QST

DEVOTED ENTIRELY TO AMATEUR RADIO

March 2010 WWW.ARRL.ORG

ANNUAL ANTENNA ISSUE

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$4.99 US $6.99 can.

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Official Journal of ARRL The national association for AMATEUR RADIO™

MARCH 2010 QST Vol 94 No 3

IC-7000

DIGITAL IF FILTERS
No optional filters to buy! All the filters you want are at your fingertips. Simply dial-in the desired width and select sharp or soft shapes for SSB and CW modes.

AGC LOOP MANAGEMENT
The digital IF filter & manual notch filter are included in the AGC loop, so you won't have AGC pumping.

35W OUTPUT IN 70CM BAND
High power MOS-FET amps supply 35W output power in 70CM band as well as 100W in HF/50MHz bands and 50W in 2M.

HIGH STABILITY CRYSTAL UNIT
The 7000 incorporates a high-stability master oscillator, providing 0.5ppm (-0°C to +50°C). A must for data operation!

DIGITAL VOICE RECORDER (DVR)
The DVR makes portable contesting or mini-DXpeditions a breeze! Record your callsign, CQ, or other information in 4 transmit playback memories with alphanumeric labels. Record incoming signals for up to 25 minutes, too!

DDS (DIRECT DIGITAL SYNTHESIZER) CIRCUIT
Icom's new DDS circuit improves C/N ratio, providing clear, clean transmit signal in all bands.

USER-FRIENDLY KEY ALLOCATION
Eight of the most used radio functions – such as NB, NR, MNF, and ANF – are controlled by dedicated function keys. Those keys are grouped around the display for easy visibility.

TWO POINT MANUAL NOTCH FILTER
Pull out the weak signals! Apply 70dB of rejection to two signals at once!

No need to steal the spotlight.

We've had it all along.

Makes ham radio so much fun, you'll never want to leave the car again. Or your home. The 7000 is ideal as a mobile or base station. So much power and so many features, yet such a small footprint. Must be an Icom. Visit your authorized Icom dealer today and start conquering the world.

HF/6M @ 100W (40W AM), 2M @ 50W (20W AM), 70CM @ 35W (14W AM) • DSP^2 - Dual DSP Processors • Digital IF Filters • Twin Pass Band Tuning • Multiple AGC Loops • MNF^2 - Dual Manual Notch Filters

For the love of ham radio.

ICOM®

Icom has the receivers for the experts...

IC-R9500 ICOM'S ULTIMATE WIDE BAND RECEIVER

- 0.005 - 3335.000MHz*
- USB, LSB, CW, FSK, FM, WFM, AM
- 1020 Alphanumeric Memory Channels
- P25 (Option UT-122)
- Five Roofing Filters and so much more!

Icom Mobile Receivers

IC-R1500

MOBILE OR PC CONTROL

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, USB, LSB, CW
- 1000 Memory Channels
- Fast Scan
- Optional DSP (UT-106)
- PCR Software Included
- Very Compact Design

IC-R2500

2 WIDE BAND RX IN 1

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, SSB, CW (Main)
- AM, FM and WFM (Sub)
- 1000 Memory Channels
- Optional D-STAR (UT-118)
- Optional P25 (UT-122)
- Optional DSP (UT-106)

Bonito

All Icom "black box" mobiles come bundled with Bonito's RadioCom 4.5 software!

...or for those just getting started.

IC-R75 WIDE BAND RECEIVER

- 0.03 - 60.0 MHz*
- Triple Conversion
- Twin Passband Tuning
- Digital Signal Processing (DSP)

Visit your favorite Authorized Amateur Dealer today!

ICOM®

*Frequency specs may vary. Refer to owner's manual for exact frequency specs.

hy-gain® ROTATORS

. . . the first choice of hams around the world!

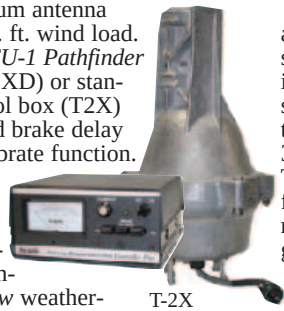
HAM-IV

HAM-IV $649.95

The most popular rotator in the world! For medium communications arrays up to 15 square feet wind load area. *New* 5-second brake delay! *New* Test/Calibrate function. *New* low temperature grease permits normal operation down to -30 degrees F. *New* alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *New* indicator potentiometer. *New* ferrite beads reduce RF susceptibility. *New* Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced antenna movement. North or South center of rotation scale on meter, low voltage control, max mast size of $2^{1}/_{16}$ inches.

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

TAILTWISTER SERIES II



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

T-2X $799.95

T-2XD $1229.95 with DCU-1

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

CD-45II

CD-45II $449.95

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

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

HAM-V

HAM-V $1099.95 with DCU-1

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

AR-40

AR-40 $349.95

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

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

HDR-300A

HDR-300A $1499.95

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

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

ROTATOR OPTIONS

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

Digital Automatic Controller

DCU-1 $749.95

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

AR-35 Rotator/Controller

AR-35 $89.95

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

RBD-5 $29.95

NEW! Automatic Rotator Brake Delay

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

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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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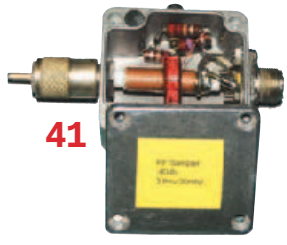

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Our Cover
Operating from "paradise" is both a joy and a challenge. The gentleman in the inset photo is John Ellis, NP2B, ARRL Section Manager for the US Virgin Islands with his 6-meter Yagi antenna. The background image depicts John's 6-element Tenadyne log periodic antenna. Both photos were taken by ARRL Chief Operating Officer Harold Kramer, WJ1B, while he was vacationing in the US Virgin Islands. See his article on page 65.

Departments

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QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc, 225 Main Street, Newington, CT 06111-1494, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

POSTMASTER: Send address changes to: QST, 225 Main St, Newington, CT 06111-1494, USA. Canada Post: Publications Mail Agreement #40612608. Canada Returns to be sent to Bleuchip International, PO Box 25542, London, ON N6C 6B2.

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Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

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

NEW

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

FTM-350R

*220 MHz 1W (USA Version only)

NEW Large (5.2" x 1.6"/130 x 40 mm) dot matrix (264 x 64 dots) LCD display for comfortable viewing for night and day. Choose your favorite LCD display from 8 vibrant color options

NEW The Display Control Head is designed for easy separation from the main RF power unit built by tough aluminum die-cast;10ft control cable included (Optional 20ft control cable available)

NEW Multi-purpose Global Positioning System display (with optional FGPS-1 GPS Receiver and Antenna. Optional FGPS-2 External GPS Receiver and Antenna is also available)

NEW Compatible with the worldwide standard data-communications system, APRS®, and SmartBeaconing™ capabilities

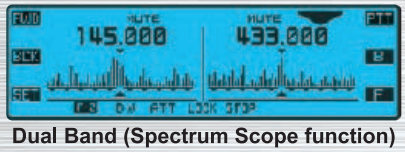
NEW Huge memory channel management capability! 500 Independent Memory channels + 9 Programmable Band Limit Memory Scan channels + 1 Rewritable Preferred channel for each L and R Band

NEW 3 Speaker System (including Built-in Dual Speakers on the rear of the Control Head for FM Broadcast in Stereo!)

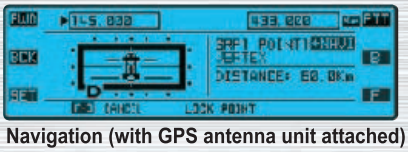
Exclusive Dual Band AF Monitor for listening to FM/AM broadcast and monitoring ham bands as well

Exclusive Built-in Barometric Pressure Sensor

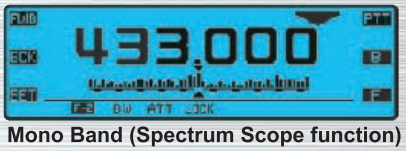
Screen Example



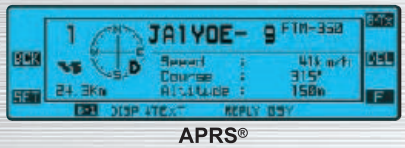
Dual Band (Spectrum Scope function)



Navigation (with GPS antenna unit attached)

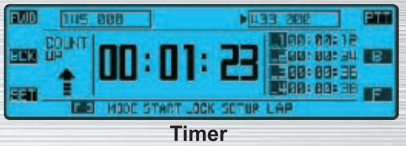


Mono Band (Spectrum Scope function)



APRS®

Barometer



Timer

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VX-8DR

A Devoted APRS® Users Version of the VX-8R Series

The optional GPS Antenna Unit FGPS-2 can be either directly attached to the radio using the microphone input jack or to the optional external microphone MH-74A7A.

• Shown with the optional FGPS-2 GPS Antenna and the optional CT-136 Adapter.

Key Addional APRS® Features of the VX-8DR include

- SmartBeaconing™ Function: When using APRS® for position tracking, the beacon timing is automatically adjusted to your traveling speed and location to plot a smoother trace to match your position and movement on a map.
- The number of Station List memories has increased from 40 to 50.
- The number of APRS® Message memories has increased from 20 to 30.
- DIGI-PATH route indication function: The APRS® Packet data includes Digipeater routing info.
- Heads up compass display to the GPS Screen: Your traveling direction is always toward the top of the display.
- The Message received LED flashing rate is selectable.

* SmartBeaconing™ from HamHUD Nichetronix

NEW

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

VX-8DR

*222 MHz: 1.5 W (USA version)

Actual size

Key Features of the original VX-8R include

- Full 5 watts FM 50/144/430 MHz – plus 1.5 watts on 222 MHz. 50 MHz AM included.
- Bluetooth® hands-free operation with the optional BU-1 and BH-1A or BH-2A.
- GPS unit and antenna optional with loads of features.
- APRS® 1200/9600 bps data communication (B band only).
- Submersible - meets IPX57 - 3 feet for minimum of 30 minutes.
- 7.4 V 1100 mAh Lithium Ion battery included. 1800 mAh LI Battery and 3 x AA battery cell case optional.
- Small size 2.36 x 3.74 x 0.92 inches.
- Simultaneous independent 2-signal dual receive function. Both V + V or U + U
- Weather receiving with Weather Alert.
- Barometric sensor included.
- Operate Amateur radio while receiving AM/FM broadcasting.
- Dot matrix LCD display provides up to 16 character Memory tags, High-resolution Spectrum Analyzer with ±50 channels indication, Wave monitoring of received/modulated signal .
- DCS and CTCSS ENC/DEC included.

* APRS® is a registered trademark of Bob Bruninga WB4APR.

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

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HF/50 MHz 100 W Transceiver

FT-950

"The Best of the Best Just Got Better"

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

COMPACT HF/50 MHz TRANSCEIVER WITH IF DSP

HF/50 MHz 100 W All Mode Transceiver

FT-450 Automatic Antenna Tuner ATU-450 optional

FT-450AT With Built-in ATU-450 Automatic Antenna Tuner

Compact size : 9" X 3.3" x 8.5" and Light weight : 7.9 lb

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

FT-897D TCXO DSP 60 m Band

HF/50/144/430 MHz 100 W All Mode Transceiver
(144 MHz 50 W/430 MHz 20 W)

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

FT-857D DSP 60 m Band

HF/50/144/430 MHz 100 W All Mode Transceiver
(144 MHz 50 W/430 MHz 20 W)

Automatic Matching for FT-897/857/450 Series Transceivers

FC-40
Automatic-Matching
200-Memory Antenna Tuner
(160 m ~ 6 m Band) WATERPROOF

Mobile Auto-Resonating 7~430 MHz for FT-897/857/450 Series Transceivers

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

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

ATAS MICRO
ATAS-25
Manually-Tuned
Portable Antenna

Real Performance, Really Portable

FT-817ND 60 m Band

HF/50/144/430 MHz
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Emergency Preparedness and the FCC Rules

"Meeting January 15-16 in the immediate aftermath of the cataclysmic earthquake in Haiti, the members of the ARRL Board of Directors had emergency communications very much on their minds."

As regular readers of this page will know, over the past year there has been much discussion about the extent to which Amateur Radio can and should be used in providing communications on behalf of licensees' employers. In general, such use is contrary to the "no pecuniary interest" standard that is built into the international definition of the amateur service. Here in the US, the FCC Rules contain the same definition but also recognize a couple of narrowly crafted exceptions for teachers and (although the station is not mentioned by name) W1AW control operators.

In an emergency – that is, in connection with the immediate safety of human life and the immediate protection of property – the FCC Rules provide that an amateur station may be used to provide essential communication needs when normal communication systems are not available. In such a situation an amateur licensee's employment status is not an issue. However, there is no provision in the rules that permits amateurs to transmit communications on behalf of their employers at other times, such as during emergency preparedness and disaster drills. This became an issue during 2009 when FCC staff was asked whether such communications were legal, and the answer – since there could be no other answer that conformed to the rules – was no.

Sensing some confusion in the amateur community, at its meeting in July 2009 the ARRL Board created an ad-hoc committee to develop guidelines for the appropriate uses of Amateur Radio on behalf of businesses and other organizations. As explained on this page in the December 2009 issue, the resulting nine-page document discusses communications by volunteers as well as by employees.

The ad-hoc committee was not asked to develop possible changes to the FCC Rules and did not do so. However, soon after the committee's work was completed and its recommendations were approved by the Board, in late October the FCC itself announced that it would entertain waiver requests from government entities to permit amateur licensees to transmit communications on behalf of their employers during government-sponsored emergency preparedness and disaster drills. The solicitation of waiver requests implied that the Commission was considering the possibility of amending its rules. The December *QST* editorial closed with an invitation for members to share their thoughts with their own Division Directors.

In many respects the ARRL Board of Directors functions like a legislative body. The 15 voting Directors are elected by the membership in each ARRL Division, so they are mindful of their constituents' views. Directors are accessible via email, postal mail and telephone. They attend club meetings, hamfests and conventions. Some Directors hold regular "cabinet meetings" prior to Board meetings in order to hear the thoughts of the elected Section Managers and other opinion leaders in the Division. Of course, the Directors are also in touch with one another in between in-person meetings.

At the request of the Executive Committee, General Counsel Chris Imlay, W3KD and ARRL staff prepared an options paper setting out the range of alternatives for rules changes – including a no-change option – with regard to pecuniary interest. The paper was circulated to the Board in early January. Thus, when the Board members assembled in mid-January there already had been a considerable exchange of information and ideas on the subject.

Following a presentation of the paper by General Counsel Imlay on the first day of the meeting, the Board members had additional opportunities to discuss the options informally during breaks and overnight. A motion was prepared and presented for consideration that represented a near-consensus view, but it was by no means a *fait accompli*; healthy debate was conducted in formal session in accordance with *Robert's Rules* and an amendment to put time limits on the duration of drills was considered before the motion ultimately was adopted in its original form.

By adopting the motion the Board instructed staff to urge the FCC to add an exception to §97.113(a)(3) of the FCC Rules to permit an amateur station licensee or control operator, on behalf of an employer, to "participate in emergency preparedness and disaster drills that include amateur operations for the purpose of emergency response, disaster relief or the testing and maintenance of equipment used for that purpose."

Needless to say, the Board's action cannot conform precisely to all of the input that Directors have received from members. ARRL members hold a wide range of views that are not easily reconciled. Many members would prefer that there be no change while many others regard the present rules as too limiting. Given that the FCC appears to be inclined to consider changes, it behooves the ARRL – as the representative of the broadest constituency of radio amateurs – to formulate an approach that addresses the bulk of the concerns about the present rules with as little impact as possible on the volunteer character of Amateur Radio.

While it is entirely possible within the existing rules for radio amateurs to train themselves as emergency communicators, a change along the lines proposed by the ARRL Board would clarify a perceived "grey area" without exposing Amateur Radio to abuse by businesses and other entities not involved in emergency response or disaster relief. We look forward to a constructive dialogue with the Commission in the weeks and months ahead.

David Sumner, K1ZZ
ARRL Chief Executive Officer

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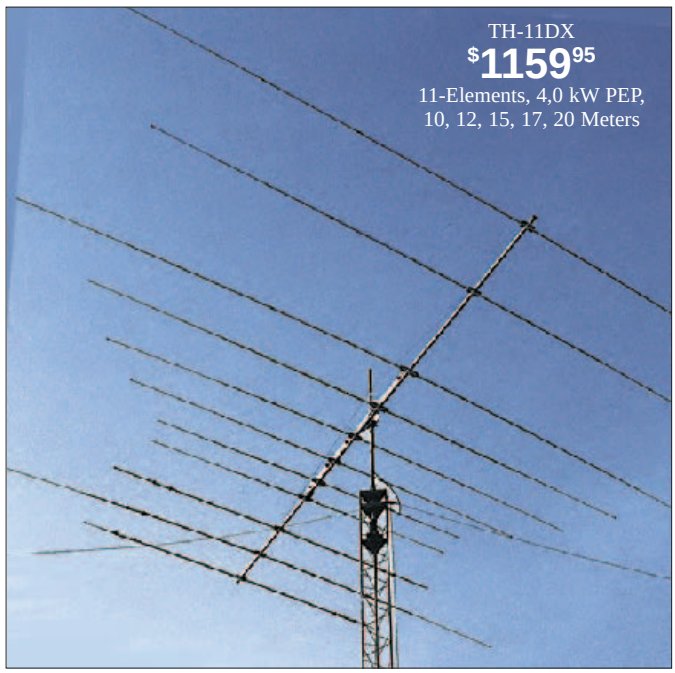

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

S. Khrystyne Keane, K1SFA
ARRL News Editor

- ARRL First Vice President Kay Craigie, N3KN, was elected the League's 15th President at the ARRL Board of Directors 2010 Annual Meeting on January 15-16 in Windsor, Connecticut. The meeting was preceded on January 14 with meetings of the Administration and Finance Committee and the Programs and Services Committee.
- President Barack Obama's new Cybersecurity Chief is an Amateur Radio operator — Howard A. Schmidt, W7HAS. In an exclusive interview, Schmidt told the ARRL that he credits Amateur Radio with getting him involved with technology.
- After the 7.0 earthquake struck Haiti, many agencies, including the Salvation Army, set up nets to provide health and welfare traffic. Members of the Radio Club Dominicano (RCD) — the Dominican Republic's IARU Member-Society — and Union Dominicana de Radio Aficionados (UDRA) went to Port-au-Prince to try to install an emergency radio communications station and a mobile station.
- Beginning with the 2010 hurricane season, the National Hurricane Center announced that it will issue watches and warnings for tropical storms and hurricanes along threatened coastal areas 12 hours earlier than in previous years.
- The Amateur Radio on the International Space Station (ARISS) program noted that it coordinated a record number — 121 — of ISS-to-school QSOs in 2009.
- The National Council of Volunteer Examiner Coordinators announced that the new Technician class question pool has been released. The pool becomes effective on July 1, 2010 and remains valid until June 30, 2014.
- Knut Magne Haugland of Norway passed away on December 25. He was 92. Haugland was one of six men, who with Thor Heyerdahl in 1947, successfully crossed the Pacific Ocean in a 45 foot raft made of balsa wood and bamboo — named *Kon-Tiki* — to prove that people from South America could have settled Polynesia in pre-Columbian times.
- The Department of Defense (DoD) issued an *Instruction* giving the three MARS services — Army, Air Force and Navy/Marine Corps — a new focus on homeland security and a new name: Military *Auxiliary* Radio System, changing the name from Military *Affiliate* Radio System.
- Users of Amazon.com's Kindle, as well as Apple's iPhone and iPod Touch, can now download *ARRL's Tech Q&A*, *General Q&A* and *Extra Q&A* directly from the online book seller.
- The ARRL has finalized arrangements to be at the 2010 Dayton Hamvention. The ARRL EXPO will feature a large exhibit in the Ballarena Hall at Hara Arena.
- In 2009, more than 7000 hams registered for the ARRL's Logbook of The World, bringing the total number of users to more than 30,000. These 30,000 hams have made upwards of 250 million QSOs — making more than 58 million QSOs in 2009 alone.
- The winner of the *QST* Cover Plaque Award for December is Robert H. Welsh, N3RW, for his article "How the Ionosphere Was Discovered."
- Registration remains open through Sunday, February 21, 2010, for these online course sessions beginning on Friday, March 5, 2010: Amateur Radio Emergency Communications Level 1; Antenna Modeling; Radio Frequency Interference; Antenna Design and Construction; Ham Radio (Technician) License Course; Propagation; Analog Electronics, and Digital Electronics.

Media Hits

Allen Pitts, W1AGP
Media & Public Relations Manager

- The ARRL's efforts to continue teaching technological and do-it-yourself Amateur Radio skills have positive results in many unexpected places. Charlie Kotan, KØTAN, noted one and wrote to us:

  In *Black Ops* from the Presidential Agent series by popular author W.E.B. Griffin, at page 709, Marine Corporal Bradley says "...If you are asking if I can use that soldering iron, then yes, sir, I can. Before I joined the Corps, I was in the ARRL. I made most of my stuff."

  "I was also in the American Radio Relay League," Casey replied. "That's how I got suckered into Special Forces; they needed people who knew the difference between an ohm and a watt."
- SKYWARN recognitions included the Lake County Amateur Radio Services (LCARS) and their use of IRLP (Internet Radio Linking Project) in weather spotting. That earned a nice hit via the *Brunswick Times-Gazette* in both North Carolina and Virginia. Marc Stern wrote an excellent article about hams' public service efforts further north in the New England snows. It was published by *Examiner.com* for the Boston region. Emergency work in ice and snow was also noted by *The Columbus Dispatch* (Ohio) in "When power is out, 'hams' pipe up" highlighting the Hocking Valley Amateur Radio Club. The *Arizona Republic* did a front page story "In the Eye of the Storm" about weather watchers, including the station at the Phoenix National Weather Service offices and Joshua Barutha, K7JGB.
- Charlotte Smith of *The Signal Item* (Carnegie, Pennsylvania) wrote a nice column about the Steel City ARC while the Livonia ARC received two good hits with the *Detroit News* for their special event at the Dossin Great Lakes Museum.
- Larry Marks, N4LDM, and his wife Tina, KI4YZT, got a nice hit about their hobby in the *Decatur Daily* (Alabama) and the Pearl River County club's Public Information Officer, Larry Wagoner, N5WLW, got a hit in the *Picayune Item* (Mississippi) titled "Ham radio stations revived."
- The Rialto ARC got a hit in the *San Bernardino County Sun* (California) comparing their current aid to the local fire department with a rescue done in 1958.
- But one of the oddest hits of all this past month has to be that ham radio is #2 in a listing of recommended "manly hobbies" to undertake by the *Art Of Manliness.com* (**http://tinyurl.com/yapbr6a**).

A New President for the ARRL...

WB8IMY

The ARRL Board of Directors met in Windsor, Connecticut just as this issue of *QST* was going to press. The Board elected Kay Craigie, N3KN as the new ARRL President to succeed Joel Harrison, W5ZN, and the first female President in the history of the League. Look for details of this and other Board actions in next month's *QST*.

Kay Craigie, N3KN, the new President of the ARRL, at the January 2010 Board meeting.

... And a Retiring President Honored

Retiring President Joel Harrison, W5ZN, chaired his last ARRL Board of Directors meeting January 15 and 16 in Windsor, Connecticut. At the conclusion of the meeting, newly-elected President Craigie presented Harrison with the ARRL Outstanding Service Award in recognition of his years of dedicated service to the organization.

WB8IMY

Retiring ARRL President Joel Harrison, W5ZN, received the Outstanding Service Award at the conclusion of the ARRL Board of Directors meeting in Windsor, Connecticut. Left to right: Retiring International Affairs Vice President Rod Stafford, W6ROD; Rick Roderick, K5UR, First Vice President; Kay Craigie, N3KN, newly elected ARRL President, Joel Harrison, W5ZN, and Dave Sumner, K1ZZ, ARRL Executive Vice President.

At $900 It's a Bargain!

Russell Skinner, WØTTT, was the winning bidder for a like-new copy of the 1964 *Radio Amateur's Handbook*. This issue was special because 1964 marked the 50th year of ARRL. The book was sold at a fund-raising auction held by the 704 Club, a part of the Society of Cable Telecommunications Engineers. Money raised from the auction was given to the Cable Television Center and Museum in Denver, which provides history of the cable television industry, along with research facilities, seminars and other functions related to cable TV.

Russell Skinner, WØTTT (center) with his prized 1964 *Handbook*. He is flanked by Les Read (left) and Bill Karnes of the Society of Cable Telecommunications Engineers.

WØTTT's winning bid was $900, which will be used for support of the collection and museum of old cable TV equipment.

Inside HQ

New Web Site and New Publications

It's been two years in the making and, if all has gone as planned, the all-new ARRL Web site should be up and running as you read this. We hope that you find it more user-friendly, helpful and nicer looking. For more details about the new Web site, see Katie Glass's article on page 63, or simply visit **www.arrl.org**.

While we have talked mostly about the public portion of the Web site, the project also required us to update our in-house software and processes since many Web applications connect to our internal information systems. While not as noticeable to the outside world, upgrading these applications helps us provide more efficient, accurate and timely customer service to our members.

To follow up on a past column, our new Amazon Kindle publications are doing surprisingly well. We currently offer all three Q & A license manuals in Kindle format. We will be publishing more titles in Kindle and other e-book formats soon. Next up will be the new version of the *Ham Radio License Manual* based on the new Technician Question Pool that takes effect in July. We will publish this book in both print and electronic versions in May. The *Ham Radio License Manual* is one of our flagship publications and, based on user and instructor feedback, our publications department continues to improve this important publication with each subsequent edition. The "Choosing a Ham Radio" section added in the last edition has proven to be an excellent resource for new and prospective amateurs. This document is also available on the Web at **www.arrl.org/members-only/choosingaradio/**.

Contrary to popular belief, the ARRL does not create the Amateur Radio Exam Question Pools. The Question Pools are developed and maintained by the Question Pool Committee (QPC) of the National Conference of Volunteer Examiner Coordinators that is comprised of 14 Volunteer Exam Coordinators (**www.ncvec.org**). The process has been in place since 1984. The Committee itself is comprised of five Amateur Extra licensees selected to represent their respective Volunteer Exam Coordinators. The current QPC Chairman is Roland Anders, K3RA, of Laurel VEC. Only one representative per VEC may serve on the QPC. The ARRL's current representative is Perry Green, WY1O, Assistant Manager of our VEC Department.

The new Element 2 Technician Class Question Pool takes effect July 1, 2010 and will be valid for four years. Each question pool must be published and made available to the public prior to its use for Amateur Radio exams. Therefore, if you would like to comment on upcoming Question Pools, you can provide your input at **QPCInput@ncvec.org**.

One final note. I was originally going to devote this column to the functions of the ARRL Lab. However, after reviewing with Lab Manager Ed Hare, W1RFI, all of things that the Lab does for Amateur Radio and the ARRL, we decided to devote an entire page of *QST* to telling its story. You'll find it on page 70.

73,

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

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e-mail: qst@arrl.org

QEX — Forum for Communications Experimenters:
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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 who could gain financially from the shaping of its affairs 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:
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Ameritron ALS-600 *Solid State FET* compact desktop station amplifier is only 4 dB below 1500 Watts -- less than an S-unit!

There are no tubes, no tube heat, no tuning, no worry rugged -- just turn on, select band and operate. 600 Watts PEP/500W CW -- lets you talk to anyone you can hear!

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Includes ALS-600PS transformer AC power supply for 120/220 VAC, inrush current protected. 32 lbs., 9½Wx6Hx12D inches.

ALS-600 Amp with Switching Power Supply
***New!* ALS-600S, $1599.** ALS-600 amplifier with 10 lb. ALS-600SPS switching power supply combo.

Switching Power Supply

ALS-600SPS $699 suggested retail

Works with all ALS-600 amplifiers. Extremely lightweight, just 10 lbs. Superb regulation, very low radiated noise. 9Wx6Hx14½D in.

From QST Magazine, March, 2005

". . . the amplifier faulted only when it was supposed to. It protected itself from our boneheaded, sleep-deprived band changing manuevers . . . "

"I found myself not worrying about damaging this amplifier. It seems quite capable of looking out for itself. . . . Kudos to Ameritron."

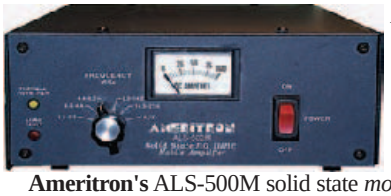
"I couldn't hear any noise at all from the SPS (*switching power supply*) on the vertical or quad…"

"I came to greatly appreciate the size, weight, reliability and simplicity of this amplifier."

"The ALS-600S makes it possible to pack a transceiver and a 600 Watt amplifier, that together weigh less than 30 pounds."

AMERITRON *mobile* 500 Watt *no tune* Solid State Amp

Instant bandswitching, no tuning, no warm-up, SWR protected, 1.5-22 MHz, quiet, compact



ALS-500M $849 Suggested Retail

Ameritron's ALS-500M solid state *mobile* amp gives you 500 Watts PEP SSB or 400 Watts CW output! Just turn on and operate -- no warm-up, no tuning, instant bandswitching. Fits in very small spaces.

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Covers 1.5-22 MHz, (10/12 Meters with $29.95 kit, requires FCC license).

Virtually indestructible! *Load Fault Protection* eliminates amplifier damage due to operator error, antenna hitting tree branches, 18-wheeler passing by. *Thermal Overload Protection* disables/bypasses amp if temperature is excessively high. Auto resets.

Typically 60-70 watts in gives full output. ON/OFF switch bypasses amplifier for "barefoot" operation. Extremely quiet fan comes on as needed. Excellent harmonic suppression, push-pull output, DC current meter. 13.8 VDC/80 Amps. 3½x9x15 in. 7 lbs.

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Protects rig from damage by keying line transients and makes hook-up to your rig easy!

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Use 1 coax for **4** antennas. No control cable needed. SWR <1.25, 1.5 - 60 MHz. Useable to 100 MHz.

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Replace **8** coax with 1! SWR<1.3 to 60 MHz.**RCS-10L, $219.95** with lightning arrestors.

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Band data from transceiver auto selects antennas. Antenna memories. No hotswitching. Rig-to-amp interface. For 3/4 BCD, 1 of 8 relay boxes. **RCS-12, $309.95**, auto controller with 8 coax relay box, to 60 MHz. **RCS-12L, $349.95**, with lightning arrestors.

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1⅝ in. thin on dashboard. Remote sensor, 25' cable. True *peak*, Cross-Needle,1.5 kW, 1.8-30 MHz. *High-SWR* LED.

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800 Watts . . . $899
with four 811A tubes

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VE Session Creates Two Ham Families

Garth Crowe, N7XKT, Wyoming Section Manager, **n7xkt@arrl.org**

COURTESY OF GARTH CROWE, N7XKT

From the left, Wyoming Section Manager Garth Crowe, N7XKT; Sterling Davis, KF7GRY, upgrade to General; Bridget Fross, KF7GRW, and ShaneAnn Fross, KF7GRX, both new Technicians; James Fross, KF7GRY, new General; Shane Fross, KC5VPT, upgrade to Extra class; Tristan Fross, KF7GRV, new Technician; Bill Torrance, N7QAX, VE; Bill Edwards, WU7Y, Liaison; Roland Miller, WY7RM, Instructor; Bob Davis, WG7Y, VE; Dell Howery, AD7KI, VE; Chris Butler, KE7ZHV, upgrade to General; Gary Horlick, K7GSH, VE; John Butler, KF7GSA, new Technician. Not shown is Jerry Boone, WY7JB, Chief Instructor.

After a wonderful Jamboree on the Air (JOTA) weekend, the Northeast Wyoming Amateur Radio Association (NEWARA) began a 5 week Technician's license class at the request of the scouts who attended. There were eight students ranging in age from 11 to adult. At the testing session on the December 12 all eight students passed their intended license.

An interesting result of this testing session was that two families joined the Amateur Radio ranks. Five of the six Frosses passed their tests and two, Bridget (Technician class) and Shane (Extra class) aced theirs. Both the Butlers passed with Chris upgrading to General and John passing his Technician test. According to Bill Edwards, WU7Y, it was the best testing session he has done in 20 years as a volunteer examiner (VE).

Six Elements by 40 Years

Del Kohler, W7JG

DEL KOHLER, W7JG

This is a photo of my 6 element triband Quad that Gene Welcome, K7EEK, and I constructed in the 1970s. The boom consisted of two 30 foot pieces of aluminum irrigation pipe telescoped over thick walled tempered aluminum pipe. It has been used primarily for chasing DX. The Quad came in handy during the Good Friday earthquake (Friday, March 27, 1964) allowing contact with a W5 mobile in Anchorage, Alaska for 36 continuous hours.

The support is a reject spiral-tapered piling 110 feet long with 10 feet in the ground. This guyless pole kept the Quad aloft for 2 years before succumbing to some unusual high winds.

CRAIG BLEDSOE, KL4E

Craig Bledsoe, KL4E, gains some altitude by standing on the roof of his mountainside location near Eagle River, Alaska (BP51) to work AO-51 during Straight Key Night (SKN). The temperature was approximately −10° F at the time. The configuration is a Yaesu VX-5R feeding a MEGA-Arrow dual-band Yagi. He used a surplus knee key from a World War II tank radio. The downlink was full of signals from all over the lower 48 and Canada. A good time was had by all.

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CORRESPONDENCE

FRUGAL, NOT CHEAP

♦ I read with some bemusement the Op-Ed piece by Neil Friedman, N3DF ["We Are Not 'Cheap,'" Jan 2010, page 93]. I, too, frequently hear that same stereotype. I wear that label as a badge of pride at times for the very reason he infers: our ability to make something from junk — why do you think it's called a junk drawer? — and our universal refusal to overpay for anything. I've been a ham for nearly 30 years and can generally tell a "cheap" ham from a "frugal" ham in a couple minutes. Both labels infer a certain level of discipline. And that is where the similarities end.

Cheap hams don't take pride in their hobby, shack or presentation. On the other hand, the frugal ham cerebrally commits resources where needed to convey both personal pride in their investment, as well as to be certain the purchased object achieves the sought after goal. The skill of frugality is an *educated trait* we hams should embrace with open arms and wear proudly. Frugality is what has kept this country going for nearly 500 years.

Thus, I agree with Mr. Friedman's statement to the extent we need to rebuke the cheap stereotype. But instead of an outright rebuke, correct the person advising that we're frugal as opposed to being cheap, preferring to not squander resources big or small, no matter the apparent condition.

MICHAEL G. McCARTHY, N9EAO
ARRL Life Member
Woodridge, Illinois

♦ Having been a licensed radio amateur since the 1940s, I found the N3DF's piece regarding hams being thought of as "cheap" to be worthy of some comment. From strictly a personal standpoint, I wear the mantle of cheapness proudly, and strongly differ with his argument that amateurs have been unfairly singled out for their stinginess with a buck. Amateurs of my era — many of them fellow teenagers like myself — had little spare cash. This meant scrounging for parts to build a project of some kind. We would often brag amongst ourselves about how little a particular rig cost us to build, and we vied for the title of "Biggest Cheapskate."

On the other hand, we had all striven diligently for our tickets, learning the code at 13 words per minute, experimenting and studying radio theory. Though we had little cash, our status as radio amateurs was of such value that most of us wanted to give something back by volunteering in various volunteer communications related activities. It did not involve actual cash contributions, plaques or other symbols of self aggrandizement. We were just pleased to get the occasional "thank you."

MICHAEL ATLAS, N7FC
Tucson, Arizona

BACK TO BASICS

♦ I have been operating this wonderful PSK mode since the very first article appeared in *QST* about 10 years ago. I was intrigued by the possibilities of keyboard-to-keyboard communications that PSK offered. The many software versions available today make operating the mode a "no brainer." In the beginning, PSK was a great rag chewing mode. But now, instead of conversation, it has become the vogue to use pre-canned macros in place of dialogue. It's rather disconcerting when I am trying to engage in conversation to get a response to a query with a pre-canned macro in a totally unrelated vein. The macros — originally intended to make operating PSK more convenient by pre-canning repetitive transmissions such as CQs, BTUs and 73s — have now, unfortunately, taken the place of conversation.

One of the original descriptions of PSK operation used the phrase "keyboard-to-keyboard *conversation*." Of course, I know that it's easier to key in a macro and then transmit it, time after time, but that's not conversation. Just think what you may be missing by overusing macros and not engaging in conversation, keyboard-to-keyboard, with the other station. Let's get back to conversation and minimize the use of macros and "catch and release" PSK operation. That's what *communication* is all about.

GENE SCHLAGEL, K2AKV/4
Delray Beach, Florida

KUDOS TO GETTING KIDS ON THE AIR

♦ I want to say "Good Job!" to those folks who are involved with the ARRL School Club Roundup. It's great that some operators get the young folks involved in ham radio. I just worked a 12 year old on 20 meters — who knows what seeds are planted for these kids and their future in ham radio? I can't say enough about the hams who get these kids involved in such a great hobby. I hope everyone would take the time to work these kids when able.

JOHN PHILLIPS, KCØPLZ
Sioux Falls, South Dakota

ANOTHER KIND OF "BIG GUN"

♦ It was with great delight that I read "From .45 Caliber to 50 Ohm" by Bob Bastone, WC3O ["Up Front," Jan 2010, page 20]. You see, I am not only a Life Member of ARRL, but of the National Rifle Association as well. I have paralleled my 50 years in ham radio with an interest in the shooting sports. I have often shot shoulder-to-shoulder with other competitors at shooting events, only to find their shooting boxes sporting their call signs or go to the parking lot to see their vehicles adorned with Amateur Radio antennas or ham license plates.

I have often wondered if hams knew of the close relationship shooting and firearms enjoyed with Amateur Radio. Are they were aware that the founder of the ARRL, Hiram Percy Maxim, W1AW, was the same Hiram Percy Maxim that is credited with the invention of the firearms silencer (or suppressor) at the turn of the 20th century? Maxim marketed his silencer — or, as he called it, a suppressor — as "a more gentlemanly way to shoot" and it was very popular with sportsmen during the '20s and '30s. Also worthy of note is that he is the son of Sir Hiram Stevens Maxim the inventor of the modern machinegun (the Maxim Machinegun). I have heard it said that the father invented the noisiest weapon on the battlefield and his son invented the most quiet.

I think it is great that the Skyview Radio Society found a way to combine safe and sane shooting with Amateur Radio. I for one had never thought of using Smith charts as targets to further not only the shooting sports, but promote a working knowledge of the charts themselves. It appears that the Skyview Radio Society is a very progressive group of Amateur Radio operators and I wish them luck in furthering not only Amateur Radio, but safe shooting as well.

STEPHEN L. HOSE, KD1DT
ARRL Life Member
Clinton, Indiana

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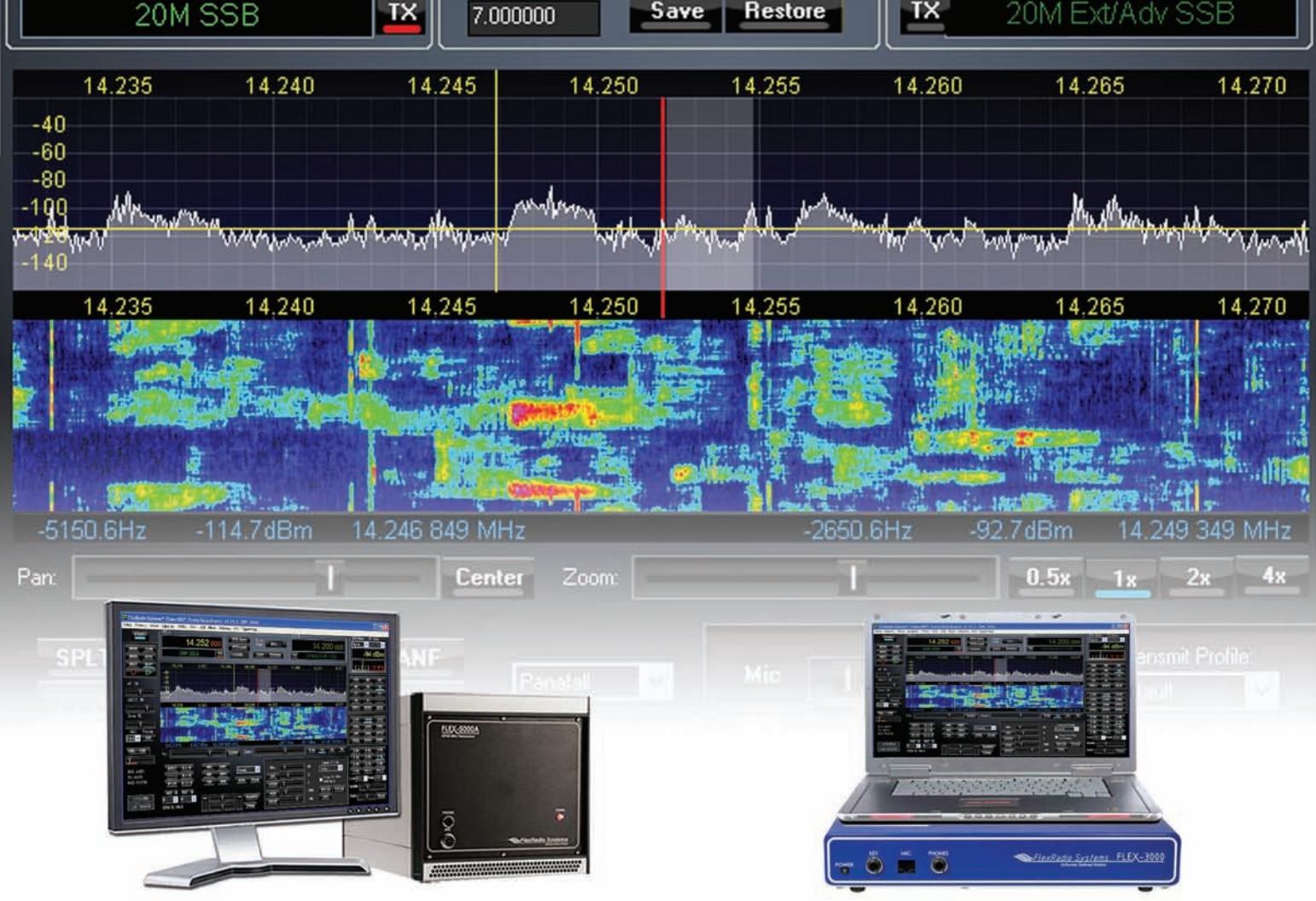

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An Experimental Look at Ground Systems for HF Verticals

In this groundbreaking work we obtain definitive results on ground system effectiveness.

Rudy Severns, N6LF

It's been over 100 years since Marconi used vertical antennas. With such a long history it would seem unlikely that anything new could be said about them. The way Amateur Radio operators use and implement vertical antennas often differs from commercial or military practice leaving amateurs with unanswered questions.

These questions can be addressed analytically or through the use of modeling and simulation, but for most of us neither is quite convincing. Actual measurements on real antennas are a lot more satisfying, at least to verify the modeling.

Some years ago, Jerry Sevick, W2FMI, (SK) published exactly this kind of information in *QST*.[1-5] Reading his articles inspired me to take another experimental look at HF ground systems. The result was an 18 month effort, partly replicating Jerry's work, but also addressing other questions such as the comparison between ground surface and elevated radial systems. These experiments have been covered in detail in a series of seven *QEX* articles. Since not everyone wants all the gory details, this article is a summary of the more interesting results.[6]

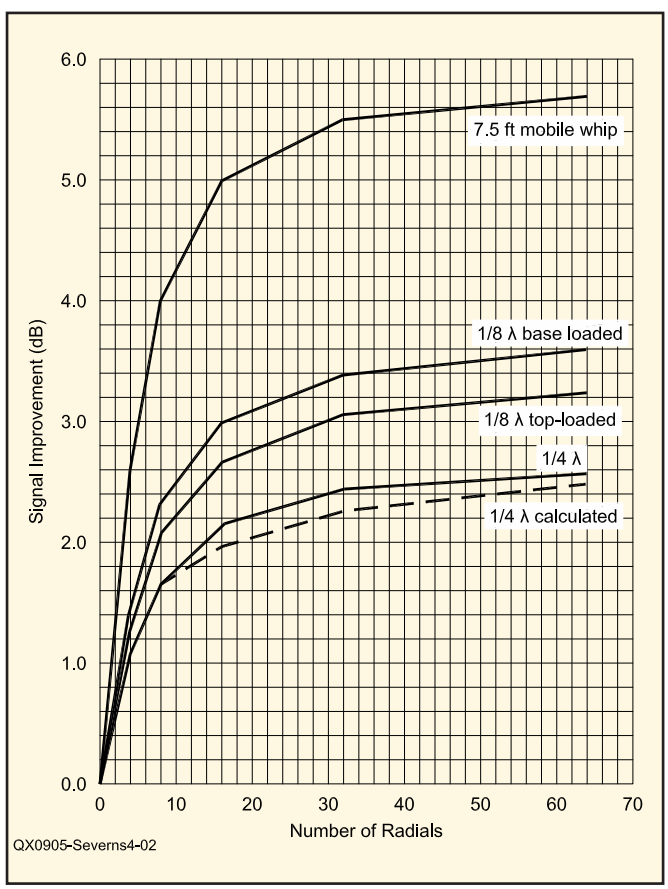

Figure 1 — Typical improvement in signal as ¼ wave radials are added to the basic ground system of a single ground stake.

Near and Far

It is important to keep in mind the role of the ground system associated with the radiation from a vertically polarized antenna. The radiation pattern for a vertical is strongly influenced by the characteristics of the soil in the neighborhood of the antenna. This is particularly true at lower angles for which the pattern is determined by soil characteristics out to a great distance (many wavelengths), often referred to as the *far-field* region.[7] As a practical matter we can't usually do much about conditions beyond perhaps ½ wavelength from the base of the vertical, other than select our location — we simply have to accept what's out there. We can, however, do a lot to reduce the losses in the immediate vicinity

[1]Notes appear on page 33.

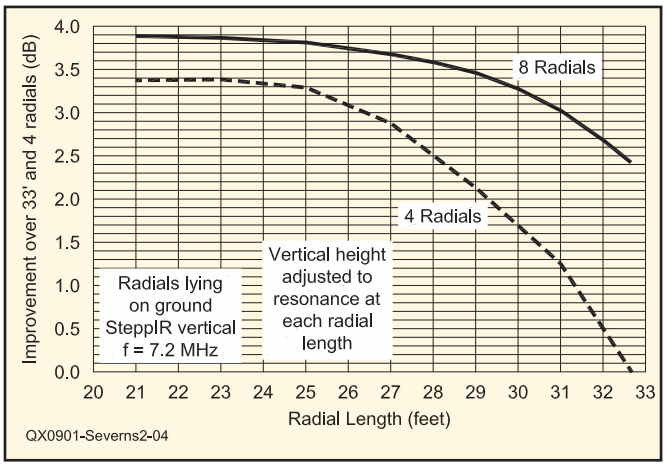

Figure 2 — Effect on signal strength of shortening radial lengths. The 0 dB reference is four 33 foot radials.

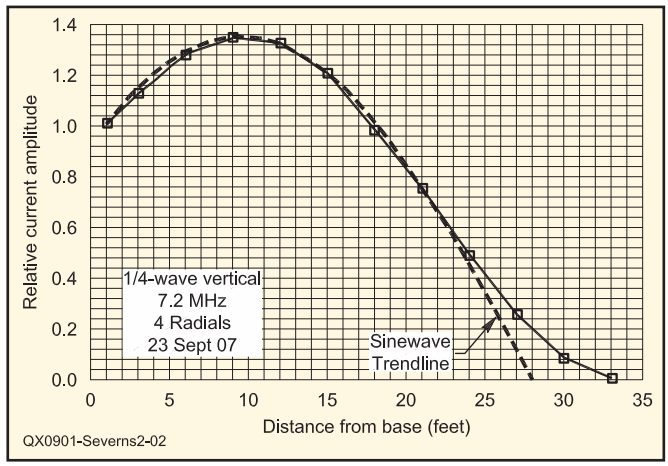

Figure 3 — Measured current distribution on a radial.

of the antenna (the *near-field* region), where the losses can be very high.[8] The purpose of the ground system is to reduce these near-field losses, increasing efficiency and allowing us to radiate as much of the antenna input power as possible, which ultimately improves our signal.

Overview of the Experiments

This work started with a 160 meter vertical with which I varied the number of ¼ wave radials and measured the change in signal strength for a fixed input power. This was interesting and educational but I realized that repeatedly laying down and picking up some 8000 feet of #12 AWG wire was not practical for more extensive investigations. I thus changed the test frequency to 7.2 MHz initially, and later added experiments for multiband ground systems (40 through 10 meters). This initial experiment also stimulated me to use the much more accurate measurement procedure that is outlined in the sidebar on the QST In Depth Web site.[9]

I went through several rounds of experiments, each one answering some questions but, of course, always generating more. In the following three sections we'll consider radials for vertical monopoles — on and above the ground and finally, radial systems for multiband verticals.

Round One — Radials on the Ground

This set of experiments used four different antennas: a ¼ wave vertical, an ⅛ wave vertical with base loading, an ⅛ wave vertical with sufficient top loading to be resonant at 7.2 MHz and a 40 meter mobile whip. I started with a single 4 foot ground stake (zero radials) and then progressively added ¼ wave radials, measuring the changes in signal strength with each increase in radial number. The results are shown in Figure 1. Note that the graph is in terms of the *improvement* in signal for a given input power for *each* antenna over the single ground stake with no radials. The graph does *not* compare the relative merit of each antenna. Obviously a short, lossy mobile whip will yield less signal, typically 10 dB less, than a full size ¼ wave vertical. The signal improvement metric gives us a direct idea of how much is gained for a given improvement in the ground system.

How Many Radials?

This graph shows several things. First it makes clear just how important a radial system is. It can make a difference of many dB in our signal strength. Keep in mind that the soil over which the experiments were done would be classified as good to very good. Over average or poor soils the signal improvements could be many dB greater than shown here. The second thing the graph shows is the point of diminishing returns. Laying down a system with at least 16 radials will give you most of the obtainable improvement. As we go to 32 and then 64 radials the improvement gets progressively smaller. It's arguable that the improvement from going from 32 to 64 radials is worth the cost and clearly the standard 120 radial BC ground system would be overkill.

A final point the graph makes is that *the shorter and more heavily loaded your vertical, the more you have to gain from improving the ground system*. The shorter the vertical, the higher will be the field intensity (for a given input power) in the near field of the antenna and the lower will be the radiation resistance. This leads to much higher ground losses, which translates to more improvement when you reduce these losses by improving the ground system.

How Long Should They Be?

Radials ¼ wave in length are known to be effective in ground systems, but I wondered what the penalty would be from using shorter radials. I was expecting to see a fairly uniform decrease in signal strength (due to an increase in ground loss) as the radials were shortened. That is *not* what I found. Figure 2 shows the results of an experiment in which I measured the signal strength while progressively shortening the radials in four and eight radial systems.

Surprisingly, shortening the radial lengths *increased* the signal strength — not by just a little bit, but by more than 3 dB. This is certainly counterintuitive, but I was seeing clues that helped explain what was happening. I noticed that with only the ground stake the resonant frequency of the vertical was much lower than expected and, as I added more radials, the resonant frequency increased slowly. Most of the change occurred between 4 and 16 radials and had pretty much leveled out by the time I had 64 radials. This suggested to me that the radials might be self-resonant below 7.2 MHz. To check this out I measured the current distribution on a radial and found it to be sinusoidal. The results are shown in Figure 3.

The maximum current point has been moved from the base of the antenna out onto the radials and this substantially increases the ground loss. The radials are resonant below the band and this affects the antenna. A wire, close to ground, can be heavily loaded by the ground, decreasing its resonant frequency. The extent of the loading will depend on the characteristics of the soil. Figure 3 shows that the maximum current point is 10 to 11 feet away from the base. Looking at Figure 2 we see that the maximum signal occurs when we have shortened the radial by this amount.

Figure 3 also illustrates a difference

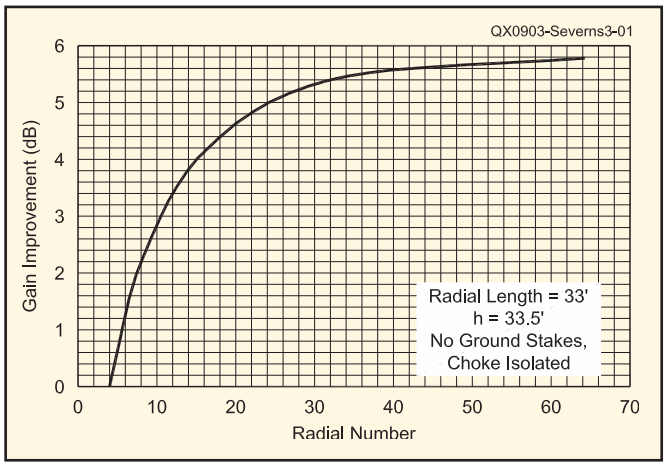

Figure 4 — Signal improvement as a function of radial number. All radials lying on the ground surface, F = 7.2 MHz.

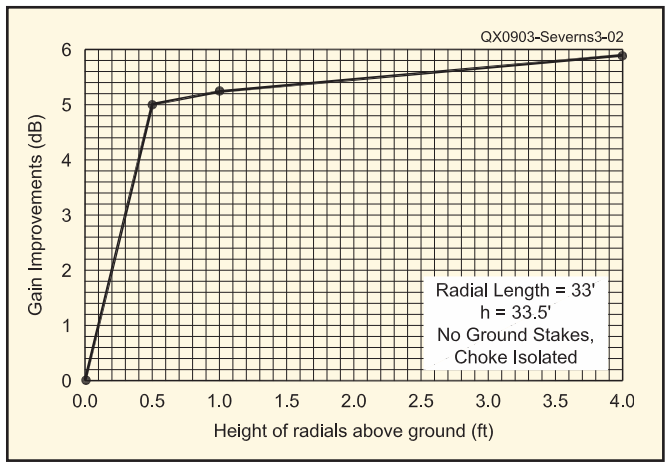

Figure 5 — Signal improvement with four radials and the antenna base at different heights. F = 7.2 MHz.

Table 1

Relative Signal Strengths for 4, 8, 16 and 32 Radials, Comparing Lengths of 33' and 21'

Number of Radials	*Normalized to Four 33' Radials (dB) 33' Radials*	*Normalized To Four 33' Radials (dB) 21' Radials*	*Gain Change (dB)*
4	0	3.08	+3.08
8	2.26	3.68	+1.42
16	3.76	3.95	+0.19
32	4.16	4.04	–0.12

between buried bare wire radials and radials lying on or very near the surface of the soil. The current distribution on a buried bare radial will usually decrease exponentially from the base regardless of its length.[10] You will not see the standing wave shown in Figure 3 except in very poor soils. The insulated radial lying on the ground surface behaves much more like a radial in an elevated radial system in that it has a sine wave-like current distribution. A buried insulated wire will be somewhere in between these two cases depending on the burial depth and soil characteristics.

You can also see in Figure 2 that the signal increases as the radial numbers increase. To check this out I extended the experiment to 32 radials, comparing 33 to 21 foot radials. The results are given in Table 1.

The results in Table 1 indicate that the excess loss due to radial resonance has pretty much disappeared by the time you reach 16 radials. This leads to some advice — rather than trying to determine the optimum radial length, which will vary with every installation due to soil differences, just use at least 16 radials. If you are limited by the total amount of wire available, you're better off to use a larger number of shorter radials rather than a few long ones.

I didn't have time to run an extensive set of experiments comparing different radial length and radial number combinations (each with the same total length of wire), but I did model that situation with *EZNEC*.[11] The modeling predicted, particularly with short verticals, that it was often advantageous to reduce the length of the radials and increase their number. The modeling showed that there is a correlation between vertical height and optimum radial lengths. More details can be found in the modeling report and in the work of others.[12-15]

Round Two — Elevated Radials

Over the past few years there has been a lot of discussion about the relative merits of ground systems using a large number of surface or buried radials versus only a few elevated radials. This stems from *NEC* modeling that indicated that four radials elevated 8 feet or so above ground could be just as effective as 120 buried radials. Many of us, including me, simply could not believe that.

I decided the best way to address this question would be to directly compare two antennas, one with a large number of ground radials and the other with only a few elevated radials. The same antenna was used in both cases, a simple ¼ wave vertical. For the surface tests I used ¼ wave radials and varied the number from 4 to 64. For the elevated tests I used four ¼ wave radials. The elevated radials were placed at 0, 6, 12 and 48 inches above ground. The results are shown in Figures 4 and 5. The 0 dB point in the graphs is normalized to the signal strength for the case of four ¼ wave radials lying on the surface (0 dB). What you see in the graphs is the improvement as you either add more surface radials or elevate the antenna and the four radials above ground.

The most striking thing shown by the graphs is that four elevated radials at a height of 48 inches are within 0.2 dB of 64 radials lying on the ground. This would seem to support the predictions from *NEC* modeling. A detailed view of the results with different elevated configurations is provided on the QST In Depth Web site.

Round Three — Multiband Ground Systems

While single band verticals are frequently used, multiband verticals are even more popular but I'd not seen any experimental work related to multiband ground systems. So I did some. The experiments were performed in two phases. The first was for radials lying on the ground and the second was for elevated radials. These represent two typical scenarios for amateurs, helping to answer a related question: "Do I put the antenna in the backyard or up on the roof?" For this series of tests I used a SteppIR III vertical.[16] The motor driven SteppIR can be adjusted to be resonant anywhere between 40 and 6 meters.

For these experiments I made up four sets of thirty-two ¼ wave radials, one set for each band (40, 20, 15 and 10 meters). I then tried several different configurations starting with sets of 32 single band radials, *one set at a time*. In this way I had a ¼ wave vertical over a ground system of thirty-two ¼ wave radials on each band. These antennas were

then measured individually on each band. I then tried groups of four and eight (32 total) ¼ radials for each band, connected all at the same time. Next I tried 32 radials each 32 feet long, followed by 16, 8 and 4 at 32 feet each.

Obviously with a multiband antenna you would not run out to the antenna and change the radials whenever you changed bands! But this data can give us a feeling for any compromises resulting from the shift from monoband to multiband ground systems.

Four radials per band (16 radials in a four band system) probably represents the most common multiband ground system in general use both for elevated and ground surface radial systems, and we will use this as one measurement standard. I could have chosen many other possible combinations but those I did choose are at least reasonable. In particular I wanted to show that a few long radials don't work very well whether on the ground or elevated.

Radials Lying on the Ground

A comparison of the relative signal strength of each configuration with radials lying on the ground was made in comparison to the four radials per band case. The detailed results of this and following cases are shown on the QST In Depth Web page. In summary, however, there was little to choose among the cases (1 dB or less) until we came to the four 33 foot case that was down 2 to 4 dB from the standard four radials per band. The best performer is found with the 32 radials of 33 feet each, which is 0.4 to 1 dB better than our standard depending on the band. This case does require almost four times as much wire, however.

In the final analysis it appears that the standard ground system works just fine, but you can add more wire and get some improvement.

Vertical and Radials Elevated 48 inches

Once again the standard multiband radial system of four elevated radials appears to work well, nearly as well as the 32 radials of 33 feet each, although it has an edge of about 1.1 dB on 10 meters. As we move to fewer long radials, however, we found a problem on 20 meters in which the gain starts to fall quickly. This is related to the fact that the 33 foot, ¼ wave, radials on 40 meters are close to ½ wave radials on 20 meters, presenting a high impedance. At eight 33 foot radials the 20 meter response is down 4 dB, and at four 33 foot radials the performance was so poor I wouldn't consider it a multiband ground system. The four long radials didn't even work well on 15 meters, on which they were close to ¾ wave long.

Elevated Versus Ground Surface Radials

How do elevated multiband and ground surface radial systems compare to each other and to a large number of radials on the ground on each band? While the details are tabulated in the In Depth Web page, some conclusions can be summarized.

The differences between a 32 radial monoband system on the ground and a four radial elevated monoband system on each band are small, as we would expect from our earlier results.

If we compare a 16 radial multiband system on the ground with the same configuration elevated, the elevated system has about a 1 dB advantage on all bands. Doubling the number of radials on the ground will reduce the differences by 0.2 to 0.3 dB. The standard multiband system works just fine if elevated, but when the radials are lying on the ground it's not quite as good. If a radial system lies on the ground, the rule is you should use more radials to achieve comparable performance.

Acknowledgments

I want to acknowledge the helping hands that Mark Perrin, N7MQ, and Paul Thompson, W8EIB, provided in the field during these experiments. My thanks also to Mike Mertel, K7IR, for the loan of a SteppIR vertical for these experiments.

In addition to creating the design for the VNA used in these experiments, Paul Kiciak, N2PK, originally suggested to me the use of a VNA for these experiments when I was moaning and groaning about more conventional techniques. Paul also provide important criticism at several points to keep me on the straight and narrow

Notes

[1]J. Sevick, W2FMI, "The Ground-Image Vertical Antenna," *QST*, Jul 1971, pp 16-19.
[2]J. Sevick, "The W2FMI 20 Meter Vertical Beam," *QST*, Jun 1972, pp 14-18.
[3]J. Sevick, "The W2FMI Ground-Mounted Short Vertical," *QST*, Mar 1973, pp 13-19.
[4]J. Sevick, "A High Performance 20, 40 and 80 Meter Vertical System," *QST*, Dec 1973, pp 30-33.
[5]J. Sevick, *The Short Vertical Antenna and Ground Radial*, CQ Communications Inc, 2003, ISBN 0-943016-22-3. This is a compendium of Sevick's earlier work.
[6]R. Severns, N6LF, "Experimental Determination of Ground System Performance — *Part 1*," *QEX*, Jan/Feb 2009, pp 21-25; Part 2, Jan/Feb 2009, pp 48-52; Part 3, Mar/Apr 2009, pp 29-32; Part 4, May/June 2009, pp 38-42; Part 5, Jul/Aug 2009, pp 15-17; Part 6, Nov/Dec 2009, pp 19-24, and Part 7, Jan/Feb 2010, pp 18-19.
[7]R. D. Straw, Editor, *The ARRL Antenna Book*, 21st Edition, pp 3-11 to 3-32. 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**.
[8]R. Severns, N6LF, "Verticals, Ground Systems and Some History," *QST*, Jul 2000, pp 38-44.
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[11]Several versions of *EZNEC* antenna modeling software are available from developer Roy Lewallen, W7EL, at **www.eznec.com**.
[12]Rudy Severns, N6LF, "Vertical Height Versus Radial Length," 2008. Available at **www.antennasbyn6lf.com**.
[13]J. Stanley, K4ERO, "Optimum Ground Systems for Vertical Antennas," *QST*, Dec 1976, pp 13-15.
[14]R. Sommer, N4UU, "Optimum Radial Ground Systems," *QST*, Aug 2003, pp 39-43.
[15]A. Christman, K3LC, "Maximum Gain Radial Ground Systems for Vertical Antennas," *NCJ*, Mar/Apr 2004, pp 5-10.
[16]**www.steppir.com**.

Rudy Severns, N6LF, was first licensed as WN7WAG in 1954 and has held an Amateur Extra class license since 1959. He is a consultant in the design of power electronics, magnetic components and power conversion equipment. Rudy holds a BSE degree from the University of California at Los Angeles. He is the author of three books, over 90 technical papers and a former editor of QEX. *Rudy is an ARRL Life Member and an IEEE Fellow. You can reach Rudy at PO Box 589, Cottage Grove, OR 97424 or at* **n6lf@arrl.net**.

Feedback

◊ In "The Doctor is IN" [Dec 2009 pp 45-46], Footnote 1 should have said: A high pass filter on a TV is traditionally used to keep the fundamental signal from an amateur HF transmitter from overloading the front end of a VHF TV receiver without attenuating the TV signal. In this application, it will keep HF harmonics of the horizontal sweep system from going up the TV antenna cable.

Strays

QST congratulates…

◊ Mark Dumpleton, 2EØNCG, for winning the Radio Arcala Essay Contest. This contest is sponsored by the Radio Arcala, OH8X, an Amateur Radio club in northern Finland. The idea behind the essay contest is to get some fresh thoughts from both young and old operators on ways to bring more people into the ranks of Amateur Radio.

Mark was awarded a plaque for his essay, which can be read in the "Young Peoples Terms" page of the Radio Arcala Web site (**www.radioarcala.com**).

Compact Stealth Five Band Inverted L Antenna

If you need to keep a low antenna profile, this may be a solution for you.

Lorraine Wilson, W1AR

Santa Clara Valley (SCV) is in the San Jose-San Francisco Bay area, popularly known as Silicon Valley in Northern California. This nickname comes from the region's large number of silicon chip innovators and manufacturers, and the many high tech businesses in the area. Technological innovations began here with innovative development of such devices as the radio and the amplifier using new materials made of silicon, including transistors, the microchip and the home computer.

I recently moved here from Connecticut and found myself in a modest ground floor apartment with an 8 × 12 foot patio and a garden with 60 foot palm trees just outside the front door. There is a covenant restriction (CR) written into the lease forbidding outdoor dish antennas. Wonderful, I thought — a tempting invitation to install a G5RV dipole or an inverted V antenna high up in the palms connected to my HF radio station set up in the living room. Outside the back bedroom were very large trees of all descriptions, and thought I had found a place that offered a good antenna location for 80 to 10 meter HF operations.

