) — Mar 5 D F R T V

7 AM-2 PM. *Spr:* Dugger ARC. Dugger Park Community Building, S Hicum St. *TI:* 146.775 (136.5 Hz). *Adm:* $5. Tables: 1 free, additional tables $1 each. Kyle Shipman, KB9ZGN, 7084 E Monroe St, Dugger, IN 47848; 812-648-2487; **kb9zgn@sbcglobal.net**; **www.kc9ak.org/hamfest.html**.

Iowa (McClelland) — Mar 5 D F

8 AM-noon. *Spr:* Southwest Iowa ARC. McClelland City Hall, 117 Main St. *TI:* 146.82. *Adm:* $4. Tables: $8. Greg Ross, NØGR, 22106 320th St, Minden, IA 51553; 712-566-2698; **GregorySRoss@gmail.com**; **swiarc.org**.

Maine (Chelsea) — Feb 5 D F H Q R

8 AM-1 PM. *Spr:* Augusta ARA. Crystal Falls, US Rte 17. *TI:* 146.88 (100 Hz). *Adm:* $5. Tables: Free. Bill Crowley, K1NIT, 150 Maple St, Farmingdale, ME 04344; 207-623-9075; **k1nit@arrl.net**; **www.w1tlc.com**.

Massachusetts (Feeding Hills) — Mar 5
D F H R T V

Set up 7 AM; public 9 AM-2 PM. *Spr:* Mount Tom Amateur Repeater Assn. Springfield Turnverein Club, 176 Garden St. 23rd Annual Hamfest. *TI:* 146.94 (127.3 Hz). *Adm:* $5. Tables: $15; tailgating $10 per space. Mary Elkins, N1TOY, 24 Shoreline Dr, Ware, MA 01082; 413-222-1990; **n1toy@arrl.net**; **www.mtara.org**.

Massachusetts (Marlborough) — Feb 19
D F H R V

Set up 6:30 AM; public 9 AM. *Spr:* Algonquin ARC. Marlborough 1Lt Charles W Whitcomb School (formerly Intermediate/Middle School), 25 Union St. *TI:* 147.27 (146.2 Hz), 449.925 (88.5 Hz). *Adm:* $5. Tables: advance $15 (by Feb 11), $20 (after Feb 11). Tim Ikeda, KA1OS, 7 Birchwood Rd, Hudson, MA 01749; 978-333-0067; **fleamarket@n1em.org**; **www.n1em.org**.

Michigan (Livonia) — Feb 20 D F R

8 AM-noon. *Spr:* Livonia ARC. Civic Park Seniors Center, 15218 Farmington Rd. 40th Annual Swap-n-Shop. *TI:* 145.35 (100 Hz),

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

146.52. *Adm:* $5. Tables: advance $16, door $20. Mike Rudzki, N8MR, Box 51532, Livonia, MI 48151; 734-941-5043; **k8uns@arrl.net**; **www.livoniaarc.com/Swap.htm**.

Michigan (Traverse City) — Feb 12 F H R V
8 AM-noon. *Spr:* Cherryland ARC. Immaculate Conception Elementary School, 218 Vine St. 38th Annual Swap-n-Shop. *TI:* 146.86. *Adm:* $5. Tables: $8. Joe Novak, W8TVT, 201 S Spruce St, Traverse City, MI 49684; 231-947-8555; **jjnovak@charter.net**; **cherrylandarc.com**.

Minnesota (St Cloud) — Feb 19 D F H R V
9 AM-1 PM. *Spr:* St Cloud ARC. National Guard Armory, 1710 8th St N. *TI:* 147.015 (100 Hz). *Adm:* $6. Tables: $16. Art Carlson, WAØNJR, 2707 15th St N, St Cloud, MN 56303; 320-267-1725; **wa0njr@hotmail.com**; **www.w0sv.org**.

New Jersey (Gloucester City) — Feb 19 D H R
8 AM-3 PM. *Spr:* Gloucester City ARC. Pine Grove Fire Association Hall, Jersey Ave at 9th St. *TI:* 447.775 (146.2 Hz), 146.82 (131.8 Hz). *Adm:* $5. Tables: no fee. Jay Goheen, KB2ADL, c/o Gloucester City Fire Headquarters, 1 N King St, Gloucester City, NJ 08030; 856-397-3703; **kb2adl@comcast.net**; **nj2gc.org**.

New Jersey (New Providence) — Feb 25 H R
7 PM. *Spr:* New Providence ARC. New Providence Municipal Center, 360 Elkwood Ave. Auction. *TI:* 147.255 (141.3 Hz). *Adm:* $5 (buyers and sellers). Jim Stekas, K2UI, Box 813, New Providence, NJ 07974; 908-665-0470; **stek1969@comcast.net**; **www.nparc.org/auction.htm**.

New York (Horseheads) — Feb 26 D H R V
8 AM-2 PM. *Spr:* ARA of the Southern Tier. NYS Armory, 128 Colonial Dr. 30th Annual Hamfest. *TI:* 147.36. *Adm:* advance $5, door $6. Tables: $17 (discounts available for early registration). Charlie Santi, KA2BED, 6 Hickory Grove Rd, Horseheads, NY 14845; 607-481-0908; fax 607-739-9817; **ka2bed@arast.org**; **arast.org**.

North Dakota (Bismarck) — Feb 26 D F H R S V
7 AM-3 PM. *Spr:* Central Dakota ARC. St Mary's Grade School, 807 E Thayer Ave. 21st Annual Hamfest. *TI:* 146.85. *Adm:* advance $6, door $7. Tables: $5. Dick Veal, KAØETO, 701-223-7481; **georgerv@bis.midco.net**.

Ohio (Lorain) — Feb 6 D F H R
8 AM-1 PM. *Spr:* Northern Ohio ARS. Gargus Hall, 1965 N Ridge Rd. Annual Winter Hamfest, free breakfast with paid admission. *TI:* 146.7. *Adm:* $6. Tables: $10. Thomas Porter, W8KYZ, 161 Herrmann Dr, Avon Lake, OH 44012; 440-930-9115; **tporter161@oh.rr.com**; **www.noars.net**.

Ohio (Mansfield) — Feb 13 D F H Q R S V
Set up Saturday 3-9 PM, Sunday 6 AM; public 7 AM-3 PM. *Spr:* InterCity ARC. Richland County Fairgrounds, 750 N Home Rd. Mid-Winter Hamfest and Computer Show. *TI:* 146.94 (71.9 Hz). *Adm:* advance $5, door $6. Tables: $14. Danny Bailey, KB8STK, 70 Euclid St, Shiloh, OH 44878; 419-896-3603; **kb8stk1@hotmail.com**; or Dean Wrasse, KB8MG, 419-589-2415; **www.w8we.org**.

Oklahoma (Elk City) — Mar 5 F V
8 AM-5 PM. *Spr:* West Central Oklahoma ARC. Civic Center, E Rte 66. *TI:* 146.76. *Adm:* $5. Tables: $5. Earl Bottom, N5NEB, Rte 1, Box 62A, Hammon, OK 73650; 580-821-0633; **n5neb@waywireless.com**.

Oregon (Rickreall) — Feb 19 F H R
9 AM-3 PM. *Spr:* Salem Repeater Assn. Polk County Fairgrounds, 520 S Pacific Hwy. *TI:* 146.86 (186.2 Hz). *Adm:* advance $7, door $8. Tables: without power $20, with power $24. Donald Brusch, K7UN, Box 5130, Salem, OR 97304; 503-931-8751; **k7un@arrl.net**; **www.w7sra.org**.

Pennsylvania (Castle Shannon) — Feb 27 D F Q R
8 AM-3 PM. *Spr:* Wireless Assn of South Hills. Castle Shannon VFD Memorial Hall, 3600 Library Rd (Rte 88). WashFest 2011. *TI:* 146.955 (131.8 Hz). *Adm:* $5. Tables: $10 (power $5 extra). Carol Danko, KB3GMN, 4246 Seton Dr, Pittsburgh, PA 15227; 412-884-1466; **n3sbf@comcast.net**; **n3sh.org**.

Puerto Rico (Hatillo) — Feb 6 D F H Q R S T V
8 AM-2 PM. *Spr:* Caribbean AR Group. Hatillo Municipal Coliseum, Carretera Numero 2. Foxhunt, conference by ARRL SM. *TI:* 147.21 (127.3 Hz), 146.52. *Adm:* Free. Tables: $10. Serafin Martinez, KP4FIE, HC 4, Box 43014, Hatillo, PR 00659; 787-221-5016; **serafinmrtnz@yahoo.com**.

Texas (Georgetown) — Feb 12 D F H R V
7 AM-4 PM. *Spr:* Williamson County ARC. Georgetown Community Center, San Gabriel Park, 455 E Morrow St. *TI:* 146.64 (162.2 Hz). *Adm:* $2. Tables: $8. Rick Trommer, W5NR, 302 Rio Bravo Rd, Georgetown, TX 78628; 512-863-2428; **w5nr@arrl.net**; **www.wcarc.com**.

Texas (Orange) — Feb 26 D F H R S T V
8 AM-2 PM. *Sprs:* Orange ARC and Jefferson County ARC. VFW Hall Post #2775, 5303 16th St (Hwy 87 N). *TI:* 147.18. *Adm:* $5. Tables: $15. Rocky Wilson, N5MTX, 3736 Third Ave, Orange, TX 77630; 409-988-8906; **rockygwilson@hotmail.com**; **www.qsl.net/w5nd**.

SOUTH TEXAS SECTION CONVENTION

March 5, Rosenberg
D F H Q R S T V
The South Texas Section Convention (10th Annual Greater Houston Hamfest), sponsored by the Brazos Valley ARC, will be held at the Fort Bend County Fairgrounds, 4310 Highway 36 S. Doors are open 8 AM-2 PM (registration begins at 7 AM). Features include swapmeet; commercial vendors; free tailgating with early buyer access before 8 AM; emergency vehicles and displays; training seminars; hands-on demos; QSO via satellite; informative lectures; featured speakers including ARRL COO Harold Kramer, WJ1B; Special Event Station W5H; DXCC card checking; foxhunt; VE sessions (registration 8 AM, testing begins at 9 AM and 10:30 AM); ARRL AREC certification testing (11 AM); breakfast and lunch available. Talk-in on 146.94 (167.9 Hz). Admission is $5, under 14 free. Tables are $10. Contact John Chauvin, K5IZO, 5631 Darnell St, Houston, TX 77096; 713-981-8281; **k5izo@yahoo.com**; **www.houstonhamfest.org**.

