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Rock-bound No More!

Page 30

QST reviews:

Inside:

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Official Journal of ARRL The national association for AMATEUR RADIO™

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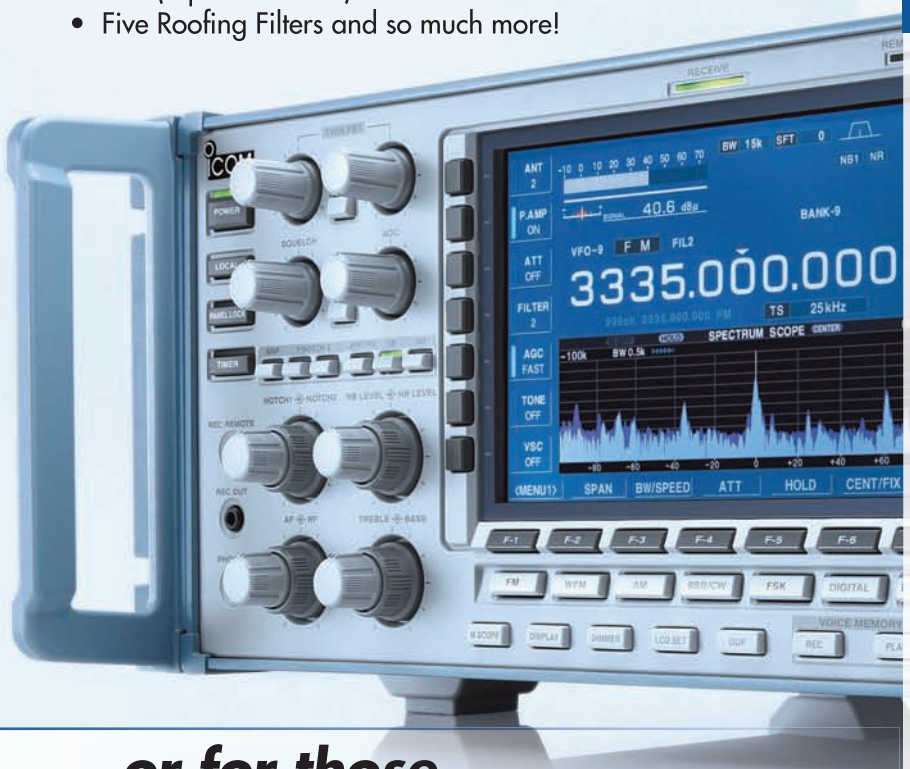

Icom Mobile Receivers

IC-R1500

MOBILE OR PC CONTROL

- 0.01 - 3299.99 MHz*
- AM, FM, WFM, USB, LSB, CW
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- Optional DSP (UT-106)
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- Very Compact Design

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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)

...or for those just getting started.

IC-R75 WIDE BAND RECEIVER

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- Twin Passband Tuning
- Digital Signal Processing (DSP)

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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!

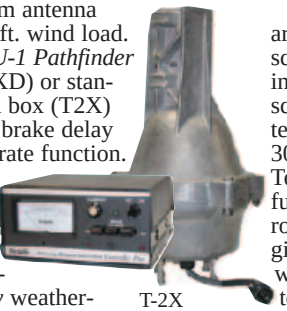
HAM-IV

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.

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NEW! Automatic Rotator Brake Delay

RBD-5
$29.95

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

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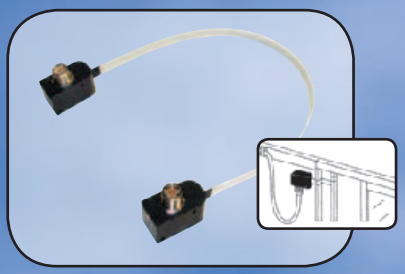


NEW! COMET CTC-50M
Window Gap Adapter!

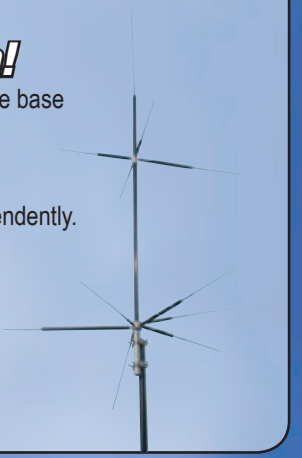
Max Power: HF 100W PEP
VHF: 60W FM
UHF: 40W FM
900MHz - 1.3GHz: 10W
VSWR: <500MHz 1.3:1
>500MHz 1.5:1
Impedance: 50Ohm
Length: 15.75"
Conn: 24k Gold Plated SO-239s

MALDOL HVU-8
Ultra-Compact 8 Band Antenna!

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

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

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



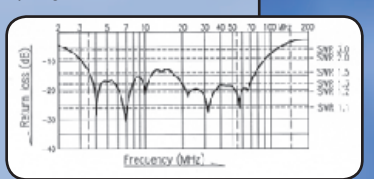
COMET CHA-250B
Broadband HF Vertical!

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

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

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

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



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

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

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

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News and Features

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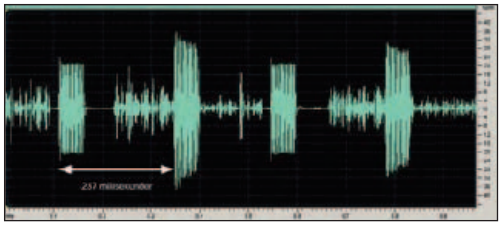

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Our Cover
Two versions of *The Rockless* — a VFO-controlled low power transceiver adapted by A. Robert Patzlaff, W9JQT, from K1SWL's successful Rock Mite design. You can build either the complete transceiver version — or just the VFO to use with another project. See page 30. The original Rock Mite was described in the April 2003 issue.

Departments

November 2009 ♦ Volume 93 Number 11

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- Loud 3 Watts of Audio Output for noisy environments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

HEAVY-DUTY 75 W 2 m FM TRANSCEIVER

FT-2900R

Size: 6.3" (W) x 2.0" (H) x 7.3" (D) / Weight: 4.0 lb

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2 m MONO BAND

Best Selling, Reliable Mobile

- 55 Watts of Solid RF Power within a compact footprint
- Loud 3 Watts of Audio Output Power for noisy enviroments
- Large 6 Digit Backlit LCD for excellent visibility
- 200 Memory Channels for serious users

NEW

ULTRA RUGGED 55 W 2 m FM TRANSCEIVER

FT-1900R

Size: 5.5" (W) x 1.6" (H) x 5.8" (D) / Weight: 2.2 lb

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*108 to 520 MHz/ 700 to 999.99 MHz (Cellular blocked)

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Actual Size

NEW 2 m/70 cm DUAL BAND FM TRANSCEIVER

FT-7900R

2 m/70 cm DUAL BAND

Size: 5.5" (W) x 1.6" (H) x 6.6" (D) / Weight: 2.2 lb

• Separation Kit for Remote Mounting (optional separation kit YSK-7800 requires)

50 W 10 m/6 m/2 m/70 cm* Quad Band FM Mobile

FT-8900R

*70 cm 35 W

QUAD BAND DUAL RECEIVE

50 W 2 m/70 cm* Dual Band FM Mobile

FT-8800R

*70 cm 35 W

DUAL BAND DUAL RECEIVE

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

COMPACT HF/50 MHz TRANSCEIVER WITH IF DSP

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

HF/50 MHz 100 W All Mode Transceiver

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

HF/VHF/UHF Portable Operation
Just Got a Lot More Powerful!
FT-897D TCXO DSP 60 m Band
HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

HF/VHF/UHF Multimode Mobile Transceiver,
now Including Built-in DSP
FT-857D DSP 60 m Band
HF/50/144/430 MHz
100 W All Mode Transceiver (144 MHz 50 W/430 MHz 20 W)

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

Automatic Matching for FT-897/857 Series Transceivers
FC-40
Automatic-Matching 200-Memory Antenna Tuner (160 m ~ 6 m Band)
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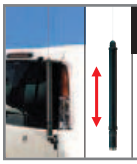

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"It Seems to Us"

It Doesn't Just Happen

"Are you enjoying the fall operating season? Whether it's because radio conditions improve or just because our attention returns to indoor pursuits as the days get shorter, on-the-air activity always picks up at this time of the year."

Do you operate on 40 meters? If you haven't been on the band lately, you're in for a real treat! Years of patient effort by the ARRL and by our sister members of the International Amateur Radio Union (IARU) have paid off. The band is more useful now than it's been in more than 70 years — and ARRL members and supporters like you were essential to making it happen.

I'm delighted to share this good news — but I also must ask for your continued support to ensure that the ARRL will always to be able to do what's needed to defend and improve your access to the radio spectrum.

When you think of 40 meters, you probably think of interference from foreign broadcasters. Here in the Americas, amateurs always have had access to 7,000-7,300 kHz — but we had to tolerate broadcasters in the rest of the world in the upper two-thirds of the band. I can recall the futility I felt as a 13-year-old Novice, trying to make myself heard through the racket with just two crystal-controlled transmitting frequencies to choose from. I remember taking the crystal holders apart and putting pencil lead on the crystals in a vain attempt to slip in between the broadcasting behemoths.

Forty years later I had the great privilege of being present in Geneva when the 2003 World Radiocommunication Conference (WRC-03) agreed that we had made the case for a wider worldwide amateur band, free of broadcasting interference. For the first time in the history of radio communication, an HF broadcasting allocation would be shifted in order to accommodate the needs of another radio service — ours!

The WRC-03 decision was very gratifying, but an important question remained: Would the broadcasters really move? The International Telecommunication Union has no enforcement authority, and operation in contravention of the international Radio Regulations is not exactly unknown. As it turned out, the transition was quite dramatic. On Friday evening of the last weekend of March, 7,100-7,200 kHz was full of broadcasters as usual — but as the new seasonal broadcasting schedule took effect on Saturday night the band cleared of all but a few. For the very first time our overseas friends could hear us on 40 meter phone without having to breach the wall of broadcasters! Over the past six months the situation has continued to improve as more broadcasters have complied with the WRC-03 decision. Nighttime operation above 7,200 kHz remains a challenge, but it's not an exaggeration to say that 40 meters is like a whole new band. As a member recently commented, "For the first time I can ragchew with Europeans on 40 meter phone from Oklahoma!"

Moving hundreds of broadcast transmitters in dozens of countries out of a band didn't just happen. It took years of patient effort by a global team of volunteers and ARRL professionals, working through the IARU, to overcome objections and marshal the necessary support.

It was an expensive undertaking, and it never could have been accomplished without the voluntary contributions — above and beyond their basic dues — of thousands of ARRL members like you.

Even as we celebrate our reborn 40 meter band we must remember that it takes hard work just to hang onto what we have. Much as we like to pursue new and improved ham bands, most of our effort must go toward frequency defense. Every day, new uses of the radio spectrum are being conceived. Each one competes for spectrum access with incumbent radio services, including ours. Not only must we defend our allocations against well-heeled backers of licensed services, we must also try to prevent the pollution of the radio spectrum by unlicensed devices. The fight goes on in Washington, Geneva, and around the globe — and there's no end in sight.

You may have heard that the WRC originally scheduled for 2011 has been pushed back to 2012, and you may have thought that this gives us an extra year to prepare. In fact, the schedule has slipped by less than three months. Decisions are being made *now* that will determine how many administrations — including the United States — will support a new secondary allocation to the amateur service at 500 kHz, and whether proposals for allocations to oceanographic radars will threaten some of our existing HF bands. We are hard at work meeting these challenges, but we need your help.

So, in this annual appeal I must ask you to be as generous as you can in supporting the ARRL Spectrum Defense Fund. Members' past response helped us to keep commercial satellites out of the 144 and 420 MHz bands, to gain access to frequencies around 5 MHz, and to win our court challenge of the FCC's flawed Broadband over Power Lines (BPL) rules. New challenges keep cropping up. Currently we are working to ensure that new short-range medical devices do not impact our ability to use our UHF and microwave bands.

No one can predict all of the threats that Amateur Radio will face in the future, but this much is certain: there will be challenges, and the ARRL — with your continued help — will be ready and willing to meet them.

While your contribution is welcome at any time, it will help us a lot if you can respond by November 30 so we can plan for the coming year. Your donation by mail, phone or on the Web at **www.arrl.org/defense** is tax deductible to the extent allowed by law. Many thanks!

David Sumner, K1ZZ
ARRL Chief Executive Officer

hy-gain HF VERTICALS

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

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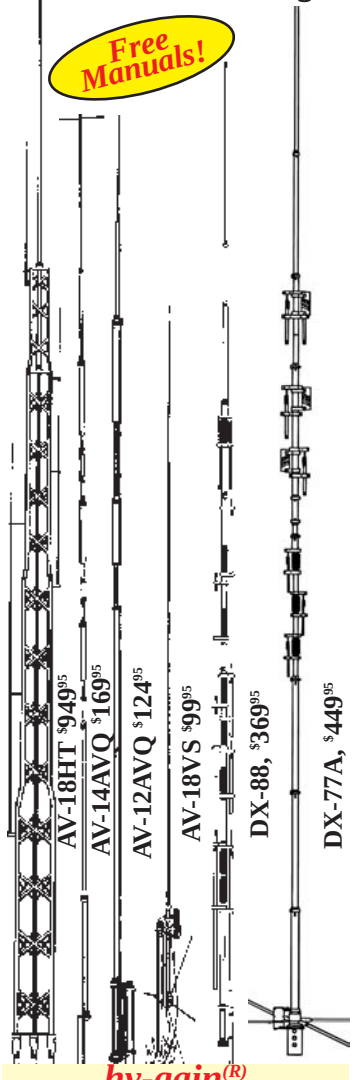


hy-gain(R) Classics

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

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

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

Heavy duty, slotted, tapered swaged, aircraft quality aluminum tubing with full circumference compression clamps is used for radiators. Includes all stainless steel hardware. Recessed SO-239 prevents moisture damage. Hy-gain verticals go up easily with just hand tools and their cost is surprisingly low. Two year limited warranty.

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

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

AV-14AVQ, $169.95. (10,15,20,40 Meters). 18 ft., 9 lbs. **The** Hy-Gain AV-14AVQ uses the same trap design as the famous Hy-Gain Thunderbird beams. Three separate air dielectric Hy-Q traps with oversize coils give superb stability and 1/4 wave resonance on all bands. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

AV-12AVQ, $124.95. (10, 15, 20 Meters). 13 ft., 9 lbs. **AV-12AVQ** also uses Thunderbird beam design air dielectric traps for extremely Hy-Q performance. This is the way to go for inexpensive tri-band performance in limited space. Roof mount with AV-14RMQ kit, $89.95.

AV-18VS, $99.95. (10,12,15,17,20,30,40,80 Meters). 18 ft., 4 lbs. **High** quality construction and low cost make the AV-18VS an exceptional value. Easily tuned to any band by adjusting feed point at the base loading coil. Roof mount with Hy-Gain AV-14RMQ kit, $89.95.

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

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

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

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

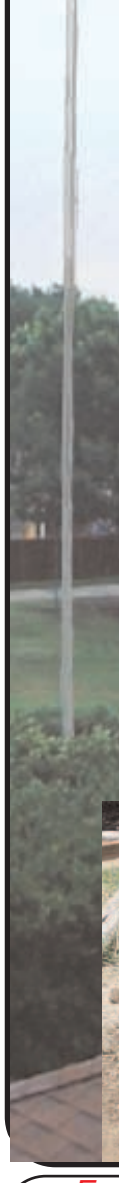
Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
AV-18HT	$949.95	10,15,20,40,80	1500 W PEP	53 feet	114 pounds	75 MPH	------
AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$124.95	10,15,20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$99.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

Hy-Gain 160-6 Meters Self-Supporting Vertical

Full 1500 Watts, 43 feet, includes base mount

New! AV-6160 $399.95 UPS SHIPPABLE

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



Exceptional Performance

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

Just talk with automatic tuner!

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

An optimized balun design allows *direct coax feed* with negligible coax loss (typically less than 1/2 dB 60-6 Meters and less than 1 dB 160-80 Meters with good quality, low-loss coax).

Extremely low wind loading

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

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

Assembles in an hour

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

Stealth Operation

Low profile. Hide behind trees, fences, buildings, bushes. Use as flagpole. Easily telescopes down during the day.

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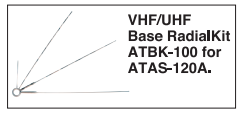

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This Just In

Joel P. Kleinman, N1BKE
jkleinman@arrl.org

In Brief

- South Africa's SumbandilaSat satellite blasted into orbit aboard a *Soyuz* rocket from the Baikonur Cosmodrome in Kazakhstan September 17.
- ARRL and the Tucson Amateur Packet Radio Group (TAPR) jointly hosted the 28th Annual Digital Communications Conference (DCC) September 25-27 in Chicago.
- On September 15, RF Concepts announced that it had purchased Boulder, Colorado-based Alpha Radio Products.
- Nominations remain open until November 1 for the first ARRL George Hart Distinguished Service Award, to be given to an ARRL member whose service to the League's Field Organization is of the most exemplary nature.
- On September 10, three more Congressmen — Geoff Davis (R-KY-4), Bill Posey (R-FL-15) and Michael Turner (R-OH-3) — pledged their support for HR 2160, The Amateur Radio Emergency Communications Enhancement Act of 2009.
- In response to a letter from ARRL President Joel Harrison, W5ZN, National Safety Council President Janet Froetscher confirmed that the NSC does not support bans or prohibitions on the use of Amateur Radios while driving.
- On September 10, the FCC released a new *Public Notice* implementing changes in CEPT reciprocal operating arrangements for US citizens who hold an FCC-issued General, Advanced or Amateur Extra class license.
- ARRL Chief Executive Officer David Sumner, K1ZZ, and Membership and Volunteer Programs Manager Dave Patton, NN1N, attended Ham Fair in Tokyo, Japan, August 22-23.
- Officials from the IARU, national IARU-member-societies and specialized Amateur Radio emergency communications groups from around the globe gathered in Tokyo August 24-25 for the Fifth Global Amateur Radio Emergency Communications Conference (GAREC 2009).
- GLA Systems — the manufacturer of the Texas Bug Catcher antennas — announced that they will cease taking orders for new antennas as of October 1. Current orders will be filled, according to the company.
- The ARRL celebrated the 140th anniversary of the birth of ARRL cofounder and first President Hiram Percy Maxim, W1AW, with a special /140 event in early September.
- In a case that goes back more than 10 years, the FCC has told a Pennsylvania utility that the utility is responsible for paying for "efforts to locate and correct instances of [power line] noise."
- Shuttle mission STS-128 launched August 28 with three ham-astronauts aboard. The successful mission landed September 11.
- All 2009 Field Day logs received have been posted to the Claimed Scores page on the ARRL Web site. Complete results will appear in December *QST*.
- The winner of the *QST* Cover Plaque Award for August is Allen Baker, KG4JJH, for his article "A 10 Meter Moxon Beam."
- Registration remains open through October 25 for these online course sessions beginning November 6: 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

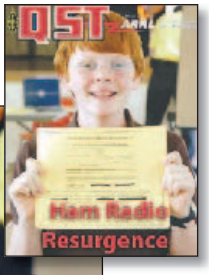
- The death of Walter Cronkite, KB2GSD, brought little mention of his involvement with Amateur Radio in most media, but within radio industry circles it was well noted that he was one of us, a ham, such as reported in *Radio World* (Alexandria, VA).
- Amateurs' skills were reported in the *St John Source* (USVI) when emergency communications for the island's Rescue group experienced mysterious interference. The St John Amateur Radio Club was called in and found the source, on a completely different island, to the relief of emergency personnel.
- The *Chicago Tribune* and other papers carried the story of the Grosse Point Lighthouse on August 15 as the Metro Amateur Radio Club took part in the International Lighthouse and Lightship Weekend. The Metro club also got nice hits in the *Evanston Review* (IN) a week later.
- The *Philadelphia Inquirer* and the *Los Angeles Times* both carried a great article by Bob Pool, "California teacher inspires a new generation." It tells of 75 new teenage hams in four years due to the efforts of science teacher Karl Beutel, KE6MAO.
- The July-August issue of *The Iowan* magazine, a beautifully crafted publication, carried a lengthy article about amateurs and SKYWARN titled "Riding the Waves" by Terri Queck-Matzie and photographer Paul Gates.
- The Amateur Radio community's creativity and technology were not lost on the media. *Make Magazine* had an excellent article by Diana Eng, KC2UHB, about "Catching satellites on ham radio" and she quickly doubled her hit score with a second article "SuitSat: Hacking for Outer Space." *QST*'s own Joel Hallas, W1ZR, reached another audience with his article "Equip your boat for amateur radio" in the US Power Squadrons' magazine, *Compass*. Meanwhile sparks from a Tesla coil and (non-sparking, I hope) Amateur Radio gear caught the attention of Baraboo, WI's *News Republic* reporter Christie Taylor at a joint techno-savvy event between Midwest hams, inventors and Tesla fans.
- Russell Smith, W3WWW, of Arc Aspicio's *Homeland Security News and Trends* newsletter wrote a good piece, "Amateur Radio and Disaster Response" for their August 25 issue, which was seen by many people involved in DHS activities. In a similar vein, J. W. Gadus, KD5KTX, interviewed very well for the radio program "Homeland Security — Inside and Out" produced through Texas A&M University.
- The battle of Jutland seemed to be resuming on September 10 when the Battleship *North Carolina*'s NI4BK station achieved a nice media hit in the Wilmington *Star News*. Firing right back within minutes with a media hit of their own, the Battleship *New Jersey*'s "Radio 2" scored in the *Philadelphia Inquirer*. The *North Carolina* operation featured Bruce and Linda Kopec, KE4EQA and KE4EQB. The *New Jersey* featured Bob Westcott, W2MAS.
- Finally, the Voice of America Bureau Chief Steve Herman, W7VOA, wrote from Kabul, Afghanistan, about what he does there to relax. Work the pile-ups! Steve is also T6AD and, together with James McLaughlin, T6AF, both Americans in Kabul may be the only active hams in Afghanistan at this time. His blog pages at **www.voanews.com** are most interesting.

BRYCE SALMI, KB1LQC

RIT ARC promotes AR: **At the 2009 Fall Club Fair at the Rochester Institute of Technology, members of the school's ARC, K2GXT, showed students and administrators everything the club has to offer. At the K2GXT table were Brent Salmi, KB1LQD; Steven Giannotti, KC2URD; Jacob Bohrer, KC2UBV, and Emily Burns, KB3PXX. At right: The RIT Mascot "Ritchie the Tiger" seemed interested, as did first year student Robert Hoops, W3EGL.**
— KB1LQC

BRYCE SALMI, KB1LQC

TOM COLLINS, W8TAC



RAY SMITH. KI6VED

Cover boy: **In late August, the Ojai Valley (CA) ARC held its first examination session for residents of the Ojai Valley. Nineteen applicants took the Technician class exam, and all but two passed. The youngest to succeed was 11 year old Randy Mitchell, KJ6BXV, of Ojai, the subject of a *QST* cover designed by my friend W8TAC.**
— Ray Smith, KI6VED

Inside HQ

New, Improved *ARRL Letter*

The ARRL Letter has the largest monthly circulation of all the ARRL newsletters, about 80,000 a week. By the time you reading this, it will have debuted in its new HTML — Web browser format. This is the *Letter*'s 28th year of publication and its third major format change. *The ARRL Letter* began as a paper publication in 1981 that was sent via regular mail. It became a weekly e-mail publication in 1997. The HTML version that we just launched is its third incarnation. It is provided at no additional charge, to any ARRL member who opts to receive it. To sign up for the *Letter*, visit **www.arrl.org/arrlletter**. Each message contains both an HTML and a plain-text version of the *Letter*. The recipient's mail program can choose which version to display. There are simple instructions on *The ARRL Letter* Web page at **www.arrl.org/arrlletter** that describe how to view the plain-text version in some of the more common mail programs. In addition, we will still post a copy of the *Letter* on the ARRL Web site.

The new format is similar to the *ARES E-Letter*, and *The ARRL Contest Update*. It allows us to add pictures, graphics, multi-media clips and active links. These enhancements could not be added with the text-based version. We have also implemented the most requested feature by our readers that lets readers click on a link at the top of the letter and immediately jump to the story within the body of the letter.

Yes, *The ARRL Letter* will now carry advertising and ARRL promotional announcements. The ads help pay the costs of the *Letter*'s production and mailing. Many readers find the ads interesting and informative, particularly since the links are connected to the advertiser's Web site. With this interactive feature, there will be no longer be the need to type a separate URL into a Web browser to take a closer look at products that you are interested in.

The transition from the text version to the HTML version has been challenging for us. The new *Letter*, obviously, reads and looks different from the previous version. News Editor Khrystyne Keane, K1SFA; *QST* Managing Editor Joel Kleinman, N1BKE, and Publications Manager Steve Ford, WB8IMY, all worked hard to create the new presentation of the editorial material. The new version contains fewer words, but it is richer in images and it links to more in-depth information about the topics discussed. Our IT Department, under the direction of Jon Bloom, KE3Z, needed to increase our IT capacity, particularly our servers, to provide the additional horsepower required to mail out almost 80,000 HTML e-mails a week.

We think you will enjoy this new format, and we welcome your comments. Tell us what you like and what you don't like, by sending an e-mail to News Editor Khrystyne Keane at **k1sfa@arrl.org**, with "ARRL Letter Feedback" in the subject line.

This is just one of the actions that we are taking here Inside HQ to provide our members with content on new media publishing platforms. Look for ARRL publications on iTunes and Kindle platforms in the months to come.

73,

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

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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.

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

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From QST Magazine, March, 2005

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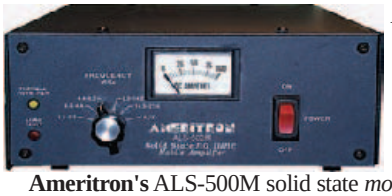

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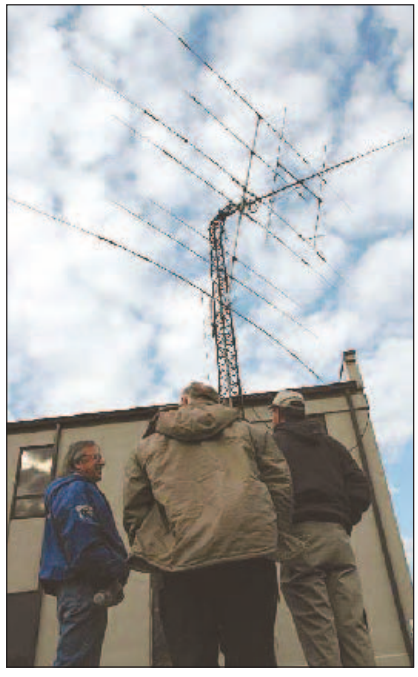
B. W. BLANTON, KJ4EDR



A bend is mended in Lexington: **From the left — Bill DeVore, N4DIT; Bill Fuqua, WA4LAV, and Brad James, WA4HBM, discuss the damage wrought by the high winds that hit the Lexington, Kentucky area.**

The members of the Bluegrass ARS had known for some time that the club tower at the back of the Red Cross Building was in trouble, but Mother Nature took full advantage of our situation sending us 50-70 mi/h wind gusts during a storm last winter. The antennas were not damaged, but the top 8 foot section of the tower was. The parts involved probably weighed more than 300 pounds and the twisted mass was hanging over the Red Cross building and swinging precariously in the wind. We felt it must be removed quickly before another storm hit us.

We had a great crew of hardy hams who braved the cold, overcast day with a wind chill ranging from 3° to12° and the parking lot surface a glare of ice. By the time we got started at about 9 AM the sun had come out, the ice was mostly gone and the wind had died down to occasional gusts.

Rocky Sebastian and Shawn Broaddus from Sebastian Sign and Crane, Inc and Tommy Wilhite from Antennas Unlimited removed the damaged top section of the tower with all six antennas intact and lowered the whole thing down onto the parking lot. Once the mass of twisted metal plus six antennas were on the parking lot surface, 11 hams from the club removed the damaged tower section from the mast and inserted a new top section with rotator and bearing plate already mounted in it. Then Rocky raised the entire thing back up to the top of the tower and Shawn bolted it in place. Not one element or phasing element on any of the antennas was harmed. This was one heck of a job.

Many thanks to Darryl Bennett, KD4CSW; Greg Cross, WA8FJK; Johnie Watson, NA4J; Pete Clough, WD4GPO; B. W. Blanton, KJ4EDR; Bill Fuqua, WA4LAV; Harold O'Donnell, K4HOD; John Barnes, KS4GL, and Barry Warfield, WA4UIV, and of course Rocky, Shawn and Tommy, for braving the wind to accomplish this task. Special thanks go to Johnie for the tower section, rotator and his expertise; Pete and B. W. for their photographs; Bill Fuqua for his tools and John Barnes for the ropes.

It was very cold out there, but we had fun doing it. That's what Amateur Radio is all about — developing friendships and sharing with others.

MIKE LICHTMAN, KF6KXG

Low-key Marconi plaque: **Mike Lichtman, KF6KXG, of Glendale, California found this memorial to Guglielmo Marconi at St George's Church, Portofino, Italy: "As we walked past the side wall of a little church, we looked up and saw this memorial to Marconi," he writes. Turns out that on March 26, 1930, Marconi transmitted a radio signal from a boat in Portofino Bay that lit up the Universal Exhibition in Sydney, Australia.**

BRIDGET HUGHES, KB3NTV

Towering sunset: **This picture was taken September 4 in Mohnton, Pennsylvania. That's NT3O and NT3Y up in NT3O's tower to fix a rotator. —** ***Laura Hughes, NT3Y***

WILLIAM H. DAVIS, N8PTJ, AND PHYLLIS DAVIS, W8LYB

Balloons over clubhouse: **Findlay, Ohio holds its annual balloon fest in August, and we were repairing the garage roof of our clubhouse (Findlay Radio Club, W8FT) when they came over. We were there with our cameras at the right time. —** ***N8PTJ***

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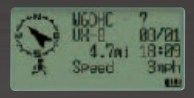

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CORRESPONDENCE

A BRAIN FOR RADIO

♦ I read that the National Safety Council feels that ham radio is not a dangerous distraction to drivers, unlike cell phones. In my more than 40 years as a ham — most of them with a radio in the car, and in my 25 years as a police dispatcher — I noticed a few things that support this. I noticed that my "attitude" when talking on the radio is considerably different than when I'm on the phone. A phone call is primary; it takes over from other tasks. The phone is usually in my hand, even if it's in hands-free mode, but that call distracts from whatever I'm doing.

When I'm driving and talking on the radio, driving is primary. I have often had to ask for fills because something happened on the road that took all my attention and nothing was left for the radio. With a phone this would have been a disaster, but with the radio, it was a fill.

At the police desk, I operated a teletype terminal, and I also had another teletype on 2 meters at home. One day I sat down at work to exchange what was actually official communications with another ham at another post around a hundred miles away. Since it was "ham to ham," I suddenly realized my posture and attitude was the same as what I used at home — quite different from work. Radio and phones seem to access completely different areas of the brain.

JOHN DAVIS, WA8YXM, ARRL Life Member
Davison, Michigan

"PLAUSIBLE DENIABILITY"?

♦ ARRL CEO David Sumner's, K1ZZ, editorial really struck a nerve ["It Seems to Us," Aug 2009, page 9]. I applaud the ARRL's efforts to keep the FCC honest and protect not only our hobby's, but our country's interests as well, essentially doing the FCC's job during their lapse in integrity. For years, I couldn't understand the FCC's refusal to acknowledge the obvious problems inherent in BPL, but I never thought it was simply the result of lying and withholding information developed by their own technical staff. Reflecting on the considerable amount of both public and private sector funds that have been expended fighting this battle, can former FCC Chairmen Powell and Martin hide behind a veil of plausible deniability based on their limited grasp of the technology, or was their conduct criminal? Should we simply hope President Obama honors his commitment to restore scientific integrity to the White House, or do we demand that government officials be held accountable? Abuse of power in our government has to be discouraged.