Figure 1 — View of the installed antenna system in the lower patio (highlighted). Note the trunk of a 60 foot palm tree in the foreground that could not be used for a dipole due to covenant restrictions. The large trees in the far background could not be used either.

The Ugly Truth

I was wrong. After moving in, I was told that this CR also applied to any outside antennas, because they might possibly be visible to neighbors. Drat — time to come up with compact stealth mode antenna options to allow having an antenna installation outdoors. There was another apartment above me, so my choices were limited to something that would fit within an 8 foot high ceiling directly above my patio.

A Plan is Hatched

I decided to purchase a Hustler five band trap vertical (5-BTV) and make some modifications so it would function as an inverted L trap antenna within the limited area of my patio.[1] The idea was that I would use as much of the antenna vertically as could fit under my patio ceiling, and then transition to horizontal for the balance of the antenna. Other brands could be used if they are capable of being bent at a right angle at around the 10 meter trap point.

Figure 2 — The horizontally mounted portion of the antenna, as seen from inside the patio.

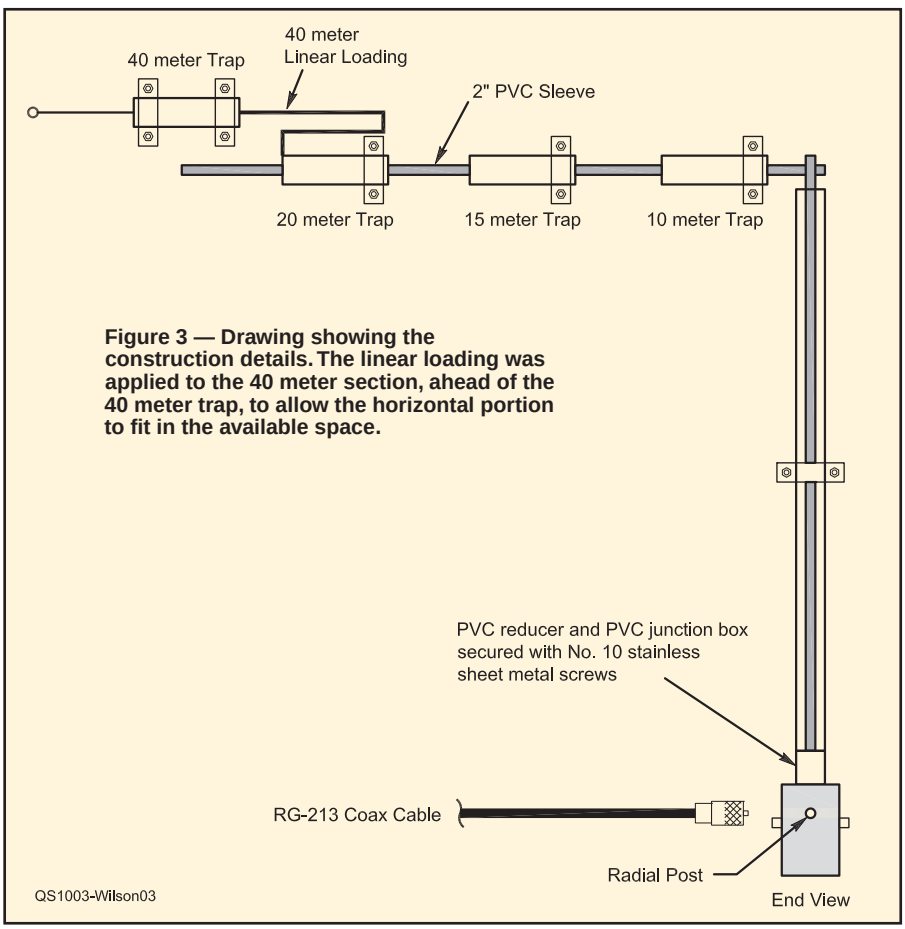

Figure 3 — Drawing showing the construction details. The linear loading was applied to the 40 meter section, ahead of the 40 meter trap, to allow the horizontal portion to fit in the available space.

Design Approach

At first, I set up the antenna in the bedroom with just a few counterpoise radial wires spread out across the carpeting, and it worked. With just 100 W of output power, and no sunspots, I effectively managed to work a total of 36 states in the continental US, as well as Mexico, Canada and Hawaii during several contest trial runs using this suboptimal antenna arrangement.

Ground System

An effective ground system is important for efficient operation of an electrical quarter wave antenna such as the 5-BTV. Higher efficiency will result in both higher effective radiated power and improved signal strength on receive. [See the article by Rudy Severns, N6LF, on ground systems in this issue — *Ed.*] Quite literally, the ground or counterpoise acts as the missing half, the other quarter wave, of a quarter wave monopole antenna system. [While a copper plated rod pounded into the soil can work, other kinds of ground arrangements can result in more than twice the signal strength, as shown in Rudy's article. — *Ed.*]

Installing the antenna outdoors with a

[1]**www.new-tronics.com/main/html/base_hf_5_band.html**.

Figure 4 — View of the antenna base. Note the stud that will connect to the ground system.

Figure 5 — The screen mesh is triple-wrapped in weed barrier plastic sheets, and covered with a 1 inch layer of top soil for concealment. The mesh is secured in the concrete patio area by double layers of aluminum aircraft aviation tape.

Figure 6 — Finished surface over ground system with top soil covering plastic sheets.

ground system of many buried wire radials would not be feasible in my garden. After modeling the antenna, I concluded that I could get reasonable results using a length of 24 inch wide galvanized chicken wire as an insulated floating (electrically isolated) counterpoise augmented by a solid earth ground rod and a few buried linear loaded wires as radials. This has worked out well for 80 through 10 meter operation.

Inverted L Radiator

The need to bend the antenna portion into a right angle at the 8 foot point is self-evident, since that is the maximum height of the patio ceiling. Ideally, it would be best to have it oriented to run straight up in the clear, perpendicular to the ground surface. Unfortunately that is not possible in my installation. Something is certainly better than nothing, and I'm pleased by the surprisingly good results.

ARRL member and Amateur Extra class licensee Lorraine Wilson, W1AR, was first licensed in 1958 and primarily operates CW. She joined the Military Affiliate Radio System (MARS) and used available surplus radio gear at her station, obtaining practical electronics training in order to provide the required 28 V dc systems.

Lorraine's interest in electronics led her to college studies in engineering and business and she now serves as a technology consultant, recently moving her operations from shoreline Connecticut to the San Francisco Bay area. You can reach Lorraine at PO Box 111656, Campbell, CA 95011 or at **w1ar@arrl.net**. QST

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Glenn Schultz, WØIJR	335	28-Sep-1984
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Frankie Mangels, AD6DC	262	14-Oct-1997
Leslie Dale, NI5S	261	06-Sep-1984
Roy Johnson, N1IKM	260	24-Jul-1995
Ralph Schutte, N6NAD	260	22-Aug-1997
Robert Hamilton, NØRN	259	19-May-1987

The Mini Horse Antenna

This compact Yagi kicks like a grown-up horse, but it's as small as colt.

Martin Hedman, SMØDTK

If you've been looking for an antenna that has reasonable gain and a nice front-to-back ratio (F/B), provides a direct match to 50 Ω coax, has a wide bandwidth, a small turning radius and great mechanical stability, this antenna may just be for you. The design, as far as I know, is brand new.

Design Concept

The configuration of the Mini Horse (MH) antenna is shown in Figure 1. Note that it is basically a three element Yagi that is shortened by end loading the driven element and folding back the parasitic elements along the diagonal support lines. The dimensions for multiple bands are provided in Table 1.

This antenna is compact, light and easy to duplicate. The design can be made either as a rigid structure, suitable for mounting on a mast and rotating, or as an end supported flexible wire array that can be suspended between two fixed supports.

I have used some antenna analyzing tools while trying to create this antenna. I have found *4NEC2* very effective. A free version is available on the Internet.[1] I did find that *4NEC2* predicts resonance higher in frequency than my physical design using same dimensions. For example, my 21 MHz antenna resonates on 21.2 MHz while the *4NEC2* software predicts a resonance at 22.6 MHz. The same factor (1.07) applies to all bands and might be the result of the use of insulated wire or the partly folded elements.

I have built this antenna for the 2 meter band and for a number of HF bands. It works very well as shown in Figure 2 and also operates over a wider bandwidth than many (see Figure 3). As with many other horizontal antennas, the Mini Horse performs better if it is at least half a wavelength above ground for best low angle performance.

Nuts and Bolts

The radiator has its ends formed as a T with the longer tail (C in Figure 1) pointed toward the director and the shorter tail (D) toward the reflector. The ends of the direc-

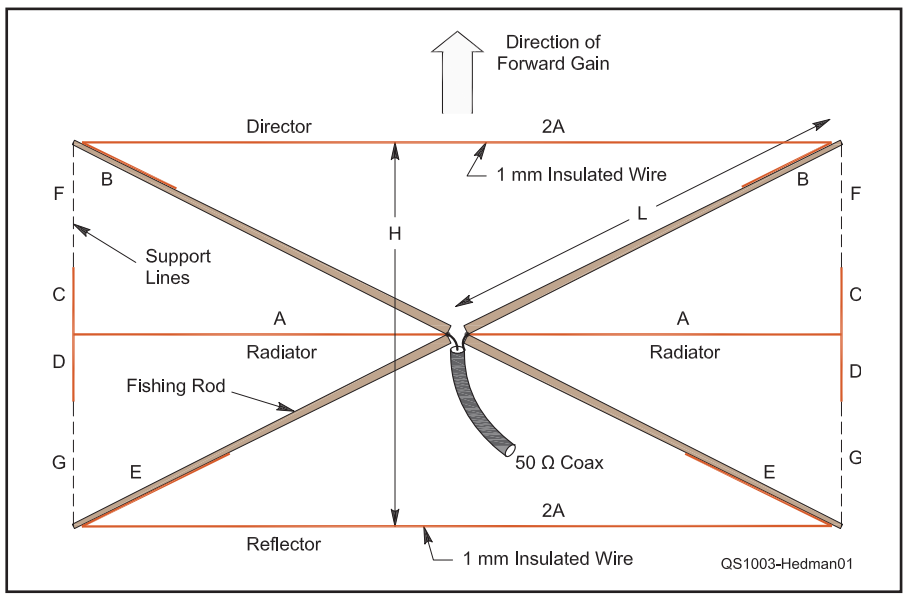


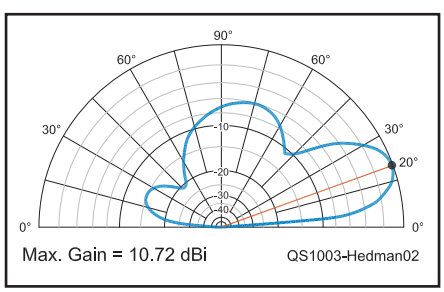
Figure 1 — Configuration of the Mini Horse antenna. The letters are keyed to the dimensions in Table 1.

Table 1

Dimensions of Mini Horse Antenna in Figure 1

MHz	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*L*
144	1' 2.2"	0' 4.7"	0' 3.5"	0' 1.8"	0' 7.1"	0' 4.7"	0' 6.5"	1' 4.5"	1' 4.3"
28	5' 11.6"	1' 10.8"	1' 6.9"	0' 9.4"	2' 11.8"	1' 10.8"	2' 8.3"	6' 11.4"	6' 11.0"
21	7' 11.6"	2' 6.3"	2' 1.2"	1' 0.6"	3' 11.6"	2' 6.3"	3' 6.9"	9' 3.0"	9' 2.6"
14	11' 11.3"	3' 9.7"	3' 1.8"	1' 6.9"	5' 11.2"	3' 9.7"	5' 4.6"	13' 10.9"	13' 9.7"
7.1	23' 10.5"	7' 7.3"	6' 3.6"	3' 1.8"	11' 10.5"	7' 7.3"	10' 9.1"	27' 9.8"	27' 7.4"

Figure 2 — Modeled elevation response of the 21 MHz Mini Horse at a height of 30 feet.



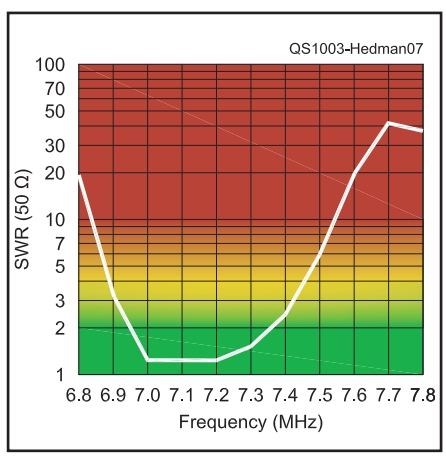


Figure 3 — Plot of the measured bandwidth of the 40 meter fixed version.

[1]**home.ict.nl/~arivoors/Home.htm**.

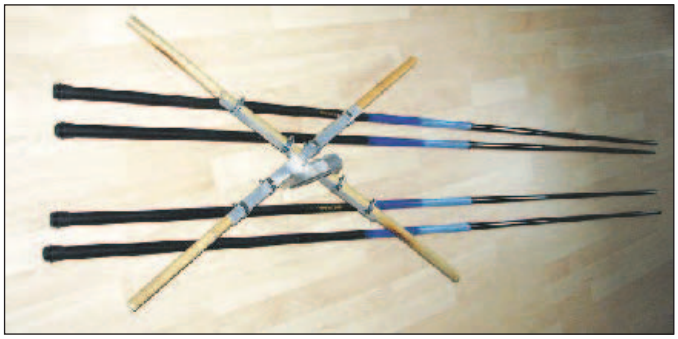


Figure 4 — View of the aluminum angle stock pieces, bamboo poles and spreaders used for the rotatable version.

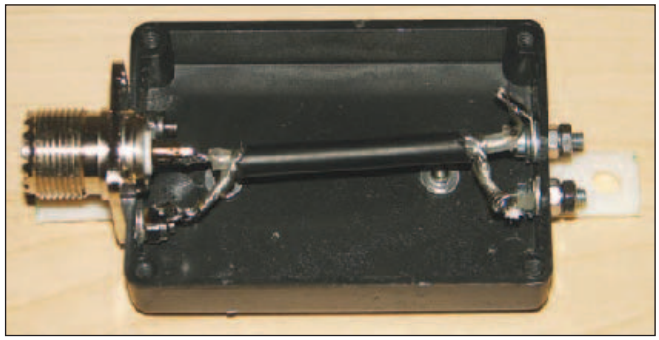


Figure 7 — The plastic utility box serves a convenient connection arrangement by providing a mounting point for an SO-239 coax receptacle.

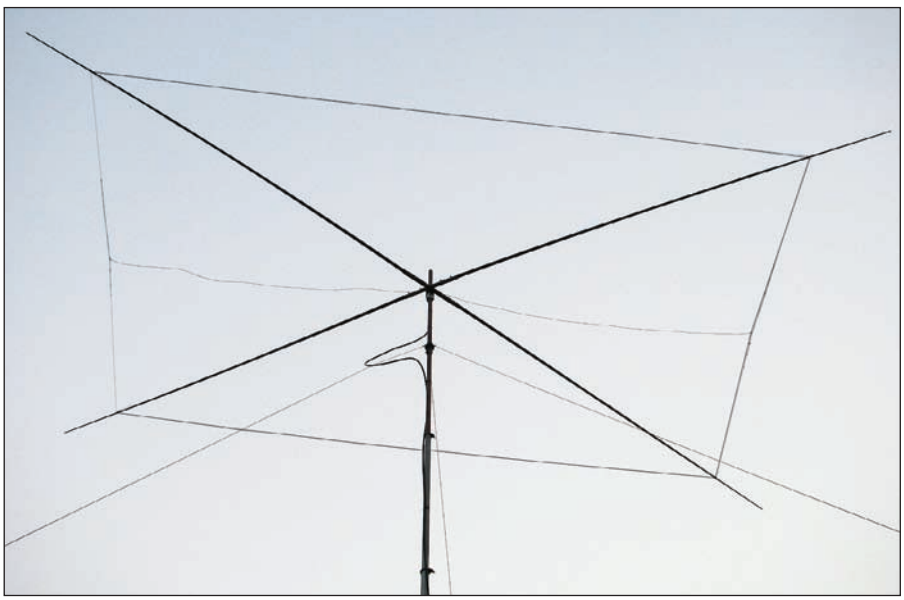


Figure 5 — The 21 MHz rotatable version at a height of 30 feet.

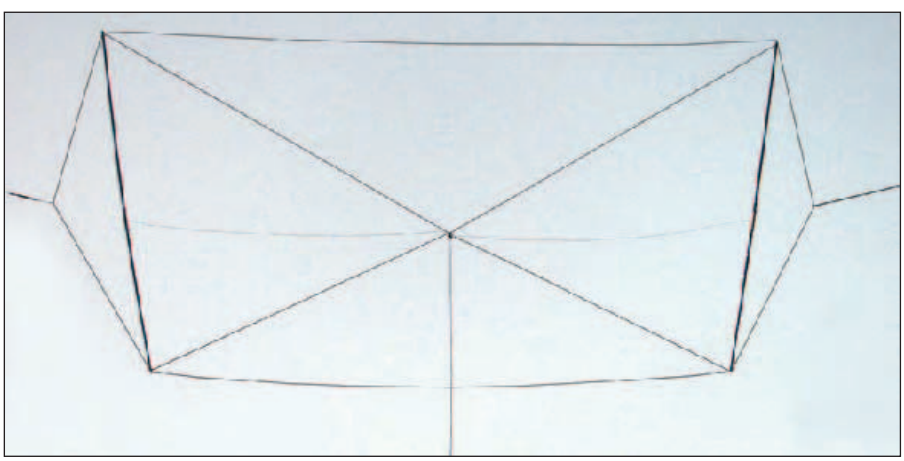


Figure 6 — View of a 20 meter implementation of the fixed version. Note the difference in the position of the pole supports.

tor and the reflector are bent and fixed to the spreaders (made of fishing pole stock) using electric tape. Support lines are fixed to the ends of the spreaders and these lines carry the radiators ends (T) by using electric tape. The spreaders are slid into bamboo poles that are fixed to a cross brace of aluminum angle stocks using hose clamps. Another two pieces of aluminum angle stock are fixed to the cross brace to attach to the mast as shown in Figure 4. A 15 meter version of the complete antenna is shown in Figure 5.

The antenna can also be constructed as a fixed wire array suspended between two fixed supports such as trees or masts. Although the wire dimensions of either version are the same, the fixed version is made using two 14 foot poles, one at each end of the array as shown in Figure 6.

Both designs use a little plastic box to hold the coaxial connector and the screws to connect the radiator as shown in Figure 7. A slice of PVC tubing is attached to the box to facilitate assembly to the mast using hose clamps. In the fixed configuration, the diagonal support lines are passed through holes at one of the ends of the box.

Martin Hedman, SMØDTK, has been a licensed Amateur Radio operator since 1965. He has enjoyed building radio equipment over the years, especially antennas. Martin has worked all his DX entities using low power and home made antennas.

Martin is now retired following a career as a telecommunication engineer. You can reach Martin at Mejselvagen 15, 43440, Kungsbacka, Sweden or at **sm0dtk@passagen.se**. *Martin's Web site,* **hem.passangen.se/sm0dtkm** *includes information on this and other antenna designs.*

New Products

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The Antenna Elevation Pattern — What's the Big Deal?

We don't usually want to transmit up, so why is the elevation pattern so important?

Joel R. Hallas, W1ZR

In our December 2009 article we discussed how to interpret antenna patterns, focusing on the meaning of the typical antenna's *azimuth* radiation pattern that describes how strong a signal we put in different directions around the globe.[1] Equally, or sometimes even more, important is the *elevation* radiation pattern.

Why Elevation Pattern?

The importance of the elevation pattern is obvious in some applications in which it applies directly. These include communication to or through aircraft and satellites, Earth-moon-Earth and various scatter modes that favor high altitude signals.

Elevation angles are equally important in a not quite as direct way. The elevation radiation angle is a major factor in determining how far our HF signals will travel via ionospheric propagation modes. This is important at both extremes. For short to medium propagation distances via NVIS (near vertical incidence sky wave) we want our signals to go, well, nearly vertical. On the other hand, for long distances we generally want the radiation to be as close to the horizon as possible for the longest distance to the reflective F layer of the ionosphere.

What Determines Elevation Angle of Maximum Radiation?

While arrays of multiple antennas above each other can focus radiation at lower elevation angles, the primary factors that determine elevation radiation angle are those that relate to reflection from the ground — antenna polarization and height.

Antenna Polarization

An antenna that is vertically polarized, such as a vertical monopole (⅝ wavelength or shorter), will have radiation that would like to be focused at the horizon, and would be, if the ground were perfectly conducting. This is due to the fact the ground reflection from a vertical antenna is in phase with the radiation from the antenna. Thus the signal from the antenna and the reflected wave add at the horizon. Unfortunately, with the exception of radiation toward an ocean from an antenna near an ocean edge, the losses of real ground result in rapid dissipation of the lowest angle radiation. Figure 1 shows the radiation of a ¼ wave long vertical monopole over typical ground compared to a seawater propagation path and perfect ground.

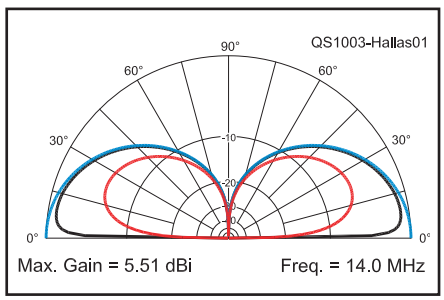


Figure 1 — Elevation pattern of a 14.1 MHz ¼ wave monopole over perfect ground (blue), seawater (black) and real ground with typical electrical parameters (red).

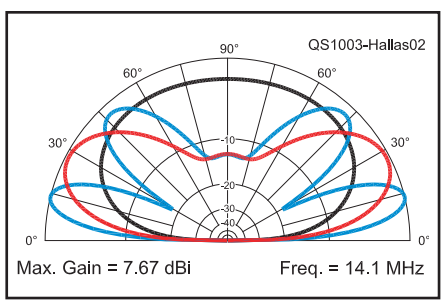


Figure 2 — Elevation pattern of a 14.1 MHz ½ wave dipole at ¼ (black), ½ (red) and 1 wavelength (blue) above real ground with typical electrical parameters.

The radiation from a horizontally polarized antenna is out of phase with that from its reflection at the horizon, resulting in cancellation of the very low angle radiation. As the height is raised, the elevation angle at which the reflection is in phase decreases, resulting in reinforcement at lower angles.

Radiation Based on Height of Horizontal Antennas

The effect of height on the radiation at the peak of a horizontal dipole is shown graphically in Figure 2 for three typical heights, ¼, ½ and a full wavelength (about 17.5, 35 and 70 feet at 20 meters). At intermediate heights, the results are in between those shown, so there's nothing magical about the particular heights chosen. While the elevation patterns of HF vertical antennas change with height, the results are much less dramatic — explaining why many use ground mounted verticals.

A comparison of Figures 1 and 2 provides insight into why those looking for low angle radiation tend to use vertically polarized antennas for the lower frequency bands and horizontal antennas for the higher bands. For a dipole to be a half wavelength high on 75 meters, for example, it requires two supports more than 120 feet high — often more difficult to find than a single support half as high for a quarter wave vertical monopole. The results are also tabulated in Table 1, showing not only the elevation angle of peak gain, but the amount of signal intensity (compared to an isotropic radiator) at that elevation as well as the intensity for each at elevation angles of 10°, 5° and 1°. Note that for the heights shown, the horizontal antennas ½ wave high and higher over the typical ground have higher signal intensity at all elevations shown than the vertical over typical ground — but the monopole at water's edge is the real champ.

All Well and Good, but How Low is Good Enough?

Fair question. HF radiation below the maximum usable frequency refracts through the ionosphere and returns to Earth some distance away — a *hop*. Some will reflect upward from Earth (especially well from oceans) and continue hopping, getting weaker with each hop and weaker with greater dis-

[1]Notes appear on page 40.

Table 1

Comparison of Vertical Radiation Angles of Simple 20 Meter Antennas over Typical Ground

Antenna	*Peak Gain (dBi)*	*Peak Elevation (°)*	*Elevation BW (°)*	*Gain (dBi) at Elevation 10°*	*5°*	*1°*
Vertical Monopole	0.0	24	38.5	–2.7	–6.1	–18.1
Monopole (seawater)	4.7	9	34.4	4.7	4.5	1.4
Dipole (¼ wave high)	5.7	62	131.0	–3.7	–9.4	–23.2
Dipole (½ wave high)	7.4	28	32.9	2.5	–3.0	–16.6
Dipole (1 wave high)	7.7	14	14.6	6.9	2.5	–10.9

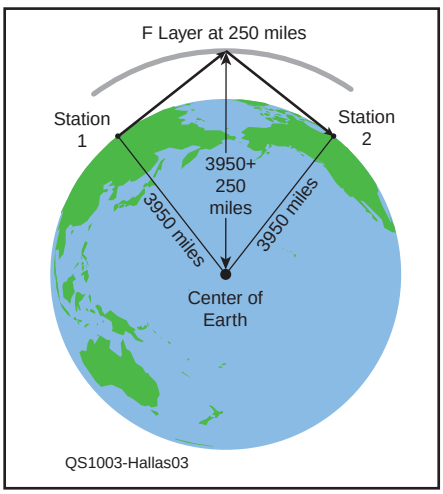


Figure 3 — Geometric ray trace model used to approximate single hop propagation distance between two stations with antennas radiating toward the horizon on a frequency below the maximum usable frequency. Not to scale.

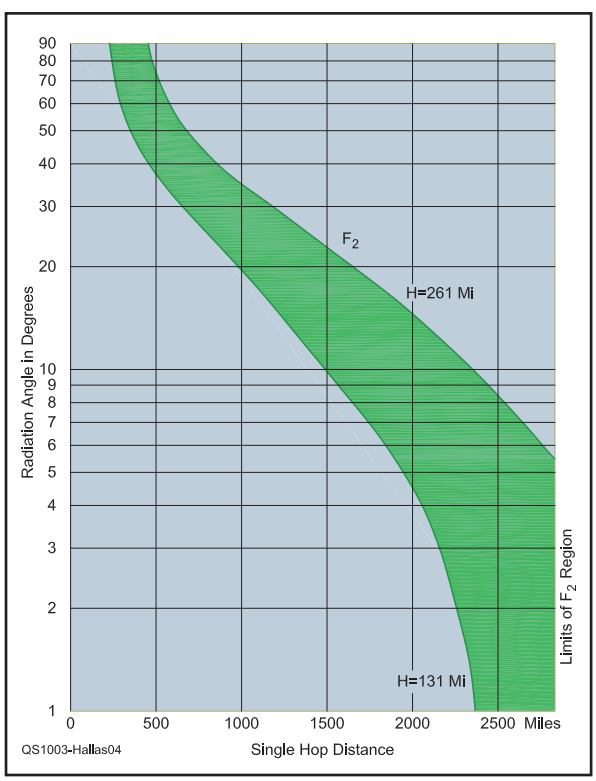


Figure 4 — Distance of one hop path via the F2 layer as a function of layer height and transmitted elevation angle.

tance through spreading over a wider area. If the station we want to work can be reached in one hop, the signal will be much stronger than if it takes two or more.

So How Far Can We Get in a Hop?

Let's start with a very simple geometric ray trace model of HF propagation. For reasons that we'll discuss, it won't be quite right, but it can serve as a starting point. Most of our longest range communication is via the ionosphere's F layer, which is considered to be between around 100 and 260 miles above the Earth's surface. Figure 3 shows the situation of two stations communicating via a single F layer hop using antennas that support communication toward the horizon (0° elevation).

For the analysis, we will consider that the effective F layer height is 250 miles and that the hop occurs via a reflection of a single "ray." Because we used 0° elevation, each of the two triangles is a right triangle, and because we know the length of two sides, we can determine that each triangle has an inside angle of 19.8°. Thus, the arc between stations 1 and 2 covers 39.9° of the 360° around the Earth, or 2751 miles.

As noted, there are a few problems with this simple model. First, the actual mechanism is refraction not reflection, so it does not happen at a single point. Rather, the wave is refracted or bent through a fairly wide portion of the ionosphere, resulting in a much less precise wave front than indicated in the simple model. Another major effect of the refraction process is that the wave front is not turned as sharply as would be a reflection, actually increasing the hop distance. This effect is often approximated as if the Earth were 4/3 of its actual size, resulting in a hop distance of up to 33% more than the ray model would predict. The actual number depends on a number of parameters, notably the fraction of the total path through the ionosphere.

Real Antennas — Real World

Perhaps the major problem with the ray model is that we don't actually transmit a ray from our antennas. As noted in Figures 1 and 2 and Table 1, our signals cover a wide range of elevation angles and each portion of our signal will have its resulting refractive path through the medium. Figure 4, borrowed from *The ARRL Antenna Book*, provides an estimate of single hop distance as a function of elevation angle and height of the F2 layer (the higher portion of the F layer).[2] For example, if the F2 layer acts at 200 miles, the middle of the band shown, and our signals transmit with elevation angles from 5° to 30°, our single hop footprint will cover respectively from around 2300 to 800 miles. Because the radiation of most of our low angle antennas will peak in the middle of that range, our strongest one hop signals will be nearly 1300 miles away.

Note that if we want reliable medium distance communication via NVIS, the radiation from the ¼ wave high dipole will illuminate the ionosphere very well for elevation angles covering 90° down to around 20°, providing coverage out to perhaps 1000 to 1500 miles. This is very useful for regional coverage if not DX.

In Summary

Our signals (fortunately) will not land on a particular rooftop 2751 miles from home (the house might not even have a ham inside!) but will cover a wide extent of distances depending on the range of elevation angles that our antenna transmits. In general, the lower elevation angles will result in stronger signals at more distant locations. It should be clear from Figure 4 that any energy we can get below 5° or 10° will provide the longest one hop distances, so having energy there will be a real plus.

It is worth noting that, while we have been discussing this topic using simple antennas as a reference, the same relationship between height of horizontal antennas and elevation angle carries over into more complex arrays such as Yagis.

Notes

[1]J. Hallas, W1ZR, "Antenna Patterns — What Do They Mean?" *QST*, Dec 2009, p 36.

[2]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**.

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

A Peak Reading RF Power Meter

Don't guess at your peak power — convert your average reading meter to a peak power instrument.

Ed Toal, N9MW

Electromechanical (*analog*) meters have provided a user interface to electronic circuits practically since the beginning of our understanding of electricity. One reason they have endured is that the user has an image of the meter scale stored in memory and a glance at the needle position usually relates the desired information to the user before they actually observe the number indicated on the scale.

This is a stark contrast to *digital* meters in which the user has to specifically read the digits and often determine a decimal place or observe a scale indication. The inertia of mechanical movements prevents this type of meter from accurately displaying electrical properties if they are not consistent over the time it takes to display the correct value. Such is the case with CW and phone RF output, as well as data and audio signals. With some electronic help, an analog meter can be made useful for these purposes.

A Peak Reading Meter Amplifier

Tom Thompson, WØIVJ, designed a circuit with a quad operational amplifier (op amp)chip utilizing three of the op amp sections.[1] Ted Gisske, K9IMM, suggested using an MCP6004 chip in place of the original LT1014 because it runs at 5 V. Ted's version is shown in Figure 1. Realizing that this meant the unit could be run powered by a 9 V battery with the MCP6004, I opted for that route.

Theory of Operation

The first op amp receives the incoming signal. The purpose of this stage is to isolate the electrical characteristics of the source from the second stage.

The second op amp stage is the key performer. It detects the peak voltage and holds it for the duration determined by the time constant of the RC circuit composed of R2 and C2. This is what we were looking for. The peak voltage is determined and held long enough to drive the meter to the correct value and for the user to observe that value.

The third op amp stage drives the meter and isolates the meter characteristics from stage two.

[1]Private communication.

Construction Notes

The schematic of the board I laid out (Figure 1) provides for ac or dc power. If you use 6 to 14 V ac to power the unit, a 1 or 1.5 A bridge rectifier should be placed at D4 and C3 and be 10 µF or larger. This was included in my board because I thought there was a possibility of supplying the required power from a filament transformer. If 9 to 18 V dc is used, the bridge position is bypassed with a jumper and C3 should be 0.1 µF.

If the input circuit should be matched to 50 Ω, a 50 Ω resistor should be placed at R4. This is a good idea if you are using a sensor unit that is designed for a 50 Ω load such as the one described in the sidebar. It also turns out that this position and the alternate diode position could be used to provide an attenuation pad.

A 5 V Zener diode may be placed at D3 if there is concern that the input voltage might exceed the chip's limit of 6 V. It is not likely it would be needed if you are using the described –40 dB RF sensor unit or using the RF sensor provided with a commercial SWR

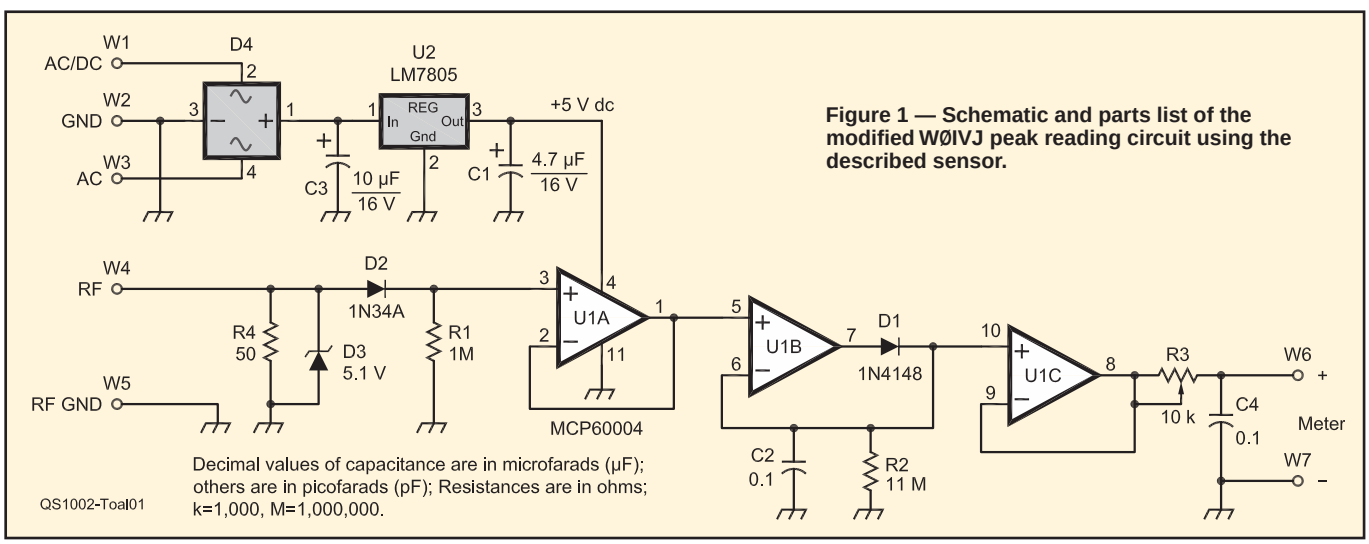


Figure 1 — Schematic and parts list of the modified WØIVJ peak reading circuit using the described sensor.

C1 — 4.7 µF, 16 V, electrolytic capacitor.
C2, C4 — 0.1 µF capacitor, C4 optional, see text.
C3 — 10 µF, 16 V, electrolytic capacitor (if ac powered).
D1 — 1N4148 silicon diode.
D2 — 1N34A germanium diode.
D3 — 5.1 V Zener diode (optional).
D4 — Bridge rectifier (if ac powered).
R1 — 1 MΩ, ¼ W, resistor.
R2 — 11 MΩ, ¼ W, resistor.
R3 — 10 kΩ, ¼ W, resistor (50 kΩ for 200 µA meter).
R4 — 50 Ω, ¼ W, resistor.
U1 — MCP6004 quad op amp IC.
U2 — LM7805 5 V regulator IC.

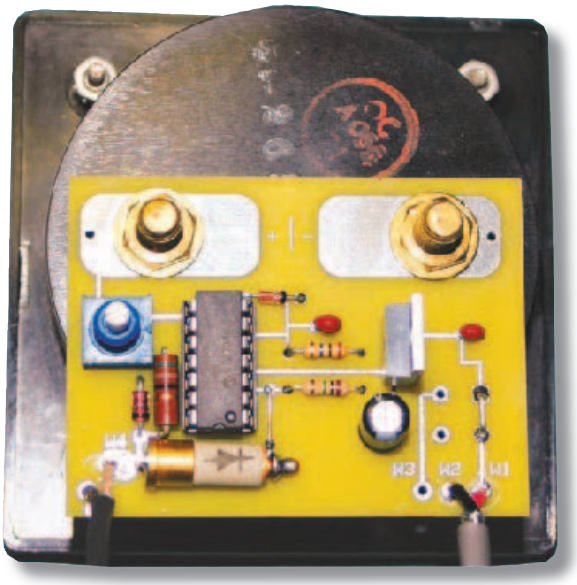


Figure 2 — The peak reading wattmeter circuit on a commercially manufactured board utilizing a 1N23E diode ready to be installed in an HF amplifier. Power is from 12 V dc available in the amplifier.

meter, if you are retrofitting an older unit.

My board was designed to mount directly on the meter terminals (Figure 2). I placed large pads for the meter lugs with a wire connection on the outer edges to mark the vertical center of the pads. A small trace was placed in the horizontal center. A straight edge can be placed on the holes and the appropriate distance measured out each way from the trace to mark the meter terminal holes. Drilling small holes first at those points for guides is a good idea. This method allowed me to use the computer layout program to center things rather than dealing with unfriendly dimensions and a ruler.

The unit must be calibrated by adjusting R3. If you are using the meter on a high power RF amplifier, you would want full scale to be around 2000 W PEP. Since a continuous RF signal will read the same on both conventional wattmeters and peak reading wattmeters, I used a Bird meter in series with this meter and a high quality dummy load and adjusted the unit so 1500 W was 75 percent of the scale. The transmitting equipment was then set for 100, 500 and 1000 W output as read on the known wattmeter and the corresponding value on this meter was noted. In this case that is a sufficient number of values to determine a useful meter scale. You may want to use one of the available meter scale computer programs to make a professional looking readout.

Performance

The performance of this circuit is noteworthy. In SSB mode if you put the radio in transmit mode and rap the microphone with a pencil, the meter will consistently display the peak value. Other units I have seen will not react that quickly and display values as little as 10 percent of the true peak value. Units that are based on sampling are hit and miss and sometimes display the wrong value. There may be a small variations in results depending on the circuitry of the RF sampling unit or variations in meter movements.

Applications

My original application was for a peak reading wattmeter in my homebrew amplifier project. It will use the –40 dB RF sensor designed by WØIVJ, which is described in the sidebar. The circuit is very compact (2.5 × 1.9 inches) so it can often be installed directly on the meter terminals and fits within the overall dimensions of the meter. Figure 2 is the assembly before mounting in the amplifier.

I have also retrofitted a Drake W4 wattmeter with this circuit. Several alterations had to be made (see Figure 3). Since the W4 sensor has diodes in the forward and reverse circuits, the diode positions on the board aren't necessary. I also discovered in short order that RF energy was coming from the sensor and interfering with the operation of the MCP6004 chip. The solution was to place a junk box toroid, about ⅝ inch diameter with 20 turns of wire, in series with the input line. I suspect most meters used in that vintage of SWR meters use 200 µA movements. The output calibration potentiometer should be 50 kΩ rather than 10 kΩ in that case.

Even when I got reasonable meter readings the scale was off. With more help from

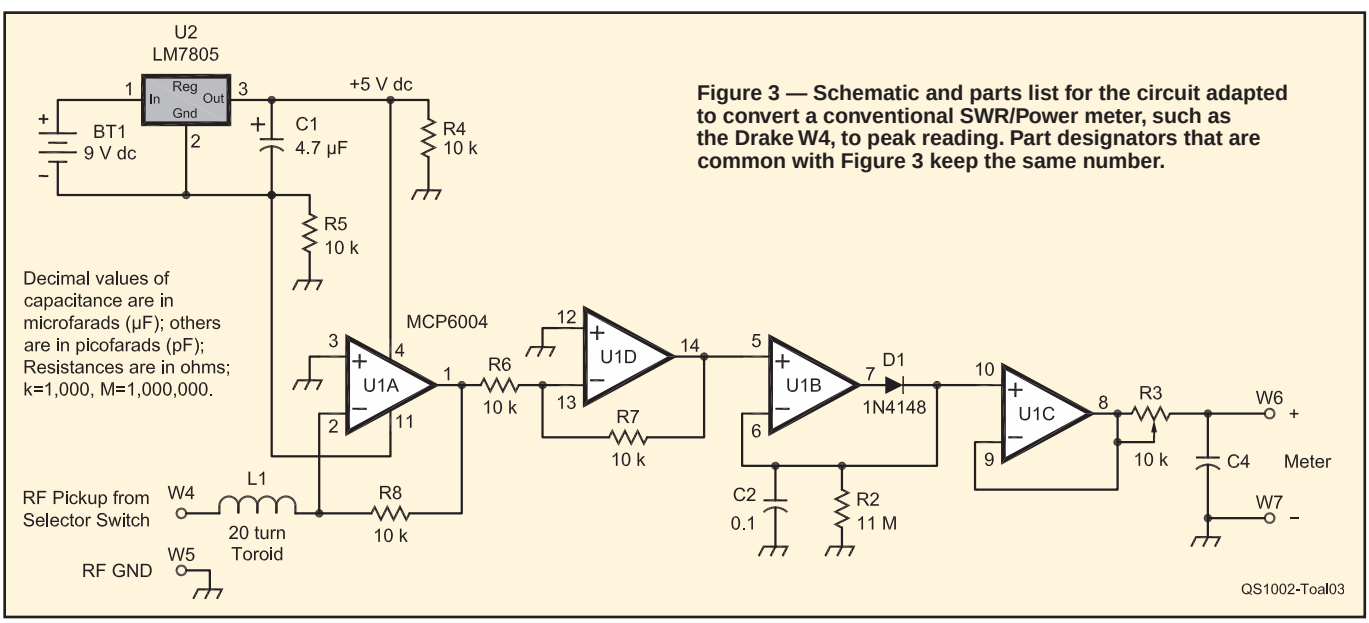


Figure 3 — Schematic and parts list for the circuit adapted to convert a conventional SWR/Power meter, such as the Drake W4, to peak reading. Part designators that are common with Figure 3 keep the same number.

C1 — 4.7 µF, 16 V, electrolytic capacitor.
C2, C4 — 0.1 µF capacitor, C4 optional, see text.
D1 — 1N4148 silicon diode.
L1 — Ferrite bead choke, see text.
R2 — 11 MΩ, ¼ W, resistor.
R3-R8 — 10 kΩ, ¼ W, resistor.
U1 — MCP6004 quad op amp IC.
U2 — LM7805 5 V regulator IC.

Measuring High Power

There are several instances in which an amateur operator needs to measure the characteristics of a high-powered transmitter. Since most test equipment inputs are limited to low power only, an attenuator is needed. Most step attenuators, however, are limited to about 0.5 W or 27 dBm. One solution to this problem is to build a simple sampler as shown in Figure A. This sampler allows the power to be dissipated in the station dummy load while providing an identical replica of the signal attenuated by 40 dB. 1500 W attenuated by 40 dB is 150 mW or 22 dBm, well within the input rating of most step attenuators. These can be used for further attenuation if needed. For example, if the step attenuator is set for 95 dB of attenuation and used with the sampler connected to a 1500 W amplifier, the result is a –73 dBm signal, S-9 on receivers with S-meters calibrated to the Collins standard.

The principle behind the sampler is very simple. A short piece of transmission line is passed through a powdered iron core of #2 material that has 63 turns of #28 or 30 AWG wire on it. The shield of the transmission line is connected to the box containing the toroid only on one side to form an electrostatic shield. This forms a current transformer. If a current I is flowing through the transmission line, then a current I / 63 A flows through the terminated winding of the secondary. The secondary is terminated with a 4 dB T pad. The product of 20 times the log of 63 yields 36 dB. The T pad provides the additional 4 dB to yield 40 dB of attenuation. This sampler is flat to ± 0.5 dB from 1.5 to 60 MHz. The schematic of the sampler is shown in Figure B. — *Tom Thompson, WØIVJ*

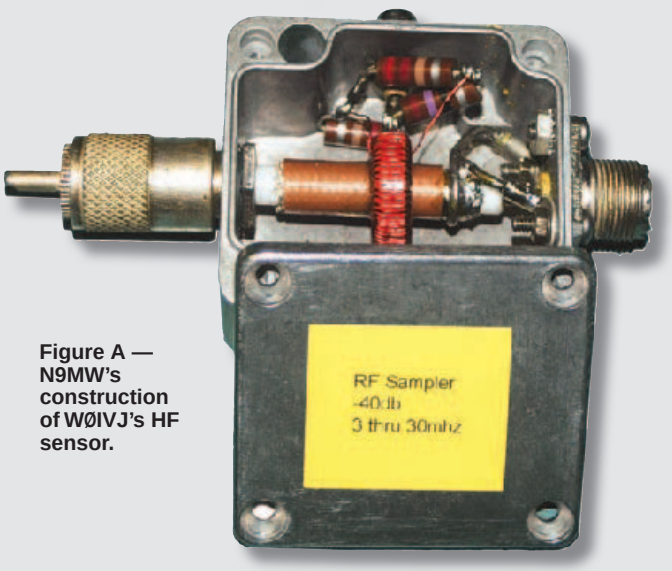


Figure A — N9MW's construction of WØIVJ's HF sensor.

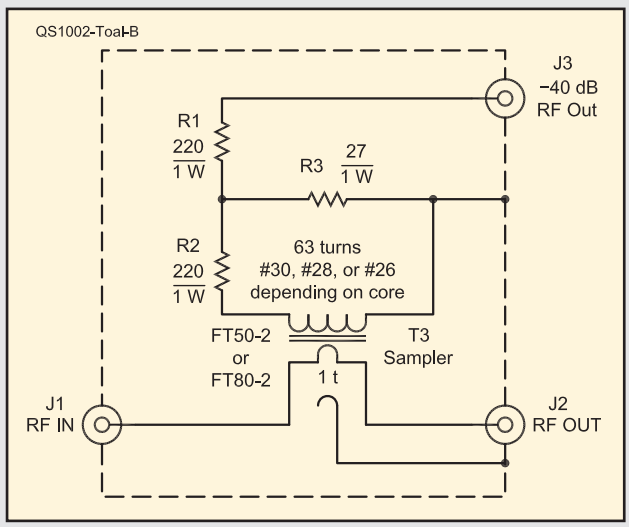


Figure B — Schematic of RF sensor by WØIVJ.

Ted and Tom we determined that the secret is to measure current, not voltage at the input. Tom suggested using the fourth op amp stage to do that. That provides an inverted voltage that is restored in the next stage. Another twist was to make the IC operate between –2.5 and +2.5 V dc with reference to ground so that the idiosyncrasies of any op amp at 0 V dc are eliminated.

This project can easily be built on perforated project board, but you may have to make allowances for the existing sensor circuitry. I noticed in one older SWR meter that they had placed large capacitors on the lines going to the meter. Those capacitors would probably have defeated the peak reading capabilities.

For the sake of observation, you could put both this unit and a conventional wattmeter in series on the output line from a transmitter or amplifier and observe the difference in what is essentially average power on the conventional meter and peak power on this meter. The possibility of using the circuit in a small box as an adapter for a VOM or VTVM is quite intriguing. This could be useful for looking at audio or data applications.

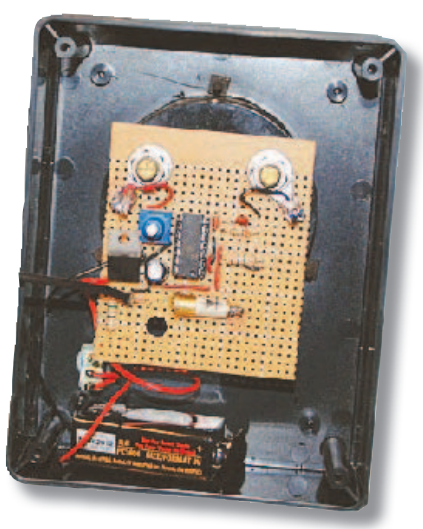


Figure 4 — The peak reading wattmeter circuit constructed on perf board. This version runs on a 9 V battery. The RF pickup is described in the sidebar.

Conclusion

The project has been fun and enlightening. Other hams have pitched in with ideas and support. And, best of all, I have a device that works for my project and other applications.

ARRL member and Amateur Extra class licensee Ed Toal, N9MW, can be reached at W8471 State Rd 39, Blanchardville, WI 53516 or at **ed@n9mw.com**.

Antennas Away from Home

Modern HF transceivers are easy to pack for vacation — how about travel antennas?

Joel R. Hallas, W1ZR

W1NCY

Our home stations usually get most of our attention, but other station setups deserve some thought too. When I travel on family vacations, I try to see if there is a way to work in Amateur Radio. It works out especially well in our family since I'm usually the first one up in the morning. After making the breakfast coffee, instead of impatiently pacing around waiting for others to shift to vertical, I can enjoy some uninterrupted ham radio time.

What's it Take?

It used to be that the size and weight of HF radio gear made it tough — no more. Whether you have an entry level radio, such as an ICOM IC-718 or Yaesu FT-450, or an advanced compact transceiver such as the Elecraft K3 or Flex-Radio 3000, you have the beginnings of a radio system in a very small corner of your car trunk or airline overhead bin.

The Transceiver Can't do Much by Itself

True enough! Planning ahead will help you bring all that you need. Finding that coax jumper in Podunk Hollow can be a real chore. All the transceivers need a power supply. Switching supplies are compact and light — some extremely so.[1] You will need a power supply for whatever the ac mains voltage is where you'll be. In addition, make sure you have the right ac plug or plug adapters and extension cords as well as a power cable to get to the radio. If you're going to be in a tent, there are many battery options — too many to discuss in a short article. Personally, I gave up on tents after a stint in the army — but that doesn't mean you should.

Be sure to bring a mic, key or paddles and headphones, especially if you will operate while others are snoozing. If your transceiver doesn't have a built-in antenna tuner, you will be glad to have a small external tuner, and don't forget the jumper cable. You will also want paper, pens, a logbook and a few tools. As shown in the photo, I even brought a folding TV table to provide an operating surface.

You Will Need an Antenna

As with any amateur station, the antenna system will make the most difference in how successful your operation will be. Any antenna that can be broken down for transport and easily erected without causing undue alarm can be used, but some are naturals.[2,3,4]

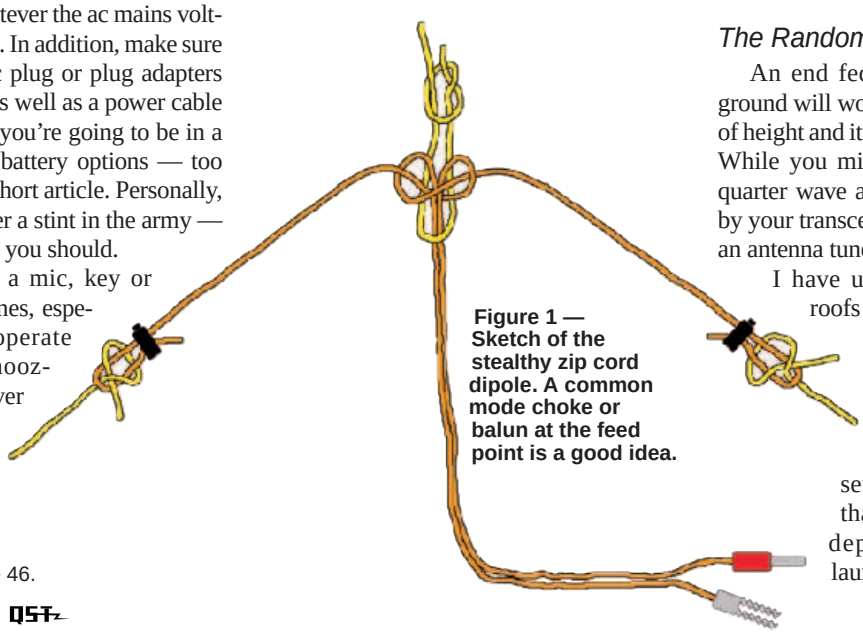


Figure 1 — Sketch of the stealthy zip cord dipole. A common mode choke or balun at the feed point is a good idea.

Antenna Choices for Your Portable Station

If your vacation focus will be Amateur Radio, perhaps with a favorite contest going on while you're away, consider renting a vacation home with a tower and Yagis for your favorite bands. There are usually some listed in the "Ham Ads" in each issue of *QST*.

If you're like me, the family vacation priorities don't start with ham radio — rather, it's something I can do when we aren't doing something else. This usually means a *make do* antenna arrangement. Fortunately, almost any kind of antenna will get out to somewhere. Some of the solutions I've found are as follows:

The Random Wire Over Something

An end fed piece of wire fed against ground will work — especially if it has a bit of height and it's at least a quarter wave long. While you might get away with an exact quarter wave and good ground fed directly by your transceiver, you had better figure on an antenna tuner.

I have used such wires flung over roofs and hauled up in trees. They always work — but don't count on breaking through any pileups! I include a 50 foot roll of nylon twine in my vacation kit. It can serve as a temporary halyard that is almost invisible when deployed. Any of the usual launching arrangements can be

[1]Notes appear on page 46.

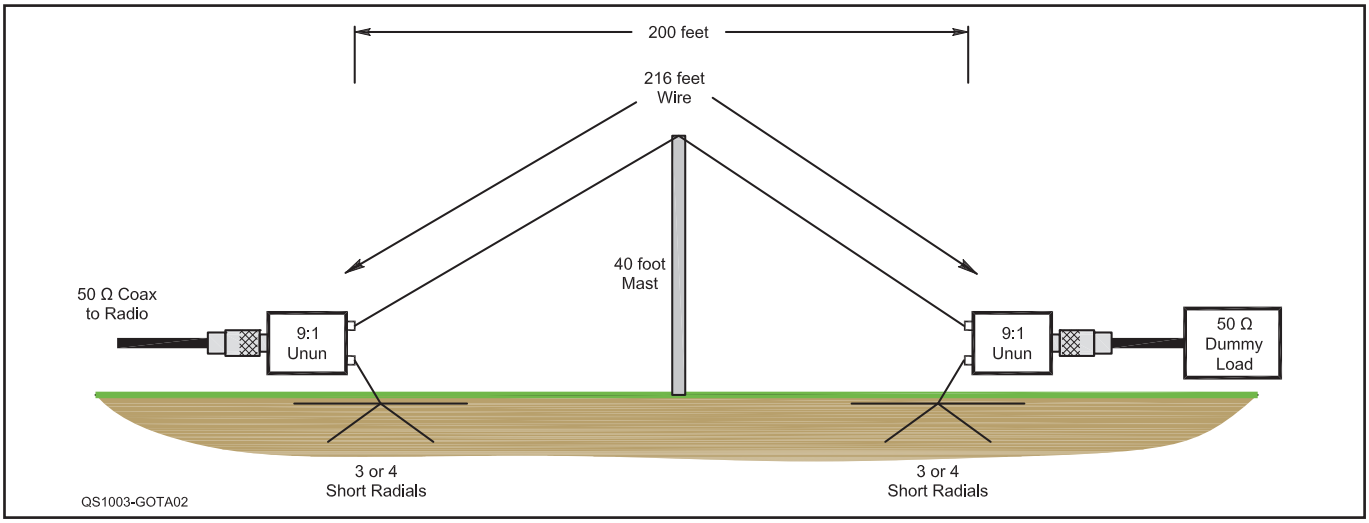


Figure 2 — The half rhombic unidirectional vertical antenna for 20 through 6 meters. If the termination is removed it becomes a bidirectional resonant half rhombic.

used to get it over that far support. If you have more wire than you can use, it is good to keep the excess at the far end in a coil. If that's not feasible, cut it off and buy a new roll next year — the pieces can be demoted to hook-up wire after vacation.

A key factor in the effectiveness of an end fed wire is the ground connection, especially if the antenna length is on the short side. It is often hard to tell what you are dealing with in a rental property — and hooking to a PVC cold water pipe will bring no joy! Depending on how the house is wired, I have had some success using a three prong ac plug with just a wire on the ground pin. If that doesn't work, a resonant quarter wave wire lying on the floor, or better outside, will serve.

Stealthy Dipoles

Dipoles and transmission lines made from zip cord have been popular portable antennas for years. A version made from lamp type zip cord was described by Jerry Hall in 1979, and an updated version made from RadioShack speaker wire (278-1385) was described by William Parmley exactly 30 years later.[5,6] The good news is that the newer version has less transmission line loss and is lighter, thinner and stealthier than the earlier type. Not surprisingly, it does cost more than the other type did 30 years back.

The dipole and transmission line are constructed from a single length of line with no need for insulators or connections, as shown in Figure 1. While Parmley suggests making the dipole and transmission line each a half wave long to provide a good direct match to his transceiver, my use of a tuner avoids that limitation and I can use the configuration as a center fed Zepp on all bands above, or even a bit below, half wave resonance.

For indoor installation in an inn or hotel room, I use plastic headed push pins to secure the antenna around the ceiling-to-wall joint. Just be sure to twist the pin gently when removing to avoid damage. This doesn't work well with modern motel structures with poured concrete walls, but there are often wood window and door trim sections that can be pressed into service. If the facility provides housekeeping service, I pull it all down and pack it up while we're off for the day.

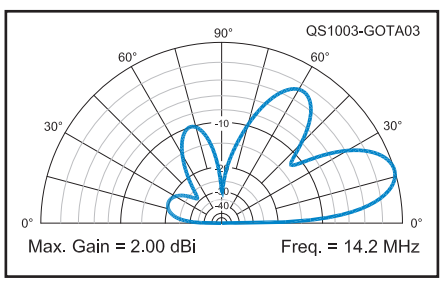


Figure 3 — Elevation pattern of the half rhombic of Figure 3 at its peak azimuth on 20 meters.

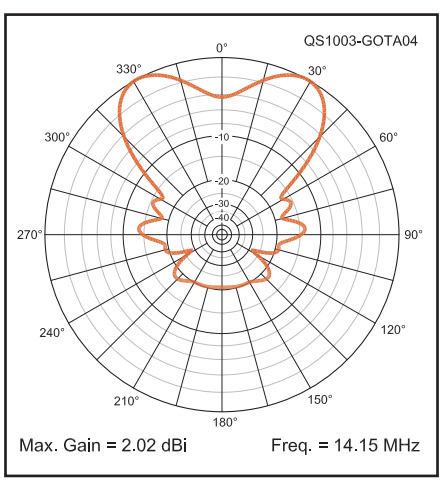


Figure 4 — Azimuth pattern of the half rhombic at its peak elevation on 20 meters.

Portable Push-Up Masts

A number of manufacturers produce collapsible masts that may be suitable for vacation use. Most are made from fiberglass or carbon fiber and are in section lengths from less than 4 feet to 8 feet. They are available in different diameters and wall thicknesses, with the larger sizes with thick walls able to support more than the thinner one, but at the cost of additional expense and weight.

There are a number of antennas that can be hung from such a mast. Over most types of ground, a horizontally polarized inverted V cut for 40 meters and fed with window line to a wide range tuner will provide very good coverage on all bands 40 meters and up. The antenna wire can also serve as two of the guy wires, with two more needed at right angles. Intermediate guys may also be required, depending on the rigidity of the mast.

There are some interesting vertically polarized antenna options as well. A 40 foot vertical wire fed from the bottom against ground radials from 160 through 20 meters will provide low angle coverage with a wide range tuner. The higher bands can also be used, but much of the radiation will be at high angles.

Another interesting choice is the half rhombic. This antenna has not received much attention in the amateur press.[7] If a span of 200 feet is available, a wideband unidirectional antenna can be achieved with little fuss as shown in Figure 2. With the 9:1 transformers shown, and only a few short ground radials at each end, a 50 Ω 1.2:1

SWR is realized from 7 to 56 MHz, avoiding the need for a tuner. The gain goes up and the radiation angle goes down with increasing frequency. It's at its best from 20 meters and up, see Figures 3 and 4, but works as well in its forward direction as a monopole on 30 and 40 meters. With two perpendicular antennas serving as guys for the pole, and appropriate switching or patching arrangements, good performance in four directions with a 20 dB F/B ratio can be achieved.

That Mobile Antenna

If your vehicle is equipped for HF mobile operation, consider using the antenna on the vehicle. While I've known folk who actually go to the car to operate, it feels more like a vacation if you can operate from the family quarters. All it usually takes is a roll of thin coax long enough to reach. A couple of 50 foot coils of coax with some barrel type (PL-258 for UHF series connectors) splices may get you there. If your usual mobile setup includes an auto tuner, you will likely need to connect directly to the antenna and have it carefully tuned to your favorite band segment. It should work at least as well as while on the highway. In fact, you can likely get away with an even longer system without having to worry about driving through tunnels and under tree limbs.

Notes

[1]M. Tracy, KC1SX, "Product Review — Gamma Research HPS-1a Switching Power Supply," *QST,* Sep 2007, pp 68-69.

[2]J. Hallas, W1ZR, *Basic Antennas — Understanding Practical Antennas and Designs,* available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9994. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[3]C. Hutchinson, K8CH, and R. D. Straw, N6BV, *Simple and Fun Antennas for Hams*, available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 8624. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[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]J. Hall, K1TD, "Zip Cord Antennas — Do They Work?" *QST,* Mar 1979, pp 31-32. This was reprinted in C. Hutchinson, K8CH, Editor, *More Wire Antenna Classics Volume 2.* Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 7709. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

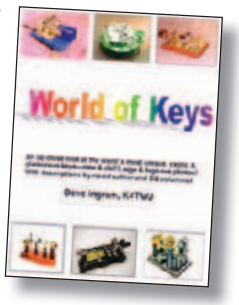
[6]W. Parmley, KR8L, "Zip Cord Antennas and Feed Lines for Portable Applications," *QST,* Mar 2009, pp 34-36.

[7]J. Mullaney, W4HGU, "The Half-Rhombic Antenna," *QST*, Jan 1946, pp 28-31.

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

New Products

KEYS III: THE WORLD OF KEYS BY K4TWJ



♢*KEYS III: The World of Keys* is the third in a series of books on keys and telegraphic instruments written by Dave Ingram, K4TWJ. Produced with glossy paper and high resolution photos, it includes detailed descriptions of prized and exotic keys, both new and old. Chapters cover Spark keys, Double Lever, Camelback, Pump and Wacky Fun keys, as well as Vibroplexes, Classic Bugs, Unbelievable Bugs, Marvelous Miniatures and modern keys, bugs and paddles. Price: $18. For more information, or to order, see your favorite dealer or visit **www.arrl.org/shop**.

MFJ COMPACT VARIABLE VOLTAGE POWER SUPPLY

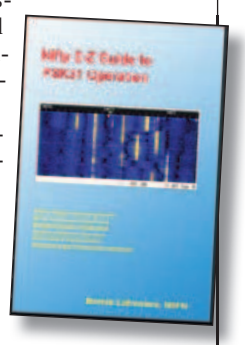
♢The MFJ-4218MV compact switching power supply has adjustable output from 0 to 24 V dc. Rated output current is 18 A at 13.8 V dc or 9 A at 24 V dc. The voltage adjustment control has a detent to set voltage at 13.8 V dc, and dual meters monitor output voltage and current. The power supply has a pair of 5-way binding posts for output connections and it is protected against short circuits, overload and overtemperature. It also has a load fault indicator with auto reset after each fault detected. The MFJ-4218MV measures 2.25 × 6 × 6.75 inches (HWD) and weighs 2.2 pounds. Input voltage is selectable, 110 or 220 V ac. Price: $129.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

WINRADIO WEATHER SATELLITE TRACKING SYSTEM

♢The WSS-420 Weather Satellite System from WiNRADiO Communications is a fully integrated hardware/software system for capturing and processing HRPT/CHRPT data streams from polar orbiting weather satellites. The system's external hardware consists of a 1.2 meter dish antenna and dual-axis rotator mounted on an adjustable tripod. The rotator is controlled by a digital positioner that interfaces with the application software via the computer's USB port. The antenna uses a patch feed and has an attached low-noise downconverter with a 140 MHz output that feeds the indoor receiver. A PCI plug-in receiver fits internally in a PC running the system software. Application software allows the WSS-420 to be operated manually or left unattended for automatic tracking and scheduling of specified satellites (all received image data is saved to disk). The system supports HRPT data streams with five multi-spectral channels from NOAA satellites and CHRPT data with 10 channels from the Feng Yun-1D satellite. Data, available immediately after a satellite pass, can be exported to NOAA Level 1B (HRPT) file format, or it can be processed with optional software. All of the individual system items are available separately. For more information, visit **www.winradio.com/index.htm**.

NIFTY *E-Z GUIDE TO PSK31 OPERATION*

♢The 70-page *E-Z Guide to PSK31 Operation* from Nifty! Ham Accessories concentrates on the practical aspects of setting up equipment for PSK31 and operating with this popular digital mode. The book explains the details of interfacing transceivers with PC sound cards, software configuration and operation. The pros and cons of building a homemade interface or purchasing a commercial interface are explored. Detailed instructions and screen shots take the mystery out of operating PSK31 software and interpreting the quality of received signals. Price: $12.95. For more information, or to order, see your favorite dealer or visit **www.arrl.org/shop** or **www.niftyaccessories.com.**



PRODUCT REVIEW

Remote Automatic Antenna Tuners and the 43 Foot Vertical

Reviewed by Phil Salas, AD5X
QST *Contributing Author*

QST has previously reviewed in-shack and remote automatic antenna tuners designed for various applications and power levels.[1,2] Recent interest in 43 foot multiband vertical antennas available from several vendors has led to a corresponding interest in remote auto tuners used specifically with these antennas. This is because the 1:4 unun (unbalanced to unbalanced transformer) typically mounted at the vertical's base for matching to 50 Ω coaxial cable provides a compromise SWR on 60 through 10 meters. SWR is very high on 160 and 80 meters resulting in corresponding coax and unun losses.