VERMONT STATE CONVENTION

February 26, Colchester
D F H Q R S V
The Vermont State Convention (HAM-CON), sponsored by the Radio Amateurs of Northern Vermont, will be held at the Hampton Inn Convention Center, 42 Lower Mountain View Dr (Rtes 2/7). Doors are open 8 AM-2 PM. Features include flea market with specialty tables, new equipment dealers, vendors, forums, demonstrations of AR communications, Special Event Station W1V, VE sessions (1 PM, all exams; $14 fee, exact change in cash), FCC Commercial License exams (1 PM, $50 fee), handicapped accessible, plenty of ample free parking. Talk-in on 145.15 (100 Hz), bulletins on 146.67. Admission is $6 in advance (by Feb 14), $8 at the door (under 13 free); early admission at 6 AM is $12 in advance (by Feb 14), $15 at the door. Tables are free while they last (first-come, first-served). Contact Mitch Stern, W1SJ, 802-879-6589; **w1sj@arrl.net**; **www.ranv.org**.

Virginia (Annandale) — Feb 27 D F H Q R T V
8 AM-1 PM. *Spr:* Vienna Wireless Society. Northern Virginia Community College, 8333 Little River Turnpike. Winterfest 2011. *TI:* 146.91. *Adm:* $6. Tables: $25. Bob Bowis, WB4KLJ, 335 N Granada St, Arlington, VA 22203; 703-829-4308; **winterfest2011@viennawireless.org**; **www.viennawireless.org/winterfest.php**.

West Virginia (Oak Hill) — Feb 12 F H R S V
9 AM-2 PM. *Spr:* Plateau ARA. Lewis Community Center, 469 Central Ave. 31st Hamfest. *TI:* 146.79 (100 Hz). *Adm:* $5. Tables: $10. Charles Hardy, KD8MOA, Rte 2, Box 301-D, Fayetteville, WV 25840; 304-640-4162; **kd8moa@arrl.net**; **plateau.9f.com**.

Wisconsin (Fitchburg/Madison) — Feb 12 D F H R
9 AM-1 PM. *Spr:* New Era Repeater Technocrats. Memorial United Church of Christ, 5705 Lacy Rd. Capital City Hamfest. *Adm:* $5 (under 13 free). Tables: $10. Steve Johnston, WD8DAS, 2309 Tulare St, Fitchburg, WI 53711; 608-276-5581; **sbjohnston@aol.com**; **www.wd8das.net/hamfest**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings, online and in the *ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts.

For hamfests: Once the form has been submitted, your ARRL director will decide whether to approve the date and provide ARRL sanction. *For conventions:* Approval must come from your director and the ARRL executive committee.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **February 1** to be listed in the **April** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL Web banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**.

75, 50 AND 25 YEARS AGO

February 1936

- The cover photo shows a receiver with "Successful Noise-Silencing Circuits."
- The editorial tells the mysterious tale of "The Shadow" — strange and bothersome interference in the radio spectrum that was heard at various points around the world. After considerable detective work and tracking by hams, the Naval Communications Reserve, and Harvard's Cruft Laboratory, the interference was found to be caused by those new-fangled diathermy machines, which were being used quite a lot for heat therapy on athletes at the beginning of the football season.
- James Lamb, W1AL, presents "A Noise-Silencing I.F. Circuit for Superhet Receivers."
- Robert Talbert, W9SHC, tells about "The Regenerative Receiver with Separate Beat Oscillator."
- In "200 Watts C.W., 75 Watts 'Phone," Frank Gow, W1AF, describes his new three-band transmitter that uses only two tubes in its R.F. line-up.
- "An Unconventional Receiver for the Ultra-High Frequencies" reports on a new development from the National Bureau of Standards.
- The Old Man breaks a long period of silence and delivers "A Few Random Remarks" that our Young Squirts should take to heart.
- George Grammer, W1DF, tells us about his latest project, "A Ten-Meter Converter," for those hams whose 10-meter receiver coverage is either not good or non-existent.
- Durward Tucker, W5VU, discusses "Types of Distortion in 'Phone Transmitters."

February 1961

- The cover shows W1FVY at his Arctic duty station on Fletcher's Ice Island.
- The editorial reminds us, once again, of the chilling story of the Wouff Hong.
- Carl Ericson, W2PPL, tells us how to get good performance on a low budget by using "The BC-453 as a Tunable I.F. in a Multiband Receiver."
- Lew McCoy, W1ICP, describes "A Combination Code-Practice Oscillator-Monitor."
- "Modified 'Little Oskey'," by Frank Blanchette, W1PKC, gives us a combination keying monitor and receiver muter for low-level blocked-grid keying.
- In "A Sturdy Lightweight 37-Footer," Henry Lenz, W3DVY, tells us how to make an antenna-support pole using inexpensive downspouting.
- Ed Tilton, W1HDQ, provides "Practical Operating Hints for 1215 Mc."
- Richard Auerbach, DL1FK, describes "The DL1FK Compact Multiband Beam Antenna" that he uses on 10, 15, and 20 meters.
- "Ice Island Revisited," by Bob Mellen, W1IJD, and Carl Milner, W1FVY, reports on 6-meter DX operation from Fletcher's Ice Island.
- "The Hurricane Donna Story," by National Emergency Coordinator Geoge Hart, W1NJM, tells us how hams from Florida to Maine helped in the wake of one of the most ferocious hurricanes ever.

February 1986

- The cover illustration reports that amateurs came through once again in the wake of Colombia's recent volcano disaster.
- The editorial reports on the Privacy Act that is now under consideration by Congress, separating fact from fiction in rumors that are circulating.
- Albert Shaio, HK3DEU, and Fred Laun, K3ZO, report on "The Colombia Volcano."
- "A Simple, Effective Receiving Aid," by Robert Sommer, N4UU, tells about his device that uses a low-pass filter for one side of a stereo speaker pair and a high-pass filter for the other, creating a spatial illusion that helps separate signals in a crowded band.
- Doug DeMaw, W1FB, describes how we can try out our new ham band with "Four Watts, QSK, for 24.9 MHz."
- W1FB also presents Part 4 of "Construct a VHF/UHF Signal Generator."
- In "CATVI Field-Strength Measurements Made Easy," Greg Bonaguide, WA1VUG, describes how we can use our 2-meter transceivers for field-strength measurements.
- Andrew Tripp, KA1JGG, and Paula McKnight, N1DNB, provide a good overview of last year's ham radio accomplishments, in "Amateur Capsule 1985."

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

NOVEMBER 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**.

529	160	115	WA5LOU	85
KØIBS	K1HEJ	W8DJG	WØCLS	W2CC
	N1UMJ	KD1LE	NØMEA	WA4UJC
472	W5DY	K2HJ	WAØVKC	NA7G
W4CAC	KGØGG		KC2UVQ	AL7N
		113	W4TTO	N9WLW
405	158	KO6V	WK4P	
K8OLY	KK7DEB		K8VFZ	83
		112	KB8GT	W5ESE
380	155	KC2ODN	KN8B	
N5NVP	W4DNA		KD8CYK	82
	K8RDN	111		N7IE
345		W1PLW	98	KK7TN
KT2D	150		K5MC	KBØDTI
	KB1NMO	110	W8CPG	
339		KB5SDU		81
KI4KWR	147	W8UL	96	KJ7NO
	KA8ZGY	KE4CB	W5GKH	
295		NM1K		80
K2HAT	145	K1YCQ	95	N4ELI
	WS6P	N9MN	K2WRC	KJ4HGH
290		KJ4MNW	K4JGA	K8KV
K2DYB	142	K4BEH	KCØM	WDØGUF
KA2ZNZ	KC2SFU	K4BG		KB5KKT
WB9YBI		K4GK	94	KCØZDA
	140	W4WNE	N8IO	KC7ZZ
284	K6HTN	W2DWR		N2YJZ
W2MTA	KK3F	W7QM	93	KD8LZB
	N2GJ	N7XG	N2DW	
278	KF7GC	N7YSS		79
KD8KWG		WI2G	92	W8IM
	135	WB6OTS	K2GW	W8QZ
265	AC6C	W2EAG		
KB2ETO	W3YVQ	WM2C	91	77
	N1QLN	WE2G	K6RAU	NA9L
260	KB2BAA	NX8A	KE5YTA	
AK2Z	K7OAH		W9LW	75
	N2JBA	109		KC5MMH
245		WD8BCS	90	N2VQA
WB9FHP	130		K4MSG	
	NN7H	108	N9VT	74
220	K9LGU	AD4BL	KA5AZK	KA8NSG
WD9FLJ	KC5OZT		KC8WH	KB2CCD
	K6JT	107	WB8SIQ	
215	N1IQI	W3CB	N8DD	73
WB9JSR	WB2FTX	N2VC	WA3EZN	N5ASU
	WØLAW		N3ZOC	
206	KB2RTZ	105	K3IN	72
WD8USA	K2TV	WB6UZX	KB3LNM	N8SY
	K4IWW		W3GQJ	KK1X
199		104	KA1EHR	
WB8RCR	128	AD8BC	K1JPG	71
	W7JSW		NU8K	N6VI
190		101	KZ8Q	
KT5SR	125	KF5CRX	KT4YA	70
	N3RB	KØLQB	WB4BIK	K5GLS
181	K9EOH		N3KB	WB4GHU
K2ABX		100	W9MBT	W9WXN
	120	K4SCL	NIØI	KØDEU
180	AG9G	N4ABM	KI4YV	NØDLK
N9VC	W4OTN	KA3OCS	WD8DHC	NØDUW
	KA4FZI	WB8HHZ		NØDUX
175	W1GMF	N8OD	89	NUØF
WA2BSS	KW1U	WG8Z	KB9KEG	KAØFUI
	N1LKJ	N8CJS	KØBXF	KBØJKU
170	N2GS	WD8Q		NØMHJ
NX9K	NC4VA	AA3SB	88	N3NTV
KE5HYW	WB8WKQ	N1JX	KB8RCR	KØPTK
		N5OUJ		KØOR
162	116	NR2F	87	KØRXC
N9DVL	KK5NU	W6WW	WA2CUW	NØUKO
		N3SW		KD7ZUP
		W3TWV		KD8AAD

The following stations qualified for PSHR in previous months, but were not properly recognized in this column: (Oct) WS6P 180, N2YJZ 85, K6RAU 81, KB9KEG 81. (Sep) KT5SR 200, KT4YA 90.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, EMA, ENY, EPA, GA, IA, IL, IN, KS, LA, LAX, MDC, ME, MI, MN, MS, NC, NFL, NLI, NNJ, NNY, NTX, OK, OR, ORG, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WNY, WMA, WPA WI, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, ID, IN, KS, MDC, ME, MI, MN, MT, NLI, NM, OH, OK, 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.