MIKE GRUSZKA, N2NW, ARRL Life Member
Owego, New York

40 METER FUN

♦ It occurred to me how fortunate we hams are with the coincidence of the low sunspot activity and lack of DX propagation on the higher bands, and the movement of short-wave broadcasters from 7.1-7.2 MHz. I recall when I was a Novice running 40 W with broadcast stations every 8 kHz across the 40 meter Novice band. I'm sure it made better operators out of those of us that survived "boot camp," but what a pleasure to hear DX on 7.142 with no heterodyne — in-the-clear operation 24/7 on the new phone band! Please thank those who worked tirelessly through the years for this accomplishment. I never thought 40 meters would be such great fun!

ED KARL, KØKL
Warrenton, Missouri

INTENTIONAL INTERFERENCE A PROBLEM

♦ Kudos and thanks to the ARRL for organizing September's Special Event honoring the 140th anniversary of the birth of Hiram Percy Maxim. As an ARRL Volunteer Examiner signing W9QL/140, I had a lot of fun working many pileups. I made more than 400 SSB contacts, about half with fellow /140 participants; I only missed a /140 WAS by two states.

Unfortunately, near the end of the event, I was the victim of severe intentional interference. The interference consisted of a S9+ "tuning" carrier interspaced by the alphabet being sent repeatedly in CW. Both were sent on top of my signal in the 40 meter phone band, as I called CQ. I doubt that there are many of us who have not experienced intentional interference at some time in their amateur career. In my opinion, the problem seems to be getting worse. A clear solution is a challenge, because the majority of us play by the rules and the perpetrators may not even be licensed hams.

I encourage those in the Official Observer program to step up reporting of all intentional interference incidents through the proper channels. I also hope that the League will continue to work closely with FCC Special Counsel Laura Smith to ensure that her group has the resources and funding they need to aggressively pursue and punish those responsible.

DAVID PRITCHARD, W9QL
Gurnee, Illinois

IS THERE ANYONE OUT THERE?

♦ I recently had to travel 3 hours to a funeral and hoped to pass the time making contacts on my VHF/UHF radio. As soon as I got on Interstate 77, I began calling CQ on 146.520, but got no response. After doing this several times, I decided to call CQ at every mile marker. I did this for the remainder of my trip, but I never made a single contact. I passed several "mobile antenna farms" on my trip, obvious radio amateurs, but still received nothing.

Whenever I am going on a trip outside my repeater's footprint, I always set my radio to 146.520 in the hopes that someone will call CQ or see my call sign on my license plate and attempt to contact me. Are hams just not monitoring 146.520 anymore? I'm not sure, but I, for one, will continue to do so.

I also encourage all amateurs to display their call sign on the rear of their vehicle or get license plates with your call sign on them. My home state of Ohio offers an Amateur Radio license plate for a small fee. By proudly displaying our call signs, we not only promote our hobby, but help identify ourselves to other operators while on the road.

KEVIN TAYLOR, KD8TAY
Loudonville, Ohio

Editor's Note: You can find information for Amateur Radio license plates for each state on the ARRL Web site at **www.arrl.org/FandES/field/regulations/local/plates.html**.

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

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A. Robert Patzlaff, W9JQT

When I first read Dave Benson's article "The Rock-Mite — A Simple Transceiver for 40 or 20 Meters," I decided it was my kind of low power (QRP) rig.[1] It was small, had straightforward circuitry and some nifty features, including a built-in keyer — all for a reasonable price. So for the last 5 years I have had a barrel of fun and made many contacts with my 40 and 20 meter versions of this kit from Dave's Small Wonders Lab.[2]

It really is a unique and clever design. In my opinion, small rigs like this provide the real thrill of QRP operating. Sure, I can crank my commercially built 100 W home station down to 5 W and work anyone I hear and call it a QRP contact. But it's not the same enjoyment as working them from a collection of small parts you put together in some clever housing. I am sure there are many QRP operators who share the same opinion.

Figure 1 — Both versions of completed Rockless transceivers.

Almost Perfect

There was, however, one enhancement that I always wanted to try — to see if this basic CW transceiver could be modified to work with a variable frequency oscillator (VFO). As provided, the Rock-Mite transmits on a single frequency controlled by a crystal (the "rock"). It would be a major improvement, in my opinion, to be able to tune across the band and answer CQ calls beyond the rock bound QRP meeting spot. Well, I dreamed about it long enough, and finally set out on a long trail resulting in this little rig very similar to the Rock-Mite circuit, but one with an added VFO board. Since it has no crystals I call it the *Rockless*.

The Two Packages

This article describes two packaging ideas for my Rockless circuitry. One version completely fits in the popular QRP housing, an Altoids tin. This miniature version incorporates a 9 mm square, single turn potentiometer for VFO frequency control using a varactor variable capacitance diode. The second and slightly larger Rockless package uses a 10 turn potentiometer for enhanced band spread tuning. The 10 turn tuning potentiometer version just won't fit in an Altoids tin sized housing. I found a slightly larger light gauge box for the 10 turn version that measures about 3½ × 5⅜ × 1 inches. See Figure 1.

Both versions incorporate the same circuitry and boards. My complete Rockless transceiver circuitry consists of two printed circuit boards: one for the VFO, referred to as the VFO board — the other for the rest of the transmitter and receiver circuitry, called the main board. This arrangement provides for flexibility in packaging and, more importantly, allows the VFO board to be easily shielded. If you are a QRP enthusiast, or Rock-Mite user, read on — this may be something you want to build.

The VFO

The VFO circuit uses a 2N4401 transistor and is based on a circuit shown as the "Practical 40 Meter VFO" found in an old copy of *W1FB's QRP Notebook*.[3] I modified this circuit for varactor tuning using a 10 kΩ potentiometer. The schematic of either version of the VFO board is shown in Figure 2.

The oscillator inductance (L1) is a shielded miniature 8.2 µH coil. The lower frequency of the tuning range is adjusted by trimmer capacitor C7. The tuning range is set by selection of R3. The oscillator can be set to tune approximately 30, 50, 70 or 100 kHz of the 40 meter band, depending on the value of R3, as shown in the schematic (Figure 2).

So with your lower tuning set to say 7025 kHz you can tune from about 7025 to 7075 kHz when the value of R3 is 22 kΩ. That covers the QRP hot spots on the band and lets you move around over 50 kHz of the band. This seems like a real luxury after being rockbound at a single frequency. There is a give and take between R3 and the setting of the trimmer to get to the lowest frequency you want in your tuning range. Smaller values of R3 will let you tune lower in the band

[1]Notes appear on page 34.

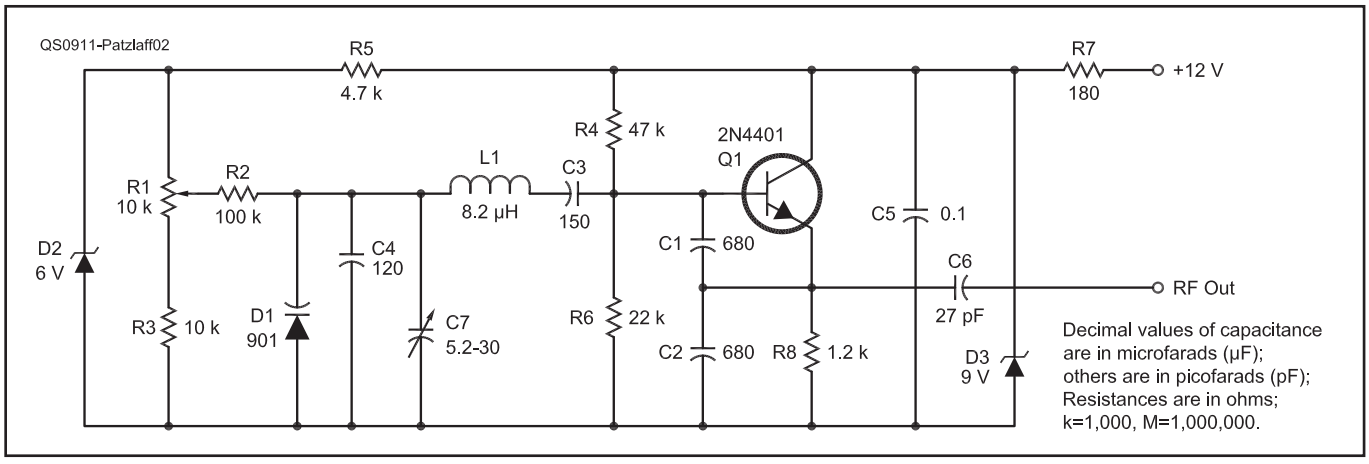
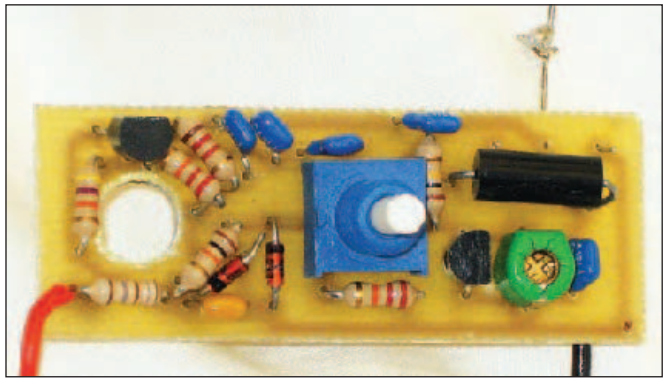


Figure 2 — Schematic of either version of the VFO board. R1 is the tuning potentiometer with parts shown for both the single and 10 turn versions, as described in the text. Only one is required. The value of R3 sets the tuning range. For R3 at 10 kΩ, the range is about 100 kHz, at 15 kΩ about 75 kHz,at 22 kΩ about 50 kHz and at 30 kΩ about 30 kHz. Digi-Key parts are available at www.digikey.com.

C1,C2 — 680 pF ceramic COG capacitor (Digi-Key P4904-ND).
C3 — 150 pF ceramic COG capacitor (Digi-Key 495-1027-1-ND).
C4 — 120 pF ceramic COG capacitor (Digi-Key 495-1483-1-ND).
C5 — 0.1 µF ceramic XTR capacitor (Digi-Key 495-3350-1-ND).
C6 — 27 pF ceramic COG capacitor (Digi-Key P4842-ND).
C7 — 5.2-30 pF variable capacitor trimmer (Digi-Key 490-1960-ND).
D1 — Type 901 varicap diode (Digi-Key MV2090S-ND).
D2 — 6 V Zener diode (Digi-Key 1N5233BDICT-ND).
D3 — 9 V Zener diode (Digi-Key 1N5239BDICT).
L1 — 8.2 µH shielded inductor (Digi-Key DN41822-ND).
Q1 — 2N4401 NPN transistor (Digi-Key 2N4401-ND).
R1 — 10 kΩ, single turn, 9 mm, potentiometer (Digi-Key 3310Y-001-103L), or:
R1 — 10 kΩ, 10 turn, potentiometer, optional, see text (Digi-Key 3590S-2-103l-ND).
R2 — 100 KΩ ¼ W resistor (Digi-Key 100KQBK-ND).
R3 — See text, ¼ W resistor.
R4 — 47 kΩ, ¼ W resistor (Digi-Key 47KQBK-ND).
R5 — 4.7 kΩ, ¼ Ω . W resistor (Digi-Key 10kQBK-ND).
R6 — 22 kΩ, ¼ W resistor (Digi-Key 22KQBK-ND).
R7 — 180 Ω, ¼ W resistor (Digi-Key 180QBK-ND).
R8 — 1.2 kΩ, ¼ W resistor (Digi-Key 1.2KQBK-ND).
Tuning knob — ⅛ inch shaft (Digi-Key 226-4120-ND).

Figure 3 — Photograph of the completely wired oscillator board ready for mounting in an Altoids tin.



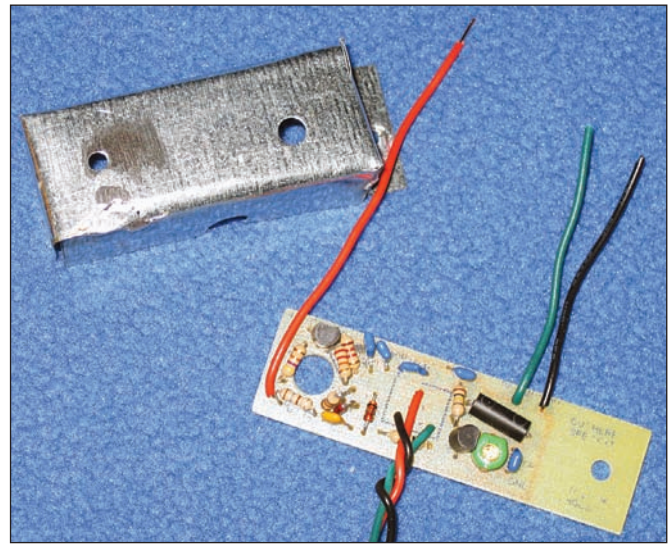


Figure 4 — Oscillator wired and with leads for the 10 turn tuning control and the fabricated oscillator shield of Figure 5.

without the need to change the value of any of the oscillator tuning capacitors. My intent was to keep the tuning in the linear portion of the MV 209 Epicap diode's tuning range.

For Altoid Tin Packaging

I use a value of 22 kΩ for R3 in my miniature Rockless in the Altoids tin to tune about 50 kHz of the 40 meter band. By limiting the overall tuning range, the tuning "feel" is slightly delicate, but reasonable with the single turn 9 mm square potentiometer used in the oscillator for an Altoids tin housing. In this package the VFO Circuit Board measures 19 × 51 mm.

Figure 3 is a photograph of the completely wired oscillator board ready for mounting in an Altoids tin. The VFO circuit board is mounted vertically, within the front ½ inch or so of an Altoids can housing. It mounts using the mounting hardware for the single turn miniature tuning potentiometer mounted on the oscillator board.

The VFO board is further mechanically stabilized by allowing the code speed changing switch to pass though a hole in the VFO circuit board. A piece of scrap Altoid tin metal is soldered over the oscillator board to shield it on the top and stabilize if from "oil can" type movements of the housing lid. I found it a good practice to put a screw in the lid to hold it securely after the entire rig is wired, tested and working.

Oscillator with 10 Turn Tuning Potentiometer

The circuitry of the VFO is the same except wire leads mount in the holes for the 9 mm control and extend to where you want to mount the 10 turn tuning potentiometer in your housing. That's the beauty of the varactor tuning because there is no RF on the leads to the tuning potentiometer.

The oscillator board is extended at one end to provide mounting holes so the board can be secured to the bottom of the housing. In this package the entire VFO board is covered with a fabricated metal shield. It exhibits excellent mechanical stability due to the rigidity of the shield. With R3 set at 10 kΩ you can tune about 100 kHz of the 40 meter band with excellent band spread feeling because of the 10 turn tuning control.

Figure 4 shows an oscillator wired with leads for the 10 turn tuning control and the fabricated oscillator shield.

The caption of Figure 2 lists the parts in the VFO circuit along with Digi-Key part numbers for reference. The shaft of the 9 mm square tuning control is ⅛ inch diameter. The 10 turn potentiometer requires a knob for a ¼ inch shaft.

Preliminary Checkout and Test of the VFO Board

After completing the parts mounting and soldering, visually inspect again, and apply 12 V dc to the oscillator board from your power source or a battery supply. Insert a milliammeter in series so you can immediately see the current draw. If you see a current over 100 mA on your meter, turn off the power supply immediately and carefully look over the circuit board again, checking for solder bridges or wiring mistakes. Normal oscillator current at 12 V should be about 16 mA.

Turn on a communication receiver and listen for the oscillator signal. It may be found below the 40 meter band. In this case carefully adjust C7 on the oscillator circuit board. Do this with the tuning potentiometer in the far counter clockwise rotation (lowest frequency setting). Walk the signal into range by adjusting C7 until you hear it on your receiver at the lowest frequency you want to cover on the 40 meter band.

This adjustment is touchy, so tune carefully and be patient. After setting the lowest frequency, turn the oscillator tuning control clockwise to determine that the frequency changes. You can listen on your communications receiver to find the tuning range. In your listening to the oscillator signal, determine that the signal sounds clean and that it is tuning the approximate range of the 40 meter band that you selected by your choice of R3.

During this initial testing process you will find that the oscillator frequency changes when you bring your hand near it. Don't be concerned at this stage but be aware that the entire oscillator board must be completely shielded after it's installed in your housing. This will be discussed in the section about packaging the circuitry. You should again check the lowest frequency and tuning range after the board is in its final assembled location.

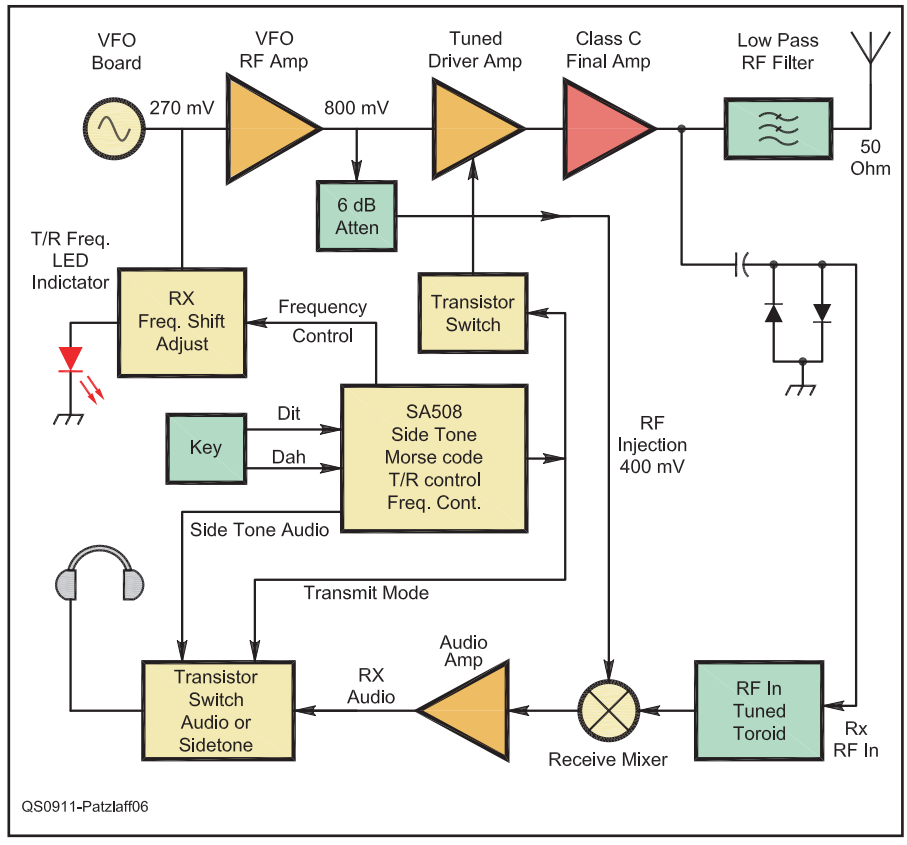


Figure 5 — Block diagram of the Rockless CW QRP transceiver.

The New "Main Board"

To accommodate changes to the Rock-Mite circuitry for VFO operation I made a new layout of the basic transmitter-receiver board that I call the "main board." It is a single sided board, with block diagram and schematic shown on the *QST* Binaries Web site.[4] The design includes the following features:

- All three ICs are 8 pin DIP size that plug into sockets.
- A toroid coil tuning circuit at the front end of the receiver matches the 1500 Ω RF mixer input.
- It fits in an Altoids can with the single turn version VFO board and all the other associated jacks.
- It is a single sided board requiring only two wire jumpers, one for keying, one for RF injection.
- The board uses most of the parts from a Rock-Mite kit.
- All RF transistors are 2N4401.

Circuitry that is different from the Rock-Mite include the following:

- The addition of capacitor C10 between pin 4 of U1 and ground. Early editions of this VFO controlled rig had a real problem with night time shortwave broadcast interference. It was not tunable interference, just an overloading of signals getting into the audio. The addition of C10 removed the majority of this interference. Without C10, night-time reception of CW signals was masked by the interference. C10 took out all but occasional interference from a Florida 6.986 MHz shortwave station — at least here at my location in Illinois. Now, even if it is occasionally heard in the background, 40 meter CW signals can still be copied well.
- Local oscillator output is now taken from a resistive voltage divider at the collector of Q3 to provide a higher level injection signal to the receiver and to reduce frequency shift. The data sheet for U1, the SA512 mixer chip, advises that for separate oscillator injection to this chip the level should be over 200 mV_{PP}. This change provides plenty of RF to the chip.
- The driver coupling to the final uses an LC circuit tuned to about 7.04 MHz and a capacitor divider to feed the final. This adds frequency selectivity to the signal reaching the final.
- Changes in capacitor values of the output pi network filter improved power output and stability in the Rockless.

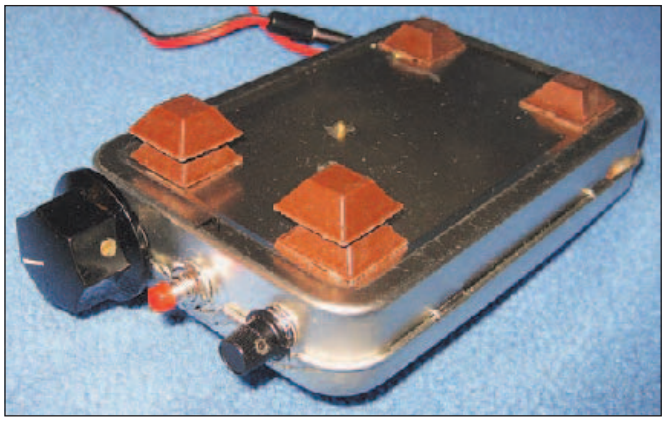


Figure 6 — Rubber stick-on pads are used to elevate the front of the case about 1 inch and the rear about ½ inch.

I strongly urge the use of the VOLUME control discussed in the original Rock-Mite article achieved by replacing R5, a 1 MΩ fixed resistor connected between pins 6 and 7 of U2, with a 1 MΩ potentiometer. The receiver has high sensitivity and plenty of gain with the new input circuit. The VOLUME control is really needed when the band is hot.

Frequency Shift Circuit

The Rockless includes an adjustable trimmer capacitor for setting the frequency offset between transmit and receive. Capacitor C30 is switched in and out of the circuit using diode switching. C30 is adjusted for proper frequency shift between transmit and receive mode. When receiving with the Rockless you should tune to the lower frequency sideband of the incoming signal, then you will transmit on the incoming station's frequency.

When you key the transmitter or operate the frequency shift key, 4.5 V appears on pin 3 of U3. Resistor R19 and LED2 are in series with this voltage and the switching diode. The LED serves as an indicator so you know when you are in the receive position. The switching diode conducts when the LED lights, thereby putting C30 into the circuit.

Rock-Mite Control Operation Review

The push button switch connected to pin 4 of U3 controls the functions of U3. A tap of the switch shifts the frequency. A slightly longer push of the switch results in three dits being heard in the earphones, indicating you have switched to CW keying speed mode. In this mode hold the paddle to the DIT side and keying speed increases and holding it to the DAH side reduces speed. No activation of the keying paddle for about 2 or 3 seconds resets to operating mode. Note that in the Rockless you should tap the switch right after applying power so that the LED glows. This indicates you are on the receive frequency.

Those who have used the Rock-Mite are familiar with this switch control. Note, too, that frequency shifting also actuates while keying the transmitter. This capability is programmed into the Rock-Mite 508 microprocessor as purchased from Small Wonder Labs. The procedure for setting the Rockless frequency shift capacitor (C30) is discussed later in this article.

Circuit Assembly

First, some helpful reminders:

- Use a small wattage iron (25 to 30 W) with a clean, sharp and well tinned tip.
- Have a damp sponge handy so you can wipe the soldering tip clean from time to time.
- Have a good magnifying glass, wire cutting and handling tools and soldering wick at hand. Also have a good light over your work area.

Packaging and wiring is a matter of choice for the builder. You may have most parts in your shack junk box. For convenience I offer my circuit boards if the builder chooses to use them.

Construction Notes for My Boards

Oscillator Board

The VFO board is supplied extended on one end to provide a mounting hole for mounting the board to the bottom of the larger housing. If you are building the package for the Altoid can version, cut the board at the line to shorten it to fit.

Put the oscillator board together first. It is rather straightforward and goes together quickly. Follow the parts location drawing that comes with the board. Use caution since some terminals are close together. Carefully check constantly for solder bridges between unwanted points. Inspect for good solder adherence and no shorts before applying power. Also note and double check the orientation of all the diodes for proper polarity, particularly the tuning varactor diode. Solder short wire leads for power and RF connections to the main board.

Mount the 9 mm square 10 kΩ tuning potentiometer on the oscillator board if you are using an Altoid size or similar housing for the radio. If you choose to build using the 10 turn tuning control, just put some wire leads in the holes long enough to reach the 10 turn tuning control. Use three different color wires, so you can identify where they came from later when you connect to the potentiometer. Check to make sure you have installed the correct value of R3 on the oscillator board for the tuning range you want. I suggest a value of 10 kΩ for R3 if you use the 10 turn potentiometer.

Large Housing Preparation — Multi-Turn Tuning Version

Here are some hints if you package your transceiver as I did. I soldered #4 brass machine nuts to the bottom of the case for mounting the circuit boards. This light metal galvanized steel takes solder nicely. If you build the multi-turn tuning potentiometer version in the larger case, you will also need to solder two #4 brass nuts to the bottom of the case for mounting the two boards. Figure 8 shows a case with the mounting nuts soldered in place.

Use the empty circuit boards as a template to mark the position of mounting holes in the rig housing. Drill ⅛ inch holes. Then put a brass #4 bolt in from the bottom and temporarily fasten the nut to hold it in place while you solder the brass nuts to the bottom of the case. Remove these bolts used to hold the nuts in place after the solder cools. You will use short #4 bolts inserted from the top of the circuit boards to mount the boards onto the bottom of the housing.

Make sure you have some plastic sheet to fit between the boards and the bare metal bottom of the case to insulate the circuit board traces and component connections from the case before you mount the circuit boards. Heavy plastic covers from report folders work nicely for this purpose. You will need to punch holes in the plastic to pass the mounting bolts.

Before installing the boards you will also need to punch or drill all holes in the sides of the case for controls, jacks and a power wire. If you need to cut away the lid of the tin to accommodate mounting hardware, you can smooth sharp edges and then tin with solder to strengthen the cut out. Use a punch if possible, or else drill and then smooth interior burrs with a rotary tool sanding wheel. Use a ¼ inch diameter hole for the power wires and insert a ¼ inch rubber grommet in the hole. After all drilling is completed, and the insulating material is in place, install all items in the housing.

In the 10 turn tuning package, two mounting nuts are used for mounting the VFO board to the bottom of the housing. One goes through the center of the hole provided on the VFO board for passing the pushbutton switch used if using the Altoids tin. A 1 inch bolt passes through the top of the shield and into the mounting nut on the bottom of the housing. This bolt should be covered with an insu-

lated tube. A ¾ inch length of ¼ inch wood dowel rod with a hole drilled through the length provides support and insulation. If you have access to ¼ inch diameter nylon tubing, it can also be used for this purpose. Carefully place the oscillator shield over the VFO board and use a ¼ inch #4 bolt at the outside end, and the 1 inch #4 bolt through the other hole and insulating tube as discussed above.

After all items are installed and mounted in the case use rubber stick on pads to elevate the front of the case about 1 inch and the rear about ½ inch (see Figure 6).

Altoids Size Housing

I made a paper template to tape around the edge of the housing to show hole locations. When the tin is completely prepared with all holes and mounting nuts in place you are ready to install the boards. Wire all connections between the VFO and main boards so you can install the two boards as a unit. Make sure all wire leads from the main board for external connecting jacks are soldered on the main board and long enough to reach their respective jacks. Now insert the two boards as a unit.

A nylon and or rubber washer inserted over the threaded connection on the tuning potentiometer will adjust the spacing of the vertically oriented VFO board from the inside of the case. Fasten the VFO with the hardware supplied with the tuning potentiometer. Now complete all connections to the jacks and switch. A miniature 1 MΩ, 9 mm square VOLUME control similar to the tuning control can be installed on the right side of the case.

Setting Frequency Shift

Connect your 50 Ω antenna for 40 meters, your keyer and you headphones. Turn on the power and tune across the band, listening for signals. Hopefully the band doesn't seem dead. If you don't hear signals, double check with your communications receiver. Remember that the Rockless uses the direct conversion receiver as in the Rock-Mite, so you will hear both side bands. Now peak the RF input trimmer (C2) for maximum signal.

This transceiver requires that you tune to the side band note of incoming signals that is lower in frequency than zero beat. Ideally you will tune about 800 Hz lower. So remember, always tune desired signals to the desired audible note lower in frequency than a zero beat with the incoming signal.

Before setting the frequency shift capacitor (C30) it is very helpful if you have a means to switch your antenna between your QRP Rockless and your communication rig. I have found the MFJ-1703 antenna/transceiver RF safety switch is very helpful for switching my antenna between QRP and high power (QRO) rigs. I set mine up with a 100 W dummy load on the second antenna receptacle. That way when one rig is on the antenna the other is on the dummy load.

First make sure the LED is illuminated. If not tap the CONTROL push button. Then tune to a strong CW signal on your Rockless (again adjust to an audio tone below the frequency of zero beat). Now switch your antenna to your QRO rig set for CW reception and tune it to receive the same station you heard on the QRP Rockless. Switch antenna back to QRP and with key down turn the Rockless TUNING control for maximum S-meter signal on your communication receiver.

Release the key, and switch your antenna back to the Rockless. Without moving the Rockless TUNING, adjust C30 for best receive signal and a pitch of about 800 Hz. Turn the Rockless tuning knob now and make sure you are on the low side of zero beat. With this adjustment you will transmit on the incoming station's frequency when you are tuned below his zero beat.

Now tune around the band for some other signals, locate them on your QRO rig receiver, and check that when you transmit, you hear it as maximum signal on your QRO rig receiver tuned to the same incoming signal. With practice you will get an idea of the incoming signal note that grabs him on your first call!

On The Air Experience

Throughout the design of this project, from breadboard to final package, I have been delighted with the many contacts I have made using a simple doublet, 110 feet of wire with 600 Ω feeder to an antenna transmatch to match my 50 Ω output requirement. The wattmeter on the transmatch reads between ½ and 1 W. Almost all contacts have been made while powered by 8 D batteries, often running well below 12 V. The Rockless operates with supply voltages from 10.5 to 14 V. I like the idea of a battery supply — no hum and always available.

Over 50 QSOs have been logged with the Rockless while in various stages of development over the past eight months. I would like to thank all those I contacted for their contacts, patience, QSL cards and helpful comments. It has been an effort of learning and enjoyment.

Getting the Parts

All new electronic parts will cost approximately $30 to $40. Some hams may have many parts already on hand and can start with them. You can use whatever style of construction you prefer for parts mounting. The parts lists provide ordering information for individual parts from a popular mail order dealer. The programmed Rock-Mite microprocessor chip (U3) may be ordered from Small Wonder Labs. Another source of the memory chip, with stored message features and automatic CQ sending, is the Ham Gadgets Store at **www.hamgadgets.com**.

For those who wish to use my boards, I offer a "get started kit" that includes the two printed circuit boards and other basic items.[5] Building time to build up the circuit boards, package and test is probably about 10 hours.

In Summary

The Rockless is a very basic circuitry QRP rig. If you are looking for narrow receive filters and other advanced technology features, this may not be your choice of a radio. Remember it receives both sidebands — always tune below zero beat.

If you like to build simple circuitry then you will enjoy making this straightforward rig for QRP and get back the thrill of contacts made from a radio put together with your own hands and experience first hand what can be accomplished with low power on 40 meters.

As mentioned earlier in the article, credit for the basic circuitry goes to Dave Benson's Rock-Mite. The change of the addition of the VFO has added greater flexibility to this radio for general CW operating in the 40 meter band. The ability to move around the band obviously provides more opportunities for contacts. Don't worry about the low power — a ½ W transmitter is only 23 dB, or about 4 S-units, below a 100 W station!