This review will focus on three 200 W auto tuners and specifically their suitability for remote outdoor use at the base of a 43 foot multiband vertical antenna. The units reviewed (from lowest to highest cost) are the MFJ-927, CG Antenna CG-3000 and SGC SG-230.

43 Foot Antenna Measurement Methods

According to the *EZNEC* antenna modeling program, a 43 foot vertical has an impedance of 3 –*j*620 Ω on 160 meters when installed over a perfect ground and not in close proximity to other objects. For bench testing a tuner's ability to match this load on 160 meters, I built a simulator circuit with an impedance of 14 –*j*590 Ω. I used 20 Ω and 50 Ω Caddock thick film resistors in parallel to give the total real resistance of 14 Ω. This simulates 3 Ω of radiation resistance plus 11 Ω of ground loss, which is probably better than most hams have on 160 meters. To simulate the reactive component, two 300 pF, 1 kV silver-mica capacitors in series provide –*j*590, a compromise reactance between the theoretical –*j*620 and the –*j*550 that I measured on my own 43 foot vertical.

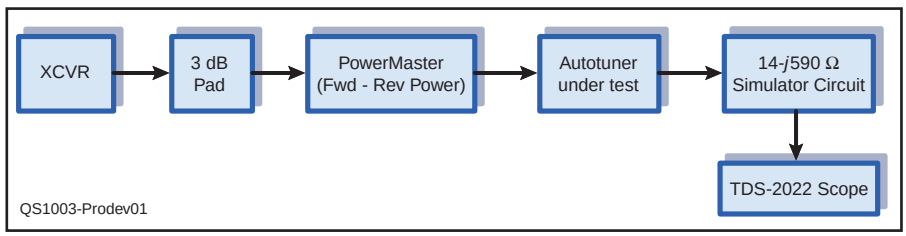


Figure 1 — Test setup used by the author for measuring expected tuner loss with a load that simulates the impedance of a 43 foot vertical antenna on 160 meters. See text for details.

Because maximum inductance and highest RF current occur on 160 meters due to the antenna's high capacitive reactance and low resistive impedance, this simulator circuit also permits the measurement of expected auto tuner loss when used with a 43 foot vertical on 160 meters. To measure the loss, I used an Array Solutions PowerMaster power/SWR meter and Tektronix TDS-2022 digital sampling oscilloscope as shown in Figure 1. I first compared the TDS-2022 and PowerMaster by feeding a 50 Ω resistive load directly and comparing the computed power level from the TDS-2022 display to the PowerMaster readings. The worst case measurement difference between the two instruments was 3%.

I set the PowerMaster to read net (forward minus reflected) power and inserted a high power 3 dB attenuator at the transceiver output to ensure that reflected power from a less than perfect auto tuner match is attenuated 6 dB further if re-reflected by the output circuitry. Actual power delivered to the load is measured by the TDS-2022, which displays not only the normal oscilloscope waveform but also digitally displays the frequency, RMS voltage and peak-to-peak voltage.

Resistive matching range and loss testing was performed in the ARRL Lab with a precision setup similar to that described in February 2003 *QST* and used in tuner reviews since then.[3] In the course of testing, ARRL Test Engineer Bob Allison, WB1GCM, noted that mounting the CG-3000 and SG-230 to a metal plate improved auto tuner efficiency. It also eliminated interaction with nearby metal objects. Without the plate, SWR changed dramatically with tuner movement on the metal test bench. Bob suggests bolting the mounting bracket of either of these tuners to a metal plate if the unit is installed on a nonconductive surface. (The MFJ-927, which is

[3]M. Tracy, KC1SX, "Antenna Tuner Testing Methods vs Accuracy," Product Review, *QST*, Feb 2003, p 75.

Bottom Line

There are pros and cons to using a remote automatic antenna tuner with an untuned antenna such as the popular 43 foot vertical. On the plus side are operating convenience and reduced SWR related coax losses. Cons include limited reactive tuning range and tuner losses. If you plan your remotely tuned antenna system properly, a remote auto tuner can be an excellent answer for multiband operation.

[1]J. Hallas, W1ZR, "Automatic Antenna Tuners — A Sample of the Field," Product Review, *QST*, May 2004, pp 71-76. *QST* Product reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

[2]J. Hallas, W1ZR, "Medium to High Power Auto Antenna Tuners — The Evolution Continues," Product Review, *QST*, Aug 2006, pp 56-61.

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

Table 1
Tuned SWR with Short Circuit or Open Load

	----- MFJ-927-----		----- CG-3000 -----		----- SG-230-----	
Band	*Short*	*Open*	*Short*	*Open*	*Short*	*Open*
160	No tune	No tune	No tune	No tune	No tune	1.4:1
80	No tune	No tune	No tune	1.3:1	No tune	1.0:1
40	2.9:1	No tune	No tune	1.7:1	No tune	2.3:1
30	No tune	No tune	No tune	2.4:1	1.2:1	1.2:1
20	4.0:1	5.0:1	1.1:1	2.2:1	1.7:1	3.0:1
17	4.0:1	No tune	1.6:1	No tune	1.9:1	1.3:1
15	No tune	3.8:1	1:4:1	1.3:1	1.6:1	1.7:1
12	No tune	No tune	No tune	1.3:1	No tune	No tune
10	1.3:1	1.9:1	1.8:1	No tune	No tune	2.0:1

Figure 2 — Each auto tuner was tested at the base of the author's 43 foot vertical antenna.

Table 2
Testing with AD5X 43 Foot Vertical

	MFJ-927	CG-3000	SG-230
Band	***SWR***	***SWR***	***SWR***
160	No tune	No tune	1.4:1
80	1.3:1	2.0:1	1.4:1
60	1.0:1	1.2:1	1.2:1
40	1.0:1	1.2:1	1.3:1
30	1.5:1	1.1:1	1.5:1
20	1.5:1	1.3:1	1.0:1
17	1.2:1	1.5:1	1.4:1
15	1.1:1	1.3:1	1.9:1
12	1.2:1	1.7:1	1.8:1
10	1.2:1	1:9:1	1.3:1

built on a metal plate with integral mounting tabs, did not exhibit this behavior.)

The ARRL Lab also tested the auto tuners with open and short circuit loads. With *lossless* tuner components, an open/short tuning solution is not possible. But no practical antenna tuner is lossless because it is built with components of finite Q. The Lab discovered that an antenna tuner can sometimes tune into its own internal losses and present a matching solution to the transmitter. Results of these tests are shown in Table 1. Generally, fewer cases where this happens indicates lower intrinsic tuner losses.

Tuning sensitivity was also measured. This is the RF power and SWR required to automatically initiate a retune. All three auto tuners specify a "must start a retune" when the SWR exceeds 2:1.

For final testing, each auto tuner was connected to the base of my 43 foot vertical and tested on each band (Figure 2) with my 100 W transceiver. Sixty feet of ½ inch Andrew Heliax connects my transceiver in the shack to the auto tuners at the base of the 43 foot vertical. Three ground rods and approximately 20 radials provide my RF and dc grounding at the antenna — certainly not a perfect ground, but probably not atypical. As a reference, I measured the resonant impedance of my 43 foot vertical on 60 meters as 48 $-j0\ \Omega$, which implies my ground loss is 12 Ω on that band. Once the tuner found a match, I recorded the SWR measured in my shack with the PowerMaster, as shown in Table 2.

MFJ-927 REMOTE AUTOMATIC ANTENNA TUNER

The MFJ-927 is the smallest of the three auto tuners tested here. It is enclosed in a weather protected container, but is not O-ring sealed. For extended outdoor operation, it would be a good idea to place the tuner under a protective cover, such as an inverted plastic storage bin.

Coaxial and random wire outputs are provided, along with an SO-239 UHF jack for the station feed line and a ground post. The MFJ-927 receives dc power on the coax feed line via an internal bias-T, so you won't need to run a separate cable for power. MFJ supplies an MFJ-4117 bias-T for inserting +12 V dc on the coax in the shack. The outside of the unit and internal circuitry are shown in the accompanying photos. Note that the inductors consist of a mix of toroidal and wide spaced air wound inductors.

Unlike the CG-3000 and SG-230, the MFJ-927 does not specify minimum antenna lengths for tuning the ham bands, but instead specifies a resistive tuning range on all bands. A little calculator work shows that with the 25 µH maximum inductance available in the MFJ-927, the minimum length antenna for 160 meters would need to be about 80 feet. Therefore the MFJ-927 does not have the inductance range required for using my 43 foot vertical on this band. I verified this by connecting the simulator circuit to the MFJ-927. The MFJ-927 tried to find a match for about 10 seconds, and then gave up.

Open/short test data is shown in Table 1. Only on 10 meters did the MFJ-927 find an open and short circuit tuning solution below a 2:1 SWR.

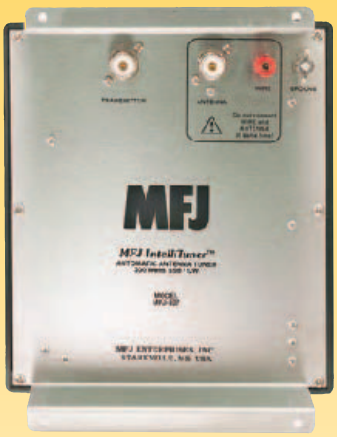
Next I connected the MFJ-927 to the base of my 43 foot vertical. Tuning was very fast, with initial tuning typically occurring in less than 2 seconds and tuning from memory essentially instantaneous. As expected, the MFJ-927 could not tune the 43 foot vertical on 160 meters but found a 1.5:1 or better match on 80 through 10 meters. Note that an external inductance can be used to allow 160 meter operation (see sidebar on page 52). The results are shown in Table 2.

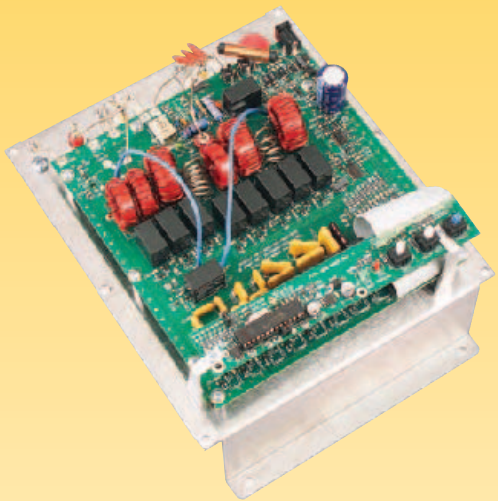
Last came the ARRL Lab testing of the resistive load tuning range and loss measurements. As you can see in Table 3, the MFJ-927 matched all resistive loads the Lab presented to it. While there were a few cases where the SWR didn't reach the 1.5:1 target,

Table 3
MFJ-927

Manufacturer's Specifications

Maximum power: 200 W PEP SSB/CW, 125 W continuous.
Minimum power for tuning: 2 W.
Frequency range: 1.8 to 30 MHz.
Tuning time: 6 seconds (initial tuning), <0.2 second if memorized.
Impedance matching range: 6 to 1600 Ω.
Matching network: Reversible-L (series L/shunt C or shunt C/series L).
Capacitor range: 0-3961 pF (256 tuning steps).
Inductor range: 0-24.86 µH (256 tuning steps).
Tuning start: 2:1 SWR
Tuning target: Less than 1.5:1 SWR
Memory channels: 2500
Memory resolution: 2 kHz on 160 meters, scaling to 28 kHz on 10 meters
Size: 7.5 × 5.5 × 9 inches; weight 3 pounds.
Power supply: 13.8 V dc ±10% at less than 750 mA.
Price: $230.





ARRL Lab Testing

Current draw: 200 mA when tuning, 13 mA static
Tuning sensitivity: At 10 W or higher, 2:1 SWR starts a retune.

Measured power loss into resistive loads (%) / Input SWR at match.

SWR	Load (Ω)	160 m	80 m	40 m	20 m	10 m
16:1	3.125	47	21	26	13	*
		1.6	**	1.6	**	1.6
8:1	6.25	31	14	27	15	*
		**	**	**	1.7	**
4:1	12.5	*	*	*	*	16
		**	**	**	**	1.8
2:1	25	*	*	*	*	*
		**	**	**	1.6	**
1:1	50	*	*	*	*	*
		**	**	**	**	1.6
2:1	100	*	*	*	*	27
		**	**	**	**	1.6
4:1	200	11	13	*	*	22
		**	1.7	1.6	**	1.6
8:1	400	12	*	*	*	20
		**	**	**	**	1.6
12:1	600	*	12	17	14	24
		**	1.6	**	**	**
16:1	800	30	12	17	14	24
		**	1.8	1.8	**	1.6

*Power loss less than or equal to 10%.
**Matched SWR less than or equal to 1.5:1.

in most cases the 1.5:1 target specification was met. The ARRL Lab also verified the 2:1 "must start tuning" specification.

The MFJ-927 has the ability to be remotely forced to retune on any given frequency with its *Sticky Tune* feature. In software version 2.4 or greater, if Sticky Tune is enabled, the MFJ-927 will always retune the first time you transmit after a power cycle. This feature is convenient if the SWR doesn't settle as low as you like and you'd like to force a retune. If you want to try for a lower tuned SWR on a given frequency, simply cycle power and then transmit on that frequency. The MFJ-927 will retune on that frequency only. Other memory locations will be unaffected.

MFJ-927 Summary

The MFJ-927 is a fast-tuning, inexpensive remote auto tuner that will give good performance from 80 to 10 meters when used with a 43 foot vertical. Its Sticky Tune feature provides a simple way to remotely force a retune on any frequency without affecting other memories. In a permanent installation, some sort of cover for weather protection would be a good idea.

Manufacturer: MFJ Enterprises, PO Box 494, Mississippi State, MS 39762, tel 800-647-1800; **www.mfjenterprises.com**.

CG ANTENNA CG-3000 REMOTE AUTOMATIC ANTENNA TUNER

The CG-3000 is enclosed in an O-ring sealed ABS plastic weatherproof container. It includes attached stainless-steel mounting brackets as well as two U bolts should you wish to mount the CG-3000 on a mast. The provided power cable, about 12 feet long, plugs into the CG-3000 via a four pin connector included on the cable. Next to the power connector is an SO-239 for the station feed line and a metric wing nut ground connection that fits a #10 solder lug. The CG-3000 antenna output is a single ceramic-insulated terminal that is also a good fit for a #10 solder lug. As seen in the accompanying photo, all inductors are close wound air-core inductors.

CG Antenna specifies a minimum antenna length of 8 meters (26 feet) for 1.8 to 30 MHz operation, or 2.4 meters (8 feet) for 3.5 to 30 MHz. Those specifications, along with the specified inductance range, indicate that the CG-3000 will provide full coverage from 160 through 10 meters with a 43 foot vertical. Testing showed this was not the case. When I connected the simulator circuit, the CG-3000 was unable to find a match. This implies that either the CG-3000 does not have the advertised inductance range, or the tuning algorithm fails to do the job on 160 meters.

During resistive load testing in the ARRL Lab (Table 4), you can see that the resistive tuning range on 160 meters is limited compared to the other bands. There were also some resistive impedances on 40 and 10 meters that could not be matched. ARRL Lab open/short test results are shown in Table 1. As you can see, tuning solutions at or below 2:1 SWR are found on most of the HF bands for opens or shorts.

Under some conditions the SWR settles close to 2:1, which is the target SWR. In those cases, I found that once the CG-3000 is tuned I could exceed a 2:1 SWR by moving frequency within that band, but a retune won't occur until the SWR increases to

Table 4
CG Antennas CG-3000

Manufacturer's Specifications

Maximum power: 200 W PEP, 125 W continuous.
Minimum power for tuning: 10 W.
Frequency range: 1.8 to 30 MHz.
Tuning time: 6 seconds (initial tuning), <0.2 second if memorized.
Impedance matching range: Not specified.
Matching network: Low-pass pi or reversible-L as needed (C-L-C)
Input capacitor range: 0-6300 pF (100 pF increments).
Output capacitor range: 0-775 pF (25 pF increments).
Inductor range: 0-64 µH (0.25 µH increments).
Tuning start: 2:1 SWR.
Tuning target: Less than 2:1 SWR.
Memory channels: 200.
Memory resolution: 5 kHz on 160 meters, scaling to 200 kHz on 10 meters.
Size: 12.2 × 9.5 × 2.8 inches; weight 13 ounces.
Power supply: 13.8 V dc ±10% at less than 800 mA.
Price: $330.

ARRL Lab Testing

Current draw: 750 mA when tuning, 413 mA static
Tuning sensitivity: At 10 W, 3.2:1 SWR starts a retune; at 50 W, 2.5:1 SWR.

Measured power loss into resistive loads (%) / Input SWR at match.

SWR	Load (Ω)	160 m	80 m	40 m	20 m	10 m
16:1	3.125	No tune	*	No tune	48	No tune
		n/a	**	n/a	2.0	n/a
8:1	6.25	13	18	20	36	No tune
		**	**	**	**	n/a
4:1	12.5	12	20	17	20	25
		**	1.9	**	**	**
2:1	25	29	17	27	19	12
		1.9	1.9	2.0	**	**
1:1	50	24	*	*	13	*
		**	**	**	**	**
2:1	100	24	*	14	31	15
		2.1	**	**	1.9	**
4:1	200	No tune	11	12	11	22
		n/a	**	**	**	**
8:1	400	No tune	11	14	14	18
		n/a	**	**	**	1.6
12:1	600	No tune	20	14	15	35
		n/a	1.8	**	**	2.0
16:1	800	No tune	38	23	24	42
		n/a	**	**	1.6	1.9

*Power loss less than or equal to 10%.
**Matched SWR less than or equal to 1.5:1.

above 3:1. Unfortunately there is no easy way to force a retune. The only way I could force a retune was to short the output of the CG-3000, let it try to tune, then reconnect the load and let it tune again. I found one other issue. The CG-3000 does not time out if it cannot find a tuning solution. It just continues to tune until you either remove RF drive, or turn off power to the unit.

After completing bench testing, I connected the CG-3000 to the base of my 43 foot vertical and measured the tuned SWR. Except for 160 meters, tuning solutions were found quickly. In most cases, the final match was better than the 2:1 target. Results are shown in Table 2.

The optional CG-CTU control unit adds power and reset switches, along with power and tuning LEDs. The reset switch puts the tuner in bypass, but does not erase memories or force a retune

CG-3000 Summary

The CG-3000 can reliably be used on 80 through 10 meters with a 43 foot vertical, but not on 160 meters as advertised. The solution presented in the sidebar may work for the CG-3000 but this was not verified. Its inability to time out when a match cannot be found is an irritant, but not really a problem. Its failure to meet its 2:1 "start tuning" specification is an issue, however, especially since there is no easy way to force a retune.

Manufacturer: CG Antenna, 5/501, Lane 1800, Hanri Rd, 200336 Shanghai, China; **sales@cgantenna.com**; **www.cgantenna.com**. We purchased the review unit from Array Solutions, which is no longer handling CG antenna products. At press time, CG Antenna was working on details for distribution of its products in the US.

SGC SG-230 REMOTE AUTOMATIC ANTENNA TUNER

The SG-230 is enclosed in a rugged O-ring sealed ABS plastic weatherproof container. Transceiver RF and power interface through a 9 foot combination 4 conductor/RG-58 cable that is permanently attached to the SG-230. On the coax input side you will find a ¼ inch diameter bolt for the ground connection, and the antenna output is a single ceramic insulated terminal with a #10 screw interface. Antenna and ground solder lugs are provided with the SG-230. All inductors are close-wound air-core inductors.

SGC specifies a minimum required antenna length of 23 feet for operation below 3.3 MHz, and 8 feet for operation above 3.3 MHz. With its specified 64 µH maximum inductance, the SG-230 should be able to match a 43 foot vertical on 160 meters. As before, I first tried tuning on 160 meters with the simulated load. This time I was successful — the SG-230 found a match within a few seconds, just as it should. At 1.85 MHz, I measured an SWR of 1.46:1 and 2.1 dB loss (38% loss).

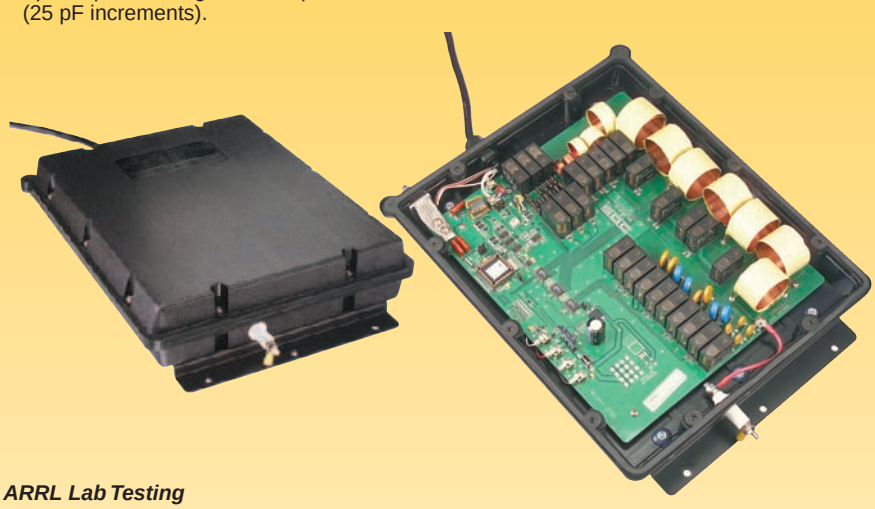
Table 5 shows the results of the ARRL Lab testing. All resistive loads were matched. In most cases the final tuned SWR was less than 1.5:1, though there were two cases where the tuned SWR settled close to the 2:1 SWR target. Open/short test results are shown in Table 1. As with the CG-3000, the SG-230 can find an open/short tuning solution of less than 2:1 SWR on most of the HF bands.

Just like the CG-3000, tuning doesn't restart if the SWR changes unless the SWR

Table 5
SGC SG-230

Manufacturer's Specifications

Maximum power: 200 W PEP, 80 W continuous.
Minimum power for tuning: 3 W.
Frequency range: 1.8 to 30 MHz.
Tuning time: 6 seconds (initial tuning), <0.2 second if memorized.
Impedance matching range: Not specified.
Matching network: Low-pass pi or reversible-L as needed (C-L-C)
Input capacitor range: 100-6400 pF (100 pF increments).
Output capacitor range: 25-800 pF (25 pF increments).
Inductor range: 0.25-64 µH (0.25 µH increments).
Tuning start: 2:1 SWR.
Tuning target: Less than 2:1 SWR.
Memory channels: 170.
Memory resolution: 10 kHz on 160 meters, scaling to 1500 kHz on 10 meters.
Size: 16 × 12 × 3.5 inches; weight 8 pounds.
Power supply: 10-18 V dc at less than 900 mA.
Price: $540.



ARRL Lab Testing

Current draw: 900 mA when tuning, 450 mA static
Tuning sensitivity: At 10 W, 3.2:1 SWR starts a retune; at 50 W, 2.5:1 SWR.

Measured power loss into resistive loads (%) / Input SWR at match.

SWR	Load (Ω)	160 m	80 m	40 m	20 m	10 m
16:1	3.125	14 **	19 **	29 2.1	13 **	25 **
8:1	6.25	* **	22 **	13 **	14 **	29 1.6
4:1	12.5	17 **	27 **	13 **	12 **	22 **
2:1	25	21 **	11 **	11 **	* **	28 1.8
1:1	50	* **	* **	* **	* **	13 **
2:1	100	* 1.6	* **	* **	* **	23 **
4:1	200	* **	* **	* **	* **	11 **
8:1	400	* **	* **	* **	* **	32 1.6
12:1	600	* **	* **	* **	17 1.6	30 **
16:1	800	* **	* **	12 **	22 **	42 **

*Power loss less than or equal to 10%.
**Matched SWR less than or equal to 1.5:1.

increases to over 3:1. Unlike the CG-3000, the SG-230 has an internal strapping option that defeats memory tuning. Internal jumper JP2 bypasses the SG-230's memories, which means that the SG-230 will always retune rather than use previously stored data. This setting will cause the SG-230 to retune every time you transmit on a new frequency.

Final testing occurred with the SG-230 attached to the base of my 43 foot vertical. I was able to find a matching solution on all bands from 160 through 10 meters with no tuning gaps. In all but two cases the final match was under 1.5:1. Results are shown in Table 2.

The optional Smartlock accessory provides power and reset switches, a tuning lock function and power and tuning LEDs. The reset switch puts the tuner in bypass but does not erase memories or force a retune.

SG-230 Summary

The SG-230 is the only auto tuner of the three reviewed here that will match a 43 foot vertical on 160 meters. While it did not meet its "must start retuning at 2:1 SWR" specification, it can be set to disable memory tuning. This setting forces a retune upon frequency change at the expense of tuning speed but in some cases is necessary to keep the transceiver happy when moving around a band. Tuning is almost instantaneous when recalling previously stored memory data.

Manufacturer: SGC Inc, 13737 SE 26th St, Bellevue, WA 98005; tel 425-746-6310; **www.sgcworld.com**.

Some Final Thoughts

I found this exercise to be very enlightening. Besides learning more about tuner reactive tuning ranges and tuner losses, I also had never considered that remote auto tuners could possibly match an open or a short. This means that you could have a failed connection at the antenna without even knowing it! Since there is probably at least one frequency or band where you may have a high but measurable untuned SWR, it would probably be worthwhile to record the untuned SWR so that you can verify connection integrity if you suspect there might be a problem. All three auto tuners discussed here come up in the bypassed mode when power is cycled, so this is an easy test to make from your shack with an antenna analyzer (if you apply RF power the auto tuners will start tuning).

There are definitely benefits to using a remote auto tuner with an untuned antenna such as the popular 43 foot vertical. First, of course, is operating convenience. You simply transmit a low power carrier for tuning and then operate. And second, you will reduce SWR related coax losses. There are always trade-offs to consider, such as reactive tuning range and tuner losses. If you plan your remote-tuned antenna system properly, a remote auto tuner can be an excellent answer for multiband operation.

Extending the MFJ-927 to 160 Meters

As discussed in the review, additional inductance is needed to allow the MFJ-927 to match a 43 foot vertical on 160 meters. I decided to add some external inductance to see if this would help the MFJ-927 tune the antenna on 160 meters. I chose to add around 30 µH, by using a 2.5 inch length of MFJ 4004-0008 coil stock. This is an air core coil of #16 AWG tinned copper wire, 2.5 inches in diameter, wound 10 TPI in series between the tuner output and the antenna base. If you order this product, you will get a 10 inch length, so there is plenty left over for other projects.

I mounted the coil in a 4 × 4 × 4 inch plastic outdoor electrical box available from most home improvement stores. I used #8 stainless steel hardware for the IN and OUT RF connections. Two binding posts (MFJ 606-0014) permit shorting the coil for normal 80 through 10 meter auto tuner operation.

I made a simple shorting wire using a pair of spade lugs. For mounting, I bolted the assembly to one of the MFJ-927 mounting holes and then connected everything to my 43 foot antenna as shown in the photo.

How does this work? Absolutely great! The MFJ-927 now easily tunes 160 meters just as on other bands. The only disadvantage is that you must manually select 160 meters or 80 to 10 meters by adding or removing the shorting strap. Finally, while this was built for use with my MFJ-927 this same assembly can be used with any auto tuner that needs additional inductance for matching low frequency, electrically short antennas. — *Phil Salas, AD5X*

DX Engineering RTR-1 Receive Antenna Interface for Transceivers

Reviewed by Mark Wilson, K1RO
QST *Product Review Editor*

During the cold winter months, many hams turn their attention toward the low bands. As 160 and 80 meters start to perk up, long distance contacts are commonplace and the bands are especially interesting in these years of low solar activity. Whether you're interested in talking with friends or searching for weak DX signals, the noise and static crashes often heard on 160 and 80 are troublesome. High noise levels are at best fatiguing, and at worst they cover up all but the strongest signals.

If you enjoy the low bands, one of the best investments you can make is a low noise receive antenna. Quite a few options are available and are described in detail in *Low Band DXing* by John Devoldere, ON4UN.[4] A couple of years ago, I installed a small loop antenna and find myself using it almost all the time while I'm operating on 160 and 80 meters.[5]

I was fortunate that my main transceiver includes a rear panel jack and switching for use with a separate receive antenna. Not all transceivers provide such switching, including another radio that I use quite a bit on HF and 6 meters. That lack of switching capability hurt one evening when my main radio died a couple of hours after the start of a 160 meter contest. I swapped in my backup transceiver, but listening to static crashes on my transmit antenna wasn't much fun.

Problem Solved

DX Engineering offers an extensive line of products for the low band operator. For the receiving end, they offer active vertical antennas, controllers, preamplifiers and Beverage antenna components. The latest addition is the RTR-1 Receive Antenna Interface for use with transceivers that don't include the necessary switching for a separate receive antenna or to provide receiver protection for those that do. The RTR-1 can also be used to switch in an external receive preamplifier (or attenuator), or as a TR switch for use with a separate transmitter and receiver.

Bottom Line

The RTR-1 Receive Antenna Interface for Transceivers offers a safe and easy way to use a separate low noise receive antenna with transceivers lacking the appropriate internal switching. It can also be used to add an external receive preamplifier or as a transmit-receive switch for stations with a separate transmitter and receiver.

The RTR-1 is housed in a sturdy metal case. As shown in Figure 3, connections are straightforward. The unit requires 12 V dc and must be connected to your transceiver's key line output via the TRANSMIT GROUND jack. In several places the manual cautions that your radio must provide a ground, not a positive voltage, on transmit. SO-239 jacks are used for the transceiver and main antenna. The receive antenna input (RX ANT IN) can be via a phono jack or F connector. These jacks are connected in parallel and intended to provide a connector choice, not connections for two separate receive antennas. Another set of jacks (MAIN ANT OUT) provides a receive-only connection to the main antenna. This output could be used to hook up a preamplifier or as an antenna connection for a second receiver.

The front panel couldn't be simpler. On the left is a POWER switch. On the right is a three position toggle switch for antenna selection. The center position (RX ANT) automatically switches the radio to the receive antenna during receive. The up position (MAIN ON) keeps the main antenna switched in on receive. The down position (also MAIN ON) does the same thing but it's spring loaded for making a quick comparison of

[4]J. Devoldere, *ON4UN's Low-Band DXing*, 4th ed. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9140. Price, $39.95 plus shipping. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[5]G Breed, K9AY, "The K9AY Terminated Loop — A compact, Directional Receiving Antenna," *QST*, Sep 1997, pp 43-46.

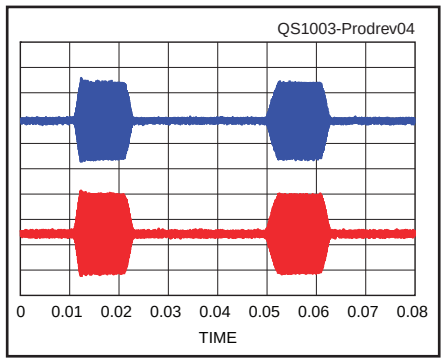


Figure 4 — The RTR-1 allows full-break-in (QSK) CW operation while receiving with a separate receive antenna. The lower trace shows the CW keying waveform at the transceiver output, and the upper trace shows the keying waveform at the MAIN ANT at the jack on the RTR-1. Keying speed is 60 WPM. Horizontal divisions are 10 ms.

Table 6
DX Engineering RTR-1 Receive Antenna Interface

Measured in the ARRL Lab

Current consumption:	Main Antenna: 8 mA. RX Antenna: 23 mA. Tested at 13.8 V dc.
Maximum rated power: 200 W.	As specified.
Port to port isolation (main antenna to receive antenna	50 dB.
Receive to transmit turnaround time (receive antenna to main antenna):	4 ms.
Transmit to receive turnaround time (main antenna to receive antenna):	4 ms.

Insertion loss:

Frequency	*Radio to Main Ant*	*Radio to RX Ant*
1.8 MHz	0.01 dB	0.4 dB*
14 MHz	0.02 dB	0.3 dB
30 MHz	0.1 dB	0.3 dB
50 MHz	0.1 dB	0.7 dB

Size (height, width, depth): 2.9 × 8 × 4.8 inches, including protrusions; weight, 2.3 pounds.

Price: $139.95.

*First unit received measured 1.1 dB.

the receive and main antennas. With power off, the radio is always connected to the main antenna so you can't accidentally transmit into your receive antenna or preamplifier. LEDs for PWR and RX ANT ACTIVE let you know what the RTR-1 is doing.

Lab Testing

Table 6 shows the results of testing in the ARRL Lab. The review unit had no problem handling its maximum rated power of 200 W. On the transmit side, insertion loss was negligible. On the receive side, it was 0.7 dB or less. Switching time measured the advertised 4 ms, fast enough for full break-in (QSK) CW operation. Figure 4 shows the transmitted signal at the RTR-1 output compared with the signal at the input. The switching circuitry in the RTR-1 does not shorten CW characters or alter the waveform.

Test Engineer Bob Allison, WB1GCM, did note that if the power supply voltage sags to around 11 V, the turnaround time lengthens and dits shorten at the 60 WPM test speed. At lower speeds (up to 40 WPM or so) the RTR-1 worked as expected at the reduced voltage. This shouldn't be an issue during normal home station operation with a regulated power supply.

Operation

My setup is very simple and I had no problem making the right connections. In a couple of minutes I was able to listen to signals on the receive antenna and automatically switch to my dipole for transmit with my backup radio. I generally don't use an amplifier, so I connected the RTR-1 to my transceiver key line output. If you use an amplifier, the manual suggests trying a Y adapter to switch the amplifier and RTR-1 simultaneously from the transceiver. If that doesn't work, the instructions suggest using an optional keying interface buffer.

The manual shows installation diagrams for use with other DX Engineering products including their RPA-1 preamplifier and combinations of ARAV2-1P active receive antennas. Another page shows a reversible Beverage system.[6] The manual is well written and detailed, with color illustrations throughout. You shouldn't have any difficulty adapting the RTR-1 to your unique station requirements.

The RTR-1 offers an easy way to add external receive antenna switching capability to the many transceivers that lack this feature. Even if your radio has a receive antenna port, the RTR-1 may afford an extra level of protection. Some radios leave the receive antenna connected all the time, but the RTR-1 disconnects the receive antenna during transmit to protect the receiver front end from strong signals on the receive antenna feed line. That's an important consideration if you run high power or don't have enough separation between your receive and transmit antennas.

Manufacturer: DX Engineering, PO Box 1491, Akron, OH 44309-1491; tel 330-572-3200; **www.dxengineering.com**.

Figure 3 — Rear panel connections are clearly labeled and straightforward. The manual shows a number of applications.

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

TECHNICAL CORRESPONDENCE

THREAD-LOCKERS AND POLYCARBONATE (OCT 2009 *QST*)

◊I enjoyed the article in the October 2009 issue of *QST* on page 42 by Joe Wonoski, N1KHB, about constructing parts from polycarbonate, also known as Lexan. As an engineer for a manufacturer of military antennas, I agree that polycarbonate is a fantastic material. We use tubes of it to construct radomes and routinely impact-test them into an oak beam at various speeds to simulate mobile operation in adverse conditions. I can attest to its strength. We also use it for mounts and insulators to hold aluminum discone and ground plane antennas together inside surveillance and jamming antennas. It is really great stuff.

The one comment I have concerns the use of thread-lockers with polycarbonate. As stated in the article, it is easy to cut, drill, and machine threads into polycarbonate. The trouble starts when one decides to use a thread-locker such as Locktite to ensure bolts and screws don't vibrate loose. As it turns out, the typical Red #272 or Blue #242 Locktite attacks the polycarbonate as well as some other plastics, and in a day or so, many small stress cracks develop around the area where the thread-locker was applied. The solution is to use Locktite's Black Max #380, which will bond metal fasteners to polycarbonate without damaging the plastic. The difference, as I understand it, is that the traditional thread-lockers are anaerobic compounds that bond parts inside threaded assemblies in the absence of oxygen, and are typically used in metal-to-metal situations. The recommended adhesive is a cyanoacrylate, commonly known as an instant or "super" glue. — *73, Rick Creager, KK4GV, 24 Scrivner Dr, Friendship, MD 20758;* **radiojeep@comcast.net**

HOMEBREW COAXIAL DIPOLE FOR VHF OR UHF (July 2009 *QST*)

◊I read with interest the July 2009 *QST* article by John E. Portune, W6NBC, about the coaxial dipole.

This antenna is closely related to the traditional "bazooka" antenna. Those who are contemplating a deployment of this type of antenna should realize that, contrary to common belief, there can be significant feed line currents. These feed line currents can dramatically affect the performance of the antenna, and may present a safety hazard in portable operation.

The feed line currents can be dramatically reduced by using the traditional "coil of coax" choke placed roughly ¼ λ down the feed line. Various sources recommend 3 to 4 turns, 5 inches in diameter, 5 to 10 inches down the feed line. Clearly, there is considerable freedom in choke design.

This antenna is not unique in this regard. *The ARRL Antenna Book* has several examples of "choke" baluns on feed lines for all sorts of antennas, even ground plane verticals![1]

In short, *don't forget to engineer the feed line too! — 73, Ward Harriman, AE6TY, 14672 Gypsy Hill Rd, Saratoga, CA 95070*; **ae6ty@arrl.net**

[Thanks Ward. Yes, I'm well aware that this is an issue with a coaxial dipole, as well as the popular J pole. I intended to add that note as part of my editing, but apparently forgot. In any event, it should be mentioned to our readers. *—73, Joel R. Hallas, W1ZR, Technical Editor,* QST; **w1zr@arrl.org**]

DOUBLE CROSS — A NOAA SATELLITE DOWNLINK ANTENNA (Feb 2008 *QST*)

◊Gerald Martes' (KD6JDJ) article in the February 2008 issue of *QST* was quite interesting in the way that he arranged the feed line and phasing lines. The author, however, didn't delve into the significance of choosing that arrangement. The double cross antenna is a Lindenblad antenna. The original Lindenblad, as conceived by Nils Lindenblad back in the early 1940s, had the four dipoles fed in phase.

The double cross uses progressive phasing, in which each dipole is 90° out of phase with its neighbor. Note that because the dipoles are fed in a series/parallel arrangement, the following explanation is not exactly correct but the end result is the same — the dipoles are all out of phase. See Figure 1, which is reproduced here from Figure 9 of the original article.

Dipole number 2, which we can call the reference dipole, is fed in phase with its opposite dipole, number 1. Dipole number 1, however, is physically rotated 180°, which, of course, makes it 180° out of phase with the reference dipole. The dipole adjacent to the reference dipole, number 4, is fed 90° out of phase as a result of an additional quarter wavelength of coax. The dipole opposite number 4, number 3, is also physically rotated 180° and as a result is 270° out of phase with the reference dipole. In summary, with reference to dipole 2, dipole 4 is 90° out of phase, dipole 1 is 180° and dipole 3 is 270°. These are all lagging the reference dipole. This is an important point, as it determines which direction the progression goes. This change in the feed arrangement compared to the original Lindenblad has a significant effect on the dipole impedance and elevation pattern and it also changes the "handedness" of the antenna.

The Lindenblad is a circularly polarized antenna. It can be right hand (RHCP) or left hand (LHCP). For terrestrial work, where signals are linearly polarized, (vertical, horizontal or somewhere in between) "handedness" is irrelevant.

Satellites, however, generally use circularly polarized antennas. The satellite antenna and the earth antenna have to match. Using a LHCP antenna to receive a RHCP signal is like using a horizontal antenna to receive a vertically polarized signal. Cross polarization may reduce the signal strength by 20 dB or more. From the perspective of standing at the center of the original Lindenblad and looking outward, if the dipoles are rotated clockwise from the horizontal then the antenna is RHCP and vice versa. Progressive phasing reverses this rule of thumb, an important point not to be overlooked.

The direction of phase progression of the dipoles is also very important. Looking down on the antenna, a RHCP antenna must have the phase progressing counterclockwise. Get it backwards and the elevation pattern will be seriously degraded from what you would expect. You must also pay close attention to the dipole orientation, whether the half of the dipole connected to the center conductor of the coax is up or down. Follow the article drawings exactly.

For satellite work, a progressive phase Lindenblad has two major advantages over the original design. Most importantly, it fills in the high elevation null that occurs in the original design. It also diminishes the magnitude of the peaks and nulls that occur with all antennas as a result of interaction with the ground. These two improvements are worth the effort of paying close attention to the feed line and phasing arrangement.

The late L.B. Cebik, W4RNL, had an excellent article on Lindenblad antennas, "Notes On Fixed Satellite Antennas," on his Web site. That Web site is being maintained by Jack Stone, publisher of *antenneX*, an on-

[1] R Dean Straw, N6BV, Ed, *The ARRL Antenna Book*, 21st Edition, 2007, ARRL. See for example, pp 6-19 and 7-6. ARRL Publication Order No. 9876, $44.95. ARRL publications are available from your local ARRL dealer or from the ARRL Bookstore. Telephone toll free in the US: 888-277-5289, or call 860-594-0355, fax 860-594-0303; **www.arrl.org/shop**; **pubsales@arrl.org**.

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line publication of antenna articles. You will probably have to create a log-in ID at **www.cebik.com**. After that is completed, search for "Notes On Fixed Satellite Antennas." The referenced article is at **www.cebik.com/content/a10/vhf/fsat.html**.

Note that I live full time on a sailboat in the Caribbean. I can be contacted via my mail service or by e-mail, but correspondence is generally slow. — *73, Doug Hurst, WP3U, 6501 Red Hook Plaza, Suite 201, St Thomas, USVI 00802*; e-mail via **kimrwhite@yahoo.com**

LOCAL RADIO NOISE

♢I've noticed a growing trend of 100 W class HF stations reporting less success in recent years. I have a theory that this may be due in part to ever-climbing local noise levels in our neighborhoods. This noise will tend to mask the weaker signals at the receive end, resulting in fewer possible "recipients" for low and medium power CQs. I find I have to be very diligent about tracking down and eliminating sources of noise in my own house just to keep my receive noise level reasonable.

I'm seeing the same thing in AM and FM broadcasting — long-time home-based listeners to our radio stations are having more trouble in recent years hearing the same old stations transmitting with the same power levels — the background noise is covering up the fringe reception. Mobile reception doesn't seem to be as troubled — except by the recent trend of traffic light systems that produce VHF interference at intersections.

The following paragraphs describe a recent study I made of the indoor situation in broadcasting, which can be extrapolated to the ham experience as well.

The impact of indoor and neighborhood noise sources for AM reception is known to our listeners to some degree, but less so for FM, thanks to the ability of FM receivers to hide the noise. But the noise masks weaker FM signals just the same — and probably digital HD as well — it just isn't as apparent to the listeners in those modes why the signal is "weak." My strong impression is that local indoor noise sources have been the cause of many of our recent reception complaints.

To try to confirm or deny my suspicions I made an informal study of some Wisconsin Public Radio listener and staff homes using a battery powered spectrum analyzer (a radio receiver with visual display of strength versus frequency) and a loop of stiff wire on a short length of coaxial cable as a pickup antenna. I wanted to get a better sense of the noise encountered in a variety of indoor situations, and see if it might explain the troubles these folks were having getting reliable radio reception.

I found that the several urban apartments I checked were awash in noise, much higher than the background level in the parking lot outside. The strongest sources I noted were recently manufactured "wall-wart" switch-mode power supplies used for charging batteries in cell phones and digital cameras. Some made a broad "hash" while others produced a series of noise peaks on discrete frequencies throughout the band, probably related to the switching frequency. Some HDTV sets and DVD players were also very noisy in both HF and VHF ranges, maybe from their power supplies as well but with their internal supplies it was impossible to be certain. Some personal computers and digital clocks and telephones were cranking out the noise as well.

Suburban homes were quite noisy too, but with more square feet of room the noise sources were more "spread out." I noticed the same line-up of noise sources, and a similar increase in the overall noise from outside in the driveway to indoors.

Urban offices on our University of Wisconsin campus in Madison were checked too. They were much noisier than outdoors on the adjacent sidewalk. I found it harder to find the specific causes of the noise in this environment. Some computers were noisy, as were quite a few of the telephones. Printers with their switch-mode power supplies were cranking out the noise as well. But the noise in the office areas was harder to pinpoint. I'm thinking there are more sources in this environment, on various floors and rooms, with more multipath reflections on the noise signals from the structures, all of which tends to "blur" the source.

Putting numbers on this noise is difficult, as moving the antenna around greatly varies the absolute strength of the noise, and the antenna's response was bound to vary to a large degree with frequency.

Stepping back and thinking of my overall experience, across all the bands I checked, in all the locations, it would be fair to say I saw as much as a 20 to 30 dB increase in overall noise going from outside to indoors. Even without hard numbers it is very clear that the modern indoor environment is much noisier than the nearby outdoor locations.

In all these situations I was able to find places to put the listener's broadcast radio and antenna to get better reception. In most cases the listener had installed their radio on a shelf or table quite close to other electronics, which were spewing out noise. I moved their radio out from among the noise sources and reception was naturally better. In some cases when I demonstrated that a particular device was causing poor reception the listener removed the offending unit. But this is "treating the symptom" rather than getting to the bottom of this problem. Better control of this noise at the manufacturing end is necessary. — *73, Steve Johnston, WD8DAS, Director of Engineering and Operations, Wisconsin Public Radio, 2309 Tulare St, Fitchburg, WI 53711*; **sbjohnston@aol.com**; **www.wd8das.net/** QST

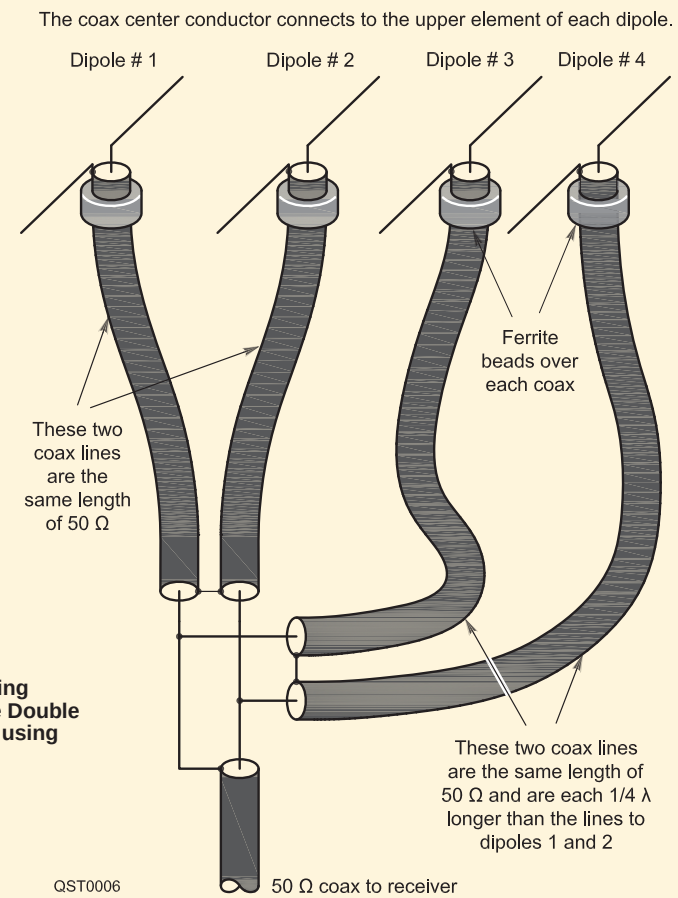

Figure 1 — Wiring harness for the Double Cross antenna using 50 Ω coax.

W1ZR

THE DOCTOR IS IN

Q Jay, KI3M, notes that his old used Heathkit Cantenna oil cooled dummy load measures 43 instead of 50 Ω. He attributed the change to deterioration of the power resistor and wonders how he can get it back to being a 50 Ω load.

A First, let me make sure that you are aware of the potential dangers of a used Cantenna. When sold by Heath, many years ago, they came without oil. Users were instructed to obtain transformer oil from an electrical supply house or the local power company. For some years while the product was in existence, most transformer oil was enhanced by adding polychlorinated biphenyls (PCBs) to improve heat transfer properties.

PCBs are now known to be highly carcinogenic and contact should be completely avoided for the safety of you and anyone around you. Heath also suggested the use of mineral oil as a safer substitute resulting in a somewhat lower power-time rating. The problem with a used Cantenna is that you often don't know what you are dealing with. I have been using mineral oil in mine since it was new and have had no difficulty, other than the strange look on my pharmacist's face when I purchased a gallon of it.

Now, as to your original question, it is actually the case that 43 Ω is within Heath's 1.5:1 specified VSWR. Mine, and probably most, are closer to 50 Ω. For many applications, a 43 Ω load is fine. If not what you want, you are faced with two issues — repair or replacement requires opening up the oil can, exposing you to potential PCB contamination — and the replacement resistor needs to be an expensive high power non-inductive resistor. The 200 W non-inductive power resistor used is likely far more expensive than a whole Cantenna at a hamfest or on auction sites.

So, if you must have precision, I'd take your multimeter to a hamfest and look for a Cantenna that measures closer to what you want. The dc resistance should be close to the HF impedance. If it feels like there is oil in it, I'd leave the lid on, handle it with great care, as potential hazardous material, and just use it. If it feels empty, I'd leave it alone unless you can determine that it has never been filled.

Note that MFJ (**www.mfjenterprises.com**) offers a similar MFJ-250 oil filled kW (for 10 minutes, 200 W continuous) dummy load that comes with PVC free transformer oil.

Q Rob, W1AVK, asks: I have installed 90° UHF connectors on the 1500 W side of my linear amplifier and also at the antenna tuner to facilitate cable dress of the heavy coaxial cable I'm using for the high power signal. I note that the SWR is unchanged from the straight connector arrangement. So far I've done testing at the 100 W level, and wonder if there are any issues with such adapters handling high power?

A ARRL Senior Lab Engineer Zack Lau, W1VT, reports that he has used such angle adapters all the way into the microwave region and hasn't experienced problems with high power use. The key with one of these, as with any RF connector is to use only top quality products, such as the Amphenol UG-646/U in Figure 1. While any part can fail, and will be more likely to fail at high power, using only top quality parts should minimize the failure probability. Some low priced coax adapters are assembled with springs instead of solder connections and can fail at any time.

In many cases, the problem may be with other connectors in the system. Manufacturer selected UHF panel jacks sometimes don't have resilient spring fingers to grasp the pin of the mating connector. Any resistance there translates to heat at high power that can result in premature failure. The sad thing is that the failure of a $2 connector could take out your final amplifier.

Figure 1 — Amphenol UG-646/U UHF type right angle coaxial adapter. Such an adapter can make it easy to move equipment close to walls, but use only good quality components.

Q Marcus, KI6WDX, asks: I'm going to build a 2 meter antenna that is designed to operate with 50 Ω coaxial cable. I have a box of 50 feet of premade (PL-259 connectors on each end) type RG-58U cable that identifies the line as having a characteristic impedance (Z_0) of 52 Ω. Will using a cable with a slightly different Z_0 cause a problem, or can I use what I have?

A RG-58 varieties have nominal characteristic impedances ranging from 50 to 53 Ω. This is generally much less significant than other variables in an antenna system. For example, an antenna with a fairly reasonable 1.5:1 SWR could exhibit a range of impedances at the transmitter including resistive impedances of 37.5 or 75 Ω.

Of more concern to me is the loss of this cable type at 2 meters. If perfectly matched, a 50 foot length of typical RG-58U cable has a loss of 3.6 dB. This means more than half (56%) of your transmitter power, as well as your received signal, will be lost as heat in the cable. If your antenna had a 2:1 SWR, the loss would be 4 dB or 60%.

Table 1

Comparison of Loss of 50 feet of Various Coaxial Cable at 146 MHz

Cable	*Loss (dB)*	*Loss (%)*
RG-58	3.6	56.3
RG-8X	2.4	42.5
LMR-200	2	36.9
RG-213	1.4	27.6
LMR-400	0.78	16.4

A comparison with 50 foot lengths of other nominal 50 Ω cables at 146 MHz is shown in Table 1. The loss is significantly higher than at HF. Note that the attenuation is directly proportional to cable length, so if you only needed 25 feet and cut and re-terminated one end, you would reduce your loss by a factor of 2.

Q Jeff, WAØVOM, asks: Would there be any advantage to installing a large boom box car amplifier battery between

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my auto electrical system and my 100 W HF/VHF mobile transceiver? I keep my dc power leads as short as possible and do not notice any problems while operating SSB at full power.

A Having a second battery to switch to can be very useful if you think that you will be operating with your engine off. Then I wouldn't hook the batteries together, but would switch between them — otherwise you will also run down your starting battery.

If you do use a standalone battery that you will heavily discharge, consider getting a deep cycle battery made for that service, as the usual starting battery won't last long if heavily discharged and recharged. The gel cell or AGM type batteries are perfect for this application, although there are also wet cell deep cycle batteries available at lower cost. Adding a boost regulator between your extra battery and the radio will allow you to continue to operate as the battery discharges to below the point at which the radio would stop working, so you might want to consider that as well.[1]

It is also possible to obtain a battery isolator that can be hooked between your vehicle alternator and your two batteries, so the extra battery is charged while your engine is running, but your radio won't discharge your starting battery. These are available from marine dealers, or can be made from heavy duty diodes. They will slightly reduce the maximum charging voltage due to the diode forward voltage drop.

Q Paul, W1SEX, asks: I have a 13 element, 2 meter Yagi in the rafters of my garage. It doesn't work very well from inside the garage, but when deployed in the clear for ARRL Field Day and other club activities, we get good results. When we deploy the antenna we usually set up for vertical polarization for FM and packet, and use a steel mast to support it. I wonder whether the performance and azimuth pattern are distorted by the mast?

A Well, I haven't modeled your particular antenna, but any vertical Yagi I have modeled with a mast in its midst had a distorted pattern with reduced gain and F/B. Yes, it will still radiate, but it won't work as well as it could. Figure 2 shows the azimuth pattern of a vertically polarized VHF Yagi without a metal mast in its midst and with a 1.5 inch diameter mast in different positions.

It will work much better with about ½ wavelength of heavy PVC, fiberglass or even a wood dowel as the upper part of the mast — extending down below the bottom of the elements. Some commercial Yagis do this as part of the design. Shorter VHF and UHF Yagis often sidestep the problem by mounting from the rear, behind the reflector, but I suspect that wouldn't work with a boom the length of yours.

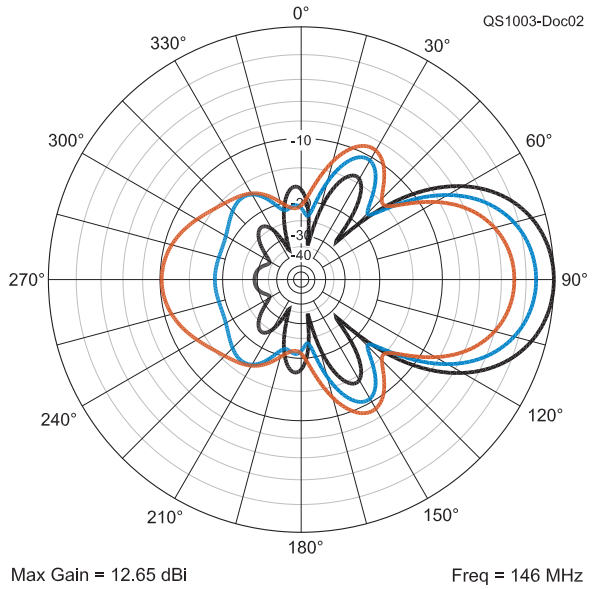


Figure 2 — Comparison of azimuth pattern of 12 element 2 meter Yagi in free space without a metal mast (black), the same antennas with a 1.5 inch diameter metal mast about half way between directors 3 and 4 (mid boom, blue) and with the vertical metal mast close to director 3 (balance point). Note the degradation in forward gain, front to back and sidelobes depending on mast position.

Q Marcus, KI6WDX, also asks: I already have mounted four permanently mounted vehicle antennas on my truck's roof arranged in a diamond like pattern. I only use one radio (2 meter, 1.25 meter and 70 cm) at a time for transmitting and the others are for the most part just used for receiving. While transmitting with one, I don't always have the other radios on.

My question is: The distance between each of my current antennas is based on answers derived from two antenna manufacturers' technical support centers. So far, all seems to be well. Now, I want to install two additional mounts in this same roof, one for HF, although the spacing between these two new antennas and the others may need to be closer. What is the minimum distance between two antennas before the distance gap becomes an RF problem for either receiving or transmitting?

A You raise an interesting question that is not easy to answer with certainty since there are so many unknowns. There are two potential issues here:

■ Antenna pattern distortion. Having multiple antennas in the same volume will surely distort all their patterns to some degree. This may be the easiest issue to contend with since, if their position and dimensions are known, an antenna modeling program such as *EZNEC* could be used to determine the effects on pattern.[2]

■ Potential receiver damage. This is the one I'm concerned about. Closely coupled antennas can easily pick up sufficient RF from a nearby transmitting antenna to damage a receiver's front end, although if none of yours failed yet, they probably will stay all right in the future. Adding new radios and antennas will compound the problem.

A potential solution to both problems is to change to multiband antennas, instead of adding new ones. Use a duplexer, or multiplexer, to split the signal to radios on different bands. The duplexer should provide more, and better defined, isolation than closely spaced antennas. We reviewed a number of samples in Product Review, Dec 2004 *QST*, available on the members Web site at **www.arrl.org/members-only/prodrev/**.[3]

In the Doctor column for January 2010, we discussed the safety of cardiac pacemakers and I suggested requesting information from the device manufacturer. Ken, ACØNJ, following a career as lead electronics engineer at a hospital, notes that manufacturers tend to be overly conservative in these matters. He suggests checking with the US Food and Drug Administration since they have standards for such devices. He suggests looking at the link DEVICE EXPERTS *on* **www.xfda.com/index.htm**.

[1]P. Salas, AD5X, "Product Review — Boost Regulators from TG Electronics and MFJ Enterprises," *QST*, Nov 2008, pp 46-49.

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

[3]J. Hallas, W1ZR, "Product Review — A Survey of 2 Meter/70 Centimeter Diplexers," *QST*, Dec 2004, pp 63-67.

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; www.arrl.org/tis/. QST

Arrow Antennas VHF/UHF J-Pole

J-pole antennas have been favorites for many years among VHF/UHF operators. They are relatively easy to install and require little, if any, tuning for minimum SWR. You'll find them made of everything from windowed 450-Ω transmission line to copper pipe.

Regardless of the construction method, a J-pole antenna is a ½ wavelength radiator, essentially an end-fed dipole with either an open or shorted matching stub. In many single-band designs, the antenna looks somewhat like the letter **J**, hence the name.

The matching stub acts as a transformer to transform the high impedance of the antenna to 50 Ω for your coaxial cable. Otherwise, the Standing Wave Ratio (SWR) at the feed point would be horrendous. But if all goes as planned, the result is an antenna with an acceptable SWR, an omnidirectional pattern and a low angle of radiation.

The Arrow Antennas model OSJ 146/440 is an open-stub J-pole, but with a twist. This antenna is a *dual-band* design, allowing you to operate on 2 meters and 70 cm with a single coaxial feed line.

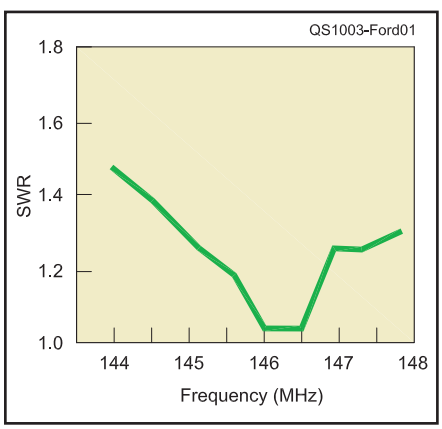


Figure 1 – The OSJ 144/440 SWR profile on 2 meters.

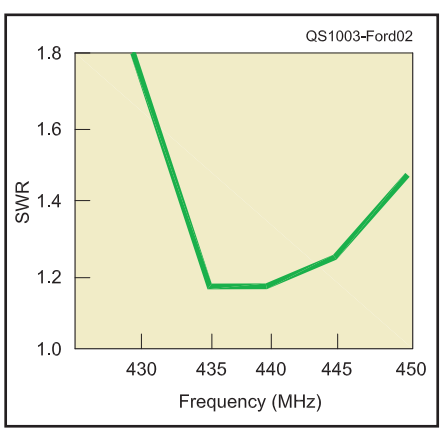


Figure 2 – Sweeping the OSJ 144/440 on 70 cm.

Quick Assembly

The OSJ 146/440 arrives in a 5-foot-long cardboard container. When you pour out the contents you find only three aluminum elements and a small bag of nuts and bolts. The ⅜-inch diameter solid elements are robust to say the least. The specifications don't mention a wind survivability rating, but I'm confident the OSJ 146/440 could withstand anything our New England weather could throw at it. From an RF standpoint, the OSJ 146/440 is rated at 1000 W.

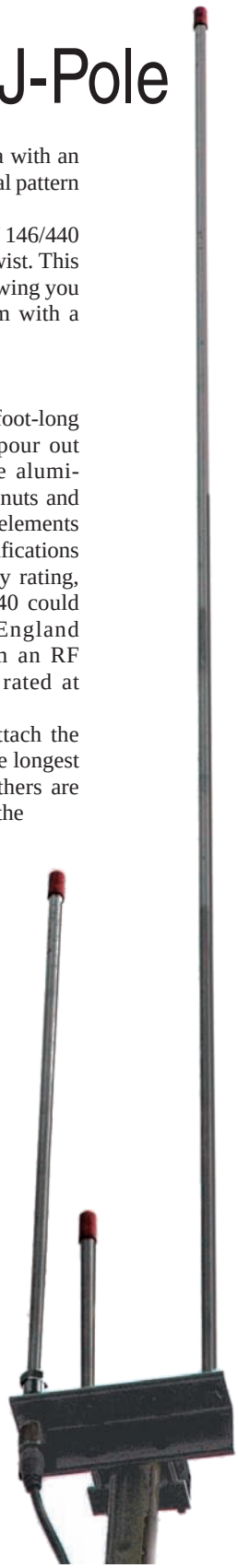
It took about 10 minutes to attach the elements to the OSJ base plate. The longest of the three is 57½ inches; the others are 19¼ and 6¼ inches. You just place the rods into the correct holes, thread on the stainless-steel hardware, tighten with a wrench and you're good to go.

On a drizzly Saturday morning I secured the OSJ 146/440 to the top of a 4-foot mast extending above my existing 6-meter antenna. Total time for assembly and mounting was less than 20 minutes. (When you're working outside in miserable weather, rapid installation is a strong selling point.)

Check-Out and Operation

I swept the antenna with an analyzer and the results are shown in Figures 1 and 2. The SWR was less than 1.6:1 across the 2 meter band, dipping to almost 1:1 around 146 MHz. On 70 cm the SWR peaked at the low end of the band, yet remained below 2:1 throughout.

The best environment for scientifically objective antenna testing is a calibrated test range. We don't have access to such a facility at ARRL Headquarters, however, so I can only provide my very *un*scientific tests and opinions.



The OSJ 144/440 installed.

For one test I fired up my APRS software and parked the transceiver at 144.39 MHz. With my old ground plane antenna I normally decoded transmissions from no more than two stations directly. After 10 minutes of monitoring with the OSJ, the "direct reception" list was populated with eight call signs. The signals from the six additional stations (digipeaters) had always been there, but they had never been strong enough for my packet TNC to decode. What a difference a decent antenna can make!

On 440 MHz I was able to access repeaters that had been unavailable to me before. I even managed to monitor the 435.30 MHz downlink signal from the OSCAR 51 satellite. Considering the fact that I didn't have a receive preamplifier at the antenna, I was gratified to see its signal peaking at S7 on my transceiver during a high-elevation pass.

The rugged OSJ 146/440 is definitely a "keeper." At less than $40, it scores high on the value scale — especially when you consider its durable construction and simple assembly.

Manufacturer: Arrow Antennas, 911 East Fox Farm Rd, #2, Cheyenne, WY 82007; tel 307-638-2369; **www.arrowantennas.com**. *$39.*

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

NØAX

HANDS-ON RADIO

Experiment #86 — Viewing Waveforms in *LTspice*

In rereading the initial *LTspice* columns, I realized that the ability to view waveforms was too important not to cover in a column of its own. As a result, the introduction to W4ENE's filter design software, *ELSIE*, will be delayed for a month.

Time Domain and Scope View

So far in this series of columns, we've performed two of the simulations available in the *LTspice* software: calculating the dc operating point (the *.op* simulation) and determining the frequency response (the *.ac* simulation). The dc operating point is a static calculation, by definition, and shouldn't change over time. The frequency response, also called an *ac sweep*, determines how the circuit behaves over a specific frequency range.

Both simulations are quite useful, but neither shows you how the circuit behaves over time — plotting a signal's amplitude against a calibrated time scale. That type of graphical output is popularly known as a *scope view*, as if an oscilloscope were connected to the circuit. More correctly, it's called the *time domain* or *waveform* view.