W1GMF 2509, KK3F 1709, KA9EKG 1430, N1IQI 1427, WB5NKD 1221, W8UL 1054, KW1U 951, WB9JSR 758, KZ8Q 727, WB8WKQ 725, N8IXF 622, N1UMT 629, WB5NKC 601, KX9K 560, K1JPG 509, N1LKJ 500.

Stations earning BPL by Originations plus Deliveries: NM1K 103.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

W1AKV **Soderberg**, John W., Weston, VT
N1BV **Coyne**, George K., Alexandria, VA
W1ECB **Jones**, Warner E., South Burlington, VT
W1FSK **Marshall**, Stephen E., Dover, NH
W1GHV **Tuttle**, Albert L., Port Orange, FL
W1HFR **Riordan**, Michael J., Reading, MA
W1RRN **Fermano**, Joseph L., Center Harbor, NH
♦W1TX **Suker**, John R., Rutland, VT
WA1ZFE **Daley**, William "Bill," Norwich, CT
WA2DNP **McKeeby**, Raymond "Jack," Turnersville, NJ
K2EAP **Csikortos**, Raymond, Corning, NY
W2FLI **Fox**, Philip E., Newville, PA
W2IAJ **Obenauf**, Frank S., Largo, FL
WA2PJW **Soper**, Clifton, Lowman, NY
ex-W2QJF **Henry**, Carl R., Sutton, MA
KC2TZE **Nelson**, Keith N., East Syracuse, NY
WA2UNP **Raff**, Dr Malcolm I., Berkeley, CA
♦WB2WBU **Sollitt**, Lawrence "Skip," Syracuse, NY
W2WQK **Egelberg**, Stanley D., Deerfield Beach, FL
WA2WUU **Landis**, Steven H., Brunswick, GA
KN2X **Henneberry**, William P., Yonkers, NY
WA3APD **Gladis**, Cyril "Cy," Aliquippa, PA
W3BBX **Broad**, William, Tatamy, PA
K3DXA **Myers**, William H., Waynesboro, PA
KA3EZK **Czajkowski**, Marion, Erie, PA
WA3JPP **Comden**, Priscilla "Tippie," Pittsburgh, PA
N3KBB **Daggett**, Thomas G., Erie, PA
K3MAN **Claussen**, George J., Lansdale, PA
WA3PPW **Sharrar**, Walter B., King of Prussa, PA
N3VW **Rawson**, William P., Divide, CO
W3ZG **Scott**, Duane E., Clinton, PA
AA4BN **Sparks**, James "Jimmy," Clewiston, FL
AB4C **Droegemeyer**, Don J., Santa Rosa, CA
♦W4CID **Huddle**, Ted H., Kirtland, OH
WD4CLY **Tudor**, Paul G., La Grange, KY
K4CVA **Shearman**, Robert "Rob," Ten Mile, TN
NJ4D **Jourdan**, Jonathan P., Rock Hill, SC
N4DMT **Campbell**, Alice "Lallie," Birmingham, AL
WD4DPA **McKeever**, James J., Ocklawaha, FL
WB4EPL **Demetropulos**, George W., Mobile, AL
KD4JQB **Bice**, Howard "Gene," Ragland, AL
KD4LJU **Verge**, Ernie E., Homosassa, FL
WA4NPR **Yount**, James E., Hickory, NC
KB4NTI **Toerpe**, Bob, Jacksonville, FL
N4NWT **Scott**, Jack J., Ocala, FL
WB4PEL **Frazier**, Charlotte E., Dunedin, FL
K4PGR **Conroy**, Mark D., Marietta, GA
W4PNC **Talsma**, Charles, Dothan, AL
N4REA **Anderson**, Robert E., Amelia Court House, VA
WX4TM **Moore**, Alfred "Tom," Valley, AL
WB4TPG **Edgerton**, David E., Brooksville, FL
KE4VEK **Meneilley**, William H., Sarasota, FL
AE4VH **Rogers**, Holt L., Toccoa, GA
KG4VQU **Taylor**, Quentin S., Vienna, VA
♦K4VXP **Smith**, Paul E., Campbellsville, KY
W4WZU **Booker**, William "Bill" Jr, Louisville, KY
KC4YVB **Archer**, Kenneth L., Midlothian, VA
♦K5ASW **Callaway**, Harry W., Marlow, OK
N5GDB **Crawford**, Lloyd B., Austin, TX
W5IBR **Bivins**, Doyle S., Wichita Falls, TX
W5MDL **Henegar**, Harold "Hal," Austin, TX
KB5MUS **Honsinger**, Donald E. Jr, Powderly, TX
WD5O **Lovett**, Barney Joe., Doddsville, MS
K5OLE **Freiberger**, David, San Antonio, TX
K5UAH **Lewis**, David C., Orange, TX
KD5UPG **Gragg**, Joe R., Palestine, TX
KC5VWK **Abruzzo**, Richard J., Albuquerque, NM
W5YGR **Miller**, August, Las Cruces, NM
N5ZJ **Hemard**, Charles J., Lumberton, MS
KG6APE **Stillman**, Patricia R., Squaw Valley, CA
♦K6BGM **Gmelin**, Caroline, Los Osos, CA
KI6CEH **Mingus**, Daniel T., Stockton, CA
KA6DLG **Diekman**, Janet, Rescue, CA
NW6F **Jacobs**, Robert C., Baja California Sur, Mexico
KG6KJF **Lemburg**, Timothy L., Oroville, CA
AH6KL **King**, Scott, Aptos, CA
N6KVA **Jones**, Richard "Dick," Omaha, NE
W6LHY **Williams**, Paul J., Phelan, CA
WA6STC **Gustafson**, Ralph H., San Diego, CA
KA6UTC **Bloomfield**, Lawrence B., Florence, OR
W6YBT **Vreeland**, Robert W., San Francisco, CA
KG6ZYT **Nelson**, Jack V., Madera, CA
N6ZZF **Goltz**, Arthur "Art," Woodland Hills, CA
KD7BYW **Compton**, Gary J., Ogden, UT
KB7BTI **Faler**, Lillian, Pullman, WA
K7CVL **Hendrickson**, Richard "Dick," Seattle, WA
AB7CW **Saravo**, Jeremy G., Flagstaff, AZ
W7DIV **Erickson**, Helge J., Hoquiam, WA
K7ERL **Lively**, Edward R., Sumner, WA
WH7FB **Golden**, Kile O., Keaau, HI
N7FC **Atlas**, Michael, Tucson, AZ
W7GHQ **Calvin**, Glendon M., Vancouver, WA
W7GSW **Hedrick**, Langdon C., Seattle, WA
WA7IFX **Van Nostrand**, Jim, Jackson, WY
W7KOV **Johnson**, Edwin W., Riverside, CA
W7KRG **Lane**, Gordon, Santa Rosa, CA
♦NG7Y **Pogue**, Myron C., Portland, OR
W7YW **Worthy**, Thomas H., Cave Creek, AZ
K7ZTM **Smith**, Landon "Pete," Jr, Layton, UT
K8AVP **Talago**, Judith A., Flemington, WV
WD8B **Fogt**, David H., Piqua, OH
♦K8DD **Kohl**, Henry R., Attica, MI
KC8DEU **Mobley**, Forrest "Tiny," Akron, OH
KC8DV **Brown**, Donald L., Bucyrus, OH
KD8EAB **Jarrell**, David T., Dunlow, WV
W8HVG **Abraczinskas**, Ray "Abe," Grand Rapids, MI
W8LLA **Van Kuiken**, John F., Gilmer, TX
♦K8OCL **Champa**, Dr John J., Richardson, TX
KC8SIX **Gillespie**, Daniel J., Ada, MI
W8SR **Henderson**, Andrew B., Dayton, OH
WB8WZO **Maines**, Duaine, Warren, OH
WB8YJM **Anderson**, Nancy L., Oak Harbor, OH
WD9ART **Turner**, Charles T., Troy, TN
K9BCB **Cannon**, Roger D., Wausau, WI
K9BX **Roberts**, Richard "Doc," Rothschild, WI
W9CZA **Benson**, Robert "Benny," Batavia, IL
KB9DAJ **Newton**, Edward, Lynn, IN
W9DDX **Grayson**, Richard R., Batavia, IL
KA9DRF **Kritchman**, James G., Lima, OH
WB9EDE **Hurley**, Edward "Ed," Sugar Grove, IL
K9JBF **Aceto**, Mario, Kenosha, WI
N9EM **Williamson**, Theodore "Ted," Table Grove, IL
W9IMY **Bishop**, Dorothy A., Dekalb, IL
KC9JLU **Repasky**, Richard, Bloomington, IN
K9JPS **Sheerar**, Lewis L., Wausau, WI
N9MX **Boyd**, Max W., Collinsville, IL
KB9QBM **Crapp**, Henry B., Cuba City, WI
KD9SJ **Dold**, Donald V., Englewood, FL
NB9V **Williamson**, Betsy L., Table Grove, IL
WA9YNE **Dudley**, Wayne W., La Porte, IN
NØBOO **Lucas**, Vasile J., Kansas City, MO
♦KØCVY **Morrison**, James F., Colby, KS
KAØDHI **Smith**, Robert G., Archie, MO
KAØDJA **May**, Glen O., Lincoln, NE
WØDYA **Jones**, Robert E., Fargo, ND
WØFKG **Krogstad**, Milton O., Omaha, NE
KØHPE **Tary**, John J., Boulder, CO
WØHZ **Chapman**, Jack C., Bloomington, MN
♦KEØK **Boyd**, Charles "Charlie," Louisiana, MO
WAØKFM **Sweeney**, Eugene C., Saint Louis Park, MN
NØMSM **Warren**, Jeff, Beatrice, NE
KBØOFN **Binkley**, Patrick M., Saint Paul, MN
WAØOXZ **Storjohann**, Erwin A., Saint Charles, MO
KØPHT **Kruse**, Lyle, Albuquerque, NM
♦WØPN **Dunbar**, Ron R. Jr, Boone, NC
WBØPVI **Atkeisson**, Ruth A., Independence, MO
WBØQAJ **Jakob**, James "Jake," Loup City, NE
KAØQFE **Every**, Francis W. Sr, Clay Center, KS
KCØUMB **Rigler**, Larry G., Lakeside, MT
WØZCM **Tollefson**, Mark M., Dickinson, ND
WBØZRM **Elliott**, Robert W., Grant City, MO
KØIBX **Fergen**, James E., Saint Paul, MN
G3BWY **Crossan**, William J., Hildenborough, Kent, Great Britain
PY1DZT **Monica**, Edson S., Rio de Janeiro, Brazil
♦XE1RX **Lutteroth**, Dr Manuel Herrera, Queretaro Qro, Mexico

♦ 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

JA HAM ENJOYS QUICK VISIT TO ARRL HQ AND W1AW

◊In November, Hiro Horiuchi, JM3EHG/W3EHG, an ARRL member from Japan, decided to make a solo visit to Newington by rail from New York City, where he was visiting a friend. According to Paul Ciezniak, K1SEZ, who served as his tourguide: "I ran into him and we spent a good two hours. Despite his limited English vocabulary, he wanted to operate SSB at W1AW, and spent an hour, working about 10 stations on 40 meter SSB."