Notes

[1]D. Benson, K1SWL, "The Rock-Mite — A Simple Transceiver for 40 or 20 Meters," *QST,* Apr 2003, pp 35-38.

[2]**www.smallwonderlabs.com**.

[3]D. DeMaw, W1FB, *W1FB's QRP Notebook* (1989 edition, p 29, overleaf) Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 3657. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop/**; **pubsales@arrl.org**.

[4]**www.arrl.org/files/qst-binaries**.

[5]The Get Started kit includes the following items: both circuit boards, schematic drawings of both boards and oversized parts placement drawings. Price, $12. Contact the author for more information.

ARRL member Robert Patzlaff, W9JQT, has had the same call sign since 1946. Bob is retired from a career in radio communications. He worked in RF system engineering and communications equipment marketing for Motorola, ITT, Federal Sign and Signal, Airfone, Amtrak and Raytheon. Bob earned a BSEE from Purdue University and is a Registered Professional Engineer. You can reach Bob at 422 West Maple St, Hinsdale, IL 60521 or at **rocklessqrp@comcast.net**. QST

A Universal Frequency Calibrator

This handy test oscillator can be a great addition to your test bench, or become part of a vintage receiver.

Mike Bryce, WB8VGE

When I got my Novice ticket, every ham shack had at least one crystal calibrator. The crystal calibrator was your shack's frequency reference. The popular 100 kHz type generated harmonics that produced a marker at every 100 kHz across all HF bands. When you calibrated your receiver to the calibrator's signal, you knew where you were tuned — within a few kHz!

Then along came the digital age and the need and use of a crystal calibration went the way of the 12AX7. With microprocessor controlled radio equipment and their digital frequency displays, you know within hertz of where your radio is tuned. To that end, there was no need to have a calibrator inside a modern digital transceiver.

What's Old is New Again

Along with many other hams, I've been fixing and restoring older ham equipment. Perhaps just to relive the days of straight keys and FT-243 crystals of bygone years. To that end, I've got a fair collection of older rigs.

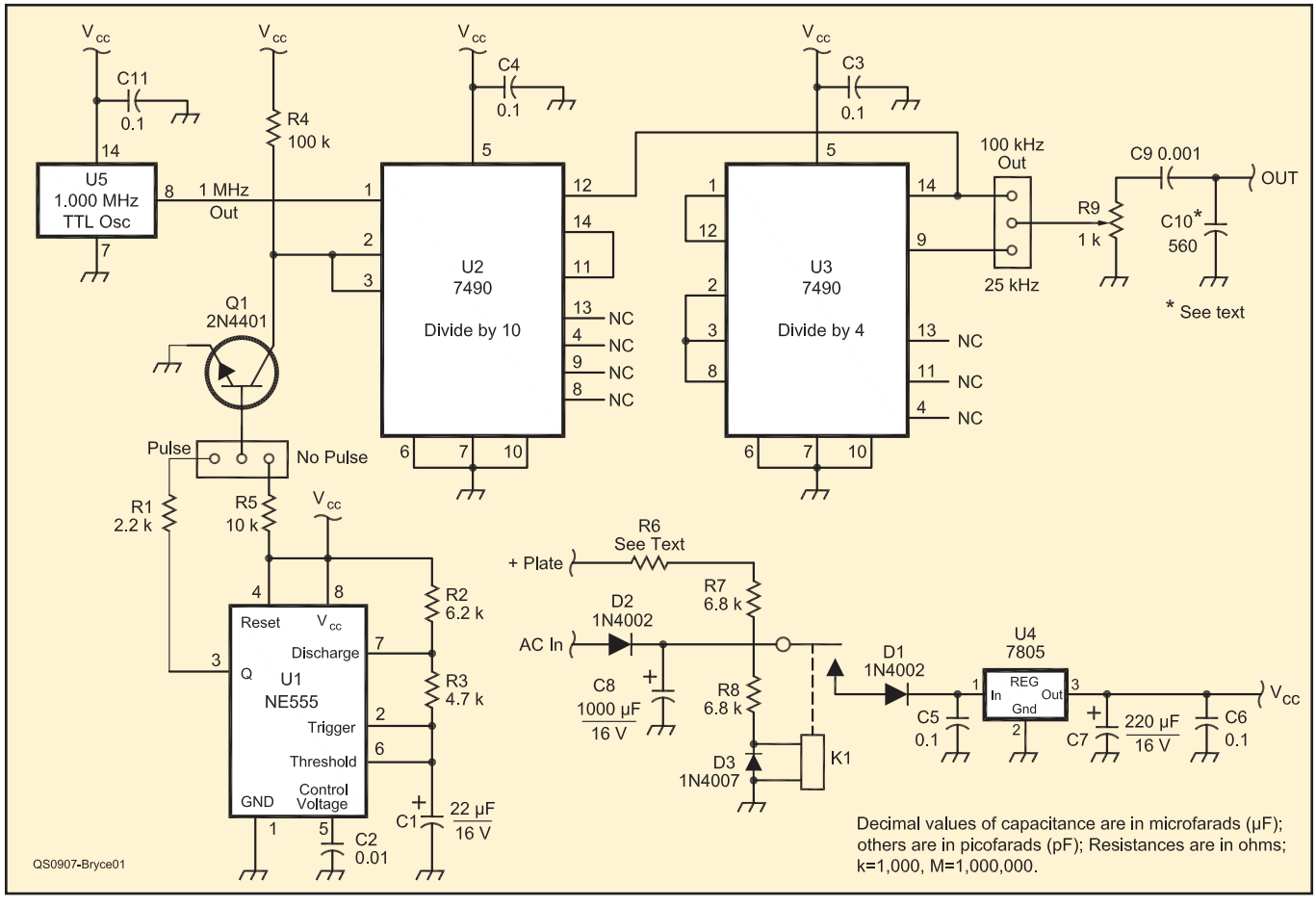


Figure 1 — Schematic diagram and parts list for the universal calibrator. Mouser parts are available at www.mouser.com.

C1 — 22 µF, 16 V electrolytic capacitor.
C2 — 0.01 µF, ceramic capacitor.
C3-C6, C11 — 0.1 µF, ceramic capacitor.
C7 — 220 µF, 16 V electrolytic capacitor.
C8 — 1000 µF, 16 V electrolytic capacitor.
C9 — 0.001 µF, ceramic capacitor.
C10 — 560 pF, ceramic capacitor (if needed; see text).
D1, D2 — 1N4002 diode.
D3 — 1N4007 diode.
K1 — Non latching relay (Mouser part 655-V23105A5003A201).
Q1 — 2N4401 NPN transistor.
R1 — 2.2 kΩ, ¼ W resistor.
R2 — 6.2 kΩ, ¼ W resistor.
R3 — 4.7 kΩ, ¼ W resistor.
R4 — 100 kΩ, ¼ W resistor.
R5 — 10 kΩ, ¼ W resistor.
R6 — See text.
R7, R8 — 6.8 kΩ, 2 W resistor.
R9 — 1 kΩ, potentiometer.
U1 — NE555 timer integrated circuit (Mouser part 511-NE555N).
U2, U3 — Decade counter integrated circuit (Mouser part 526-NTE74LS90).
U4 — 5 V regulator integrated circuit (Mouser part 512-LM7805CT).
U5 — 1.0 MHz TTL oscillator module.

Most of the older tube receivers I have in my collection lack the 100 kHz calibrators. Calibrators were options on most receivers of the time. Throughout the decades, these calibrators were removed from the original receivers and often sold separately. Countless more have made a one-way trip into the infamous junk box, never to see the light of day again. If you can find these optional calibrators at a hamfest or online auction, you'll pay a premium.

What to Do?

Well, if this were 1975, all you would need would be a 100 kHz crystal wrapped around your favorite oscillator circuit. Wire in the calibrator to the receiver or just use a short hunk of hookup wire as an antenna and you're done.

But times have changed. If you can find a 100 kHz crystal, they're quite expensive. I've been quoted over $35 for a single crystal. Another popular method is using a 1 MHz microprocessor crystal and then dividing the output by 10, producing 100 kHz in the process. A 1 MHz crystal is about $15 a copy.

An even cheaper way to produce a 100 kHz signal is to use a 2 or 4 MHz microprocessor crystal and then divide by either two or four. The result would be 1 MHz. This would be divided again by 10 to produce the desired 100 kHz.

The Universal Calibrator

Instead of using microprocessor crystals I decided to go with a TTL clock oscillator running at 1.00 MHz. These oscillators are fully compatible with TTL logic building blocks and come in a sealed and shielded package. Best of all, they're only a buck or so each.

There's no need to set the oscillator's output against another frequency standard such as WWV, either. The oscillator's output frequency has been laser trimmed at the factory so it's about as close to 1.0000 MHz as possible.

The universal calibrator produces a 100 kHz square wave output. The output is derived by dividing the original 1 MHz by 10. You can also select an output signal of 25 kHz. To help find the calibrator signal on a busy band, you can have the output of either marker pulse on and off.

To keep the TTL logic happy, a built-in 5 V regulator is used. The calibrator gets its power from tapping off the 6.3 V ac filament string that powers the tubes. You can just feed it any positive dc voltage up to 18 V dc if you'd rather not tie it to the receiver. The circuit is shown in Figure 1.

Of course no calibrator worth its salt would require modifications to the receiver, so the universal calibrator will work with about any receiver I know of. Including the old Heathkit HR-10 and Drake 2C. It will also work with solid state receivers and transceivers, too. This includes the popular Ten-Tec Century 22, Century 21 and the analog version of the Ten-Tec Argosy.

The universal calibrator is easy to build. If you assemble the circuit correctly it will fire right up. A complete kit of parts including a double-sided PCB is available from the author.[1]

Here's How it Works

The heart of the calibrator is the TTL oscillator running at 1.00 MHz. The output of the oscillator is divided by 10 to produce an output of 100 kHz. An old school 74LS90 IC does the dirty work. You can use this 100 kHz output as is, feeding it directly to the receiver's input via the voltage divider trimmer R9.

[1]Notes appear on page 37.

Capacitor C9 is used to couple the output from the calibrator to the receiver's input. The value shown is but a stab in the dark. Some receivers will require much less coupling even with the trimmer set to minimum. You can add an extra capacitor, C10, to reduce the output even more if need be. Your mileage may vary, so feel free to experiment with the values.

To produce the 25 kHz signal, the output from the first divide-by-10 IC, U2, is fed into a second 74LS90, U3. This time around U3 is configured to divide the input by four, producing the required 25 kHz output. Jumper J1 is used to select either the 100 kHz or 25 kHz output.

To pulse the marker on and off, the popular LM555 timer/oscillator IC is used. The output of the timer, on pin three, is sent to Q1. When the timer's output is high, Q1 is turned on and pulls the reset pins of U2 low, allowing U2 to perform the divide by 10 function. When Q1 is turned off, the reset pins of U2 are allowed to go high, stopping the divide-by function. The output then will pulse on and off in step with U1. If you don't want the pulse output, by selecting resistor R5, you keep Q1 fully saturated and the reset lines are held low. The timer is never turned off, just bypassed.

The Power Supply

Since the TTL oscillator and the divider ICs require 5 V, a 7805 regulator is used. The input for the regulator can be either +12 V dc or you can tap 6.3 V ac from the filament string. If you use the filament string, diode D2 provides half wave rectification of the filament voltage while capacitor C8 filters the resultant dc. If you have access to +5 to +18 V dc, you can bypass the D2/C8 combination and supply power directly to D1. This diode provides simple "oops" protection should you apply

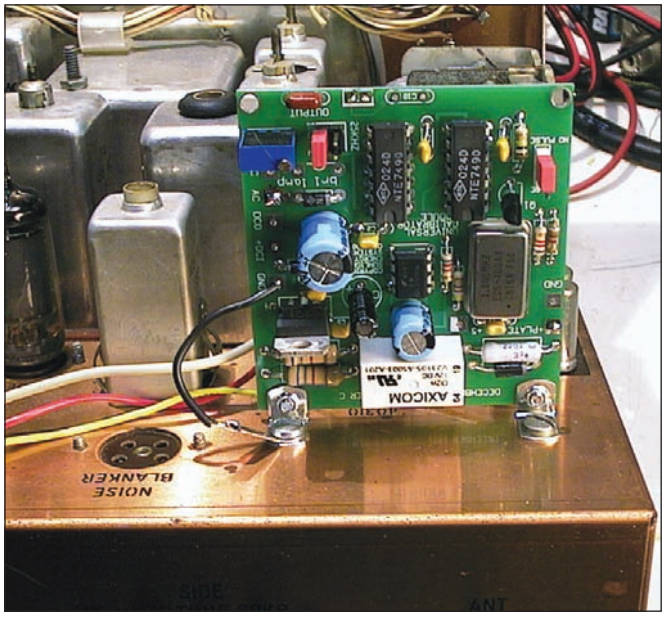


Figure 2 — The finished PCB mounted inside the Drake 2C receiver. The PCB mounts to the chassis via the two screws that hold the audio transformer underneath. The TTL oscillator is the large can in the center of the right side of the PCB.

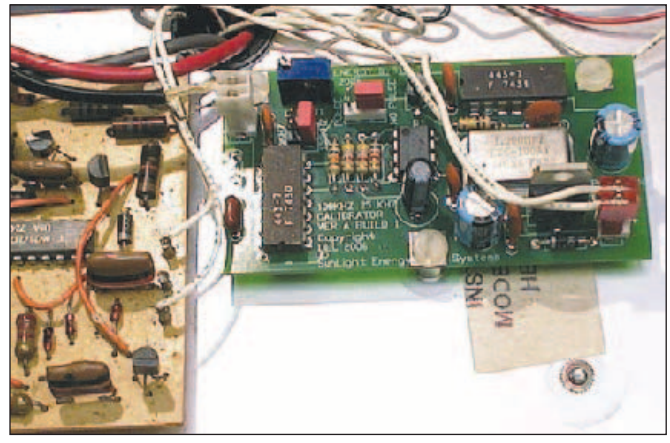


Figure 3 — Here's the solid state version of the calibrator mounted inside the Ten Tec Century 22.

reverse voltage to the circuit.

To make the whole shebang work in the older receivers required some serious head scratching. In receivers such as the Heathkit HR-10 and the Drake 2C, you turn on the calibrator by turning the plate voltage on or off to the tube used in the calibrator.[2] I tried using large dropping resistor to reduce the normally +150 V or so down to the +5 V need by the TTL circuits. The concept worked, but it was not pretty.[3]

The solution is shown in Figure 1. Instead of dropping huge amounts of energy as heat, I use a small signal relay (K1) instead. In a nutshell, resistors R6, R7 and R8 limit the current and thus the voltage drop across the relay's coil. When you turn on the calibrator switch on the front panel of the Heathkit HR-10, relay K1's contacts pull in and complete the circuit. This turns on the calibrator and you're ready to set your dial.

Because the plate voltage varies from one receiver to another, you may need to play with the values of the three resistors. The values shown on the schematic will work with the Heathkit HR-10 and should get you close for many others. If the B+ voltage is greater than 180 V, insert R6 and trim for 12 V across K1, when energized. Diode D3 shunts any voltage generated when the relay coil's magnetic field collapses.

But Wait, There's More!

I had such a good time playing with this circuit, I changed the PCB a bit for use with some of the older solid state radios. In this version, the relay and resistors R6 through R8 are gone. Diode D1 and capacitor C8 are also eliminated. The footprint of the PCB used in the solid state version will drop right into the Century 22 (see Figure 3) and Argosy HF transceivers.

Building Your Version

Since there is nothing critical about the circuit, you can use any construction method you please. I personally don't care to wire up three ICs using perforated board. I would suggest using the popular *dead bug* construction method if you don't want to use the PCB.

Other than making sure you have the correct parts in their correct location, there's not much to go wrong. While I am not much of a supporter of IC sockets anymore, especially those cheap tin plated ones, feel free to use IC sockets for U2 and U3.

Check-out

Once you have all the parts stuffed in the PCB, it's time to test the basic circuit before installing it in the receiver. Select 100 kHz output with the jumper on J1. Select NO PULSE with the jumper at J2.

You'll need a receiver or a transceiver. Turn your radio to an odd 100 kHz harmonic, such as 7.1 MHz. Connect a clip lead to the output pad. Now drape the clip lead over the receiver/transceiver or stick the clip lead directly into the receiver's antenna connection. If you are using your transceiver, make sure you can't accidentally transmit. You'll surely toast the calibrator with a 100 W burst of RF.

Figure 4 — The handy signal source and test generator. I installed a solid state version of the calibrator inside a small plastic box. I wire the jumpers to switches so I could control the calibrator without opening up the box. A green flashing LED keeps me mindful when the power is on. The whole shebang runs on four AA batteries.

Apply +12 V to the +DCIN pad. This bypasses the rectifier and filter parts for right now. Turn the receiver's dial back and forth to find the calibrator's signal. If you don't hear the signal or it's a tad too weak, move the wire around the receiver's chassis. When you verify you have the calibrator's signal, dial up the next marker, 7.2 MHz for example.[4] Once again, you should hear the marker at that frequency. Set the jumper for 25 kHz, and at every 25 kHz you should hear the marker as well. Set the output back to 100 kHz and select PULSE output. The marker you hear in the receiver should now be pulsing on and off. If the circuit passes the test, you can put the calibrator into the receiver of your choice.

Putting the Universal Calibrator to Work

The calibrator can be installed in a number of older tube based receivers. Each one is different, so you may need to do a bit of snooping to find the location of the required voltages. What you need is always right at the calibrators socket on the receiver's chassis. Since many of the original calibrators were sold as options, they plugged into the chassis. Heathkit uses an 8-pin octal plug while Drake chose a 4-pin plug. I found the small 4-pin socket for the Drake hard to come by so I just ran wires through the socket and soldered them to the pins underneath.

You'll need ground, the plate voltage (which is turned on and off by the calibrator's switch mounted on the front panel of the receiver) and filament voltage.

Simply wire the calibrator to a suitable plug and then mount the PCB to the chassis using adhesive backed nylon standoffs. Of course, you could install the calibrator's PCB inside a small box made out of double sided PCB material or even a small utility box. The choice is yours.

The solid-state version is a bit easier. If you're installing the calibrator into another rig, then all you need to do is supply +12 V when you want to turn the calibrator on.

In both versions, you may need to play with the values on the output. The values shown are real close and should work with just about any receiver. Generally, set the level so the S-meter reads a good 10 over S-9 on 3.500 MHz. Don't overload the receiver with too much signal from the calibrator.

I've assembled a few of the calibrators into small project boxes as shown in Figure 4. Powered by four AA batteries, it's a portable signal source. It's just the thing to have on the bench when working on equipment. I extended the jumpers to switches so I can turn off the pulse output and or select either 100 kHz or 25 kHz outputs. I wired in a panel-mounted potentiometer to adjust the output as needed.

This calibrator makes a great signal source to check out either receivers or transceivers. So the next time the bands seem to be really dead, and you're wondering if someone stole your antenna or if a solar flare occurred, break out the calibrator. If you can hear the calibrator, then the receiver must be working.

This is one project you will find more and more applications for. The need to have an accurate signal source is almost as important today as it was in 1975.

Notes

[1]A complete kit of parts is available from the author at 955 Manchester Ave SW, North Lawrence, OH, 44666. The tube version is $35. The solid state version is $30. US shipping for either version is $6.

[2]The mounting holes for the PCB match the holes used to mount the audio transformer on the Drake 2C.

[3]This is more than likely the most popular way of turning the calibrator on and off in vintage receivers. They normally kept the calibrator ready, but turned the plate voltage off when not needed.

[4]The output of the calibrator is a square wave. Square waves are rich in odd harmonic energy. Therefore, the signal levels at even frequencies will be lower.

Mike Bryce, WB8VGE, an ARRL member, has written many QST *articles and is the author of the ARRL book* Emergency Power for Radio Communications. *You can reach him at 955 Manchester Ave SW, N Lawrence, OH 44666 or at* **prosolar@sssnet.com**. *He also maintains a Web site at* **www.theheathkitshop.com**. QST

Electromagnetic Pulse and Its Implications for EmComm

Another look at nuclear EMP and how to maximize the likelihood of equipment survival.

H. Robert Schroeder, N2HX

This article discusses the characteristics of nuclear electromagnetic pulse (EMP) and its potentially harmful effects on electrical equipment.[1] It also describes some of the techniques that have been employed to reduce resulting damage, many of which the reader can perform on his own equipment.

What's EMP All About?

During cold war era atomic weapon tests in the South Pacific, peculiar things were happening back on the Hawaiian Islands. Strings of streetlights were being blown out, fuses were popping and circuit breakers were being tripped right around the time the Starfish nuclear device was detonated in 1962.[2] In 1945, Italian physicist Enrico Fermi had predicted that an EMP would be produced if a sufficient quantity of gamma and X-rays from a hydrogen bomb interacted with the Earth's atmosphere. It was during the Starfish nuclear experiment at the Johnston Atoll that scientists began to make the connection between the electrical disruptions in Hawaii and the timing of the nuclear detonations. Indeed, it was Fermi's predicted EMP that was causing the problem.

Measurements made in Oahu revealed that the Starfish device, detonated at a height of 400 km, induced an EMP with an electric field of 5.6 kV/m some 800 miles from ground zero. The rise time of the pulse was measured at 38 ns — considerably faster than that of a lightning strike.

Nuclear generated EMP is produced by the interaction of a nuclear device's X-ray and gamma particles with the various gas molecules that form our atmosphere. This interaction results from some electrons in the air molecules momentarily being bumped out of their normal orbits. When these displaced electrons return to their orbit they give up the energy that had been imparted to them.

Figure 1 illustrates the resulting electromagnetic field that is produced by the recoil of the electrons. This field propagates through space and induces a current into any metal object in its path.[3] This can include spacecraft, aircraft or any metal conductors on, above or even below the ground. As was discovered during the Starfish test, these EMP collectors can couple the pulse into any nearby electrical circuit resulting in damage to components, particularly semiconductor junctions, or disruption of computer processors. Vacuum tubes, because there are no sensitive internal connections between the electrodes, are much less likely to suffer EMP related damage than solid state devices.

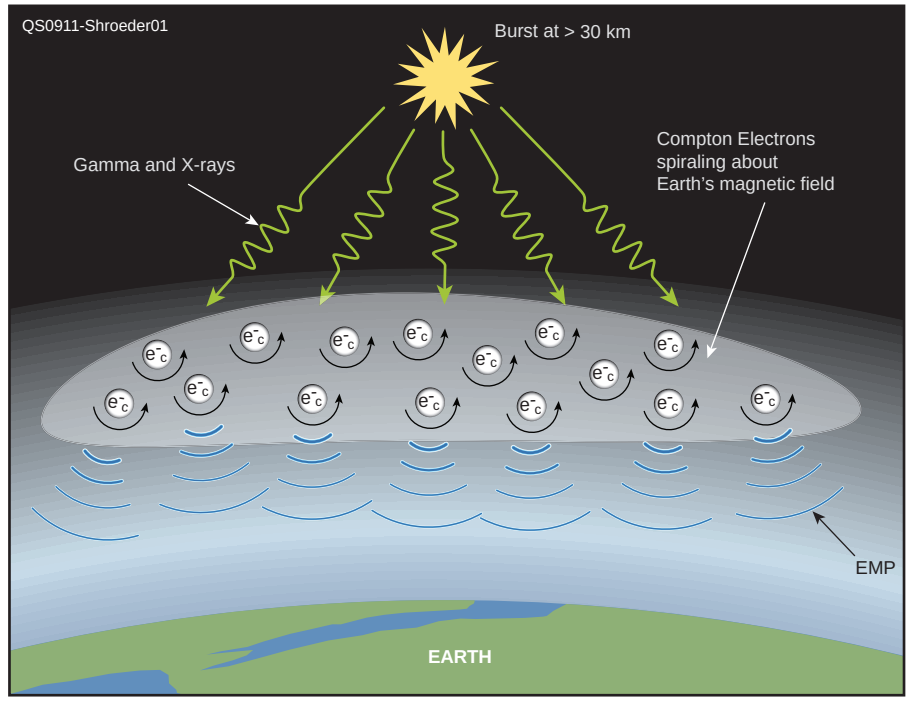


Figure 1 — Diagram of the effects that result in the generation of a nuclear EMP. High bursts can result in EMP covering the continent, with few other effects on the surface.

Figure 2 illustrates that a strategically placed aerial burst could couple high levels of energy into most of the continental United States. The consequences of our nation's power grid and communications networks being disrupted would be a major impediment to an appropriate response. Because we've come to depend on electronics for nearly everything, this threat is still a sobering reality today.

A Close Look at the Threat

Let's take a look at what an EMP looks like. Before we undertake any program of remediation, it's important to understand the characteristics of the pulse itself.[4] As shown in Figure 3, a typical EMP that would be produced by a high altitude nuclear explosion produces both electrical (E) and magnetic (H) fields propagating together as a transient electromagnetic wavefront.

The *threat level* that unshielded electronic components might be exposed to is an

[1]Notes appear on page 41.

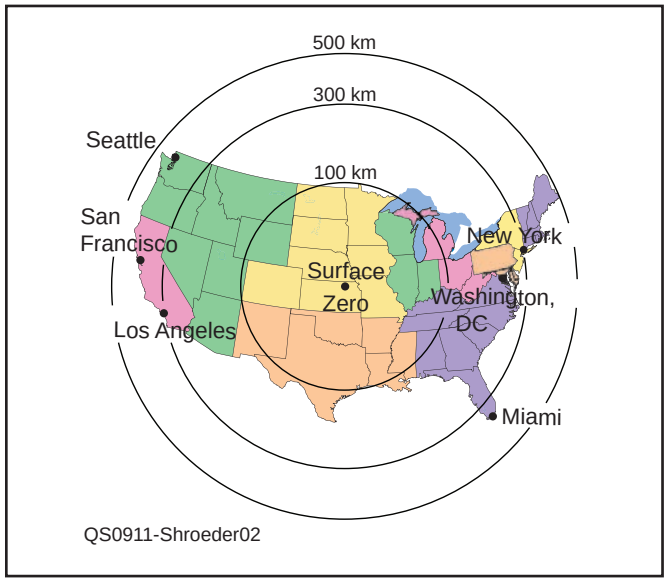


Figure 2 — Region affected by EMP as a function of detonation height.

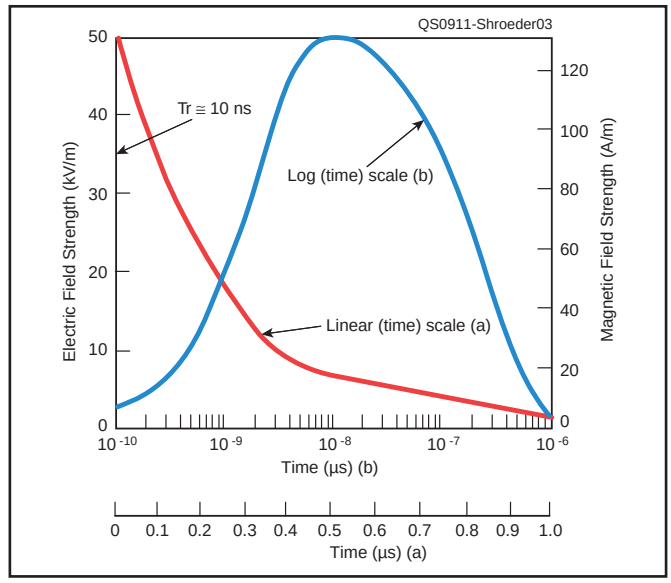


Figure 3 — Time domain electric and magnetic field EMP pulse characteristics.

E field in the order of tens of kilovolts per meter, and H fields in the order of hundreds of amperes per meter. Figure 4 shows the cumulative energy content of the EMP from its creation to its completion. This graph is the result of many contributing factors including the wave's polarities, cancellation due to reflections, and the permeability and permittivity of the air. The total energy density is about 0.9 joules per square meter (J/m^2).

Notice in particular the rise time of the pulse. The reciprocal of time is frequency and calculations based on the timing of the pulse using Fourier analysis indicate that 99 percent of the EMP pulse's energy is concentrated below 100 MHz. Note that this finding has nothing to do with the operating frequency of the radio equipment that gets exposed. It simply means that the EMP pulse's rise time produces energy with components from VLF to the VHF part of the electromagnetic spectrum.

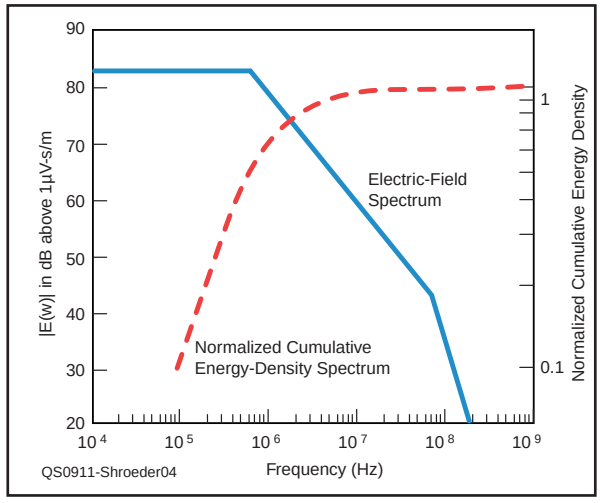


Figure 4 — Frequency domain plot of EMP frequency spectrum.

Given the bandwidth that EMP occupies, we can expect that conductors as short as ¼ wavelength at, say 144 MHz, would make good EMP *collectors*. In real world terms, this would be a piece of wire, antenna, pipe or other metal objects on the order of 19 inches long. Until objects get so long as to have canceling effects, longer conductors will generally pick up more EMP energy than shorter ones.

Figure 5 is a representation of EMP rise time. As you can see, EMP is a much faster event than lightning. When considering what kinds of components an EMP can damage, two things become apparent. First, it should be clear that an EMP can be accumulated on very short conductors. Second, because of the extremely fast nature of the pulse, we have to pay particular attention to lead length when attaching our EMP protection devices. Hams who build equipment that operates at VHF and above are well aware of this issue.

How EMP Gets to Sensitive Equipment

While it is possible for equipment to be damaged by EMP through direct coupling, the usual mechanism is a two stage process. Wires exposed to the EMP threat pick up the EMP pulse signal and carry it into or near the equipment, at which point it is coupled to susceptible devices. This is the so-called *EMP coupling* problem.

Facilities generally can't operate without external connections such as antennas, power and telecommunications lines. In addition some nonelectrical systems such as plumbing runs, winch cables, towers and even building girders can pick up and couple EMP to other areas.

Minimizing EMP Coupling

The first step in EMP remediation is to minimize, to the extent possible, all coupling of EMP signals into susceptible areas. This is generally accomplished through a combination of shielding, filtering and surge suppression. Almost all protected systems include all of those techniques applied at multiple levels, as described below. The subject of grounding and shielding has been treated in *QST* many times and is dealt with in the various ARRL manuals and handbooks.[5] The good news is that if EMP protection is carried out in earnest, lightning protection is generally provided as a bonus. Unfortunately, the converse is not always the case because of the higher frequency components of the EMP waveform.