The convention for *SPICE* based circuit simulations is to refer to time domain simulations as *transient analysis*. The word *transient* refers to the reaction of the circuit to a temporary (or transient) change, not necessarily a sharp pulse also called a "transient." For example, the *step waveform* is often used as the changing input in which a signal instantly changes from one voltage to another voltage. The resulting *step response*, when graphed in the time domain, tells a lot about the circuit's ac characteristics. Another common transient response input signal is the *impulse function* and it looks a lot more like a transient, consisting of an infinitely narrow pulse. The circuit's output is then called the *impulse response*. *LTspice* can simulate all of these responses and more.

Most of the time, we're interested in seeing an oscilloscope-like view of the voltage or current at a particular spot in the circuit. To become familiar with using the transient analysis simulation, we'll revisit a familiar circuit — the 555 timer.

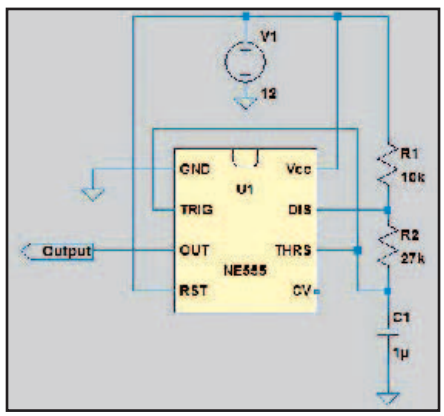


Figure 1 — The astable 555 timer circuit. Because this is a simulation, no bypass capacitor is required on the CONTROL VOLTAGE (CV) pin. In the real world, a bypass capacitor would be good practice.

Timer Circuit Review

Take a few minutes to download Experiment #51 and read about the 555 timer.[1] We're going to simulate the continuously oscillating *astable* version of the circuit. From the original experiment, we can follow the basic sequence of events. The timing capacitor, C1, charges toward V_{CC} through the combination of R1 and R2. As the capacitor voltage reaches ⅔ V_{CC}, the threshold comparator output turns on the discharge transistor (connected to the DIS pin) and the capacitor starts to discharge through R2. When the capacitor has been discharged to ⅓ V_{CC}, the trigger comparator turns off the discharge transistor and the cycle begins again. This creates a train of pulses at the output while C1 charges and discharges between ⅓ and ⅔ V_{CC}.

The total time it takes for one complete cycle is the charge time, T_C, plus the discharge time, T_D:

$$T = T_C + T_D = [0.693 \times (R1 + R2) \times C1] + [0.693 \times R2 \times C1] = 0.693 \times (R1 + 2 \times R2) \times C1$$

[1]All previous Hands-On Radio experiments are available to ARRL members as downloadable PDF files at **www.arrl.org/tis/info/HTML/Hands-On-Radio/**.

and the output frequency is:

$$f = 1/T = 1.443 / [(R1 + 2 \times R2) \times C1]$$

The duty cycle of the output waveform is the ratio of time the output is ON (at V_{CC}) to the total period of the waveform, T:

$$\text{duty cycle} = T_C / T = (R1 + R2) / (R1 + 2R2)$$

Note that duty cycle is always greater than 50% because R1 is always greater than zero.

Setting Up the Timer Circuit

Build the circuit shown in Figure 1. It's a basic astable 555 timer circuit. You can find the 555 timer symbol by selecting MISC and then NE555 after clicking on the COMPONENT tool. The 555 symbol's pins are arranged differently than you might be accustomed to, so the circuit will look different when compared to Experiment #5. If you want an alternate arrangement for future use, you can edit the symbol. Assign values to all of the components and the voltage source as shown and create the OUTPUT port using the labeling tool as explained in the previous experiment.

You may have noticed a small change from a "real" circuit. The CONTROL VOLTAGE pin (CV) is left open circuited in our simulation. In an actual circuit, this would be bypassed to ground with a small value capacitor so that noise won't affect the switching thresholds. In our simulation world, though, there are no stray or unwanted signals and CV can be safely left unconnected.

Calculate the charge and discharge times (25.6 msec and 18.7 msec, respectively), the total period and frequency of the output waveform (44.3 msec and 22.6 Hz), and the duty cycle (57.8%).

Time Domain "Scope" Simulation

Now we are ready to turn on our simulated oscilloscope. Use SIMULATE > RUN and then select the TRANSIENT tab. The only required value to be entered is STOP TIME. A value of 0.5 seconds will allow the simulation to run for several waveform cycles. We will let *LTspice* use its default value for the time

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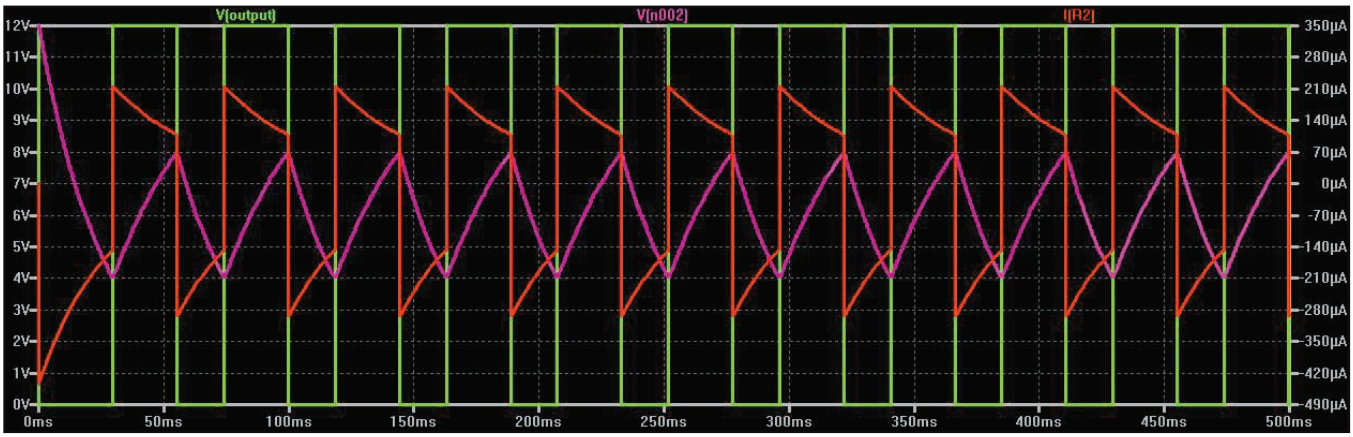

Figure 2 — Three waveforms in the 555 timer circuit. Green is the output voltage, magenta is the capacitor voltage, and red is the current through R2. Voltage is calibrated on the left Y axis and current on the right Y axis.

step. Click the OK button and the label .TRAN .5 will appear on the schematic. (In the parlance of *SPICE*, this is referred to as a *dot tran* command.) A blank waveform or *trace* window will appear above the schematic waiting for you to identify which voltage or current to plot.

Move the cursor to the OUTPUT port symbol so that it changes to a red voltage probe then click. The trace window should fill up with a pulse train swinging between 0 and 12 V. (If not, check your schematic wiring.) The label V(OUTPUT) will appear at the top of the window in the same color as the trace. Now move the cursor to the junction of R2 and C1 and click again. The charge-discharge waveform of the capacitor voltage will appear as a second trace labeled V(N002). Let's get fancy and move the cursor over R2, where it will change to a current probe, and click again. A third trace labeled I(R2) will appear along with a numeric scale at the right calibrated in µA. Using the capacitor voltage trace as a clue, which way is the current flowing in R2 when *LTspice* assigns it a positive value? (Top to bottom, causing C1 to charge.) You should now see a window with three traces as in Figure 2.

Customizing Your Time Domain View

If you right click anywhere in the trace window that is not on a trace or axis, a menu will appear in which you can click GRID to turn the X-Y gridlines on and off. My Figure 2 will look a little different than your trace window because you are probably using the default colors and trace widths. To change the color of a trace, move the cursor to the trace's label [such as V(N002)] and right click. The EXPRESSION EDITOR window will appear with a default color selection menu that you can change. To increase the trace thicknesses so that they are easier to see, select TOOLS > CONTROL PANEL. Then click the WAVEFORMS tab and click the box for PLOT DATA WITH THICK LINES.

Just as in a real 'scope, you can also change the scale of the axes. Move the cursor to just below the X axis so that it changes into a ruler. Click and a window will appear showing axis values for the minimum (LEFT) and maximum (RIGHT) times and the divisions (TICK). You can change the values to shrink or expand the time scale. The same controls are available for both Y axes on the left and right. Feel free to experiment with the scale settings.

Voltage and Current Measurement

If you've used a modern, digital scope, you know that one of its most handy features is the ability to use on-screen cursors to measure voltage and time. No more squinting and moving traces to use the graticule for imprecise measurements. The same feature exists in *LTspice*.

Move the cursor to the label for capacitor voltage, V(N002), and right click. In the EXPRESSION EDITOR window, from the ATTACHED CURSOR menu select 1ST. A pair of lines, one vertical and one horizontal, will appear in the trace window along with a small window showing the value of the trace where the lines cross. Move the cursor to the intersection of the lines and a yellow 1 will appear. Click and hold the left mouse button then move the mouse left and right. The intersecting lines will follow the capacitor voltage trace and the value window will show voltage and time. Verify that the capacitor charges and discharges between ⅓ and ⅔ V_{CC} and that the charging and total periods are as predicted above. Can you explain why the first output cycle of the 555 is longer than the rest? (The capacitor has to be discharged starting from 12 V, not 2/3 V_{CC}.)

Further Reading

Continue to experiment with the *.tran* command and read about it and other *dot* commands in the *LTspice User's Manual*. See if you can figure out how to plot the sum and difference of voltage traces as described in the section "Waveform Arithmetic." Keep an eye on the Hands-On Radio Web page for additional *LTspice* hints and tips.

Next Month

Okay, okay — I promise that next month we'll try W4END's filter design software, *ELSIE*. Remember that it is included in the CD that comes with *The ARRL Handbook*.[2] If you haven't yet tried this software, you'll have a great opportunity next time.

[2]The ARRL Handbook for Radio Communications, 2010 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1448 (Hardcover 1462). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**. QST

New Products

TEN-TEC POWER SUPPLY/ SPEAKER

♢The Ten-Tec Model 940 switching power supply/speaker console provides 13.8 V dc at up to 25 A for powering HF transceivers and other equipment. Input voltage is switchable (90-132 or 180-264 V ac). The internal 4 Ω speaker is rated to handle up to 5 W and is designed for voice and CW communications. Multiple output connectors are provided on the rear panel for connection of an HF transceiver and up to three low-current accessories without the need to resort to an external power supply strip. The Model 940 style and color match current Ten-Tec Orion II, Omni VII and Jupiter transceivers. Price: $299. For more information, visit **www.tentec.com**.

AG1YK

HINTS & KINKS

STEPPIR MOUNTING — A BETTER WAY

◊[Before starting this procedure you should put on a hard hat and review tower safety procedures. — *Ed.*] I have found a simple way to mount a SteppIR Yagi antenna with the 30-40 meter upgrade. Place the antenna leaning up against the tower with the boom vertical. Lower the rope from the gin pole so that the rope is between the tower and the antenna (see Figure 1A). Tie the rope close to the center of the boom. Begin raising the antenna while holding onto one side of the lower fiberglass rod. This will cause the antenna to flip (windmill). Allow it to rotate till the fiberglass rods are vertical and the boom is horizontal. Continue raising the antenna. At the top, flip the 30-40 meter trombone element up over the gin pole and down on the mast — like throwing a loop up over a stake (see Figure 1B).

Another thing about the 30-40 meter element is that the element tapes are flat and will bend from side to side but not up and down. Therefore the tape has a tendency to twist or bind because of sag near the ends of the fiberglass rods where they fold back.

To correct this, I made a 4 foot removable extension with two double pulleys, which I added to my mast above the SteppIR. I fastened two lengths of ¼ inch diameter antenna rope ⅔ of the way out from the boom to both sides of the 30-40 meter element. I then pulled the rope ends back to the boom before I raised the antenna. After I got the antenna up, I put the ropes through the pulleys and installed the extension and pulled the fiberglass rods up horizontal. The unit now operates a lot more smoothly. [Note that SteppIR has a Truss Kit available for the DB36. — *Ed.*] — *73, Pete Peters, W7OW, 7520 N Whitehouse Dr, Spokane, WA 99208-6144,* **w7ow@hotmail.com**

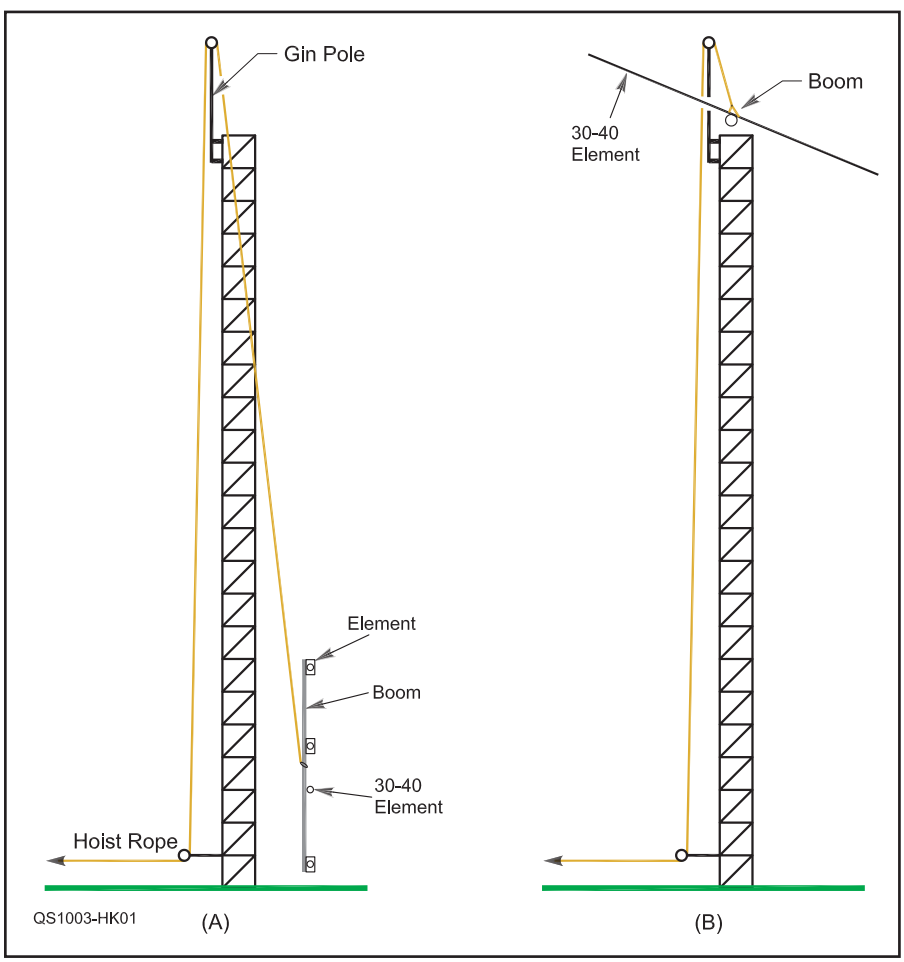

Figure 1 — A diagram showing how to raise the SteppIR with the 30-40 meter upgrade. At (A) is the position of the antenna on the ground. At (B) is the position of the antenna at the top having been rotated with the 30-40 upgrade loop element passed over the mast.

STOPPING WIND DAMAGE TO LADDER LINE

◊I just finished reading Tomm's, W2BFE, question in the April 2008 issue of *QST*, about replacing his window line with open wire line to stop wind damage.[1] I have had the same problem with the ladder line feeding my G5RV. I solved the problem after noticing trucks on the interstate using straps to secure their loads. The straps that were straight and flat would move or vibrate in the wind but those that had a twist did not move. I questioned one truck driver and he says the twist acts like an air foil and stabilizes the strap in the wind. I thought this might be a solution to my problem with the wind causing my ladder

[1]J. Hallas, "The Doctor is IN," *QST*, Apr 2008, p 67.

LOUIS PAULY, N8KXM

Figure 2 — A view of the ladder line tied to the support rope and twisted to minimize its interaction with the wind.

line to whip like a jump rope and eventually come apart.

I secured my ladder line to the antenna support rope with zip ties about every 3 to 4 feet. After tying off the rope and before attaching the coax I give the ladder line about 3 or 4 twists (see Figure 2). This keeps the ladder line in place in moderate winds (5-10 mi/h) and I have had it withstand winds of 20 mi/h and above. I don't notice any change in performance and I haven't had to replace my ladder line because of wind damage since. — *73, Louis Pauly, N8KXM, 8610 Penny Rd, Pleasant Hill, OH 45359-9784,* **n8kxm@arrl.net**

PASSING CABLES THROUGH STUCCO WALLS

♢I've seen several ways to run coaxial cables through walls to outdoor antennas, but none seemed as flexible, easy, or unobtrusive as my method. I used a standard outdoor four outlet receptacle housing backed up by an ⅛ inch aluminum plate cut to size and drilled for four threaded UHF female-female bulkhead mount adapters. I added a piece of ¼ inch closed cell foam between the stucco siding and the aluminum plate. The receptacle box came with a foam gasket already in place on its back side.

By using 90° UHF connectors I can easily route as many as four RG-8 or RG-58 lines out to the antennas, although my installation has only two UHF adapters for now (see Figure 3). These adapters project through the stucco and wood sheathing into the basement close to my radios. The receptacle box comes with a frosted plastic snap-on cover and knock-outs that provide holes for the wires. To prevent tampering, I can lock the box. When I disconnect the outdoor coax, the box looks like just another power outlet. I protect the connectors with silicone grease. — *73, Jon Titus, KZ1G, 14253 S Trailview Way, Herriman, UT 84096,* **kz1g@arrl.net**

JON TITUS, KZ1G

Figure 3 — The assembled and mounted outlet box containing two UHF connectors. A neat and tidy installation.

USING A BROADCAST LOOP ON 160 METERS

♢The Terk Technologies AM Advantage tunable loop antenna does a great job as a receiving antenna for the 160 meter band by just setting the tuning dial as high as it will go. Along with an inexpensive Ten-Tec Model 1056 direct conversion receiver kit that I assembled for 160 meters, I was able to give our grandson a fully functional Amateur Radio receiving station, without an outdoor antenna or any of the "wires and things" that his parents might object to. The Saturday evening AM broadcast on 1860 kHz, nightly W1AW code practice and bulletins, and cross-country sideband roundtables, are all received very reliably and "Q5" with this desktop receiving system. Best reception is in the plane of the loop; the directivity helps eliminate noise. The antenna is available from Amateur Electronic Supply, C Crane and possibly others, for about $50. — *73, Dean Lewis, W9WGV, 1193 Azalea Ln, Palatine, IL 60074,* **w9wgv@arrl.net**

MORE ON TUNER WEATHERPROOFING

♢In response to the hint from N1GY in the December 2009 issue, Randy, N7CKJ, and Walter, KC2KZJ, have some additional thoughts.

■ Randy, N7CKJ, would like to point out that the Z-11Pro can be fitted with an internal AA battery pack for power. Since the Z-11Pro is also fully automatic (meaning they only need RF applied in order to tune), the need for a control cable is minimal. Once you've found a suitable weatherproof container drill holes for the antenna cables and ground only. With internal batteries installed, all one needs to do is apply a small amount of RF to the tuner (I use the AM mode on my radio) and watch the SWR indicator on your radio. When the SWR settles down, you're tuned and can start making contacts.

A similar setup was used by Ric, K5UJU, at a recent Field Day operation. He mounted his LDG tuner to a post, attached a balun and doublet antenna and simply covered the tuner with a plastic bag. With the coax run into their communications bus, he only needed to go to AM and transmit a low powered carrier until the SWR settled. With this arrangement, he was capable of operating on virtually any HF band he chose. — *73, Randy Jones, N7CKJ, PO Box 162, Colville, WA 99114,* **rjones@theofficenet.com**

■ Regarding the watertight plastic container, Walter, KC2KZJ, points out that this would be satisfactory for a daytime event where the temperature did not drop. If this is left sealed during a temperature drop, water condensation would develop inside and damage the tuner. For example, let's say that the container is sealed at 70° F with a dew point of 55° F. If left overnight as the temperature drops to 45° F, the air inside would reach saturation at 55° F and water would be condensing all the way down to the 45° F overnight temperature.

To prevent condensation a desiccant pack should be placed inside the container. This pack works by absorbing the water in the air and lowering the dew point temperature to a very low number, perhaps −10° F. These packs usually contain silica gel and should last several weeks in a sealed container. They can be restored by heating in a slightly warm oven to drive off the absorbed water. See the manufacturer's instructions for the exact recharge temperature. New electronics packed in plastic bags are often packed with a small desiccant pack inside the bag to stop water condensation as a result of temperature excursions during shipping. — *73, Walter Mellish, KC2KZJ, 13 White Oak Dr, Livingston, NJ 07039-1220,* **wmellh@aol.com**

MORE ON THE RECEIVE INDICATOR

♢In the December 2009 Hints and Kinks, George Allen, N1NBQ, mentions that since the receive indicator is designed to interface to a radio where one side of the speaker is grounded, a 1:1 audio isolation transformer is needed to interface to a speaker output that has both sides live.[2] Another solution is to connect the ground of the input to the radio ground and connect the high side of the input to either side of the speaker through a dc blocking capacitor.

The value of this capacitor depends upon the input impedance of what is being connected to the speaker output and how much low frequency response is desired. For Amateur Radio use, driving an 8 Ω device, a 220 µF electrolytic will do. The positive side of this capacitor should go towards the radio output. Do not ground or connect anything else except the speaker to the other side of the radio output. — *73, Mike Kiley, WA9ZPM, 5445 137th Pl, Crestwood, IL 60445-1525,* **wa9zpm@arrl.net**

[2]G. Allen, N1NBQ, "Hints and Kinks," *QST*, Dec 2009, p 51.

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

The New ARRL Web Site has Arrived!

Grab your keyboard and see what the new ARRL Web has to offer.

Katie Glass
ARRL Digital Content Manager

We've completely re-done our online store in the new ARRL Web.

The new Licensing, Education & Training page allows you to get important licensing information and connect with the FCC about rules and regulations.

It has been about two years in the making, but at long last we're throwing the switch on the new ARRL Web site at **www.arrl.org**.

Everyone at Headquarters has been excited about this project. We've been able to streamline several processes—from the online store, to registering for a class, to finding a club and much more. We've made improvements with you in mind, making sure that we've created the easiest, most enjoyable online experience possible.

Take some time to explore each section of the new Web site. You'll no doubt discover that some of the material has been relocated, but we think it's for the better. For example:

■ Now Membership has its own section, where you can manage your membership, update your member profile, connect with other ARRL members and more. Find it at **www.arrl.org/membership**.

■ Licensing, Education & Training allows you the ability to both get important licensing information and connect with the FCC about rules and regulations. Go to **www.arrl.org/licensing-education-training**.

■ In On the Air, you'll see calendars for upcoming events. You'll get contest-specific information both at-a-glance and in detail. Visit **www.arrl.org/on-the-air**.

■ Regulatory & Advocacy has its own section; no longer hidden behind "Services." The link is **www.arrl.org/regulator-advocacy**.

■ Public Service has had several sections added to it, plus there are many pieces of the Public Service section that have been reorganized. See what we've done at **www.arrl.org/public-service**.

■ Get Involved offers several new sections with ways to interact with fellow hams as well as non-hams. There are helpful hints about how to serve in an emergency situation, as well as the new ARRL Donation form. Visit **www.arrl.org/get-involved**.

■ We've completely re-done our online store. Enjoy an easier and quicker check-out experience. Search for more products and periodicals at **www.arrl.org/publications-online-store**.

■ You can now find information about ARRL's sections and divisions in our About ARRL section. Search for your section and if you're an SM or Director, get all of your pages in this section. Look for **www.arrl.org/about-arrl**.

■ News and Features is where you'll get all of your online and *QST* columns, as well as any and all Public Relations information. This is a media-heavy section, with *PowerPoints*, videos and audio files all for you to download. See for yourself at **www.arrl.org/news-features**.

■ Last, but certainly not least, is the Technology section. Here you'll find a more organized listing of all technical subjects. Plus, when you visit **www.arrl.org/technology**, you'll find advanced search features that will help you get the article(s) you're looking for.

I know, the new Web site will take some getting used to. But give it some time. I think you'll learn to love it like I do.

We'll be rolling out even more new features soon. They'll include: a new HQ tour video, Members-only forums, online forms, and much more!

As always, please let us know what you think. Feel free to e-mail me directly, **kglass@arrl.org**, with your questions or comments. Already, from the response to my first column, we've been able to integrate some of your suggestions and questions. QST

Remote Antenna Tuners

Sometimes the best place to put a tuner is at the antenna.

Steve Ford, WB8IMY

In their most basic forms, antenna tuners are little more than variable impedance transformers. They bridge the impedance "gap" between the antenna system and your radio. By adjusting the tuner, you can transform, say, a 100 Ω antenna system impedance to 50 Ω for your transceiver. This transformation is important because your radio is designed to expect a 50 Ω load at its output. An impedance other than 50 Ω manifests itself as an elevated standing wave ratio (SWR). When your radio detects an SWR greater than about 1.5:1, it will usually respond by reducing its output power to protect the power transistors.

If you're like most hams, you're probably accustomed to seeing the antenna tuner at your operating position, often right next to the radio. This is fine, except you need to keep in mind that the flat 1:1 SWR the tuner provides only exists between the tuner and the radio — the SWR between the tuner and the antenna remains unchanged. See Figure 1. Depending on the type of feed line you are using between the tuner and the antenna, a high SWR can result in substantial RF loss (both received and transmitted).

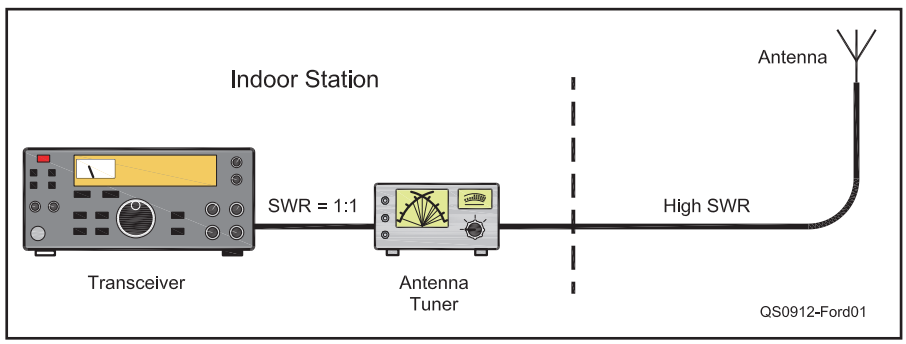

Figure 1 — Although the antenna tuner in your station may provide a 1:1 SWR for your radio, the SWR on the feed line between the tuner and the antenna remains unchanged. Depending on the type of feed line you are using, and the length, you may be losing a lot of received and transmitted RF.

Put the Tuner at the Antenna

There is no reason why the antenna tuner can't be located at the antenna, or very close to it. The advantage is that the 1:1 SWR is now present on the feed line all the way back to your radio. This allows you to use a single feed line at many different frequencies without incurring the RF loss penalty.

But how can you adjust an antenna tuner when it isn't in your station?

A *remote* automatic antenna tuner is designed to make all the tuning adjustments automatically, either when the tuner senses RF power at its input, or when it receives a command signal from the radio. The usual tuner contains an array of inductors and capacitors that are switched in and out of the circuit through small microcomputer-controlled relays. When tuning, the remote tuner "seeks" the lowest SWR possible, typically 2:1 or less, within a matter of seconds.

Some remote tuners are also weatherproof to withstand the elements. All you need to do is connect the tuner to the antenna and provide dc power, either through the feed line using a *power inserter*, or via a separate cable. For example, you could place a remote tuner at the bottom of a 16 foot vertical pipe with the "hot" side of the tuner connected to the pipe and the ground terminal connected to several 16 foot radial wires laying on the soil (see Figure 2). This configuration would probably provide a 1:1 SWR for your radio from 14 to 30 MHz.

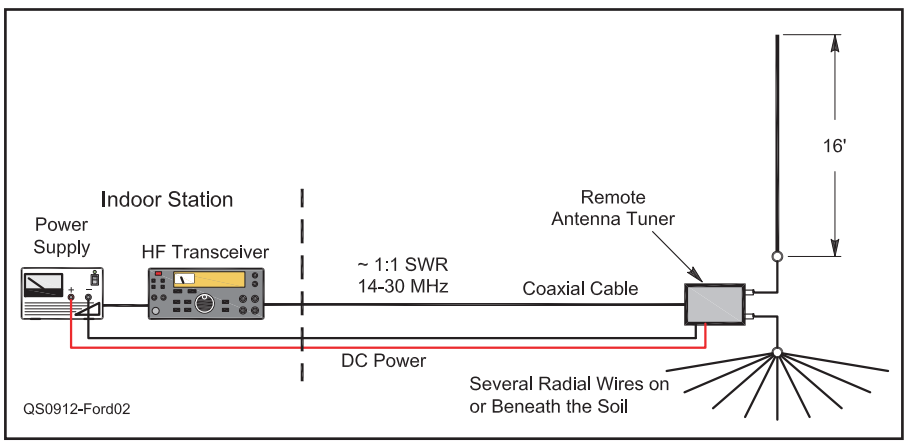

Figure 2 — In this example, a remote antenna tuner at the base of a 16 foot vertical antenna will likely provide a low SWR on all bands between 14 and 30 MHz.

Remote tuners are available from a number of sources. Several of the major transceiver manufacturers provide remote tuners specifically designed for their radios. Other companies such as LDG, MFJ, SGC and Array Solutions offer remote tuners that can be used with any rig.

And don't forget that these flexible devices can also provide multiband operation from your car or boat. If convenience and efficiency are the problems, a remote tuner may be the solution.

Steve Ford, WB8IMY, is the Editor of QST. *You can contact him at* **sford@arrl.org**.

PHYLLIS BENTON, NP2MZ

Amateur Radio in the US Virgin Islands

From a ham standpoint these islands have split personalities. They're American, yet they're also DX!

By Harold Kramer, WJ1B

Hams dream of operating from tropical islands. Basking in the sun, working the pileup, what could be better? I recently took my vacation in the US Virgin Islands and learned a great deal about the unique challenges of island operating.

The US Virgin Islands are located in the Caribbean and consist of three principal islands. St Thomas is the tourist island with a population of about 55,000. A more private island, St John's, has a population of 4300. I stayed in the town of Christiansted on the Island of St Croix, the geographically largest of the islands, with a population of about 53,000. St Croix is known as the "wild," as in "wilderness," Island. My host was ARRL Section Manager John Ellis, NP2B, and I also visited my friends Brian, KP2HC, and Ann, KP2YL, Keegan, all of whom reside in Christiansted. Ann manages the Incoming QSL Bureau and Brian is the ARRL card checker.

On USVI there is the constant threat of storms and hurricanes. Hurricane Hugo devastated St Croix in 1989 with much of the destruction still visible. John's house was destroyed except, miraculously, for the shack. After Hugo, John and his neighbors put his towers back up, fired up the generator and went on the air handling traffic for people on the Island.

John needs a backup generator since the Island suffers from more than occasional power blackouts. Phyllis Benton, NP2MZ, the ARRL's PIO on St John, told me that she knows several hams on the island that depend on solar-fed batteries all the time and have conventional battery backups for emergency purposes. "Backup power is a must when you live in a hurricane-prone area, and where power can go off — not all that often, but sometimes several hours at a clip. Being in the middle of the ocean, far away from most stores, means you need to make do with what you have and at least know the basics about fixing things. Low tech can often work to your advantage when it comes to gear and things need to be dependable. Cans of compressed air and electrical spray for removing volcanic dust that comes from the Montserrat volcano, and for dealing with salt-air corrosion, are worth their weight in gold!"

Brian agrees. "Unless you bring it yourself, or a visiting friend brings it for you, virtually everything you need must be ordered and shipped. This makes you think twice before starting a project or a repair. The salt air can have serious effects on your equipment both indoors and out. The closer you are to the water the more serious the problem it becomes. Because electricity is expensive, few hams have A/C in their shacks to take the moisture out of the air. Regular station maintenance is the only way to prevent untimely problems from taking you off the air," he said.

Above: The photo is a homebrew 20-meter dipole at daybreak, overlooking Coral Bay, St John. Notice the PVC and blue painter's tape — another item that can be used for so much!

I asked Brian what is unique about being a ham in USVI. He said that is always a pleasure meeting visiting hams and showing them around the island. He and Ann also enjoy the camaraderie among hams on the island, including contesters who visit regularly. There are only 50 ARRL members in USVI and Brian told me that licensing new hams is a difficult challenge. The island is small and the economy does not allow most islanders to consider a hobby such as ham radio.

What bands work best? John told me that since it is summer on St Croix 12 months of the year, 40 meters is iffy and 80 meters is limited due to the constantly high noise levels. Working 160 meters is difficult because with few tall trees to support the wires, you cannot get enough antenna height. Seventeen and 20 meters are best and the Europeans come in strong on these bands. "I don't consider us to be in a DX location," John said. "We are only a 3 hour flight from the States; we use the same currency and pay Federal taxes. However, the US Virgin Islands qualifies as a separate DXCC entity and we get a steady stream of QSL cards for award credit."

Phyllis was surprised when longtime contesters and DXers from the States said they wanted her QSL card so they could add another country. "I figured everyone had already had a QSO with the US Virgin Islands. Guess not. Think about it: with a year-round population of about 4000 residents on St John,

HAROLD KRAMER, WJ1B

The home of KP2HC and KP2YL with their 40-meter dipole overlooking the hilly terrain of St Croix.

GARRY FISHER, K9WZB

Sharon Fisher, K7WZB, operating Special Event Station K2V at Radio Reef on St Croix.

a club with 12 active members may seem pretty robust. But not everyone is working HF on a regular basis and propagation can be challenging. The nice thing is that when they do hear me, most people seem eager to talk to someone on a little patch of earth in the middle of the sea. Some have visited the area before; others are planning a trip, or would like to have a DXpedition to the tropics. This is a pleasant location to DX from and it provides a different perspective for stateside hams."

Ann, KP2YL, told me that she creates an SSB pileup almost every time that she goes on the air. She attributes it to good propagation with a great shot across the Atlantic, the KP2 prefix, and being a woman! She and Brian said that while it's fun to run pileups as the DX station, there are times when you just want to chat. Most ops are considerate, but there are some who insist on sending their call several times when you've turned it over to the station that you are in QSO with. This can be very frustrating for the "DX" operator.

QSLing can be time consuming and costly for a station on USVI. Since many of the ops on the Island are not major DXpedition operators, they pay to have their own cards printed and mailed. USVI ops always appreciate a self-addressed stamped envelope with US postage to the States, or an IRC or a *green stamp* (dollar bill) for DX QSLs. The island ops emphasized that stations should look up their QSL information online and follow any special QSL instructions that are listed or given out by the on-air operator.

Antennas in Paradise

Building effective antennas on USVI can be a challenging since the terrain varies considerably. The islands were created by volcanic eruption and there are many hills and valleys. John is lucky. His 35 foot towers have a direct view of the Caribbean and straight shot to Europe since his property is at 135 feet, a high elevation for St Croix. Many operators have signal-blocking mountains behind their houses.

Grounding can also be a problem. According to John, "Much of the islands are rock. One would think that in this idyllic environment, surrounded with salt water, a good ground would be easy to come by. Wrong assumption! I have found that the only things that work for me are balanced antennas because it is difficult, if not impossible, to get a decent ground."

USVI operators confront some of the same antenna issues that we have Stateside. Brian and Ann rent their home and they are prohibited from putting up a tower. They have inconspicuous antennas including an inverted V for 20 meters and a 40 meter dipole mounted on bamboo poles that are only about 15 feet above ground. However, they are also located on top of a rise and have a straight shot to Europe. On St John's, Phyllis also uses dipoles — "one running into the woods, the other on some PVC with one end hanging from a Frangipani tree. They won't win any beauty contests, but they seem to work just fine and they can be taken down easily when storm season comes."

Antenna restrictions are generally not a problem since most ops live in rural areas with mostly dirt roads. I learned that nobody is that concerned about what their neighbors do...up to a point. Most antenna complaints arise from people buying property in view of an existing antenna that they don't like to look at! A few operators noted that neighbors usually feel differently about antennas after a hurricane takes out normal communications and Amateur Radio is the only way of getting word to the outside world.

Emergency Communications

Emergency communications, particularly using digital modes, was on the minds of the dozen folks that I met with from the US Virgin Island Amateur Radio Club on St Thomas. FEMA representatives had previously met with club members and the club is working on their emergency communications plans.

Paul Jordan, NP2JF, President of the St John club's ARES® group, told me that "Emergency communications are important to us here in the Territory. We have agreements with all the local emergency agencies to help them out if needed. We have about 15 hams on island year-round and usually 8 to 12 check into the Virgin Islands Weather Net every morning, including several from Tortola, British Virgin Islands that we consider our international ARES®D members. Tortola and St Thomas are less than a mile apart at the closest point, so we cooperate on an international level in emergencies. We also conduct a daily Virgin Islands weather and traffic net on the St John ARC repeater. Check-ins come from all three of the US Virgin and the British Virgin Islands."

Paul told me that hurricanes have taken down several of the local repeaters, but there is at least one operational 2 meter repeater on each of the three islands. "In an emergency, we use the 2 meter repeater that is still working, usually the St John ARES machine. We try that first, then the repeater output frequency on simplex, and then 146.520 MHz, the national simplex calling frequency." From his home station at 650 feet above sea level, Paul can reach 100 miles east and connect with repeaters in Puerto Rico. "After a hurricane, when everything else has blown away, St John hams can always find a piece of wire on the ground. They'll cut it to the length of a working antenna, throw it into a coconut tree, hook up their personal radio to a car battery and make contacts with FEMA and the National Hurricane Center back in the States."

I also met with 15 members of the St Croix Amateur Radio Club where we had a discussion about boating and Amateur Radio. With the lack of new hams on the Island, they also were interested in the ARRL's educational and public relations initiatives.

Operating on a tropical island has its unique challenges, but I can't wait to return!

Harold Kramer, WJ1B, is the Chief Operating Officer of the ARRL. You can contact him at **hkramer@arrl.org**.

An Appalachian Journey

A different kind of DX — ham radio on the Appalachian Trail.

Dennis Blanchard, K1YPP

Figure 1 — K1YPP standing up high and in the clear on McAfee Knob in Virginia.

Since the early beginnings of Amateur Radio there has been a compelling desire to take the radio equipment into the field. Today, as much as ever, amateurs take their gear to Field Day, public outings, in RVs, automobiles and even motorcycle mobile. In 2007 I decided to hike the Appalachian Trail (AT) and take a low power CW station with me. In addition, I carried a Yaesu, VX1-R handheld transceiver for 2 meter/440 FM. My goals were to carry the radios for the length of the AT, make at least one CW contact from each state and do it all in 1 year. These goals seemed reasonable, yet proved far more difficult than anticipated.

The AT is 2176 miles long and covers 14 states. It traverses mountains, valleys, boreal forests and mucky swamps often during very challenging weather. For this hike I needed a light, compact and durable radio that I could carry in a backpack.

I could not compromise the hiking equipment, food or water for a luxury such as a radio. I decided to homebrew an 80/40 meter low power transceiver. The transmitter generated 1.25 W. The receiver section was based on the transceiver designed by Roy Lewallen, W7EL, with modifications for 80 meters.[1] A battery pack of 8 lithium AA batteries supplied power for the radio, my cell phone and the VX1-R. The antenna consisted of two pieces of ¼ λ resonant wire, one to throw up into a tree, the other to act as a counterpoise, eliminating the need for an antenna tuner. My goal was to have the radio, key and antenna weigh less than 3 pounds and it was just over that (without the batteries).

Georgia

The trail starts at Springer Mountain in northern Georgia. Northern Georgia means serious mountains. I found myself surprisingly exhausted for the first few days. I didn't have the energy to put up an antenna until the third day at the hiker hostel in Neels Gap. There was a picnic table behind the hostel where I set up the station. I persevered for 2 hours without making a contact. I heard dozens of folks calling CQ but they were not hearing my answer. Obviously something was amiss. Since it was getting late, I admitted defeat and packed up the gear.

On day five, I investigated and realized that the receiver offset tuning knob had somehow shifted considerably from where it was supposed to be. Subsequently, my transmit frequency was many kilohertz from the receive frequency, thus explaining the lack of communications. I reset it and almost immediately made contact with Jim, W2VEC, in Tennessee and then with Rich, WA1SKQ, in Cranston, Rhode Island. I was elated that things were working at last. I wasn't too far from leaving Georgia and was in danger of not meeting my goal of contacts from each state.

North Carolina/Tennessee

I didn't operate again until day 25, near Hot Springs, North Carolina. The demands of hiking every day and setting up and tearing down camp overwhelmed any desire to put the station on the air. I was staying at a hiker hostel and decided to take a "Zero Day" (hiker parlance for a day with zero hiking miles). It was a beautiful Saturday morning. I hiked a few miles to a high spot on the trail. Forty meters was alive and I had no trouble making many contacts, among them N8RGF and W9IND. Since I was sitting right on the state border, I counted one contact for North Carolina, the other for Tennessee. They both took the time to chat with me a bit and it felt wonderful to know that everything was working so well.

Virginia

Damascus, Virginia is a real outdoors town, the entire economy seems to center around AT hikers. Similar to what I did in Hot Springs, I hiked back up the AT to a high spot. It was Sunday morning of the ARRL Field Day weekend. I had many things to do that day, so I only operated for about an hour, but the equipment was working fine and I made a number of contacts. On my hike back to town I realized that I didn't want to count those contest contacts for Virginia since my goal was to have actual CW conversations

[1]R. W. Lewallen, W7EL, "An Optimized QRP Transceiver," *QST*, Aug 1980, pp 14-19.

Figure 2 — My "shack" for my 2008 Field Day contacts near Duncannon, Pennsylvania.

along the trail. Virginia has 525 miles of the AT (see Figure 1) so there would be other opportunities.

At this point I was starting to have occasional chest pains. When I arrived in Pearisburg, Virginia, I decided to go home to Sarasota, Florida. As soon as the doctors looked at me, they put me into surgery for a six-artery heart bypass!

By May 2008 my cardiologist let me go back to the trail in Pearisburg, Virginia. A friend offered me an AT Sprint 3A (ATS-3A) four band radio. The radio is a kit, designed by another AT hiker Steve Weber, KD1JV. (Farther up the trail, in Maine, I had the pleasure of hiking with Steve for a few days). It fits in an Altoids tin, weighs 7 ounces and takes up almost no space compared to my homebrewed radio. I also changed antennas. I switched to a 51 foot random wire with a series L tuner, with a 15 foot counterpoise. The new antenna allowed me to conveniently utilize the four band capability of the ATS-3A.

At Daleville, Virginia I made several wonderful CW contacts. The new radio was working well. One afternoon I followed a side trail to a scenic vista below which, in a parking area on the Blue Ridge Parkway, I spotted a pickup truck with an antenna farm, obviously Amateur Radio. I climbed down the rocky cliff and went over to the vehicle and said hello. It was K4GUN, operating the June VHF contest. I wasn't even aware it was a contest weekend. We said our hellos; I climbed back up the hill then put my VX1-R on the air and gave him contacts on 2 meters and 440 MHz. The signal reports were quite impressive.

West Virginia

West Virginia only has about 4 miles of the AT most of which is in the town of Harpers Ferry. West Virginia is the psychological halfway point for northbound AT hikers since this is where the AT Conservancy (sort of a "hikers" ARRL) has its headquarters.

John, N3NFO, works at the Conservancy front desk. I showed him the ATS-3A and he was so impressed with it he took a few photos for possible future coverage in their journal, *AT Journeys*. He also advised me to stop at their Boiling Springs, Pennsylvania office and look for WA3KCP.

I got on the air behind my motel and while operating had several deer stop by. I had to chase them away when they tried to chew on my counterpoise. Even though the location was down in a valley, next to the river, surrounded on all sides by mountains, I managed to make two contacts, though the signal reports were weak.

Maryland

My operation from Maryland was from another RF "hole." I did manage two contacts, but it was rough going. A number of hikers were sitting around watching me and were fascinated that I could communicate with another station hundreds of miles away with a "mint tin" and a piece of wire in a tree.

Pennsylvania

I stopped at the ATC regional office in Boiling Springs and met John, WA3KCP. I showed him the portable station I was carrying and he set up a schedule with me for that evening. We managed to find each other on 40 meters and I worked several others as well. This ATS-3A was proving to be quite the radio.

Field Day 2008 arrived when I was at Duncannon, Pennsylvania. Basically I repeated last year's exercise and hiked south to a place called Hawk Rock and operated the contest (see Figure 2). Rain threatened for a while, but then the sun came out and it was a glorious day. Conditions were very favorable and I had no trouble filling a page of my log with contacts. The antenna wire was only a few feet above the ground, hung from a tree limb, and the counterpoise was a 15 foot of wire. Altitude and good location can really make the difference with low power and a mediocre antenna.

New Jersey

Many do not realize that the AT goes through New Jersey. I camped at the High Point Shelter, which is very near the highest point in the state — a great radio location. I set up on the picnic table and made several 40 meter contacts. I kept an eye on the woods around the shelter; a black bear kept spying on me. As soon as I left the shelter I could see it looking around for food.

New York

I camped at the Morgan Stewart campsite, the last one in New York. Try as I might, I couldn't make contact. I tried unsuccessfully for over an hour. It was obviously a transmitter problem. I didn't realize that the batteries were so low that minutes after tuning up, they didn't have enough power left to run the transmitter, yet the receiver was still working fine.

The next morning I still needed to make the New York contacts, so I changed the batteries and immediately made contact with Jerry, K1HKF, in Falmouth, Massachusetts.

Connecticut

I was born and raised in Connecticut and was thrilled to be passing through this state again. I camped near Salisbury at Silver Hill, a great location. Unfortunately, for some inexplicable reason, I had great difficulty making any contacts that evening. I finally did work KC4KNN, Weaverville,

The AT on the Internet

Appalachian Trail Conservancy:
www.appalachiantrail.org

K1YPP Trail Journal:
www.trailjournals.com/k1ypp

Appalachian Trail 2 Meter Repeater Guide:
www.fred.net/kathy/at/hamguide.html

KD1JV Designs
(source for the AT Sprint Transceiver):
kd1jv.qrpradio.com

Appalachian Trail Amateur Radio Award:
www.n3epa.org/Pages/AT/AT.htm

North Carolina, but the signals were weak so we kept it short.

Massachusetts

Murphy was to stick with me for a while. Near Mount Greylock, the highest peak in Massachusetts, I stopped around noon at the Mark Noepel shelter. It was only a few more miles to Mt Greylock but the weather looked threatening. I quickly put up the antenna and set up my station at the shelter. It started to rain very hard. Unfortunately, right then a number of young through hikers showed up. I tried to operate but it proved impossible since they had a portable CD player. The CD player combined with the noise from the rain made it impossible to hear the receiver. My friends finally left and I made contact with Lou, WB2AAI, in Sandy Ridge, Pennsylvania.

Vermont

Finally, I left Murphy behind. At Quimby Mountain in Vermont I had a solid, 25 minute contact with Bob, K2OGT. He was only a few hundred miles away in Long Island, New York but after the poor conditions I had been having recently, it was a thrill.

New Hampshire

At Dartmouth College, in Hanover I set up on a park bench on the quad. The antenna situation was less than optimum as there were college students everywhere enjoying the sunny weekend afternoon. I didn't want to hit anyone throwing a heavy object into the trees to hang the antenna, so I just hung it on some of the lower limbs, not too far over my head.

I struggled for a while to make a contact, but Kevin, KE3V, a really sharp operator found my weak signal. I think I could have banged two sticks together and he would have heard me.

All along the AT there are people known as "Trail Angels" who offer a helping hand to hikers. In central New Hampshire Kathy, KD2VX, was just such a Trail Angel (see Figure 3). She had written me when I started the hike the previous year and offered her assistance. Kathy has hiked the entire Maine section of the AT and is no stranger to how tough things are on the trail.

Figure 3 — Kathy, KD2VX, an AT "Trail Angel" who assisted K1YPP in the North Woodstock, New Hampshire area.

Figure 4 — K1YPP finishes his hike at the summit of Mt Katahdin in Maine on October 1, 2008. The weather was cold with heavy rain and winds of 60 mi/h.

I contacted her when I was in the White Mountains and she offered to pick me and two others up and take us to North Woodstock for resupply. She showed up at the Route 112 Kinsman Notch parking lot wearing her "QRP: Power is no substitute for skill" T-shirt. I'm certain my two friends were a bit confused by our constant conversations about low power operation, antennas and general ham jargon.

Maine

I cheated a bit in Maine. Rather than carry the radio across the whole state, I mailed it ahead to Millinocket. Maine is undoubtedly the toughest segment of the whole AT. One section of the trail runs through the "100 Mile Wilderness" and I needed to carry all the food I could, so I made room by not carrying the radio. In retrospect I didn't use all my provisions so I could have carried it. Signs warn hikers to carry enough food for 10 days, but I made it through there in 5½ days.

I fired up the ATS-3A at the campground at the foot of Mount Katahdin, the trail terminus (see Figure 4). As soon as I turned it on, I heard Mike, AA9AA, sign his call twice. I wasn't certain if he had called CQ but gambled he did and called him. He immediately replied and we had a fine contact. My CW sending was awful, I was shivering, my hands were freezing and it was tough forming the characters, but Mike did a great job of copying me. He was another of those outstanding operators who seem to have super ears.

Florida

I returned to Florida just as winter is setting in up in Maine. Although I didn't meet all of my original goals, I am quite satisfied with my hike. I didn't finish it all in 1 year; the heart surgery added a few months to the overall hike. I did operate CW from the trail in all 14 states the AT traverses and, as a bonus, operated Field Day on two occasions. Above all else, I absolutely enjoyed having the radio along. Today's technology has shrunk radios to the point where they can be carried long distances and still prove to be an effective communications system.

I rarely used the VHF FM radio; my original intention was to have it along for emergency communications. There are long sections of the trail where there is no cell phone coverage and I was usually able to hear a repeater from just about everywhere on the trail.

Would I do it again? Probably not. Once is enough, and there are still too many other things I haven't done. Six months spent walking in the woods is a major commitment and beyond the reach of most people. Do I recommend bringing along Amateur Radio? Certainly. I do highly recommend taking your low power gear along on shorter hikes. Taking your radio into the field today is as much fun as ever.

All photos by Dennis Blanchard, K1YPP.

Dennis Blanchard, K1YPP, a Life Member of the ARRL, was licensed in 1962 at the age of 15 and now holds an Extra class license. His interest in radio led him to a career in Electrical Engineering designing modems for Digital Equipment Corporation and Cisco Systems until his recent retirement. He is married to Jane, KA1FUN, and has a daughter Aine, K1ZEO, and a son.

Dennis enjoys low power CW operation as well as PSK31. He likes to combine Amateur Radio with his other outdoor interests, bicycling and hiking. Dennis can be reached at 2940 Yorktown St, Sarasota, FL 34231-6138, **k1ypp@arrl.net**.

The ARRL Lab

Harold Kramer, WJ1B

Amateur Radio is a technical avocation. The ARRL Laboratory, in one form or another, has been a component of the ARRL and integral to its mission since the 1920s. The Lab provides technical services that are essential to the ARRL and its members.

The heart of the ARRL Lab is its staff of five. Overseeing the Lab's operations is Lab Manager Ed Hare, W1RFI. Senior Lab Engineer Zack Lau, W1VT, specializes in supporting members through the Technical Information Service (TIS); Lab Engineer Mike Gruber, W1MG, specializes in RFI issues; Lab Engineer Bob Allison, WB1GCM, is in charge of conducting Product Reviews and testing, and Lab Assistant Tony Nesta, AA1RZ, supports all Lab functions.

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Zack Lau, W1VT, Bob Allison, WB1GCM, and Mike Gruber, W1MG, in the "cage," an RF shielded area where products can be tested without interference from outside signals.

Serving the Members

First and foremost, the Lab provides the TIS service for our members. Large portions of the Lab's resources are devoted to answering member questions submitted through the TIS, which receives about 500 inquiries per month. TIS activities include: answering member technical questions, fulfilling requests for article reprints, soliciting and training outside volunteers to maintain specific TIS Web pages, supporting ARRL software products, helping members use ARRL's online resources and being the ARRL's technical presence at various Amateur Radio events.

QST's Product Reviews are one of its most read columns and the Lab does all of the *QST* Product Review testing. In 2009, they reviewed 23 Amateur Radio products for publication. To assure both the accuracy and integrity of the testing process, the Lab maintains long term records of equipment tested and keeps the test equipment and facilities in proper repair and calibration. They also document the test methods used in the ARRL testing program and update the Test Procedures Manual to reflect any new or revised test procedures. As a natural extension of product testing the Lab serves as a technical interface between the ARRL and equipment manufacturers.

Along with Product Reviews, the Lab staff performs product testing and compliance evaluation for Amateur Radio equipment prior to accepting manufacturer advertising and they provide technical support to the ARRL Business Services (advertising) department. They also provide valuable input to *QST* and ARRL book authors and editors on technical matters.

Another of the Lab's responsibilities is handling RFI issues. In 2009, Lab Engineer Mike Gruber dealt with over 1000 RFI related e-mails. For our members, the Lab provides ongoing support in resolving interference problems, conducts field investigations of RFI occurrences and maintains technical membership contacts to help resolve Electromagnetic Compatibility (EMC) issues.

Serving Ham Radio

Beyond direct member services, the Lab is deeply involved in many legal and regulatory issues affecting ham radio as a whole. It provides extensive support for the ARRL Technical Relations Office, General Counsel and internal ARRL departments in the form of technical research, technical analysis, reports and electronic testing. In recent years, the Lab has provided technical support for BPL issues, maintained contact with hams in local BPL trial areas and participated in industry and professional society discussions about BPL interference and standards.

Industry and Regulatory Agency liaison is another of the Lab's responsibilities. The Lab works with the FCC and other governmental and regulatory agencies on Amateur Radio technical compliance issues. Members of the Lab staff also serve on industry committees such as the IEEE Standards Coordinating Committee 28 (RF safety); IEEE P1775 BPL EMC Standards Working Group; IEEE EMC Society Standards Development Committee and others. Lab staff also represents Amateur Radio at the industry standards committees of organizations such as the IEEE, ANSI and The International Special Committee on Radio Interference (CISPR).

Within the electronics/RF industry the Lab has worked with the IEEE on the creation of an IEEE Recommended Practice for the resolution of power line noise and they participate in the IEEE Working Group in developing the standard. The Lab also acts as a liaison to the FCC enforcement division on power line noise complaints.

The Lab supplies essential support to the ARRL's advocacy objectives related to EMC issues. They conduct electronic design, research and development in support of ARRL objectives related to EMC; perform electronic testing primarily focused on EMC measurements; perform technical reviews of ARRL EMC material for ARRL publications, and maintain records of Amateur Radio EMC cases.

Serving the League

The Lab Manager is the Trustee for W1HQ, the ARRL Headquarters club station. W1HQ serves as the Lab's test station for equipment evaluations and the Lab staff is responsible for maintaining W1HQ in good working order. They provide technical services such as evaluating and refurbishing equipment for the annual ARRL online auction, acting as a liaison to ARRL Board committees on technical matters and maintaining the ARRL's in-house library.

The ARRL's Lab provides a multifaceted range of technical support services for the ARRL, its members and for Amateur Radio overall.

Harold Kramer, WJ1B, is ARRL Chief Operating Officer. He can be reached at **wj1b@arrl.org**.

2009 Sees Surge of New Amateur Radio Licensees

This past year was a banner year for new Amateur Radio licensees. According to ARRL VEC Manager Maria Somma, AB1FM, the FCC issued more than 30,000 new ham radio licenses. "In 2009, the demand for Amateur Radio exam sessions remained elevated and is still running at a higher rate than before the FCC's restructuring of the license requirements in 2007," Somma said. "This high level of exam session activity has produced an elevated influx of new applications, far outpacing recent years."

A total of 30,144 new licenses were granted in 2009, an increase of almost 7.5 percent from 2008. In 2005, 16,368 new hams joined Amateur Radio's ranks; just five years later, that number had increased by almost 14,000 — a whopping 84 percent!

"When looking at the statistics over the last 10 years, these are the highest numbers we've seen," Somma explained. "Additionally, our total number of licensees across all three classes has grown each year." Currently there are 682,500 licensed Amateur Radio operators in the US, an almost 3 percent rise over 2008. In 2008, there were 663,500 licensed amateurs; there were 655,800 in 2007. Broken down by license class, at the end of 2009 there were 17,084 Novices, 334,245 Technicians, 150,970 Generals, 60,795 Advanced and 119,403 Amateur Extra licensees.

NEW FCC LICENSES ISSUED 2005 THROUGH 2009					
Year	2005	2006	2007	2008	2009
Jan	876	1,274	1,647	1,755	1,960
Feb	1,357	1,605	2,435	2,998	2,263
Mar	1,705	2,531	3,478	2,816	3,463
Apr	1,486	1,728	2,673	3,090	3,430
May	1,651	2,283	2,607	2,562	2,717
Jun	1,493	1,967	2,281	2,402	3,011
Jul	906	1,401	1,786	2,077	2,220
Aug	1,500	1,623	2,183	2,084	2,102
Sep	1,139	1,357	1,462	1,763	2,116
Oct	1,385	1,781	2,109	2,303	2,404
Nov	1,540	1,993	2,132	2,197	2,344
Dec	1,330	1,569	1,935	2,019	2,114
Totals	16,368	21,112	26,728	28,066	30,144

In 2009, the FCC issued more than 30,000 new Amateur Radio licenses — a 7.4 percent increase in the number of new licenses issued in 2008. At the end of 2009, there were 17,084 Novices, 334,245 Technicians, 150,970 Generals, 60,795 Advanced and 119,403 Amateur Extra class licensees.

"The ARRL VEC has been busy meeting the needs of the Amateur Radio community by helping people to become radio amateurs or upgrade their existing licenses," Somma said. "In 2009, ARRL VEs administered 44,595 exam elements at 6369 ARRL VEC-sponsored exam sessions. The number of amateurs who want to be Volunteer Examiners and who want to teach Amateur Radio classes is also going up — we've seen a spike in the number of applications from General and Extra class radio amateurs who want to give back to their community by serving as ARRL examiners and instructors."

Somma applauded all the volunteers whose "hard work and contribution of countless hours of time helps to ensure the future of Amateur Radio. The ARRL VEC thanks our 32,411 VEs from around the world whose dedication and service helped to contribute to the success of Amateur Radio. I am delighted by these important achievements. 2009 was a very good year for Amateur Radio and I am excited by the promise of 2010."

WHITE HOUSE NAMES HAM AS NEW CYBERSECURITY COORDINATOR

On December 22, President Barack Obama named Howard A. Schmidt, W7HAS, as the new White House Cybersecurity Coordinator. According to the White House, Schmidt — an ARRL member — is one of the world's leading authorities on computer security, with some 40 years of experience in government, business and law enforcement and "will have regular access to the President and serve as a key member of his National Security Staff. He will also work closely with [President Obama's] economic team to ensure that our cybersecurity efforts keep the nation secure and prosperous."

OFFICIAL WHITE HOUSE PHOTO

President Barack Obama greets White House Cybersecurity Chief Howard A. Schmidt, W7HAS, in the Cross Hall of the White House on December 17, 2009.

In a 2003 interview with *The New Atlantis* magazine, Schmidt described cybersecurity as "the realization that computer systems affect our basic needs on a daily basis. Electricity, water, telephone —

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these things are all run by computers, and my job is to work with owners and operators and government agencies to make sure that they continue to function properly and are not disrupted because of security events that then, in turn, affect our daily lives."

In an exclusive interview with the ARRL, Schmidt said that he credits Amateur Radio with getting him involved with technology: "In high school, one of my friends was a ham and he got me interested in shortwave radio, which in turn got me into building shortwave radios and equipment, many from Heathkit. As I got older, I took courses in electronics and built a number of projects, preparing me for my first ham radio ticket. I love technology, and it was Amateur Radio that caused me to build my first computer — a Sinclair ZX-80 to use for EME calculations. I studied all about the OSCAR systems and would build equipment to monitor when they would pass within range of Arizona. Building these computers to support my ham radio hobby gave me the technical skills that I needed to start doing computer crime investigations and work on the early stages of computer forensics, in turn enabling me to start working on cybersecurity issues."

Schmidt is no stranger to the White House — he served as a cyber-adviser in President George W. Bush's White House. After the 9/11 attacks, President Bush appointed Schmidt as the Vice Chairman of the President's Critical Infrastructure Protection Board and as the Special Adviser for Cyberspace Security for the White House. While at the White House, he assisted in the creation of the US National Strategy to Secure Cyberspace, becoming Chairman in January 2003. In May 2003, Schmidt retired from the White House after 31 years of public service in local and federal government and joined the online auction site eBay as their Vice President and Chief Information Security Officer and Chief Security Strategist.

Schmidt said that as with many other things, his love for Amateur Radio took a back seat to work, family and life in general: "While I got rid of all of my RTTY equipment back in the early 90s, I have continued to follow all of the great advances of ham radio." He said that only just recently, he got back into the hobby. Now that Schmidt has rediscovered how much fun Amateur Radio can be, he has no plans to let his enjoyment pass him by again. "I have my multi-band handheld transceiver next to my suitcase to take back to DC with me," he told the ARRL. "I hope to set up a station once I get settled. I do not plan on letting any more years slip by and not enjoying this great hobby."

GET READY FOR THE 2010 ARRL TEACHERS INSTITUTES

The ARRL Teachers Institute (TI) on Wireless Technology continues to evolve and expand. Seven TIs are planned for 2010, providing in-service training opportunities for 80 teachers. This year, two "graduate level" Teachers Institutes covering space technology and basic electronics in more detail have been added.

According to ARRL Education & Technology Program Coordinator Mark Spencer, WA8SME, the TIs have become an integral part of the resources made available to teachers and schools through the ARRL's Education & Technology Program (ETP). Totally supported by generous donations from the Amateur Radio community, the Teachers Institute is a 4 day intensive, in-residence learning opportunity designed for motivated teachers and other school staff who want to learn more about wireless technology. A typical agenda for the training includes learning, and learning how to teach, basic electronics and the art and science of radio. On the air activities include radio direction finding, satellite contacts that bring space technology directly into the classroom through radio, an introduction to microcontroller programming and the basics of robotics, and just enjoying ham radio operation.

"We believe it is increasingly important for today's education to include a foundation in wireless technology," Spencer explained. "The goal of the TI is to provide teachers with the skills and resources they need to learn more about wireless technology so that they can bring the concepts to their students in their classrooms." Participating teachers can use the TI to fulfill their continuing professional education requirements needed to maintain their teaching credentials and they can receive 3 hours of graduate level college credit.

S. KHRYSTYNE KEANE, K1SFA

On the third day of the Teachers Institute, participants venture outside to discuss radio astronomy and to make a satellite contact. Mark Spencer, WA8SME (right), demonstrates that the teachers can build an inexpensive radio telescope using a satellite TV dish.

In 2010, there will be five TI sessions: May 24-27 at the New Mexico Military Institute in Roswell, New Mexico; June 14-17 at Walhalla High School in Walhalla, South Carolina; June 21-24 at Parallax, Inc in Rocklin, California, and July 19-22 at ARRL Headquarters in Newington, Connecticut. There will also be a session in February for Tucson (Arizona) Unified School District personnel. In addition to the regular TI sessions, the ARRL will be offering two TI2 sessions. One will focus on space and be held in Dayton, Ohio; it is sponsored by the Dayton Amateur Radio Association (DARA). The other will be held at ARRL Headquarters and will focus on basic electronics. Educators who attend these sessions must have previously attended a regular TI session. Registration for the Roswell and Walhalla sessions closes on April 15, while participants desiring the other sessions have until May 15 to register.

If you are a teacher, or you know a teacher who could benefit from the experience, I encourage you to check into the Teachers Institute. The dates, locations, and application for this year's TIs can be found on the ARRL Web page at **www.arrl.org/ti**. If you want additional information, you can contact Mark Spencer, WA8SME, the ARRL Education & Technology Program Coordinator (and TI instructor) at 530-495-9150 (Pacific Time Zone) or at **mspencer@arrl.org**.

MARS GETS NEW NAME AS IT FINE TUNES MISSION

On December 23, the Department of Defense (DoD) issued an *Instruction* concerning MARS, effective immediately. This *Instruction* gives the three MARS services — Army, Air Force and Navy/Marine Corps — a new focus on homeland security and a new name: Military *Auxiliary* Radio System, changing the name from Military *Affiliate* Radio System. The *Instruction* is the first major revision to MARS since January 26, 1988 — as such, the first revision since the 9/11 attacks and Hurricane Katrina, two major events that changed the way Amateur Radio dealt with emergency communications.

In the past, MARS had focused primarily on emergency communications and health

and welfare support. The DoD's *Instruction* now directs the three MARS services to provide what it calls "contingency radio communications" to support US government operations, DoD components and "civil authorities at all levels," providing for national security and emergency preparedness events. MARS units will still continue to provide health and welfare communications support "to military members, civilian employees and contractors of DoD Components, and civil agency employees and contractors, when in remote or isolated areas, in contingencies or whenever appropriate." MARS must also be capable of operation in "radio only" modes — without landlines or the Internet — and sustainable on emergency power (when public utility power has failed); some MARS stations must be transportable for timely deployment.