For more information about visiting ARRL HQ and W1AW, see **www.arrl.org/visit-us/**.

PAUL CIEZNIAK, K1SEZ

Hiro, JM3EHG/W3EHG, made his way from New York City to Newington (and returned the same day) to see ARRL HQ and operate W1AW.

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• D-STAR & GPS upgradeable 2M/70CM • 50/15/5W RF output levels • RX: 118-173.995, 375-549.995, 810-999.99 MHz** • Analog/digital voice with GPS (optional UT-123) • 500 alphanumeric memories

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• 100W HF/6m Transceiver, gen cov. receiver • Dual DSP 32 bit • Three roofing filters- 3, 6, 15khz • 5.8 in WQVGA TFT display • Hi-res real time spectrum scope

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• 65W Output • Optional D-STAR format digital operation & NEMA compatible GPS interface • CTCSS/DTCS encode/decode w/tone scan • 207 alphanumeric memories • Weather alert

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• 160-10M • 100W • Simple & tough with IF DSP • AGC Loop Management • Digital IF Filter • Digital Twin PBT • Digital Noise Reduction • Digital Noise Blanker • USB Port for PC Control

Analog + Digital Dual Bander D-STAR

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• D-STAR DV mode operation • DR (D-STAR repeater) mode • Free software download • GPS A mode for easy D-PRS operation • One touch reply button (DV mode) • Wideband receiver

IC-V80 2M Handheld Transceiver

• 2M @ 5.5W • Loud BTL audio output • Military rugged • Classic 2M operation

Analog + Digital Dual Bander D-STAR

D-STAR READY

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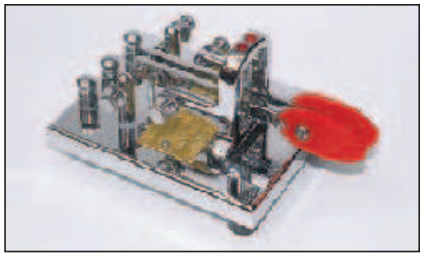

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Microphones

HEI-GM-4	GOLDLINE 2-element Mic, HC4	$129.00
HEI-GM-5.1	GOLDLINE 2-element Mic, HC5.1	$129.00
HEI-HM-10-DUAL	Desk Mic, HC4 & HC5 Elements	$119.00
HEI-ICM	Desk Mic for ICOM, 8 ft. attached	$99.00
HEI-PR781	Dynamic Cardioid Studio Quality Mic	$169.00

Headsets

HEI-PROSET-4	Boom Mic/Headset, HC4	$125.00
HEI-PROSET-5	Boom Mic/Headset, HC5	$125.00
HEI-PROSETIC	Boom Mic/Headset/Adapter, ICOM Electret	$139.00
HEI-PSE-6	**PROSET Elite** with HC-6 element	$165.00

We are "Clamp Central"!

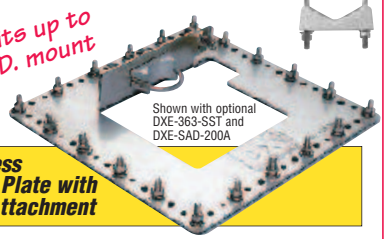
High Strength Stainless, Aluminum & Polymer Clamps

Building an antenna from scratch? Refurbishing a well-used "old friend" or experimenting with your own project? We have the best hardware for your application.

See the many sizes at DXEngineering.com

The best clamps on the planet!

Now fits up to 3" O.D. mount



Stainless Radial Plate with Coax Attachment

NOT CHEAP ALUMINUM!
GUARANTEES BEST RADIAL SYSTEM CONDUCTIVITY OVER TIME

Makes radial attachment a snap!
- Fits 3" pipe, 4x4 and 6x6 posts
- 0.125" thick 304 stainless steel
- Accommodates up to 120 radials
- Patented high current coax connection to radials

DXE-RADP-3	Complete with 20 stainless bolt sets	$54.50
DXE-RADP-1HWK	20 sets of 1/4" stainless hardware	$7.50
DXE-SSVC-2P	Stainless Saddle Clamp for attachment to round tube 1" to 2" O.D.	$11.95
DXE-SSVC-3P	Stainless Saddle Clamp for attachment to round tube 2" to 3" O.D.	$14.95
DXE-363-SST	Silver/Teflon® bulkhead connector	$6.95
DXE-VFCC-H05-A	Vertical Feedline Current Choke	$134.95
DXE-RADW-500K	Radial Wire Kit, 500 feet of wire, 20 lugs, 100 steel anchor pins	$61.90
DXE-RADW-1000K	Radial Wire Kit, 1,000 feet of wire, 40 lugs, 200 steel anchor pins	$123.95
DXE-STPL-100P	Steel Radial Wire Anchor Pins, 100 pack	$16.00

Biodegradable Anchor Pins Also Available

hy-gain

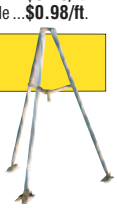
Antenna Rotors

HYG-AR-35	Light Beam/TV	$89.95
HYG-CD-45II	8.5 Sq. ft. Rating	$419.95
HYG-HAM-IV	15 Sq. ft. Rating	$594.95
HAM-HAM-V	15 Sq. ft. Digital Control	$919.95
HYG-T-2X	20 Sq. ft. Rating	$689.95
HYG-HDR-300A	25 Sq. ft. Rating, Heavy Duty	$1,339.95

Rotor Accessories

DXE-CW8	8-Wire Rotor Cable	$0.48/ft.
DXE-CW8-HD	8-Wire Heavy Duty Rotor Cable	$0.98/ft.

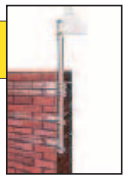
Heavy Duty Tripod Roof Mount



- Ideal for medium size antennas like the DX Engineering HEXX Beam or small HF and VHF Yagi or tri-band antennas
- 1 1/2" O.D. heavy-duty steel legs, 10" long mounting feet with tar strips
- 30 lag bolts included
- 5 ft. tall, 2" O.D. steel antenna/rotor mounting mast

RON-1011 ..... $149.95

Heavy Duty Chimney Roof Mount



- Ideal for medium size antennas with rotors like the DX Engineering HEXX Beam or small HF and VHF Yagi or tri-band antennas
- 24 ft. long stainless steel straps
- Rotor-ready 24" upper and 42" lower masts
- Fits multiple-flue residential and commercial chimneys
- Four 1 1/2" wide, 11 gauge steel corner brackets
- Shipped partially assembled

RON-3324 ..... $149.95

The Experts in Phased Antenna Systems!

Four-Square Hybrid Controllers

Our hybrids offer 20dB F/B and up to 5dB gain at a lower cost than most beams. Available for 160 through 10 meters.

COM-ACB-4 Series ..... from $364.95

2-Element Vertical Controllers

No space for a four-square phased vertical array? Three switched patterns—available for 160 through 10 meters.

COM-PVS-2 Series ..... from $333.95

Stack Yagi Switches

The STACK-2 is ideal for tribanders, logs or monobanders. The K3LR-design STACK-3 is for monoband 3-stack Yagis. Select any combination.

COM-STACK-2 ..... $221.95

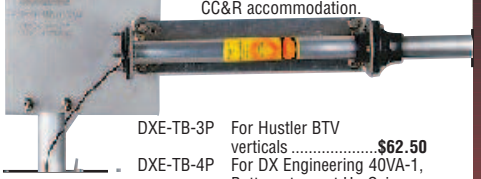
COM-STACK-3 ..... $399.95

Call us for custom-tuned phasing cables and monoband antenna systems!

ONE MAN TILT OVER

Thick, Laser Cut Stainless Steel Tilt Base

- Patented cam action allows you to easily raise or lower DX Engineering, Hustler, Hy-Gain, or Butternut for tuning, weather or CC&R accommodation.



DXE-TB-3P	For Hustler BTV verticals	$62.50
DXE-TB-4P	For DX Engineering 40VA-1, Butternut, most Hy-Gain 1/4-wave verticals	$87.50
DXE-TB-6P	For Hy-Gain 14AVQ	$87.50

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**except the special Elecraft K3 cable*

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- USB port powered
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- Supports all sound card digital and voice modes
- Requires radio interface cable

Coaxial Cable Prep Tools

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long-lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	$39.95
DXE-UT-808X	Cable Stripper for RG-8X, 9258, etc	$39.95
DXE-UT-80P	PL-259 Assembly Tool	$22.95
DXE-UT-80N	2-Piece N Connector Tool	$22.95
DXE-CNL-911	Coax Cable Cutters	$23.75
DXE-170M	Precision Shear Side Cutters	$7.95

Now available in cost-saving tool kits with carrying case

DXE-UT-CASE	Molded carrying case only	$22.95
DXE-UT-KIT1	Basic Coax Cable Prep Kit	$99.95
DXE-UT-KIT2	Complete Coax Cable Prep Kit	$174.95

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with purchase of any new LDG tuner!

Purchase any new LDG tuner between Oct 15 2010 and March 15, 2011 and receive a Free SP-200 200W Surge Protector from LDG*.

NEW! AT-600Pro

The LDG AT-600Pro will handle up to 600 watts SSB and CW, 300 on RTTY (1.8 – 30 MHz), and 250 watts on 54 MHz. It will match virtually any kind of coax-fed antenna and will typically match a 10:1 SWR down to 1.5:1 in just a few seconds. You can also use the AT-600Pro with longwires, random wires and antennas fed with ladder line just by adding a balun. It has two antenna ports with a front-panel indicator, and separate memory banks for each antenna. Easy to read LED bar-graph meters showing RF power, SWR and tuner status, tactile feedback control buttons and an LED bypass indicator. Operates from 11 – 16 volts DC at 750 mA. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $359.99***

radio not included

AT-897Plus

for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897Plus Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price$199.99***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-100ProII

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch with LEDs, allowing you to switch instantly between two antennas. The AT-100ProII requires just 1 watt for operation, but will handle up to 125 watts. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $229.99***

Z-11ProII

Meet the Z-11ProII, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11ProII uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. Includes Icom interface cable, DC power cable and coax jumper.
Suggested Price $179.99

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required. A coax jumper cable is also induced for fast hook up.
Suggested Price $129.99.