Shielding

Just as with our usual radio signals, since the frequency spectrum is similar, shielding can be effective in keeping EMP out of areas that have sensitive equipment and wiring. Of course, the shielding is circumvented any time a conductor passes from the outside to the inside of the shield. Penetrations should be held to the minimum. All penetrations should be filtered to restrict the bandwidth to the minimum required for the desired signal. For example, if power system wiring is

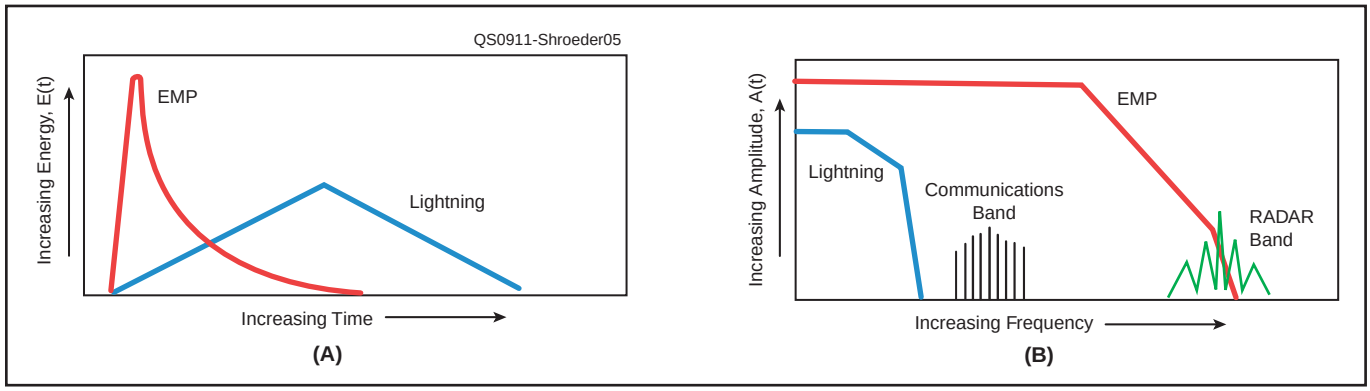


Figure 5 — Comparison of time and frequency domain of EMP compared to lightning.

filtered to only pass 60 Hz energy and telephone wiring 300 to 3000 Hz, an examination of the spectrum indicates that much of the EMP picked up on the outside wires will not make it into the shielded space.

Surge Protection

Even with filtering, there may be enough energy to cause damage. Surge protection refers to the kind of devices used to short our antenna cables to ground in the case of a lightning strike. The difference is that the EMP pulse has a much faster rise time and thus more high frequency components than lightning. This means that the relatively long ground wires we often use in lightning protection will have much too high an impedance for EMP. The result is that high frequency common mode signals pass through. The most effective EMP surge protectors are mounted as a part of penetrations through shielded boundaries with direct connection to the shield at the point of entry.

In addition, the shunting element must respond very quickly to catch the fast rise time signal. There are solid state devices that fire more quickly than gas or air gaps and can absorb high currents.

Protecting Against EMP Damage

As with any shielding, filtering and surge protection, each protective device removes a fraction of the harmful signal. Thus, protection is usually most effective if applied at multiple levels. Additional filtering and surge protection can be applied as each conductor enters a piece of equipment, and even again at sensitive components within the equipment.

Table 1 describes the available types of protective devices along with some of their characteristics. Devices that are always in the circuit such as fuses, metal oxide varistors (MOVs), toroid chokes, ferrite beads and beyond cutoff waveguides provide continuous transient protection. Open spark gaps and gas discharge tubes only react when the transient exceeds the particular arc-over potential for the device. These work on heavy, high current transients, but don't protect against little ones.

Another feature to consider is whether the protection device fails immediately upon sensing the first transient, or whether it can take a series of transients over a long period of time before having to be replaced. Installing a pair of ⅛ A AGX glass fuses in series with the tip and ring of a telephone or audio circuit can help protect the equipment against lightning. However, such a sensitive fuse is likely to blow every time a strong thunderstorm passes through and it won't fuse fast enough to stop EMP. In a home environment, replacing these fuses after each transient would be annoying, but not impossible.

The Nature of Connections

Coupling to signal or control wires generally occurs in what is called *common mode*; that is, the coupling occurs to all conductors in parallel, between all conductors in common and ground, as if they were a single large wire. This type of signal tends to be induced into conductors from external sources such as lightning, EMP, ignition noise and arcing motor brushes. *Differential mode* signals, the usual signals we want on the wires, appear between the conductors in a cable.

Any differential mode noise tends to be produced by electronic equipment itself. SCRs, voltage regulating semiconductors and switching power supplies are examples of such sources. The two types of signals are not mutually exclusive. Thus a cable could have both signals in common and differential mode at different levels.

The termination of the wires in a cable can also result in a conversion of modes. For example, if two wires have a common mode signal induced in them, and one of the wires is grounded at the equipment, the other will end up with a differential signal with respect to ground. A recent *QST* article provides a discussion of RFI, noise and the use of ferrite devices to suppress common mode signals.[6]

No Connections are Even Better

Perhaps the best protection is to not connect anything to sensitive equipment until after the EMP (or lightning, for that matter) threat has passed. By keeping the equipment in a shielded and protected environment, and removing all power and signal cables, the equipment is likely to survive either threat.

Unfortunately, with cables disconnected, most equipment can't be operated effectively. Fortunately, many amateur stations include backup equipment that could be kept in that condition until needed following failure of the primary system. The amateur station that has vacuum tube equipment as backup is even better off, since it is less susceptible to damage than solid state gear.

Deciding What to Protect

The cost of EMP suppression devices and the labor to install them is not an inexpensive venture if you're hardening an entire building such as an emergency operations center (EOC), server farm or some other kind of critical facility. Whatever kind of installa-

Table 1

Properties of Protective Device Types

Device	*Self Resetting*	*Failure Mode*	*Service Life*
Fuse	No	Opens	Unlimited
Gas discharge tube	Yes	N/A	Unlimited
Spark gap	Yes	N/A	Unlimited
Zener diode	Yes	Opens	Unlimited
Metal oxide varistor (MOV)	Yes	Shorts	Limited capacity
Toroid/ferrite	Yes	N/A	Unlimited
Beyond cutoff waveguide	Yes	N/A	Unlimited

tion you want to harden, the same mission critical items always appear on the list. These include primary ac power, telecommunications circuits, emergency generators and their related systems (fuel pump, speed controller, changeover switchgear), environmental control systems such as HVAC, air handlers, hot water heaters, fire and security alarms, fluorescent light ballasts, radios, computers, peripheral equipment, towers, antennas and basically anything else you deem important. Clearly, the list of electrical systems is extensive, and the quantity and variety of suppressors needed to protect them all can become costly.

Fortunately, the typical ham who wants to protect his or her shack and some critical systems around the home won't find the task quite that daunting.

Lastly, a word about MOVs. Although MOVs are great for absorbing transients, they must be sized for the specific application. Another concern is that MOVs wear out after they've reached their absorption capacity. After successfully protecting against a number of spikes, they may short out and leave the connected equipment unusable.

In order to be effective, ground leads should be as short and as straight as possible and have no sharp bends. Antenna, power and signal wires should be as short as possible; however, adding a loop or two close to the equipment forms a choke that will help attenuate some high frequency transients. Lastly, and this is often the hardest for some hams, the shack or EOC communications center wiring should be as neat as possible.

I'm Ready To Survey, Now What?

If your home is a stand-alone dwelling or a townhouse/condo, take a walk around outside and examine where and how the electrical utility enters the structure. Is there a utility-provided ground rod installed near the foundation? The NEC no longer allows cold water pipes to suffice as a system ground because of the increased use of PVC and PEX, which are nonconductive plumbing materials. Additional grounding recommendations can be found by searching the Internet for *Motorola Grounding Standard R56*.[7]

Now examine where your telephone and cable TV cables penetrate the foundation and check for a proper lightning arrestor. The telephone service should go into a plastic fixture called a demarcation box. Most of these contain two doors. On the customer side, the door is fastened with a straight or Phillips screw. On the telco side, the door is secured with a ⅜ inch hex head screw. Behind the telco door is a copper ground strap and one or more pair of onetime surge protectors. There should be a ground wire leading from the strap to some kind of decent ground. Visually inspect all of these components (after you brush away the spider nests) and make sure all ground components are tight and clean. Document your findings on your survey sheet and photograph the ground system, particularly points of connection. By so doing, you'll have something to compare against when you perform your next inspection. Any other subscriber wiring such as cable TV or satellite dish must have a pass-through style lightning arrestor near the wall penetration and contain a properly installed ground wire and rod. Sharing the same ground rod is suitable as long as each conductor is fitted with its own clamp. Never compromise an existing ground wire connection by loosening it to install another utility's ground wire. If you have a tower or any other kind of supporting structure, make sure it's properly grounded. All wiring that goes to the outside world should be protected. The protection devices should be applied as closely as possible to the equipment you want to harden.

If you live in an apartment house, you may not be able to gain access to the places where the utilities enter the building. If this is your situation, you'll likely have to confine your EMP protection measures to just your apartment space.

Move inside your dwelling and take a close look at your power utility circuit breaker panel. Examine the exterior of the panel to see if a gas discharge arrestor has been installed. If you don't see one or you are unsure, call your local construction code enforcement office and ask for an electrical inspection. They're usually done free of charge. Gas discharge arrestors are the bare minimum protection you should have on your breaker panel. Always have work inside the panel performed by a licensed electrician. As a supplement to the gas discharge arrestor, MOVs provide additional surge protection, but their installation requires a professional to insure there is no fire damage upon their eventual failure. For testing the integrity of conventional 120 V receptacles, a useful piece of test equipment is a plug-in wiring polarity tester such as the Ideal 61-035 circuit tester. It costs under $20 and can literally be a lifesaver if you're not sure whether a receptacle is properly wired.

Summary

Protecting Amateur Radio facilities from an EMP threat can be a formidable task, yet it can be accomplished with the appropriate effort. Each organization or amateur operator needs to decide on the likelihood of different scenarios and assign priorities accordingly. If you go to the effort of hardening your station for the EMP threat, you will likely also benefit from enhanced protection against lightning.

Notes

[1]*The Effects of Nuclear Weapons*, 1977, US Departments of Energy and Defense. **www.amazon.com**.

[2]For more information on the Starfish test and related measurements, see **en.wikipedia.org/wiki/Starfish_Prime**.

[3]Data for Figures 1 through 5 was based on *Civil Preparedness Guide 2-17, ElectroMagnetic Pulse Protection Guidance*, February 1991, Federal Emergency Management Agency.

[4]An excellent comprehensive series of detailed articles on all facets of EMP, including testing and device evaluation was presented in *QST* in 1986. While some of the amateur equipment is different, the characteristics of EMP and the remediation techniques described remain unchanged. Those who would like to look deeper are encouraged to see: D. Bodson, W4PWF, "Electromagnetic Pulse and the Radio Amateur"; Part 1, *QST*, Aug 1986, pp 15-20; Part 2, *QST*, Sep 1986, pp 22-26; Part 3, *QST*, Oct 1986, pp 38-41; Part 4, *QST*, Nov 1986, pp 30-34. All are available for member download on the *QST* Archives Web site at **www.arrl.org/members-only/qqnsearch.html**.

[5]See, for example, E. Sutton, KD7PEI, "Obtaining Good Ground," *QST*, Aug 2008, pp 37-40.

[6]J. Hallas, W1ZR, "A Quick Look at Radio Frequency Interference," *QST*, May 2009, pp 61-62.

[7]Search under BUSINESS SOLUTIONS at **www.motorola.com**.

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From 1979 to 1982, Bob worked as a broadcast engineer for New Jersey Public Television at which time he joined Chapter 18 of the Society of Broadcast Engineers. He is also a member of the IEEE Princeton Section and serves as acting chairman of the IEEE Educational Society.

Bob is currently the Communications and Warning Officer for the New Jersey Office of Emergency Management. As an adjunct instructor at FEMA's Emergency Management Institute, he taught the EMP Protection and Maintenance course and built the first EMP learning laboratory at EMI. Bob has founded his own company called Adroit Consulting, which deals with all aspects of science and technology as well as EOC facility design. He is a past president of the Delaware Valley Radio Association, Inc and currently serves as its repeater director.

You can contact Bob at PO Box 7361, Ewing, NJ 08628 and at **rschroeder@ieee.org**. QST

Improving a 30 Year Old, 2 Meter, Four Element Beam

A. J. "Buzz" Hopkins, WB3FXW

This project started as an effort to resurrect and improve a more than 30 year old, four element, 2 meter beam. It rapidly grew into a learning exercise in the use of modeling capabilities available for use on the modern personal computer. This antenna uses a gamma match that consists of an element parallel to the antenna's radiator (driven element) and connected to the radiator by a tuning strap. The gamma element is actually a sleeve (tube) containing a metal rod insulated from the tube. This setup creates a variable capacitor that makes tuning a gamma match more straightforward (see Figure 1).

The Raw Materials

The original gamma match consisted of a tube with a piece of RG-8 coax, stripped of its outer jacket and shield, inside the match tube. While the original antenna functioned properly, it did not have the performance that should have been available from a four element beam. The original Yagi specifications called for a gain of 11.15 dBi with a front-to-back ratio of 18 dB.[1] The SWR readings of this antenna ranged from 1.5:1 at 144 MHz to 1.0:1 at 146 MHz and back to 1.5 to 1 at 148 MHz. Not too bad for an antenna over 30 years old. My research into Yagi antennas led me to believe that the antenna was not living up to its specifications or its potential.

The Tools

I first purchased *The ARRL Antenna Book*, a marvel of information about antennas.[2] More importantly, it came with a CD full of what turned out to be very useful programs. After becoming familiar with two particular programs, I embarked on my antenna improvement project. The first program, *GAMMA* is an *MS-DOS* based program that calculates the length of the gamma match and the value of the necessary capacitor for the match. The second, *YW*, is a modeling program for Yagi type antennas.

YW, Yagi for *Windows*, was the main program used. *GAMMA* was used as a sanity check. To use *YW* one merely has to input the antenna characteristics or dimensions. Since I had an existing antenna I had only to measure the physical dimensions of every component — element lengths and spacing and boom size and cross section. This data was entered into the appropriate section in the program (see Figure 2).

Making it Happen — Getting the Answers

The dimensions *YW* uses to describe an antenna (Figure 2) are shown as one half of the total length for the elements. The spacing is cumulative along the boom with the reflector always starting at 0.0 inches. An element's diameter is shown on the row above the element. When the next element is the same diameter as the previous one the diameter is not shown.

Next, the operating frequency range was entered (Figure 3). I used 144 MHz to 148 MHz as I desired to have the antenna perform well on 2 meter SSB (horizontally mounted) as well as on FM simplex and through repeaters (vertically mounted). After I entered the antenna's physical characteristics, *YW* provided gamma match dimensions (see Figure 4). The result was significantly different than the gamma match originally provided with the antenna — it was over 2 inches shorter from the antenna feed point to the base of the tuning strap.

Making it Happen — Into the Shop

The next step was to build the calculated gamma match — what to use? The answer was found in the plumbing section of the local home center. A ⅜ inch copper toilet supply pipe, chrome plated no less, was found

Figure 1 — A picture of the gamma match installed on the four element beam showing the feed point, capacitor construction and the tuning strap connected to the driven element (radiator).

[1]Notes appear on page 44.

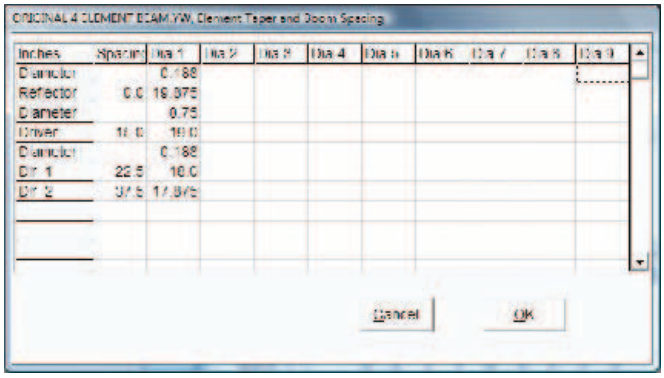


Figure 2 — Dimensions for the beam antenna being analyzed are entered into this table accessed by the ELEMENTS button on the *YW* control panel.

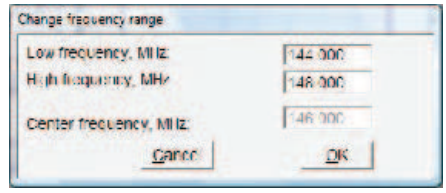


Figure 3 — Frequency selection by using the FREQ button on the *YW* control panel.

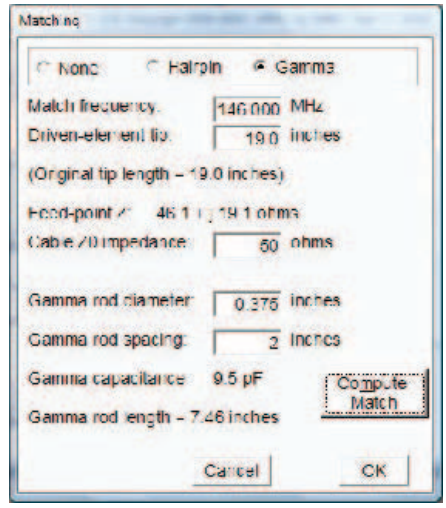


Figure 4 — Calculation of the gamma match accessed by the MATCH button on the *YW* control panel.

for the outer side of the gamma capacitor and a toilet ball rod (⅛ inch in diameter) fit the need for the inner conductor. I made a gamma match using the dimensions given by *YW*. The program gave no indication about how to construct the capacitor part of the gamma match so some trial and error was needed. Electrical tape was used as an insulator. My antenna analyzer helped measure the capacitance during each iteration but that proved to be unnecessary as I became more familiar with the tuning aspects of a gamma match. Several iterations got me close and gave me a reasonable SWR curve across the 2 meter band. The resulting SWR, gain and front-to-back ratio calculated by *YW* for this antenna were not within the parameters that my research told me could be attained with a four element beam.

I was not happy with the results I obtained for the gamma match but I ordered the material I needed to complete the match in aluminum rather than use the plumbing supplies I started with. The tube is ⅜ inch aluminum tube, the inner rod is 3⁄16 inch aluminum rod and the insulator started out to be a plastic drinking straw from the kitchen. The straw was replaced quickly with electrical tape as the straw proved not to be able to fill the space between the gamma rod and the gamma tube — a snug fit was necessary so I used electrical tape for the insulator.

Adjusting the gamma match was very easily accomplished using the data from *YW*. Looking at Figure 4 you can see two specifications that describe the match — the value of the capacitor and the rod length. Using the rod length dimension you set the distance from the bottom of the tuning strap to the antenna feed point. Adjusting the distance to be exactly the dimension given by *YW* takes only a minute or two. The tuning strap can then be tightened on the driven element and the capacitor value can be set by moving the gamma tube through the tuning strap to adjust the SWR of the antenna to 1.0 to 1 at the center frequency of the antenna. (Do not adjust the gamma match while transmitting!)

Making it Happen — Checking it Twice

I have included a graph of the original antenna (Figure 5) with the gamma match calculated by *YW*. No improvement in the SWR was noted with the revised gamma match (black line). Figure 5 shows the antenna gain of 9 dBi using the red line with the values shown on the left side of the graph — over 2 dBi less than the specs. The front-to-back ratio of 12 to 13 dB is shown by the green line (values on the right edge

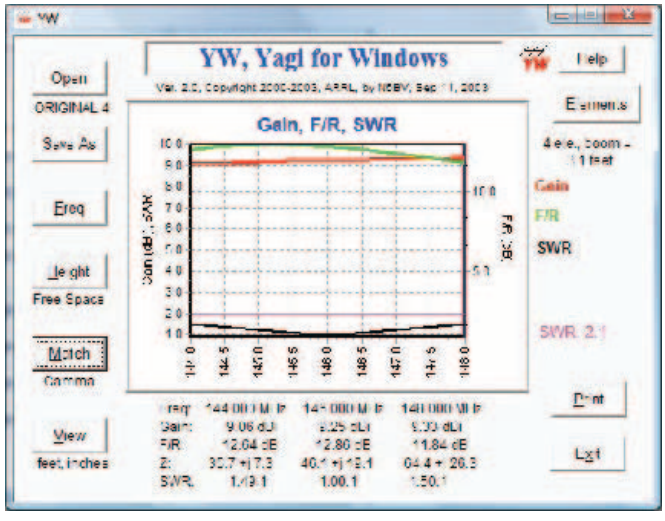


Figure 5 — The control panel for *YW* giving a graphical description of the original antenna.

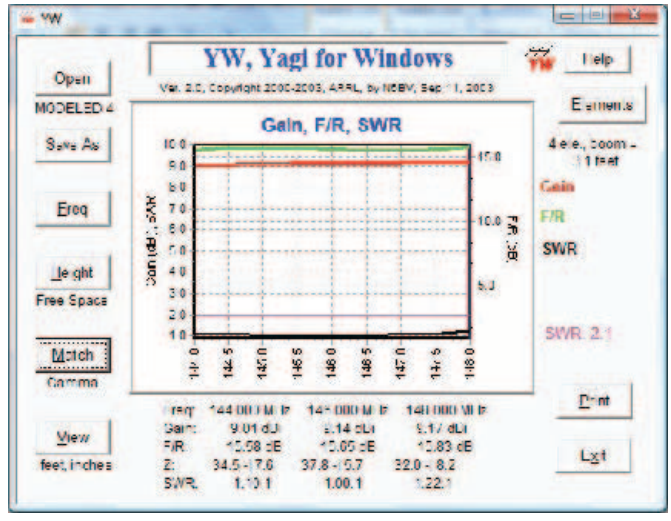


Figure 6 — The *YW* control panel showing the graphical representation of the modeled antenna.

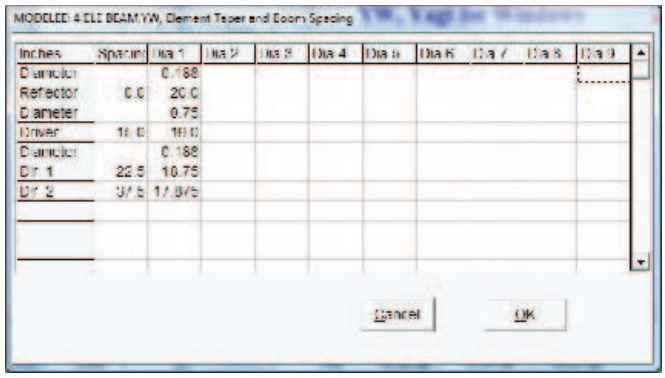


Figure 7 — The revised dimensions are shown for the reflector and first director (Dir 1).

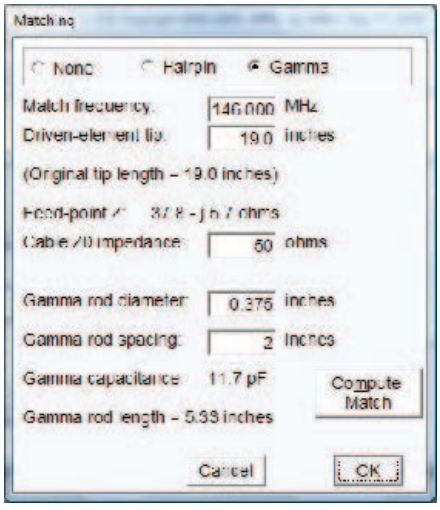


Figure 8 — The revised gamma match calculation after the antenna elements have been changed in length.

Figure 9 — An example of the temporary method to lengthen the elements is shown. A piece of #14 AWG wire is taped to the element to make a cross section approximating the diameter of the element.

of the graph) — nowhere near the 18 dB in the specs. The magenta line, marked SWR, is a reference line provided by the program to highlight the results when the modeled antenna has exceeded that modeling criteria.

I accepted the fact that the gamma match itself was not the reason for the antenna's poor performance. I then started to model the antenna — changing the lengths of the elements and the spacing on the boom. This was not difficult and was very educational. I could readily see what any change in any dimension did to the resulting specifications. I cannot emphasize enough the power contained in *YW*.

Making it Happen — Round Two

I designed an antenna that had better specifications than mine came with by changing every dimension of the antenna in some way. I thought that maybe I could get a similar result by minimizing changes. So, I went back to the original antenna modified by the newly calculated gamma match and started to note what improved or got worse with each change. I found that only two changes were needed to get a better SWR match across the entire 2 meter band, maintain a 9 dBi gain across the band and increase the front-to-back ratio to 15.5 dB — also across the band (Figure 6). The changes required were to increase the length of the reflector by ¼ inch and to increase the first director by 1½ inches (Figure 7). Due to the two changes made, a new gamma match was calculated about 2 inches shorter than the original revised calculated match (Figure 8).

The next step in the process was to apply the changes to the antenna. I temporarily taped #14 AWG bare wire to the two elements so that ⅛ inch was added to each end of the reflector and ¾ inch was added to each end of the first director (see Figure 9). I made the revised gamma match, installed it and adjusted it (as described above). My measured results from the antenna matched the SWR calculations given by *YW*. I could only measure the SWR to one decimal place with my analyzer but the actual measurements were 1.1 to 1 at 144 MHz, 1.0 to 1 at 146 MHz and 1.2 to 1 at 148 MHz. Clearly, *YW* modeling made a difference for this antenna both in improved SWR and in the additional reach experienced by the improved front-to-back ratio.

The final part of the project was to order material for the new reflector and cut the original reflector to the length of the revised first director, install the revised elements and put the antenna into service.

I can only hope that this article encourages you to try *YW* and the other programs on the CD that is included with *The ARRL Antenna Book*.

Notes

[1]Antenna gain is often provided based on two different references. Gain in dBi, as in this article, means gain compared to antenna that radiates equally well in all directions, an *isotropic* antenna. Gain expressed in comparison to that of a dipole, dBd, is also used. Since a dipole has a gain of about 2.1 dBi, the same antenna will have a lower numerical gain by that amount if expressed in dBd. Either figure can be used as long as it's clear which is at play.

[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**.

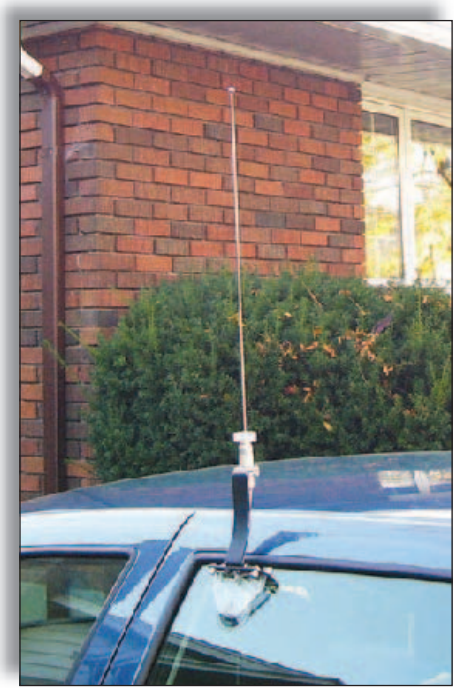
Photos by the author.

ARRL member Buzz Hopkins has been licensed since 1977. He holds a BS degree in Accounting from Drexel University in Philadelphia, Pennsylvania and is a semi-retired CPA with memberships in the American, Pennsylvania and Vermont professional CPA societies. He is a member of the RF Hill Amateur Radio Club in Perkasie, Pennsylvania and has written several articles on antenna modeling for the club's monthly newsletter, the Megahertz Times. *Buzz enjoys working the bands from his home in Pennsylvania and also working portable from his home in Vermont. He may be reached at PO Box 1472, North Wales, PA 19454 or at* **wb3fxw@arrl.net**.

Feedback

◊In "Measuring Radio Frequencies" [Sep 2009, pp 36-39], the description of vernier operation in *Improved Measurement Precision* was not quite correct. It should have said that the 10 divisions of the vernier scale were equal in length to nine divisions of the main scale, thus allowing the subdivision of each main scale division into tenths. In Figure 3, the correct reading is 60.4. Thanks to Al, NW2M, for picking up the error.

◊The W1AW Qualifying Runs [Oct 2009, p 87] should have read as follows: W1AW Qualifying Runs are 10 PM EDT Monday, October 5 (0200Z October 6) and 4 PM (2000Z) Wednesday, October 21. The West Coast Qualifying Run will be transmitted on 3590 and 7047.5 kHz by station K9JM at 9 PM PDT Wednesday, October 14 (0400Z October 15)(40-10 WPM). Unless otherwise indicated, code speeds are from 10-35 WPM.



Removable Car Window Antenna with Cross Over Connector

Operate from any vehicle without a need to drill holes.

Jean-Yves Morin, VE2MHZ

It is often difficult to install a transceiver and its associated antenna in a modern motor vehicle. In many cases a major challenge is establishing a connection between the antenna on the outside of the vehicle and the radio inside, without drilling holes in the vehicle body. This article describes a removable UHF/VHF antenna that uses no fastening devices, neither magnet nor adhesive, while respecting the integrity of the vehicle.

Application

This mount is designed to provide a quickly removable antenna system. That, combined with a V/UHF transceiver equipped with a plug designed for what used to be called a cigarette lighter socket, should be all it takes to set up temporary operation in a rental or leased car for casual or emergency operations.

The antenna element may be a quarter or half wave UHF, VHF or lightweight multiband antenna designed for mounting on a UHF type SO-239 coax jack. The connection to the radio is made through a coaxial jumper cable with a BNC plug on one end and a plug to match the radio's antenna connection on the other. For safety's sake, leave enough of that cable to allow opening the door without pulling on the cable. Secure the coaxial cable to the inner headrest support with an elastic cord. The hook will hold it to avoid the cable dangling down in front of the window.