The Secretaries of the Army, Air Force and Navy are to encourage participation in MARS, the *Instruction* states, saying this may be accomplished "by establishing and funding an active MARS program within each Military Department, which shall then assign a MARS-licensed staff representative to manage operations, readiness, planning, procedural and technical development, documentation, standards, training, equipment, program and membership administration, and other matters necessary for mission accomplishment." The Secretaries are also tasked with bringing new personnel into their MARS services; the *Instruction* calls on them to establish programs "to promote civilian interest, recruit qualified volunteers, sponsor them for basic background checks and furnish them suitable training in contingency support communications."

Membership in any of the three MARS services is open to qualified active duty, Guard and Reserve personnel, as well as those in civilian agencies who report to civil authorities or their supporting organizations (including nongovernmental organizations) and private US citizens who meet age, education and other criteria — such as an FCC-issued Amateur Radio license — imposed by a DoD Component MARS office.

In Brief

● **First Chinese Amateur Radio Satellite Now in Space**: AMSAT China (CAMSAT) reports that at around 0230 UTC on December 15, China launched its first Amateur Radio satellite — named XW-1 — into space; on December 21, it received OSCAR designation Hope-OSCAR 68, or HO-68. The microsatellite — a secondary payload aboard the CZ-4C rocket launched from the Taiyuan Satellite Launch Center — was launched into a Sun-synchronous orbit with an apogee of approximately 1200 kilometers. XW-1 successfully reached orbit at 0253 UTC. "Amateur Radio Operators around the world have received beacon signals from XW-1," said AMSAT-NA OSCAR Number Coordinator Bill Tynan, W3XO. "XW-1 has been coordinated through IARU Amateur Satellite Frequency Coordination Panel. As XW in Chinese means 'hope,' it had been requested that this word be used as the prefix for the new OSCAR number. Therefore, with the above information and the authority vested in me by the AMSAT-NA President, I hereby designate this latest Amateur Radio satellite as Hope OSCAR 68 or HO-68." HO-68's communications payload includes a beacon and three crossband transponders operating in FM, SSB/CW and digital modes.

● **NCVEC Releases New Technician Class Question Pool**: The Question Pool Committee (QPC) of the National Conference of Volunteer Examiner Coordinators (NCVEC) released the new Technician class (Element 2) question pool on January 4. This new question pool will become effective for all examinations administered on or after July 1, 2010 and will remain valid until June 30, 2014. The current Technician question pool that became effective July 1, 2006 will expire June 30, 2010. The new Technician pool contains approximately 400 questions, from which 35 are selected for an Element 2 examination; it will contain graphics and diagrams, something new for this element. The current General class question pool was effective July 1, 2007 and is valid through June 30, 2011. The current Amateur Extra class pool was effective July 1, 2008 and is valid until June 30, 2012. You can find the new Technician question pool on the NCVEC Web site (**www.ncvec.org/page.php?id=356**).

● **Last Surviving Crew Member of *Kon-Tiki* Expedition Passes Away**: Knut Magne Haugland of Norway passed away on December 25. He was 92. Haugland was one of five men, who with Thor Heyerdahl in 1947, successfully crossed the Pacific Ocean in a 45 foot raft made of balsa wood and bamboo — named *Kon-Tiki* — to prove that people from South America could have settled Polynesia in pre-Columbian times. Heyerdahl and his companions sailed the raft for 101 days more than 4300 miles across the Pacific Ocean before smashing into a reef in the Tuamotu Islands on August 7, 1947. The expedition used call sign LI2B and carried three watertight radio transmitters: the first operated on the 40 and 20 meters, the second on 10 meters and the third on 6 meters. Each unit was made up entirely of 2E30 vacuum tubes providing 10 W of RF input. As an emergency backup, they also carried a German Mark V transceiver originally re-created by Britain's Special Operations Executive in 1942. Other equipment included a hand-cranked emergency set of the Gibson Girl type for use on the maritime bands, a special VHF set for contacting aircraft and two British Mark II transmitters. The *Kon-Tiki* also carried a National Radio Company NC-173 receiver. Dry batteries and a hand-cranked generator supplied the power. Haugland was also a member of the Norwegian Resistance during World War II. Read more about his life at **www.arrl.org/news/stories/2009/12/28/11269/?nc=1**.

COURTESY *KON-TIKI* MUSEUM

Knut Haugland and Torstein Raaby work the radios onboard the *Kon-Tiki*.

Message Handling — the ORS and the Brass Pounders' League

Warren Rothberg, W4WR, Assistant Section Manager and Official Emergency Station in the Southern Florida Section
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"Several ARRL Field Organization appointments have a role to play in emergency and public service communications. This series of column articles intends to highlight the resilient nature of the ARRL Field Organization and how it maintains its readiness to respond. — Ed."

At one time or another, an Amateur Radio operator is exposed to the National Traffic System (NTS) usually through the handling of radiograms. That exposure might be at a county fair, the ARRL club booth at a public display or just by tuning in to listen to a local VHF traffic net. The ARRL was founded based on the need to relay messages (thus our name). Spark gap transmitters were not known to cover great distances. So, the League's founding president, Hiram Percy Maxim, devised a method of passing "message traffic" by relays. If you are lucky enough to become a traffic net member, you are carrying on a century old tradition.

Perhaps most radio amateurs don't even know that handling message traffic can lead to one of the most prestigious awards the ARRL can bestow. Long before a radio amateur qualifies for any traffic handling award, he or she usually obtains an appointment (based on the Section Manager's or Section Traffic Manager's recommendation) as an ARRL Official Relay Station (ORS). (You get to wear a neat call sign and name badge too.)

The Official Relay Station

The appointment as an ORS signifies that the radio amateur has achieved a superior level of proficiency and commitment through being involved in National Traffic System nets on a regular and continuing basis.

From the ARRL Web site: "[The ORS appointment] is for traffic-handlers, regardless of mode employed or part of the spectrum used.

"The potential value to his country and community of the skilled operator with traffic know-how is enhanced by his readiness to function in the community interest in case of emergency. Traffic awareness and experience are often the signs by which experienced amateurs may be distinguished."

STEVE EWALD, WV1X

The Brass Pounders' League medallion is a onetime award available to licensed radio amateurs who achieve Brass Pounders' League status for 3 months.

Traditionally, there have been considerable differences between procedures for traffic handling by CW, phone, RTTY, digital, packet and other modes. Appointment requirements for ORS do not deal with these, but with factors equally applicable to all modes. The appointed ORS may confine activities to one mode or one part of the spectrum if he or she wishes. There is no versatility requirement, although versatility does indeed make it possible for anyone to perform a more complete public service.

There is the expectation that the ORS will set a high standard in traffic handling, regardless of how it is done. An ORS cannot be deficient in any aspect of traffic handling as it applies to any method used.

The ORS — What It Takes.

The basic requirements to become an ORS are:

- Full ARRL membership and Novice class license or higher. [In other words, any class of Amateur Radio license is acceptable.]
- Transmissions, by whatever mode, must be of the highest quality, both technically and operationally. For example, CW signals must be pure, chirpless, clickless and code sending must be well spaced and properly formed. Voice transmission must be of proper modulation percentage or deviation, precisely enunciated with minimum distortion.
- All ORSs are expected to follow standard ARRL operating practices (message form, ending signals, abbreviations or prowords, etc).
- Regular participation in traffic activities, either independent or ARRL sponsored. The latter is encouraged, but not required.
- Handle all record communications with speed and reliability, setting an example in efficient operating procedures. All traffic is relayed or delivered promptly after receipt.
- Report monthly to the STM, including a breakdown of traffic handled during the past calendar month.

An "announcement" on a local club net, for example, does not qualify as formal

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traffic. In addition to the ARRL requirements, some sections may have additional requirements that go beyond what is required by the League.

Earning the Official Relay Station appointment is, in itself, a great honor. It demonstrates your ability to handle all kinds of traffic on one or many modes with a high degree of professionalism representing the "best of the best" in the NTS organization.

Brass Pounders' League

Having achieved the level of proficiency that entitles you to the Official Relay Station appointment, the NTS program goes one more step to issue one of the most prestigious awards available for the traffic handler: A Brass Pounders' League medallion.

The Brass Pounders' League medallion is a onetime award available to licensed radio amateurs who achieve Brass Pounders' League status for 3 months.

The Brass Pounders' League is open to all amateurs in the US, its possessions and Canada who report to their Section Managers 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.

A description of how an individual radio amateur should properly count traffic handling points (for his or her monthly station activity report and also for the monthly Brass Pounders' League credit) may be found in the *Public Service Communications Manual* (**www.arrl.org/FandES/field/pscm**). In general, originating (taking the message from your next door neighbor, for example), sending, receiving (passing the message on a traffic net) and delivery (calling the recipient of the message and briefly explaining who you are and why you are calling) each earn one point. Also keep in mind that there are certain times of the year when it's easier to achieve this many message points — like the holidays or Mother's Day, etc.

I should mention that the first thing you should do when delivering a message is to assure the recipient that this is just a greeting or congratulations via Amateur Radio or whatever might apply. Be sure you put the recipient at ease upon making this public contact.

Achieving those 500 points or a combined 100 origination and delivery points in any calendar month — and doing it for 3 months — is no small task. That is why the Brass Pounders' League medallion is an achievement to be proud of.

Amateur Radio operators who qualify for the Brass Pounders' League each calendar month are recognized in the "Field Organization Reports" column in *QST*. My Brass Pounders League medallion is one of my most treasured awards.

STMs ORGANIZE AND MANAGE TRAFFIC FLOW

Steve Ewald, WV1X,
Public Service Specialist

An Amateur Radio operator's ability to handle messages accurately comes in handy during daily operations and an emergency situation certainly amplifies the need for these skills. The ARRL Field Organization is designed to help radio amateurs and the Field Organization appointees to realize their capabilities by working together.

For example, the ARRL Section Traffic Manager's (STM) role in the section's Field Organization is to supervise traffic handling organization at the section level. The job entails coordinating all traffic efforts within the section, regardless of mode or National Traffic System affiliation, so that routings within the section and connections with other networks and digital traffic nodes will result in orderly and efficient traffic flow.

The Section Traffic Manager is appointed by the Section Manager (SM) and the STM should be a person at home and familiar with traffic handling on all modes, must have at least a Technician class license and should possess the willingness and ability to devote equal consideration and time to all section traffic matters. As with all Field appointments, full ARRL membership is required. The duties of the STM include the following:

1. Establish, administer and promote a traffic handling program at the section level, based on, but not restricted to, National Traffic System networks.

2. Develop and implement one or more effective training programs within the section that address the needs of both traditional and digital modes of traffic handling. Insure that Net Managers (NM) provide support for amateurs new to formal network traffic handling and those who handle formal traffic on a "casual" basis, via RTTY, AMTOR and Packet based message storage and bulletin board systems.

3. Cooperate and coordinate with the Section Emergency Coordinator (SEC) so that traffic nets and emergency nets in the section present a unified public service front.

4. Recommend candidates for Net Managers and Official Relay Station appointments to the Section Manager. Issue appointments/cancellations and appropriate certificates. At the SM's discretion, the STM may directly make or cancel NM and ORS appointments.

5. Insure that all traffic nets within the section are properly and adequately staffed, with appropriate direction to Net Managers, as required to provide coverage of all Net Control and liaison functions. Assign liaison coverage adequate to insure that all digital bulletin boards and message storage systems within the section are polled on a daily basis, to prevent misaddressed, lingering or duplicated radiogram-formatted message traffic.

6. Maintain familiarity with proper traffic handling and directed net procedures applicable to all normally used modes within the section.

7. Collect and prepare accurate monthly net reports and submit them to ARRL Headquarters, either directly or via the Section Manager but in any case on or prior to the established deadlines.

8. Section Traffic Managers are encouraged to earn all certification levels of the ARRL Emergency Communications Course. QST

New IARU Officers Attend Geneva Meetings

Reported by Brennan T. Price, N4QX
ARRL Chief Technology Officer

Amateur Radio had a busy agenda in Geneva this past fall as two major events in the ITU calendar convened. As always, Amateur Radio operators from around the world were present to advocate for the needs and interests of the Service.

HANI RAAD, OD5TE

IARU Secretary General Hamadoun Touré, HB9EHT, visits the IARU exhibit at ITU Telecom World on October 9, 2009. Left to right: Hani Raad, OD5TE; Hans Zimmermann, F5VKP; Dr Touré; Brennan Price, N4QX; Hans Ehlers, DF5UG, and ITU Radiocommunication Bureau staffer Attila Matas, OM1AM/HB9IAJ.

IARU at ITU Telecom World 2009

In October, the International Amateur Radio Union (IARU) continued its traditional presence at ITU Telecom World, an international forum and exhibition of telecommunication ministers, regulators and industry players. The 2009 exhibition was held in Geneva from October 5-9. Participants and delegates came from 186 countries and included UN Secretary General Ban Ki-moon. The exhibition floor accommodated 456 exhibitors from 46 countries.

The IARU exhibit was managed by ARRL Technical Relations Manager Brennan Price, N4QX. Staffing support was provided by several representatives of IARU Region 1 Member Societies, including Hani Raad, OD5TE; Hans Ehlers, DF5UG; Hans Zimmermann, F5VKP; Gerald Lander, HB9AJU, and Betty Mangin, F6IOC. Throughout the event, the IARU booth welcomed past and present hams, interested passers-by and regulators from several countries who were briefed on the capabilities and regulatory goals of Amateur Radio. Publications from several IARU member societies were displayed, with the *RSGB Microwave Handbook* generating a substantial amount of interest among visitors.

The weeklong exhibit was capped with a Friday afternoon visit from ITU Secretary General Hamadoun Touré, HB9EHT. Despite a busy agenda, Dr Touré was generous with his time at the IARU booth and accepted the publications on display as contributions to the ITU library after the exhibit.

New IARU Officers Make First Visit to ITU During Study Group 5

Preparation for 2012 World Radiocommunication Conferences (WRC-12) takes place at many levels within the ITU Member States, throughout broader geographic regions and on the world stage. For Amateur Radio, among the most active meetings between conferences are those of ITU Radiocommunication Sector (ITU-R) Study Group 5 that considers the needs of terrestrial services, including the Amateur Radio and Amateur Satellite Services. Study Group 5 and most of its constituent Working Parties, including Working Party 5A — the home of Amateur Radio within the ITU-R structure — met from November 23-December 8, 2009.

The meeting was the first attended by IARU President Tim Ellam, VE6SH, and IARU Vice President Ole Garpestad, LA2RR. Ellam and Garpestad presented their credentials to ITU Secretary General Touré on November 30, giving the ITU a 2010 edition of *The ARRL Handbook for Radio Communications*.

The meeting was also the first for Ken Pulfer, VE3PU, as Amateur Radio Working Group Chairman. Pulfer replaced retiring ARRL Chief Technology Officer Paul Rinaldo, W4RI, as Chairman after the May 2009 Study Group 5 meeting. National delegations included Brian Rawlings, VE3QN (Canada); Ulrich Mueller, DK4VW (Germany); Jay Oka, JA1TRC, and Hitoshi Yoshida, JK1MZT (Japan); Bram van den Berg, PBØAOK (Netherlands); RSGB President Colin Thomas, G3PSM (UK), and ARRL Technical Relations Manager Brennan Price, N4QX (USA).

Much of the Amateur Working Group's activities focused on WRC-12 Agenda Item 1.23, considering a secondary allocation of about 15 kHz to the Amateur Service within the range 415-526.5 kHz, taking into account the need to protect existing services. Resistance to this agenda item by the International Maritime Organization and some maritime interests is substantial. Nevertheless, work did progress on compatibility studies with incumbent services, particularly maritime NAVTEX data broadcasts and aeronautical non-directional navigational beacons.

Concurrently, Working Party 5B — which is considering several WRC-12 Agenda Items of potential impact to Amateur Radio— met. Work progressed on Agenda Item 1.14, considering an allocation to radiolocation within the range 30-300 MHz, and Agenda Item 1.15, considering allocations to HF oceanographic radar applications. At this time, it appears that the proponents of these agenda items are considering spectrum well away from bands allocated to the Amateur Radio Service. Nevertheless, ITU deliberations are inherently fluid, and these items and others merit continued vigilance.

The next meetings of Working Party 5A are scheduled for May 2010. IARU Member Societies throughout the world are encouraged to make their views on Agenda Item 1.23 known to their administrations and to lobby their administrations to submit contributions. QST

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

This Month in Contesting

Sean Kutzko, KX9X
ARRL Contest Branch Manager, kx9x@arrl.org

A NEW CONTEST: THE ARRL ROOKIE ROUNDUP, APRIL 18 FROM 1800-2359 UTC

Beginning in 1952, the ARRL Novice Roundup served as a training ground for newly licensed amateurs to develop good on-air skills and practices while operating in a competitive environment. It was fun and rewarding; many a contester (including Yours Truly) first tasted competitive Amateur Radio by participating. One of the greatest aspects of the event was that more experienced operators took the time to work the newbies. It was a way to give back and feed the contest tributaries in a very practical way.

After the Technician license became the de facto entry class license and more new hams enjoyed their operating on VHF and UHF frequencies, participation in the Novice Roundup began to wane. By 1995, only a couple of hundred entries were received and the Novice Roundup was retired.

I have heard from many amateurs and read several discussions on the CQ Contest e-mail reflector in the past few years that the need for an entry-level event still exists. I also received the input of several amateurs interested in bringing more youth into competitive radio. To that end, the ARRL has created the Rookie Roundup, a contest for new operators that brings elements of the old Novice Roundup into the 21st century.

While the old Novice Roundup was a week long, the new Rookie Roundup will be held three times per year, each event lasting 6 hours on Sunday afternoons from 1800-2359 UTC. Each event will focus on one specific mode, so that all major modes will be covered once in a calendar year: SSB, CW and RTTY. The first Rookie Roundup will use SSB and be held on Sunday, April 18. Entries will be Single Operator only with a limit of 100 W. Using the spotting networks is allowed, although self-spotting or asking others to make a spot is not.

One of the most frequent requests from young contesters is to embrace more technology in logging and adjudication, much like multiplayer games over the Internet and gaming systems. The Rookie Roundup will be the first ARRL-sponsored event that utilizes 100% real time contact logging, scoring and adjudication. Contacts will be "logged" on an Internet server for immediate validation — no after-contest log submission.

Results will be published online within minutes after the contest. Scoring will be based on call areas only; national winners will not be recognized due to the difference in propagation from call area to call area. Certificates will be available for all participants for free download shortly after the event.

What is a Rookie?

In the Rookie Roundup a Rookie is an operator who has been licensed 2 years or less, regardless of license class. Just as in the Novice Roundup, a cornerstone will be more experienced operators getting on the air and working Rookies. Rookies will be allowed to work anybody, while non-Rookies can only work Rookie stations. If you have ever expressed the opinion that we need to encourage contesting activity among the newly licensed, the Rookie Roundup provides you a way to do just that. I encourage all veteran contesters to participate in this event and help encourage new operators to enjoy the radiosport tradition.

Here are some rules highlights:

- Each Rookie Roundup segment will be 6 hours long, from 1800 UTC through 2359 UTC Sunday afternoons. The April event will be the SSB segment, August the RTTY segment and December the CW segment.
- The exchange consists of the calls of both stations, name, year two-digit year first licensed and state, province or DXCC entity (country).
- There are 70 total multipliers: the 50 US States plus the District of Columbia (DC), 13 Canadian Provinces, 5 Mexican call areas (XE1, XE2, XE3, XF1, XF4) and one generic "DX" multiplier for any other DXCC entity.
- Rookie stations must identify themselves as a Rookie. On phone, simply saying the word "rookie" after their call will suffice. For CW and RTTY, Rookies must sign /ROK.
- Non-rookie operators may provide in-person coaching to a Rookie operator, but may not operate the radio or log contacts for the Rookie. All station functions related to transmitting, receiving, making contacts and logging those contacts must be performed by the Rookie.

Complete rules for the Rookie Roundup can be found online at **www.arrl.org/contests/forms**.

The Rookie Roundup is a great tool for all newly licensed amateurs to get active on HF, embrace 21st century technology and have fun while learning practical on-air skills that can be applied to any other aspect of the hobby. It also offers the veterans a way to get involved with newer members of our ranks and work them on the air. This would also be a great activity for your club's Elmer program.

Let's get on the air, rally for the newcomers and make some contacts! I'll be looking for you in the first ever Rookie Roundup.

Operating Tip of the Month

"Come back to the light. Pulling an all-nighter in your favorite contest? Warm, dark environments at night play directly into your body's natural desire for sleep. Fight that natural pattern by leaving as many lights on in your shack as possible and lowering the temperature of the room."

CONTEST CORRAL

in association with the *National Contest Journal*

MARCH 2010

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site
Feb 28, 0100Z - Mar 1, 0259Z	3.5-14		CQC Winter QSO Party	✘	✘		RS(T), S/P/C, name, CQC nr or power	www.cqc.org
Feb 28, 1700Z - Mar 1, 0300Z	3.5-28		North Carolina QSO Party	✘	✘		RS(T) and NC county or S/P/C	www.w4nc.com
Mar 2, 1900Z - Mar 2, 2100Z	3.5		YL CW Party		✘		RST, serial, if YL "YL," name	www.agcw.org
Mar 6, 0000Z - Mar 7, 2400Z	**1.8-28**		**ARRL International DX**	✘			**RS and state, province, or power**	www.arrl.org/contests
Mar 6, 0900Z - Mar 6, 1700Z	3.5-28		High Speed CW Contest		✘		RST and HSC nr or "NM"	hsc-contest@gmail.com
Mar 6, 2200Z - Mar 7, 1200Z	1.8-28		Open Ukraine RTTY Championship			✘	Regional abbreviation and serial	www.ucc.zp.ua
Mar 7, 1100Z - Mar 7, 1700Z	28		DARC 10 Meter Digital "Corona"			✘	RST and serial	www.darc.de/referate/ukw-funksport/
Mar 9, 1700Z - Mar 14, 1700Z	3.5-21		CLARA and Family HF Contest	✘	✘		RS(T), name, QTH, and CLARA	www.clara.comm.sfu.ca
Mar 13, 0000Z - Mar 14, 2359Z	3.5-28		Heavy Metal Rally	✘	✘		RS(T) and serial, plus "V" if vintage equip	www.xe1rcq.info/heavymetal.htm
Mar 13, 1000Z - Mar 14, 1000Z	3.5-28		RSGB Commonwealth Contest		✘		RST and serial (Commonwealth only)	www.rsgbcc.org/hf/calendar10.shtml
Mar 13, 1400Z - Mar 13, 2000Z	3.5-28		AGCW QRP Contest		✘		RST, serial, class, AGCW number or NM	www.agcw.org
Mar 13, 1500Z - Mar 13, 1800Z	3.5-28		QRP ARCI HF Grid Square Sprint		✘		RST, 4-digit grid square, QRP ARCI number	www.qrparci.org
Mar 13, 1600Z - Mar 14, 1600Z	3.5-28		EA PSK31 Contest			✘	RST + serial or EA province	www.ure.es
Mar 13, 1900Z - Mar 14, 1900Z	1.8-28	50-440	Idaho QSO Party	✘	✘	✘	RS(T) and S/P/C	www.nx7tt.com
Mar 14, 0000Z - Mar 14, 0400Z	**3.5-14**		**North American RTTY Sprint**			✘	**Both call signs, serial, name, and S/P/C**	www.ncjweb.com
Mar 14, 1800Z - Mar 15, 0100Z	3.5-28	50+	Wisconsin QSO Party	✘	✘	✘	WI county or S/P/C	www.warac.org
Mar 20, 0000Z - Mar 21, 2400Z		3.4G	EU EME Contest	✘	✘		TMO/RS(T) and "R"	www.dubus.org
Mar 20, 0001Z - Mar 20, 2359Z	28		10-10 Mobile QSO Party	✘	✘	✘	Call, Name, county & S/P/C, 10-10 number	www.ten-ten.org
Mar 20, 0200Z - Mar 22, 0200Z	3.5-28		BARTG HF RTTY Contest			✘	3-digit serial and 4-digit time	www.bartg.org.uk
Mar 20, 0500Z - Mar 20, 0800Z	1.8-7		OK1WC Memorial Contest	✘	✘		RS(T) and serial	www.hamradio.cz/ok1wc
Mar 20, 1200Z - Mar 21, 1200Z	1.8-28		Russian DX Contest	✘	✘		RS(T), serial or oblast abbr	www.rdxc.org
Mar 20, 1200Z - Mar 21, 1600Z	21		9KCC Contest	✘	✘		RS(T) and serial	www.9k2hn.com/9kcc
Mar 20, 1400Z - Mar 21, 2000Z	3.5-28		Oklahoma QSO Party	✘	✘	✘	RS(T) and OK county or S/P/"DX"	www.okdxa.org
Mar 20, 1800Z - Mar 21, 1800Z	1.8-28	50,144	North Dakota QSO Party	✘	✘		RST and ND county or S/P/C	www.w0cq.com
Mar 20, 1800Z - Mar 22, 0100Z	1.8-28	50-440	Virginia QSO Party	✘	✘	✘	Serial and VA county/city or S/P/C	www.qsl.net/sterling
Mar 27, 0000Z - Mar 28, 2400Z		144, 10G+	EU EME Contest	✘	✘		TMO/RS(T) and "R"	www.dubus.org
Mar 27, 0000Z - Mar 28, 2400Z	1.8-28		CQ WPX SSB Contest	✘			RS and serial	www.cqwpx.com

All dates refer to UTC and may be different from calendar date in North America. Times given as AM or PM are local times and dates.
Refer to the contest Web sites for full rules, scoring information, operating periods or time limits and log submission information.
No contest activity occurs on 60, 30, 17, 12 meters. Serial = Sequential number of the contact. S/P/C = State, Province, DXCC Entity.
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

Sean's Picks

- QSO Parties this month: Idaho, North Carolina, North Dakota, Oklahoma, Virginia, Wisconsin.
- ARRL International DX Contest, SSB (March 6-7): DX works only US and Canada and vice versa. With so much DX on the bands, don't let this weekend slip by without making some contacts.
- North American RTTY Sprint (March 14): Four hours of fast-paced RTTY goodness. RTTY is easier than ever, thanks to free software and inexpensive or easy-to-build interfaces. If you're not playing on RTTY, you're missing out on big fun.
- BARTG HF RTTY Contest (March 20-21): If you like the RTTY Sprint, go 48 hours in a world-wide contest. Everybody works everybody in this weekend-long digital donnybrook.
- Russian DX Contest (March 20-21): *Privet!* All antennas aim towards the country with the most time zones. See how many Oblasts you can work.
- CQ WPX SSB Contest (March 27-28): Call sign prefixes are the multipliers in this 48 hour event. Log as many different prefixes as you can and work towards your CQ-WPX award.

In the March/April "Contesting 101"

Kirk, K4RO takes a look at the contest "Meta View:" moving beyond the mechanics of copying call signs, to evaluating conditions and adjusting strategy accordingly. Contesting 101 can be found in the *National Contest Journal*, published six times per year. For subscription information, visit **www.arrl.org/ncj**.

2009 IARU HF World Championship Results

Who Needs Sunspots . . . ?

Carl Luetzelschwab, K9LA

In spite of being in the deepest solar minimum of our lifetimes, contesters came out in record numbers to participate in this increasingly popular summer event. The 2009 running ended up with 3404 log submittals, which is 6.4% more than the 2007 record. If the past trends continue, the 4000 log barrier should be broken in several years.

Participation Statistics

The three Low Power categories (Mixed, Low Power; Phone, Low Power; and CW, Low Power) continue to dominate the entries. In fact, the Low Power logs were 58% of all the logs. I've said it before in previous results and I'll say it again — if you don't have an amplifier, the IARU HF World Championship is a great contest in which to participate.

Regarding zone participation, this year's contest had activity from 49 ITU zones. That's down one zone from last year and down two zones from 2007. For you traveling contesters, think about activating some of the rare ITU zones next year.

As in previous years, Zone 28 (Eastern Europe) led the pack with the highest number of entries. Zone 29 entries came in second place, with less than half of the Zone 28 total. Zone 8 (North America, East Coast) rounded out the Top Three.

WARD SILVER, NØAX

Gator, N5RZ, hard at work on 15 meters at W1AW/KL7 while station owner Rich, KL7RA, keeps 40 meters hopping in the background.

Being at solar minimum, one would expect 20 meters to bear the brunt of the activity. Indeed, 20 meters was the workhorse band — with almost 50% of the total number of QSOs. With the recent solar activity, though, it appears that Cycle 24 is finally starting its ascent. This should shift more of the QSOs to 15 meters and 10 meters next year. That will be a pleasant experience based on the past several years.

New Records

The 2009 event resulted in four new records. As you can see in World Record and W/VE Records tables, all of these came from W/VE stations. In Single-Op, Mixed, Low Power, **VE3DZ** bested the 2006 record of **K1XM** by 55%. In Single-Op, Phone, Low Power, **N1UR** narrowly beat his own 2008 record by 2.6%. In Multi-Op, the **K1LZ** team moved the old 2001 **KH6ND** record from 2,111,350 to 2,554,760 — up 21%. Finally, in Single-Op, CW, QRP, **W2GD** smashed the old 166,370 score set by **N2WN** in 2007, ending up with 427,392 points for a whopping 257% increase.

Congratulations to all the new record holders. With more sunspots hopefully on the way, next year's event should provide more opportunities to set new records. Take a couple of minutes, study the records and set a course to best them next year.

HQ Results

There were 62 entries in the HQ category. After the last QSO was made, the **AO8HQ** team beat the **DAØHQ** team by 3.1%. Congratulations to the entire AO8HQ team in pulling off this win.

In the W/VE HQ competition, the crew at **NU1AW/KH6** bested the **W1AW/KL7** team by a good amount — 11.8% — but remember that propagation in KL7 is usually worse than propagation in KH6. Under the circumstances, the KL7 crew did a commendable job. You can read more about the W1AW/KL7 operation in the online sidebar written by **N1TX** for the expanded write-up at **www.arrl.org/contests/results**.

With the number of HQ stations participating this year, **KC2TA** commented in the contest soapbox, "Worked a lot more HQ stations than in past attempts, but fewer sections overall." **WP3GW** added "Low score and more multipliers = Lots of HQ's!!!" Let's hope the HQ participation trend continues — it adds excitement to the contest. (You can read all of the Soapbox entries online at **www.arrl.org/contests/soapbox**.)

Mixed Results

The winners in the Single-Op, Mixed categories for the World were **OK7CM**, **UT2UZ** and **4LØA** (**UUØJM**, op) in QRP, Low Power and High Power, respectively. The W/VE winners were **N5DO** (QRP), **VE3DZ** (Low Power) and **VE3EJ** (High Power).

Phone Results

In the Single-Op, Phone-only category, the World winners for QRP, Low Power and High Power were **HA5KDQ** (**HA5NB**, op), **IZ2FOS** and **UT5UGR**, respectively.

World Records

World	*Call*	*Score*	*Year*
HQ	R9HQ	26,342,498	2006
Single Op Mixed HP	3V1A	4,414,517	2007
Single Op Mixed LP	HG3M (HA3MY op)	2,095,522	2004
Single Op Mixed QRP	HG5Y	1,067,647	2007
Single Op Phone HP	CN2R (W7EJ op)	4,718,736	2005
Single Op Phone LP	D4C	2,975,632	2008
Single Op Phone QRP	HG1W) (HA1WD op)	348,517	2007
Single Op CW HP	CT3EN (CT1BOH op)	3,829,848	2005
Single Op CW LP	HA8DU	2,278,782	2006
Single Op CW QRP	HA5KDQ (HA7ANT op)	1,412,260	2006
Multi-Op	P3A	7,008,176	2003

W/VE Records

W/VE	*Call*	*Score*	*Year*
HQ	W1AW/4	10,720,370	2000
Single Op Mixed HP	KQ2M	2,810,088	2001
Single Op Mixed LP	**VE3DZ**	**1,179,150**	**2009**
Single Op Mixed QRP	NØKE	187,590	2008
Single Op Phone HP	KH6ND	2,257,190	2002
Single Op Phone LP	**N1UR**	**508,540**	**2009**
Single Op Phone QRP	KC5R	172,080	2007
Single Op CW HP	VY2ZM (K5ZD op)	2,631,694	2005
Single Op CW LP	W1RM	1,065,110	2006
Single Op CW QRP	**W2GD**	**427,392**	**2009**
Multi-Op	**K1LZ**	**2,554,760**	**2009**

Likewise for W/VE, the top performers were **N1YWB** in QRP (see the online write-up for N1YWB's narration of his operation in this extremely tough category in which only 50 logs were received), N1UR in Low Power and **W7WA** in High Power.

CW Results

In the Single-Op, CW-only races, World first place went to **HG5A** (**HA5IW**, op) for QRP, **HG7T** (**HA7TM**, op) for Low Power and **OHØR** (**OH2PM**, op) for High Power. For W/VE, **W2GD** came out on top in QRP, **VE3NE** ended up in first for Low Power and **VY2ZM** topped the list for High Power.

Multi-Op Results

In the well-represented Multi-Op category, the top World score was turned in by the crew

W/VE

Single Operator, Mixed Mode, QRP

Call	Score
N5DO	122,015
NØKE	119,340
NØLY	21,645
W5ESE	9,430
VE3MGY	5,434
VA3JFF/W1	2,226
N7FG	192

Single Operator, Mixed Mode, Low Power

Call	Score
VE3DZ	1,179,150
W5ZL	776,768
VE2XAA	563,022
NR3X (N4YDU, op)	484,145
K9OM	479,493
KØAD	344,650
WØVX	278,460
KB9OWD	267,860
VE3FDT	241,529

Single Operator, Mixed Mode, High Power

Call	Score
VE3EJ	2,176,200
NN1N	2,102,960
VE3AT	1,783,754
K6XX	1,244,000
K3ZO	1,194,597
NR4M (N2YO, op)	1,021,410
N4PN	977,835
AA4NC	920,220
WØEWD	865,053

Single Operator, Phone Only, QRP

Call	Score
N1YWB	15,300
W2EVL	10,848
WD9FTZ	7,360
VA3WPV	6,076
WBØIWG	4,752
WB7OCY	4,379
NDØC	3,993
N1TM	2,600
NN7SS (K6UFO, op)	420
KC9AMM	215

Single Operator, Phone Only, Low Power

Call	Score
N1UR	508,540
N2QT	215,982
KK1KW	175,997
K1PLX	153,976
VE9ZX	143,262
KA2KON	78,764
W5GFI	62,730
N3TR	53,530
KS4X	49,588
VE9JT	46,460

Single Operator, Phone Only, High Power

Call	Score
W7WA	1,574,048
K5TR	1,215,240
WB9Z	1,196,316
KØRH	522,585
K5ER	362,080
W4SVO	295,380
W6AFA	173,455
WA5ZUP	157,921
NX9T	154,584
WA4TII	132,288

Single Operator, CW Only, QRP

Call	Score
W2GD	427,392
N2WN	182,574
AA1CA	48,590
K4MF	46,547
VA3SB	42,704
N4PSE	41,148
W5JBV	33,900
VA3RKM	24,882
NVØU	19,270
VE6BIR/3	18,753

Single Operator, CW Only, Low Power

Call	Score
VE3NE	705,172
W1RM	670,320
W7YAQ	391,170
WB4TDH	363,952
W2/E78WW	341,643
W1NN	333,904
W5EK	323,360
WD4AHZ	307,992
WI2E	274,950
KTØK	262,136

Single Operator, CW Only, High Power

Call	Score
VY2ZM	2,567,726
K3CR (LZ4AX, op)	1,886,247
N2IC	1,681,920
N4AF	1,591,348
VE2EKA (VA2WDQ, op)	1,339,404
NR5M (N5NU, op)	1,320,123
W5KFT (K5PI, op)	1,297,910
N4OGW	1,251,156
N3BB	1,241,048
K9NW	1,122,300

Multioperator

Call	Score
K1LZ	2,554,760
NØNI	1,690,856
NX5M	1,580,642
WE3C	1,429,428
KD4D	1,342,348
VE3UTT	1,221,880
KB1H	1,108,540
W5XZ	1,088,054
K2LE	1,086,000
WØSD	1,075,680

Worldwide

Single Operator, Mixed Mode, QRP

Call	Score
OK7CM	494,596
HA5BKV/P (HA1CW, op)	474,572
HG1W (HA1WD, op)	460,408
OK2BYW	281,952
RW3AI	230,985
OM7DX	230,490
LY4BF	181,305
IKØXBX	176,571
SP9RQH	130,539
N5DO	122,015

Single Operator, Mixed Mode, Low Power

Call	Score
UT2UZ	1,331,166
VE3DZ	1,179,150
RU6CQ	1,171,500
F6HKA	977,942
W5ZL	776,768
OK6Y (OK2PTZ, op)	732,978
RA3AWW (YT1NT, op)	623,562
VE2XAA	563,022
UX1UX	553,163
RV9WZ/2	524,484

Single Operator, Mixed Mode, High Power

Call	Score
4LØA (UUØJM, op)	3,144,130
RA3CO	2,946,714
RG9A (UA9AM, op)	2,865,261
RS3A (RA3CW, op)	2,318,294
RG6G (RW6HX, op)	2,243,532
VE3EJ	2,176,200
RG3K	2,163,114
NN1N	2,102,960
VE3AT	1,783,754
RO4W (RD4WA, op)	1,679,346

Single Operator, Phone Only, QRP

Call	Score
HA5KDQ/P (HA5NB, op)	201,804
PE2KP	92,225
TI5N (W8QZA, op)	68,052
SQ2DYF	44,774
RA3AD	39,795
YO2LYN	39,312
CO7PH	36,594
F5BEG	34,424
HB9EGA/P	17,920
N1YWB	15,300

Single Operator, Phone Only, Low Power

Call	Score
IZ2FOS	779,738
UV8M (UX3MR, op)	748,02
EF1W (EA1WS, op)	637,92
RW1CW	551,304
N1UR	508,540
KP2/AA1BU	483,165
SP4XQN	464,340
8SØC	456,412
YO7LFV	452,690
F5OWT	435,006

Single Operator, Phone Only, High Power

Call	Score
UT5UGR	2,161,761
UW5Q	1,827,090
ES5RW	1,774,215
US5D (UT7DX, op)	1,741,865
YL7A	1,693,727
W7WA	1,574,048
SP9LJD	1,545,943
KH7XS	1,471,464
DP4K (DL8OBQ, op)	1,261,480
K5TR	1,215,240

Single Operator, CW Only, QRP

Call	Score
HG5A (HA5IW, op)	529,674
W2GD	427,392
OK3C (OK2ZC, op)	378,585
RA3AN	337,161
HA6IAM	309,468
UA1CUR	270,972
UA6LCJ	229,900
N2WN	182,574
SP4GFG	181,984
DD1IM	175,794

Single Operator, CW Only, Low Power

Call	Score
HG7T (HA7TM, op)	1,955,259
ZC4LI	1,356,138
EF3A (EA3KU, op)	1,295,640
EA7RM	1,218,838
OL6P (OK2PP, op)	995,265
RX9AF	966,575
RA9AP	957,814
RK1AM	906,010
UA9SP	893,775
DJ6BQ	849,325

Single Operator, CW Only, High Power

Call	Score
OHØR (OH2PM, op)	2,728,224
VY2ZM	2,567,726
4O3A (UT5UDX, op)	2,388,237
OL3A (OK1DRQ, op)	1,945,053
UU5WW	1,904,841
YU1LA	1,889,308
K3CR (LZ4AX, op)	1,886,247
UA6LV	1,854,669
UW1M (UR5MW, op)	1,834,904
LY4L	1,830,610

Multioperator

Call	Score
P33W	5,305,692
CN3A	4,970,890
5B4AII (RW3QC, op)	4,168,070
UZ2M	3,942,289
HG6N	3,591,224
RK4FWX	3,348,225
RC9O	3,068,163
CR3A	3,019,464
RK9CWW	2,712,262
K1LZ	2,554,760

HQ and Administrative Council Report

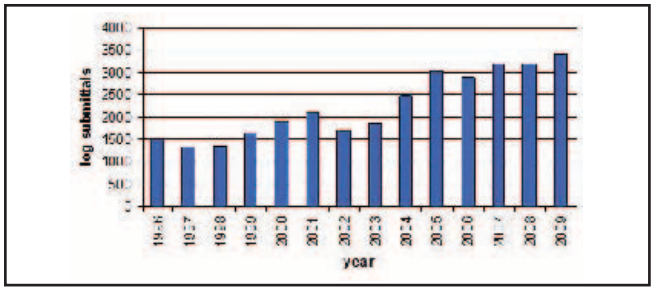
IARU Headquarters Stations

Call	Score	QSO	Mults
AO8HQ	24,260,860	11,041	460
DAØHQ	23,531,500	22,525	500
OL9HQ	22,531,495	16,557	497
SNØHQ	22,361,905	18,565	505
GB7HQ	22,182,068	15,394	478
TMØHQ	21,886,038	16,088	459
*IUxHQ	20,450,778	16,225	482
9AØHQ	20,350,278	15,985	486
S5ØHQ	17,917,896	13,695	488
YTØHQ	17,379,576	14,858	459
E7HQ	17,298,216	14,170	468
LYØHQ	16,975,432	12,528	463
YRØHQ	15,913,230	13,691	482
PA6HQ	15,421,696	11,304	428
HGØHQ	15,365,460	12,696	465
YL4HQ	15,236,240	11,330	454
OE1A	15,068,260	12,580	454
LXØHQ	14,159,760	10,766	410
OH2HQ	13,385,752	9,850	409
CR5HQ	13,150,604	9,711	404
H2Q	13,101,596	7,291	388
EM5HQ	12,828,564	10,234	426
LZ7HQ	10,542,420	10,895	420
SK9HQ	8,849,640	7,702	348
*8NxHQ	7,851,473	10,007	371
ZW5HQ	7,473,649	4,837	337
SXØHQ	6,682,081	8,457	371
OPØHQ	6,336,045	6,125	309
OZ1HQ	6,151,385	6,035	317
NU1AW/KH6	6,083,640	4,854	262
RØHQ	6,030,045	5,435	315
W1AW/KL7	5,442,144	5,682	249
HB9HQ	4,670,580	6,147	340
ER7HQ	4,564,431	4,891	333
EIØHQ	4,044,402	4,347	306
A71A	3,781,260	2,788	315
*BxHQ	3,758,110	3,873	290
9K9HQ	3,591,540	2,982	270
CX1AA	2,736,332	2,155	292
LN2HQ	2,623,050	3,164	261
Z3ØHQ	2,605,516	4,245	292
EKØHQ	2,425,372	2,873	236
ZL6HQ	2,328,469	2,405	209
P4ØHQ	1,873,520	1,890	220
9Y4HQ	1,696,464	1,954	189
5NØHQ	1,409,436	1,918	153
ES9A	1,181,547	1,751	261
TC7HQ	1,162,260	1,540	165
ZF1A	777,592	1,604	142
AT1HQ	666,915	989	173
LR4D	570,663	829	163
VR2HK	516,816	1,073	144
VK7WI	460,782	841	126
T4ØC	413,567	1,061	131
YB41AR	384,901	705	121
BVØHQ	343,720	1,025	104
HSØAC (HSØ/OZ1HET, op)	191,906	452	121
HQ2W	99,382	388	79
XE1LM	92,178	382	81
YS1YS	62,000	280	62
DX1HQ (DU1BP, op)	52,155	201	61
ZSØHQ	10,710	119	42

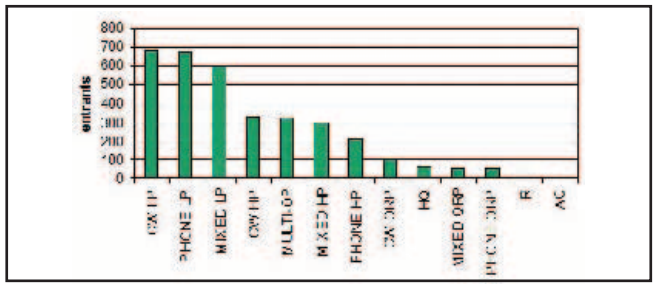
*Lower case "x" signifies multiple prefixes used.

Administrative Council and Regional Official Stations

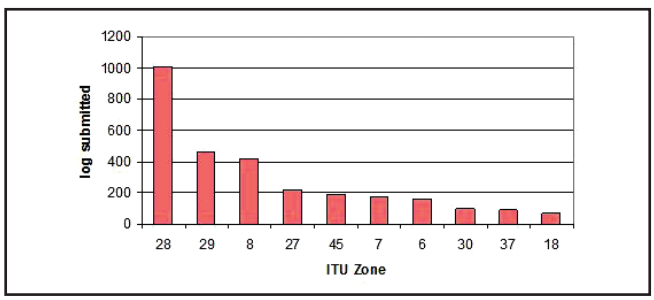
Call	Score	QSO	Mults
K1ZZ	1,574,400	2,104	240
9A5W	685,216	1,182	184
YV5AMH	636,576	920	152
JA1TRC	479,376	917	144
XE1KK	388,773	825	153
G3PSM	196,690	445	170
VE6SH	53,682	268	69
HB9JOE	35,217	197	117
OD5TE	21,780	248	18
9Y4NED	4,572	49	36
LZ1US	1,360	40	20
ZS4BS	132	6	6



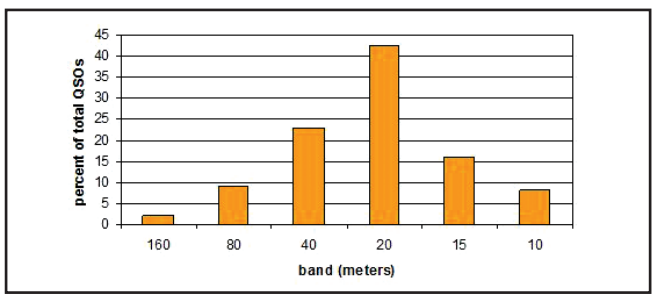
Log Submittals by Year.



Entrants by Category.



Entrants by ITU Zone.



QSOs by Band.

W/VE Regional Leaders by Category

For Class: A=Single Operator, Mixed Mode; B=Single Operator, phone only; C=Single Operator, CW only; D=Multioperator.
For Power: A=QRP; B=Low Power; C=High Power.

Northeast Region
(New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

Call	Score	Class	Power
VA3JFF/W1	2,226	A	A
VE2XAA	563,022	A	B
VE2AWR	114,363	A	B
WA2MCR	86,219	A	B
K3TN	71,388	A	B
W3DQN	41,325	A	B
NN1N	2,102,960	A	C
K3ZO	1,194,597	A	C
K5ZD	775,320	A	C
W1EBI	500,795	A	C
K1AR	302,841	A	C
N1YWB	15,300	B	A
W2EVL	10,848	B	A
WBØIWG	4,752	B	A
WB7OCY	4,379	B	A
N1TM	2,600	B	A
N1UR	508,540	B	B
KK1KW	175,997	B	B
K1PLX	153,976	B	B
VE9ZX	143,262	B	B
KA2KON	78,764	B	B
AD1DX	61,710	B	C
N1BCL	54,372	B	C
AD1L	45,658	B	C
WA1OUI	24,790	B	C
N2MUN	23,744	B	C
W2GD	427,392	C	A
AA1CA	48,590	C	A
W1IG	8,695	C	A
K8CN	3,565	C	A
N3XRV	2,800	C	A
W1RM	670,320	C	B
W2/ E78WW	341,643	C	B
WI2E	274,950	C	B
VE9HF	234,328	C	B
AI2N	122,330	C	B
K3CR (LZ4AX, op)	1,886,247	C	C
VE2EKA (VA2WDQ, op)	1,339,404	C	C
AA3B	1,112,208	C	C
WC1M	844,662	C	C
NO2R	622,966	C	C
K1LZ	2,554,760	D	
WE3C	1,429,428	D	
KD4D	1,342,348	D	
KB1H	1,108,540	D	
K2LE	1,086,000	D	

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

Call	Score	Class	Power
NR3X (N4YDU, op)	484,145	A	B
NN4F	202,020	A	B
K3AN	175,942	A	B
WJ2D	80,040	A	B
AD5WI	67,118	A	B
NR4M (N2YO, op)	1,021,410	A	C
N4PN	977,835	A	C
AA4NC	920,220	A	C
K4ZW	910,272	A	C
NF4A	778,104	A	C
N2QT	215,982	B	B
KS4X	49,588	B	B
K4AOC	38,394	B	B
K4MDX	34,580	B	B
K4WES	22,847	B	B
K5ER	362,080	B	C
W4SVO	295,380	B	C
NX9T	154,584	B	C
WA4TII	132,288	B	C
KA8Q	80,073	B	C
N2WN	182,574	C	A
K4MF	46,547	C	A
N4PSE	41,148	C	A
W5JBV	33,900	C	A
K4OSO	15,962	C	A
WB4TDH	363,952	C	B
WD4AHZ	307,992	C	B
WA1FCN	245,864	C	B
KR4F	173,128	C	B
AA4FU	169,264	C	B
N4AF	1,591,348	C	C
N4OGW	1,251,156	C	C
K5GO	1,079,488	C	C
K4RO	895,050	C	C
K4BP (NA4K, op)	771,274	C	C
W5XZ	1,088,054	D	
N1LN	911,064	D	
K4PB	190,026	D	
N4TCP	156,165	D	
W4QM	126,882	D	

Central Region
(Central and Great Lakes Divisions; Ontario Section)

Call	Score	Class	Power
VE3MGY	5,434	A	A
VE3DZ	1,179,150	A	B
K9OM	479,493	A	B
KB9OWD	267,860	A	B
W9IU	246,400	A	B
VE3FDT	241,529	A	B
VE3EJ	2,176,200	A	C
VE3AT	1,783,754	A	C
W8MJ	395,382	A	C
VE3XN	143,260	A	C
VE3TW	59,532	A	C
WD9FTZ	7,360	B	A
VA3WPV	6,076	B	A
KC9AMM	215	B	A
KB8UUZ	41,448	B	B
W8KNO	41,238	B	B
VA3TPS	15,708	B	B
AB8JR	11,700	B	B
KC9GZB	8,910	B	B
WB9Z	1,196,316	B	C
VA3XH	54,684	B	C
K9JIG	25,155	B	C
K9DN	12,960	B	C
N9UY	9,933	B	C
VA3SB	42,704	C	A
VA3RKM	24,882	C	A
VE6BIR/3	18,753	C	A
KA6SGT	8,568	C	A
AI9K	2,940	C	A
VE3NE	705,172	C	B
W1NN	333,904	C	B
NS9I	127,846	C	B
K9QVB/9	120,768	C	B
VE3XD	111,079	C	B
K9NW	1,122,300	C	C
VE3OI	742,320	C	C
N8PW	483,164	C	C
N8BJQ	301,392	C	C
K8GL	296,865	C	C
VE3UTT	1,221,880	D	
VE3YAA	460,672	D	
NV8N	214,760	D	
N2BJ	172,536	D	
W8ZHO	129,537	D	

Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

Call	Score	Class	Power
N5DO	122,015	A	A
NØKE	119,340	A	A
NØLY	21,645	A	A
W5ESE	9,430	A	A
W5ZL	776,768	A	B
KØAD	344,650	A	B
WØVX	278,460	A	B
NR9A	141,250	A	B
VE4YU	126,360	A	B
WØEWD	865,053	A	C
N5XZ	368,715	A	C
KEØUI	210,168	A	C
K7IA	193,456	A	C
KØDEQ	132,600	A	C
NDØC	3,993	B	A
W4PJP	18	B	A
NØAT	14	B	A
W5GFI	62,730	B	B
KJ5T	42,368	B	B
WBØTSR	41,218	B	B
WAØLJM	32,955	B	B
AB5NX	32,760	B	B
K5TR	1,215,240	B	C
KØRH	522,585	B	C
WA5ZUP	157,921	B	C
K9MWM	51,282	B	C
AD5XD	39,808	B	C
NVØU	19,270	C	A
KEØG	16,769	C	A
KIØG	2,980	C	A
AA5TB	1,840	C	A
W6GMT	1,595	C	A
W5EK	323,360	C	B
KTØK	262,136	C	B
NG7M (@W7CT)	220,313	C	B
N5AW/Ø	143,360	C	B
K6XT	123,799	C	B
N2IC	1,681,920	C	C
NR5M (N5NU, op)	1,320,123	C	C
W5KFT (K5PI, op)	1,297,910	C	C
N3BB	1,241,048	C	C
NØAV	610,090	C	C
NØNI	1,690,856	D	
NX5M	1,580,642	D	
WØSD	1,075,680	D	
K5CM	409,440	D	
KØKX	248,292	D	

West Coast Region
(Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

Call	Score	Class	Power
N7FG	192	A	A
WA6FGV	98,490	A	B
KD4HXT	79,156	A	B
W7QN	68,124	A	B
K6RAD	49,704	A	B
AA6YX	47,804	A	B
K6XX	1,244,000	A	C
KC6X	309,808	A	C
VA7ST	290,192	A	C
K7RL	180,804	A	C
W6TK	159,936	A	C
NN7SS (K6UFO, op)	420	B	A
N1MMY	102	B	A
N3WG	42,180	B	B
K6EGF	16,116	B	B
K7MY	12,240	B	B
KI6JJW	11,100	B	B
N7FLT	11,094	B	B
W7WA	1,574,048	B	C
W6AFA	173,455	B	C
NB7V	107,667	B	C
N6IFR	77,700	B	C
KB6FB	59,430	B	C
N7IR	16,400	C	A
N6MA	8,640	C	A
N7OU	2,720	C	A
KZ2V	910	C	A
KX7L	627	C	A
W7YAQ	391,170	C	B
VA7KO	197,736	C	B
K7QQ	183,339	C	B
K7WP	166,635	C	B
WN6K	123,046	C	B
N6RO	1,001,070	C	C
K6NA	932,076	C	C
K7RAT (N6AN, op)	838,440	C	C
KC7V	602,795	C	C
K4XU	372,680	C	C
N7AT	841,472	D	
K6LRG	666,976	D	
N7WA	602,937	D	
N7BV	581,501	D	
NX6T	355,416	D	

Continental Leaders by Category

For Class: A=Mixed Mode; B=Phone Only; C=CW Only; D=Multioperator. *For Power*: A=QRP; B=Low Power; C=High Power.

Africa

Call	Score	Power	Class
EA8OM	327,120	A	B
CT3HF	126,720	A	B
EA8BQM	12,296	A	B
5R8KD	140,896	A	C
CN8YE	55,008	B	B
EC8ADS	14,076	B	B
EA8CNR	3,201	B	B
EA8CER	60,784	B	C
CT9/DK7TM	37,760	B	C
ZS5NK	9,030	B	C
EA8NQ	37,765	C	B
V55X (V51YJ, op)	10,863	C	B
ZS6WR (ZS6C, op)	9,450	C	B
AN8A (EA8MQ, op)	545,376	C	C
ZS4U	151,074	C	C
AN8X (EA8AY, op)	55,020	C	C
CN3A	4,970,890	D	
CR3A	3,019,464	D	
CR3L	2,095,848	D	

Asia

Call	Score	Power	Class
JR3RWB	103,790	A	A
RAØAY	60,839	A	A
RK9DO	28,830	A	A
JM1NKT	386,694	A	B
RV9UP	325,480	A	B
RL9AA	309,519	A	B
4LØA (UUØJM, op)	3,144,130	A	C
RG9A (UA9AM, op)	2,865,261	A	C
RX9FM	1,582,009	A	C
JA2MWV	6,630	B	A
4L1FP	1,092	B	A
BD4EXL	696	B	A
UA9QA	314,109	B	B
A61BK	303,885	B	B
7Z1SJ	266,399	B	B
RU9AC	1,137,726	B	C
UA9QCQ	1,072,014	B	C
RA9CB	428,064	B	C
RA9CEX	108,288	C	A
JR1NKN	38,554	C	A
RA9MU/QRP	9,000	C	A
ZC4LI	1,356,138	C	B
RX9AF	966,575	C	B
RA9AP	957,814	C	B
RX9TL/9 (RX9TL/9, op)	1,778,098	C	C
RX9AM	1,773,504	C	C
RX9SA	1,084,608	C	C
P33W	5,305,692	D	
5B4AII (RW3QC, op)	4,168,070	D	
RC9O	3,068,163	D	

Europe

Call	Score	Power	Class
OK7CM	494,596	A	A
HA5BKV/P (HA1CW, op)	474,572	A	A
HG1W (HA1WD, op)	460,408	A	A
UT2UZ	1,331,166	A	B
RU6CQ	1,171,500	A	B
F6HKA	977,942	A	B
RA3CO	2,946,714	A	C
RS3A (RA3CW, op)	2,318,294	A	C
RG6G (RW6HX, op)	2,243,532	A	C
HA5KDQ/P (HA5NB, op)	201,804	B	A
PE2KP	92,225	B	A
SQ2DYF	44,774	B	A
IZ2FOS	779,738	B	B
UV8M (UX3MR, op)	748,020	B	B
EF1W (EA1WS, op)	637,920	B	B
UT5UGR	2,161,761	B	C
UW5Q	1,827,090	B	C
ES5RW	1,774,215	B	C
HG5A (HA5IW, op)	529,674	C	A
OK3C (OK2ZC, op)	378,585	C	A
RA3AN	337,161	C	A
HG7T (HA7TM, op)	1,955,259	C	B
EF3A (EA3KU, op)	1,295,640	C	B
EA7RM	1,218,838	C	B
OHØR (OH2PM, op)	2,728,224	C	C
4O3A (UT5UDX, op)	2,388,237	C	C
OL3A (OK1DRQ, op)	1,945,053	C	C
UZ2M	3,942,289	D	
HG6N	3,591,224	D	
RK4FWX	3,348,225	D	

North America

Call	Score	Power	Class
FG1PP	2,822	A	B
AL9A	159,948	A	C
XE1V	37,288	A	C
TI5N (W8QZA, op)	68,052	B	A
CO7PH	36,594	B	A
KP2/AA1BU	483,165	B	B
TG9ANF	84,788	B	B
WP3GW	27,222	B	B
J39BS	225,968	C	B
KP2B (WP3A, op)	34,840	C	B
HP1AC	25,740	C	B
XE2WWW	26,288	C	C
XE1EE	228	C	C
XE2WK	17,169	D	

Oceania

Call	Score	Power	Class
DV1UBY	1,408	A	A
VK4XES	10,416	A	B
KH7T	10,125	A	B
YC6JRT	1,525	A	B
VK3TDX	134,640	A	C
WH2X	118,708	A	C
KH6FI	67,732	A	C
DV1JM	110,618	B	B
YB1TJ	42,712	B	B
YC9MDX	34,578	B	B
KH7XS	1,471,464	B	C
YBØNDT	65,120	B	C
DU1AV	42,944	B	C
VK2AYD	121,832	C	B
ZL1TM	107,016	C	B
VK4TT	25,774	C	B
9M6BG	784,896	C	C
KG6DX	307,530	C	C
VK6DXI	165,254	C	C
WH2DX	368,874	D	
9M6BRC	958,230	D	
VK6AA	713,464	D	
ZL1T	37,840	D	

South America

Call	Score	Power	Class
PY2SEX	272,300	A	B
LQØF	153,500	A	B
PP5JY	15,810	A	B
PJ2T (K8LEE, op)	1,212,408	A	C
PY2WC	467,556	A	C
PV8AA (PV8DX, op)	425,964	A	C
PY2BN	4,884	B	A
PY2SF	1,302	B	A
PY5AP	112	B	A
ZX2B (PY2MNL, op)	249,660	B	B
PW2P	87,084	B	B
LU2UF	73,414	B	B
LV5V (LU5VV, op)	227,772	B	C
LU1FDU	164,940	B	C
LR2F	51,324	B	C
PY2QA	378	C	A
LU3FID	57,855	C	B
YV1FM	26,075	C	B
XR3A (CE3DNP, op)	25,545	C	B
PYØFF	30,150	C	C
LU1DZ	12,204	C	C
HC2A	6,732	C	C
ZY7C	1,901,520	D	
LP1H	1,688,310	D	
LT1F	1,265,694	D	

at **P33W**. Although they had fewer QSOs, they found more than enough multipliers to beat the **CN3A** team.

In the W/VE Multi-Op competition, the **K1LZ** team beat out the **NØNI** team by a sizable amount. Of course, this is not too surprising with K1LZ being on the East Coast (EMA) and NØNI in the Midwest (IA).

Close Races

The closest race this year was between two W/VE stations in the Single-Op, Mixed QRP category. In this tight race, **N5DO** squeaked by **NØKE** by 2.2%. Interestingly, N5DO had 37 fewer QSOs than NØKE, but N5DO managed to find 13 more multipliers. There's a good lesson here — don't sacrifice multipliers for rate.

The second closest race involved the HQ stations. As previously reported, the **AO8HQ** team beat the **DAØHQ** team by 3.1%. The scenario for this win is identical to the HQ results last year. The AO8HQ team took advantage of the fact that their QSOs with Europe from their Zone 36 location in Africa were worth five points compared to three points for Europeans working other European Zones. That point differential is tough to overcome and resulted in the AO8HQ win although they had only half the QSOs and about 10% fewer multipliers than the DAØHQ effort. It sure looks like EA8 is the ideal HQ location for this contest.

CARL LUETZELSCHWAB, K9LA

A friendly competition between multi-single entries by Chuck, N7BV (left) and Mike, N7WA, turned into a real Washington horse race.

The third closest race was again between two W/VE stations. In the Single-Op, Mixed, High Power category, **VE3EJ** edged out **NN1N** by 3.5%. VE3EJ ended up with enough QSOs more than NN1N to make up for somewhat fewer multipliers.

A West Coast Horse Race

Although this write-up focuses on the winners of the various categories, the majority of the entrants in this contest do not expect to come out on top. They enter for other reasons. A good reason is for the sheer fun of it. Another reason is to participate in a local competition. One such local competition was between the Multi-Op teams of **N7WA** and **N7BV**.

After log checking, the N7WA crew squeezed by the N7BV crew by 3.7%. As is seen in other close races, the N7WA team made fewer QSOs, but their multiplier total allowed them to come out on top. Note the comparison of QSOs, Mults, Points and Score in N7WA's sidebar in the online version of the Championship results. This indeed was a photo finish and you can read more about it in the online sidebar.

Propagation

The 2009 contest appears to have been blessed with some great sporadic-E openings in both Europe and North America. This resulted in several European HQ stations making close to 3000 QSOs on 15 meters and close to 2000 QSOs on 10 meters. Not bad at the solar minimum, huh?

For more details on propagation during the contest, check out the "Propagation" column in the January/February 2010 issue of the *National Contest Journal* (NCJ).

The 2010 Contest

Mark your calendars for the weekend of July 10-11 in 2010. Remember that WRTC-2010 (with the participants located in Russia) will run concurrently with the IARU contest — this should make for a very interesting event. QST

The 2009 ARRL 10 GHz and Up Contest Results

August 15-16 and September 19-20, 2009

Jon Platt, WØZQ
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Year-in and year-out, microwave operators who place near the top are those who blend knowledge and experience with a big dose of perseverance. It is perseverance that empowers us to try a long shot propagation path, only to find a nice signal, then pause and marvel at the amazing world of microwaves.

2009 Contest Highlights

This year all 107 logs claimed at least one contact on 10 GHz. Figure 1 shows a histogram of the "Best 10 GHz DX" in km. The most common best-DX distance was 350 to 400 km with 17 stations in this range. The average best 10 GHz DX distance was 402 km.

This best DX went to Mickie, W1MKY; Dale, AF1T, and Russell, K2TXB. These three completed a 704 km contact from Martha's Vineyard (FN41ql) to Mark, K1MAP, and Connie, NG4C, both collocated in Virginia Beach, Virginia (FM26aq).

On the 24 GHz band, Mike, N1JEZ, located on Mount Mansfield (FN34om) and Ray, VE3FN, located on Mont Tremblant (FN26rf) reported that band's best DX at 234 km with signals good enough for SSB.

The longest 47 GHz contact, 143 km, is claimed by Ron, K6GZA, from Mt Saint Helena and Bob, KF6KVG.

Tom, WA1MBA, reported the contest's best 78 GHz DX contact at 41 km. This contact was made from the top of Mount Wachusett in central Massachusetts.

BRUCE RICHARDSON, W9FZ

Chris Cox, NØUK, this year's second place 10 GHz category winner enjoying some of the nicer weather in the Upper Midwest.

2009 Contest Results

In the 10 GHz Only contest category, out of 76 logs Bruce, W9FZ, led the way with a total of 76,172 points. He made 387 contacts with 26 different stations. Bruce operated with the Northern Lights Radio Society who concentrated their resources by operating predominantly from one fixed site and with one rover pack.

Finishing right behind Bruce were his fellow rover pack members. Jon, WØZQ, and Chris, NØUK, actually tied for second place with 75,246 points while Holly, KØHAC, finished in fourth place with 74,810 points. The highest number of unique calls worked in the 10 GHz Only category once again goes to Glenn, KE6HPZ, shared with Richard, WB6JDH, with 59, up from 56 last year.

In the "And Up" category with 31 logs, last year's 10 GHz Only category winner Gary, WBØLJC, claimed first place with a score of 75,522 points from 387 contacts with 26 different operators. Capturing the top spot for the most number of unique contacts was Lars, AA6IW, with 70 — a new all-time record surpassing the record of 66 set in 2005 and a strong sign of the growth and interest in our microwave spectrum. Of the 31 competitors in this category, 30 logs reported contacts on 24 GHz, 7 on 47 GHz, 3 on 78 GHz, with no claimed contacts on Light.