Z-100Plus

Small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds. Includes Icom interface cable, DC power cable and coax jumper.
Suggested Price $159.99

*To receive your free SP-200, simply fill out the rebate form available at www.ldgelectronics.com and mail to LDG along with a copy of your dated sales receipt. All rebate forms must be received by LDG before March 31, 2011. Limit one per household, valid worldwide.

LDG Electronics, Inc. 1445 Parran Road, St. Leonard, MD 20685 ***Phone 410-586-2177 • Fax 410-586-8475***

The #1 Line of Autotuners!

AT-1000Pro

The AT-1000Pro has an Automode that automatically starts a tuning cycle when the SWR exceeds a limit you set. Operates at any power level between 5 and 1,000 watts peak. RF Relay protection software prevents tuning at greater than 125 watts. Tunes from 1.8 to 54.0 MHz (inc. 6 meters), with tuning time usually under 4 seconds, transmitting near a frequency with stored tuning parameters, under 0.2 seconds. 2000 memories. 2 Antenna connections. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $599***

- ***RF Sensing***
- ***Tunes Automatically***
- ***No Interface Cables Needed***

AT-200Pro

The AT-200Pro features LDG's new "3-D memory system" allowing up to eight antenna settings to be stored for each frequency. Handles up to 250 watts SSB or CW on 1.8 – 30 MHz, and 100 watts on 54 MHz (including 6 meters). Rugged and easy-to-read LED bar graphs show power and SWR, and a function key on the front panel allows you to access data such as mode and status. Includes Icom interface cable, DC power cable and coax jumper. ***Suggested Price $249***

NEW! YT-450

LDG's newest tuner is specially designed for Yaesu's newest 100 watt radios. The YT-450 interfaces directly with the Yaesu FT-450 and FT-950 radios, making integration easier than ever. Simply connect the tuner to the radio with the supplied cables and you are ready to operate. DC power and all control is done through the interface cable. Just press the tune button on the tuner and the rest happens automatically: mode and power are set, a tune cycle runs and the radio is returned to its original settings. It will quickly match nearly any kind of coax fed antenna with an SWR of up to 10:1. 2000 memories recall settings in an instant! An extra CAT port on the back allows seamless connection to a PC. You have the newest radio, now get the newest tuner to go with it! ***Suggested Price $249.99***

IT-100

Matched in size to the IC-7000 and IC-706, the new IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible. ***Suggested Price $179.99***

KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver (except TS-480HX). The KT-100 actually allows you to use the Tune button on the radio. The LEDs on the front panel indicate tuning status, and will show a match in seconds, or even less of you've tuned on or near that frequency before. Has 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

YT-100

An autotuner for several popular Yaesu Radios. An included cable interfaces with your FT-857, FT-897 and FT-100 (and all D models) making it an integrated tuner, powered by the interface. Just press the tune button on the tuner, and everything else happens automatically: mode and power are set, a tune cycle runs, and the radio is returned to its original settings. It's the perfect complement to your Yaesu radio. ***Suggested Price $199.99***

Meters!

FT Meter 2.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Still Only $49***

FTL Meter For Yaesu FT-857(D) and FT-897(D). 4.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu. ***Suggested Price $79.99***

NEW! M-7600 For IC-7600. It will display S-meter on receive, or power out, SWR, ALC level or supply voltages, all selectable from the radio's menu. What's more, the M-7700 and the virtual meter on your radio can work together. ***Suggested Price $79.99***

NEW! YT-847

YT-847 Autotuner is an integrated tuner for the Yaesu FT-847. An included CAT/Power cable interfaces with your FT-847. Just press the tune button on the tuner and everything else happens automatically! The mode is set to carrier and the RF power is reduced, a tune cycle runs and the radio is returned to the original settings. Also includes coax jumper cable. ***Suggested Price $249.99***

Visit our website for a complete dealer list.

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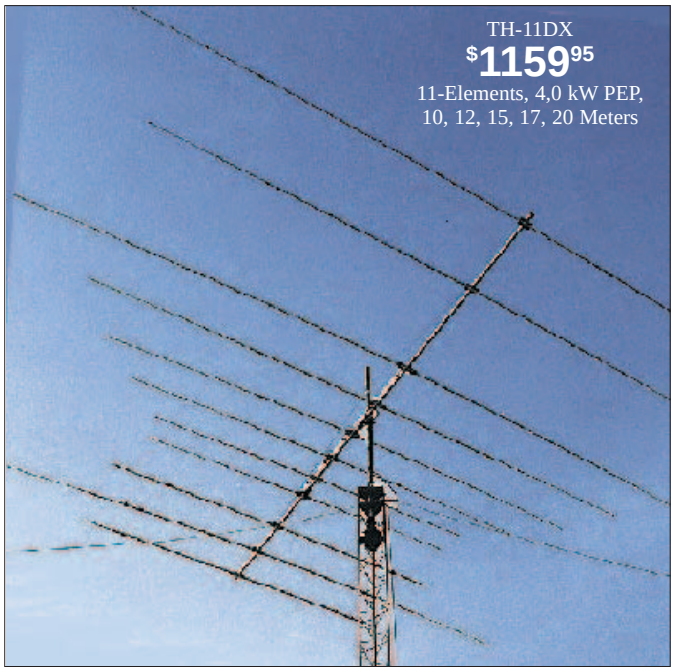
LDG

hy-gain HF BEAMS...

. . . are stronger, lighter, have less wind surface and last years longer.

Why? Hy-Gain uses durable *tooled* components -- massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing -- virtually no failures!



TH-11DX, $1159.95. 11-element, 4.0 kW PEP, 10,12,15,17,20M

The choice of top DXers.

With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is *the "Big Daddy" of all HF beams!*

Handles 2000 Watts continuous, 4000 Watts PEP.

Every part is selected for durability and ruggedness for years of trouble-free service.

Features a low loss log-periodic driven array on all bands with monoband reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

Stainless steel hardware and clamps are used on all electrical connections.

TH-7DX, $869.95. 7-element, 1.5 kW PEP, 10,15,20 Meters

7-Elements gives you the *highest average gain* of any Hy-Gain tri-bander!

Dual driven for broadband operation without compromising gain. SWR less than 2:1 on *all* bands.

Uniquely combining monoband and trapped parasitic elements give you an excellent F/B ratio.

Includes *Hy-Gain's* diecast aluminum, rugged boom-to-mast clamp, heavy gauge element-to-boom brackets, BN-86 balun. For high power, upgrade to BN-4000.

TH-5MK2, $759.95. 5-element, 1.5 kW PEP, 10,15,20 Meters

The broadband *five element* TH5-MK2 gives you outstanding gain.

Separate air dielectric *Hy-Q* traps let you adjust for maximum F/B ratio on each band.

Also standard is *Hy-Gain's* exclusive *BetaMATCH™*, stainless steel hardware and compression clamps and BN-86 balun.

TH-3MK4, $469.95. 3-element, 1.5 kW PEP, 10,15,20 Meters

The super popular TH-3MK4 gives you the *most gain for your money* in a full-power, full-size durable Hy-Gain tri-bander!

You get an impressive average gain and a whopping average front-to-back ratio. Handles a full 1500 Watts PEP. 95 MPH wind survival.

Fits on average size lot with room to spare -- turning radius is just 15.3 feet. Four piece boom is ideal for DXpeditions. Rotates with CD-45II or HAM-IV rotator.

Features *Hy-Gain BetaMatch™* for DC ground, full power *Hy-Q™* traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hardware. BN-86 balun recommended.

TH-2MK3, $369.95. 2-element, 1.5 kW PEP, 10,15,20 Meters

The 2-element TH-2MK3 is Hy-Gain's *most economical* full power (1.5kW PEP) full size tri-bander.

For just $339.95 you can greatly increase your effective radiated power and hear far better!

Ruggedly constructed, top-performing, compact 6 foot boom, tight 14.3 foot turning radius. Installs almost anywhere. Rotate with CD-45II or HAM-IV. BN-86 balun recommened.

EXP-14, $599.95. 4-element, 1.5 kW PEP, 10,15,20 Meters

Revolutionary 4-element compact tri-bander *lets you add 40 or 30 Meters!* Has 14 foot boom and tight 17.25 feet turning radius. Fits on roof tri-pod, mast or medium duty tower.

Hy-Gain's *patented* broadbanding *Para Sleeve* gives you less than 2:1 VSWR. 1.5kW PEP.

BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

Truly *competitive against giant tri-banders at half the cost!*

QK-710, $179.95. 30/40 Meter option kit for EXP-14.

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space . . . Installs anywhere . . . 14.75 ft turning radius . . . weighs 21 lbs . . . Rotate with CD-45II, HAM-IV

Fits on light tower, suitable guyed TV pole, roof tri-pod

TH-3JRS, $359.95. Hy-Gain's *most popular* 3-element 10, 15, 20 Meter tri-bander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design.

Excellent gain and F/B ratio let *you* compete with the "big guns".

Tooled manufacturing gives you *Hy-Gain* durability with 80 MPH wind survival.

Model No.	No. of elements	avg gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq.ft. area	Wind (mph) Survival	boom feet	Longest Elem. (ft)	Turning radius(ft)	Weight (lbs.)	Mast dia O.D.(in.)	Recom. Rotator	Sugg. Retail
TH-11DX	11	*For Gain and F/B ratio--See...* • www.hy-gain.com • Hy-Gain catalog • Call toll-free 800-973-6572		4000	10,12,15,17,20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1159.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$869.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$759.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$469.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$359.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$369.95**
EXP-14	4			1500	10,15,20 opt. 30/40	7.5	100	14	31.5	17.25	45	1.9-2.5	HAM IV	$599.95

Tooled Manufacturing . . . Highest Quality Materials

1. Hy-Gain's famous super strong *tooled* die cast *Boom-to-Mast Clamp*

2. *Tooled* *Boom-to-Element Clamp*

3. Thick-wall *swaged* aluminum tubing

Tooled *manufacturing* is the difference between Hy-Gain antennas and the others -- they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially *tooled* machinery.

Hy-Gain antennas feature *tooled* swaged tubing that is easily and securedly clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts.

Hy-Gain *antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.*

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hy-gain

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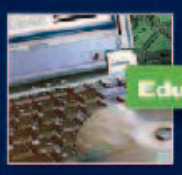

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Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
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RX-7-05

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-706 MK II-G Multimode Mobile

- TX: HF/6M/2M/440 MHz • RX: 0.03-199, 400-470 MHz
- Power: 100W (HF/6M), 50W (2M), 20W (440 MHz)
- Memories: 107 • AF-DSP • IF Shift • Preamp/attenuator
- RMK-706 included • Quantities are limited!