Construction Details

Figures 1 through 4 illustrate the fabrication and construction details. Additional

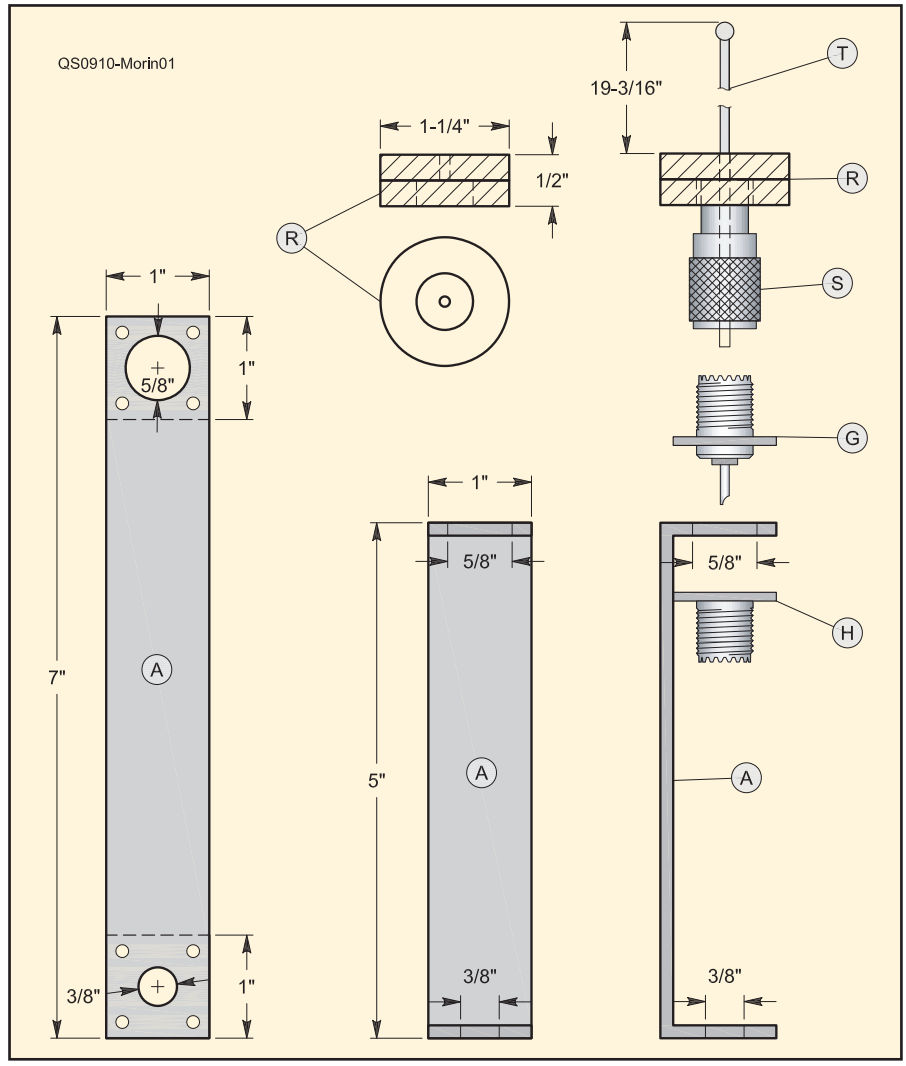


Figure 1 — Fabrication and assembly details of antenna and suction cup supports. See Table 1 (and Table 2 in the *QST* Binaries Web version of this article) for details of fasteners and pieces keyed to Figures 1 through 4.[1]

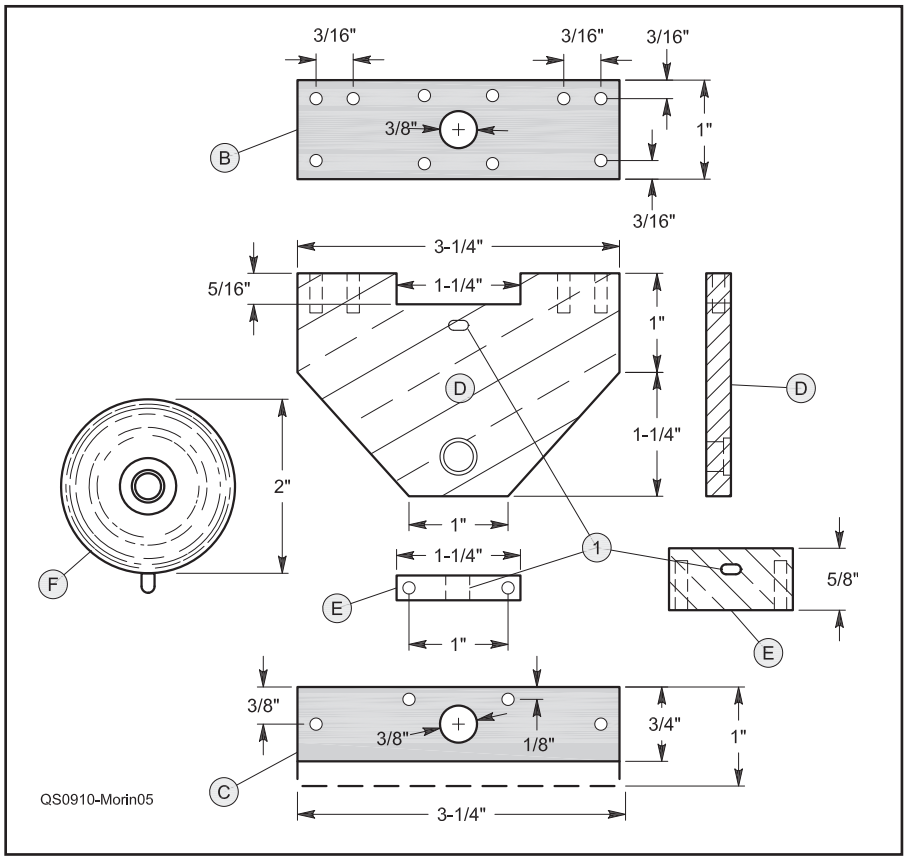


Figure 2 — Fabrication and assembly details of suction cup supports.

Table 1

Required Fasteners

Quantity	*Description*
12	Machine screws, #6-32 × ½" stainless steel or brass
12	Self-locking (nylon insert) nuts, #6-32
6	Sheet metal screws #4 × ½" stainless steel
2	Hex nuts, #6-32 brass

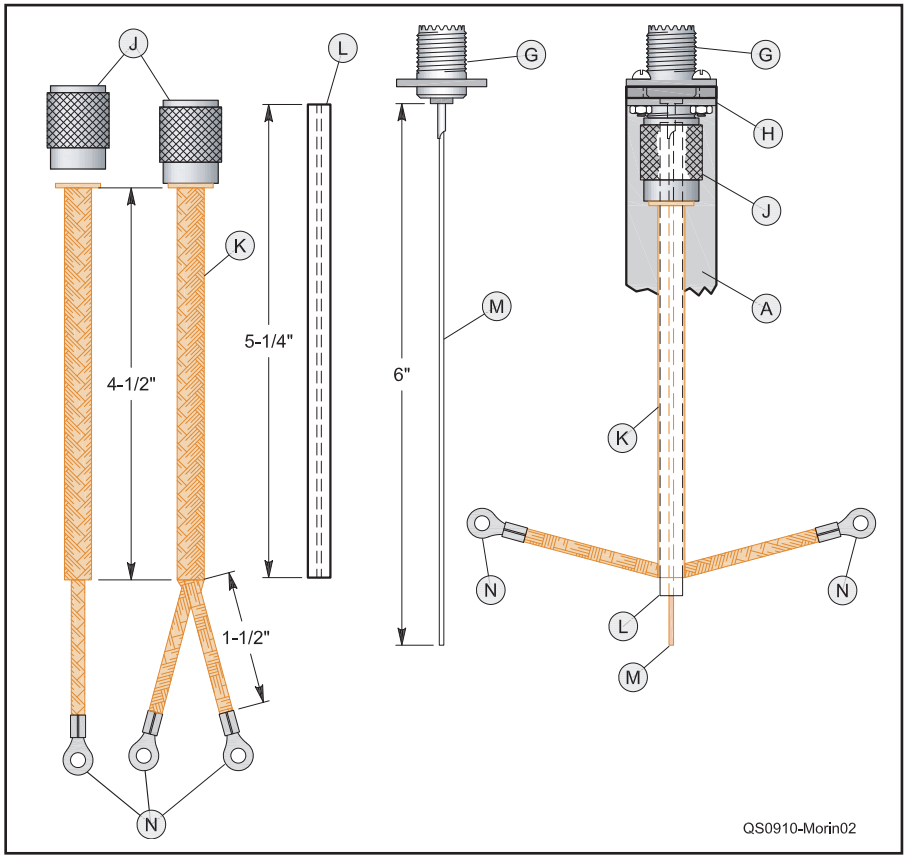


Figure 3 — Details of antenna connection cable.

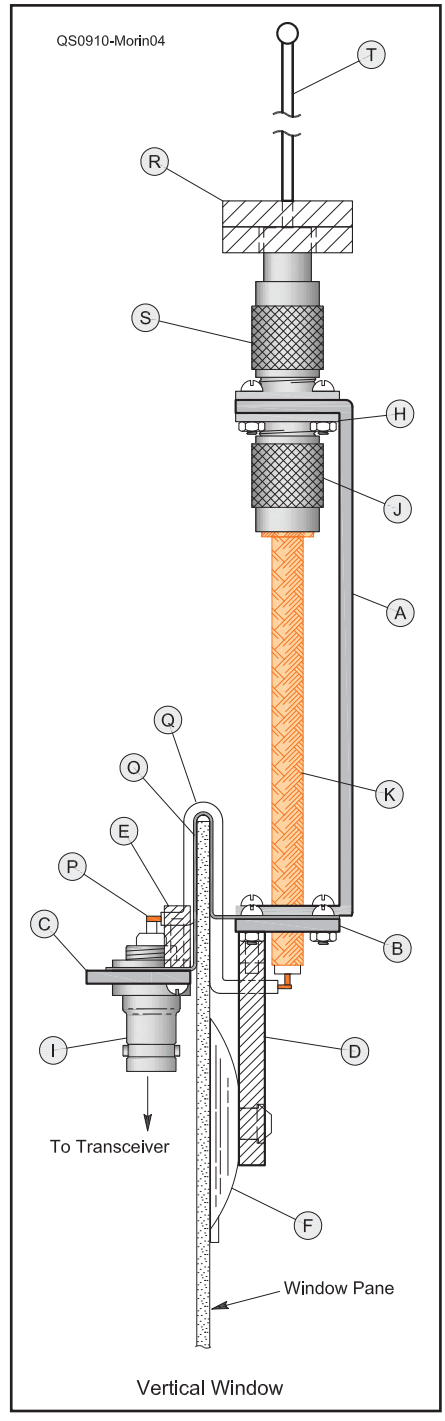


Figure 4 — Side view of completed mount as installed on straight window glass. For curved glass, bend in a vise to fit and bend antenna support outward to clear.

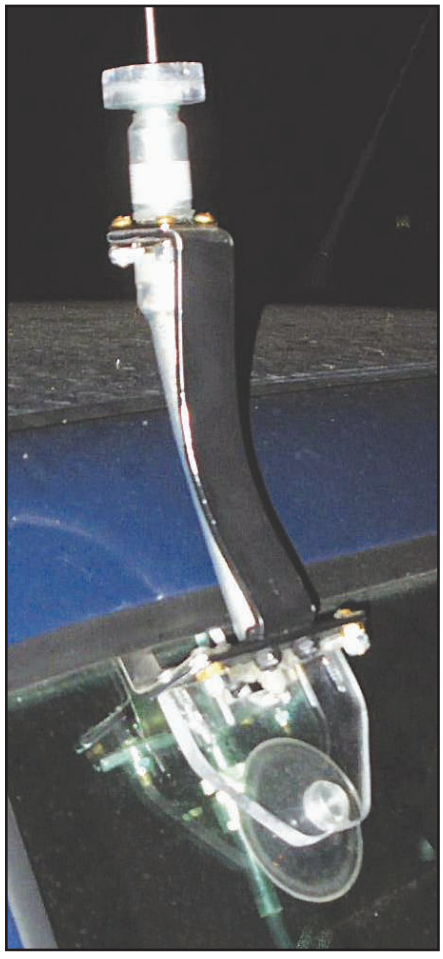


Figure 5 — Side view photo of completed mount installed on window.

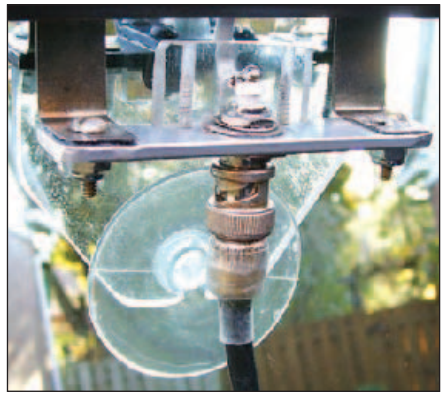


Figure 6 — Antenna mount as seen from inside the vehicle.

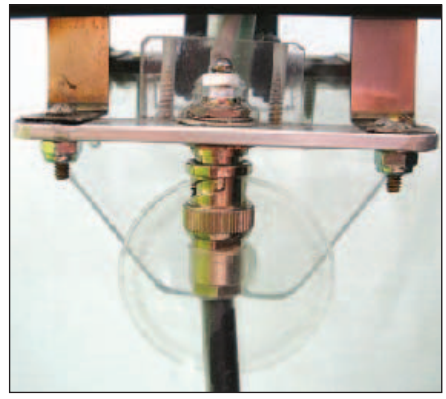


Figure 7 — Close-up of mount from inside with window lowered.

Figure 8 — Mobile operating position — all removable without leaving a scratch.

details and drawings including notes keyed to the letters on the drawings are on the *QST* Binaries Web site.[1] The required standard fasteners are listed in Table 1. Use slightly oversize drill bits for machine screw clearance holes and slightly undersized bits for sheet metal screw holes.

Installation

It is time to install your antenna on the edge of the window glass. It is generally supported between the completely closed window pane and its frame on any vertical displacement window either electric or manual, or even on a swing-out window. If the glass is curved, don't try to shape the supports on the window; rather, bend in a vise until it fits smoothly to the glass contour and the antenna mount is vertical.

The recommended installation spot is on the window situated behind the driver of the car. In a two door car or a tractor cab, however, the best place may be opposite the driver or operator. The antenna should be placed close to the door hinge side of the door. The inside coaxial cable needs a loop long enough to allow the door to open, but short enough not to entangle a foot in it. Use an elastic cord to tie the coaxial cable with a hook to the inner headrest support to avoid it dangling down. Prepare the window by cleaning the glass and moistening the area where the suction cup will attach. Figures 5 through 7 show the antenna mounted on the car, while Figure 8 shows the operating position.

For final adjustments, avoid anything that might cause antenna detuning. I have found that open car doors or proximity to objects in the garage can result in unexpected readings.

Conclusion

This antenna has been designed with an eye toward durability and efficiency and to provide safe and dependable operation. Use the material recommended and you should have years of enjoyment.

Photos by the author.

ARRL Member Jean-Yves Morin, VE2MHZ, has been a licensed Amateur Radio operator since 1989. He currently holds a Superior class license including 12 WPM Morse certification. He earned his college degree at Lauzon Institute of Technology and is now retired from a career as an electrical Inspector with the Quebec Building Board. Jean-Yves is also a member of the Union Métropolitaine des Sans-Filistes de Montreal (Greater Montreal Wireless Union), Radioamateur du Quebec Incorporated (RAQI), Droit-Humain (Human-Rights) Lodges Delta number1572 and Mozart number 1740 of Academy of Ancient Music. He and his wife, Suzanne, have two sons who are hams: Frederic, VE2FMC, and Benoit, VE2MIN.

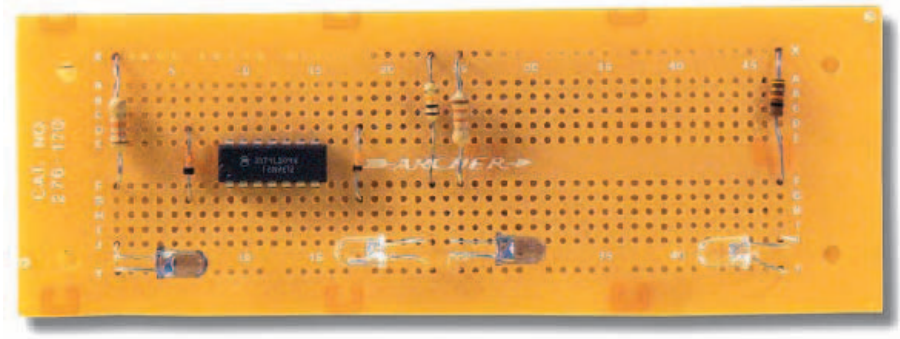
You can reach Jean-Yves at 12080 Rue Grenet, Montreal, QC H4J 2J3, Canada or at **fmfitzlite@hotmail.com**.

[1] **www.arrl.org/files/qst-binaries**

The Finger Wiggle Paddle

A one-evening project with many uses.

Paul Danzer, N1II



I was at a meeting, bored, and as the speaker droned on and on (sound familiar?) I realized I was twiddling my fingers. This brought on memories of a mechanical finger paddle I built and used with my keyer many years ago. After tuning the speaker out — not hard to do — I started to sketch out an updated electronic version of the finger paddle. Just as with the mechanical version, with a little practice, reasonable speed and accuracy comes after a bit of practice.

In this case, however, the finger paddle has a lot more uses than just sending Morse code. The photo shows the workbench version, built on a RadioShack breadboard. I am right-handed, so my forefinger fits between the two LED-appearing devices on the left front, and my middle finger between the two on the right. The board is shown before adding the connecting jumpers for the circuit.

An infrared (IR) emitting LED and an IR detecting photo transistor pair are available from RadioShack in one bubble pack for a few dollars. If a visible light detector and conventional LED were used, the detector would have to be shielded from room light. Using IR devices has the advantage that there is very little IR energy — normally generated when things get hot — around my shack except when I get angry at an inconsiderate operator tuning up on top of the station I am trying to work.

Basic Paddles

The bare bones circuits are shown in Figures 1A and 1B. They are identical and the outputs at point A and point B are connected to the paddle wires going to your keyer. Diodes D2 and D4 provide the level shifting needed for some keyers.

The unit is powered from a +5 V supply. Many shacks these days are already wired for +12 V so a standard regulator circuit (Figure 2) can be used to provide the needed +5 V dc. The low power 78L05 will do nicely. Radio Shack carries the 1 A 7805 so that may be more convenient. Unfortunately TTL logic needs very close to 5 V, and three 1.5 V batteries in series just won't work reliably.

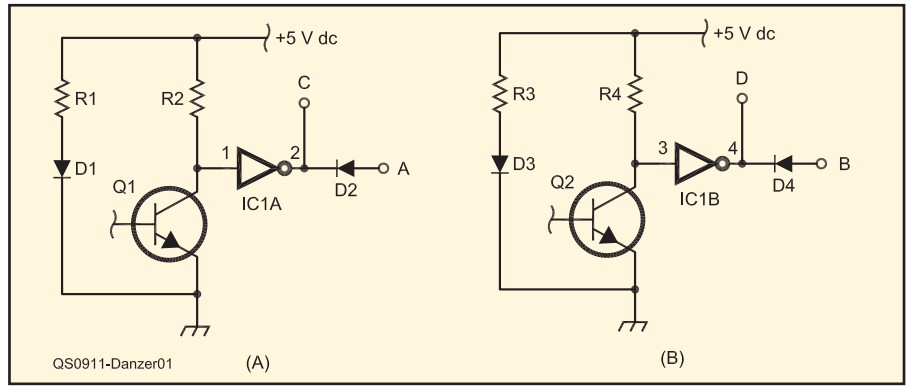


Figure 1A and B — The two identical circuits use IR to sense the position of your fingers. The parts required are listed below. Most of the parts above can be bought at RadioShack. Electronix Express of Avenel, New Jersey (www.elexp.com) carries a full line of 74XX integrated circuits, as do many other suppliers.

C1, C2 — 1 µF, 50 V dc polarized capacitor (RadioShack 272-996).
D1 and Q1, D3 and Q2 IR emitter and detector pair (RadioShack 176-142).
D2, D4 — Switching diode such as 1N914 (RadioShack 276-1122).
D5, D6 — Rectifier diode such as 1N1004 (RadioShack 276-1101).
IC1 — TTL Integrated Circuit 7404. See note below.
IC2 — 5 V regulator, see text. Type 78L05 or 7805 (Radio Shack 276-1770) suitable.
IC3 — TTL D flip-flop type 7474. A J-K flip flop such as the 16-pin 7476 is also suitable. Tie the inputs and clock to ground and use the PRESET and CLEAR inputs.
K1 — Reed relay 5 V dc, 20 mA coil (RadioShack 275-232).
R1, R3 — 1.2 kΩ, ¼ W resistor.
R2, R4 — 10 kΩ, ¼ W resistor.
Breadboard chassis in lead photo is RadioShack 276-170.

Note: The number on the IC3 package may say 74XX04, where XX is one or two letters. Any TTL NAND gate or NOR gate can be used by tying all gate inputs together.

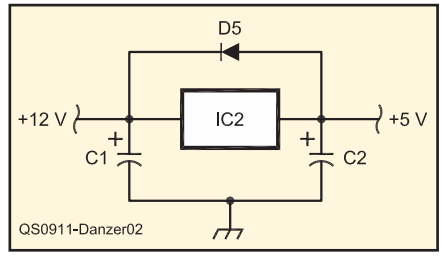


Figure 2 — If you do not have a +5 V power supply you can use this circuit to provide +5 from a +12 V source. The diode is used to prevent any effect of reverse voltages from the filter capacitors.

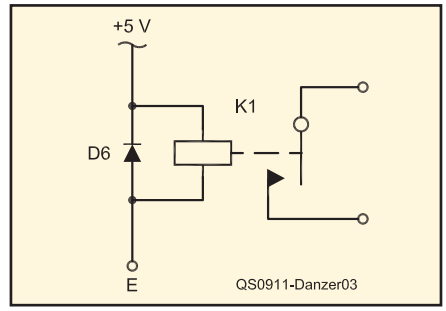


Figure 3 — This relay is wired to energize if point E goes to ground. It can be wired to work the other way — connect the point shown as +5 to the driving circuit and point E to ground.

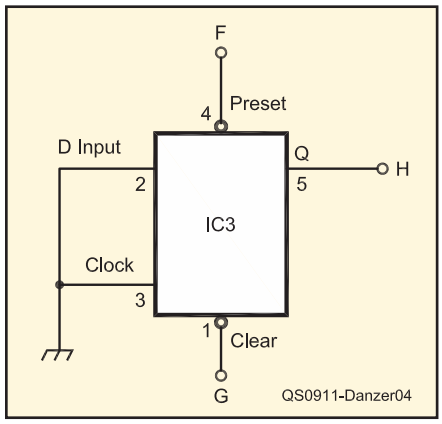


Figure 4 — The flip-flop will remember which finger last interrupted the IR path. When it is connected to the relay in Figure 3 you can control any load within the capability of the relay.

When you mount the IR diodes and IR photo transistor, Murphy's Law may apply and you can mount one or both of the units with their leads reversed — despite the fact that the package they come in clearly labels the leads. Fortunately it is easy to tell if either or both are backward. You cannot see the output of an IR LED unless you are Superman or the Bionic Woman, so you will just have to use a voltmeter. If the diode is in correctly a voltmeter should measure 1.0 to 1.5 V across it. Backward, the voltmeter will measure the full power supply voltage of 5 V.

Now place the voltmeter across the photo transistor and lift one lead of R2 or R4. If the voltage across the transistor changes it is in correctly — otherwise, reverse its leads.

Finger Operated Switch

You might want to experiment with using the same circuit as a finger-operated switch. Connect point E on the relay circuit (Figure 3) to point C in Figure 1A. Stick a finger between the diode and the photo transistor and the relay closes; remove your finger and the relay opens. Want the relay to lock in place? Just use the flip-flop shown in Figure 4. Connect points F and G (Figure 4) to C and D in Figure 1. Then connect point H in Figure 4 to point E in Figure 3.

It doesn't matter which point (F or G) is connected to the sensors (A and B) — place your finger in one IR path and the relay will close and stay closed. Interrupt the other IR path and the relay will open and stay open.

What are you going to control with the relay? The unit called for in the parts list will handle ½ A at 120 V dc — so just use your imagination!

ARRL Member Paul Danzer, N1II, was first licensed in 1953, and now holds an Amateur Extra class license. Paul has been operating 40 meter CW almost constantly since he first started. He uses his years of experience as an electronic engineer to design and build small, one-night ham radio projects. Currently he is a Professor of Computer Science at Housatonic Community College in Connecticut. He can be reached at **n1ii@arrl.net**.

New Products

12 GHz PLL-STABILIZED CRYSTAL OSCILLATOR FROM KUHNE ELECTRONIC

◊The Kuhne Electronic MKU LO 12 PLL can be connected to an external 10 MHz reference to achieve high frequency accuracy necessary for EME (moonbounce), WSJT digital and tropospheric DX communications. The 10 MHz signal can be supplied by a highly stable OCXO, a reference oscillator from a frequency counter, a rubidium frequency standard or a GPS controlled frequency source. If a 10 MHz reference frequency is not available, the unit's internal crystal oscillator can be used. This crystal oscillator is frequency stabilized by a precision crystal heater. The unit also features automatic activation of the PLL if an external 10 MHz signal is supplied, overvoltage and reverse polarity protection, and helical and microstrip filters for high spurious and harmonic rejection. Specifications: Output frequency: 11952 MHz (for 24 GHz), 12024 MHz (for 24 GHz USA) and 11736 MHz (for 47 GHz). Output power: 35 mW. Frequency stability (0-40°C) typically 5 ppm without 10 MHz reference frequency. External reference: 10 MHz, 2-10 mW. Requires 12-14 V dc at 260 mA. For more information, visit **www.db6nt.de**.

DRY DUMMY LOAD FROM MFJ

◊The MFJ-263 dry dummy load uses metal film resistors mounted on a large heat sink for low SWR into the microwave range. The load is specified for SWR of less than 1.1:1 from dc to 1 GHz, 1.2:1 at 1.5 GHz and 1.5:1 at 3 GHz. Power rating is 125 W continuous and 300 W for 10 seconds. The load uses an N connector. Price: $99.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

SHORT MOBILE HF WHIPS FROM MFJ

◊ MFJ-23xx series short HF mobile whip antennas are designed for light duty mounts that use a standard ⅜-24 connector. Built like the MFJ HamTenna series of continuously loaded antennas, these whips are 36 inches tall and collapse to 25 inches for storage. Rated for 250 W PEP, they are thin, lightweight and said to have a very low wind resistance. An adjustable stainless-steel tip allows for SWR adjustment. Available models: MFJ-2375T (75 m), MFJ-2360T (60 m), MFJ-2340T (40 m), MFJ-2330T (30 m), MFJ-2320T (20 m), MFJ-2317T (17 m), MFJ-2315T (15 m), MFJ-2312T (12 m), MFJ-2310T (10 m) and MFJ-2306T (6 m). Price: $22.95 each. Recommended 5-inch magnet mount: MFJ-335BT, $21.95. Trunk lip mount: MFJ-345T, $39.95 or MFJ-348T, $42.95. Other mounts are available. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

Repair and Calibrate Those Wattmeter "Slugs" with Confidence

They're too pricey to toss. Here's how to bring them back to life.

Frederick Glenn, K9SO

Amateur Radio operators are notorious for opening up their equipment just to see how it works. The first thing many do with a new radio is to pull out the screws and inspect the insides. But one piece of equipment many amateurs own has almost always been immune to this internal inspection process. Perhaps it is held in such reverence that we don't want to fool with something that works so well. Whatever the reason, very little has been published about the inner workings of the venerable wattmeter *slug* and how to repair it.

The author's Web site has links to mathematical descriptions of the types of directional couplers used by the portable wattmeter companies.[1] This article is intended to describe the inner workings from a mechanical as well as from a non-technical electrical viewpoint. This, along with a cursory reading of the theory contained in Web site links, will give you a good understanding of what is critical inside these elements and what is not. This, in turn, should give you the confidence to open up and repair or recalibrate the slugs themselves if the need should arise. Keep in mind that the manufacturer still supports these products for repair. Depending on your skill level, this may be a better option for some readers.

The Electrical Basics

Two different RF sensing techniques are employed inside the wattmeter slugs. The one most often used at HF and low VHF frequencies will be referred to as a *modified Bruene bridge* approach. The Bruene bridge is named after Warren Bruene (then WØTTK) who originally described the design used by the Collins Radio Corporation in a 1959 *QST* article.[2,3] At higher VHF and UHF frequencies, an approach referred to as a *frequency compensated Monimatch* or simply the Monimatch is used. The Bruene bridge is called a *modified Bruene* here, since the usual realization of this method uses a toroid core to encircle the center conductor of the transmission line.

Since that would not work with a slug approach, the pickup loop in the slug is wound on an external core. Many authors note that the Monimatch design is frequency dependent, but it too can be compensated.[4] The details of the compensation are described in technical papers on directional couplers linked at my Web site, but here it is simply pointed out that the compensation is accomplished in much the same manner as in the Bruene coupler.

In general, the low frequency response is limited by the self-inductance of the pickup loop so the Bruene approach with a pickup wound on a ferrite core is typically used below 60 MHz. The astute reader

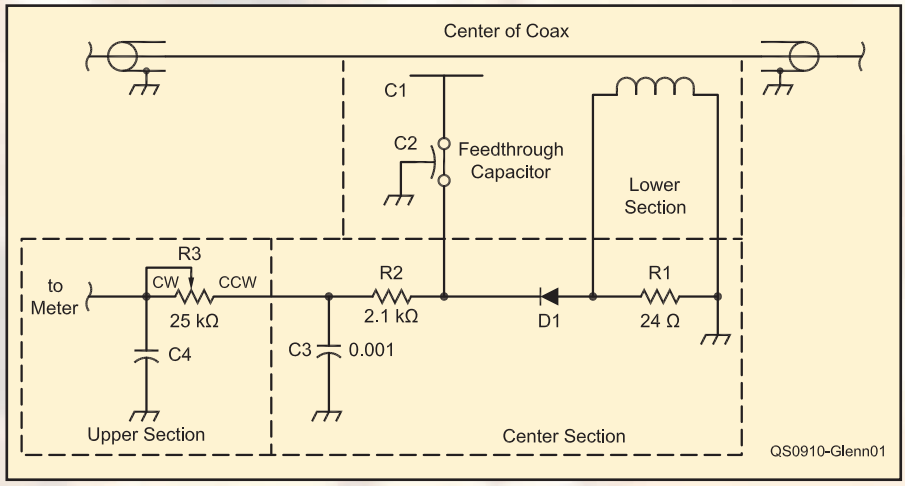


Figure 1 — 2.5 kW HF element schematic. This configuration is predominantly used below 60 MHz. Note that values have changed over the years. These values should be considered typical but are provided for reference only.

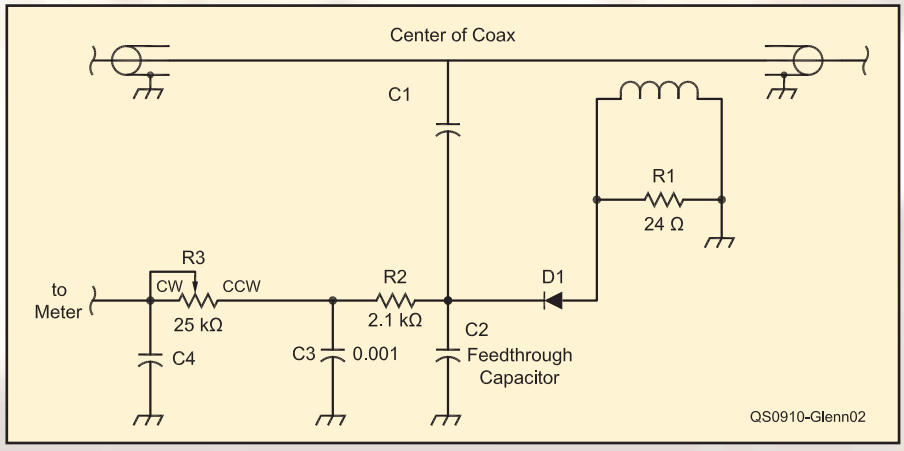


Figure 2 — Bruene bridge schematic. (Figure 1 redrawn…values shown taken from 2.5 kW HF element).

[1]Notes appear on page 52.

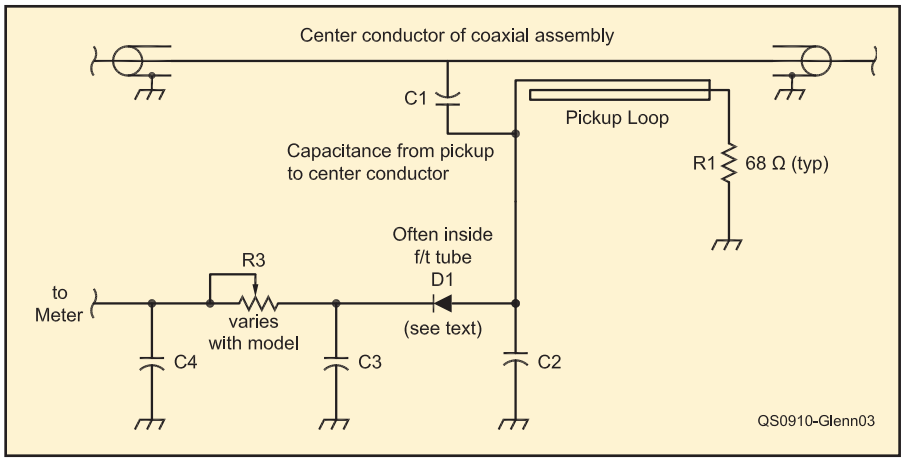


Figure 3 — Basic "Frequency-Compensated Monimatch." C2 provides the frequency compensation. R1 is typically a fixed value resistor.

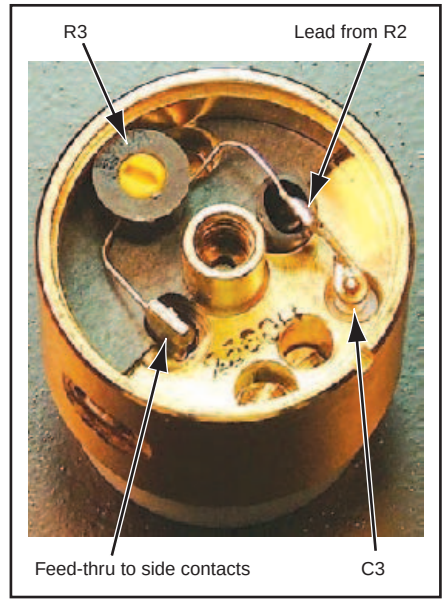


Figure 4 — Photo of upper level (below cover and nameplate of a 2.5 kW HF element).