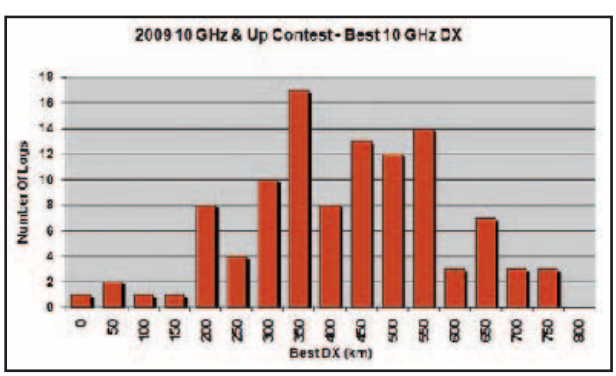

Figure 1 — 10 GHz and Up 2009 Results

Top Ten Scores

10 GHz Only Score		*10 GHz and Up Score*	
W9FZ	76,172	WBØLJC	75,522
NØUK	75,246	AA6IW	56,472
WØZQ	75,246	WB6CWN	51,934
KØHAC	74,810	W6BY	42,258
NØKP	55,160	K6GZA	36,290
KK6MK	54,238	W6QIW	34,224
WA2VOI	53,556	WØGHZ	33,450
WØJT	42,112	N6RMJ	32,588
AF1T	40,428	W1GHZ	27,355
KE6HPZ	37,695	N6TEB	26,666

Participation by Call Area

Call Area	*Entries*	*Call Area*	*Entries*
6	35	3	6
1	16	2	3
Ø	15	9	2
8	11	7	2
VE	8	5	2
4	7		

Beam Me Up!

The expanded version of this article at **www.arrl.org/contests/results** contains additional discussion, analysis, graphs, photos and tables.

Looking Ahead — The 25th Running

Weak signal VHF clubs are a key to microwave contesting. If you don't have one in your area, start one. If you do have one in your area, now is a good time to discuss your club's plans for next year's 10 GHz and Up contest — it's an outstanding club-building opportunity. Make sure to catch the fun and adventure that is the ARRL 10 GHz and Up contest on August 21-22 and September 18-19, 2010. QST

The ARRL September VHF QSO Party — Results

Midwest tropo heats things up.

Jeff Klein, K1TEO
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In 2009 the September VHF QSO Party saw a return to normalcy after Hurricane Ike heavily impacted the 2008 affair. Participation returned to much healthier levels with a very respectable 594 logs submitted and a group of Midwest rovers who organized an impressive effort in an area of the country where VHF operators are usually a bit scarce. (Read the sidebar "Midwest Mania" in the online version of this article.) Conditions for much of the country seemed to be about average. Fortunately, in the Midwest good tropo conditions were available for much of Saturday evening into Sunday. The enhancement seemed best in Illinois, Iowa and Missouri toward eastern W8, western New York and Pennsylvania.

While the enhanced band conditions led to some higher than normal results in the Midwest, even those in other areas of the country found ways to work sizable grid totals. Over half of K5QE's 101 2-meter grids were worked on EME. Top Multioperator station W2SZ managed a number of WSJT scatter contacts to enhance their total and W3SO added some 432 grids to the west from WPA to reach 54 on that band. K1TEO in Connecticut focused on working rovers in grids otherwise unavailable.

Results

Single Operator

Single Operator, Low Power remains the most popular category with about half of the contest entries. Top score in this competitive category came from K2DRH in EN41 with 286,000 points, a new Central Division record despite running low power. His competition came from a couple of mountain-toppers as WB1GQR took second place while K1TR took third. Todd, KC9BQA, was fourth followed by W3PAW. K1KG and W3SZ were right behind. AF1T, N4QWZ and WB2SIH rounded out the leader board.

Repeating in the High Power category was Jeff, K1TEO. Right behind him were Herb, WA2FGK, and the June contest winner Dave, K1RZ. Bob, K8TQK, used some of the tropo enhancement to build a fine score of 161,000 to finish in fourth, with K3TUF a close fifth. K1GX and K8MD were next, followed by K4QI, W9GA and K9EA.

The QRP Portable category saw some of the best competition in awhile. While Chris, KA1LMR, had another good score to repeat as the overall winner, he had some closer competition as N8XA and W9SZ used enhanced conditions to finish second and third. N8XA's score of 25,000 was a new Great Lakes Division record. N3YMS submitted the first-ever QRP Portable score from Delaware, taking fourth with 19,000, with WB2AMU and KB5YZG following.

Single Operator, Low Power

K2DRH	286,426
WB1GQR (W1SJ, op)	139,731
K1TR	114,912
KC9BQA	87,945
W3PAW	81,220
K1KG	79,860
W3SZ	76,560
AF1T	66,708
N4QWZ	64,896
WB2SIH	64,200

Single Operator, High Power

K1TEO	533,115
WA2FGK (K2LNS, op)	341,550
K1RZ	333,917
K8TQK	161,210
K3TUF	151,478
K1GX	95,568
K8MD	95,142
K4QI	92,225
W9GA	86,870
K9EA	79,254

QRP Portable

KA1LMR	44,772
N8XA	25,410
W9SZ	23,562
N3YMS	19,440
WB2AMU	3,115
KB5YZG	2,574
N1QLM	1,100
N7XB	893
N8CUX	690
NØJK	480

Limited Multioperator

W3SO	277,508
W4IY	210,370
AA4ZZ	187,488
KA2LIM	163,785
W2LV	139,417
W4NH	119,700
N8ZM	75,843
W1QK	40,794
WO9S	38,592
W4APP	32,928

Multioperator

W2SZ	1,346,428
K1WHS	505,680
K3YTL	324,729
N3NGE	302,770
K5QE	301,052
KBØHH	133,936
N9UHF	85,404
N8KOL	79,016
W2EA	72,910
K3EOD	63,714

Rover

N6NB/R	331,331
N6VI/R	318,801
W6TAI/R	317,660
N6MU/R	316,686
AF6O/R	314,580
W6XD/R	310,665
KK6KK/R	283,520
W6YLZ/R	273,672
W1RT/R	237,510
VE3OIL/R	128,466

Limited Rover

KO4MA/R	53,392
K2QO/R	33,600
N2SLN/R	25,026
WAØVPJ/R	24,824
N9WU/R	14,250
NØLP/R	10,080
W7CE/R	9,953
K9GY/R	6,156
W6GLS/R	5,670
K8DOG/R	4,964

Unlimited Rover

K5RNT/R	13,019
KRØVER/R	12,997
W3HMS/R	12,000

Multioperator

W3SO moved up a spot from 2008 to take first in the Limited Multioperator category. For the third year in a row, W4IY and AA4ZZ followed W3SO in that order. The WNY group at KA2LIM moved up to fourth. W2LV finished fifth, while W4NH and N8ZM both moved up a notch from 2008 to take the next two places.

W2SZ continued their top scoring in the Multioperator category. In 2009 the K1WHS crew came away with a second place finish. The next three finishers were very close, with K3YTL next followed by N3NGE. K5QE was less than 1% behind N3NGE despite poor conditions in Texas. KBØHH's well-equipped station moved up from 10th in 2008 to take number six. N9UHF and N8KOL were next from the Midwest, followed by easterners W2EA and K3EOD.

Rovers

A total of 83 rovers submitted entries. As was the case in 2008, the Unlimited category saw three entries. All three were separated by only 1000 points, as K5RNT/R was the winner. KRØVER/R missed winning by less than 0.2% with W3HMS/R right behind. Congratulations to all three on some great competition.

The Limited Rover category attracted 33 entrants. With nearly 400 contacts, KO4MA's top-scoring rove made a lot of southeastern US stations very happy. The top scorers in this category came from throughout the country with K2QO and N2SLN in second and third from WNY, WAØVPJ and N9WU next from the upper Midwest and NØLP from Colorado in sixth. W7CE made the list from Washington, followed by K9GY, W6GLS and K8DOG.

The "traditional" Rover category continues to attract the largest number of entrants with 47 in this contest. The top eight rovers travelled together throughout Southern Cali-

Regional Leaders

Northeast Region
(New England, Hudson and Atlantic Divisions; Maritime and Quebec Sections)

WB1GQR (W1SJ, op)	139,731	A
K1TR	114,912	A
W3PAW	81,220	A
K1KG	79,860	A
W3SZ	76,560	A
K1TEO	533,115	B
WA2FGK (K2LNS, op)	341,550	B
K1RZ	333,917	B
K3TUF	151,478	B
K1GX	95,568	B
KA1LMR	44,772	Q
N3YMS	19,440	Q
WB2AMU	3,115	Q
N1QLM	1,100	Q
KM3G	24	Q
W3SO	277,508	L
KA2LIM	163,785	L
W2LV	139,417	L
W1QK	40,794	L
W3HZU	16,008	L
W2SZ	1,346,428	M
K1WHS	505,680	M
K3YTL	324,729	M
N3NGE	302,770	M
W2EA	72,910	M
W1RT/R	237,510	R
K3LFO/R	66,125	R
NN3Q/R	52,972	R
WA3PTV/R	47,321	R
WA2IID/R	47,090	R
K2QO/R	33,600	RL
N2SLN/R	25,026	RL
W3BC/R	3,315	RL
WA1T/R	3,193	RL
KB2BSL/R	3,100	RL
W3HMS/R	12,000	RU

Southeast Region
(Delta, Roanoke and Southeastern Divisions)

N4QWZ	64,896	A
K4LY	53,582	A
WB4WEN	26,220	A
N4HN	10,710	A
W8FR	8,646	A
K4QI	92,225	B
W4RX	54,463	B
WB4SLM	52,632	B
W3IP	29,862	B
WJ9B	22,446	B
KB5YZG	2,574	Q
K4RSV	84	Q
W4IY	210,370	L
AA4ZZ	187,488	L
W4NH	119,700	L
W4APP	32,928	L
KØXXX	2,368	L
N4JQQ	12,240	M
W4YCC	4,840	M
AG4V/R	24,357	R
KO4MA/R	53,392	RL
AI4GR/R	3,162	RL
AD4IE/R	1,170	RL
KB4JHU/R	300	RL
N3KKM/R	80	RL

Central Region
(Central and Great Lakes Divisions; Ontario Section)

K2DRH	286,426	A
KC9BQA	87,945	A
WØUC	43,758	A
WN8R	22,860	A
K9MU	21,844	A
K8TQK	161,210	B
K8MD	95,142	B
W9GA	86,870	B
K9EA	79,254	B
VE3ZV	77,088	B
N8XA	25,410	Q
W9SZ	23,562	Q
N8CUX	690	Q
KC9MMM	20	Q
K9PLS	15	Q
N8ZM	75,843	L
WO9S	38,592	L
W9RM	10,640	L
N9TF	5,400	L
KC9ECI	240	L
N9UHF	85,404	M
N8KOL	79,016	M
KB8O	17,400	M
W8PGW	14,848	M
W8RU	12,376	M
VE3OIL/R	128,466	R
VE3SMA/R	104,400	R
W9SNR/R	91,264	R
KF8QL/R	11,118	R
NE8I/R	10,166	R
N9WU/R	14,250	RL
K9GY/R	6,156	RL
K8DOG/R	4,964	RL
K9JK/R	3,660	RL
VE3RKS/R	1,560	RL

Midwest Region
(Dakota, Midwest, Rocky Mountain and West Gulf Divisions; Manitoba and Saskatchewan Sections)

NØLL	33,376	A
W6ZI	23,912	A
KØSIX	16,827	A
NØWJY	12,375	A
KØPQW	11,505	A
WQØP	41,697	B
WØGHZ	31,061	B
KØAWU	27,354	B
WØZQ	14,980	B
K5LLL	12,480	B
NØJK	480	Q
KØNR	168	Q
WØDJM	104	Q
NØLD	7,353	L
WD5IYF	2,627	L
KØKU	1,134	L
KCØDEB	338	L
N5KV	4	L
K5QE	301,052	M
KBØHH	133,936	M
WØEEA	34,087	M
W9FZ/R	71,136	R
AE5P/R	37,260	R
N5AIU/R	35,190	R
WRØI/R	16,520	R
KK6MC/R	12,006	R
WAØVPJ/R	24,824	RL
NØLP/R	10,080	RL
W3DHJ/R	1,380	RL
ABØYM/R	1,040	RL
K5MRA/R	714	RL
K5RNT/R	13,019	RU
KRØVER/R	12,997	RU

West Coast Region
(Pacific, Northwestern and Southwestern Divisions; Alberta, British Columbia and NWT Sections)

K6VCR	44,640	A
K6XN	12,384	A
K1YQP	12,177	A
K6TSK	10,868	A
W6OMF	6,240	A
KC6ZWT	17,066	B
KC6SEH	9,460	B
K7JX	9,243	B
K7ND	7,437	B
K6SVG	5,566	B
N7XB	893	Q
KF6CVA	24	Q
W6DTW	24	Q
VE6STP	21	Q
VE7IHL	8	Q
WA6ZTY	2,921	L
K6EU	2,550	L
KE6GFF	1,462	L
WG6D	976	L
K7HPT	798	L
VE7IY	20,246	M
K6LRG	16,271	M
W6YX	12,374	M
WA7NCL	429	M
N6NB/R	331,331	R
N6VI/R	318,801	R
W6TAI/R	317,660	R
N6MU/R	316,686	R
AF6O/R	314,580	R
W7CE/R	9,953	RL
W6GLS/R	5,670	RL
K6LMN/R	3,753	RL
K6JRA/R	3,752	RL
N6ORB/R	3,172	RL

BRUCE RICHARDSON, W9FZ

W9FZ participated in the Midwest Mania by roving from several grids. Here is Bruce and his rover getting ready to start the contest from grid EM08.

fornia operating on ten bands in each of eleven grids. N6NB led the group with 331,000. Congratulations to N6VI, W6TAI, N6MU, AF6O, W6XD, KK6KK and W6YLZ who finished in that order and helped the Southern California Contest Club win the Club Competition. W1RT and VE3OIL both travelled to nine grids and scored well to take the next two places.

Regional Results

Northeast

In the QRP Portable category, in addition to KA1LMR, N3YMS and WB2AMU with top nationwide scores, the next two regional positions were taken by N1QLM and KM3G. In the Multioperator category, W3SO led the region's Limited entries followed by KA2LIM, W2LV, W1QK and W3HZU. W2SZ, K1WHS, K3YTL, N3NGE and W2EA all were in the overall Top Ten for Multioperator. In the Rover category, W1RT had the top score, followed by K3LFO, NN3Q, WA3PTV and WA2IID. WA3PTV and WA2IID were separated by only a handful of points. Limited Rovers W3BC, WA1T and KB2BSL were all neck and neck for regional top scores behind national leaders K2QO and N2SLN.

Southeast

N4QWZ led the region's Single Operator, Low Power entries, followed closely by Doug, K4LY. WB4WEN, N4HN and W8FR rounded out the leader board. In the High Power group, K4QI had the top score and a leading national score. Jim, W4RX, was next with WB4SLM right behind, followed by W3IP and WJ9B.

The Limited Multioperator category was particularly competitive in the Southeast region with W4IY, AA4ZZ and W4NH among the top stations in the contest, and W4APP and KØXXX joining them in the regional Top Five. N4JQQ had the top Multioperator score in the region. KO4MA's 20 grid rover and first place national finish provided lots of contacts. AI4GR and AD4IE were next in line in the Limited category, while AG4V had the top traditional Rover score in the region.

Central

K2DRH and KC9BQA had top nationwide scores in the Single Operator, Low Power category. They were followed by Central region stations WØUC, WN8R and K9MU. Four of the top five High Power stations in the region achieved Top Ten status, as well. Just missing that list but taking fifth in the Central region was VE3ZV. QRP Portable competitors N8XA and W9SZ fared well overall and were followed by N8CUX regionally. Limited Multiops N8ZM and WO9S were at the top of their category followed by W9RM and N9TF. In the Multioperator group N9UHF was tops followed by N8KOL, KB8O, W8PGW and W8RU.

VE3OIL, VE3SMA and W9SNR recorded excellent scores in the traditional Rover category. KF8QL and NE8I were next. In the Limited Rover category the top three made the national Top Ten scene; N9WU, K9GY and K8DOG. K9JK and VE3RKS rounded out the Central leaders.

Midwest

Larry, NØLL, did his usual great job from Kansas, to lead the Single Operator, Low Power operators, followed by W6ZI, KØSIX, NØWJY and KAØPQW. Scores were fairly close among the top High Power stations with WQØP operating portable to lead the pack, with Minnesotans WØGHZ, KØAWU and WØZQ following. Kansas was apparently the place to be with NØJK taking the top QRP Portable spot and NØLD taking the Limited Multioperator competition. K5QE's terrific effort in the Multioperator category broke up the Kansas winning streak, though second went to KBØHH operating from western Kansas. The WØEEA team did well once again to take third in the region.

Bruce, W9FZ, led the traditional Rovers with a great 71,000 effort from 10 grids along the route shown in Figure 1. Other top scorers were AE5P, N5AIU, WRØI and KK6MC. WAØVPJ and NØLP made the national top listings for the Limited Rover category with W3DHJ finishing third in the Midwest region.

Western

Out in the West, the Single Operator, Low Power category was dominated by California operators K6VCR, K6XN, K1YQP, K6TSK and W6OMF. In the High Power category Californians KC6ZWT and KC6SEH had the highest scores, but the W6 dominance was broken up by Washington stations K7JX and K7ND. N7XB had the leading score in

QSO Leaders By Band

Single Operator Low Power

50 MHz

K1TR	204
WB1GQR (W1SJ, op)	173
K2DRH	152
N3RG	133
W3PAW	115

144 MHz

K1TR	241
WB1GQR (W1SJ, op)	222
K2DRH	201
WB2SIH	155
WB2CUT	149

222 MHz

WB1GQR (W1SJ, op)	80
K2DRH	78
K1TR	72
WB2SIH	68
KC9BQA	68

432 MHz

K2DRH	117
K1TR	114
WB1GQR (W1SJ, op)	92
WB2SIH	84
KC9BQA	83

902 MHz

WB1GQR (W1SJ, op)	27
K2DRH	24
K6VCR	21
K1KG	20
W3PAW	19

1296 MHz

K2DRH	33
WB1GQR (W1SJ, op)	33
K6VCR	31
AF1T	24
K1KG	24

Single Operator High Power

50 MHz

K1RZ	208
K2AX	198
WA2FGK (K2LNS, op)	185
K1TEO	182
K1VW	140

144 MHz

K1TEO	304
KA1ZE	244
K1RZ	220
WA2FGK (K2LNS, op)	190
W2KV	178

222 MHz

K1TEO	113
K1RZ	93
WA2FGK (K2LNS, op)	87
K3TUF	75
K8TQK	61

432 MHz

K1TEO	142
K1RZ	125
WA2FGK (K2LNS, op)	101
W9GA	81
K3TUF	79

902 MHz

K1TEO	60
WA2FGK (K2LNS, op)	45
K1RZ	44
K3TUF	31
K1GX	27

1296 MHz

K1TEO	73
K1RZ	57
WA2FGK (K2LNS, op)	48
K3TUF	35
K1GX	33

Single Operator Portable

50 MHz

KA1LMR	65
N8XA	63
N3YMS	41
WB2AMU	31
N7XB	22

144 MHz

KA1LMR	88
N3YMS	68
N8XA	64
W9SZ	53
KB5YZG	40

222 MHz

KA1LMR	41
N3YMS	25
N8XA	22
W9SZ	18
WB2AMU	4

432 MHz

KA1LMR	49
N3YMS	33
W9SZ	30
N8XA	22
KB5YZG	19

902 MHz

KA1LMR	15
W9SZ	12
N8XA	4

1296 MHz

W9SZ	15
KA1LMR	14
N3YMS	6
N8XA	5
KC9MMM	1

Multioperator

50 MHz

W2SZ	501
K1WHS	395
K3YTL	390
W4IY -L	325
W3SO -L	312

144 MHz

W2SZ	435
W3SO -L	383
K1WHS	383
K3YTL	357
W4IY -L	335

222 MHz

W2SZ	149
K1WHS	124
W3SO -L	117
K3YTL	106
KA2LIM -L	103

432 MHz

W2SZ	196
W3SO -L	190
K1WHS	175
K3YTL	142
N3NGE	125

902 MHz

W2SZ	74
K5QE	49
K1WHS	46
N3NGE	41
K3YTL	24

1296 MHz

W2SZ	92
K1WHS	54
K3YTL	48
K5QE	45
N3NGE	41

-L denotes Limited Multioperator

Multiplier Leaders By Band

Single Operator Low Power

50 MHz

K2DRH	62
K4LY	37
N4QWZ	34
K9MU	31
W3PAW	29

144 MHz

K2DRH	72
N4QWZ	46
K4LY	43
KC9BQA	36
W6ZI	36

222 MHz

K2DRH	42
KC9BQA	31
N4QWZ	28
WB1GQR (W1SJ, op)	25
K4LY	25

432 MHz

K2DRH	50
N4QWZ	37
KC9BQA	28
K4LY	28
K1TR	27

902 MHz

K2DRH	20
KC9BQA	14
WB1GQR (W1SJ, op)	11
K1KG	11
WB3IGR	10

1296 MHz

K2DRH	21
K1KG	12
NØLL	12
N4QWZ	11
WB1GQR (W1SJ, op)	11

Single Operator High Power

50 MHz

K1TEO	48
K1RZ	47
WA2FGK (K2LNS, op)	43
K8TQK	40
K4QI	39

144 MHz

KA1ZE	61
WA2FGK (K2LNS, op)	54
K8TQK	54
K1TEO	54
K4QI	45

222 MHz

K1TEO	44
K8TQK	43
K3TUF	33
K4QI	33
K1RZ	32

432 MHz

K1TEO	43
K8TQK	41
K4QI	37
WA2FGK (K2LNS, op)	35
K1RZ	34

902 MHz

K1TEO	28
WA2FGK (K2LNS, op)	22
K8TQK	18
K3TUF	18
WQØP	17

1296 MHz

K8TQK	27
K1TEO	26
K1RZ	22
WA2FGK (K2LNS, op)	21
K4QI	21

Single Operator Portable

50 MHz

N8XA	36
N3YMS	19
KA1LMR	18
WB2AMU	14
N7XB	8

144 MHz

N8XA	34
N3YMS	22
KB5YZG	21
KA1LMR	21
W9SZ	17

222 MHz

N3YMS	16
N8XA	15
KA1LMR	14
W9SZ	10
WØDJM	2
WB2AMU	2
W6DTW	1
K9PLS	1
KF6CVA	1

432 MHz

N3YMS	17
N8XA	15
KA1LMR	15
W9SZ	14
KB5YZG	12

902 MHz

W9SZ	8
KA1LMR	7
N8XA	2

1296 MHz

W9SZ	11
N3YMS	6
KA1LMR	5
N8XA	3
KC9MMM	1

Multioperator

50 MHz

K5QE	69
K1WHS	68
W4IY -L	58
W4NH -L	55
W3SO -L	51

144 MHz

K5QE	101
W2SZ	87
AA4ZZ -L	81
W3SO -L	61
W4IY -L	56

222 MHz

W3SO -L	46
AA4ZZ -L	41
W2SZ	41
W4IY -L	38
K3YTL	38

432 MHz

W3SO -L	54
AA4ZZ -L	44
W2SZ	42
K3YTL	41
W4IY -L	41

902 MHz

W2SZ	38
K5QE	23
K1WHS	19
N3NGE	19
KBØHH	18

1296 MHz

W2SZ	39
K5QE	23
KBØHH	19
K1WHS	19
K3YTL	18

-L denotes Limited Multioperator

Club Competition

Club Name	*Score*	*Logs*
Medium Club Category		
Southern California Contest Club	2,582,754	14
North East Weak Signal Group	1,696,516	21
Potomac Valley Radio Club	898,541	23
Mt Airy VHF Radio Club	795,307	20
Society of Midwest Contesters	455,160	23
Nacogdoches ARC	374,294	5
Badger Contesters	356,051	16
Contest Club Ontario	343,721	9
Carolina DX Assn	254,548	6
Rochester VHF Group	197,849	4
Northern Lights Radio Society	183,588	15
Yankee Clipper Contest Club	180,660	11
Tennessee Contest Group	65,564	5
Florida Weak Signal Society	52,781	8
Northern California Contest Club	45,895	12
Pacific Northwest VHF Society	39,864	12
Bergen ARA	12,832	4
North Texas Microwave Society	5,739	4
Florida Contest Group	4,763	3
Grand Mesa Contesters of Colorado	4,747	3
Contest Group Du Quebec	4,303	6
Oklahoma DX Assn	450	3
Arizona Outlaws Contest Club	262	3
Local Club Category		
Murgas ARC	687,927	6
Stoned Monkey VHF ARC	85,525	7
Chippewa Valley VHF Contesters	50,550	4
Raritan Bay Radio Amateurs	27,210	5
Schenectady Museum ARA	15,518	3
Dauberville DX Assn	6,304	3
Portage County Amateur Radio Service	1,242	3

the QRP Portable category. There was tight competition in the Limited Multioperator category with WA6ZTY, K6EU and KE6GFF reporting similar scores. Likewise the top three Multioperator stations were close with VE7IY coming out ahead of K6LRG and W6YX.

The pack rovers had the greatest national impact with N6NB, N6VI, W6TAI, N6MU and AF6O finishing in that order in the region and overall in the contest. Another tight competition occurred in the Limited Rover category with W7CE taking first in the Western region, with W6GLS, K6LMN, K6JRA and N6ORB following.

Club Competition

A total of 23 Medium clubs and seven Local clubs took part in the Club competition. For the third year in a row, the Murgas ARC of Pennsylvania took top honors in the Local competition — this time with nearly 700,000 points. Second went to the Stoned Monkey VHF ARC with seven log submissions while the Chippewa Valley VHF Contesters took third among the Local clubs. Scores in the Local category were a good deal higher, as the number two club from 2008, the Raritan Bay Radio Amateurs, took fourth, though they managed to more than double their 2008 score.

After several years of impacting the national rover results, the group led by N6NB not only dominated that category, but also won the Medium Club competition, defeating the 2008 champs from the North East Weak Signal Group. Likely this marks the first time a West Coast Club has achieved the high club score in a VHF Contest. Third place went to the Potomac Valley Radio club, whose 23 logs tied with the fifth place Society of Midwest Contesters for the most club logs. Fourth went to the Mt Airy VHF Radio Club.

Conclusion

It was good to see activity return to more normal levels after the downturn in the 2008 contest. Scores were up as the activity improved with some additional boost from the enhanced conditions in the Midwest. Stay tuned for 2010 to see who has the next great idea to make the September contest one to remember.

BRUCE RICHARDSON, W9FZ

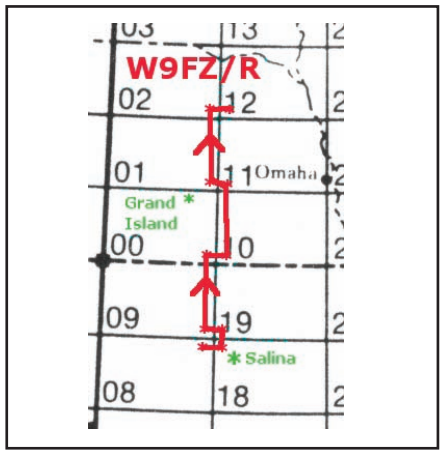

Figure 1 — How does a rover hit 10 grids in a single contest? Here is W9FZ's path from Kansas grid EM08 north to Nebraska's EN12.

Online Version

You won't have to wait for sporadic-E to get more photos and information about the contest and Midwest Mania. Read the expanded version of the results online at **www.arrl.org/contests/results**.

Strays

A HELPING HAMS CHRISTMAS

◊ The West Tennessee Amateur Radio Society is pleased to announce to return of Gary King, W4WKZ, to the Amateur Radio waves. Gary, who is legally blind, has been off the radio for almost 2 years. He was very active part of the Amateur Radio community participating in the daily weather reporting of conditions at his home in Medon, Tennessee to the National Weather Service in Memphis. He has been off the air due to damage to his antenna system nearly 2 years ago.

The story began back in November 2008 when a longtime friend, Bob Alper, W6KT, came to visit Gary. He noticed the damage to Gary's 60 foot tower and antenna array. Gary, not being able to make the repairs himself, was left with no way to use his ham radio equipment. Bob quickly got in contact with Philip Julian, KG4NVN, the treasurer of West Tennessee Amateur Society (WTARS) here in Jackson. Bob and Philip worked together to make a plan for repairing Gary's tower and antenna system.

During the summer heat of July 2009, a group of WTARS members assembled at Gary's home to begin the repair project. The group mixed and poured more than 80 pounds of concrete, by hand in a 5 gallon bucket, to make a new base for the existing tower. During the next 4 months a new antenna system and other tower installation items were purchased.

On December 5, 2009, the group returned to Gary's home to complete the repairs. Philip, KG4NVN, contacted local crane operator Randy Rushing of Rushing's Crane Service. Randy happily agreed to bring his equipment out for the installation of the new antennas. All of Randy's expenses were donated to the project. He is known throughout the community for his willingness to serve others during local emergencies and disasters and is part of the Baptist Disaster Relief Ministry.

The group installed on Gary's tower a Diamond X50 dual band vertical. This antenna will give Gary the coverage he needs to reach the local repeaters and ample simplex coverage. They also installed a home brew HF multiband wire antenna built by Randy Bennett, W4RFB. The wire antenna was installed on a pulley system allowing for easy lowering and raising, eliminating the need to climb the tower to tune or make adjustments.

At the end of the day Gary was back on the air. WTARS has given Gary back the joys he once had in the Amateur Radio hobby. WTARS would like to give a special thanks to Philip Julian, KG4NVN, for taking the lead on this project. Philip spent a countless number of hours in preparation for this project. We also give a special thanks to Randy Rushing of Rushing's Crane Service in Jackson for providing the bucket crane to complete the installation. — *Lee Towater, KF4NZV*

COURTESY OF PHILIP JULIAN, KG4NVN

The WTARS Christmas Crew. Front row from the left: Chris Brazzell, KF4WNB; Tom Goodman, AI4DB. Back row from the left: Greg Flanagan, N4GMF; Chris Wray, KD4MPN; Mike Winslow, N4GMW; David Benefield, KI4SLM, and Randy Bennett, W4RFB.

W3ZZ

THE WORLD ABOVE 50 MHz

Two Meter DXCC via Terrestrial Propagation

By now everyone knows of the quest for working the 48 contiguous United States on 2 meters by terrestrial modes enjoyed by VHF operators living in a narrow stretch of land in the central US. Kevin Kaufhold, W9GKA, brought this endeavor up to date in the July 2008 "World Above 50 MHz" column and has provided further updates in the intervening 2 years.

I recently learned that my neighbor Chris Patterson, W3CMP, and I share an even more obscure interest — the desire to work as many DXCC entities as possible from the US by terrestrial propagation without any EME. We all know that this is a viable pursuit from Europe where a centrally located European, say in northern Italy, could be within reach of almost enough countries to make DXCC. Aside from the ~68 DXCC entities in Europe, he can potentially work more than half a dozen in northern Africa, a dozen in the Middle East and even a handful in southern Africa on transequatorial propagation (TEP).

But what about amateurs in the United States? DXCC rules say that you can work entities from any place in a given country so you are only limited by the geographical limits of the 48 contiguous states. And you might be surprised at how many countries are contained within a reasonable range if you move around. Let's now take a look at the possibilities based on research that Chris and I did to see what has actually been worked and could be worked given the limits of 2 meter propagation.

What Can be Worked?

What is close to the US? For practical purposes we are limited to distances of 2500 km or less in most instances. This means all of the Caribbean, a few countries in northern South America, a few countries in the nearby Pacific Ocean, a few countries east of Canada, Alaska and one entity in the central Pacific that is reachable only by a special set of circumstances.

Let's start with some parameters. Two meters provides three types of propagation over long distances: tropospheric ducting, E layer refraction and spread F layer (TEP). In theory tropospheric ducting should have no limitations but in practice all but a few special ducts cover no more than 2500 km. The warm waters of the Caribbean might support greater distances than that but long ducts require both warmth and stable air masses and the Caribbean contains a lot of unstable air. Thus the best ducts *inside the Caribbean* may be in the Northern Hemisphere winter when they may have trouble reaching all but the most southerly locations in the US.

Two meter E_s is relatively rare in the United States especially when compared to Europe, but it does happen and the good news is that single hop distances readily approaching 2500 km do occur to the Caribbean. The bad news is such openings

This Month

March 28 Excellent EME conditions*

*Moon data from W5LUU

Table 1

DXCC Entities Workable from the Continental 48 States by Terrestrial Propagation

DXCC	*Grid*	*Distance*	*From*	*Date*	*Stn1*	*Stn2*	*Prop*	*Source*
4U1UN	FN30	386	FM19	06/09/1991	4U1UN	W3ZZ	T	W3ZZ
C6	FL16	1403	FM19	12/13/1997	C6AIE	W3ZZ	MS	W3ZZ
CO	EL83		FN41	05/15/1998	CO2OJ	W1LP	T	W1LP
	EL83		FM19	08/12/1997	CO2OJ	W3ZZ	MS	W3ZZ
	EL83		FN10	05/27/1990	CO2KK	WA3HMK	ES	W3CMP
CP	FH53		EM32	09/23/1987	CP5CL	W5UNY	TEP*	WA50
CY9	FN97	1497	FN10	06/06/1999	CY9SS	WA3HMK	MS	W3CMP
CYØ	FN93	1365	FN10	05/24/1996	CYØAA	WA3HMK	MS	W3CMP
FP	GN16	1744	FN10	08/12/1995	FP5EK	WA3HMK	MS	W3CMP
HI	FK58	2556	FN10	10/04/1986	HI8VSC	KI3W	ES?	KI3W
K	FM19	50	FM19	08/18/1981	W3XO	W3ZZ	T	W3ZZ
KG4	FK29	881	EL95	02/29/1996	KG4CM	WB4MJE	T	N1WON
KH6	BK29	4333	CN87	07/01/1995	KH6HME	W7FI	T	WA50 WEB
KL7	CO45	2297	CN87	11/17/2000	KLØRG	K7CW	MS	K7CW
KP2	FK77	2000	EL98	06/14/1981	KV4FZ	FL^	T	KV4FZ; WA50
KP4	FK68	2490	FM19	07/01/1996	KP4A	W3ZZ	ES?	W3ZZ
V4	FK87	2342	FM14	07/01/1996	V47KV	W4FSO	ES	W6JKV
VE	FN25		FM19	01/09/1977	VE3ASO	W3ZZ	T	W3ZZ
VP2M	FK86	2063	EL95	06/14/1981	VP2MNQ	FL^	T	WA50
VP2V	FK77	1824	EL95	06/14/1981	VP2VGR	FL^	T	WA50
VP5	FL31	1998	FM19	12/13/1992	VP5/WA3HMK	W3ZZ	MS	W3ZZ
		2140	FN10	07/05/1989	VP5D	KI3W	ES	KI3W
		2218	FN31	05/10/1988	VP5D	WA1VRH	T	ZL4AAA
VP9	FM72	1322	FM19	05/19/1984	VP9IB	W3ZZ	ES	W3ZZ
		1392	FN10	04/20/1986	VP9IB	WA3HMK	MS	W3CMP
XE	DL98	295	EM00	05/14/1994	XE2LQB	W5OZI	T	W5OZI
ZF	EK99	700	EL95	06/07/1995	ZF2CP	W4EMB	T	W3CMP

*Via repeater
^Florida
Sources: WA50 = WORLD ABOVE 50 MHz
In addition to the entities listed in Table 1, the following are within range of the continental US but are without contacts:
From EL95 — 6Y, 8P, CX, FJ, FM, FS, HH, HK, HKØA, HKØM, HP, HR, J3, J6, J7, J8, KP1, KP5, LU, OA, P4, PJ/C, PJ7, PY, TI9, V2, YN, YV, YVØ, ZP
From EL15 — TG, TI, V3, YS
From DM12 — FO/C, XF4
From FN64 — OX

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are not only infrequent but apparently very short in duration as noted below. Finally there is always the possibility of TEP from the most southern locations in the US at or below 30 degrees latitude. This type of activity is not so unusual especially from the Caribbean to southern South America but Chris has unearthed only two reported instances that may have reached the United States mainland.

The Ideal Geographic Locations

Neither Chris nor I are in an ideal location for working the maximum number of DXCC entities on 2 meters. The best locations are either in southern Florida or in the boot of Texas. We have maps that show locations centered on Miami, Florida (EL95us). Southern Florida covers almost the entire Caribbean except for Barbados, a little of northern South America (HK, P4, PJ/C, YV) and essentially all of Central America. Brownsville, Texas covers some parts of Central America better (TG, TI, V3, XE, YS) and finds much of the Caribbean beyond the 2500 km barrier.

Both of those southern locations are within the TEP zone. During times of high solar flux index associated with higher sunspot numbers, this opens up possibilities to CE, CP, CX, LU, OA, PY and ZP. Four countries are in range from the northeastern US: FP, CY9 and CYØ have been worked and OX (GP60) could be worked from eastern Maine (FN64mt). To work Revilla Gigedos XF4 located south of Baja California, you can travel to San Diego (DM12jr). Many VHFers in California believe that a tropo duct may exist between at least southern California and the Galapagos HC8. Alaska is close enough to work from the Pacific Northwest/Seattle (CN87um).

Finally there is the known transpacific duct that forms between the Pacific coast of the US and Hawaii. Given the efforts particularly of Chip, N6CA, we know that this is a repeatable, serious, stable duct that has yielded contacts from 144 MHz to 5.7 GHz with only 10 GHz left unworked. Bob, K6QXY, points out that this duct has a very particular structure, forming usually at a very high altitude approaching 3000 meters at the KH6 end but dropping to less than 1000 meters at the west coast end. While contacts with KH6 stations at lower altitudes occur, they are quite rare.

Theoretically if the duct follows the Earth's curvature it must extend *past* KH6 but no serious attempts have been made to explore this possibility. Were beacons available we could test locations like KH3, KH4, KH5 and V73. These pose problems even on islands that have a ham radio population. Neil, V73MS, reports that 2 meter beacons are not feasible because of possible interference to very closely colocated ALTAIR radar.

The Band Map

Table 1 provides 27 claimed contacts with 22 of the 62 possibilities for working DXCC entities from some place in the lower 48. We start with W, VE and 4U1UN (UN headquarters in New York City). Chris and others in the Northeast have worked all the entities off the east coast of Canada, FP, CY9 and CYØ. Eastern Maine is within MS range of parts of OX with no contact found. Chris and I have worked some of the nearby Caribbean — C6, CO, VP5, VP9, as have other locals in the greater Washington, DC area and stations in the Southeast.

Deeper into the Caribbean via E_s I have worked KP4, KI3W has worked HI8 and Jimmy, W6JKV, and Mike, K6MYC, worked into FM14 from V47KV and heard but did not complete with me in an opening lasting only seconds. Though exact US call details are not given, KP4EOR describes a big tropo opening from his area to eastern Florida during the contest on June 14, 1981. KP4, KP2, VP2M and VP2V were involved. John, WZ8D, provided further information on VP2MNQ. We also got a detailed report from Bob, ZL4AAA, of the amazing tropo opening from his location at VP5D and much of the east coast up to New England on May 9-10, 1988. Quite a few US stations have worked KP4 via various modes, probably because of the high activity in KP4 and N1WON provided information about KG4CM.

As noted by FJ5DX, there are numerous reports of 2 meter TEP from the Caribbean to South America listed at EA6VQ's TEP page, **www.vhfdx.net/tepsaqsos.html**, but Chris has been able to locate only two instances of possible TEP from the US to South America. Both are unusual and neither is a simplex contact.

Flavio, PY2ZX, recounts a report from December 1981 *QST*, "What may be the first recorded occurrence of 2 meter transequatorial propagation being observed within the continental US is reported by W5UNY. Bill says that on the evening of September 23, CP5CL (Cochabamba, Bolivia) checked into a net on the 147.81/21 WB5QFM/R repeater located 10 miles south of Arcadia, Louisiana [located in EM32 — *Ed.*]. The South American was full quieting into the repeater for about 30 minutes and then dropped to what Bill characterizes as 3 × 5 for the next 2 hours... . This report is interesting as it indicates that, in the southern states at least, 2 meter TE is possible from the continental US."

Joe, CT1HZE, tells us that he has tried to collect information about remarkable 2 meter contacts for a long time, but does not have much about mainland USA to non US DXCC entities. He does point us to a contact between Steve, WB9YWN (now AF9X) and Luis, LU1DMA (GF05) on March 1, 1979 as recorded on Luis' Web site at **www.lu1dma.com.ar/50anios/50anios.htm**. This contact was apparently heard by a KP4 who could hear Luis but not Steve. With the help of W9SZ, Chris tracked Steve down. At that time Steve was active Navy operating both maritime mobile and land-based from Charleston, South Carolina. After discussion with Luis and Steve, we believe that Steve was located in Bermuda at the time. Thus again we have a TEP contact with North America but not the American mainland.

Paul, K7CW, tells us of 2 meter contacts between southern KL7 and the mainland including one he made in the 2000 Leonids. The first were probably those of former World Above editor Bill Smith (now WØWOI) in 1970. Others have followed, most recently in CO35/45. No 2 meter contacts from XF4 are reported, though E_s from there ought to be prevalent. The Hawaiian transpacific duct has yielded contacts from Washington south to the Mexican Baja.

The Status

Chris and I have canvassed many possible leads for this column without unearthing as much information as we had hoped. In addition to those mentioned, among those who responded were W1LP, K3ICH, W3NZL, WA3EOQ, K4SUS, KE4WBO, KD5XB, NI4Z, W5UN, N6CW, N7DB, WA7TZY and NP3CW. They provided some important leads to new information. Some key sources are no longer with us: K2RTH, W4EMB and WB2QLP, and others were unreachable.

We chased down false leads like YW5N to the US in the 1992 CQWW VHF WPX contest, which turned out to be a 6 meter contact (thanks Joe, N6CL). The bottom line is that more of these countries could be worked if there were sufficient activity from the DX entity side. This has been a fascinating exercise with many interesting twists and turns. Chris and I would like to know if you, the reader, have any information about working entities in Table 1 *without* listed contacts. If so please e-mail Chris at **w3cmp@aol.com**.

ON THE BANDS

6 meters. December is the peak of the minor E_s season for us and the peak of the major E_s season in the Southern Hemisphere. This month features three unusual long distance series of contacts to the Southern Hemisphere. Two involve Jack, OA4TT

(N6XQ) (FH16tw) on the geomagnetic equator, who has already shown that he can work 3 E_s hop+ distances into the US.

The first on December 12 (2349Z) was to Scott, VK4CZ (QG62lp) (13,069 km) with 519/529 pure signals with no flutter or obvious magnetic modulation. Jack was running 1 kW to an 8 element Yagi 8 meters high and Scott was running 100 W to an 8 element K6STI Yagi 20 meters AGL. On December 26 Jack worked Bob, ZL1RS (RF64vs) (10,915 km) on CW and SSB with 559/55 signals. The third on December 31 has Bob, K6QXY, working ZL1RS and ZL3NW and being heard by E51CG and VK3OT.

For the first two contacts we know that there was intense E_s at the western end of the path on 6 meters: VK/ZL into E51, A35. The 10 meter contest was just ending on the 12th. Extremely poor conditions improved markedly associated with a shift in the geomagnetic B_z component to negative some 22 hours earlier and the appearance of both F2 and E_s propagation on 10 meters. ZLs were being worked widely in the US on 10. Ten meters was open to South America on the 26th with a CE beacon being heard. K6QXY was hearing ZL video on the 31st but with weak signals.

Joe, CT1HZE, raises one possibility for the OA4TT contacts, multihop E_s over an all-water path. Carl, K9LA, agrees but notes that F2 involvement at the OA end cannot be completely ruled out even though this would be over-the-MUF based on F2 soundings indicating an F2MUF of ~25 MHz. Jack is on the geomagnetic equator so there cannot be a TEP component and there is no polar path, which would argue against the SSSP-type propagation proposed for the JA/US and JA/Europe long DX by JE1BMJ. Since the K6QXY contacts cross the geomagnetic equator, those must involve some form of F2. Whatever the mode of propagation, these were wonderful contacts. [My thanks to OA4TT, VK4CZ, K6QXY, W3EP, N3DB, W7GJ, CT1HZE and VK6KXW for comments and data — *Ed.*].

On the 9th Graham, KE4WBO (EL96) worked V44, KP4, YV, TI, YN, XE and heard HC8GR/B. Jon, NØJK (EM17) reports 2 hours into ID/MT. December 13 Vic, WB4SLM/p (EM85) was working west TX. December 14 Al, K7ICW (DM62) worked from TX to GA and north to IA. The December 18 *Daily DX* reports ZL3JT into E51, VK6, 8 and hearing VK9 and 9V1. On December 19 ZL2TPY reported hearing CE Muzak on 48 MHz 2 days after an earthward C4 class CME. On December 22 the prop reflectors report VK6 hearing E51USA/B (~8200 km). NØJK spotted W9 working W1, VE2, 3 on the 28th. Finally December 31 saw the first US auroral E opening at high latitudes in a long time — a harbinger of things to come?

Tropospheric ducting. Vic, WB4SLM, notes a fairly substantial tropo opening December 13-14. The opening covered from west Texas EM00, EM03 north to EM29, EN22 and EM69; east to EM99, FM07; southeast to GA and EL87 in FL. Ott (EM85) worked DL99 in TX (ODX~1740 km) on 2 meters. On the UHF/SHF bands EM13 worked EM55 on 2.3 GHz, EM39 on 902-2.3 GHz and 5.7 GHz, and EM29 on 1296 MHz. On the 26th Graham, KE4WBO (EL96) worked up the coast to FM16/17 on 2/432 MHz and EM92 on 1296 MHz.

Meteor scatter. For the Geminids on December 14 Bill, KØAWU (EN27ed) (160 W) worked W3UUM (EL29pw) (100 W) on 222 MHz via FSK441 with strong pings. Al, K7ICW, heard virtually nothing from his DM62 location using analog.

HERE AND THERE

W3KKN SK. Ernie Kenas, W3KKN, one of the founders of the Packrats, passed away December 11. He was a well known contester and an active VHF+ operator since the early 1950s.

Ex-N6HQK SK. Ernie Smith, ex-N6HQK, a pioneer and world-class expert on sporadic E propagation, passed away on October 21. Many of us remember Ernie's interesting presentation on E_s at Central States in 1999. (Tnx W3OTC)

N4MW Beacons. Dave, N4MW, reports that a new family of GPS-locked beacons N4MW/b is active in FM17kn: 144.280 MHz (5 W), 222.080 MHz (5 W), 432.280 MHz (10 W), 903.280 MHz (50 W), 1296.280 MHz (6 W) and 10,368.280 MHz (1.5 W). QST

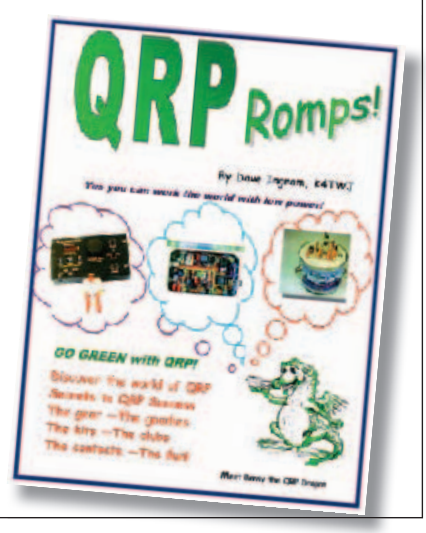
New Products

BHI RADIO MATE COMPACT KEYPAD

♢The Radio Mate from bhi Ltd is a compact keypad for the Yaesu FT-817, FT-857 and FT-897 that enables many of the common functions of these radios to be used more easily. Of specvial interest to portable, mobile and disabled operators, the Radio Mate provides a number of shortcuts including band change, direct frequency entry, VFO functions and mode selection. A new "direct frequency nudge" feature allows fine tuning of the frequency on your radio directly from the keypad. By pressing keys 1-6, the frequency can be moved ±10 or 100 Hz; ±1, 10 or 100 kHz; and ±1 MHz. A one-touch memory function offers 40 memory locations for frequency and mode; press to recall or press and hold to store. The TUNE function causes the radio to transmit a 10 second carrier for adjusting an antenna tuner. The Radio Mate requires no external power and connects to an ACC socket/CAT interface on the radio. Price $159. For more information, or to order, visit the US distributor, W4RT Electronics, at **www.w4rt.com**.

QRP ROMPS! BY K4TWJ

♢*QRP Romps!* by Dave Ingram, K4TWJ, contains late breaking details on what's hot and happening in QRP gear, goodies, on-the-air activities, clubs, conventions and fun projects. Chapters highlight commercially made gear, kits of all types and antenna ideas. There's also a collection of palm-size transmitters and receivers you can build in a few hours. The chapter on operating strategies and tried-and-proven successful secrets for DXing is beneficial to high power and low power operators alike. Price: $18. For more information, or to order, see your favorite dealer or visit **www.arrl.org/shop**.



W3UR

HOW'S DX?

K4M — Midway Atoll 2009

TOM HARRELL, N4XP

The K4M team installing one of the low band verticals on the beach. The yellow flags on the guys and vertical were a requirement of the USFWS so the local birds would not fly into them.

Joe Pater, W8GEX; Tom Harrell, N4XP, and Janet Pater, W8CAA

Midway Atoll, a US possession in the mid Pacific, is a National Wildlife Refuge administered by the US Fish and Wildlife Service (USFWS). Amateur Radio operations were plentiful while the US military occupied Midway from before World War II until the early 1990s. In 1996 the island was transferred to the US Department of the Interior and the USFWS. Under USFWS administration, requests by amateurs to activate the atoll were not approved.

In January 2009, the USFWS approved a DXpedition for October 2009. The USFWS announced the DXpedition operators would be W6OSP, N7CQQ, N6HC, N4XP, K9CT, I8NHJ, WB4JTT, DJ9ZB, W8GEX, N4PN, AA4NN, KH7U, 9V1YC, ND2T, K6TD, WA7NB, W6KK and N1DG. The DXpedition leaders would be N4XP and WB4JTT.

Planning continued for 8 months. N4XP and WB4JTT established a management team for five specific areas: N1DG, Information Technology; W6OSP, finance; KH7U and WB4JTT, transportation and logistics, and W8GEX, radios/amplifiers/antennas. Managers selected other team members to assist their duties. For 6 months Skype calls and e-mails were used to iron out all details.

The Dates are Decided

The USFWS set the DXpedition dates for October 9-19, 2009, which was just prior to the migration that brings about 1.5 million birds to the island on or about October 19. Transportation was next. Boats weren't allowed, so an airplane charter was arranged. The only aircraft available was one that could carry only 17 passengers. Since our team had 19 members, we decided that two team members would fly on a USFWS charter flight on October 4 and the rest of the team on our charter scheduled for October 5. Weight restrictions meant all of our personal belongings, radio equipment and supplies would have to be shipped in a container on a USFWS supply barge to Midway in August.

There was a lot of work to be done. KH7U had worked with many DXpeditions to the Pacific islands and had experience with USFWS procedures. Therefore, he interfaced with the USFWS on behalf of the team. He had amassed a large inventory of equipment from earlier DXpeditions and we used some of it. He also provided the staging area in Hawaii and coordinated all logistics.

With October 9 set as the departure date for Midway, the first part of the team, WB4JTT, W6OSP and N4XP, arrived in Hawaii. Our plans started to fall apart immediately, however, with news that the aircraft that was taking us to Midway was grounded. Others arrived on the 6th and the remaining members arrived by Wednesday evening the 7th. The airplane problem continued and we were put into a hold position. We continued to be told the aircraft would be fixed "soon." At least the equipment had arrived on Midway and we were together as a team.

Plane Problems

With the aircraft grounded we did not leave as scheduled. As this went on until Sunday morning, we were all very frustrated. While they were trying to fix it, we started searching for another aircraft. One of our team members, WA7NB, suggested we go to the airport and look around for other aircraft that could take us. So WA7NB, N1DG and KH7U went to the airport and talked with other airplane owners. No other aircraft was available and we had to wait for our aircraft to be repaired.

On Wednesday, the Midway Refuge Manager offered to add one more person to the team. The first person who could go was NF4A, who was very happy to be invited and eagerly accepted. With only 24 hours to get to Hawaii, he secured flights, packed some clothes and was off. Twenty-three hours later NF4A arrived at the Hawaii airport, a bit disheveled, but still glad to be a part of the team. Now we settled into a waiting game with Friday and Saturday passing with no signs of the aircraft being repaired.

On Sunday morning, we received a call from the pilot telling us they had fixed the problem and that we would depart at 3 PM. The team went to the airport with the hope that we could all go on the initial flight, but as we had been told previously, the plane was not big enough to accommodate us. W6OSP and NF4A would go on the USFWS charter flight Tuesday. The initial team departed on Sunday at 3:30 PM.

Midway at Last

Upon arrival on Midway we were met

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by Matt Brown, the Refuge Manager. We attended a class about Midway Atoll given by USFWS personnel to familiarize us with the island and most importantly, about the wildlife. We then went to the barracks for the night and slept.

Matt met us at the barracks at 6:30 the following morning. After we ate breakfast he took us to the warehouse where our equipment had been stored. The equipment was moved to our beach operating area. We also were given bicycles for our personal transportation. The only motorized vehicles on Midway were a fire truck and an ambulance with all other persons using either a bicycle or golf cart. While we were there our team used bikes.

As planned, the CW and SSB camps were separated by about 500 feet. The SSB station was in a tent and the CW station was located inside the tavern used by the Midway staff. USFWS was worried about the birds and restricted the antennas to verticals only. The Switchable Vertical Dipole Arrays proved to be sturdy, but had to have flapping ribbons added to alert the birds. All the other antennas had ribbons added also. Because of the large number of antennas and the extreme heat, the antenna fields were not fully erected till late the next afternoon. We had planned for the antennas to be placed at the water line but the USFWS would not permit this because of the possible disruption to the Hawaiian Monk Seals. Most antennas were placed 100-200 feet from the shore.

Because there was no electric power service outside the buildings, KH7U had worked with USFWS to install 110 and 220 V junction boxes prior to our arrival. From those boxes we used large electric cords to run the power to our stations. Midway 2009 paid for the electrical source and it is being left for future DXpeditions.

Our plan was to have all stations on the air at the same time, but because of our 3 day delay we decided to put each station on as it became operational. The first CW contact was with ZL2IFB; on SSB it was with JE1AON, both on 20 meters. Five stations were operational within the first 13 minutes of operation. Once we were up and running, everything went smoothly. Following an operating schedule made by N1DG, each operator worked a 3 hour shift and then had 6 hours off. Conditions were very good almost 24 hours a day, with Europe coming through with good signals on at least one band at any given time.

Midway Calling *Midway*

Before the DXpedition, AB6RM contacted W6OSP to set up a schedule with the aircraft carrier USS *Midway*, now a museum in San Diego. It was learned their station would be manned by Amateur Radio operators who are Midway Museum volunteers.

COURTESY JOE PATER, W8GEX

Charlie, W6KK (foreground) Dave, WB4JTT; and Charlie, NF4A, working CW from the "tavern."

We had a fine contact with W6OSP, a former US Navy communications technician as our operator. At the time of the schedule we had to close the regular operation's pileups, move to the USS *Midway* frequency and established contact with NI6IW on the USS *Midway*.

Off Duty

Our sleeping rooms were in a former US Navy barracks and were quite comfortable. All meals were served in Clipper House, the island cafeteria, which had good food. We would relieve the five operators on duty during "dining time" in order for them to eat and then they would go back and finish their shift.

The weather on Midway was pleasant, though hot at times. It was extremely hot the first 2 days while we were building antennas, but it cooled off with beautiful, sunny weather the remaining time. As luck would have it, while we tore down the weather turned windy with a warm rain. In fact, on Sunday morning, our last full day on the island, the wind blew down one of the Titanex verticals.

Final Tally

Our operating plan called for removing one station at a time so we would be on the air as long as possible. The last contacts were on CW with NH7CU and on SSB with AA1V. In the end 60,739 contacts were made with over 18,465 unique call signs. The contact breakdown by continent was: Africa — 171 (0.1%), Asia — 17,449 (29%), Europe — 12,677 (21%), North America — 28,251 (47%), Oceania — 1348 (2%) and South America — 833 (4%).

We left Midway for Honolulu on Monday, October 19, again with 17 team members. This time N7CQQ and WB4JTT remained behind for the USFWS flight on Friday. While waiting, they would close out the operation and package the equipment for return, either on an upcoming flight or on the USFWS supply vessel.

The 3 day delay in transportation to Midway reduced the on-air time to 6½ days, but still 61,000 contacts were made. Propagation proved to exceed all expectations with conditions open to many areas of the world 24 hours a day. Much emphasis was put on working Europe and we were happy with the number of European contacts.

One of the goals of the Midway 2009 team was to ensure that those who are preserving Midway Atoll were left with a positive feeling toward ham radio. Our goal was to make it possible for more operations take place from Midway. This operation produced no problems for the local birds and many positive comments were received while we were there. We are confident ham radio will again be heard from Midway Atoll.

A Final Word

We would like to thank the DX community for their patience and their financial support. Without that help, this trip would not have been possible. The team tried very hard to give you a very professional DXpedition. We are most grateful to you. Of course, our gratitude also goes to the US Fish and Wildlife Service and especially the Midway Refuge Manager Matt Brown and his staff for the support provided in making the operation happen, but most of all for allowing our DXpedition to take place.

We also wish to thank NCDXF, the Colvin Foundation, INDEXA, GDXF, SWODXA, SEDXC, the Swiss DX Foundation, EUDXF, the Lone Star DX Association, OZDXF, RSGB, the Carolina DX Association, the Clipperton DX Club, ACOM, Rig Expert, Heil Sound, WXØB, Davis RF, WriteLog, Vibroplex, Autek, the Battle Creek Group, ELLI print, W8AEF and W6SZN — all of whom were principal sponsors of this DXpedition. Nor do we want to forget those other clubs, associations and the many DXers who provided additional financial support to help make this operation a success. Finally, those who provided computer, electronic, financial, logistical and QSL support throughout the operation — AA1V, DL9RCF, W5DNT, W6XA, Margarett Blackwell, W8CAA, OK1KT, AH6NF, WH6GS and AH6OZ also have our deep appreciation.

AT THE FOUNDATION

New Goldthorpe Scholarship Added for 2010

In December 2009 the ARRL Foundation unanimously approved terms for the Ted, W4VHF and Itice, K4LVV Goldthorpe Scholarship. Ted, W4VHF, serves as President of the Carolina DX Association and he and Itice, K4LVV, are active operators chasing DX and operating during contests from their home in Charlotte, North Carolina. The Goldthorpes have been continuing generous supporters of ARRL education programs since 2002. Now they have made a significant commitment to education by endowing a new scholarship with the ARRL Foundation. This annual scholarship will be awarded for the first time in 2010 to a young radio amateur who demonstrates financial need, volunteer service in community activities and active involvement in Amateur Radio.

Each year the ARRL Foundation awards more than 50 scholarships to radio amateurs seeking higher education. All information about the scholarships, including descriptions, application forms and instructions are found on the Web at **www.arrl.org/arrlf**. QST

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Jan 15-Dec 12, 2359Z-2359Z, TC2Ø1Ø. Istanbul, Republic of Turkey. TCSWAT. Istanbul 2010 European Capital of Culture Award. All bands. Certificate. TCSWAT/Op TA1HZ - Tevfik A.K., PO Box 73 Karakoy, Istanbul 34421, Republic of Turkey. **www.ta0u.com/2010/eng/pdf/2010AWARDCatalogue.pdf**

Feb 19-Feb 21, 2300Z-2300Z, W3G. Catasauqua, PA. TDF Radio Club. 278th Anniversary of George Washington's Birthday. 18.130 14.226 7.180 3.880. QSL. Elixander Valladares, 841 Poplar St, Catasauqua, PA 18032. **www.ka3kdl.com**

Mar 3-Mar 13, 1400Z-2300Z, W2R. Robbinsville, NJ. Delaware Valley Radio Association. Robbinsville Township, NJ 150 Year Anniversary. 14.270 7.200. QSL. Michael Moreken, 55 Sharon Rd Apt E-22, Robbinsville, NJ 08691-1329. **ab2io@arrl.net**, **Robbinsville150.org** *or* **www.qrz.com/db/ab2io**

Mar 6, 1800Z-2359Z, Katy, TX. KT5TX, Katy Amateur Radio Society. 30th Anniversary Special Event. 7.280 3.900. Certificate. Allan Hill, NQ5B, 1907 Mound Lake Dr, Richmond, TX 77406. **nq5b@arrl.net** *or* **people.consolidated.net/pburrow/kars**

Mar 13, 1400Z-2100Z, W4OT. Vero Beach, FL. Vero Beach Amateur Radio Club. 107th Anniversary, Pelican Island National Wildlife Refuge. SSB 14.260 7.190 CW 14.140 7.040. Certificate. VBARC/W4OT, PO Box 2082, Vero Beach, FL 23961. **www.fws.gov/pelicanisland/** *or* **www.vbarc.net**

Mar 13, 1700Z-2359Z, NI6IW. San Diego, CA. USS *Midway* (CV 41) Museum Radio Operations Room. Medical Corps Birthday 1871 and Neil Armstrong making 7 orbits in Gemini 8 1966. SSB 14.320 7.250 CW 14.060 7.055 PSK-31 7.070 D-STAR 2m/70 SOCAL rptrs. QSL. USS Midway Radio Room, 910 N Harbor Dr, San Diego, CA 92101-5811. **kk6fz@arrl.net**

Mar 20, 1400Z-1900Z, WC5C. Azle, TX. Tri-County Amateur Radio Club. 1st Activation Goat Island — United States Island. 28.350 21.350 14.250 7.250. QSL. David Johnson, KB5YLG, 820 Wood Ln, Azle, TX 76020. **wc5c@arrl.net** *or* **www.wc5c.org**

Mar 20, 1400Z-2000Z, W4BKM. Macon, GA. Macon Amateur Radio Club. 28th Annual Cherry Blossom Festival. 145.37 14.240 7.225 7.055. Certificate. MARC, PO Box 4862, Macon 31208-4862. **members.cox.net/w4bkm**

Mar 20-Mar 21, 1300Z-0100Z, W1W. Gardner, MA. Mohawk Amateur Radio Club. 25th Anniversary of the Mohawk Amateur Radio Club. SSB 14.260 7.260 3.885 RTTY 14.090. QSL. John Dould, 41 Gauthier Rd, Barre, MA 01005. **www.mohawk-arc.org**

Mar 20-Mar 22, 2359Z-2359Z, TC2Ø1ØPSG. Istanbul, Republic of Turkey, TCSWAT. Pilot Sabiha Gokcen. All Bands. Certificate. TCSWAT/A. K. Tevfik, TA1HZ, PO Box 73 Karakoy, Istanbul 34421, Republic of Turkey. *Contacts can be used for the Istanbul 2010 European Capital of Culture Award*. **www.ta0u.com/2010/eng/pdf/TC2010PSG.PDF**

Mar 21, 1000Z-2300Z, K5B, Las Cruces, NM. Mesilla Valley Radio Club. Bataan Memorial Death March Marathon. 21.305 14.229 7.184 3.808. QSL. Mesilla Valley Radio Club, PO Box 1000, Las Cruces, NM 88004-1443. **www.n5bl.org/bataan**

Mar 27, 1300Z-1600Z, VE3XR. Brampton, ON, Canada. Peel and Mississauga Amateur Radio Clubs. Ham-Ex Annual Hamfest. 14.265 7.260 3.750. QSL. Via bureau or direct to Jeff Richardson, VA3QSL, 36 Crawley Dr, Brampton, ON L6T 2S1, Canada. **www.ham-ex.ca**

Mar 27, 1700Z-2359Z, KF7FTF. Scottsdale, AZ. Tranquility Base Amateur Radio Club. Supporting responsible pet ownership and shelter adoptions. 14.260 7.230. Certificate. Tranquility Trails Animal Rescue, Attn: QSL, 7701 E Gray R, Ste 105-106, Scottsdale, AZ 85260. **info@TranquilityTrail.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/contests/spevform.html**. 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 **May** *QST* would have to be received by **Mar 1**. In addition to being listed in *QST*, your event will be listed on the *ARRLWeb* Special Event page. Note: All received events are acknowledged. If you do not receive an acknowledgment within a few days, please contact us.

Special Events listed in this issue include current events received through January 10. You can view all received Special Events at **www.arrl.org/contests/spev.html**. QST

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

K2TQN

VINTAGE RADIO

Don Mix Returns Home

Coming home wasn't easy for Don Mix and the *Bowdoin* crew. Like Arctic explorers before them, they found the weather conditions there are unpredictable and cause unexpected problems. And in this case they almost didn't come back, or more correctly, the *Bowdoin* almost didn't come back.

The summer there was colder than expected. Even though the ice disappeared beyond the harbor, Refuge Harbor was covered with ice, just as solid as during the winter before. The wind and waves help break up the ice, but the harbor was somewhat protected and the ice there didn't clear.

In Everett S. Allen's book, *Arctic Odyssey, The life of Rear Admiral Donald B. MacMillan*, Captain MacMillan said, "In June pools and puddles appear on the surface of the sea ice, followed normally by a rapid breakup of harbor ice and a drifting away of the floating pans, large and small. Blue water can be seen then, and one knows summer has come.