IC-718 Multimode HF Transceiver

- TX: HF (except 60M) • RX: 0.03-30 MHz
- Power: 5-100W • Memories: 101 • DSP built-in
- SSB, CW, RTTY and AM (2-40W)

IC-2200H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207
- D-Star upgradable with optional UT-118

IC-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-208H 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • Memories: 512
- RX: 118-173, 230-549, 810-999 MHz (cell blk)
- Power: 55/15/5W (2M), 50/15/5W (440 MHz)

IC-7700 Multimode HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen
- Two 32-bit floating DSPs • Power supply built-in
- Three roofing filters • External VGA connector
- Automatic antenna tuner • USB memory drive socket

AES

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407-894-3238
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orlando@aesham.com

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Included items are available for limited time.

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Radios by ICOM

FT-270R 2M FM HT

- TX: 144-148 • RX: 136-174 • Power: 5/2/0.5W
- Memories: 200 • Extra large LCD display & speaker

VX-6R 2M/440 FM Dual Band HT

- TX: 144-148, 222-225, 430-450 • RX: 0.5-999 (cell blkd)
- Power: 5/2.5/1/0.3W (1.5W on 220) • Memories: 900
- Submersible 3 feet for 30 minutes

VX-8DR Quad-band FM HT

- TX: 50-54, 144-148, 222-225, 430-450 MHz
- RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
- Power: 5/2.5/1/0.05W (1.5W on 220 MHz)
- Optional GPS Unit FGPS-2 with either CT-136 adapter or MH-74A7A hand mic provides you with APRS® data

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-1900R 2M FM Mobile

- TX: 144-148 • RX: 136-174
- Power: 55/25/10/5W • Memories: 221

FT-8800R 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 108-520, 700-999 MHz (cell blkd) • Power: 50/20/10/5W (2M), 35/20/10/5W (440 MHz) • Memories: 1000
- Crossband repeat • YSK-8900 included!

FT-8900R Quad-Band FM Mobile

- Same as FT-8800R but TX: 28-29.7, 50-54, 144-148, 430-450 MHz and RX: 28-29.7, 50-54, 108-180, 320-480, 700-985 MHz (cell blkd) • Power: 50/20/10/5W (10/6/2M), 35/20/10/5W (440 MHz) • YSK-8900 included!

FT-450AT

100W HF/6M Compact Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 500 • IF DSP Technology
- Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter and clarifier
- Includes Auto Antenna Tuner

FT-950 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner
- 32-bit Floating Point DSP • Built-in high stability TCXO
- Optional DMU-2000 Data Management Unit displays various operational conditions
- Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000 100W HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 10-100W
- Memories: 99 • Auto Antenna Tuner • 32-bit Floating Point DSP • Dual In-Band Receive • Internal Power Supply
- Optional DMU-2000 Data Management Unit displays various operational conditions
- Optional MTU tune units for 160M, 80/40M and 30/20M bands allowing you to pull through weak signals

FT-2000D 200W HF/6M Transceiver

- FT-2000 except RF output is 200W and supplied power supply is external

FTDX-5000MP

FTDX-5000 Series – Covers HF and 6M;

Three different configurations all running 10-200W on CW, SSB, FM, RTTY & PKT and 5-50W on AM • RX: 0.03-60 MHz • Memories: 99 • The "D" and "MP" model comes with SM-5000 Station Monitor that features an excellent bandscope • The "MP" comes with high stability ±0.05ppm OCXO & 300 Hz roofing filter

FTDX-5000 Basic Model & ±0.5ppm TCXO
FTDX-5000D With Station Monitor & ±0.5ppm TCXO
FTDX-5000MP With Station Monitor, ±0.05ppm OCXO & 300 Hz Roofing Filter

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It's Here! NEW!

FTDX-5000/D/MP Series
Shown above withSM5000 Station Monitor (optional on some versions).
$200 Coupon

FT-2000/FT-2000D
HF,6M, 100W/200W

FT-950
100 Watts of power output on SSB, CW, and FM (25 Watts AM carrier).

$100 Coupon

FTM-350R
2M/440 50W
220MHz 1W
APRS & WIRES Ready
GPS (optional)

$200 Coupon

FT-450 & 450AT
state of the art IF DSP technology, world class performance, easy to use

$20 Coupon

FT-897D
HF/6/2/440 all mode Portable 100W HF/6, 50W 2M, 20W, 440MHz

$20 Coupon

FT-817ND
HF/6/2/440

FREE YSK-857 with Purchase
$20 Coupon

FT-857D
HF/6/2/440 all mode

FREE MH-68B6J with Purchase
$40 Coupon

FTM-10R
144/440MHz 50/40W

FREE YSK-8900 with Purchase

FT-8800R
2M/440MHz

FREE YSK-8900 with Purchase

FT-8900R
10M/6M/2M/440MHz

$10 Coupon

FT-1900R
144-148MHz

$10 Coupon

FT-2900R
2 meter transceiver

FREE YSK-7800 with Purchase

FT-7900R
Dual bander

FT-60R
Dual band

FT-250R
2 Meter

FT-270R
2M 5W

$50 Coupon
NEW!

VX-8GR
Full 5 watts 144/440MHz

$10 Coupon

VX-3R
2M/440MHz

$20 Coupon

VX-7R/RB
Triple Band

VX-8DR
Full 5 watts

$300 Coupon

FTDX-9000C/D/MP
400 watts, dual analog meter sets, LCD display, memory card installed, main and sub receiver VRF, full dual rx, external power supply.

ICOM

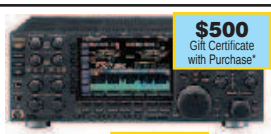
Coupons and free items expire March 31, 2011.

$500 Gift Certificate with Purchase*

IC-7700
No compromise RX performance

$200 Gift Certificate with Purchase*

IC-7600
USB, LSB, CW, RTTY, PSK31, AM, FM



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IC-7800
HF/6m @ 200 Watts, HF/50 MHz All Band

IC-7200
HF/6 100W

INCLUDED WITH YOUR PURCHASE RMK-7000

IC-7000
HF/6M/2M/440
IF DSP

$25 Coupon

IC-718
HF 100W on HF, VOX operation

D-STAR Compatible
$20 Gift Certificate with Purchase*

ID-880H
2M/440 Dual Band

NEW!

IC-T70A
2M/440MHz 5W HT

IC-2200H
2M 65W FM Mobile

IC-R9500
144/430(440) MHz and above 2GHz band, +5dBm IP3 capability

D-STAR Compatible
$40 Gift Certificate with Purchase*

IC-2820H
2M/440 dual bander

NEW!

IC-V80
2M 5.5W

* Restrictions apply, contact your HamPROS Dealer for details.

KENWOOD

Coupons good thru January 31, 2011

NEW!

TS-590S
160-6 meters

NEW!

TH-D72A
144/440 MHz 5W HT/GPS/TNC

$275 Coupon

TS-480HX/TS-480SAT
HF/6M All-Mode Transceiver

TH-F6A
2/220/440 HT

$30 Coupon

$30 Coupon

TM-V71A
1000 Alpha Memories, Dual Display

$225 Coupon TS-2000S
$275 Coupon TS-2000X

TS-2000S/ TS-2000X
High performance true IF/stage DSP on main band.

$40 Coupon

TM-D710A
2M/70cm Mobile 50W/50W, Optional Voice Synthesizer,

$25 Coupon

TM-271A
2M FM Transceiver

LDG ELECTRONICS

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.

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.

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

MFJ-269
$389.95

A high contrast LCD gives precision readings and two side-by-side analog meters make antenna adjustments smooth and easy.

415 to 470 MHz Range features

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.

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.

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http://www.mfjenterprises.com *for instruction manuals, catalog, info*

MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B $259.95

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B $359.95

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt *Legal Limit*

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 $699.95

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B $219.95

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 $219.95

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 $199.95

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 $179.95

G5RV Antenna

MFJ-1778 $44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!* **MFJ-1778M, $39.95.** G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

Fully *weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

MFJ-926 $399.95

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

MFJ-927 $259.95

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http://www.mfjenterprises.com for instruction manuals, catalog, info

MFJ TUNERS

New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

***New TrueActive*™** peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D $389.95

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New crank knob lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12\frac{7}{8}$Wx6Hx$11\frac{5}{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob ***Differential-T***™

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10\frac{3}{4}$Wx$4\frac{1}{2}$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. $10\frac{3}{4}$x$4\frac{1}{2}$x$10\frac{7}{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

MFJ-969 $219.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3\frac{1}{2}$Hx$10\frac{1}{2}$Wx$9\frac{1}{2}$D inches.

MFJ-949E ***deluxe*** 300 Watt Tuner

MFJ-949E $179.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3\frac{1}{2}$Hx$10\frac{5}{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E ***super value*** Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10\frac{1}{2}$Wx$2\frac{1}{2}$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$6\frac{1}{2}$x$2\frac{1}{2}$ 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 $4\frac{1}{2}$x$2\frac{1}{4}$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. $7\frac{1}{4}$x$2\frac{1}{4}$x$2\frac{3}{4}$ 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$2\frac{1}{2}$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.

Dealer/Catalog/Manuals

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Antennas, Equipment and Techniques for DXcitement on 160, 80 and 40 Meters

By John Devoldere, ON4UN

This fifth edition features new and updated material. Highlights include…

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…a new examination of **phased arrays**, with new concepts such as the hybrid-fed 4-square array and opposite-voltage feed system. This is a must-read for every serious antenna builder!

…dozens of new propagation maps based on DX Atlas, as well as an in-depth analysis of the influence of sunspot cycles on 160-meter ducting.

…a new discussion of cutting edge technology including **Software Defined Radio** and the revolutionary **LP-500 Digital Station Monitor**.