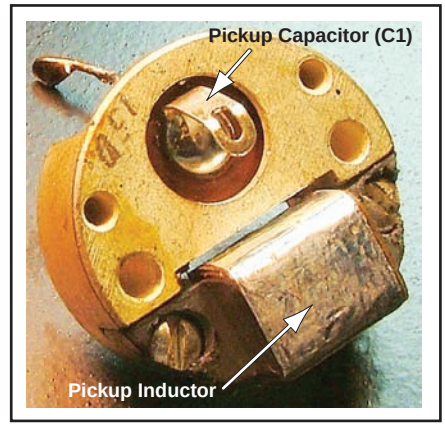


Figure 5 — Lower, Bruene pickup level, of a 2.5 kW HF slug.

will see that there is little actual difference between the two circuits after the frequency compensation is applied to the Monimatch approach.

In a Monimatch configuration, balance (or maximum directivity) is achieved if

$$R = \frac{M}{CZ_0}$$

where M is the mutual inductance between the pickup inductor and the center coax line and C is the capacitance to the center coax line.[5] This result can facilitate attempts at achieving balance since the balance point can be reached simply by adjusting the value of R. Typically, balance in a Bruene bridge is achieved by adjusting C.

Figure 1 shows a Bruene based wattmeter slug schematic divided into compartments. More on this compartmentalization later, but it is redrawn in its more usual form in Figure 2. Figure 3 shows a basic frequency compensated Monimatch circuit typically used at VHF and UHF. The HF values in Figures 1 and 2 are taken from a 2.5 kW element built in 1982. The reader is cautioned that the actual values and the construction details shown here have likely changed in their details over the years, but the fundamentals have not.

One last electrical comment before going on to the mechanics: It is a misconception to think of the diode as a simple rectifier. At the low excitation levels encountered here, the diode acts neither as a square law detector nor as a rectifier or peak detector.[6] The difference is explained in the author's paper on RF detectors to be found on the K9SO Web site, but if the diode were acting simply as a square law detector, the meter scale would be linear. If it were acting like a peak detector, it would follow a square law (to the second power). In practice, in the design implementation discussed here, it is a little of both and this combination mode of operation is referred to as *mixed mode* by the author. The printed meter scale compensates for the mixed operating modes. Essentially, this can make the diode a critical component to match and track the existing meter scale.

The Mechanics

The typical Bruene slug configuration is constructed in three mechanical layers here referred to as *upper, center* and *lower*. The upper level is accessed by removing the nameplate and then removing the center screw holding an internal cover. The nameplate is glued on, but it can be easily removed without damage after soaking the element upside down overnight in a thin layer of solvent such as MEK. (Solvents such as MEK should be used in a sealed container and with adequate ventilation per the label instructions.)

Removing the white lower cover accesses the lower level. Removing the components on the upper level accesses the center level after removing two more recessed screws. Fortunately, the upper level components operate at dc and are thus not critical with respect to their physical placement. Physical placements of components on the center level are not critical either. Center level components may be replaced and dressed in the original fashion. Figure 4 shows the components of the upper level.

Removing the white lower cover accesses the lower section. On some units this can be easily removed by compressing the outer perimeter of the cover at the base using a large diameter string. Compress the bottom by twisting the string. If this is done carefully, the bottom cover can be worked off and later simply pushed back on. If you are removing the cover, be careful not to bump anything inside. Fortunately, even though the lower level houses the most critical components (the inductive and capacitive pickups), these are usually not what goes wrong and there may be no need to remove the lower cover at all to achieve a repair. If for nothing more than completeness, the lower levels of two HF elements are shown in Figures 5 and 6.

It is interesting to compare Figures 5 and 6 (2.5 kW and 50 W HF slugs). As might be expected, the size of the pickup capacitor plate and the number of turns on the coil are the only differences. If an element is completely dead, it is not likely that this level even needs to be opened. The problem is likely to be elsewhere. If dropped, however, the inductor leads could conceivably break or the solder connection of the capacitor could break free.

A coupling plate distorted by mechanical shock would manifest itself as a reduction in element directivity while one that has broken free would surely rattle. The inductor leads can be tested from the center level

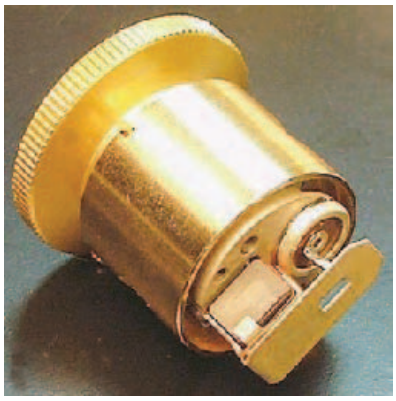


Figure 6 — Photo of a 50 W HF Element lower level showing a similar Bruene pickup.

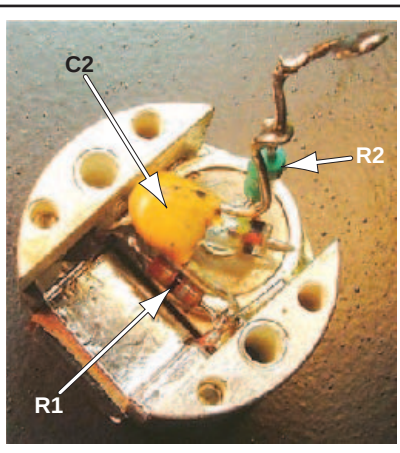


Figure 7 — Center level photo (must unsolder upper level connections and remove two screws).

without removing the bottom cover. Again, neither of these are the most likely points of failure as they are mechanically quite robust. Unsoldering the upper level pot, the noncritical feed through connections, and removing two more recessed screws reveals the center level shown in detail in Figures 7 and 8.

Finally, Figure 9 shows the lower level of a Monimatch 100 W UHF element. The higher frequency VHF and UHF pickups vary widely since the Monimatch design depends on the capacitance of the pickup loop wire to the center conductor of the transmission line. In this design, the pickup wire is doubled to increase that capacitance. The pickup also functions as the inductive coupling (M). Obviously, the dielectric of the cover comes into play here as well as in the Bruene design.

If the Monimatch designs have lost directivity, look at the value of the terminating resistor on the lower level. In the earlier designs that the author has seen, these were carbon composition resistors. Although good performing resistors at RF frequencies, they are prone to drift in value (usually upward) with time. This particular resistor is color-coded at 68 Ω but was measured to be 75 Ω. Directivity of the coupler is critically dependent on this value. Since drift is usually toward a higher value, an added parallel resistor (being careful not to change the capacitance) may be a good solution. Theoretically, adjusting the spacing of the pickup can also restore balance, but this is not recommended. Directivity is important for maintaining forward/reverse power accuracies with mismatched loads and should not be overlooked. By specification, the wattmeter elements only achieve a minimum 25 dB directivity factor and typically are no better than 30 dB. Most lab quality instruments are >40 dB.

In Summary

The most likely failures the author has seen are related to components on the upper and center levels. These components are easily accessed and repaired. They are also mostly operated at dc so the physical placement and lead dressing are not critical to performance or accuracy. Most replacement components are easily found and are not critical (with the possible exception of the diode). The reader is cautioned that these elements have been produced for many years and this article does not represent all of the variations used over the years. An understanding of the operation of the individual components should allow most repairs, since the underlying theory has not changed.

A common failure is the adjustment potentiometer. Good results have been reported by replacing the diodes with germanium parts (getting hard to find) or even Schottky diodes but the author has not verified this. Remember that the diode is a critical component to track the printed meter scale as the diode acts in mixed mode rather than either as a square law or peak detector. Small wattage carbon composition resistors, as used in these designs, are still available and will likely last another 20 years or so. Following the repair, recalibration is as simple as adjusting the series potentiometer to an element of known accuracy. Be sure to replace the bottom cover before calibration if it was removed, as the dielectric will affect the value of the parasitic capacitance. Reassemble and glue the cover plate back on and you've just saved yourself a lot of money.

Special thanks to Jeff Whalin, KC9JOB, who helped develop the methods used to open up these elements without damage.

Notes

[1]**www.k9so.net**.
[2]W. Bruene, WØTTK, "An Inside Picture of Directional Couplers," *QST*, Apr 1959, pp 24-27.

Figure 8 — Additional center level view.

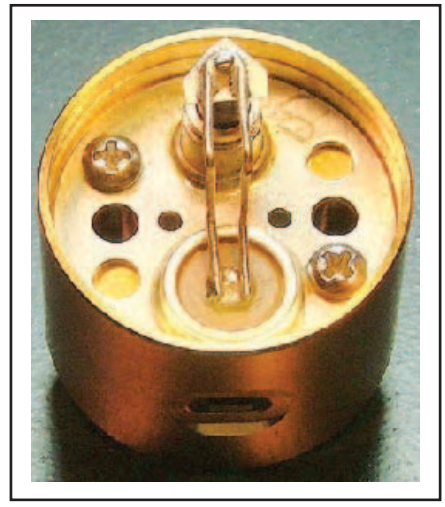


Figure 9 — 100 W UHF slug with "Monimatch" pickup.

[3]See especially ZL1AN's excellent and detailed technical analysis of the Bruene bridge on **www.k9so.net**.
[4]See Note 2.
[5]F. Glenn, K9SO, "Analysis of a Portable Wattmeter," posted at **www.k9so.net**.
[6]F. Glenn, K9SO, "Square Law Detectors," posted on **www.k9so.net**.

ARRL Life Member Frederick Glenn, K9SO, is an Amateur Extra class licensee first licensed in 1964 as WN9MVZ. He holds BS and MS degrees in Electrical Engineering and has previously had articles published in QEX. *Frederick is currently President of Glentek Corporation of Hoffman Estates, Illinois. You can reach Frederick at 320 Castlewood Ct, Hoffman Estates, IL 60067-4714 or at* **k9so@arrl.net**.

The Antenna Dipper

This easy to build device can be used to help an antenna or adjust an antenna tuner.

Scott McCann, W3MEO

The antenna dipper is a simple device that provides an indication of antenna system resonance. It is particularly useful for portable and mobile operation as it is small and a lot easier to take along than a full size antenna analyzer. It avoids causing interference to other stations as well as stress on your transmitter that results from keying your transmitter to adjust antenna settings. The dipper uses crystals to determine the frequency of operation. The crystals do not have to be any special size or exact frequency, just near the desired operating spot. I used FT-243 type crystals because I had them as well as an appropriate socket.

Easy to Build

I built my unit in the small box as shown. There are few enough parts that it can be built on a few terminal strips, on a piece of perforated prototype board or your own printed circuit. I built the bridge section of the dipper using 47 Ω resistors because that is very close to the 50 Ω most transmitters like to see, but you could substitute other values for the 47 Ω resistors if you wish to build it for a different impedance.

The RF choke, L1, is one I had of around 1.5 µH, but anything from 1 to 2.5 µH should be fine. I had a 100 µA meter in my junk box, but your 50 to 200 µA meter will work fine. The value of C2 can be adjusted to provide more or less of an indication on your meter. A larger value should provide additional deflection.

And Easy to Use

To use the device, plug in a crystal, connect the antenna and turn on the power. As you adjust the tuner or antenna you will get a dip on the meter if the antenna system is closely matched to 50 Ω. If adjusting an antenna or tuner, make changes until you get the minimum reading.

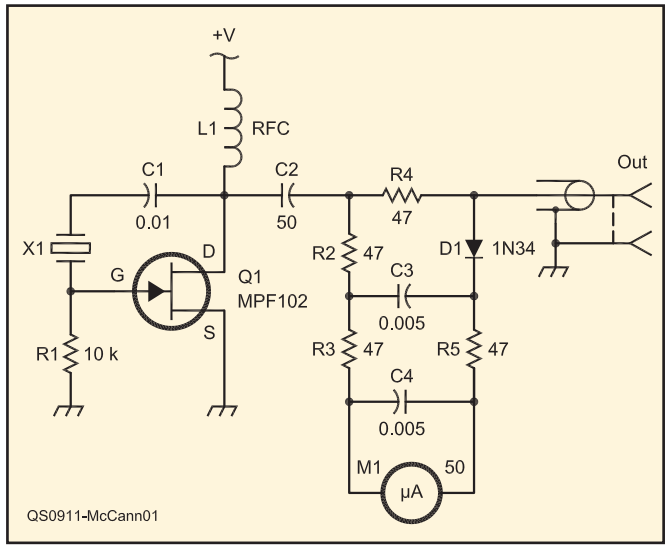


Figure 1 — Schematic of the Antenna Dipper. Parts are not critical, except that R2 through R5 should match the desired impedance.

C1 — 0.01 µF ceramic capacitor.
C2 — 50 pF polystyrene capacitor.
C3, C4 — 0.005 µF ceramic capacitor.
D1 — 1N34 or equivalent germanium diode.
M1 — 50-200 µA meter (see text).
Q1 — MPF102 or equivalent junction field effect transistor.
R1 — 10 kΩ, ¼ W resistor.
R2-R5 — 47 Ω, ¼ W resistor (see text).
X1 — Piezoelectric crystal resonant at desired frequency to match holder used. Check *QST* advertisers for crystals.

But Wait, There's More!

This instrument is also useful as a spotting oscillator to find a specific frequency for a net or schedule. Just listen for the crystal frequency in your receiver. To use as a broadband field strength meter, just turn off the power and plug in a short whip or wire antenna with a banana plug into the coax connector and observe the relative field strength on the meter.

This is a field instrument, not intended as a replacement for a full size antenna analyzer so it only has an L (low) and H (high) indication for SWR and a relative scale for field strength. A 9 V battery is all you need for power.

I built my unit with a switch and an LED power indicator, but these are optional. Crystals for other bands can be adapted. I bought a small circuit board type 14 MHz crystal and soldered it into an FT-243 shell for a 20 meter setup as that is the highest band I need.

ARRL member Scott McCann, W3MEO, has been licensed since 1957 and now holds an Amateur Extra class license. He is a retired college professor, now active in Army MARS (AAR3FK) and enjoys low power portable operation as well as weak signal VHF. Scott can be reached at 160 Shields Ln, Queenstown, MD 21658-1278 or at **achess@juno.com**.

PRODUCT REVIEW

ICOM IC-7600 HF and 6 Meter Transceiver

Reviewed by Rick Lindquist, WW3DE
National Contest Journal Managing Editor

Already widely known as the "PROIV," ICOM's IC-7600 HF+50 MHz transceiver is an apparent and worthy successor to the extremely popular IC-756PROIII.[1] Whatever ICOM's designation, the IC-7600 is a terrific performer with a fine complement of useful tools for DXing and contesting! Granted, the IC-7600 is not *totally* new and different with respect to the older PROIII and the more recent IC-7700 and IC-7800 transceivers.[2] This review will include some comparisons, as appropriate, to the models with which it shares some DNA. Let's see how the IC-7600 stacks up.

A Stylish Makeover

On its face, the '7600 looks similar to its PRO series forbears, the most notable exception being a larger and improved LCD display (Figure 1). My wife liked the new display after comparing the PROIII and the '7600 side by side, so it *must* be better. The IC-7600 is essentially the same convenient size and weight as the PROIII with a similar front-panel layout. Some may mourn the replacement of the PROIII's moving-coil meter with an excellent digital emulation on the '7600's larger display. ICOM has a similar implementation on the IC-7700 and IC-7800, and all offer a choice of *faux* meter styles, too — standard (analog), edgewise and bar.

If you're already familiar with the PRO line, you'll feel right at home with the '7600. If you're a newcomer, you'll find the IC-7600 has a gentle learning curve. ICOM's plain-language menus are a major reason for this.

Wider is Better

Legends and icons on the 5.8 inch 400×240 pixel display feature clean, straight lines. For example, on the PROIII, the current operating mode appears in a stylized horizontal tube, sort of like a hot dog or a blimp. The MODE indicator on the IC-7600 is a smallish but very visible blue rectangle with white letters. The RIT/XIT readout is smaller than the PROIII's, and it's in a different display location that I never quite got used to (the RIT/XIT readout on the PROIII places larger numerals directly below the last three digits of the main frequency readout). As with the IC-7700, the IC-7600 offers only an "A" or a "B" display — one essentially an inverse of the other — plus three font choices — basic, italic and round. The basic and round styles are quite similar, but the round characters are a bit fatter.

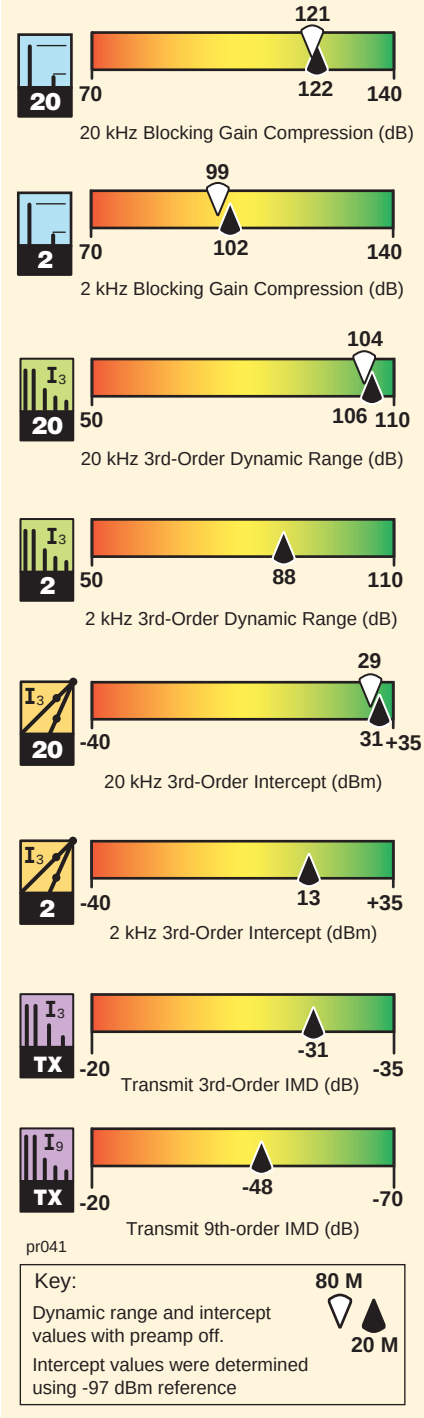
After complaining about the limited viewing angle of the IC-7700's otherwise excellent display, we're pleased to note that the IC-7600 offers excellent horizontal and vertical visibility from just about any angle. The IC-7600 does *not* provide for connecting an external VGA video display, however.

Cleaner Lines

Aside from its fabulous display, the '7600's uncluttered front-panel has a smooth,

[1]R. Lindquist, N1RL, "ICOM IC-756PROIII HF/6 Meter Transceiver," Product Review, *QST*, Mar 2005, pp 56-59. *QST* Product reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.
[2]R. Lindquist, N1RL, "ICOM IC-7700 HF and 6 Meter Transceiver," Product Review, *QST*, Oct 2008, pp 41-47.

Key Measurements Summary



Bottom Line

The IC-7600 represents a superb synthesis of ICOM's popular PROIII and the IC-7700/7800 transceivers, both in style, features and capability. Another winner!

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

semi-gloss surface that may be easier to clean than the PROIII's. The rest of the box closely resembles the PROIII's, but without the sunken front apron and with sharper, rather than rounded, features. The '7600's larger knobs — the hefty, clean-edged rubber-ringed tuning knob is like the one on the IC-7700 — ease their use.

The radio's bright-white control legends are larger and easier to read than those on the PROIII. While I do appreciate the PROIII's oversized red keypad numerals for entering a frequency, those on the '7600's keypad, though smaller, remain easy to read, and the keypad buttons are larger to start with. In addition, the "pointer" markings on the IC-7600's knobs are simple to see, and the rings on concentric controls contrast ever so slightly in hue and sheen. All knobs — even the *stem* controls — are fatter than the PROIII's. On the other hand, the stem controls are in a more congested location on the '7600 because of its larger display. The IC-7600 overcomes the absence of contrasting colors on knobs and front panel legends in part by employing variations in button styles and shapes.

One minor unintended consequence of the front-panel rearrangement: The TRANSMIT, TUNER and MONITOR buttons are in a horizontal line on the left-hand side of the panel, above the AF GAIN control. On several occasions when I wasn't paying close-enough attention, I hit the TRANSMIT button instead of the neighboring TUNER button, which has a status LED. The MP-W and MP-R scratchpad memory buttons also can blend in with their neighbors, so you have to pay closer attention to ensure you're not pressing the adjacent *hard* memory buttons. On the PROIII, the scratchpad memory keys are not only larger and off by themselves, but are in a contrasting light gray.

Some additional visibility issues are worth a mention. The right-pointing arrows on the seven multi-function keys lining the left hand side of the display blend into the background, especially in soft light; these are not filled in with a contrasting color to make them easier to distinguish one from the other, much less to see them at all in low light. In a similar vein, legends on the six LCD function keys just below the display can be difficult to tell apart.

Just below the LCD function keys are six mode switches. In addition to the FILTER and EXIT/SET keys, the '7600 offers individual mode keys for SSB, CW, RTTY/PSK and AM/FM. As a PROIII user, I appreciated *not* having to share the CW mode with the RTTY key. Unbundling the CW key also means you can quickly swap from CW to CW-R when flipping your tuning direction, as I often do during search-and-pounce (S&P) contest operation.

The UP ∆ and DOWN ∇ buttons for memory scrolling are positioned right next to the main tuning knob, making them more obvious and handy. Depending upon how ham-handed (get it?) you are, their placement may make the tuning knob more vulnerable to the inadvertent jog when using them. I didn't have any problems in this regard.

I was pleased to find a feature on the '7600 that announces signal strength reading, frequency and mode in an agreeable female voice. It's possible to deactivate the S meter and mode components. This is standard equipment on the IC-7700 too. The '7600 back panel looks about as you would expect and is shown in Figure 2.

How Much Would You Pay . . .?

As the late TV huckster Billy Mays might have hollered in another life, "How many times have you been embarrassed by transmitting on top of the DX when you *thought* you were in split? Well, worry no more!" The IC-7600's mother of all SPLIT indicators makes it really difficult *not* to know when you're working split. The nearly 1-inch-long LED indicator along the top edge of the display looks like a mini-fluorescent lamp. An on-screen SPLIT legend of contrasting shade accompanies the bright light. ICOM also has placed the TX, RX and DUAL WATCH LEDs above the display where they belong; display icons reiterate the status of these functions.

In a similar "isn't that *amazing*!" vein, the IC-7600 lets you type in desired text for CW and digital memories using a USB (universal serial bus) keyboard. This is a vast improvement over having to "dial" in the memory contents one character at a time using the main tuning knob, although it's a bit of a hybrid system. To enter letters, you still must press the upper-case or lower-case TEXT button on the transceiver's display while in edit mode. In like fashion, to enter numbers you still must press the 123 button. Pressing SHIFT on the keyboard doesn't work.

Shape Shifting

ICOM has imbued the IC-7600 with top-notch DSP IF filters, but the implementation is not without some minor wrinkles. Basic IF filter selection is essentially identical to the PROIII's setup with the exception of AM. On the IC-7600, you can set the AM passband between 200 Hz (!) and 10 kHz in 200 Hz steps for a total of 50 discrete filter pass-band widths plus full dual pass-band tuning. On the PROIII, the IF filter passband choices for AM are fixed at 9, 6 or 3 kHz, with a simple IF (ie, single pass-band) shift available. For FM the IC-7600 offers three fixed passband choices, 15, 10 and 7 kHz, just as on the PROIII.

To select a basic filter shape (sharp or soft) requires going to the FILTER menu, rather than to the DSP menu as on the PROIII. If you pick SHARP or SOFT on the FILTER menu, that shape setting applies to all three available filter bandwidth settings. The FILTER SHAPE SET menu lets you configure filter shapes for SSB/SSB-D (data) and CW that are independent of the shape setting on the FILTER menu, but within strict limitations that favor CW or AFSK modes only.

Here's the thing: You can separately set CW filters 500 Hz or narrower and 600 Hz or wider to default automatically either to soft or sharp. On SSB-D (for AFSK), it's possible to have the radio default automatically to soft or sharp when the filter setting is greater than 600 Hz. The same is possible for SSB, although whichever shape you set becomes the default for any *practical* SSB filter. It would be far more useful for typical SSB operation if, for example, you could set the filter shape to default automatically to sharp when the filter setting is less than 2 kHz or so, not 600 Hz. In any case, it's just a couple of button presses to change the filter shape to whichever setting you want.

Diddles

While the PROIII can decode RTTY on its display and transmit RTTY from memories without the use of a PC, the IC-7600 offers full transmit and receive capability in RTTY and PSK31. Just plug a USB keyboard into the radio, bring up the DECODE screen for the relevant mode and you're ready to roll, digitally speaking. Unfortunately this capability doesn't extend to CW.

The DECODE screens for RTTY and PSK31 feature helpful, but diminutive, waterfall displays for finding and tuning signals. The PSK31 screen includes a tiny, ever-changing phase readout to lend further assistance, plus AFC and NET; the RTTY tuning indicator is in the upper right hand corner of the main display. This was the simplest and easiest RTTY and PSK31 experience I've ever had (well, at least since reviewing the IC-7700)!

The PSK31 and RTTY waterfall displays cover 1195 to 1805 kHz (610 Hz) with the center at 1500 (there's a choice of 1000, 1500 and 2000 Hz in both digital modes) — quite a bit less real estate than you'll find on a PC screen with *DigiPan* or similar software. While using narrow filter settings you must tune manually from waterfall to waterfall; otherwise, you won't always see them, just hear them. For RTTY, the waterfall display covers 1905 to 2515 (also 610 Hz) with a twin-peak waveform that lets you tune signals with precision. It's possible to adjust and read out the THRESHOLD.

Text appearing on the screen — red for transmitted text and green for received — is quite small, as is the "window space" available. Pressing the WIDE button gives you more on-screen elbow room, but if you've enabled the mini spectrum scope (the only one available in digital modes), it yields to the larger text window. In addition, lines of text don't always break appropriately, so you need to pay closer attention. Copy on the IC-7600's decoder screen seemed compa-

rable to what I was seeing via the *MMTTY* engine on my PC's display.

Using submenus on the DECODE screens, it's possible to save RTTY or PSK31 memories on a USB compatible medium, such as a flash drive (you can also save voice memories this way, but not CW). The RTTY and PSK31 memories are separate.

Contesting in RTTY and CW with the '7600 (using a computer logger and RTTY engine) was lots of fun, especially given the exceptional receiver. In these higher duty cycle modes — especially RTTY — the radio got quite warm to the touch, although the on-screen temperature gauge remained well within the normal range. The cooling fan is barely noticeable.

Magic Decoder Button

ICOM's APF (audio peak filter) skipped radio generations. First appearing (in a somewhat different implementation) on ICOM's original IC-756, APF turned up again on the IC-7800 and IC-7700 transceivers. Its incarnation on the IC-7600 includes a new twist. The TPF (twin-peak filter) for RTTY, an RTTY FIL menu selection on the PROIII, has been promoted to the front panel APF/TPF button on the IC-7600. More on that feature in a bit.

Pressing the APF/TPF button in CW imposes one of three mini audio-peaking filters — 80, 160 or 320 Hz or NAR, MID and WIDE — atop whatever DSP IF filter settings are in play. To hear much of a difference, the IF filter must be set to a passband that's significantly greater than the APF setting. For example, you might use the 80 Hz setting when you've got the IF filter set to, say, 150 Hz. When you press the button, the current setting appears briefly on screen, although you can disable this. You can choose either a "soft" or "sharp" APF shape via a menu.

On CW the effect of the APF is not especially dramatic when you've already selected a narrow IF filter, but it does help further quell background noise. The noise reduction processor (NR), readily at hand, can do the heavy lifting in that department, although the APF seems to boost signal-to-noise ratio. It's at its best when you're using, say, a 500 or 800 Hz IF DSP filter and need a little more help.

For RTTY, the TPF is exceptionally effective. Pressing the APF/TPF button in RTTY mode alters the radio's AF response by punching up the mark and space frequencies, 2125 and 2295 Hz. During the July North American QSO Party RTTY event, the TPF brought "S-nuttin'" signals (as we called the weak ones while I was growing up in Northern New Jersey) right out of the mud so they'd print. The '7600 lets you use the TPF in tandem with any of the three IF filter bandwidths (plus soft or sharp contour) you've set up in advance, and you can take full advantage of the dual-passband IF shift (PBT) feature. On the PROIII with the RTTY tuning meter enabled, you can choose just one of five possible IF bandwidths for RTTY, you're restricted to a single-passband IF shift and switching away from the RTTY filter setting disables the TPF.

The radio's NOTCH operates in a somewhat similar fashion to the APF/TPF, although the manual notch is adjustable via a front-panel control. You can pick from NAR, MID or WIDE notch filters. As with the APF/TPF feature, enabling the notch by pressing

Table 1
ICOM IC-7600, serial number 0201165

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-60 MHz; transmit, 1.8-2.0, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.	Receive, as specified; transmit, as specified.
Power requirement: 13.8 ±15% V dc; receive, 3.5 A (max audio); transmit, 23 A (100 W out).	13.8 V dc; receive 2.4 A (max audio); transmit, 18 A (100 W out). Operation confirmed at 11.7 V (83 W output).
Modes of operation: SSB, CW, AM, FM, RTTY, PSK.	As specified.
Receiver	**Receiver Dynamic Testing**
SSB/CW sensitivity: 2.4 kHz bandwidth, 10 dB S/N: 0.1-29.99 MHz, 0.15 µV; 50-54 MHz, 0.12 µV.	Noise floor (MDS), 500 Hz bandwidth: *Preamp* *off* *1* *2* 0.137 MHz –124 –126 –129 dBm 0.505 MHz –130 –138 –141 dBm 1.0 MHz –130 –138 –141 dBm 3.5 MHz –131 –139 –141 dBm 14 MHz –131 –139 –141 dBm 50 MHz –132 –141 –143 dBm
Noise figure: Not specified.	14 MHz, preamp off/1/2: 16/8/6 dB
AM sensitivity: 6 kHz bandwidth, 10 dB S/N: 0.1-1.799 MHz, 6.3 µV; 1.8-30 MHz, 2 µV; 50-54 MHz, 1.6 µV.	10 dB (S+N)/N, 1-kHz, 30% modulation: *Preamp* *off* *1* *2* 1.0 MHz 1.70 0.65 0.55 µV 3.8 MHz 1.50 0.59 0.50 µV 50 MHz 1.60 0.62 0.54 µV
FM sensitivity: 15 kHz bandwidth, 12 dB SINAD: 28-30 MHz, 0.5 µV; 50-54 MHz, 0.3 µV.	For 12 dB SINAD: *Preamp* *off* *1* *2* 29 MHz 1.05 0.38 0.29 µV 52 MHz 0.62 0.24 0.22 µV
Spectral display sensitivity, preamp off/1/2: Not specified.	–105/–116/–121 dBm.
Blocking gain compression: Not specified.	Gain compression, 500 Hz bandwidth* *20 kHz offset Preamp off/1/2* *5/2 kHz offset Preamp off* 3.5 MHz 121/122/117 dB 111/99 dB 14 MHz 122/123/120 dB 113/102 dB 50 MHz 119/121/120 dB 105/98 dB
Reciprocal mixing (500 Hz BW): Not specified.	20/5/2 kHz offset: –105/–91/–82 dBc.