"But no such change occurred at Refuge Harbor. By the latter part of July, when the *Bowdoin* had been locked in the ice more than three hundred days, MacMillan grew somewhat alarmed. Was it possible that Refuge did not break out each summer? He asked [Eskimo] Etukasuk, who said that he thought some years it did and some years it didn't, and that was no comfort at all. It was not wise to let time answer the question, either, for they were not provisioned for two years; if caught, it would be necessary to abandon ship and retreat south to the winter igloos of the Eskimos."

Ice Bound

Meanwhile, Mix was preparing the radio station to operate from the masthead antennas while at sea, taking down the long wire antennas between the *Bowdoin* and the adjacent hills. He replaced the tubes in the receiver and transmitter, checked the batteries and made sure all was secure and working. He expected to use them while en route home.

MacMillan noted the sun had melted the ice near land in the harbor and thought there was a good chance if he could reach that open water, they might be able to follow the land to the harbor entrance and the open water beyond.

Again from the book, "For days they strewed parallel lines of ashes from the galley stove upon the harbor ice from the bow of the *Bowdoin* to the nearest point of land dead ahead. Ice can be easily but slowly cut by placing dark material on its surface, which absorbs heat from the sun's rays. The black path of ashes led to a margin of open water bordering the shore — a narrow lane leading to the harbor entrance, now their only exit.

"Mac spent days sounding every foot of the way and believed he had located every ledge and boulder that might bar their progress. There was one particularly dangerous spot on the north shore, a granite ledge which projected under the water nearly to the edge of the harbor ice. This was visible on the mean low water and partly exposed on the spring tides. The rise and fall was ten feet. The *Bowdoin* drew ten feet; there obviously was no margin here. A strong northerly wind, for which he hoped, might be of help in blowing the ice sheet away from the shore, thus widening and deepening the channel.

"On the night of July 29, at dead high water, he decided to make the attempt, wind or no wind…."

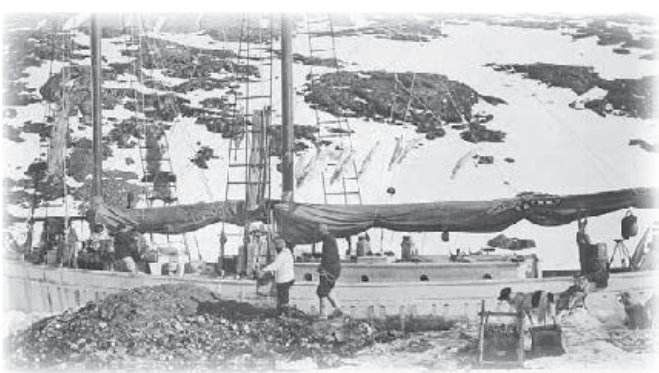
Proceeding slowly at first, breaking through the ash line in the ice, the *Bowdoin* proceeded to the open water near the shore. MacMillan then ordered "Full speed ahead" figuring he could bounce the *Bowdoin* over the underwater rock.

The *Bowdoin* hit hard and attempts to go forward or backward were to no avail. They were hard aground at "dead high water," at the top of the world, with no one around to help.

Aground in the Arctic

What happened next was taken from Mix's diary:

1924 July 30 Wednesday
An eventful day. Two lines were run out from the mastheads to the shore & out to the harbor ice & set up by the throat bulkheads as the water dropped. The bow came up to an alarming angle about 4 AM. She shuddered & Abe & Bill went to the harbor ice. A few minutes later she shuddered again, the shore lines parted & she fell down on her port rail with a crash. John jumped over the starboard side & Robbie the port side & swam to safety. Dick & I scrambled for the high rail & hung on until she settled with the port rail just under water. As soon as it was determined that she



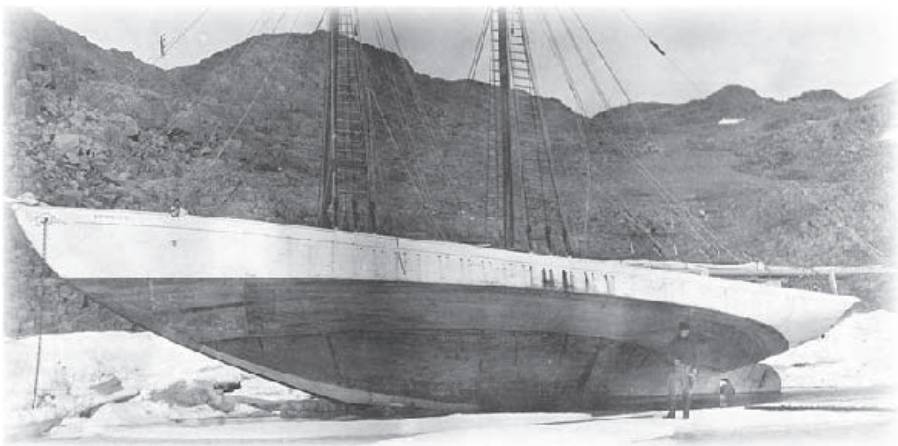
Abe, Bill, Tom, Kakutia and Dick loading ballast on June 9, 1924.

Don Mix using kayak, showing the ice melt around the ship.

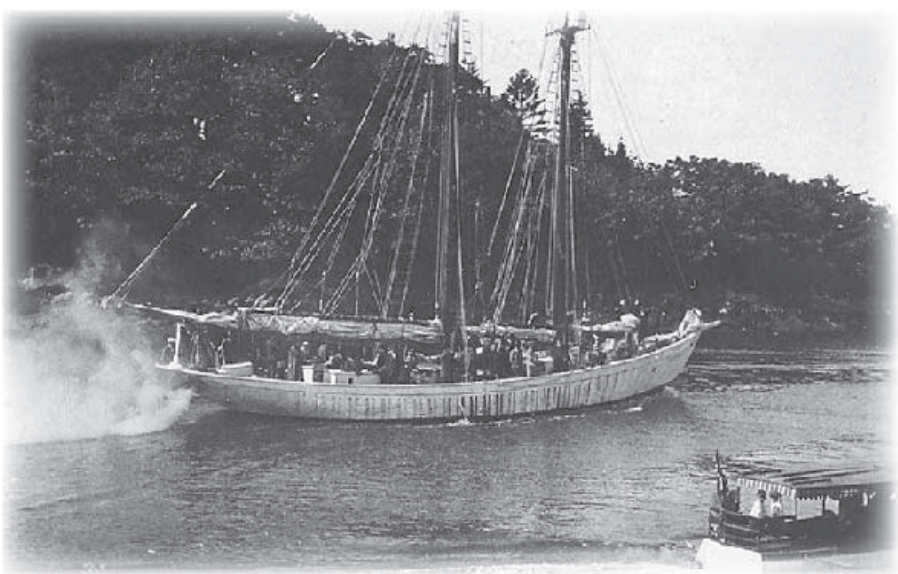
John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

After the lines broke at 3 AM July 30, 1924, the *Bowdoin* settled on the port side as the tide went out.

View from the stern, showing how close the water was to coming in.



The *Bowdoin* settles on its starboard side the second time the tide went out.



***Bowdoin* returning on the Sheepscot River, Wiscasset, Maine, September 20, 1924**

would go no further, we went aboard to see the damage. Below, both fore and aft were a mess — everything thrown about in confusion. Bill's false teeth got into the coffee pot. Tom looked at bottom & reported her shoe badly shattered, but keel OK thus far. Her bow was still way up in the air. The ship was unloaded of everything heavy onto the ice. Breakfast on ice. Eskimos went into camp ashore right after she struck.

We then waited for high tide. The hatches were all closed. As the tide rose however she came up fine & at high tide was up normal again. Ran kedge anchor out astern. The high tide was poor however & after a few attempts started to make ready for the fall. Ran double guys from each masthead ashore & set up on them & listed her to starboard. As the tide fell she listed more & more but after cocking bow up quite a bit settled at a comparatively moderate angle though the low tide which was extremely low & which brought out the rock on which she is hanging. The keel is in V shaped cut. In looking her over Tom found a serious hole on the starboard side & a minor one on the port side. I got a few winks while waiting for the rise ashore which we hope will be a good one. Leaking quite badly at 7:30 PM. At about 9:30 PM an early high tide straightened her up and after a few minutes at the windlass she slid off into deep water. Warped her alongside harbor floe & loaded up again.

One last minute problem was when an iceberg drifted in to close the harbor entrance. But with MacMillan's expert seamanship he managed to break through the ice alongside the berg and they escaped to open water.

The *Bowdoin* was headed home. Several stops along the way were made to drop off the Eskimos and their dogs in Greenland, pick up supplies and visit friends. Mix was on the radio again making contacts, sending messages and scheduling the September 20 arrival of the *Bowdoin* at Wiscasset, Maine.

Conclusion

I'll be giving a slide show presentation on Don Mix's 1923-24 expedition on Thursday, March 25, 2010 at 1 PM at the CC-AWA meet in Charlotte, North Carolina. For more information on this and the expedition please visit **www.k2tqn.com**.

All photos courtesy of the Mix family. QST

WB8IMY

ECLECTIC TECHNOLOGY

The Cost of Codecs

Employing perhaps the crudest definition possible, a *codec* is a device or software application that encodes and/or decodes a stream of digital data. Codecs make it possible to squeeze large amounts of information into relatively small files or bandwidths. When it comes to radio, codecs are critical to the digital communications revolution.

You probably encounter codecs on a daily basis, although you may not realize it. Do you listen to music on your computer or a portable device? Chances are those songs exist as *MP3* files. MP3 is a codec that compresses what would otherwise be enormous WAV audio files. Your favorite movies reside on single DVDs thanks to the squeeze applied by another codec known as *MP2*.

Hams who experiment with digital voice applications rely on codecs to create (and decode) voice data within bandwidths that correspond to SSB signals, or even narrower. The problem with codecs is that they require a certain expertise to create. As a result, an efficient codec can be worth a substantial amount of revenue in the corporate universe. To borrow from the movie *Field of Dreams*, if you build it, they will come. "They" being electronics manufacturers arriving with wads of cash for the right to use your nifty codec.

This means that corporations guard the rights to their codecs jealously, making it difficult for amateurs to legally use them at anything approaching a reasonable cost. Fortunately for hams, we have access to some free codecs, the result of changes taking place as the notion of *Open Source* becomes more widely accepted. Open Source doesn't necessarily mean unlicensed, but it does mean that the software in question is freely available for use. Major corporations are beginning to adopt this approach, at least with some of their products, and hams may be able to reap the benefits.

A recent example comes from communications chip company Broadcom in Irvine, California. They've announced that they'll be making their BroadVoice family of voice codecs available free of charge. There is a method to what may seem like Broadcom's business "madness." Their strategy is simple: Make the codecs free to system developers and those developers will naturally gravitate towards using Broadcom-based solutions. What may be free now can turn a tidy profit later.

The ICOM ID-1 23-cm D-STAR transceiver.

The company says it is releasing its wideband and narrowband *BroadVoice* codecs in both floating-point and fixed-point *C* code as open source software under the GNU Lesser General Public License (LGPL), version 2.1, as published by the Free Software Foundation.

The BroadVoice family of voice codecs comes in two variants: a 32-kbit/s version called *BroadVoice32* for wideband speech sampled at 16 kHz, and a 16-kbit/s version called *BroadVoice16* for narrowband telephone-bandwidth speech sampled at 8-kHz. BroadVoice16 in particular may have some applications for HF digital voice.

Now it is up to the Amateur Radio community to exploit the free goodies!

D-STAR on 23 cm?

D-STAR activity is growing and most of it is taking place on 2 meters and 70 cm. If you live in a major metropolitan area, you probably have at least one D-STAR repeater nearby. Tune around with an analog FM transceiver and listen for the characteristic roars of D-STAR transmissions. The roaring noise represents your fellow amateurs communicating with D-STAR's digital voice capability, and possibly sending information simultaneously over the low-speed "DV" stream.

Too bad we aren't seeing more D-STAR on 23 cm (1200 MHz) where we can make use of its 128 kbps "DD" capability. I know the 23 cm band is a foreign country to most hams. It is microwave, technically speaking, but the propagation is similar to 450 MHz. I had the chance to try an ICOM ID-1 23-cm transceiver with a friend recently and was intrigued by the performance. We weren't setting the world afire at 128 kbps, but we did swap digital images at a pretty good clip over a 10-mile path with just omnidirectional antennas.

If you're at all interested in D-STAR on 23 cm, you might want to join the free Yahoo discussion group D-STAR_23cm. You'll find it online at **http://groups.yahoo.com/group/D-STAR_23cm/**.

I-PSK

A couple of columns ago I was raving about the abundant Amateur Radio applications for the iPod Touch. The ink was hardly dry on the issue when I discovered *I-PSK* by Luca Facchinetti, IW2NDH. This application allows you to send and receive PSK31 with your Touch (or iPhone).

The *I-PSK* application in action on an iPod Touch.

The only downside is that *I-PSK* does not create a waterfall display to allow you to select from multiple signals. Instead, you have to manually tune your transceiver while watching the *I-PSK* spectrum. Still, for $1.99 it is tough to beat.

Look for Luca's app in the iTunes store. See the video demo on YouTube at **www.youtube.com/watch?v=e4SIB6wCMfs**.

QST

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

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

Alabama (Mobile)—Apr 10 D F R V
Set up Friday after 3 PM, Saturday 7-8 AM; public 8 AM-2 PM. *Spr:* Mobile ARC. Elk's Lodge, 2671 Dauphin Island Pkwy. Hamfest and Computer Show. *TI:* 146.82 (203.5 Hz). *Adm:* $5, under 13 free. Tables: $10. Jerry Myers, KG4YIA, 3100 Rand Ct, Mobile, AL 36606; 251-473-5813; **kg4yia@email.com**; **w4iax.net**.

Arizona (Scottsdale)—Mar 13 R T V
6 AM-noon. *Sprs:* Scottsdale ARC and ARCA. Fort McDowell Casino, Hwy 87 and Fort McDowell Rd. *TI:* 147.36 (162.2 Hz). *Adm:* Free. Tables: $10. Ed Nickerson, WU7S, 902 N 73rd Pl, Scottsdale, AZ 85257; 480-949-5162; fax 480-292-8789; **enickerson427@aol.com**; **scottsdaleamateurradioclub.ning.com**.

Arizona (Tucson)—Mar 27 D F H R S V
6-11 AM. *Spr:* Radio Society of Tucson. Kino Sports Complex, Ajo Way and Forgeus Ave. *TI:* 146.8 (156.7 Hz). *Adm:* Free. Tables: $5. Randy Malick, KFØX, Box 37005, Tucson, AZ 85740; 520-203-3006; **randy@kf0x.com**; **www.tucsonhamfest.com**.

Arkansas (Fort Smith)—Apr 3
D F H Q R S T V
8 AM-3 PM. *Spr:* Fort Smith Area ARC. Columbus Acres, 10203 Columbus Acres Rd. *TI:* 146.94, 146.64 (88.5 Hz), 444.5. *Adm:* advance $8, door $10. Tables: $10. Jimmie Lowrey, W5JNL, Box 6622, Fort Smith, AR 72906; 479-649-7249; fax 866-829-6269; **W5JNL@arrl.net; www.HangingJudgeHamfest.com**.

Arkansas (Hoxie)—Feb 20 D F H R S V
8 AM-1 PM. *Spr:* Lawrence County ARC. Hoxie Community Center, 500 SW Lawrence St. *TI:* 147.045. *Adm:* $5. Tables: $7. Glendal Floyd, W5WEC, 104 NW Larkspur Ln, Walnut Ridge, AR 72476; 870-886-1360; **w5wec@sudden link.net**; **w5wra.org/winterfest_2010.htm**.

SANTA CLARA VALLEY SECTION CONVENTION
March 20-21, Seaside (Monterey), CA
D F H R S V
The Santa Clara Valley Section Convention (RadioFest 2010 – "A Celebration of Amateur Radio"), sponsored by the Naval Postgraduate School ARC, will be held at the General Stillwell Community Center, 4260 Gigling Rd (old Fort Ord). Doors are open Saturday 9 AM-5 PM, Sunday 9 AM-2 PM. Features include flea market (Sunday), commercial vendor booths, ham radio demos, free VE exams, fantastic speakers, Saturday eve dinner. Talk-in on 146.97 (94.8 Hz). Admission is $1. Tables are $100. Contact Sal De Franco, N6SPD, Box 721, Seaside, CA 93955; 831-324-0727; fax 831-337-5200; **sal@n6spd.com**; **www.radiofest.org**.

Colorado (Longmont)—Apr 3 D F H R V
8 AM-2 PM. *Spr:* Longmont ARC. Boulder County Fairgrounds, 9595 Nelson Rd. *TI:* 147.27. *Adm:* $5. Tables: $15. Jim Walker, NØXDA, Box 86, Longmont, CO 80502; **n0xda@msn.com**; **w0eno.org/?q=node/352**.

Connecticut (Dayville)—Mar 20 D F H R V
8 AM-noon. *Spr:* Eastern Connecticut ARA. St Joseph Church Hall, 350 Hartford Pike. *TI:* 147.225 (156.7 Hz). *Adm:* $2. Tables: $10. Paul Rollinson, KE1LI, 182 Wrights Crossing Rd, Pomfret Center, CT 06259; 860-928-2456; fax 860-928-3844; **ke1li@arrl.net**; **www.qsl.net/k1muj/**.

Connecticut (Southington)—Mar 21
D F H Q R V
8 AM-noon. *Spr:* Southington ARA. Southington High School, 720 Pleasant St. 27th Annual Hamfest. *TI:* 147.345 (77 Hz). *Adm:* $5. Tables: $20. Norm Fusaro, W3IZ, 586 King St, Bristol, CT 06010; 860-584-1403; **w3iz@sbcglobal.net**; **www.chetbacon.com/flea2010.pdf**.

Florida (Dade City)—Mar 13 (Rain Date: Mar 20) F H R T V
8 AM-noon. *Spr:* East Pasco ARS. Dade City American Legion Hall, 8th and Church St. *TI:* 146.88. *Adm:* $5 (sellers only). Gary Mentro, N3OS, 11028 Ewing Dr, Dade City, FL 33525; 813-902-2602; fax 352-458-3291; **n3os@arrl.net**; **eparsonline.org**.

Florida (Fort Walton Beach)—Mar 19-20
D F H Q R S V
Friday 5-9 PM; Saturday 8 AM-3 PM. *Spr:* Playground ARC. Northwest Florida Fairgrounds, 1958 Lewis Turner Blvd. *TI:* 146.79 (100 Hz). *Adm:* $5. Tables: $10. Scott Morgan, AC5LT, Box 873, Fort Walton Beach, FL 32549; 850-496-1819; **ac5lt@arrl.net**; **www.w4zbb.org**.

Florida (Punta Gorda)—Mar 13-14
D F H R T
Saturday 8 AM-3 PM, Sunday 8 AM-2 PM. *Sprs:* Peace River Radio Assn and Englewood ARS. Tropical Gulf Acres Clubhouse, 28245 Pasadena Dr. *TI:* 147.255 (136.5 Hz). *Adm:* $5. Tables: $10 (tailgate space $5). Geahardt Woster, K7CXW, c/o PRRA, Box 510943, Punta Gorda, FL 33951; 941-575-9210; **k7cxw@arrl.net**; **www.w4dux.net** and **www.earsradioclub.org**.

Coming ARRL Conventions

February 12-14
Northern Florida Section, Orlando*

February 27
Vermont State, Colchester*

March 6
South Texas Section, Rosenberg*

March 6-7
Alabama State, Birmingham*

April 23-25
Idaho State, Boise

April 24
Arkansas Section, Rogers
Louisiana Section, Monroe

April 25
New Jersey State, Ewing

April 30-May 2
EMCOMMWEST, Reno, NV

May 1
South Carolina Section, Spartanburg

*See February *QST* for details.

SOUTHERN FLORIDA SECTION CONVENTION
March 20, Stuart
D F Q S T V
The Southern Florida Section Convention (35th Annual Event), sponsored by the Martin County ARA, will be held at the Martin County Fairgrounds, 2616 SE Dixie Hwy. Doors are open for setup Friday 2-7 PM, Saturday 7-8 AM; public 9 AM-5 PM. Features include indoor swap tables, commercial vendors, huge tailgate area, forums, Satellite demonstration, QSL card checking, VE sessions. Talk-in on 147.06 (107.2 Hz). Admission is free. Tables are $12. Contact Doug Shields, W4DAS, 1450 SE 11th St, Stuart, FL 34996; 772-349-7820; fax 810-963-5192; **w4das@arrl.net**; **www.mcaraweb.com**.

Florida (West Palm Beach)—Mar 13
D F H Q R S T V
8 AM-4 PM. *Spr:* Palms West ARC. Family Service Center, 5841 Corporate Way. *TI:* 146.67 (110.9 Hz). *Adm:* Free. David Fowler, K4DLF, 2702 Starwood Ct, West Palm Beach, FL 33406; 561-676-3007; **k4dlf@arrl.net**; **www.palmswestradio.org**.

Georgia (Marietta)—Mar 20 D F H R S T V
8 AM-3 PM. *Spr:* Kennehoochee ARC. Jim Miller Park, 2245 Callaway Rd. 57th Annual Hamfest. *TI:* 146.88 (100 Hz). *Adm:* advance $5, door $6. Tables: $20. Don Heppe, W5LGK, 1425 Ridgeway Dr NW, Acworth, GA 30102; 404-630-1249; **w5lgk@bellsouth.net**; **www.w4bti.org**.

Illinois (Fox Lake)—Apr 10 D F H R S T V
8 AM-1 PM. *Spr:* Western Lake County ARS. Lakefront Park, 71 Nippersink Blvd. TechFest. Focus on emergency services. *TI:* 147.03 (107.2 Hz). *Adm:* Free. Tables: $15. Joe Serocki, N9IFG, 35144 Sheridan Dr, Ingleside, IL 60041; 224-715-7766; **joeserocki@gmail.com**; **www.welcars.org**.

Indiana (Columbus)—Mar 27 D F H R T V
8 AM. *Spr:* Columbus ARC. Bartholomew County 4-H Fairgrounds, 750 W County Rd 200 S. 27th Annual Hamfest. *TI:* 146.79 (100 Hz). *Adm:* advance $4.50, door $5. Tables: $8. Marion Winterberg, WD9HTN, 11941 W Sawmill Rd, Columbus, IN 47201; 812-342-4670; **carc_in@bcremc.net**; **www.qsl.net/carc**.

Indiana (LaPorte)—Feb 27 D F H R V
7 AM-2 PM. *Spr:* LaPorte ARC. LaPorte Civic Auditorium, 1001 Ridge St. *TI:* 146.61 (131.8 Hz), 146.52. *Adm:* $5. Tables: $12. Clarence Rozinski, N9ROH, Box 30, LaPorte, IN 46352; 219-380-9684; **n9roh@k9jsi.org**.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

Indiana (Terre Haute)—Mar 13
D F H R S T V
8 AM-1 PM. *Spr:* Wabash Valley ARA. Terre Haute National Guard Armory, 3614 Maple Ave. *TI:* 146.685 (151.4 Hz). *Adm:* $5. Tables: Free. Nick Vinardi, N9WG, Box 172, New Goshen, IN 47863; 812-870-9459; **n9wg@hotmail.com**; **www.w9uuu.org**.

Kentucky (Elizabethtown)—Apr 3
D F H R S T V
8 AM-2 PM. *Spr:* Lincoln Trail ARC. State Fire Rescue Training Area 5, 630 College Street Rd. *TI:* 146.98. *Adm:* advance $5, door $6. William Madison, KD4RMY, 352 Meadowview Dr, Elizabethtown, KY 42701; 270-360-1478 (phone and fax) or 270-300-4030; **williammadison@windstream.net**; **www.qsl.net/ltarc/index.html**.

LOUISIANA STATE CONVENTION
March 12-13, Rayne
D F H Q R S V
The Louisiana State Convention (50th Annual Event), sponsored by the Acadiana ARA, will be held at the Rayne Civic Center, 300 Frog Festival Dr. Doors are open Friday 5-8 PM, Saturday 8 AM-2 PM. Features include Crawfish Boil (Friday, $14 per serving); flea market; commercial dealers; DXCC, VUCC, and WAS card checking; AMSAT demo; forums; special guest from ARRL HQ Norm Fusaro, W3IZ, MVP Assistant Manager; meetings; VE sessions; foxhunt; on site RV parking with power and water ($20 per night); refreshments. Talk-in on 146.82. Admission is $4 in advance, $5 at the door. Tables are $10 (swap), $15 (dealers). Contact John Cunniff, W4JHC, Box 51174, Lafayette, LA 70505; 337-981-6256; **jhcunniff@cox.net**; **www.w5ddl.org/hamfest/index.htm**.

MAINE STATE CONVENTION
March 26-27, Lewiston
D F H Q R S V
The Maine State Convention (32nd Annual "Andy" Hamfest and Computer Fair), sponsored by the Androscoggin ARC, will be held at the Ramada Conference and Convention Center, 490 Pleasant St. Doors are open Friday 7-9 PM, Saturday 8 AM-noon. Features include exhibitors, vendors, new and used radio and electronics gear, computers, forums, VE sessions, handicapped accessible, refreshments. Talk-in on 146.61. Admission is $7 in advance, $8 at the door. Tables are $8. Contact Cory Golob, N1URA, 63 Jordan Bridge Rd, Sabattus, ME 04280; 207-514-0202; **cory.m.golob@gmail.com**; **www.w1npp.org**.

MARYLAND STATE CONVENTION
March 27-28, Timonium
D F Q R S T V
The Maryland State Convention (41st Annual Greater Baltimore Hamboree and Computerfest), sponsored by the Baltimore ARC, will be held at the Maryland State Fairgrounds, 2200 York Rd. Doors are open Saturday 6 AM-4 PM, Sunday 6 AM-2 PM. Features include giant indoor and outdoor show and sales areas, flea market, dealers, tailgating, forums, QSL card checking (Saturday, 9 AM-1 PM), Special Event Station, free VE exams (Saturday only, 9 AM, Crowne Plaza Hotel; John Creel, 301-572-5124; **creewb3gxw@aol.com**), banquet. Talk in on 146.67 (107.2 Hz). Admission is $6 per day. For table prices, see web site. Contact Bill Dobson, N3WD, Box 922, Reisterstown, MD 21136; 443-590-1444; fax 410-256-1130; **w3ft67@yahoo.com**; **www.gbhc.org**.

Michigan (Lowell)—Apr 3 D H R S V
8 AM-noon. *Spr:* AR Group of Youth in Lowell. Lowell High School, 11700 Vergennes St. *TI:* 145.27, 146.62 (94.8 Hz). *Adm:* $5. Tables: $5 (5-ft). Al Eckman, WW8WW, 725 Bowes Rd, Apt K6, Lowell, MI 49331; 616-450-4332; **al.eckman@sbcglobal.net**; **www.argyl.org**.

Michigan (Marshall)—Mar 20 D H R V
8 AM-2 PM. *Spr:* Southern Michigan ARS. Marshall Activities Center, 15325 W Mighigan Ave. 50th Annual Michigan Crossroads Hamfest. *TI:* 146.66. *Adm:* $5. Tables: $10. John Davidson, KC8WMM, c/o SMARS Marshall Hamfest, Box 934, Battle Creek, MI 49016; 269-962-7145; **hamfest@w8df.com**; **www.w8df.com/hamfest.html**.

Minnesota (Buffalo)—Mar 27 D F H R V
8 AM-1:30 PM. *Spr:* Robbinsdale ARC. Buffalo Civic Center, 1306 County Rd 134. 29th Annual Midwinter Madness Hobby Electronics Show. *TI:* 147.0. *Adm:* $8. Tables: $20. Jerry Dorf, NØFWG, Box 22613, Robbinsdale, MN 55422; 763-537-1722; **k0ltc@k0ltc.org**; **www.k0ltc.org**.

Missouri (Mount Vernon)—Apr 3
D F H R S T V
8 AM-2 PM. *Spr:* Ozarks ARS. Mount Vernon Middle School, 731 Landrum St. *TI:* 146.97. *Adm:* advance $4, door $5. Tables: advance $8, door $10. Mike Sanders, KØAZ, 18169 Hwy 174, Mount Vernon, MO 65712; 417-466-0401 or 417-205-6000; **k0az@centurytel.net**; **w0oar.com**.

NEBRASKA STATE CONVENTION
March 20, Lincoln
D F H S V
The Nebraska State Convention, sponsored by the Lincoln ARC, will be held at the Lancaster Event Center, 84th and Havelock Ave. Doors are open 8 AM-4 PM. Features include flea market; vendors; forums; special guest from ARRL HQ Bob Allison, WB1GCM, ARRL Laboratory Test Engineer; VE sessions; handicapped accessible. Talk-in on 146.76. Admission is $5 (before Mar 1), $8 (after Mar 1); under 18 free. Tables are $10 each before Mar 1, $15 after Mar 1; $20 at the door. Contact Reynolds Davis, KØGND, 3901 S 42nd St, Lincoln, NE 68506; 402-488-3706 (phone and fax); **reynoldsd1@aol.com**; **www.lincolnhamfest.org**.

New Hampshire (Henniker)—Mar 21
D F R S V
8 AM-2 PM. *Spr:* Contoocook Valley RC. Henniker Community School, 51 Western Ave. *TI:* 146.895 (100 Hz). *Adm:* $3. Tables: $10. Donald Curtis, N1ZIH, 353 N State St, #1, Concord, NH 03301; 603-717-2086; **n1zih@comcast.net**; **www.k1bke.org**.

New Jersey (Bergenfield)—Apr 10
D F H R T
7:30 AM-noon. *Spr:* BSA Venture Crew 7373. St John the Evangelist Church Conlon Hall (Gym), 19 William St. Auction, pancake and sausage breakfast. *TI:* 146.955 (141.3 Hz), 146.52. *Adm:* advance $5, door $7. Tables: $15 (1 table); $25 (2 tables). Gordon Beattie, W2TTT, Venture Crew 7373/Troop 139, c/o St John the Evangelist Church, 29 N Washington Ave, Bergenfield, NJ 07621; 201-314-6964; fax 201-387-8896; **w2ttt@arrl.net**; **www.troop139.org**.

New Jersey (Tinton Falls)—Apr 10
F H R T V
8 AM-noon. *Spr:* Jersey Coast Chapter of the NADXA. Luigi's Restaurant, 5119 Asbury Ave. *TI:* 146.52. *Adm:* $5. Tables: $10. Mike DiPersio, KC2Q, Box 357, Bradley Beach, NJ 07720; 908-415-6162; **kc2q@arrl.net**; **nadxa.org**.

New Jersey (Township of Washington)—Mar 7 D H R (Auction)
1-4 PM. *Spr:* Bergen ARA. Westwood Regional High School, 701 Ridgewood Rd. *TI:* 146.79 (141.3 Hz). *Adm:* Free. James Joyce, K2ZO, 286 Ridgewood Blvd N, Township of Washington, NJ 07676; 201-664-6725; fax 201-265-1366; **k2zo@arrl.net**; **www.bara.org**.

New York (Middletown)—Apr 10 D F H R V
8 AM-2 PM. *Spr:* Orange County ARC. Town of Wallkill Community Center, 2 Wes Warren Dr. *TI:* 146.76 (100 Hz). *Adm:* $6. Tables: $12. Bruce Baccaro, K2ULZ, 4 Taffy Ln, Newburgh, NY 12550; 845-562-4226; **k2ulz@ocarc-ny.org**; **www.ocarc-ny.org**.

New York (West Seneca)—Mar 14 D H R S V
7:30 AM-2:30 PM. *Spr:* Lancaster ARC. Ismailia Shrine Center, 1600 Southwestern Blvd (Rte 20). Greater Buffalo Hamfest. *TI:* 147.255 (107.2 Hz). *Adm:* $7. Tables: $7. Luke Calianno, N2GDU, 1105 Ransom Rd, Lancaster, NY 14086; 716-481-5747; **luke48@gmail.com**; **gbhamfest.hamgate.net**.

North Carolina (Concord)—Mar 13-14
D F H Q R S V
Saturday 8:30 AM-5 PM; Sunday 9 AM-1 PM. *Spr:* Mecklenburg ARS. Cabarrus Arena and Event Center, 4751 Hwy 49 N. *TI:* 146.655, 146.94. *Adm:* advance $7, door $10. Tables: $20. Charlotte Hamfest Info, W4BFB, 16007 Wynfield Creek Pkwy, Huntersville, NC 28078; 704-948-7373; **2010HamfestInfo@w4bfb.org**; **www.w4bfb.org/hamfest**.

NORTH CAROLINA STATE CONVENTION
April 3, Raleigh
D F H Q S V
The North Carolina State Convention (38th Annual RARSFest), sponsored by the Raleigh ARS, will be held at the North Carolina State Fairgrounds Exposition Center, 1025 Blue Ridge Rd. Doors are open 8 AM-3:30 PM. Features include huge electronics flea market; computers; new equipment dealers; vendors; forums and meetings; VE sessions (9 AM sharp, walk-ins accepted, $14 fee; Joe White, WA4GIR, 919-387-9152, **wa4gir@arrl.net**); QSL card checking; contests; Special Event Station that you can operate; hands-on construction projects; Youth Lounge (special guest Duncan MacLachlan, KUØDM, ARRL Youth Editor); RV parking with full hookup ($25 per night; 919-612-6767); handicapped accessible. Talk in on 146.64. Admission is $7 in advance (by Mar 27), $8 at the door; age 16 and under admitted free when accompanied by paying adult. Tables with 2 chairs are $18 each in advance (by Mar 26), $20 each after Mar 26. Contact Chuck Littlewood, K4HF, 2005 Quail Ridge Rd, Raleigh, NC 27609; 919-872-6555 (phone and fax); **k4hf@arrl.net**; or Steve Ferrarini, KJ4BX, 919-247-8690; **steve.kj4bx@gmail.com**; **www.rars.org/hamfest**.

Ohio (Jackson)—Apr 10 D F H R T V
Set up 8 AM; public 9 AM-1 PM. *Spr:* Jackson County ARC. Jackson County YMCA, 594 E Main St. *TI:* 146.79 (167.9 Hz). *Adm:* $5. Tables: $10. Don Barnhart, KD8HHG, 31 Anna Marie Dr, Londonderry, OH 45647; 740-887-3533; **kd8hhg@yahoo.com**; **www.jacksoncountyarc.org**.

Ohio (Perrysburg/Toledo)—Mar 21
D H R S V
8 AM-2 PM. *Spr:* Toledo Mobile Radio Assn. Owens Community College, 30335 Oregon Rd. 55th Toledo Hamfest and Computer Fair. *TI:* 147.27. *Adm:* $6. Tables: $20 (regular), $25

(wall). Brian Harrington, WD8MXR, 4463 Holly Hill Dr, Toledo, OH 43614; 419-385-5624; **brian.harrington@utoledo.edu**; **tmrahamradio.org**.

OKLAHOMA STATE CONVENTION

March 12-13, Claremore

D F H S V

The Oklahoma State Convention, sponsored by the Green Country Hamfest Assn, will be held at the Claremore Expo Center, 400 Veterans Pkwy. Doors are open for setup on Friday at noon and Saturday at 7 AM; public Friday 5-9 PM, Saturday 8 AM-5 PM. Features include large indoor flea market; commercial vendors and dealers; fantastic free forums; free test table (check it before you buy it); on-site VE sessions; handicapped accessible; on-site RV parking. Talk-in on 147.09, 444.35. Admission is $8 in advance, $10 at the door (under 13 free); good both days. Tables are $10 in advance, $15 at the door (electricity is $15; cords not provided). Contact Merlin Griffin,WB5OSM, Box 470132, Tulsa, OK 74147-0132; 918-520-7668; **wb5osm@hotmail.com**; **greencountryhamfest.org**.

Ontario (Brampton)—Mar 27. Jerry Fenkell, VE3OBX, **info@ham-ex.ca**; **www.ham-ex.ca**.

Pennsylvania (Greensburg)—Mar 14
D F H R

8 AM-2 PM. *Spr:* Foothills ARC. Greensburg Hose Company #1, 10 McLaughlin Dr. *TI:* 147.18 (131.8 Hz). *Adm:* Free. Tables: $10. Frank Rossi, N3FLR, 707 9th St, Irwin, PA 15642; 724-989-0462; **n3flr@arrl.net**; **www.w3lww.org/**.

Pennsylvania (Spring Grove)—Apr 10
D F H Q R S T V

8 AM-2 PM. *Spr:* York Hamfest Foundation. Porter Community Fire Company, 1199 Porters Rd. 54th Annual Hamfest. *TI:* 147.33 (123 Hz). *Adm:* $5. Tables: advance $15, door $20. Tabitha Zier, N3TOH, 3 Cardinal Dr, Hanover, PA 17331; 717-632-6719; **tazier@embarqmail.com**; **www.yorkhamfest.org**.

Tennessee (Memphis)—Apr 10
D F H R S T V

9 AM-2 PM. *Spr:* Mid-South ARA. Bartlett Station Municipal Center, 5868 Stage Rd. *TI:* 146.85 (107.2 Hz). *Adm:* Free. Tables: Free. Tony Brignole, WA4KHN, 2444 Lacosta Dr, Bartlett, TN 38134; 901-372-2738; **abrigno@comcast.net**; **www.maraonline.org**.

Tennessee (Tullahoma)—Mar 20
D F H R S T V

8 AM-2 PM. *Spr:* Middle Tennessee ARS. First Methodist Church Gym/Activity Center, 208 W Lauderdale St. Famous TN BBQ. *TI:* 146.7 (114.8 Hz). *Adm:* $5. Tables: $10 (6 ft), $15 (8 ft). Harvey Pratt, KB4JD, Box 932, Tullahoma, TN 37388-0932; 931-455-5619; fax 931-967-3344; **hlpratt@bellsouth.net**; **www.qsl.net/mtars**.

Tennessee (Union City)—Mar 20
D F H Q R S T V

7 AM-2 PM. *Spr:* Reelfoot ARC. Tennessee National Guard Armory, 2017 E Reelfoot Ave. *TI:* 146.7 (100 Hz). *Adm:* $5. Tables: Free. Glenn Snow, N4MJ, 9170 E Walnut Grove Church Rd, South Fulton, TN 38257; 731-479-1971; **n4mj@yahoo.com**; **www.reelfootarc.com**.

Texas (Irving)—Mar 13 F V

8 AM-2 PM. *Spr:* Irving ARC. Betcha Bingo Hall, 2420 W Irving Blvd, #125. 8th Annual Hamfest. *TI:* 146.72 (110.9 Hz). *Adm:* advance $3, door $4. Tables: advance $8, door $10. Coleta Taylor, KD5QFH, 107 E 7th St, Irving, TX 75060; 972-579-9089; **coleta.mt@verizon.net**; **www.irvingarc.org**.

WEST TEXAS SECTION CONVENTION

March 20, Midland

D F H Q R T V

The West Texas Section Convention (55th Annual St Patrick's Day Hamfest), sponsored by the Midland ARC, will be held at the Midland Lions Club, 200 Plaza Ave. Doors are open for setup Friday 3-9 PM, Saturday 7 AM; public 8 AM-3 PM. Features include large indoor flea market; new equipment dealers; ARRL Forum; VE sessions (1 PM); DXCC, WAS, and VUCC card checking; handicapped accessible; RV parking; snack bar. Talk-in on 147.3. Registration is $8 in advance, $9 at the door. Tables are $10 each (on-line registration available). Contact Joe Coldewey, KK5ZG, 4510 Fairbanks Dr, Midland, TX 79707; 432-697-7846; **kk5zg@grandecom.net**; **hamfest.w5qgg.org**.

Texas (Orange)—Feb 27 D F H R T V

8 AM-3 PM. *Sprs:* Orange ARC and Jefferson County ARC. VFW Post 2775, 5303 16th St (Hwy 87 N). *TI:* 147.18. *Adm:* $2. Tables: $15. Rocky Wilson, N5MTX, Box 232, Orange, TX 77631-0232; 409-988-8906; **rockygwilson@hotmail.com**; **www.qsl.net/w5nd**.

COMMUNICATIONS ACADEMY

April 10-11, Seattle, WA

D H R S

The Communications Academy (12th Annual Event – Bringing Professionalism to Amateur Emergency Communications), co-sponsored by the WWA Medical Services Team, ARES, Bellevue EARS, RACES, Seattle ACS, and the Shoreline ACS, will be held at the South Seattle Community College (Olympic Bldg and Jerry Brockey Student Center), 6000 16th Ave SW. Doors are open both days from 8 AM-5 PM. Features include two days of continuing education training in emergency management; basic radio communications; technical and hands-on communications; communications van display; vendors; networking; Portable Radio Kit Contest. Registration for two days is $50 (by Mar 28), $55 (from Mar 29 thru Apr 7) and $60 at the door. Registration for one day is $30 (by Mar 28), $35 (from Mar 29 thru Apr 7) and $40 at the door. Group registration of 5 or more receive a 10% discount (all registration fees include lunch). Contact Marina Zuetell, N7LSL, Box 15624, Seattle, WA 98115; 206-524-6567; fax 206-526-1338; **n7lsl@arrl.net**; **www.commacademy.org**.

West Virginia (Charleston)—Mar 20
D F H Q R S V

9 AM-2 PM. *Spr:* Charleston Hamfest Committee. Coonskin Armory, 1707 Coonskin Dr. 26th Annual Charleston Area Hamfest and Computer Show. *TI:* 145.35 (95.5 Hz). *Adm:* $5. Tables: $5. Jim Damron, N8TMW, 4607 Baxter Dr, Charleston, WV 25302; 304-965-5349; fax 304-965-7753; **n8tmw@arrl.net**; **www.w8gk.org/**.

Wisconsin (Eau Claire)—Mar 13 D H R

8 AM-2 PM. *Spr:* Eau Claire ARC. Grace Lutheran Church, 202 W Grand Ave. 22nd Annual AR Equipment Auction. *TI:* 146.91 (110.9 Hz). *Adm:* $5. Jim Staatz, KI9H, 202 W Grand Ave, Rm 310, Eau Claire, WI 54703; 715-415-1150; **ki9h@arrl.net**; **www.ecarc.org/**.

Wisconsin (Jefferson)—Mar 14 D F H R V

8 AM-1 PM. *Spr:* Tri-County ARC. Jefferson County Fairgrounds Activity Center, 503 N Jackson Ave. *TI:* 145.49 (123 Hz). *Adm:* $5. Tables: $6. Paul Marowsky, KD9PM, Box 411, Johnson Creek, WI 53038; 920-674-4968; **hamfest@w9mqb.org**; **www.w9mqb.org**.

To All Event Sponsors

Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests.html**) 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/FandES/field/hamfests/regform.html** for an online registration form. Dates may be recorded up to two years in advance.

Events that are sanctioned by the ARRL receive special benefits, including an announcement in these listings and online, donated ARRL publications 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 **March1** to be listed in the **May** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's Web site for possible late changes, for driving directions and for other event details. Please note that postal regulations prohibit mention in *QST* of prizes or any kind of games of chance such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and *ARRLWeb* banner advertising. Call the ARRL Advertising Desk at 860-594-0207, or e-mail **ads@arrl.org**. QST

Strays

DAVID WILLIAMS, N9GZK

This Indianapolis company shares its initials with a famous membership organization.

OP-ED

DX Etiquette

Randy Johnson, W6SJ

Maybe it was because so little else was going on at the time that the Mellish Reef DXpedition was the only action in town. As I listened to the pileups, it was simply disgusting to hear.

Ham radio is about communication. Compared to e-mails or phone calls, we interject different, more technically difficult variables, our equipment and propagation. Those add spice and challenge to the process. We have all earned our licenses and often possess technical expertise beyond that. By those achievements we earn the respect of our fellows. So at its heart, ham radio is about communicating between people who respect each other.

Sometimes people go off on a DXpedition. In the case of Mellish Reef, a couple of guys go off to a dangerous part of the world. Just getting there is risky and they are far from medical help if they should suddenly need it. They spent *a lot* of money, suffer privation, eat lousy meals, stay up until odd hours and worry about the tent being blown away in 50 mi/h winds and torrential rains.

Someone willing to do this is making you a gift of a contact from a rare entity. So not only should you appreciate the gift itself, you should consider the generosity of the gift-giver.

Some people don't see it like this. We hear this comment from the pilot station, that "there have been a lot of complaints about our low band (and CW) focus, including comments that 'this is no way to run a DXpedition.'"

Complaints? Probably from some guy who sits at home with all its attendant comforts. He gets a cup of hot coffee, wanders into a warm shack and spends a little time on the air. He then complains because the operators aren't operating to his convenience. To me this shows a fundamental lack of respect, certainly not appropriate behavior to demonstrate to someone who is giving you a gift.

When you go to as much trouble as those guys, you should be able to do whatever you want when you get there.

Next, let's talk about pileup operating practices. There are two important messages when the operator says W1AW 5NN. It's a message to W1AW: "I heard you" and a message to *every other ham in the pileup*: "I am not talking to you. Stop transmitting."

When the operator says, W1 W1? it really means, "Everyone whose call isn't W1, stop transmitting." Many operators seem not to grasp this. I can't believe it when the operator calls JA1? and people with calls like "W9" or "K5," people whose calls are nowhere close to JA1, keep calling. Why? They even call when the guy says W1AW 5NN when it is clear that the operator is listening 5 kHz away.

I have been the rare DX and it should come as no surprise that the contact rate is a function of being able to pick out full call signs quickly. Interference from inconsiderate operators necessitates repeats, especially when working a weak station. Remember that somewhere in the world *you* are the weak station and 10 other guys are louder than you are. Guys with big signals need to give those guys a break, too.

When you have to ask for repeats, all those calls from other stations only slow down the rate and make it more difficult for everyone. Every request for a repeat is a lost contact. Every ugly pileup probably means that the poor operators with 100 W stations and wire antennas never get to make even one contact.

The 150 per hour rate is a contact every 24 seconds — easy to do if you hear the call sign the first time. When interference necessitates asking for repeats, it slows the rate to 1 minute — 60 per hour. That is when you get an ugly pileup.

I know that all the good operators will read this and nod their heads because they operate intelligently. The poor operators will read this and not think I am talking about and to them. Well, I am. How would you like to go to your next DX Club meeting and have someone play an audio tape of a pileup, one that shows that *you* are the inconsiderate operator?

All in all, the great operators at VK9GMW made 20,000 contacts during their stay. I'd guess that if operators calling them had all shown respect, they might have hit 30,000. Wouldn't that have been nice? Thanks for the gift, guys. For the record I made contacts on 160, 80 and 40 meters with 100 W and a wire antenna. Made my day.

In the final analysis, it's really not a matter of how the DXpedition comported itself. It's about how the rest of us deported ourselves. Let's show more respect and demonstrate that we appreciate the gifts that others give us.

Randy Johnson, W6SJ, an ARRL member, was first licensed in 1951. Randy had a great time with a 40 W US Army ARC-5 tank transmitter. In December 2001 — exactly 50 years after getting his first license — Randy upgraded to Extra Class. He has made three DX-Ventures to The Bahamas where he operated as C6AWS. Randy is a member of FOC, the First Class CW Operators Club, the Southern California DX Club and the Southern California Contesting Club. He can be reached at 31 Skysail Dr, Corona Del Mar, CA 92625-1437, **w6sj@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).

75, 50 AND 25 YEARS AGO

March 1935

- The cover photo shows Ross Hull finishing up a large V.H.F. antenna.
- The editorial notes, with pride, that the A.R.R.L. has organized hams all over the country into a cohesive group with a single voice.
- "Amateurs around the World by Plane," by Robert Wilson, W1FJ, tells the story of the 30,000 mile globe-circling flight of pilot Richard Light, with the author on board as radio operator and navigator.
- Ross Hull proudly reports "Hartford-Boston link Established on Two and One-Half Meters," with the results exceeding all expectations.
- George Grammer presents a 10-page discussion of "Grid-Bias Modulation for the General Purpose Transmitter."
- George's article is immediately followed by a discussion of "Grid-Bias Modulation of the 100-Watt Type Power Amplifier," by Walter Wirkler and Art Collins, W9CXX.
- Robert McConnell, W8FJ, and August Raspet tell us how to get "More Audio Watts from a Single Type 10" for modulator use.
- O. H. Brewster, W1BMT, and Lew Bellem, W1BES, present "A New High-Efficiency High-Gain Audio Power Amplifier" that uses a pair of 203-A power tubes.

March 1960

- The cover photograph shows a slick little homebrew dummy load for V.H.F. made from a handful of 2-watt carbon resistors.
- The editorial exclaims, "Whew!" as it announces that the recent Geneva Radio Convention left all our privileges intact! A full report is in this issue.
- Ed Tilton, W1HDQ, presents a "Self-Contained Portable Station for 50 Mc." Weighing only a few pounds, the compact transceiver is useful for ragchewing or emergency work.
- In "Build Your Own Receiver?" Halford Greenelee, W3AXF, describes a ham-band receiver of unusual design.
- Joseph Thornwall, W4FGM, describes "The 'Magkee'," an electronic keyer that uses magnetic cores and transistors.
- "Transistor V.F.O. with Linear Tuning," by Thomas Arnold, K7KCI, tells about the author's compact mobile V.F.O.
- Ed Tilton, W1HDQ, tells about the cover photograph in "V.H.F. Dummy Loads." He explains the techniques that must be used at V.H.F. in building these compact units from banks of 2-watt carbon resistors.
- Katashi Nose, KH6IJ, presents "Notes on Parasitic Beams." The big signal that comes from KH6IJ makes this article required reading!
- Lew McCoy, W1ICP, presents "A Poor Man's *Q* Multiplier" that can be used to provide better selectivity with the popular BC-454 and BC-455 surplus "command receivers" that are still available for a few bucks.
- A. L. Budlong, W1BUD, and John Huntoon, W1LVQ, discuss "The Geneva Radio Conference" in detail.
- John Chambers, W6NLZ, looks into the future, with "After Sunspots — What?"
- Dana Atchley, W1HKK, turns our minds toward *real* DX, in "Speculations on Communications with Other Planet Civilizations."

March 1985

- The cover photograph shows the 25-foot homebrew dish of contest group OE9XXI, with the caption "EME Contesters: Masters of Moonbounce."
- The editorial asks the rhetorical question, "Are the Bands Too Crowded?" and then examines the current situation.
- Chip Angle, N6CA, presents "A Quarter-Kilowatt 23-cm Amplifier," a comprehensive seven-page discussion.
- Stewart Beal, VE3MWM, tells about "The VE3MWM All-Mode PTT Switch," which is so sophisticated that it uses a microprocessor!
- Doug DeMaw, W1FB, discusses "Learning to Use Field-Strength Meters."
- Al Bry, W2MEL, presents "Beam-Antenna Pattern Measurement," and tells us how we can measure the patterns of our station antennas.
- Part 15 of "First Steps in Radio," by Doug DeMaw, W1FB, explains about "Diodes and How They Are Used."
- Neil D. Friedman, N3DF, entertains and enlightens us with "Amateur Radio Licensing: A Seven-Decade Overview."

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

DECEMBER 2009

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/FandES/field/pshr/**.

590
W7TVA

560
AC8AR

486
KØIBS

340
KB2RTZ

335
N2LTC
N4HUB

330
KT2D

327
KI4KWR

310
W2MTA

290
KA2ZNZ

273
NC4VA

285
WB7WOW

263
W4CAC

245
K2HJ

230
WD9FLJ

220
WB9YBI

210
KB2BAA

218
W5KAV

216
KJ4AWB

215
W2SFD

200
AK2Z

201
K7OAH

193
WI2G

191
N4HHP

190
WB9FHP
WB8RCR

186
W2KFV

182
WA2BSS

175
W5DY
K8MFK

170
KE5HYW

161
KC7ZZ

160
KB2FED
NA9L
N7CM
KGØGG

152
KB2ETO

150
N1UMJ

149
K2ABX

145
K3CSX
KK3F
WB9JSR
K8RDN

142
K4DLF
W7JSW

141
K4DND

140
K7BFL
WB2KNS
WØLAW
K7EAJ
KA8ZGY

136
K7BC

135
W3YVQ
KØLQB
WD8USA

134
K2BRG
W2LIE

132
KF7GC

130
N2JBA
AE5NS
K6JT
WB2FTX
W4AGA
K9EOH
N2DRB
K4IWW
W4DNA
W4FAL
KB8GT

128
W2DWR

125
W7EKB
NN7H
KK5NU

120
W7QM
AG9G
K9LGU
KA4FZI
W8UL
K2UL
W1GMF
N1LKJ

118
N2DW

116
W4AVD

115
N3RB
N1IQI

114
K2GW
WB8OIF

113
KB3LFG

110
W7GB
N7BEC
K5KV
WM2C
N8IO
W6DOB
N7XG
N7YSS
K1YCQ
K2TV
KE4PAP
W2EAG
KK5GY
WB4GHU

109
KB1NMO

105
KE4CB
N4JRW
KD1LE
N4ABM

103
N7EIE

102
N2VC

101
K3FP

100
W7GHT
K4SCL
NX9K
WG8Z
N8OD
WB8SIQ
N9AUG
WB8HHZ
K2AN
N2YJZ
KS3Z
W3TWV
N1JX
N2GS
N2GJ
W4KLB
W9WXN

WB4FDT
K4BG
K4GK
KB2KLH
W2DSX
NX1Q
K1HEJ
KI4YV
W4TTO
WØCLS
NØMEA
NØUKO
N9MN
NR2F
W1SGC
NX8A
KD8CYK

99
AA3SB
KK1X

98
KI6RUW

97
K5MC
N8NMA

96
K3RC
K8AMR

95
KCØM
KB5PGY
WB2HPI
KM1N

93
KK7DEB

92
W7ELI

90
WE2G
N9VC
N3KB
N4MEH
WØGCB
WD8Q
N8DD
KA8NSG
WA2CUW
KB3LNM
K3IN
N3ZOC
WB4BIK
KØBXF
AAØM
K4MSG
KA1GWE
NIØI
K1JPG
KA1EHR
NU8K
W3GQJ
W8IM

89
WA4UJC
K4BEH

88
WB6UZX
KC5OZT

87
N7NVP
W2CC
KD4HB

86
K6RAU

85
KB9KEG
W3CB

84
AD4BL
W5GKH

83
WB8VNV

81
WDØGUF
N8SY
KB8NDS
KB1KRS

80
K7MQF
KE7DVV
KE5PWL
N3SW
KC2SFU
W9MBT
KB3MXM
W4WNE
N5EEO
W1PLK
KDØCDQ
W1PLW
WØADZ
KCØZDA
K8KV
WB8WKQ

76
W6SX

75
KBØDTI

74
W5XX
KK7TN

72
W8DJG
W7VSE

71
KB3KKY
KC2SYM

70
KT5SR
KC4PZA
KC2OOY
KØDEU
NØDLK
NØDUW
NØDUX
NUØF
KAØFUI
KBØJKO
NØMHJ
N3NTV
KØPTK
KØOR
KØRXC
KØUKO
KD7ZUP

The following stations qualified for PSHR in November, but were not recognized in this column last month: WD8USA 130, K8AMR, 108, KM1N 94.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AL, AR, AK, AZ, CO, CT, EB, EMA, ENY, EPA, EWA, GA, ID, IN, KS, LA, MDC, MI, MN, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OH, OK, OR, ORG, SC, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WMA, WPA, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, GA, IA, IN, LA, MDC, ME, MI, NC, KS, MO, MT, NLI, OH, SD, SFL, SNJ, STX, SV, VA, WPA, 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.

NI1QI 2036, WB5NKD 1362, KA9EKG 1332, W8UL 1142, KW1U 1018, KK3F 1016, WB8WKQ 701, WB5NKC 695, W1GMF 649, WB9JSR 606, N1UMJ 593, N8IXF 572, K4IWW 561, W7QM 545. Stations earning BPL by Originations plus Deliveries: NM1K 131, K8LJG 114.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

K1AOS **McAllister**, John, Johnston, RI
W1BX **McCarter**, Craig A., West Dover, VT
WB1GBU **Edmunds**, Edward W., Framingham, MA
W1OGT **Burkett**, Robert L., Rumford, RI
W1QQL **Woods**, William C., Lynn, MA
♦N1CRK **Polayes**, Maurice "Moe" B., Needham Heights, MA
♦W1TF **Tyrrell**, Ralph E., Statham, GA
W2HGI **Dade**, William R., Hillside, NJ
KS4AUL **Kaplan**, Saul E., West Palm Beach, FL
WV2HJK **Chaffee**, Laird H., West Stockholm, NY
K2IZV **Slutter**, Phillip L., Tinton Falls, NJ
N2CKM **Lee**, Joseph H., Somers Point, NJ
W2KXG **Stonitsch**, John, Glen Cove, NY
W2LRR **Brody**, Morton, Flushing, NY
W2MJP **Mulberg**, Jerry, Bronx, NY
KA2OVS **Weaver**, John Scott, Alfred, NY
K2RVQ **Marrone**, Nicholas F., Franklin Square, NY
W2SFV **Hosler**, Norman W. Jr, Lake Ariel, PA
N2URB **McGarvey**, David D., Pearl River, NY
WB3AEX **Heinefield**, William B., Baltimore, MD
KW3T **Goretski**, Rudolph, Reading, PA
KR4UP **Poore**, Charles A. Jr, Germantown, MD
W3GII **Wagner**, Robert P., Reading, PA
♦W3PWG **Madara**, Rolland E., Lansdowne, PA
W3UH **Lavigna**, Andre P., Reading, PA
W4AKM **Ryals**, Andrew J., Cocoa, FL
♦W4AUP **Sides**, William Peyton "Pete," Montgomery, AL
K4BHL **Bragdon**, Kenneth D., Fairacres, NM
K4EEL **Lee**, Martin E., Port Charlotte, FL
K2ZIP **Mattoon**, Everett J., Tupper Lake, NY
KI4FQS **Corum**, Mary G., Mountain City, TN
KB4FZN **Cole**, Eileen L., Clearwater, FL
AB4GD **Rioux**, Albert F., Homosassa, FL
W4HDF **Anderson**, Oren S., Birmingham, AL
W4HRR **Good**, Joseph R. Jr, Augusta, GA
♦W4LBQ **Smith**, Matthew FSC, Memphis, TN
WB4LHR **Taylor**, Jim, Mount Sterling, KY
KU4YI **Freeman**, Clifford G., Tellico Plains, TN
KF4RT **Burkett**, Vernon T., Tarpon Springs, FL
KC4S **Johnson**, Harold M., Cookeville, TN
KE4UOG **Franke' Leatherland**, Martha C., Phenix City, AL
W4UYT **Hopkins**, James E., Fairhope, AL
K4DLG **Gendle**, David L., Grant, FL
KC5BC **Neal**, Charles L., Albuquerque, NM
WD5HLD **Thomas**, Donald, Meridian, MS
K5JLE **Miller**, Wayne L., El Paso, TX
N5JRK **Warden**, James E., Henryetta, OK
KC5MAP **Underwood**, Merlyn D., Albuquerque, NM
W5MAQ **Rice**, Floyd Arthur Jr, Austin, TX
KB5ROC **Wright**, David J., Iuka, MS
♦K5SRL **Liljekvist**, Stanley R., Plano, TX
NO5N **Murphy**, Tommy M., Ethel, MS
W5IRV **Block**, Irvin, Houston, TX
KA5YQV **Davis**, Mary G., Copperas Cove, TX
AD6OG **Casson**, Harvey, Moraga, CA
♦K6CQR **Gessert**, Edward C. Jr, Grass Valley, CA
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W6TFH **Sabourin**, Frank M., Vancouver, WA
WA7KNL **Foltz**, Curtis H., Carson City, NV
W7LMH **Jensen**, Carlos M., Salt Lake Cty, UT
KA7LMQ **Jenkins**, Kay R., Spangle, WA
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AC7UM **Kohler**, James A., Bellingham, WA
KC7Y **Barnes**, Robert G., Mesa, AZ
K7ZY **Welch**, Dale W., Tucson, AZ
KC8CDF **Silver**, Charles W., Ontonagon, MI
W8DUA **MacGregor**, James A., Kalamazoo, MI
K8HZ **Walls**, Roy K. Sr, Grove City, OH
♦W8ICO **Parsley**, Edgar H., Naples, FL
N8LBG **Aldrich**, Woodrow "Woody" S., Spring Lake, MI
N8KKF **Sanders**, Kenneth E., Grand Haven, MI
W8QOV **Smith**, Franklin M. "Doc," Upper Sandusky, OH
KC8VPN **Davis**, Pamela S., Marietta, OH
W8YCI **Carrington**, Wilbur "Bill" A., Grand Rapids, MI
W9AFY **Stapel**, Carl A., Menasha, WI
KB9AUP **Collins**, Terry M., Tomahawk, WI
W9FYP **Hanneman**, Richard, Marshfield, WI
W9GRX **Burden**, Earl E., Kenosha, WI
N9GTB **Steaffens**, William C., Stoughton, WI
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K9JEK **Lipke**, Howard H., Wisconsin Rapids, WI
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WBØJYJ **Larson**, Howard G., New Ulm, MN
WBØOAA **Grande**, Walter, Mesa, AZ
KBØPHP **Droessler**, Jean M., Dubuque, IA
WØYBF **Silberstein**, Richard, Boulder, CO
NØIBX **Whitney**, Wyman A., Pierre, SD
VE3BYP **Nettleton**, Leonard W., Chatham, ON, Canada
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♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Gail Iannone ♦ Silent Keys Administrator ♦ sk@arrl.org

W1AW Schedule

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US Time + 4 hours. For the rest of the year, UTC = Eastern US Time + 5 hours.

♦ **Morse code transmissions:** Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13 and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13 and 10 WPM.

Code bulletins are sent at 18 WPM.

♦ **W1AW Qualifying Runs** are sent on the same frequencies as the Morse code transmissions. West Coast Qualifying Runs are also transmitted monthly. See "This Month in Contesting" in this issue for further details on the Qualifying Runs. Underline one minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any) and complete mailing address. The initial certificate is available for a $10 fee. Subsequent endorsement stickers are available for a $7.50 fee.

♦ **Digital transmissions:** Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095 and 147.555 MHz.

Bulletins are sent at 45.45-baud Baudot and BPSK31. MFSK16 will be sent only as time allows.

On Tuesdays and Fridays at 6:30 PM Eastern Time, Keplerian elements for many amateur satellites are sent on the regular teleprinter frequencies.

♦ **Voice transmissions:** Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59 and 147.555 MHz.

♦ **Notes:** On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM on Monday through Friday. FCC licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

During 2010, Headquarters and W1AW are closed on New Year's Day (January 1), Presidents' Day (February 15), Good Friday (April 2), Memorial Day (May 31), Independence Day (observed July 5), Labor Day (September 6), Thanksgiving and the following day (November 25 and 26) and Christmas (observed December 24).

For more information, see **www.arrl.org/w1aw.html**.

PACIFIC	MTN	CENT	EAST	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	CODE BULLETIN				

HAMSPEAK

The following are brief descriptions of Amateur Radio related terms found in this month's issue of *QST*. More information on most can be found in *The ARRL Handbook*, or other specialized ARRL publications.[1] See also **www.arrl.org/qst/glossary.html**.

Antennas Away from Home

Inverted V — Common name for a center fed dipole antenna in which the center is supported at a higher point than the ends, giving the appearance of an inverted letter V. Such antennas operate in a manner similar to a horizontal dipole at a height about 2/3 as high.

Zip cord — Kind of wire found in lamp cords and speaker wire in which the two conductors and their insulation can be easily pulled apart, thus "unzipped." They do not, however, rezip.

The Antenna Elevation Pattern — What's the Big Deal?

DX — Long distance communication — generally with stations in other countries. Often used to refer to desired countries and prefixes needed for various operating awards.

F layer — The highest of the identified layers of the ionosphere, and the most important for long range HF propagation. During the day it often acts as two distinct sub layers, F1 and F2. These appear to merge at night into a single layer. For more about this topic, see **www.arrl.org/members-only/tis/info/pdf/119962.pdf**.

Ionospheric propagation modes — Propagation of radio waves via a region extending above the earth's surface from a distance of about 30 to 250 miles. This region is ionized by solar radiation and can refract radio waves depending on frequency and ionospheric conditions.

Maximum usable frequency (MUF) — The highest frequency that will be propagated via ionospheric propagation modes between a particular pair of end points. Higher frequencies pass through the ionosphere and are useful for space communication.

Near vertical incidence sky wave (NVIS) — A mode of communication in which HF signals are launched at vertical, or near vertical, elevation angles to return from the ionosphere and provide short and medium range (typically to 1000 miles) communication.

Scatter modes — Mode of medium to long range radio wave propagation typically effective in the upper HF or VHF region in which radio waves are dispersed from their line of sight (LOS) path to cover an area that would not otherwise be covered. Common scattering mediums include ionized meteor trails, aircraft or ionospheric anomalies.

[1]*The ARRL Handbook for Radio Communications,* 2010 Edition. Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 1448 (Hardcover 1462). Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

Compact Stealth Five Band Inverted L Antenna

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

Trap antenna — Kind of multiband antenna in which parallel resonant traps are used to electrically isolate sections of the antenna to provide resonant operation on more than one frequency range.

The Doctor is IN

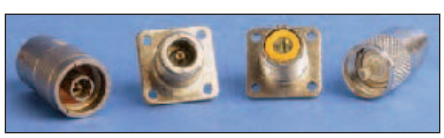
Boost regulator — Electronic device that operates from a discharging battery and outputs a constant voltage, typically 13.8 V dc, as the input voltage is reduced.