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- The Feed Line and the Antenna
- Receiving Antennas
- The Dipole Antenna
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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.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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QST QuickStats

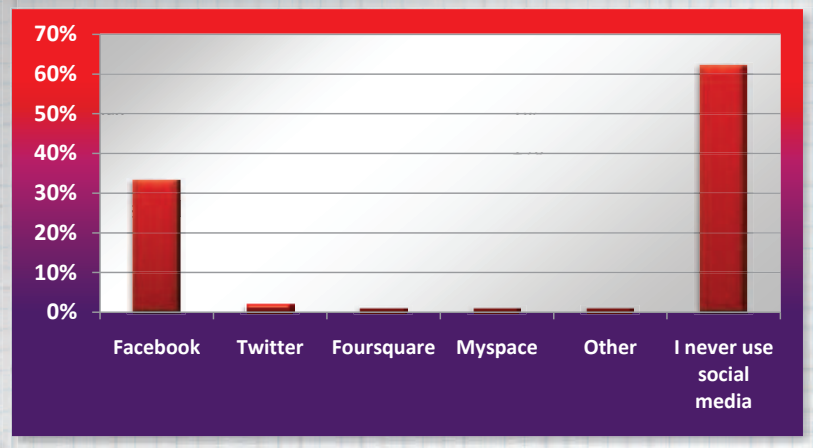
sta·tis·tics (st-tstks) n.
1. (used with a sing. verb) The mathematics of the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling.
2. (used with a pl. verb) Numerical data.

www.arrl.org/QuickStats

Online QuickStats Poll Results for November 10 through December 10.

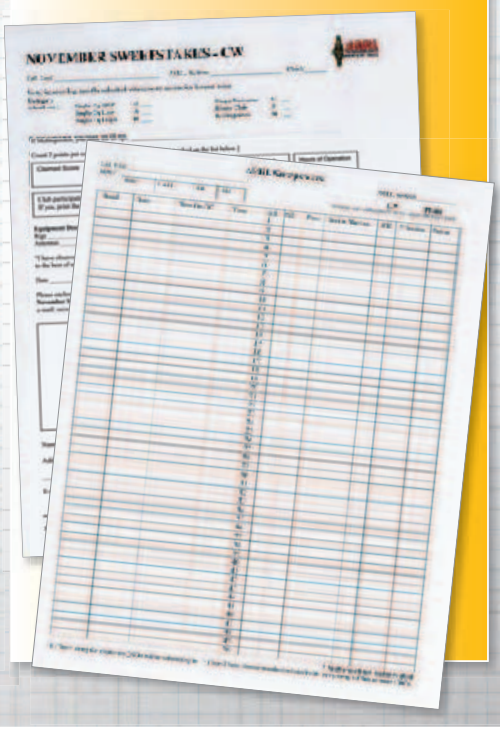
Get on the Web and vote today at **www.arrl.org/quickstats**!

Which social media platforms do you use most often?



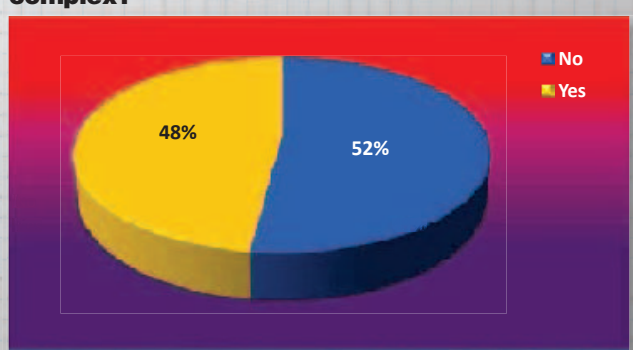
It's in the Mail (or in the E-Mail) ...

- *QST* doesn't travel alone to mailboxes throughout the world. For the best postage rates, *QST* is shipped with 2 million other publications in a highly efficient process known as *co-mailing*.
- As of press time, 1457 ARRL November Sweepstakes CW logs and 1514 Sweepstakes SSB logs have arrived by e-mail. In contrast, only 40 paper logs have arrived by postal mail.



Looking back over the last several years, do you think the amount of time you spend on the air has increased or decreased?

From an operator's point of view, have modern Amateur Radio transceivers become too complex?



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, 3½ inch high, ¾ inch thick *pressure-treated* wood panel. Has excellent insulating properties. Weather-sealed with a heavy coat of long-lasting white outdoor enamel paint. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthru Panel

MFJ-4603
$89.95

Four 50 Ohm *Teflon*(R) SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm *Teflon*(R) coax *N-connector* lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz *F-connector* makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage *ceramic feedthru insulators* lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna *ceramic feedthru insulator*.

***5-way** binding posts* lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive *Adaptive Cable Feedthru*™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to 1¼X1⅝ in). Adapts to virtually *any* cable size. Seals out rain, snow, adverse weather.

3 Coax, Balanced Line, Random Wire

Best Seller! 3 *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Separate high voltage *ceramic* feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$69.95

6 Coax

6 high quality *Teflon*(R) coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$59.95

4 Balanced Line, 2 Coax

4 pairs of high-voltage *ceramic* feed-thru insulators for balanced lines and 2 coax connectors.

New!
MFJ-4600
$79.95

5 Cables, any-size

5 *Adaptive Cable Feedthrus*™. Pass any cable with connector: 2 cables with large connectors up to 1¼x1⅝ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

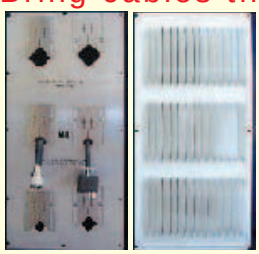
MFJ-4604
$99.95

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 1¼x1⅝ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ *Wall Plates*

MFJ-4614
For 4 Cables
$34.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls *without removing connectors* (up to 1¼x1⅝ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes *stainless steel* plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612
For 2 Cables
$24.95

MFJ-4611
For 1 Cable
$14.95

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MFJ *Speech Intelligibility* Enhancer

. . . makes barely understandable speech highly understandable!

MFJ-616
$189.95

"What did you say?" Can you hear but . . . just can't always understand everything people are saying?

As we get older, high frequency hearing loss reduces our ability to understand speech. Here's why . . .

Research shows that nearly *half* the speech intelligibility is contained in 1000 to 4000 Hz range, but contains a miniscule 4% of total speech energy.

On the other hand, the low frequencies, 125 to 500 Hz have most of the speech energy (55%) but contribute very little to intelligibility -- only 4%.

To dramatically improve your ability to understand speech, you must:

First, drastically increase the speech energy above 500 Hz, where 83% of the speech intelligibility is concentrated.

Second, drastically reduce speech energy below 500 Hz where only 4% of speech intelligibility lies.

The MFJ-616 splits the audio speech band into four overlapping octave ranges centered at 300, 600, 1200 and 2400 Hz. You can boost or cut each range by nearly 20 dB.

A balance control and separate 2½ Watt amplifiers let you equalize perceived loudness to each ear so both ears help.

By boosting high and cutting low frequencies and adjusting the balanced control, speech that you can barely understand become highly understandable!

Even if you *don't* have high frequency hearing loss, you'll dramatically improve your ability to understand speech. You'll get an edge in contesting and DXing and enjoy ragchewing more.

Here's what *QST* for April, 2001 said . . . *"I expected a subtle effect at best, but I was astonished . . . The result was remarkably clean, understandable speech without hissing, ringing or other strange effects . . . made a dramatic improvement . . ."*

Immuned to RFI. Has phone jack, on/off speaker switch, 2 inputs, bypass switch. 10Wx2½Hx6D". Needs 12 VDC.

MFJ-1316, $21.95. For 110 VAC operation. Provides 12 VDC/1.5 Amps.

MFJ-72, $69.80. *All-in-one MFJ-616 Accessory Pack.* Includes MFJ-392 headphones, two MFJ-281 speakers and MFJ-1316 power supply. ***Save $7!***

Try it for 30 Days

Order from MFJ and try it -- No obligation. If not delighted, return it within 30 days for refund less shipping.

MFJ Contest Voice Keyer

Transformer-coupled -- No RFI, hum or feedback . . . 75 seconds total, 5-messages . . . Records received audio . . .

MFJ-434B
$199.95

Let this *new* microprocessor controlled MFJ *Contest Voice Keyer*™ call CQ, send your call and do contest exchanges for you in your own natural voice!

Store frequently used phrases like "CQ Contest this is AA5MT", "You're 59" . . . "Qth is Mississippi" . . . Contest by pressing a few buttons and save your voice.

Record and playback 5 natural sounding messages in a total of 75 seconds. Uses *eeprom* -- no battery backup needed. Use your mic or its built-in mic for recording.

You can repeat messages continuously and vary the repeat delay from 3 to 500 seconds. Makes a great voice beacon and calling CQ is *so* easy.

You can also record and play back off-the-air signals -- great help if you didn't get it right the first time! No more "*Please repeat*".

A playing message can be halted by the *Stop Button*, your microphone's PTT/VOX, remote control or computer.

Has jack for remote or computer control (using CT, NA or other program). Lets you select, play and cancel messages.

Your mic's audio characteristics do not change when your MFJ-434B is installed.

All audio lines are RF filtered to eliminate RFI, audio feedback and distortion. An audio isolation transformer totally eliminates hum and distortion caused by ground loops.

New! **It's** easy to use -- just plug in your 8 pin round or modular mic plug, set the internal jumpers for your transceiver and plug in the appropriate (included) cable for your rig.

Built-in speaker-amplifier. Speaker/phone jack. Use 9 Volt battery, 9-15 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2½Hx6½D in.

MFJ-73, $34.95. MFJ-434B Remote Control with cable.

60 dB Null ***wipes out*** noise and interference

MFJ-1026
$199.95

Wipe out noise and interference *before* it gets into your receiver with a 60 dB null!

Eliminate all types of noise -- severe power line noise from arcing transformers and insulators, fluorescent lamps, light dimmers, touch controlled lamps, computers, TV birdies, lightning crashes from distant thunderstorms, electric drills, motors, industrial processes . . .

It's *more effective* than a noise blanker! Interference much stronger than your desired signal can be completely removed without affecting your signal.

It works on *all modes* -- SSB, AM, CW, FM -- and frequences from BCB to lower VHF.

You can null out strong QRM on top of weak rare DX and then work him! You can null out a strong local ham or AM broadcast station to prevent your receiver from overloading.

Use the MFJ-1026 as an *adjustable phasing network.* You can combine two antennas to give you various directional patterns. Null out a strong interfering signal or peak a weak signal at a push of a button.

Easy-to-use! Plugs between transmitting antenna and transceiver. To null, adjust amplitude and phase controls for minimum S-meter reading or lowest noise. To peak, push reverse button. Use built-in active antenna or an external one. MFJ's exclusive *Constant Amplitude Phase Control*™ makes nulling easy.

RF sense T/R switch automatically bypasses your transceiver when you transmit. Adjustable delay time. Uses 12 VDC or 110 VAC with MFJ-1312D, $15.95. 6½x1½x6¼ in.

MFJ-1025, $179.95. Like MFJ-1026 less built-in active antenna, use external noise antenna.

MFJ ***tunable*** Super DSP filter

MFJ-784B
$279.95

Only MFJ gives you *tunable* and *programmable* "brick wall" DSP filters.