ARRL Lab Two-Tone IMD Testing*

Band/Preamp	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–27 dBm	–131 dBm	104 dB	+25 dBm
		–13 dBm	–97 dBm		+29 dBm
14 MHz/Off	20 kHz	–25 dBm	–131 dBm	106 dB	+28 dBm
		–12 dBm	–97 dBm		+31 dBm
		0 dBm	–61 dBm		+31 dBm
14 MHz/One	20 kHz	–33 dBm	–139 dBm	106 dB	+28 dBm
		–20 dBm	–97 dBm		+19 dBm
14 MHz/Two	20 kHz	–39 dBm	–141 dBm	102 dB	+12 dBm
		–24 dBm	–97 dBm		+13 dBm
14 MHz/Off	5 kHz	–37 dBm	–131 dBm	94 dB	+10 dBm
		–20 dBm	–97 dBm		+19 dBm
		0 dBm	–50 dBm		+25 dBm
14 MHz/Off	2 kHz	–43 dBm	–131 dBm	88 dB	+1 dBm
		–24 dBm	–97 dBm		+13 dBm
		0 dBm	–31 dBm		+16 dBm
50 MHz/Off	20 kHz	–29 dBm	–132 dBm	103 dB	+23 dBm
		–15 dBm	–97 dBm		+26 dBm

Receiver	Receiver Dynamic Testing
Second-order intercept: Not specified.	Preamp off/1/2, +63/+63/+59 dBm.
DSP noise reduction: Not specified.	Variable, 15 dB maximum.
Notch filter depth: Not specified.	Manual notch: 75 dB; auto notch: 57 dB; attack time: 37 ms.**
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset, both preamps on: 29 MHz, 72 dB†; 52 MHz, 72 dB†. 10 MHz channel spacing: 52 MHz, 110 dB.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 79.4 µV; preamp 1, 33.5 µV; preamp 2, 16.4 µV.
Squelch sensitivity: SSB, CW, RTTY, 3.2 µV; FM, 0.3 µV.	At threshold, both preamps on: SSB, 1.2 µV; FM, 29 MHz, 0.13 µV; 52 MHz, 0.12 µV.
Receiver audio output: >2 W into 8 Ω at 10% THD.	2.13 W at 10% THD into 8 Ω. THD at 1 V RMS, 0.25%.
IF/audio response: Not specified.	Range at –6 dB points (bandwidth):‡ CW (500 Hz): 336-803 Hz (476 Hz); Equivalent Rectangular BW: 486 Hz; USB (2.4 kHz): 228-2735 Hz (2507 Hz); LSB (2.4 kHz): 228-2725 Hz (2497 Hz); AM (10 kHz): 130-4600 Hz (8940 Hz); AM (6 kHz): 130-3150 Hz (6040 Hz)
Spurious and image rejection: HF and 50 MHz, (except IF rejection on 50 MHz): >70 dB.	First IF rejection, 14 MHz, 108 dB; 50 MHz, 84 dB. Image rejection, 14 MHz, 121 dB; 50 MHz, 118 dB.

Transmitter	Transmitter Dynamic Testing
Power output: HF and 50 MHz: SSB, CW, RTTY, PSK, FM, 2-100 W; AM, 1-30 W.	HF: CW, SSB, RTTY, PSK, FM, typically 1.2-105 W; AM, 0.7-32 W. 50 MHz: CW, SSB, RTTY, PSK, FM, 1-100 W; AM, 0.5-29 W.
Spurious-signal and harmonic suppression: >50 dB on HF, >63 dB on 50 MHz.	HF, 70 dB; 50 MHz, more than 70 dB. Meets FCC requirements.
SSB carrier suppression: >40 dB.	>70 dB.
Undesired sideband suppression: >55 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order (worst case band): HF: –31/–35/–41/–48 dB; 50 MHz: –31/–34/–45/–55 dB.
CW keyer speed range: Not specified.	6 to 48 WPM.
CW keying characteristics: Not specified.	See Figures 3 and 4.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 16 ms.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 21 ms; FM, 11 ms. Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 5.

Size (height, width, depth): 4.6 × 13.4 × 11 inches; weight, 22 pounds.

Price: $3999.

*Receiver testing was performed with the bandwidth set to 500 Hz and 3 kHz roofing filter. ARRL Product Review testing now includes two-tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The IP3 column is the calculated third-order intercept point. Second-order intercept points were determined using –97 dBm reference.

**Single beat note. Reduces two beat notes by 45 dB with attack time of 106 ms.

†Measurement was noise-limited at the value indicated.

‡Default values, sharp setting. Bandwidth is variable; smooth setting is available. CW bandwidth varies with PBT and pitch control settings.

the button briefly flashes the current notch setting on screen, although you can disable this too. In addition to the manual notch, an automatic notch is available in SSB and AM mode. It's extremely effective against multiple heterodynes, although as broadcasters migrate from the amateur bands, these are becoming less of an issue.

The IC-7600's digital noise blanker not only lets you set NB level but NB depth and width. This feature is helpful for pulse-type noise, such as ignition interference, and it seems to generate less crud than many less-capable noise blankers impose. I was able to use the NB in conjunction with the noise-reduction feature to substantially reduce noise that included impulse spikes apparently emanating from a nearby solar panel installation. Very aggressive/extreme settings like these can add considerable distortion to desired signals, however.

Time Warp?

Others may appreciate the record/play feature more than I did. This feature, which lets you record off-the-air audio and then play it back, on or off the air, did not improve much with the jump from one model to the next. It could be convenient when helping someone adjust their audio or compare antennas, but you'll have to figure out how it works first. The manual's description of this feature is difficult to comprehend, and using it is far from intuitive.

The IC-7600 provides separate front-panel REC and PLAY buttons. It records continuously, so it can replay the 15 seconds of audio that you heard *before* you pushed the REC button. There's no on-screen indication that you're in record mode (the PROIII has a blinking on-screen REC indicator). At the default setting, the radio will play back up to 15 seconds per "cut." The VOICE menu indicates the frequency and recording date of each cut.

You and Me and Rain on the Roof

The inclusion of selectable roofing filters several years ago marked a sea change in Amateur Radio transceiver design. As with many of its peers, the PROIII did not have this feature — it used a single 15 kHz wide roofing filter. The implementation on the IC-7600 is essentially identical to that of the IC-7700, with a choice of three crystal band-pass roofing filters at 15, 6 and 3 kHz in the first IF.

ARRL Lab Test Engineer Bob Allison, WB1GCM, suggests thinking of a roofing filter as "a first line of defense against any adjacent strong signals, especially multiple signals." The roofing filter follows the first mixer, and it has the effect of reducing the passband of the first IF, he explains.

On the IC-7600 you can impose a roofing filter bandwidth setting of 15 kHz, 6 kHz or 3 kHz on any DSP IF filter setting. Allison says being able to insert a narrower roofing filter helps to reduce overloading in the IF amplifier and mixers that follow; the DSP IF filtering takes over to help with the rest. So, the narrower roofing filter does not determine the receiver's *ultimate* IF bandwidth but will enhance dynamic range since all but the *strongest* adjacent signals are attenuated before hitting the receiver's first IF.

"This is very desirable for CW, SSB and digital modes," Allison asserts. He allows, however, that no roofing filter is completely

Figure 1 — The IC-7600's display packs in a lot of information and is readable from a variety of viewing angles.

Figure 2 — The rear panel of the IC-7600 includes all the usual connectivity as well as the new USB jack for control and audio signals.

impervious. "I guess all roofs leak if it rains hard enough," he quips.

From a practical standpoint, there's a significant difference in noise — especially on an active band — when you switch from a 15 kHz to a 3 kHz roofing filter. The difference between 6 kHz and 3 kHz is hardly discernable under most circumstances, although the IC-7600 is already a very quiet receiver. [The difference is most dramatic during crowded conditions with many strong stations, such as during contests or DX pileups — *Ed.*]

We measured the two-tone third-order IMD dynamic range of the PROIII on 14 MHz at 5 kHz spacing, preamp off, at 77 dB — good in 2005 but modest by today's standards (the ARRL Lab did not routinely make a 2 kHz measurement back then). In the intervening years, other receiver designs have upped the ante. The '7600's big brother, the IC-7700, came in at 99 dB under the same conditions — more than 20 dB better — and at 87 dB at 2 kHz spacing.

Now comes the IC-7600. The ARRL Lab measured the receiver's two-tone third-order IMD dynamic range on 14 MHz, 5 kHz spacing, preamp off, at 94 dB — nearly within measurement error or unit-to-unit variation of the IC-7700's 99 dB. At the 2 kHz spacing, preamp off, it was 88 dB. All told, this performance is *substantially* superior to the PROIII's.

Control Freak

Although the Amateur Radio world has lagged a bit in keeping up with personal computer technology, USB ports have become commonplace over the past few years. The IC-7600 has a front-panel USB A port and a rear-apron USB B port. Connecting a USB cable between the B port and your computer's A port (or USB hub) not only avails PC control of the transceiver but a two-way baseband audio signal path — *very* slick!

For ICOM users, USB connectivity obviates the need to purchase a CI-V level converter for another $130 or so. There's still a CI-V REMOTE jack on the radio's rear apron, however, to enable transceiver operation with another ICOM CI-V equipped transceiver or receiver. For command and control purposes, you can select either CI-V or ASCII code output from the USB serial connection.

Getting up and running with USB port control is not just plug and play, however. You first must download a USB driver from the ICOM Web site. Installing this on my PC was not quite as straightforward as I'd hoped, but this may have had more to do with my unfamiliarity with *Windows Vista* — the operating system on the ham shack laptop.

I also had to download the latest version of *N1MM Logger*, so I had an IC-7600 driver. Curiously, turning the radio off while leaving the PC on routinely caused my computer to change the COM port assignment. I kept IC-7600 parameters in both of the COM ports *N1MM Logger* looked for.

Initially I ran into a brick wall when trying to get my *N1MM Logger* voice files to play via the USB connection while retaining the ability to use the mic and VOX — something that's easy to do with the PROIII, which lacks USB connectivity. To modulate the IC-7600 via the USB, you either can play audio files from your PC via the USB or use the microphone and VOX, but you cannot do both at the same time *unless* your logger's IC-7600 driver includes the correct commands. (The menu also offers MIC,ACC for either as well as just ACC choices; it's also possible to send audio to the IC-7600 via pin 4 of the ACC 1 jack on the rear apron.)

According to ICOM, "Switching between those inputs can be done using a set of our new CI-V commands through the same USB port." The ICOM representative recounted how he was able to toggle those inputs "with no problems at all" using a command testing program.

I'm not sure about the "no problems" part. A semblance of success came only after fiddling with menu settings, entering lengthy macro strings in *N1MM Logger* and reading the help file and the IC-7600 *Instruction Manual*. The end result was an unwieldy CAT command string that — most times — convinced the radio to switch to USB audio input before playing a .wav file, then switch back to MIC audio input when it was done. Given the macro execution delay involved, it's unclear if this fix would work in the heat of a fast-paced contest. This appears to be more of a software issue than a radio issue, and the ICOM rep expressed confidence that drivers in later logging software versions would improve switching capability.

The ACC menu includes provisions to adjust the USB audio input level as well as to enable a squelch (either on or open) for audio output from the radio via the USB connection. It can take a bit of tweaking to balance the various audio levels between the radio and the PC, especially if you're planning to use your logger's voice memories rather than the very nice ones in the radio. The ACC menu also offers three separate selections to modulate for AFSK via the USB connection.

Tone of Voice

A lot of audio tailoring is available for transmit and receive — much more than on the PROIII. You can set a receiver audio high-pass (100-2000 Hz) and low-pass (500-2400) filters in steps for SSB, AM and FM modes. Alternatively, you can make separate TREBLE and BASS settings. For CW and digital modes, you can only set high-pass and low-pass limits. Using this feature on SSB can help to roll off unwanted noise without impairing readability. On the transmit side, you not only can set transmission passbands for WIDE, MID and NAR, but adjust TREBLE and BASS settings for voice modes. After very little tweaking I got uniformly good audio reports while using the IC-7600 with my Heil boom set.

The speech compressor/transmit bandwidth feature has become a bit more complicated to use than it is on the PROIII, although that radio's toggle/press-and-hold system can try your patience. The IC-7600 diverts you away from the front panel to a menu to set both compression level — a front-panel control on the PROIII — and transmit bandwidth preference. Pressing and holding the COMP button accesses this COMP/TBW menu, where you

can select a NAR, MID or WIDE transmit bandwidth preference for the COMP ON and the COMP OFF conditions. (Setting the passband parameters for NAR, MID or WIDE is done via the SET/LEVEL menu, as it is on the PROIII.) The menu includes bar-style compression and ALC level meters for getting the adjustment right on target.

I found even the maximum MONITOR level setting too low to be useful. The monitor's output level also depends upon the setting of the AF control (as on the PROIII), and this can lead to wildly divergent audio levels when switching back to receive.

Scoping Things Out

The spectrum scope is very flexible, much more so than the PROIII's, and the *Instruction Manual* spends eight pages explaining the ins and outs of this feature. In the CENTER mode, the '7600 offers span choices of ±2.5, 5, 10, 25, 50, 100 and 250 kHz. In the FIXED mode, it displays the entire band (or a customized setting), excepting 10 and 6 meters. The more spectrum you're trying to view the more jagged the sweep.

It's possible to display markers for your transmitting, receiving and dual watch frequencies. A number of spectrum scope parameters, including waveform colors and sweep speeds, are menu-settable. You can pick a SLOW, MID or FAST sweep speed for each span selection. I found the narrower span options — 2.5 and 5 kHz — in CENTER mode especially useful while contesting in CW to determine precisely what was going on both sides of my run frequency.

Jots and Tittles

■ Unlike the IC-7700, the '7600 has a main receiver and a sub-receiver. The radio's *Dual Watch* function lets you listen to two signals in the same band at the same time [but combined in a single audio channel, unlike a full sub-receiver function — *Ed.*] — the DX station's transmit and listening frequencies, for example. Some prospective '7700 buyers considered the unit's lack of a sub-receiver as a deal breaker.

■ The IC-7600 "boots up" nearly instantly — no waiting!

■ It's possible to update the radio's firmware via the Internet. The procedure for doing so is essentially identical to the one we described in our IC-7700 review.

■ You must fashion your own external keypad for *direct* (ie, non-menu) access to the voice, CW or digital memories. Alternatively, you can access the voice and CW memories via the USB keyboard using the F1-F4 keys.

■ The radio's AUTO TUNE feature for CW and AM is convenient and useful, especially for the pitch-challenged. Sometimes it was unable to lock on the signal — perhaps because of fading — and would return to where it started (it only tries for two seconds). If you press AUTO TUNE with the RIT on, it changes the RIT frequency, not that of the main dial. This makes sense, I suppose, but the *Instruction Manual* doesn't mention it.

■ When turned rapidly, the main VFO tuning rate will automatically accelerate at AUTO or SLOW rates, or you can disable this feature off altogether.

■ The AGC menu lets you customize the fast, mid and slow parameters for all modes but FM. It does not appear possible to turn off the AGC in FM mode.

■ The '7600 can engage preamps and other features on the AM Standard Broadcast Band (530-1710 kHz) and below (ie, MW and LW). This is a sensitive BC band receiver! I could hear New York City AM stations in Delaware at mid-day.

■ Accessing transmit memories for phone modes remains confusing and awkward. You shouldn't have to consult the *Instruction Manual* simply to record a voice clip. There simply are too many menu screens, and the radio mixes memories for off-the-air recording (VOICE MEMORY) with the transmit memories you'd use in a contest.

■ The '7600's speaker is up-firing and sounds quite good, although setting an accessory (or a second radio!) atop the IC-7600 could muffle the audio.

■ The rear-panel SEND control jack for TR switching a linear amplifier or other accessory offers improved voltage and current-handling capabilities from those of the PROIII. ICOM says the TR control voltage must be less than 16 V dc at 0.5 A with the mechanical relay or 250 V ac at 0.2 A with solid-state switching (a menu selection).

■ ICOM's CAT command set for the IC-7600 still does not include any means to control, clear or even read the value of the RIT/XIT. These are features some ICOM watchers had hoped would appear in the IC-7600's command set. The command set does include instructions to turn the RIT/XIT "quick clear" feature on or off and read its status, however.

■ The RIT/XIT tuning rate is way too leisurely for my taste — about 0.1 kHz per turn on CW, identical to the PROIII's. I'd prefer it to be coarser to minimize twisting.

■ While in CW mode, a readout under the FILTER sub-menu displays the precise CW pitch frequency, eliminating any guesswork.

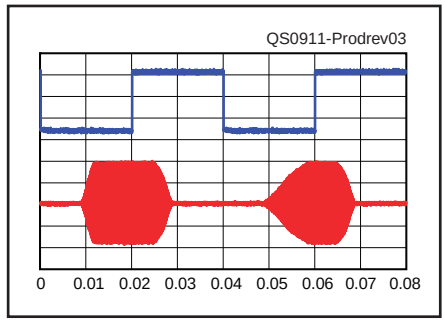


Figure 3 — CW keying waveform for the IC-7600 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

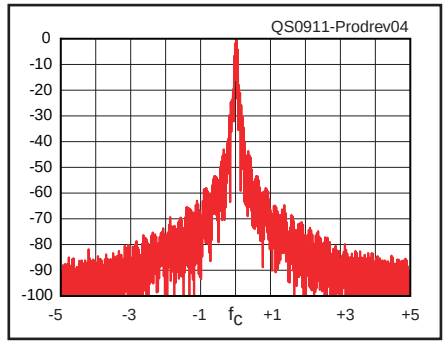


Figure 4 — Spectral display of the IC-7600 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

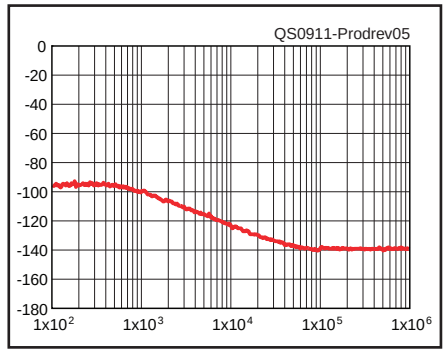


Figure 5 — Spectral display of the IC-7600 transmitter output during composite-noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

My Take

While the jury still may be out as to whether the IC-7600 qualifies as a top-tier transceiver, its frills, feature set and performance alone make it a must-see for serious contesters and DXers, if not for discerning casual operators.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 800-872-4266, fax 425-454-1509, **www.icomamerica.com**.

Update to FlexRadio FLEX-3000 Product Review

In the Product Review for the FLEX-3000 [October 2009, pp 45-51], in Table 1 we reported values for "Second Order Dynamic Range," instead of our usual "Second Order Intercept." While this is valid data, it is not a figure that members are used to seeing. The corresponding second order intercept is +69 dBm with the preamp off and +21 dBm with the preamp on. Further testing proved the figure with the preamp on to be rather poor and lower than we've seen at the Lab for other radios. Upon consulting FlexRadio Systems, they acknowledged the problem and came up with a modification to the radio hardware and software to improve the second order intercept with the preamp on. We received and tested an updated FLEX-3000 at the ARRL Laboratory shortly afterward. Results for the updated radio are shown in Table 2.

Notice that there are now two preamplification levels, instead of the one level in the original design. Both of the new preamp settings have improved second order dynamic range, resulting in higher second order intercept figures. Third order IMD dynamic range also improved considerably with the new preamp modifications.

In the original review, we also reported the reciprocal mixing as "better than 112 dBc." This is the case with AGC on at certain settings. To get a better understanding of how noise from adjacent signals affect the noise floor, we have provided before and after data with the AGC off

FlexRadio Systems has informed us that all FLEX-3000s shipped beginning in September include the preamp modifications. To determine if your FLEX-3000 incorporates the IP2 upgrade, check to see if the TRX board hardware revision is revision G or higher. Open *PowerSDR* and click on SETUP/GENERAL/HARDWARE CONFIG/. Look at the last letter of the TRX serial number. If it is Rev G or later, it indicates the IP2 improvement is in place. Contact FlexRadio if you have an earlier version and you desire to receive this upgrade. It will be provided at no cost.

The provided software contained everything needed to easily upgrade to Power SDR v.1.18.3. The folks at FlexRadio graciously worked with the ARRL Lab to improve their product. It was a pleasure working with them. — *Bob Allison, WB1GCM, ARRL Test Engineer*

Table 2

FlexRadio FLEX-3000, serial number 3109-0286

Test results before and after modification.

Noise floor (MDS), 500 Hz bandwidth:

	Preamp off	*Preamp 1*	*Preamp 2*
14 MHz, before:	–120 dBm	–135 dBm	n/a
14 MHz, after:	–121 dBm	–126 dBm	–135 dBm
Noise figure, before:	27 dB	12 dB	n/a
Noise figure, after:	27 dB	21 dB	12 dB

Blocking gain compression:

Gain compression, 500 Hz bandwidth:

	20 kHz offset	*5/2 kHz offset*
	Preamp off/on	*Preamp off*
14 MHz, before	112/105 dB	112/112 dB
	Preamp off/1/2	*Preamp off*
14 MHz, after	113/111/114 dB	113/113 dB

Reciprocal mixing, 14 MHz

	20/5/2 kHz offset
Before, AGC on:	Better than 112 dBc
Before, AGC off:	91/90/89 dBc
After, AGC off:	91/91/91 dBc

ARRL Lab Two-Tone IMD Testing

	Band/Preamp	*Spacing*	*Input Level*	*Measured IMD Level*	*Measured IMD DR*	*Calculated IP3*
Before:	14 MHz/Off	20 kHz	–23 dBm	–120 dBm	97 dB	+26 dBm
			–14 dBm*	–97 dBm		+28 dBm
			0 dBm*	–13 dBm		+7 dBm
After:	14 MHz/Off	20 kHz	–22 dBm	–121 dBm	99 dB	+28 dBm
			–14 dBm*	–97 dBm		+28 dBm
			0 dBm*	–13 dBm		+7 dBm
Before:	14 MHz/On	20 kHz	–40 dBm	–135 dBm	95 dB	+8 dBm
			–37 dBm	–97 dBm		–7 dBm
After:	14 MHz/1	20 kHz	–27 dBm	–126 dBm	99 dB	+23 dBm
			–19 dBm*	–97 dBm		+20 dBm
After:	14 MHz/2	20 kHz	–36 dBm	–135 dBm	99 dB	+14 dBm
			–27 dBm	–97 dBm		+8 dBm
Before:	14 MHz/Off	5 kHz	–24 dBm	–120 dBm	96 dB	+24 dBm
			–15 dBm	–97 dBm		+26 dBm
			0 dBm*	–13 dBm		+7 dBm
After:	14 MHz/Off	5 kHz	–23 dBm	–121 dBm	98 dB	+26 dBm
			–14 dBm*	–97 dBm		+28 dBm
			0 dBm*	–14 dBm		+7 dBm
Before:	14 MHz/Off	2 kHz	–25 dBm	–120 dBm	95 dB	+23 dBm
			–15 dBm*	–97 dBm		+26 dBm
			0 dBm*	–13 dBm		+7 dBm
After:	14 MHz/Off	2 kHz	–26 dBm	–121 dBm	95 dB	+22 dBm
			–14 dBm*	–97 dBm		+26 dBm
			0 dBm*	–14 dBm		+7 dBm

Second-order Intercept, 14 MHz

	Preamp off	*Preamp 1*	*Preamp 2*
Before:	+69 dBm	+21 dBm	n/a
After:	+69 dBm	+55 dBm	+45 dBm

ADC clipping level (single tone)

	Preamp off	*Preamp 1*	*Preamp 2*
Before:	–8 dBm	–31 dBm	
After:	–7 dBm	–13 dBm	–21 dBm

*IMD level exceeds the threshold of ADC clipping. Single tone clipping reported above. Two tone clipping occurs at –13 dBm.

W1ZR

THE DOCTOR IS IN

Q Dustin, NØDRC, asks: I have two questions regarding ¼ wave ground plane antennas. First I was wondering if I could gain anything by connecting two ¼wave ground planes together via a splitter cable. Second I was wondering if there is a way to get any dB gain or add dB gain to a ¼ wave antenna?

A The short answer is yes. Antenna gain is a matter of redirecting energy — just as with a reflector behind a light bulb. You get more energy in some directions at a cost of less energy in other directions. In the case of a ground plane or a quarter wave monopole, there are two axes to consider.

■ *The horizontal or azimuth direction.* By having multiple monopoles spaced some distance apart and fed in appropriate phase, the energy can be maximized in particular directions around the antenna. A popular arrangement is to feed two monopoles in the same phase, spaced ½ to ⅝ wavelengths apart. The energy will be focused in directions in which the distance to each antenna is the same. The resulting gain in those directions will be from 3 to 4 dB (more than twice the effective power in the desired direction). The configuration is shown in Figure 1 with the azimuth pattern for an HF array ¼ wave above ground in Figure 2.

To feed them in phase, the lengths of coax from the two antennas need to be the same and the impedance of the two in parallel will be around half that from one element with the same length of coax. This is called a *broadside array* and can be made with more than two elements for an even sharper or narrower beam with higher gain.

Another way is to feed them out of phase. By spacing the antennas ½ wave apart and feeding them 180° out of phase, the maximum radiation will be in both directions along the line of the antennas. This is called an end-fire array. By making them ¼ wave apart and feeding them 90° out of phase a pattern in a single direction will result along the line of the antennas. This is a bit more complicated to achieve because the mutual impedances between the antenna elements make it non-trivial to force equal currents into both antenna elements.

■ *The vertical or azimuth direction.* By placing vertical antenna elements above each other and feeding them in phase, a collinear array is formed. The wavefronts from the multiple elements add close to the horizon, providing stronger signals at low elevation angles in all horizontal directions. This can be quite effective for VHF anten-

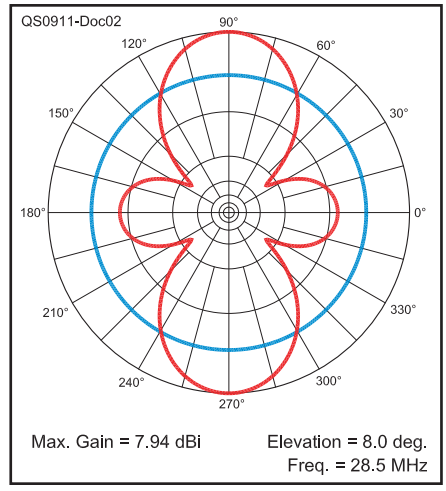


Figure 2 — The azimuth pattern of two ¼ wave ground planes at the same height and fed in phase (red) as shown in Figure 1. This is compared to the omnidirectional pattern of a single ground plane (blue). The two 10 meter ground planes are each 50 feet off the ground and separated by ½ wavelength. The gain achieved in the direction perpendicular to the plane of the antennas (broadside) is predicted by *EZNEC* at more than 4.6 dB, at the expense of much less effective power in some other azimuth directions.[1]

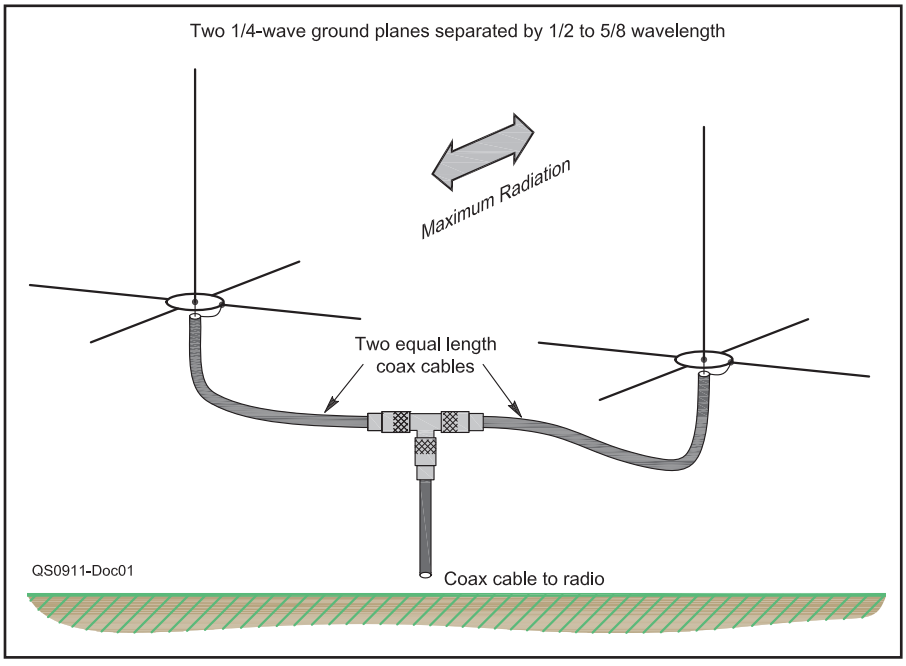


Figure 1 — Two ¼ wave ground planes in phase. The two antennas are fed in parallel through identical lengths of the same type of coax to insure the signals arrive at both antennas in the same phase.

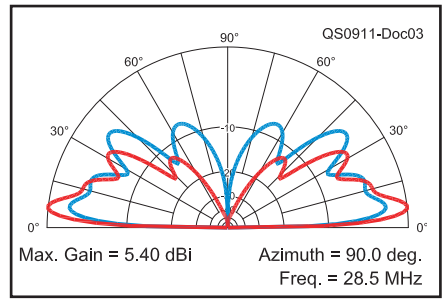


Figure 3 — The omnidirectional elevation pattern of two ¼ wave ground planes, one above the other, fed in phase (red) compared to the omnidirectional pattern of a single ground plane (blue). The bottom 10 meter ground plane is 50 feet off the ground, the higher base ⅝ wave above the lower base. The omnidirectional gain achieved by compressing the signal closer to the horizon is predicted by *EZNEC* at more than 2 dB.

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

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nas on relatively flat ground and for HF DX operation that wants low angle radiation.

Some simple cases are an end fed half wave, as in the J antenna or the 0.625 wave monopole that provides more than 3 dB gain over a single ¼ wave. Both require somewhat more complicated feeding arrangements than a ¼ wave. More sections are possible but somewhat complicated due to the fact that connecting them by transmission lines is difficult since the transmission lines end up in the antenna fields. Some typical results are shown in Figure 3. A study of some of the possibilities was presented in *QST* some time back.[2]

Q Bob, W7WOW, asks: Will a lightning arrestor bleed off the local area ground charge through the antenna, actually reducing the chance of lightning striking the antenna?

A I am not prepared to address the part of your question about "reducing the chance of a strike" since I am not aware that it is well established in science.

In any event, some lightning arrestors will drain off induced charges and some won't, depending on the design. Most arrestor specifications indicate whether or not a dc path is provided for the antenna connection, as well as if a dc ground is provided. The reason that this is an issue is that some transmission lines are used to carry dc as well as RF, typically using a device called a "bias T" to insert and remove the dc for remote switching or antenna tuner power, for example.

Arrestors for such lines typically have a low dc impedance in series with the line and a high shunt dc impedance to avoid interfering with the dc function. Other arrestors are usually designed with a low dc shunt resistance that will bleed off any accumulated charge.

If you don't need to carry dc, it is a good idea to bleed the charges accumulated on the antenna to avoid a shock hazard or an equipment threat. The voltage can get quite high — perhaps high enough to damage a solid state receiver front end — before it gets to the point that the gap fires.

Q Jeff, K7JF, asks: I am setting up my beam antenna for the first time. I understand there is a true north and a magnetic north (or south for the Southern Hemisphere). What is the difference between true and magnetic? For which of the two should my beam be initially calibrated? If magnetic north, how do I know where to set the beam.

A Magnetic north is the direction a compass needle points to, while true north is the direction to the earth's northerly rotational axis point. They are indeed different in most places, and the difference is different for each spot on earth. It also changes slightly over time. The difference is referred to as magnetic variation on nautical charts and as magnetic declination in some other venues.

NOAA's National Geophysical Data Center provides information on the nature of this phenomenon as well as maps showing the correction at **www.ngdc.noaa.gov/geomag/declination.shtml**.

For example, at my station location in Connecticut, in 1981 the magnetic variation was 13° W with an annual increase of 4 minutes. That means in 2009, it should be a bit less than 16°. If you look at the US map on the above Web site you will see that they have it near the –15° line.

In addition to the Web site, you can find your variation on any nautical or aeronautical chart of a location near your station, on any coast and geodetic survey map or by calling your town engineer or building department. To convert magnetic north readings from your compass to true north, subtract if the variation is westerly (negative on the NOAA map), add if easterly.