Dummy load — Sometimes called dummy antenna. Device designed to accept and dissipate the power from a transmitter without radiating it. This is generally used for transmitter testing to avoid interfering with other spectrum users.

Duplexer — Device that allows a repeater or other transmitter and receiver to simultaneously (duplex mode) use the same antenna.

Multiplexer — Usually passive device that combines multiple signals, such as telephone trunk connections or multiple RF carriers, onto a single transmission system.

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



An Experimental Look at Ground Systems for HF Verticals

NEC — Numerical electromagnetic code. Underlying calculating engine that performs the antenna analysis in programs such as *EZNEC* and *NEC2GO*.

Radial — Portion of a usually vertical antenna, designed to provide an artificial ground or also sometimes a connection to real ground. Typically, multiple radials project radially from the antenna base in multiple directions. See **www.cebik.com/gp/gr.html**.

Top loading — Electrically lengthening a vertical antenna by placing loading inductance or capacitance structures near the top of the antenna. This can be more efficient than having the loading near the bottom.

Vertically polarized antenna — Antennas in which the electric field is vertical. These are generally physically oriented perpendicular to the earth's surface.

The Mini Horse Antenna

Bandwidth — The difference between the highest and lowest frequency component of a signal waveform or highest and lowest frequencies passed in a system. In an antenna, the term bandwidth often refers to the difference between the highest and lowest frequency for which the SWR is below an application suitable value, often 2:1.

Driven element — Antenna element in a multielement parasitic array that is connected to the transmission line.

End loading — Electrically lengthening an antenna element by placing loading inductance or capacitance structures near the outward ends of the antenna. Such an antenna can be more efficient than having the loading near the center or feed point.

Front-to-back ratio — The ratio of the power going in the desired direction to that at 180° from the desired direction in a directive array. It, along with forward gain, are often used as figures of merit for such antennas. See **www.arrl.org/tis/info/antheory.html**.

Parasitic element — Antenna element in a multielement array. The parasitic elements do not connect to the transmission line, but rather receive radiated energy from the *driven* element and reradiate to contribute to the antenna's directional pattern.

Yagi — Multielement directive antenna in which many of the elements are not directly connected to the driven element(s). The other elements are parasitic and receive and reradiate energy due to electromagnetic coupling. Often used as a rotatable antenna system in the upper HF through UHF regions. It is more properly called a Yagi-Uda array, named after its inventors. See **www.arrl.org/tis/info/Yagi-V.html**.

A Peak Reading RF Power Meter

Electromechanical (analog) meter — Device that indicates the average amplitude of a signal by the motion of a needle that moves through an arc in proportion to the signal level.

VOM — Volt-ohm-milliammeter. Basic test instrument that can be switched to measure the electrical voltage, resistance or current in different ranges. Originally an analog instrument, VOMs are now commonly available in digital form.

VTVM — Vacuum tube voltmeter. Voltmeter in which a dc coupled amplifier is used to increase the sensitivity and the input impedance compared to an analog meter alone. This is used to make measurements in circuits that would be excessively loaded if an analog meter were used directly.

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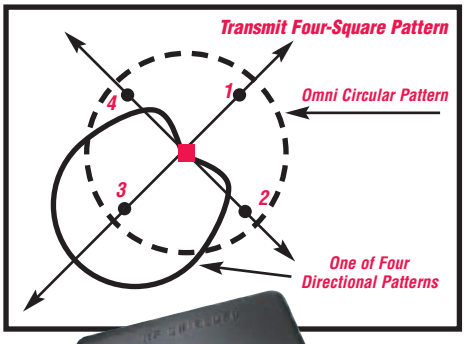

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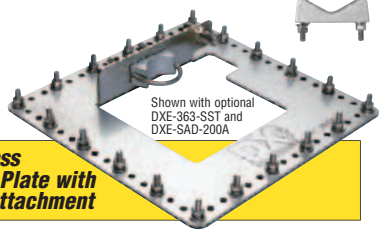

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2010

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NEW! IT-100

Matched in size to the IC-7000 and IC-706, the 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***

radio not included

Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Powered by four AA internal Alkaline batteries (not included), no additional cables required. A coax jumper cable is also induced for fast hook up. ***Suggested Price $129.99***

Z-11Pro

The Z-11Pro, 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. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. ***Suggested Price $179***

NEW! AT-100ProII

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-100Pro requires just 1 watt for operation, but will handle up to 125 watts. All cables included. ***Suggested Price $229***

radio not included

FTL 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***

M-7700 For IC-7700. 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! 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. ***Suggested Price $159.99***

KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver. Has 2,000 memories for instant recall. 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***

NEW! 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

AT-200Pro

The AT-200 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. All cables included. ***Suggested Price $249***

See AT-1000Pro Review in Nov. '08 CQ

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. All cables included. ***Suggested Price $599***

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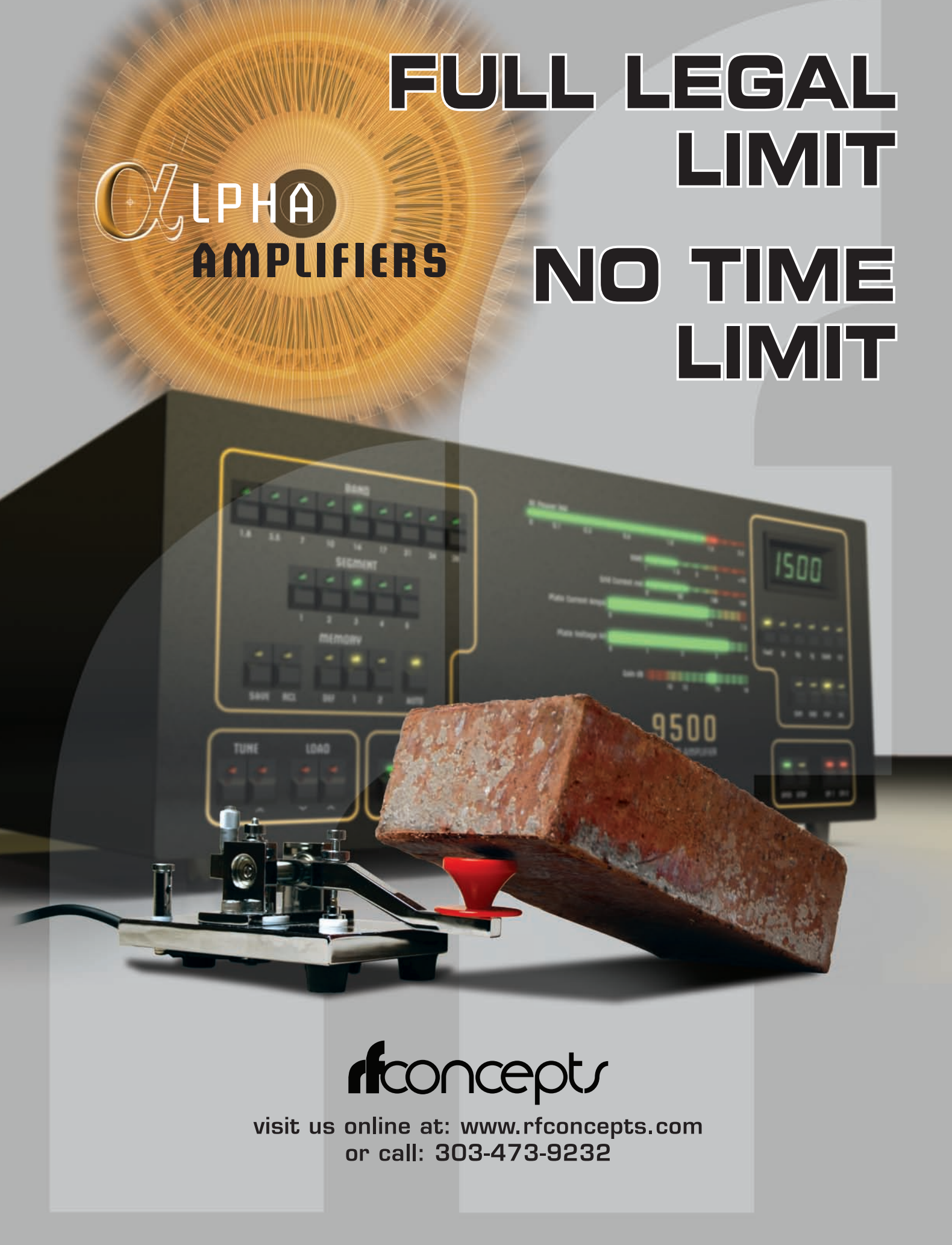
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RX-7-05

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- RX: 150 kHz - 1300 MHz (cell blkd)
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- Memories: 503 • 41 band-widths with sharp or soft filter shape • RMK-7000 included!

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- 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
- Dual DSP units • 3, 6 & 15 kHz 1st (roofing) filters

IC-2820H 2M/440 FM Mobile

- TX: 144-148, 430-450 MHz • RX: 118-549.95, 810-999.990 MHz (cell blkd) • Power: 50/15/5W
- Packet ready (9600 BPS – 6-pin DIN) • Upgradable D-Star DV (digital voice) & GPS capabilities w/optional UT-123

IC-7700 Multimode HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen
- Two 32-bit floating DSPs • Power supply built-in
- Three roofing filters • External VGA connector
- Automatic antenna tuner • USB memory drive socket

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- TX: 160-15M/6M • Power: 1000W (180-264 VAC), 500W (90-132 VAC) • Automatic band change & antenna tuner • Two input & Four output connectors
- Easily connects to any current Icom HF transceiver

IC-7800 Multimode HF/6M Transceiver

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen • Two receivers
- Four 32-bit floating DSPs • Power supply built-in
- Three roofing filters • External VGA connector
- Automatic antenna tuner

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VX-3R

FT-250R 2M FM HT

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- Increased audio output & added "Memory Only" mode

VX-3R Compact 2M/440 FM HT

- TX: 144-148, 430-450 • RX: 0.5-999 (cell blocked)
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VX-7R - Silver Version

VX-8DR

VX-7R Quad-band FM HT Silver Case

- TX: 50-54, 144-148, 222-225, 430-450 MHz
- RX: 0.5-999 MHz (cell blocked) • Memories: 900
- Power: 5/2.5/1/0.05W (0.3/0.05W on 220 MHz)

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- RX: 0.5-999 MHz (cell blocked) • Memories: 1200+
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FT-2900R 2M FM Mobile

- TX: 144-148 • RX: 137-174
- Power: 75/25/10/5W • Memories: 221
- Added "Memory Only" mode and EPCS operation

Comes with a standard DTMF hand mic.

FTM-350R 2M/440 FM Mobile

- TX: 144-148, 430-450 at 50/20/5W and 222-225 at 1W
- RX: 0.5-1.8, 76-250 & 300-1000 MHz (cell blocked)
- Memories: 500 + 500 • Optional Bluetooth® kit allows hands free operation • Optional internal GPS unit FGPS-1 or external FGPS-2 & CT-136 adds GPS and APRS® features
- Large 5.2" x 1.6" and bright LCD screen has 8 selectable background colors is easy to read in almost any condition

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-9000D shown)

FTDX-9000 Series – Covers HF and 6M;

Three configurations including a 200W and 400W versions. Class-A operation at 100W (400W version or 75W with the 200W version). The 200W versions feature a built-in power supply. There is an included external power supply for the 400W version. All models also feature analog meters.

FTDX-9000D 200W, 6.5" TFT Display
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DMU2000 Data Management Unit ..... **Call**
FH2 Remote Keypad **84.95**
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FT950

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DMU2000 Data Management Unit..... **Call**
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MD200A8X Desk top mic **379.95**
SP2000 External Speaker..... **175.95**
UTUNINGKIT A, B, or C model..... **Call**

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The FT-450(AT) is an amazing compact radio that bundles the most desirable IF DSP features of the FT-2000 and FT-950 into a convenient sized lightweight package. Suitable for home, portable, or mobile use, the economical FT-450(AT) is a rugged 100 watt HF/50MHz radio unequalled in its price class. Available with or without factory installed antenna tuner.

ATAS120 Auto tuning antenna **299.95**
ATU450 Auto antenna tuner..... **149.95**
FC40 Auto antenna tuner..... **249.95**
MD100A8X Desk top mic..... **129.95**
MMB90 Mobile mount..... **33.95**

FT897D

The FT-897D is a rugged, innovative, multiband, multimode portable transceiver for the amateur radio MF/HF/VHF/UHF bands. Providing coverage of the 160-10 meter bands plus the 6 m, 2 m, and 70 cm bands and it's capable of 20-Watt portable operation using internal batteries, or up to 100 Watts when using an external 13.8-volt DC power source.

ADMS4B Programming software/cable **51.95**
ATAS120 Auto tuning antenna..... **299.95**
CT39 Packet Cable..... **9.95**
CT62 Computer Interface Cable..... **32.95**
FC30 Bolt on auto antenna tuner **189.95**
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ATAS120 Auto tuning antenna..... **299.95**
CT39 Packet Cable..... **9.95**
CT62 Computer Interface Cable..... **32.95**
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JTPS28 Jetstream Power Supply..... **84.95**
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YF122S 2.3 kHz SSB Filter..... **164.95**
YSK857 Separation Kit..... **39.95**

FT817ND

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YF122S 2.3 kHz SSB Filter..... **164.95**

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Massive heatsink guarantees 75 watts of solid RF power, Loud 3 watts of audio output, 200 memory channels, CTCSS and DCS encode/decode built in.

JTPS14M Jetstream Power Supply..... **49.95**
MLS100 External Speaker..... **46.95**
MX2 Hustler 2m Mag Mount..... **32.95**

FT1900R

The ruggedly built yet compact new FT1900R 2m transceiver brings you Yaesu's legendary mechanical toughness along with outstanding receiver performance and 55 watts with crisp, clean audio that will get your message through!

JTPS14M Jetstream Power Supply **49.95**
MLS100 External Speaker..... **46.95**
MX2 Hustler 2m Mag Mount..... **32.95**

FT250R

Compact yet incredibly rugged, the FT250R 2-meter handheld is derived to perform under the most difficult operating conditions. It is packed with the leading-edge features you've come to expect from a Yaesu product. The FT250R's die-cast aluminum case houses a large, high-output speaker and the illuminated keypad provides easy viewing during night time operation

SMAUHF SMA-UHF Adapter **3.50**
SMABNC SMA-BNC Adapter **3.50**
ADMS1F Software and cable..... **38.95**
EDC5B Cigarette Lighter Cable..... **23.95**
FBA25A AA Battery case **21.95**
MH34B4B Speaker Mic **33.95**
VC25 Vox Headset **62.95**

FT270R

The FT270R is a compact, high performance submersible FM hand held providing up to 5 watts of RF power, along with loud audio output (800 mW) for the 2m or 70cm amateur bands. Submersible up to 3ft for 30 minutes. Long operating times thanks to the supplied 1400 mAh Ni-MH battery pack.

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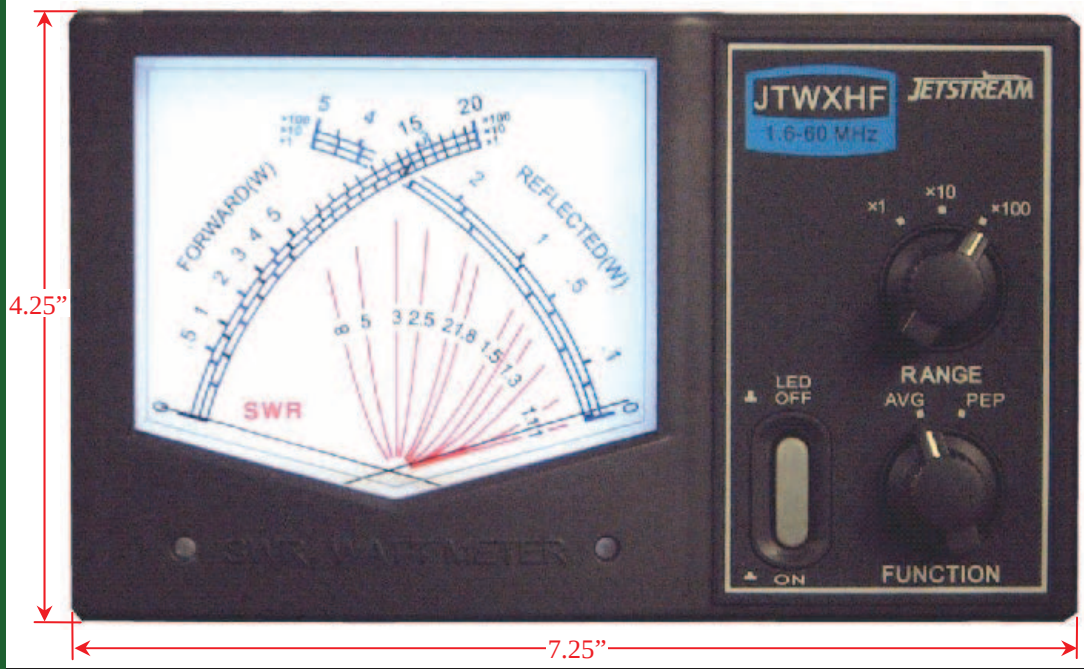

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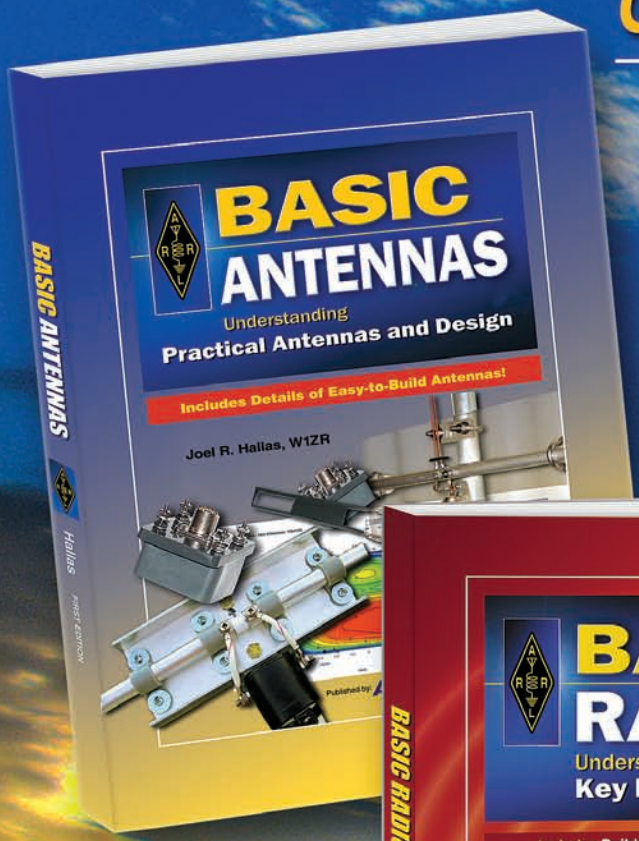

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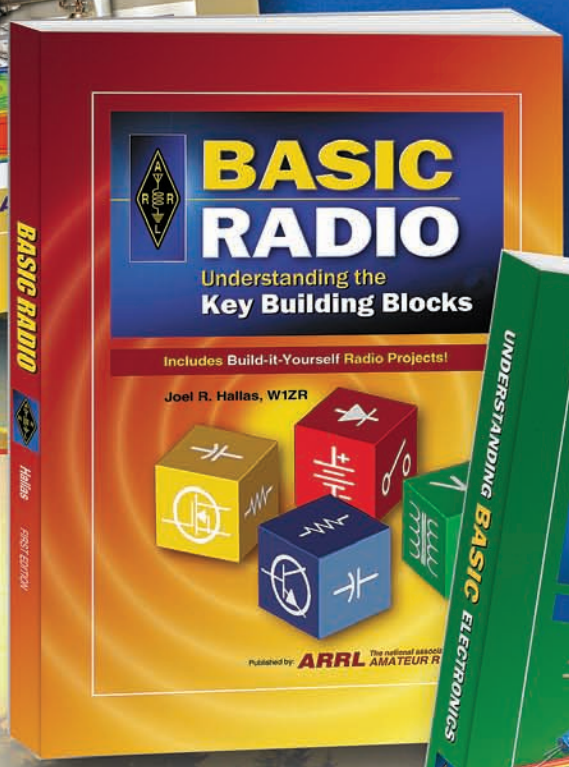

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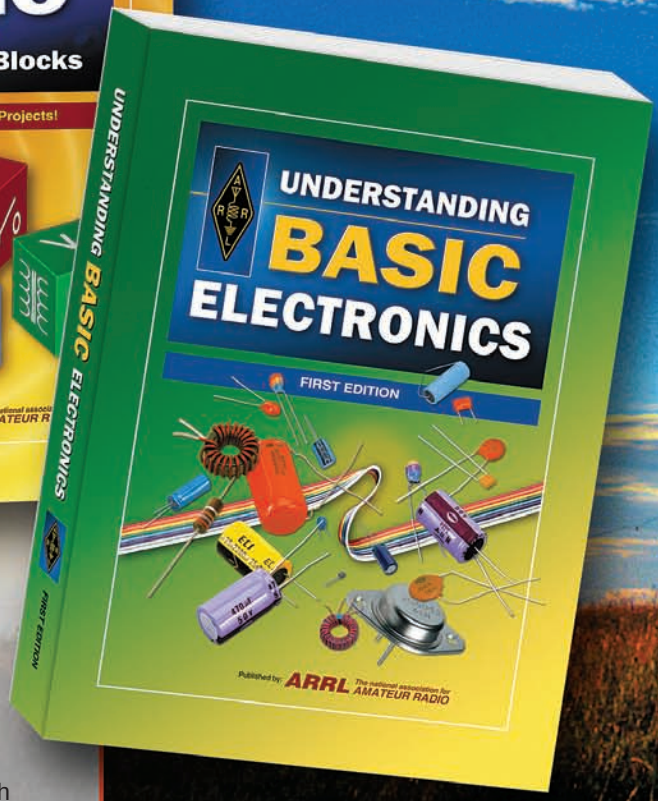

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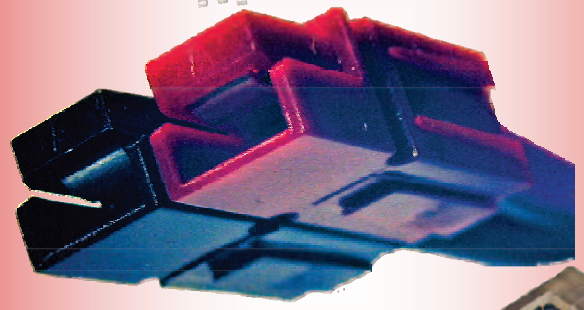

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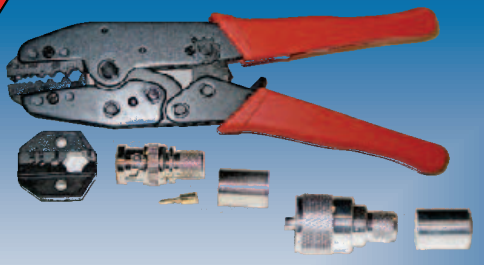

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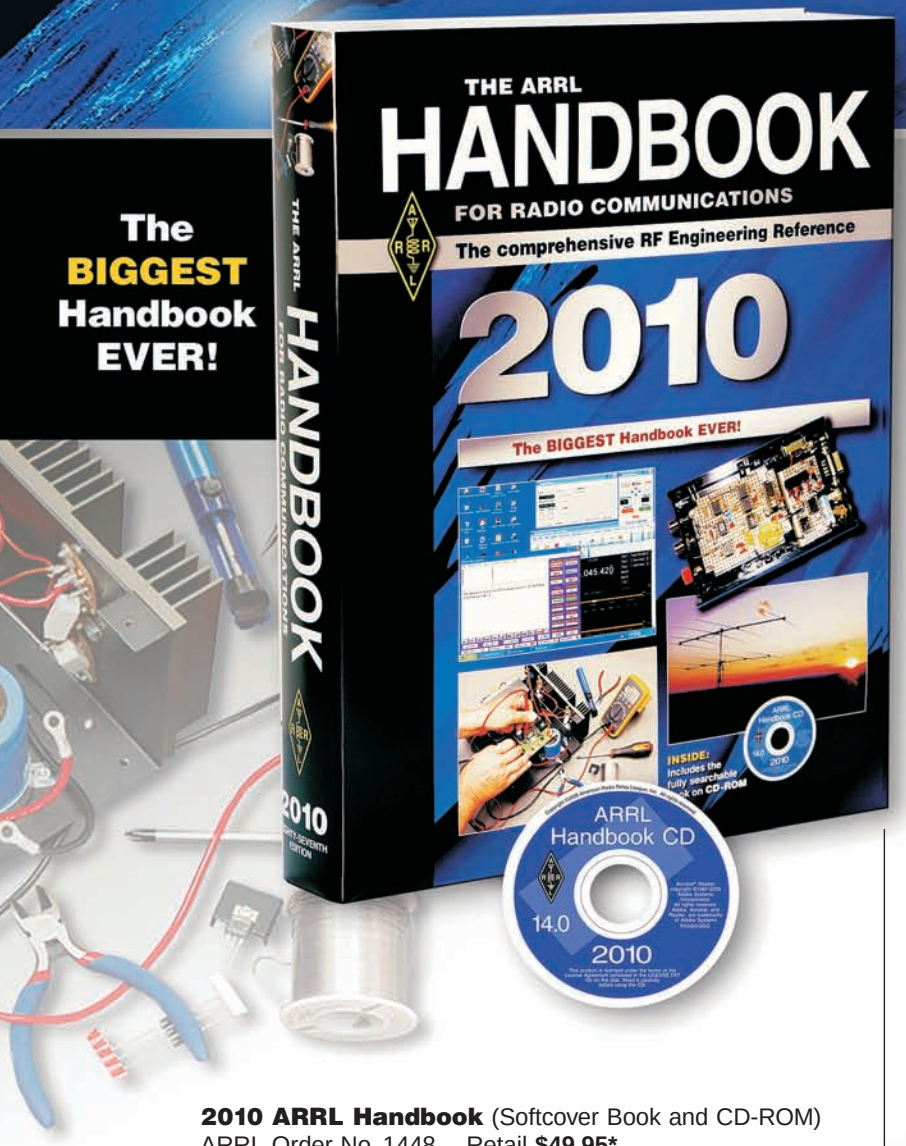

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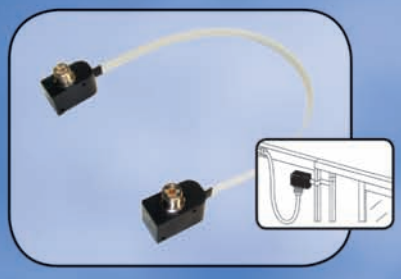

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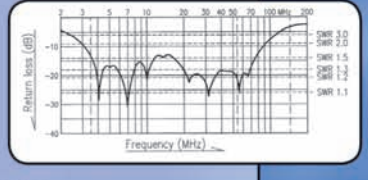

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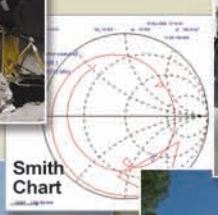

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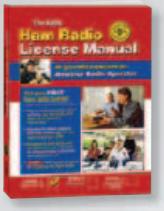

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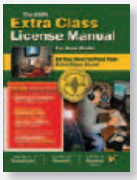

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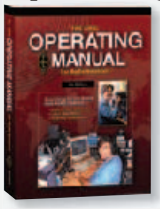

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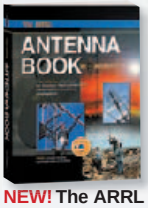

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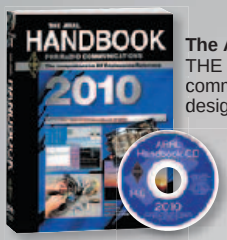

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RC-2, $49.95. Remote Control. On/Off,pre-amp On/Off, selects SSB/FM. With 25 foot cable.

Power Curve -- typical output power in Watts										
B-1018-G	25	50	140	150	160	160	--	--	--	--
B-2518-G	5	7	40	60	80	100	125	160	160	160
B-5018-G	--	2	15	25	40	50	70	100	130	160
Watts In	.25	.5	3	5	8	10	15	25	35	50

35 Watts for 2 Meter HT

For handhelds up to 8 Watts. 35 Watts out for 3-8 Watts in (18 W out/1W in)! 18 dB *GaAsFET* preamp. All modes: FM, SSB, CW. RF sense T/R switch. Reverse polarity protection. Includes mobile bracket, 1 year warranty. 5¼Wx1¾Hx4¾D in.

B-34-G $119.95

35 Watts, $99.95, FM only

B-34, $99.95. 35 Watts out for 2 Watts in. Like B-34-G, FM only, less pre-amp, mobile bracket. 3⅛Wx1¾Hx4¼D in.

MIRAGE Dual Band 144/440 MHz Amp

Boost your *dual band* 144/440 MHz handheld to a powerful mobile/base -- 45 Watts on 2 Meters/ 35 Watts on 440 MHz! Works with all FM handhelds to 7 Watts. Includes *full duplex* operation -- lets you talk on one band, listen on other at same time. Auto band selection, RF sense T/R switch, single connector, reverse polarity protection, 5Wx1¾Hx5D in. Mobile bracket. One year warranty.

BD-35 $179.95

100 Watts for 2M HT

100 Watts out for 2-8 Watts in! Great for HTs up to 8W. FM, SSB, CW. 15 dB *GaAs-FET* preamp, RF sense T/R, high-SWR protected.

B-310-G $229.95

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MIRAGE . . . the world's most rugged VHF/UHF amplifiers!

the *finest* antenna tuner made!

. . . the VECTRONICS HFT-1500

- ***High Current Roller Inductor***
- ***SSB*Analyzer Bargraph™***
- ***Cross-Needle Meter***
- ***6 Position Antenna Switch***
- ***Built-in 4:1 Balun***
- ***Gear driven Turns Counter***

The VECTRONICS HFT-1500 is not just an antenna tuner . . . it's a beautifully crafted work of art, using the finest components available and the highest quality construction.

Every HFT-1500 aluminum cabinet is carefully crafted with a super durable paint that won't scratch or chip.

Attractive two-color Lexan front panel is scratch-proof. Take a quarter. Scratch the front panel. You won't leave a mark!

Arc-Free Operation

Two 4.5 kV transmitting variable capacitors and a massive roller inductor gives you arc-free operation up to 2 kW PEP SSB.

Precision Resetability

A sturdy hand cranked roller inductor lets you quickly fly from band to band. A precision 5-digit gear driven turns counter lets you accurately retune.

HFT-1500 $479.95

Large comfortable knobs and smooth vernier drives make tuning precise and easy. Bright red pointers on logging scales make accurate resetability a breeze.

Absolute Minimum SWR

You can tune your SWR down to the absolute minimum! **Why?** Because all network components -- roller inductor and variable capacitors are fully adjustable.

Tune any Antenna

You can tune any *real* antenna from 1.8 to 30 MHz, including all MARS and WARC bands. You can tune verticals, dipoles, inverted vees, Yagis, quads, long-wires, whips, G5RVs, and more.

SSB*Analyzer Bargraph™

Exclusive 21 segment bargraph lets you visually follow your instantaneous voice peaks. Has level and delay controls.

Accurate SWR/Power Meter

A shielded directional coupler and backlit Cross-Needle meter displays accurate SWR, forward and reflected power simultaneously. Reads both peak and average power on 300/3000 Watt scales.

6 Pos. Ceramic Antenna Switch

Select two coax fed antennas (tuned or bypassed), balanced line/wire or bypass.

Built-in Balun

A heavy duty two ferrite core 4:1 balun feeds dual high voltage Delrin terminal posts for balanced lines. 5.5x12.5x12 inches. One year limited warranty.

Call toll-free, 1-800-363-2922

Order the HFT-1500 from Vectronics. Try it for 30 days. If you are not completely satisfied, return it for a full refund, less shipping and handling -- no hassles.

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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.

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MFJ All-Band G5RV Antennas

Operate all bands through 10 Meters, even 160 Meters, with a single wire antenna!

MFJ-1778
$44.95

The famous G5RV antenna is the most popular ham radio antenna in the world! You hear strong signals from G5RVs day and night, 24/7.

And it's no wonder . . . it's an efficient, *all band* antenna that's only 102 feet long -- shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

Use as Inverted Vee or Sloper, and it's even more compact and needs just one support.

With an antenna tuner, you can operate all bands 80 Meters through 10 Meters and even 160 Meters with an antenna tuner and a ground.

MFJ's fully assembled G5RV handles 1500 Watts. *Hang and Play™* -- add coax, some rope to hang and you're on the air!

MFJ-1778M, $39.95. *Half-size*, 52 foot *G5RV JUNIOR* covers 40-10 Meters with tuner. Handles full 1500 Watts.

MFJ All Band Doublet

MFJ-1777
$59.95

MFJ-1777 is a 102 foot *all band* doublet antenna that covers 160 through 6 Meters with a balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for ladder line (100 ft. included). Authentic *glazed ceramic* end insulators. Handles full 1500 Watts.

MFJ *Dual Band* 80/40 *or* 40/20M Dipoles

MFJ-17758
$89.95
80/40 Meters

MFJ-17758 is a short 85 foot long *dual band* 80/40 Meter dipole antenna. It's *full-size* on 40 Meters and has ultra-efficient end-loading on 80 Meters. Handles full 1500 Watts. Super-strong injection-molded center insulator with built-in SO-239 connector and hang hole. Solderless, crimped construction. 7-strand, #14 gauge hard copper wire. Connect your coax feedline directly, no tuner needed. **MFJ-17754, $59.95.** Short coax fed 42 foot long *dual band* 40/20 Meter dipole antenna. *Full-size* on 20 Meters, ultra-efficient end-loading on 40 Meters. Same construction as MFJ-17758.

MFJ *Single Band* Dipole Antennas

Ultra high quality center fed dipoles will give you trouble-free operation for years. Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. Heavy duty 7-strand, 14-gauge hard copper antenna wire. Extremely strong solderless crimped construction. Authentic *glazed ceramic* end insulators. Use as horizontal or sloping dipole or inverted vee. Handles full 1500 Watts. Simply cut to length for your favorite frequency with cutting chart provided.

MFJ-1779A $69.95 160M, 265 ft.
MFJ-1779B $49.95 80-40M, 135 ft.
MFJ-1779C $29.95 20-6M, 35 ft.

True 1:1 Current *Balun & Center Insulator*

MFJ-918
$24.95

True *1:1 Current Balun/ Center Insulator* forces equal antenna currents in dipoles for superior performance. Reduces coax feedline radiation and field pattern distortion -- your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots in your shack. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*® coax and *Teflon*® coax connector. Handles full 1.5kW 1.8-30 MHz. Stainless steel hardware with *direct* 14 gauge stranded copper wire connection to antenna. 5x2 inches. Heavy duty weather housing.

RF Isolator

MFJ-915
$29.95

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted stray RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 5x2 in. Handles full 1500 Watts. Covers 1.8-30 MHz. **MFJ-919, $59.95.** 4:1 current balun,1.5 kW. **MFJ-913, $29.95.** 4:1 balun, 300 Watts.

Antenna Switches

MFJ-1704
$79.95
4-Positions

MFJ-1704 heavy duty *antenna switch* lets you select 4 antennas or ground them for static and lightning protection. Unused antennas automatically grounded. Replaceable lightning surge protection. Good to 500 MHz. 60 dB isolation at 30 MHz. 2.5 kW PEP. Less than .2 dB insertion loss, SWR below 1.2:1. SO-239 connectors. Handy mounting holes. 6¼Wx4¼Hx1¼D in.

MFJ-1702C
$39.95
2-Positions

MFJ-1702C Like MFJ-1704, but for 2 antennas. 3Wx2Hx2D"

MFJ-1700C
$99.95

MFJ-1700C *Antenna/ Transceiver Switch* lets you select one of six antennas and one of six transceivers in any combination. Plug in an antenna tuner or SWR wattmeter and it's always in-line for any antenna/transceiver combination. Has lightning surge protection. Handles 2 kW PEP SSB, 1 kW CW, 50-75 Ohm loads. Unused terminals are automatically grounded. 1.8 to 30 MHz. SO-239 connectors. 4¾W6½Hx3D inches.

MFJ-1701
$69.95

MFJ-1701 *Antenna Switch* like MFJ-1700C but lets you select one of six antennas only. 10Wx3Hx1½D inches.

33 ft. Telescoping fiberglass Mast

3.8 feet collapsed, 3.3 lbs.

MFJ-1910
$79.95

Super strong fiberglass mast has huge 1¾ inch bottom section. Flexes to resist breaking. Resists UV. Put up *full size* inverted Vee dipole/vertical antenna in minutes and get *full size performance!*

Make your own antennas

Dipoles, G5RV, Random Wire, Doublets, Beverage Antennas, etc.

MFJ-16C06, $4.56. 6-pack authentic *glazed ceramic* end/center antenna insulators. **MFJ-16B01, $19.95.** Custom injection-molded UV-resistant center insulator has built-in coax connector and hanging hole. **MFJ-18G100, $24.95.** 100 ft. of flexible, 7-strand, 14-gauge solid copper antenna wire. **MFJ-58100X, $49.95.** 100 ft. 50-Ohm RG-8X with PL-259s on each end. **MFJ-18H100, $34.95.** 100 feet, 450 Ohm ladder line, 18 gauge copper covered steel.

Lightning Surge Protectors

Ultra-fast gas discharge tube shunts 5000 amps peak. Less than 0.1 dB loss. Up to 1000 MHz. SO-239s. **MFJ-270, $29.95.** 400W PEP. **MFJ-272, $39.95.** 1500W PEP.

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MFJ-259B *1.8-170 MHz* SWR Analyzer

World's most popular SWR analyzer is super easy-to-use

Reads SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . frequency counter . . . side-by-side meters . . . Battery charger . . . battery saver . . . low battery warning . . . smooth reduction drive tuning . . .

World's most popular SWR analyzer! ***The famous MFJ-259B gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance from 1.8 to 170 MHz.***

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

You can 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.

It has built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance from HF to VHF -- 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Call your favorite dealer for your best price!

MFJ-259B
$289.95

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and more!

Free Manual: call, write or download

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1312D, $15.95. Its rugged all metal cabinet is a compact 4x2x6¾ in.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ SWR Analyzers™

MFJ-249B, $269.95. Like MFJ-259B, but reads SWR, true impedance magnitude and frequency only on LCD. No meters.

MFJ-209, $159.95. Like MFJ-249B but SWR meter only. No LCD/frequency counter.

MFJ-219B, $119.95. UHF *SWR Analyzer* covers 420-450 MHz. External frequency counter jack. 7½x2½x2¼ in. *Free* "N" to SO-239 adapter.

SWR Analyzer Accessories

Dip Meter Adapter

MFJ-66, $24.95. Plug a dip meter coupling coil into your MFJ *SWR Analyzer*™ and turn it into a sensitive and accurate bandswitched dip meter. Takes guesswork out of winding coils and determining resonant frequency of tuned circuits and Q of coils. Set of two coils cover 1.8-170 MHz depending on your *SWR Analyzer*.

Genuine MFJ Carrying Case

MFJ-29C, $24.95. Tote your MFJ-259B anywhere with this MFJ custom carrying case. Has back pocket with security cover for carrying dip coils, adaptors and accessories. Made of special foam-filled fabric -- 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 so you can use your MFJ *SWR Analyzer*™ without taking it out of your case.

MFJ-99, $60.85. Accessory Package for MFJ-259/B/249/B/209. Includes MFJ-29C carrying case, MFJ-66 dip meter adapter, MFJ-1312D 110VAC adapter. ***Save $5!***

Tunable Measurement Filter

MFJ-731, $99.95. *Exclusive* MFJ tunable RF filter allows accurate SWR and impedance measurements 1.8-30 MHz in presence of strong RF fields. Virtually no effect on measurements. Works with *all* SWR Analyzers.

MFJ *No Matter What*™ warranty

MFJ will repair or replace (at our option) your MFJ *SWR Analyzer*™ for one full year.

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1.8-170 MHz *plus* 415-470 MHz SWR Analyzer

All-in-one handheld antenna test lab lets you quickly check/tune HF, VHF, ***UHF*** antennas anywhere. Measures: SWR, Return Loss, Reflection Coefficient, R, X, Z, Phase Angle, Coax cable loss, Coax cable length, Distance to short/open in coax, Inductance, Capacitance, Resonant Frequency, Bandwidth, Q, Velocity Factor, Attenuation, more!

MFJ-269
$389.95

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More hams use MFJ SWR Analyzers™ than any others in the world!

MFJ *IntelliTuner*™ Automatic Tuners

More hams use MFJ tuners than all other tuners in the world!

World's most advanced Automatic Antenna Tuners feature world renowned MFJ AdaptiveSearch™ and AutomaticRecall™ algorithms -- world's fastest ultra-wide range tuning. Nine World Class models! Choose your features: Digital/Analog/Audio SWR-Wattmeter, Antenna Switch, Balun, Radio Interface, Digital frequency readout, Remoteable, Coax/Balanced Lines/Wire Tuning, Field Upgradeable . . .

MFJ-993B 300 Watt *IntelliTuner*™

The World's Best Selling Automatic Antenna Tuner!

The MFJ-993B *IntelliTuner*™ lets you tune any antenna -- balanced or unbalanced -- *automatically* and *ultra fast*.

It's a comprehensive automatic *antenna tuning center* complete with SWR/Wattmeter, antenna switch for two antennas and 4:1 current balun for balanced lines.

MFJ's exclusive *IntelliTuner*™, *Adaptive Search*™ and *Instant Recall*™ algorithms give you *ultra fast* automatic tuning with over 20,000 *VirtualAntenna*™ Memories.

Select 300 Watt SSB/CW power level and match 6-1600 Ohm antennas ***Or . . .*** select **150 Watt** SSB/CW power level and match *extra wide-range* 6-3200 Ohms!

You get a highly efficient L-network, 1.8-30 MHz coverage, Cross-Needle *and* digital meters, audio SWR meter, *backlit* LCD, remote control port, radio interface, heavy-duty 16 amp/1000V relays.

MFJ-993B **$259.95**

The MFJ-993B automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, these tuner settings are instantly restored and *you're ready to operate in milliseconds!* 10W x2¾ Hx9D". Use 12-15 VDC/1 amp or 110 VAC with **MFJ-1316, $21.95**. Radio interface cables, remote control available. See ***www.mfjenterprises.com***

for 600 Watt amps

AL-811/ALS-600/ALS-500

For 600 Watt amps like Ameritron AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. 10,000 *Virtual Antenna*™ memories. Cross-Needle SWR/Wattmeter. 10Wx2¾Hx9D inches.

MFJ-994B **$359.95**

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

1500 Watt ***Legal Limit***

for Ameritron AL-1500/1200/82 amps

Roam the entire HF spectrum 1.8-30 MHz *hands-free* with full *1500 Watt* legal limit on SSB/CW and near-perfect SWR! Lighted LCD/Cross-Needle Meter.

MFJ-998 **$699.95**

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

Extra *wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B **$219.95**

200 Watt...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 **$219.95**

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 **$199.95**

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

No *extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 **$179.95**

G5RV Antenna

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feed-point insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

MFJ-1778 **$44.95**

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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New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive*™ peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D $389.95

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$Wx6Hx$11^{5}/_{8}$D inches.

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

***No Matter What*™ Warranty**

Every MFJ tuner is protected by MFJ's famous one year *No Matter What*™ limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob ***Differential-T***™

MFJ-986 $349.95

Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^{3}/_{4}$Wx$4^{1}/_{2}$Hx15 in.

MFJ-962D ***compact*** kW Tuner

MFJ-962D $299.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{3}/_{4}$x$4^{1}/_{2}$ x$10^{7}/_{8}$ in.

MFJ-969 300W ***Roller Inductor*** Tuner

MFJ-969 $219.95

Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $3^{1}/_{2}$Hx$10^{1}/_{2}$Wx$9^{1}/_{2}$D inches.

MFJ-949E ***deluxe*** 300 Watt Tuner

MFJ-949E $179.95

More *hams use MFJ-949s than any other antenna tuner in the world!* Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, *full size* peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, *QRM-Free PreTune*™, scratch proof Lexan front panel. $3^{1}/_{2}$Hx$10^{5}/_{8}$Wx7D inches. **MFJ-948, $139.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E ***super value*** Tuner

MFJ-941E $139.95

The *most for your money!* Handles 300 Watts PEP, covers 1.8-30 MHz, *lighted* Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. Sleek $10^{1}/_{2}$Wx$2^{1}/_{2}$Hx7D in.

MFJ-945E HF/6M ***mobile*** Tuner

MFJ-945E $129.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8x2x6 in. *Lighted* Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz *and* 6 Meters. 300 Watts PEP. **MFJ-20, $6.95,** mobile mount.

MFJ-971 ***portable/QRP*** Tuner

MFJ-971 $119.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x$6^{1}/_{2}$x$2^{1}/_{2}$ in.

MFJ-901B ***smallest*** Versa Tuner

MFJ-901B $99.95

MFJ's smallest (5x2x6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902 ***Tiny Travel*** Tuner

MFJ-902 $99.95

Tiny $4^{1}/_{2}$x$2^{1}/_{4}$x3 inches, full 150 Watts, 80-10 Meters, has tuner bypass switch, for coax/random wire.

MFJ-904H, $149.95. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$x$2^{1}/_{4}$x$2^{3}/_{4}$ inches.

MFJ-16010 ***random wire*** Tuner

MFJ-16010 $69.95

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

MFJ-906/903 ***6 Meter*** Tuners

MFJ-906 $99.95

MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $69.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

MFJ-921/924 ***VHF/UHF*** Tuners

MFJ-921/924 $89.95

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8x$2^{1}/_{2}$x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

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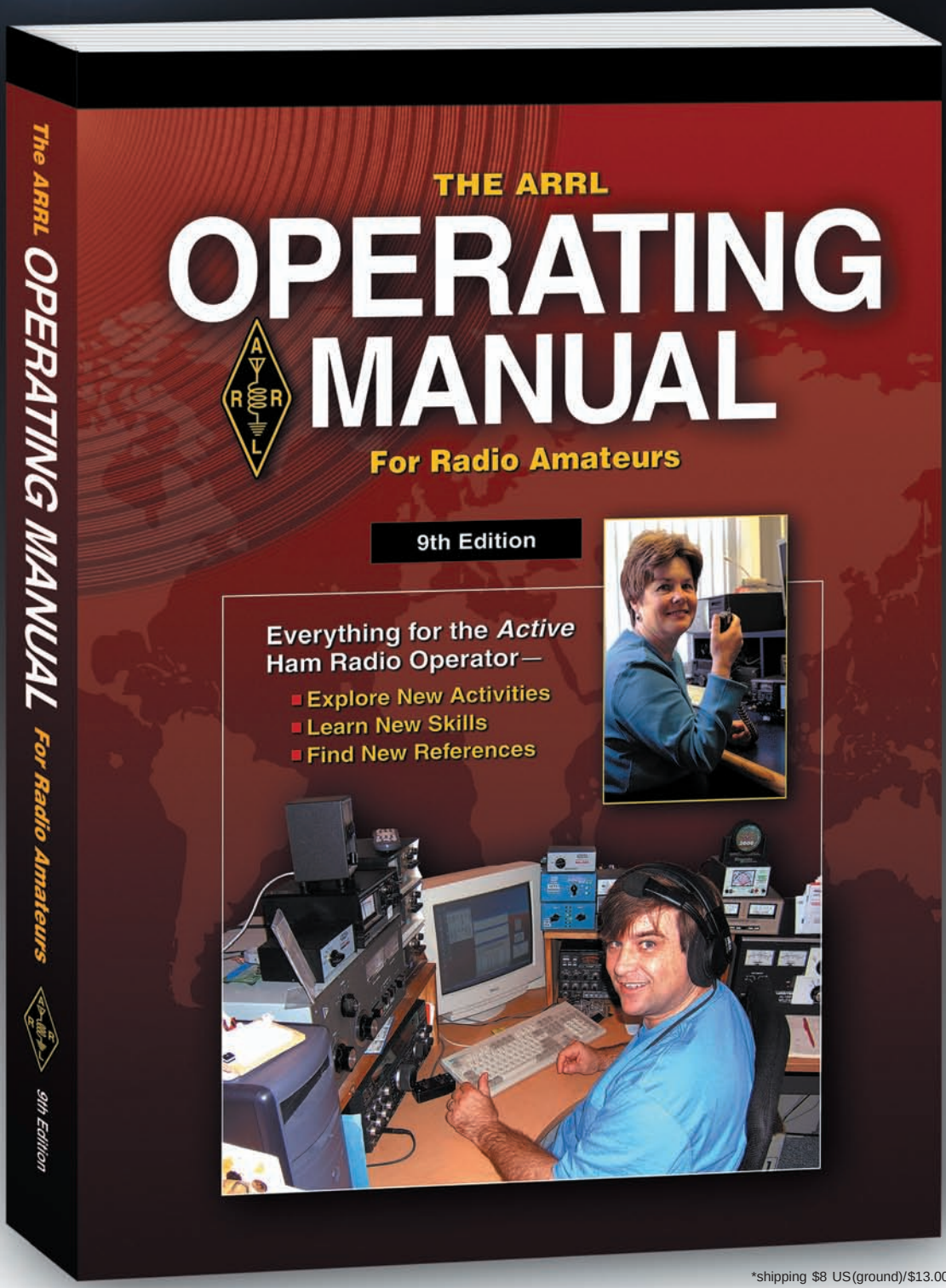

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MFJ *Balanced Line* Antenna Tuner

Superb balance . . . Very wide matching range . . . Covers 1.8-54 MHz . . . Cross-Needle SWR Wattmeter . . . Handles 300 Watts . . . Compact size . . .

The MFJ-974HB is a* fully balanced true *balanced line antenna tuner. It gives you superb current balance.

Johnson Matchbox

For decades, the Johnson Matchbox has been the standard of comparison for balanced line antenna tuners. But, it had a severely limited matching range and covered only 80, 40, 20, 15 and 10 Meters.

***The** MFJ-974HB is its successor*. It meets today's needs and even surpasses the Johnson Matchbox outstanding performance.

Everything You Need

The MFJ-974HB gives you excellent current balance, very wide matching range(12-2000 Ohms) and covers 1.8 through 54 MHz *continuously* including all WARC bands, 160 Meters, 6 Meters and the new 60 Meter band. Handles 300 Watts SSB PEP and 150 Watts CW.

Tuning is fast and easy - - just three tuning controls. You can adjust for highly efficient broadband low-Q operation or use higher Q when you encounter extreme loads.

A large three-inch lighted Cross-Needle SWR/Wattmeter lets you read SWR, peak or average forward and reflected power *all at a glance* on 300/60 or 30/6 Watt ranges.

A ground post is provided to ground one output terminal so you can also tune random wires and coax fed antennas.

Compact 7½Wx6Hx8D in. fits anywhere.

Tunes any Balanced Line

The MFJ-974HB tunes any balanced lines including 600 Ohm open wire line, 450/300 Ohm ladder lines, 300/72 Ohm twin lead - - shielded or unshielded.

Superb current balance minimizes feedline radiation that can cause troublesome TVI /RFI, painful RF bites, mysterious RF feedback problems and radiation pattern distortion.

Excellent Balance, Excellent Design

The MFJ-974HB is a *fully balanced* wide range T-Network. *Four* 1000 Volt air variable capacitors are gear driven. A high-Q air wound tapped inductor is used for 80-10 Meters with separate inductors for 6 and 160 Meters. The tuning components are mounted symmetrically to insure electrical balance.

MFJ-974HB
$209.95

A 1:1 *current* balun is placed on the low impedance 50 Ohm input side to convert the balanced T-Net-work to un-balanced operation. An efficient balun is made of 50 ferrite beads on RG-303 *Teflon*™ coax to give very high isolation. It stays cool even at max power.

Balanced Line = Extremely Low Loss

Balanced lines give extremely low loss.

Doublet, horizontal loop, vertical loop, quad, double extended Zepp, Lazy H, W8JK antennas all give efficient multi-band operation when fed with balanced lines.

6-80 Meter Balanced Line Tuner

MFJ-974B
$189.95

MFJ-974B, $189.95. Same as MFJ-974H but for 6-80 Meter operation (no 160 Meters).

160-6 Meters All Band Doublet Antenna

MFJ-1777, $59.95. 102 feet doublet antenna covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator provides stress relief for 450 Ohm ladder line (100 feet included). Authentic *glazed ceramic* end insulators. Handles 1500 Watts.

MFJ 1500 Watt ***Fully Balanced*** Antenna Tuner

Fully balanced MFJ-976 handles 1500 Watts legal limit . . . Extra-wide 12-2000 Ohms matching range . . . continuous 1.8 to 30 MHz coverage including all WARC bands . . . Four separate 500 pF in two gangs gives you a total of 2000 pF capacitance . . . Heavy duty 1:1 current balun . . . more!

MFJ-976
$499.95

The MFJ-976 is a 1500 Watt Legal Limit *fully balanced* antenna tuner.

You get *superb* current balance, very wide matching range (12-2000 Ohms) and *continuous* 1.8-30 MHz coverage including all WARC bands. Handles *full* 1500 Watts SSB *and* CW.

You can tune *any* balanced lines including 600 Ohm open wire line, 450/ 300 Ohm ladder lines, 300/72 Ohm twin lead -- shielded or unshielded. Also tunes random wires and coax fed antennas.

MFJ's *fully balanced* extremely wide-range T-network gives you simple, fast three knob tuning. No complicated switching between high and low impedance and switching in additional capacitance of L-networks.

Four separate 500 pF in two gangs gives you a total of 2000 pF for highly efficient low loss operation on 160 Meters.

You get superb 10 Meter performance due to MFJ's low minimum capacitance and exclusive *Self-Resonance Killer*™ high-Q *AirCore*™ roller inductor with silver plated contacts.

Heavy duty 1:1 current balun gives you *superb balance* and stays cool even at 1.5kW.

True *active* peak reading lighted Cross-Needle SWR/Wattmeter lets you read SWR, *true peak* or average forward and reflected power all at a glance on 300/ 3000 Watt ranges. 12Wx6Hx15¾D inches.

Ladder line, Twin lead, Insulators, Copper wire . . .

Super-strong fiberglass 450 Ohm ladder line insulators

MFJ-16D01, $8.95. *Center* insulator. Double weave ladder line stress-relief. Strong wire tie points. Hang hole.

MFJ-16E01, $9.95. Feedpoint *End* Insulator. Double weave ladder line stress relief. Built-in SO-239 connector.

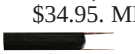
MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at mid-point with SO-239, quadruple weave-through ladder line stress relief.

MFJ-16C06, $4.56. Authentic *glazed ceramic* Insulator, 6-pack.

450 Ohm Ladder Line

Extremely low loss, open-frame construction. Heavy duty black polyethylene. Solid 18 gauge wire. MFJ-18H050, **50 Ft.**, $19.95. MFJ-18H100, **100 Ft.**, $34.95. MFJ-18H250, **250 Ft.**, $89.95.

300 Ohm Twin-Lead



20 gauge stranded copper wire. Black polyethylene. MFJ-18T050, **50 Ft.**, $24.95. MFJ-18T100, **100 Ft.**, $44.95. MFJ-18T250, **250 Ft.**, $99.95.

Copper Antenna Wire

Flexible, 7-strand, 14 gauge, hard solid-copper wire. Strong/long-lasting. MFJ-18G100, **100 Ft.**, $24.95. MFJ-18G250, **250 Ft.**, $59.95.

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MFJ high-accuracy *Digital* SWR/Wattmeter

MFJ's high-accuracy digital SWR/Wattmeter gives you three 10-bit frequency compensated power ranges!

MFJ-826B
$179.95

New!

An optimum power range is automatically selected. Each range has full 10-bit resolution. A low range (25 Watt full scale), a mid-range (250 Watt full scale) and a high-range (1500 Watts full scale) covers the entire amateur power spectrum with high accuracy.

A built-in frequency counter selects the appropriate frequency compensated data set to insure highest accuracy for each band. It also displays your transmitted frequency and provides digital frequency readout for older rigs and QRP rigs such as MFJ-9420/9040/9340.

True peak or average forward and reflected power, SWR and frequency are *simultaneously* displayed.

Bargraphs makes tuning antenna tuners, amplifiers and transmitters easy. You can select bargraphs to display forward and reflected power *or* forward power and SWR *or* SWR only.

MFJ's PeakHold™ freezes high-est forward power displayed (bar segment also) for 1, 2 or 3 seconds.

MFJ's *TrueActive*™ peak reading circuit gives you *true* peak or average power.

When SWR is greater than 1.5 to 3 (selectable) an alarm LED lights and buzzer sounds.

Has large high-contrast *backlit* LCD display.

Use 12 VDC or 110 VAC with optional MFJ-1312D, $15.95. 6½Wx2⅝Hx6D inches.

MFJ *giant* SWR/Wattmeter

World's *largest HF SWR/Wattmeter has giant 6½ inch meter!*

This one you can SEE! Extra-long scales gives you highly accurate SWR and power measurements. Huge numbers makes reading easy across your shack.

Like your analog watch, one glance at the meter needle gives you fast and accurate readings without actually reading the scale.

MFJ's exclusive *TrueActive*™ peak reading circuit captures *true* peak or average forward and reflected power readings.

Has 20/200/2000 Watt ranges for accurate QRP or QRO operation.

MFJ-868
$149.95

Exclusive MFJ Wattmeter *Power Saver*™ circuit turns on meter only when RF power is being measured.

Covers 1.8-30 MHz. Use 9 volt battery or 12 VDC or 110 VAC with MFJ-1312D, $15.95. 7Wx5½Hx5D in. SO-239 connectors.

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Giant 144/220/440 MHz SWR/Wattmeter
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MFJ-862
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Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

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Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

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Lighted 3" C/N Meter, SWR/Watts, 1.8-30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B
$39.95

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B
$149.95

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403
$119.95

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

MFJ-1164B
$79.95

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

Transceiver Surge Protector

MFJ-1163, $69.95. Protects your expensive transceiver from damaging power surges. Capacitive decoupling and *ultra-fast* MOVs protection. 4 AC outlets.

MFJ all-in-one *Transmit Audio Console*

MFJ-655B
$219.95

MFJ all-in-one *Transmit Audio Console* gives you an *8-Band Equalizer* for full quality ragchewing audio *or* powerful, pileup penetrating speech . . . Adjustable *Noise Gate* gives you transparent, back-ground noise reduction . . . Clean low-distortion *Compressor* gives you more powerful, richer, fuller sounding speech and higher average power SSB . . . Smooth *Limiter* keeps audio peaks from over-driving your transmitter, prevents SSB distortion and splatter. *Universal Mic-Interface* lets you use any microphone with any transceiver. Has low-noise preamp, mic voltages, PTT jack, impedance matching, level controls, RF/audio isolation, VU meter, headphone monitor, auxiliary input.

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No more picking up and hauling around heavy, bulky supplies that can give you a painful backache, pulled muscle or hernia.

These babies are clean . . . Your buddies won't hear *any* RF hash on your signal! *None* in your receiver either! These super clean *MightyLites*™ meet all FCC Class B regulations.

Less than 35 mV peak-to-peak ripple under 25 or 45 amp full load. Load regulation is better than 1.5% under full load.

You won't burn up our power supplies!

MFJ Power supplies are *fully protected* with Over Voltage, Over-temperature and Over Current protection circuits.

MFJ *MightyLites*™ can be used anywhere in the world! They have switchable AC input voltage and work from 85 to 135 VAC or 170 to 260 VAC. Replaceable fuse.

A whisper quiet internal fan efficiently cools your power supply for long life.

22 Amp Continuous

Ham Radio's smallest and lightest 22 Amp continuous power supply is also its best selling!

MFJ-4125 $109.95

22 Amps continuous/25 Amps max at 13.8VDC. 5-way binding posts on front, 5A quick connects on back. 85-135/170-260 VAC input. 2.9 lbs. 5¾Wx3Hx5¾D".

MFJ-4125P, $124.95. Adds 2-pairs *Anderson PowerPoles*™.

22 Amp Continuous

22 Amps continuous, 25 Amps maximum. Like MFJ-4125 but adds Volt/Amp meters, cigarette lighter plug. Adjustable 9-15 VDC Output. 5¼Wx 4½Hx6D in. Weighs 3.7 lbs. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4225MV $149.95

40 Amp Continuous

***MightyLite*™**

40 Amps continuous, 45 Amps max. Adjustable 9-15 VDC output. Volt/Amp meters, cigarette lighter plug, front 5-way binding posts, two rear quick connects. 5.5 lbs. 7½Wx 4¾Hx9D inches. Use 85-135 VAC or 170-260 VAC input. Replaceable fuse.

MFJ-4245MV $199.95

75 Amp Continuous

75 Amps continuous. Adjustable 13.8-14.2 VDC output. Reverse polarity, over-current/temperature, brown-out input protection, 7.8 lbs. 6½Wx3½Hx10D in. 108-132 VAC. Great for Ameritron's ALS-500M mobile amplifier!

MFJ-4175 $359.95

High Current Multiple DC Power Outlets

Power multiple Transceivers/accessories from a single DC power supply . . . Keeps you neat, organized and safe . . .Prevents fire hazard . . . Keeps wires from tangling up and shorting . . . Fused and RF bypassed . . . 6 foot, 8 gauge color coded cable . . .

Versatile 5-Way Binding Posts

MFJ-1118 $84.95

MFJ-1118, $84.95. Power two HF and/or VHF rigs and six accessories from your main 12 VDC supply. *Built-in 0-25 VDC voltmeter*. Two pairs 35 amp 5-way binding posts, fused and RF bypassed for transceivers. Six pairs RF bypassed binding posts provide 15 Amps for accessories. Master fuse, ON/OFF switch,"ON" LED. 12½x2¾x2½ in.

MFJ-1116 $59.95

MFJ-1116, $59.95. 8 pairs binding posts, 15A total.Voltmeter, on/off switch.

MFJ-1112 $44.95

MFJ-1112, $44.95. 6 pairs binding posts, 15 Amps total.

MFJ-1117 $64.95

MFJ-1117, $64.95. Powers *four* transceivers simultaneously (two at 35 Amps each and two at 35 Amps combined). 8x2x3 inches.

All PowerPoles™

MFJ-1128 $104.95

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April 2010	Friday, February 12, 2010	Monday, February 15, 2010
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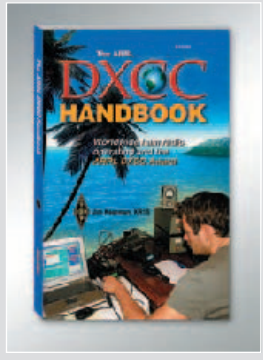

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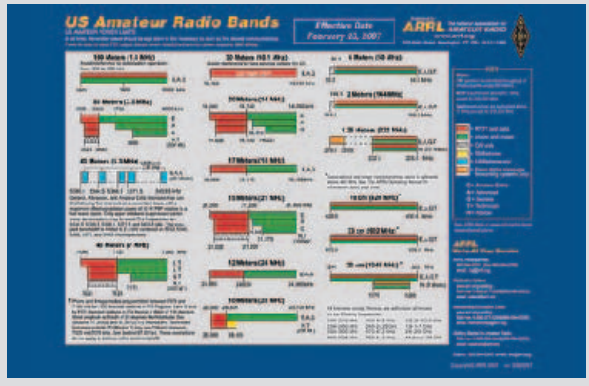

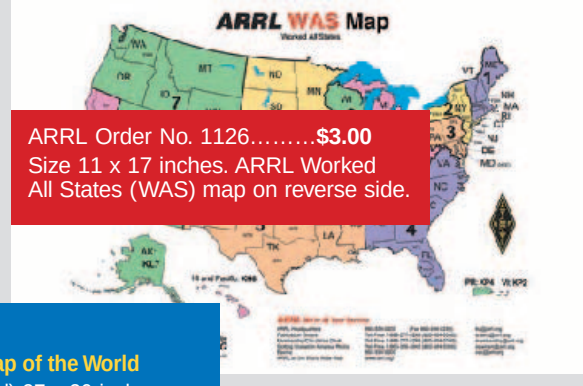

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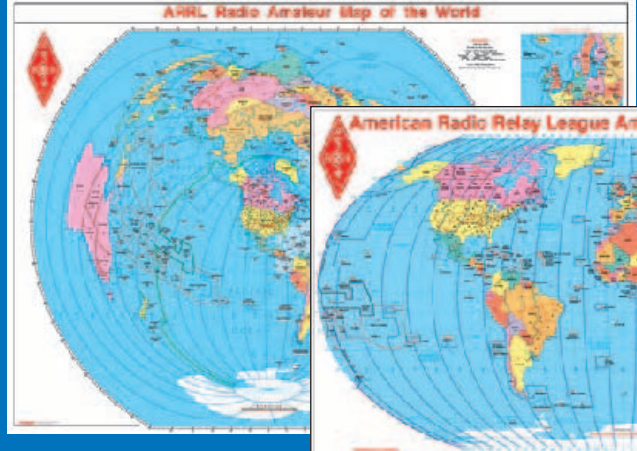

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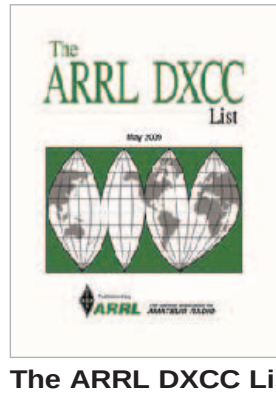

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