You can continuously *tune* low pass, high pass, notch and bandpass filters and continuously *vary* bandwidth to pinpoint and eliminate interference.

Only MFJ gives you 5 factory pre-set and 10 programmable pre-set filters you can customize. **Automatic** notch filter searches for and eliminates multiple heterodynes. Advanced adaptive noise reduction silences background noise and QRM.

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http://www.mfjenterprises.com for instruction manuals, catalog, info

MFJ *Pocket size* Morse Code Reader™

Hold near your receiver -- it instantly displays CW in English! Automatic Speed Tracking . . . Instant Replay . . . 32 Character LCD . . . High-Performance Modem . . . Computer Interface . . . Battery Saver . . . More!

Is your CW rusty?

Relax and place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker . . .

Then watch CW turn into solid text messages as they scroll across an easy-to-read LCD display.

No cables to hook-up, no computer, no interface, nothing else needed!

Use it as a backup in case you mis-copy a few characters - - it makes working high speed CW a breeze - - even if you're rusty.

Practice by copying along with the MFJ-461. It'll help you learn the code and increase your speed as you instantly see if you're right or wrong.

Eavesdrop on interesting Morse code QSOs from hams all over the world. It's a universal language that's understood the world over.

MFJ *AutoTrak*™ automatically locks on, tracks and displays CW speed up to 99 Words-Per-Minute.

Simply place your MFJ-461 close to your receiver speaker until the lock LED flashes in time with the CW. Digs out weak signals. Phase-Lock-Loop even tracks slightly drifting signals.

MFJ-461 $89.95

Of course, nothing can clean up and copy a sloppy fist, especially weak signals with lots of QRM/QRN.

The MFJ-461's serial port lets you display CW text full screen on a bright computer monitor -- just use your computer serial port and terminal program.

When it's too noisy for its microphone pickup, you can connect the MFJ-461 to your receiver with a cable. A battery saving feature puts the MFJ-461 to sleep during periods of inactivity. It wakes up and decodes when it hears CW.

Uses 9 Volt battery. Fits in your shirt pocket with room to spare - smaller than a pack of cigarettes. Tiny 2¼x3¼x1 inches. 5½ ounces.

Super easy-to-use! Just turn it on -- it starts copying instantly!

MFJ-26B, $9.95. Soft leather protective pouch. Clear plastic overlay for display, push button opening, strong, pocket/belt clip secures MFJ-461.

MFJ-5161, $16.95. MFJ-461 to computer serial port cable (DB-9).

MFJ-5162, $7.95. Receiver cable connects MFJ-461 to your radio's external speaker 3.5 mm jack.

MFJ-5163, $10.95. Cable lets you use external speaker when MFJ-461 is plugged into radio speaker jack. 3.5 mm.

MFJ Morse Code *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators -- and *they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-464 $199.95 *(Keyboard, paddle not included.)*

MFJ-551, $39.95. RFI suppressed keyboard, a must to avoid RFI problems.

MFJ Iambic Paddles

MFJ-564 Chrome
MFJ-564B Black
$69.95

MFJ *Deluxe Iambic Paddles*™ feature a full range of adjustments in tension and contact spacing. Self-adjusting nylon and steel needle bearings, contact points that almost never need cleaning, precision machined frame and non-skid feet on heavy chrome base. Works with all MFJ and other electronic keyers.

***Miniature* Travel Iambic Paddle**

MFJ-561, $24.95. 1¾Wx1¾D x¾H inches. *Formed* phosphorous bronze spring paddle, stainless steel base. 4 ft. cord, 3.5 mm plug.

MFJ Code Oscillator

MFJ-557 $39.95

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base -- stays put on your table! Portable. 9-Volt battery or 110 VAC with MFJ-1312D, $15.95. Earphone jack, tone and volume controls, speaker. Adjustable key. Sturdy. 8½x2¼x3¾ inches.

MFJ-550, $14.95. Telegraph Key Only with adjustable contacts. Handsome black.

MFJ Deluxe CW Keyer

Deluxe MFJ Keyer has all controls on front panel for easy access -- speed, weight, tone, volume knobs, and tune, semi/auto, on/off push-buttons. You get all keyer modes, dot-dash memories, self completing dots/dashes, jam- proof spacing, sidetone, built-in speaker, type A /B keying. RF proof. Solid state keying. 7x2x6 inches.

MFJ-407D $79.95

MFJ-401D, $69.95. Econo Keyer II has front-panel volume/speed controls (8-50 wpm), tune switch. Internal adjust weight, tone. Solid state keying. Tiny 4x2x3½ inches.

Keyer/Paddle Combo

MFJ-422D $189.95

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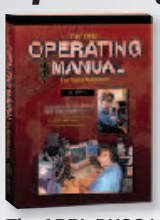

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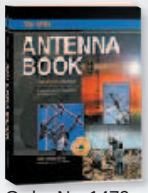

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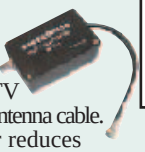

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Watts In	.25	.5	3	5	8	10	15	25	35	50

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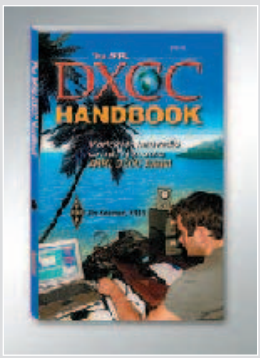

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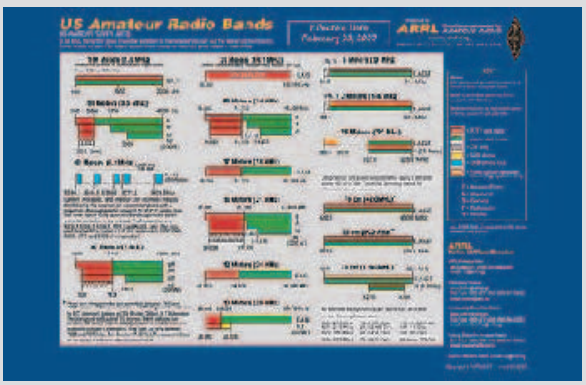

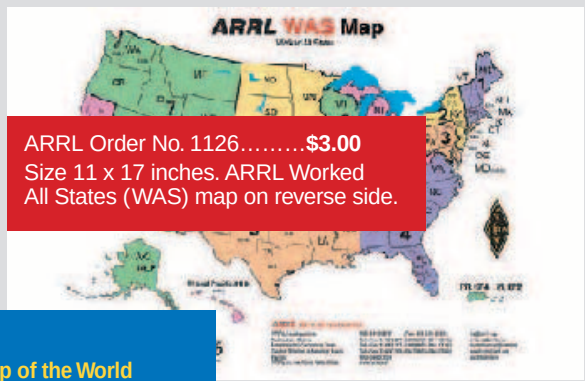

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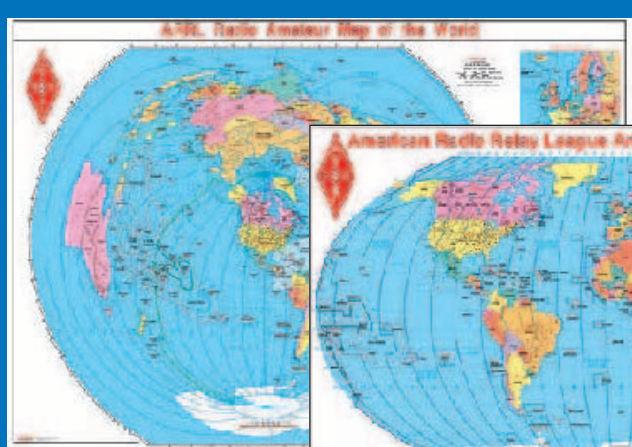

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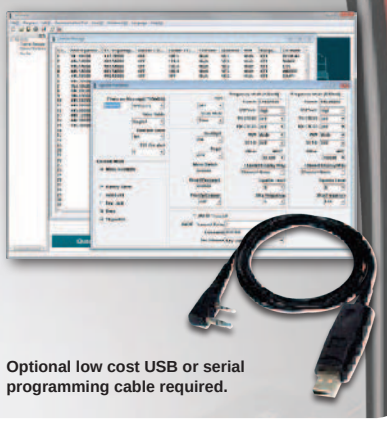

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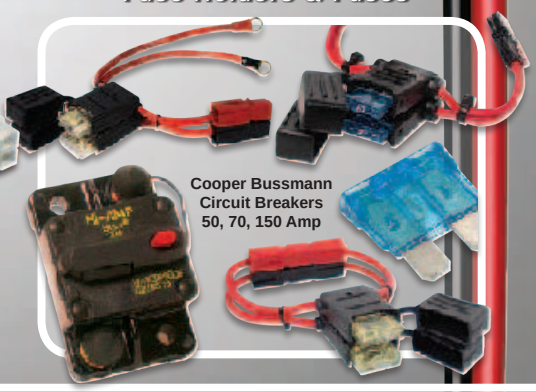

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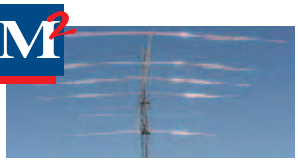

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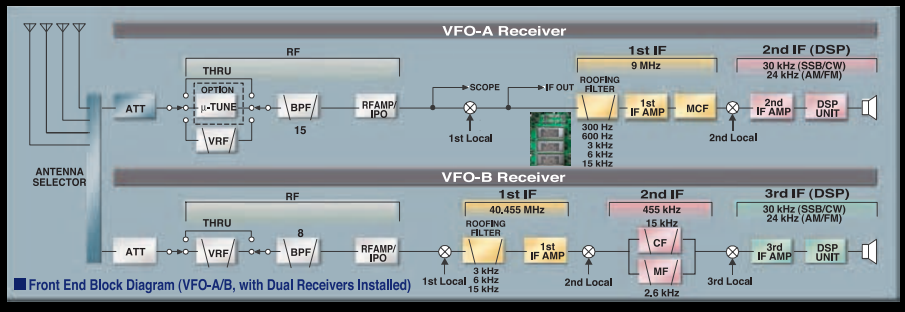

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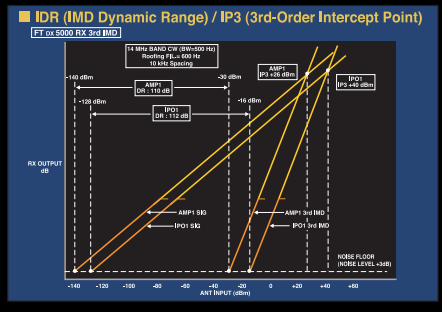

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