Conceptually either a true or magnetic reference could be used, as long as you keep track and convert everything to the same basis. All propagation programs that I am aware of give bearings with respect to true north, so I would suggest calibrating your rotator controller to true rather than magnetic bearings.

Q Mike, K3LG, asks: Our group was discussing antenna feeds and wonder why there is no wire antenna in a dipole configuration fed with window line, using a delta match. It seems that it could be used as a simple way to match the balanced feed line to a wire dipole. We understand the fanned section can radiate and might be difficult to adjust to a perfect match, but are there other drawbacks?

A A delta or T match (see Figure 4) has been used many times to connect a balanced line, or feed system to a dipole, or a Yagi driven element, if a match on a particular band is desired. It has the advantage that the dipole wire can be left continuous, and for either match configuration, the center of the dipole can be grounded, sometimes an advantage. Generally, radiation from a properly balanced and adjusted delta match is negligible.

I think the main reason that such matching arrangements are not often seen on wire dipoles is that many users of window line fed dipoles use the configuration because it can be an effective multiband system when used with a wide range tuner at the shack end. By using it with a matching section, it will only work well on the single band that the match is adjusted for.

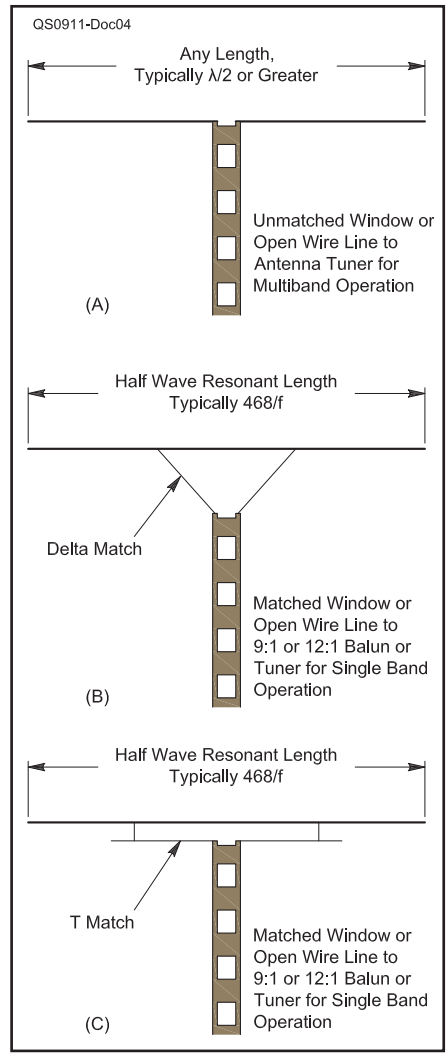

Figure 4 — Matching arrangements for connecting a balanced line to a dipole. At A, the usual center fed dipole feed. At B the delta match and at C a T match. Neither the arrangement at B nor at C requires that the element be cut, and both elements can be grounded at the center. The matches at B and C work best on a single band, while the arrangement at A is often used on multiple bands with an antenna tuner performing the matching function.

◊ *There was considerable interest in my answer [August 2009 column] to NØPNQ's question about a GMT clock for his PC. Bob Craig, K8RC, wrote to say that he is a time hobbyist and has written a* Windows *clock program that also can be used. It will automatically synchronize your computer's internal clock to an atomic clock.* NixieClock *is available at no cost from Bob's Web site at* **www.clockvault.com**.

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

[2]H. Thomas, K6GWN, "A 2-Meter Phased Array," *QST*, Jan 1998, pp 61-66.

SHORT TAKES

Depiction Emergency Management Software

By David Friedman, KE7GOY
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In the winter of 2008, the Snohomish County (Western Washington) Department of Emergency Management declared a widespread flood emergency. The organization I am involved with, MuttShack Animal Rescue and Response, was activated and I became its Disaster Response Director. There was a problem, though: I was in New Orleans on vacation, more than a thousand miles away. Despite the distance, I was still able to fulfill my role thanks to Amateur Radio, the Internet and a software application for *Windows* named *Depiction*.

Answering the "What If?" Questions

Depiction is designed with emergency management and planning in mind. It allows everyday users to build interactive and simulated scenarios by integrating freely-available data with their own custom input. By incorporating information about personnel, resources, and other assets in-place, *Depiction* gives you the ability to modify reality, so to speak, by altering rules and behaviors and seeing the results. "What if the water changes direction or my mobile communications van needs a new route? If I need to move radio operators to locations and still know their assets? If this arterial were blocked, how would I get my team to the hospital?"

Depiction let me plot all of my resources on a dynamic map to get an instant perspective on events. This data can come in a variety of formats, such as publicly available data on repeater locations, JPEG images and area maps, or user-generated text or *Excel* files that contain lists and locations of Amateur Radio operators, ARES/RACES volunteers, SKYWARN observers and other critical volunteers (including a summary of their operating capabilities). *Depiction* placed me on the scene, at least in a virtual sense.

While an Internet connection is needed to download certain data, *Depiction* also works offline with saved data. *Depiction* can download and integrate maps, elevation plots, weather data, "fly over" imagery, situation reports, damage assessments and volunteer movement (from the Automatic Packet/Position Reporting System [APRS]). Then, once critical data has been uploaded, you can take your computer offline and use it in the field as a replacement for unwieldy binders. Best of all, unlike a static paper map, you can position or move resources or objects anywhere within *Depiction* to provide increased situational awareness.

Depiction in Action

Soon after MuttShack was activated for the flooding event, I was able to create a "depiction" of the activity centered on the specific locations. The software quickly aggregated data from the MuttShack volunteer database, ARES/RACES lists, shelters, hospitals, EOC/IC locations and more. Instead of being pushpins on a single image, the volunteers appeared as "elements" in the graphic depiction. The volunteer elements, for instance, have properties that distinguish them on the basis of not only their locations, but also skill sets, credentials, training and equipment – information that is crucial in decision-making related to their deployment. *Depiction* also allowed integration of information from the field via text e-mails that I received from a variety of sources.

Information from the incident command came in via phone and radio relay. This, in conjunction with updated maps from the County DEM, helped me observe the current extent of the event. Talking to my liaison, I was able to locate potential options for staging areas for personnel and animals, as well as shelters. *Depiction's* controls allowed me to zoom in and out of the emergency areas, view multiple layers of information in separate windows, visually distinguish the volunteers based on their skill sets using color-coded mapping and get an overview of the surrounding terrains and crucial evacuation routes.

As I received updates on the resources from the scene, I made recommendations to the Animal Rescue Liaison on the assignment of specific tasks to the volunteers based on their proximity to resources. Based on the reports from the field, I was able to continually update the locations of the volunteers as well as the locations and status of resources. In addition, I was able to respond to emerging conditions on the ground by using the simulation elements of *Depiction* to introduce road barriers and determine alternate transportation routes, and convey them to the teams.

Evolving Software

The makers of *Depiction* are increasingly aware of its potential for use in the Amateur Radio community. They have recently released an add-on that lets users view APRS data and are actively soliciting feedback for further customizations. Trial versions of *Depiction* can be downloaded from their Web site and the full product can be purchased for less than $200.

Manufacturer: Depiction, Inc, tel 425-297-1950; **www.depiction.com**. *$199. APRS Add-On: $19.95. Community volunteer discounts. Minimum system requirements: Microsoft* Windows XP *with Service Pack 2 (SP2) or* Windows Vista*; 400 MHz Pentium Processor (1 GHz recommended); 512 MB RAM, or 1 GB when running on* Vista *(1 GB recommended); up to 570 MB hard drive space (includes up to 500 MB for* .NET *frameworks); minimum display setting of 800 × 600, 16-bit high color (32-bit true color recommended).*

Depiction **displaying information during the winter 2008 storms and flooding in Western Washington. Note how it indicates Red Cross shelters, Amateur Radio operator resources, NOAA weather radar and more.**

NØAX

HANDS-ON RADIO

Experiment #82 — Antenna Height

Ask an experienced ham about antenna height and the answer will often begin, "It depends…" On what? Doesn't an antenna work better higher above ground? Well, it depends! There is such a thing as "too high," believe it or not, and we'll do a quick modeling experiment this month to illustrate why.

Antenna Modeling

In the "good old days" antenna design involved a lot of "cut and try" consisting of cutting the wire or tubing, assembling the antenna and hoisting it into position. Those with access to a test range could actually measure the antenna's pattern. But most amateurs could only evaluate the antenna by patiently conducting comparisons and trying to draw conclusions despite the changing conditions. Today, the personal computer has given amateurs access to sophisticated modeling programs that take a lot of the cutting and trying out of the process — if you were careful in applying the modeling tool.

We're going to make use of one of the most popular modeling programs, *EZNEC* by W7EL, to observe the effects of antenna height above ground.[1] If you already own *EZNEC*, skip ahead to the next section. If not, download the free demo copy of *EZNEC 5.0* from the program's Web site. It's a full featured version of the program, including the help information, but limited in the precision with which it can analyze an antenna. The demo version will suffice for this experiment. If you develop a taste for modeling larger or more complex antennas, you can buy a package with additional capabilities from the same Web site. The ARRL also offers an online antenna modeling course.[2]

The Backyard Dipole

EZNEC comes with a number of prepared antenna models. If you run the program and click the OPEN button (or select FILE, then OPEN), you'll see a list of available model files. The one we're going to work with is called BYDIPOLE (*backyard dipole*). It's an electrical half wave (λ/2) long, center fed dipole, cut for the 20 meter band. Open this file, review the antenna structure and the program's configuration. By clicking the right-arrow (>) next to WIRES, you can see that the dipole is made from 33.43 feet of #12 AWG bare wire, fed in the middle and suspended at a height of 30 feet. Click VIEW ANT to see the antenna and keep this window open as you make changes as a check.

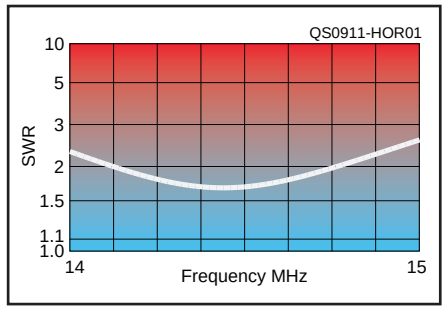

Figure 1 — The SWR curve for the back yard dipole at a height of 30 feet over *EZNEC's* Real Ground. The resonant frequency of 14.46 MHz indicates the dipole is too short.

Click the SWR button and plot SWR from 14 to 15 MHz in steps of 0.02 MHz. By moving the cursor along the curve, you can find the frequency of resonance at which the feed point reactance is zero — 14.46 MHz — out of the band! According to the well-known formula for dipole length, l (in feet) = 468/f (in MHz), the length checks out as 33.43 feet. What happened? The constant 468 in the length formula is an approximation based on a dipole that is higher above ground in terms of its wavelength. Multiplying 33.43 × 14.46 shows that 484 would be more appropriate. Recalculating the wire length as 484 / 14 = 34.57 feet results in resonance at 14 MHz. Find the length for which resonance occurs at 14.175 MHz, the center of the band. (34.14 feet) What is the feed point impedance at resonance? (87 Ω)

There's Always an Angle

Go back to the main *EZNEC* screen, click > next to GROUND TYPE, select FREE SPACE and run the SWR curve again. You'll have to extend the SWR curve below 14 MHz because the resonant frequency drops to 13.8 MHz at which the feed point impedance is 72 Ω. The absence of ground reflection causes the resonant frequency to be lower. The reflection creates an *image* antenna as far below the surface as the real antenna is above ground. This is the same model for the vertical ground-plane antenna, except that the dipole is horizontal and above ground.

The image antenna has two primary effects. The first, as you have observed, is to change the resonant frequency and feed point impedance from the free space values. The second is to create a two element phased array with one element being the real antenna and the image forming the second element. The combination of the fields from both result in the radiation pattern of the antenna.

Figures 2A through 2G show the elevation radiation pattern of the dipole at six electrical heights; from ⅛ through 2 λ. Table 1 shows several measurements for each height. First, the dipole length is shown for resonance at 14.175 MHz along with the l × f constant. The next column shows feed point impedance and SWR at resonance. Finally, maximum gain with respect to an isotropic radiator in free space (dBi) is shown along with the vertical angle at which it occurs. Our simple backyard

Table 1

Variation in Dipole Performance with Height

Height in Wavelengths at 14.175 MHz (feet)	*Resonant Length in Feet (l × f)*	*Feed-point Impedance in Ω (SWR)*	*Max Gain (dBi) at Angle (Degrees)*
⅛ (8.8)	33.0 (467.8)	31.5 (1.59)	7.4 @ 90
¼ (17.4)	32.9 (466.4)	81.7 (1.63)	5.6 @ 62
½ (34.7)	34.1 (483.4)	69.6 (1.39)	7.4 @ 28
¾ (52.0)	33.4 (473.4)	73.4 (1.47)	7.3 @ 18
1 (69.4)	33.9 (480.5)	71.9 (1.44)	7.7 @ 14
1½ (104.1)	33.8 (479.1)	72.0 (1.44)	7.8 @ 9
2 (138.8)	33.8 (479.1)	72.3 (1.45)	7.9 @ 7

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

[2]ARRL online course EC-004, "Antenna Modeling"; **www.arrl.org/cce/courses.html#EC-004**.

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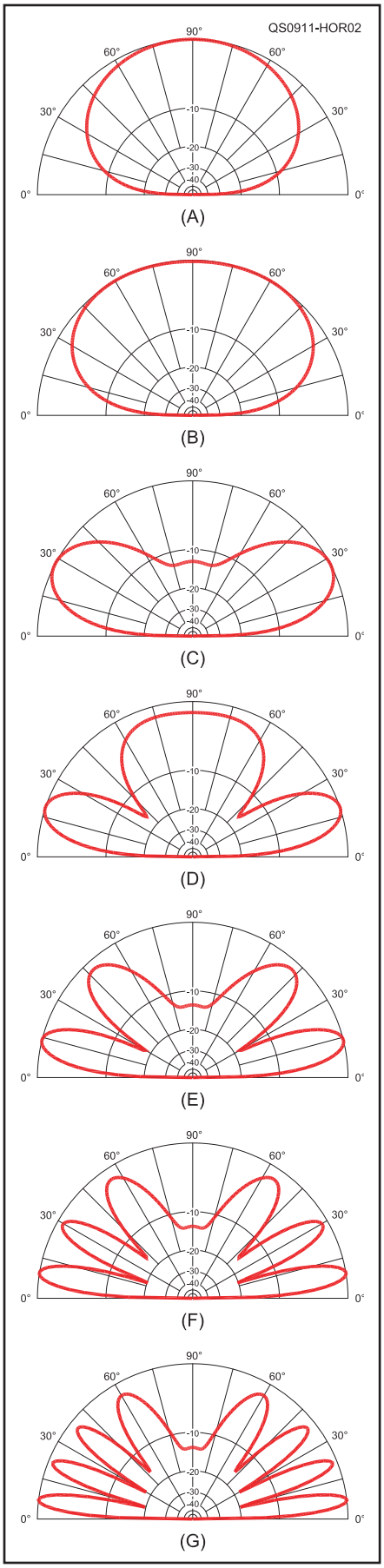

Figure 2 — Six radiation patterns for the dipole at different heights: (A) ⅛ λ, (B) ¼ λ, (C) ½ λ, (D) ¾ λ, (E) 1 λ, (F) 1½ λ, (G) 2 λ.

Antenna Modeling: Boon or Bane?

As anyone who has ever used a computer simulation program knows, pitfalls abound. In fact, while creating Figure 2, the author misentered some parameters, leading to some serious head-scratching about the dipole's surprising behavior! Nevertheless, no one seems to be clamoring for the days before modeling software.

It's important to pay attention to the limitations of any program, usually discussed in the users manuals. Results too good to be true, very different than expected, or that change dramatically with small changes in the design often indicate a problem. Because of modeling programs, antenna design has blossomed in Amateur Radio, one of the most active areas of experimentation and discovery. Skeptics need not fear that the computer will completely displace construction and on the air tests. As W7IUV once said, "I don't think anyone has made an *EZNEC* to *EZNEC* contact yet!"

dipole is a fairly complex antenna!

You can see why using the formula 468/f can lead to a lot of extra antenna trimming — the variation from 466.4 at ¼ λ high to 483.4 at ½ λ high results in a difference of 1.2 feet! The most rapid change takes place between heights of ¼ and ½ λ — about where most hams install a 20 meter dipole. Impedance also varies from 31.5 to 81.7 Ω. As the antenna is raised beyond 1 λ, resonant length and feed point impedance stabilize near their free-space values.

The radiation pattern, however, does not stabilize — quite the opposite! Starting from a low height and radiating mostly straight up, the pattern flattens out until at ½ λ it is radiating mostly at low vertical angles because the signal reflected from the ground cancels the direct radiation in the vertical direction. This would be a good DX antenna, but poor for short skip and regional coverage.

As the antenna is raised to ¾ λ, the reflected energy no longer cancels, creating a large vertical lobe. Even though the main lobe has essentially the same gain and is at a lower angle (18°) than at ½ λ, short-skip high-angle signals would be stronger, creating interference to low angle DX signals. The pattern continues to break up into more and more lobes as the antenna is raised. Even though the maximum gain and vertical angle are very similar above ½ λ, the on air performance of these antennas, especially on a crowded band, would be very different!

Gaining Gain

If you are struggling to hear and be heard through the pileups on 20 meters and are wondering if your dipole would do any better if raised from its present 35 feet to about 50 feet, take a look at Figure 3. The red line shows the difference in gain between the dipole at ¾ λ (50 ft) and ½ λ (35 ft). If the red line is above 0, the higher dipole has more gain.

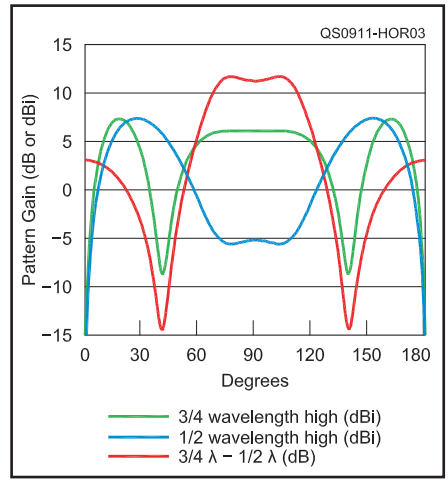

Figure 3 — The difference in gain (red) between the dipole at ¾ λ high (green) and ½ λ (red). The higher dipole has more gain at low angles, but also at high angles.

The higher antenna does have a bit more gain below 22° — a maximum of 3 dB near the horizon. However, in the large range of vertical angles between 22 and 56°, the lower dipole is stronger. And what of the angles above 56°? If you are having trouble with interference from nearby and regional stations, the higher dipole would be a poor choice because it will hear those stations 10 to 12 dB better than the low antenna. Higher is not always better — you would have to raise the dipole to 1 λ or higher before it begins rejecting high angle signals.

Recommended Reading

The best antenna reference for hams is *The ARRL Antenna Book*.[3] For those who want an easier to digest introduction to the subject, the ARRL also offers *Basic Antennas*.[4] There are a number of other excellent books that focus on specific types of antennas or offer collections of designs. Hams love reading about antennas — almost as much as using them!

[3]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**.

[4]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**.

W1ZR

GETTING ON THE AIR

A Closer Look at Window Transmission Line

Joel R. Hallas, W1ZR, and
Bob Allison, WB1CGM

"We've recommended this low loss line many times — but there have been some questions."

Window line, sometimes called ladder line, is very popular with amateurs due to its published low loss and relatively low cost. The low loss, when matched, makes it feasible to use it in unmatched systems without adding significant loss compared to other cable types. Table 1 provides a comparison of matched and unmatched loss for typical window line compared to several popular coax types in both matched and mismatched conditions.

The advantages of window line become clear as glass. The loss of window line, which costs about the same as small coax, is much lower than that of even the much more expensive premium coax. In the matched case, both will provide adequate performance in most HF applications. In the mismatched case, the window line really shines, allowing practical multiband antennas such as the popular center fed Zepp to be operated efficiently.

Of course coax has advantages, too. Unlike window line, coax can be buried (but only if rated for direct burial), coiled and run through metal ducts — all are problems for window line with its fields surrounding the line rather than being inside, as with coax.

Table 1

Loss Comparison of 100 feet of Open Wire, Window and Coax Line Based on *TLW*[1,2]

Line Type	*Matched Loss (dB)*			*Loss with 10:1 SWR (dB)*		
Frequency (MHz)	*3.7*	*14.2*	*28.4*	*3.7*	*14.2*	*28.4*
Open Wire Line	0.03	0.07	0.1	0.14	0.35	0.50
Window Line	0.05	0.1	0.15	0.02	0.50	0.71
RG-8X	0.58	1.25	1.87	2.16	3.95	5.30
LMR240	0.44	0.89	1.27	1.66	3.18	4.01
RG-8	0.39	0.72	1.00	1.50	2.70	3.46
LMR400	0.23	0.46	0.66	0.93	1.93	2.48

[1]*TLW* transmission line analysis software included in and written by 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**.

[2]Note that there are differences between manufacturers' coax in generic types, such as RG-8 and RG-8X. Check manufacturers' specifications to make sure you know what you are getting. Representative types are shown.

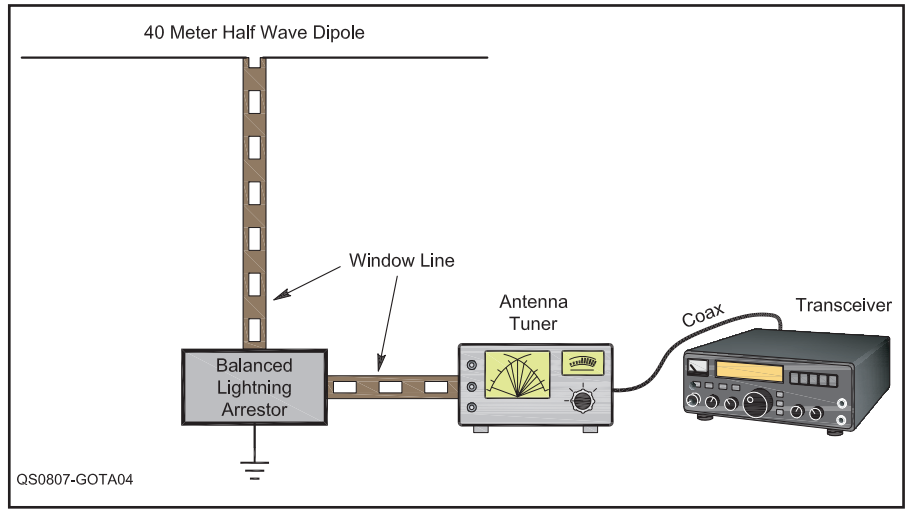

Figure 1 — The center fed Zepp, a popular balanced antenna fed with mismatched window line on multiple bands.

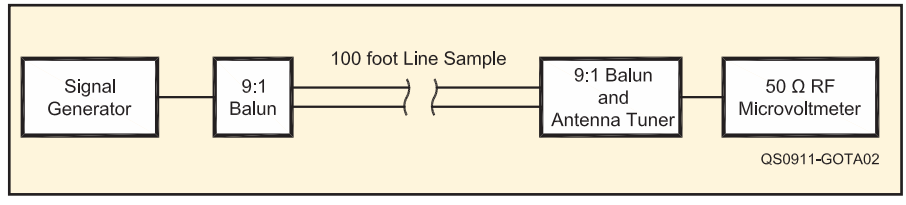

Figure 2 — Test setup used to obtain the data. The generator was an IFR 2041, the RF microwattmeter an HP 437B, the baluns were matched Amidon W2FMI 9:1 HB450 units and the tuner was a discontinued Ten-Tec model 291 pi-network tuner.

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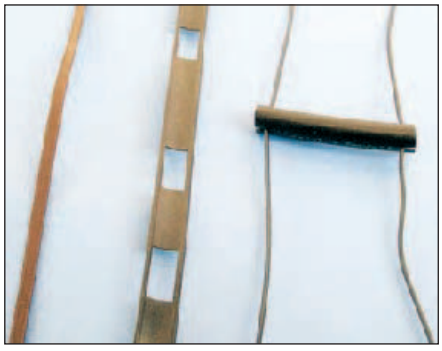


Figure 3 — Comparison of (left to right) TV type 300 Ω twinlead, nominal 450 Ω window line and 600 Ω open wire line.

Figure 4 — ARRL Laboratory Engineer Bob Allison, WB1GCM, recording baseline data with test instruments and back-to-back baluns.

So What's New Here?

So far this is the same story we've told many times. While the case presented is strong, it is all based on specifications for new and dry window line. Unfortunately, outdoor transmission line has a propensity to get both old and wet — what's the story then? W1ZR uses a 100 foot center fed Zepp (Figure 1), and has happily for many years. Changes in tuner settings in wet weather, compared to the recorded (dry) settings, have been noted, indicating that something is happening. If it's just a change in characteristic impedance, he doesn't mind retuning as needed, but if losses are going up, he may have to rethink his choice of line.

In an effort to determine what's happening, your authors decided to run some tests simulating real world weather conditions — at least those in a Connecticut summer. The conjecture was that any changes were most likely due to water (or water and dirt) standing on the web between the conductors. Thus we set up the test system shown in Figure 2 in order to find out.

The test setup made use of calibrated ARRL Lab test equipment, along with various items scrounged from the authors' stockpiles. The nominal 50 Ω test equipment was connected to the line under test via commercial 9:1 baluns while a small pi-network antenna tuner was connected between the load side balun output and the RF microvoltmeter to compensate for impedance variations. In spite of the accuracy of the test equipment, we decided that due to a number of variables in the setup — particularly the possible impedance variations, this test would only be used to note any differences in attenuation between dry and adverse condition versions of the same samples. The differences in dry performance are too small to be noted.

The test samples were three 100 foot lengths of different transmission line:

- True Ladder Line, a modern 600 Ω open wire transmission line with discrete spacers between the conductors rather than a web; see **www.trueladderline.com**.
- A section of nominal 450 Ω window line used for a number of years at W1ZR.
- A section of unused 450 Ω window line waiting for the next project at WB1GCM.

A photo of the two types of line is shown in Figure 3 compared to TV twinlead. Following calibration of the equipment and measurement of balun loss (Figure 4), testing was ready to commence.

The attenuation of each sample was recorded at 3.7, 14.2 and 28.4 MHz; elevated under dry conditions (see Figure 5), lying on dry ground, lying on wet ground and then thoroughly wet down with the hose (Figure 6) to simulate heavy rainfall. For each measurement, the antenna tuner was adjusted to provide the maximum output, just as W1ZR would retune in the rain. In addition, for each case we took measurements without the tuner. We couldn't find a suitable inside location at ARRL Headquarters that had folks willing to be subjected to the simulated rain conditions, so we were relegated to the ARRL side yard.

And the Answer Is...

Our results were interesting, enlightening and somewhat surprising. Our measurement of the dry line agreed with *TLW* predictions within a few tenths of a dB in each case, with or without the tuner. Our conclusions:

- The new and "aged in the woods" windowline showed no statistically significant differences in attenuation.
- Laying about 95 feet of each line on dry ground with typical cut grass resulted in a significant increase in attenuation. This ranged from 3 to 10 dB at 3.7 MHz to 10 to 20 dB at 28.4 MHz. Interestingly, the open wire line had the largest increase, perhaps because the conductors got closer to the ground, not being elevated by the grass. Keep in mind these are matched losses; the loss with a 10:1 SWR would be off the charts. This tends to validate the long-held belief of *QST*'s "Doctor" that running window line near lossy objects or burying it in plastic conduit is not a good idea.
- Repeating the on-the-ground tests on water saturated ground provided an interesting and unexpected, to us, result. The attenuation was virtually the same as the elevated case! W1ZR's hypothesis is that the wet ground is acting more like a conductor than a lossy medium and the individual wires are acting like balanced strip-line transmission lines. The tuner settings between the wet and dry cases were different, tending to support this. This is rather dicey and I don't recommend it without a bit more research.
- To simulate an old piece of line with accumulated contaminants, we took the old piece of line and smeared mud on it for its entire length. Surprisingly, there was negligible difference in loss, although as might be expected, the tuner settings were different than for the "untreated" sample.
- The big answer we were looking for was that no elevated lines had more than around 0.1 to 0.2 dB of additional loss in the simulated rain. The open wire had the least change, as expected, because so little of its dielectric had standing water. The window line did have somewhat different tuner settings when wet, in agreement with the observations at W1ZR. QST

Figure 5 — WB1GCM adjusts the tuner for maximum signal into the microvoltmeter. Results were also taken with the tuner out of the circuit.

Figure 6 — *QST* Technical Editor Joel Hallas, W1ZR, simulates a Connecticut spring shower.

AG1YK

HINTS & KINKS

PIGEONHOLE WORK TOP

◊ Here is a method of working on projects which will enable you to keep up with small hardware and tools. It is a pigeonhole wood frame that rests on your workbench top and performs a number of functions not possible with a normal flat work top (see Figure 1).

The project you are working on is laid on the center front of the frame's dividers, convenient to your hands. You can store tools, parts, solder (I keep four rolls of solder in the bottom left holes) and even a small clamped light to illuminate the work. Note that pliers fit handily in the dividers, as do screwdrivers, knives and even the DVM when mounted on a paint stirring stick with a rubber band. Small equipment, panel meters and PC boards can be placed at an angle convenient for testing and you can temporarily store line cords and meter test leads in any convenient hole.

A few 2 × 6 inch wooden tabs with rubber bands are handy to keep parts visible while working on equipment. Pairs of alligator clips, soldered together back-to-back can be clamped on the dividers to hold wires or components.

A couple of well placed nails in the top of the supporting workbench will keep it from sliding. You can place supports under the far end to tilt the surface or if you prefer a variable tilt, a pair of quarter inch bolts and angle brackets on the sides will suffice. If you need a flat surface, a clip board can be laid on top, using the clip to hold a PC board or diagram.

My pigeonhole work top was bought at a yard sale, doubtless originally designed to hold small beverage glasses when mounted on a wall of a club or meeting room. Laid flat on your workbench, it makes an ideal work surface that keeps control over tools, knives, small parts and everything but the soldering iron, which is kept on the side for safety.

After my garage sale purchase, I found a similar item in the Harriet Carter catalog. It is called a *Shot Glass Curio* and sells for under $20. If you have woodworking skills, mine is constructed from plywood and its dimensions are 20 × 27 × 2½ inches. The depth of 2½ inches seems optimum because deeper would make retrieval of parts more difficult. Each hole is 2⅜ inches square.

It will seem strange at first to work on a "holey" surface, but after a few minutes you will appreciate the greater utility of the uneven pigeonholes. — *73, John Townsend, W4RIZ, 2406 Foxcroft Rd, Wilson, NC 27896*

JOHN TOWNSEND, W4RIZ

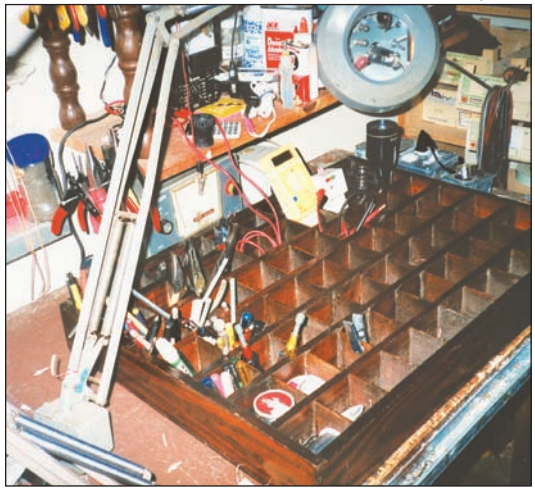


Figure 1 — The pigeonhole frame can hold a multitude of small parts, tools and other workshop sundries, keeping them all in easy reach during a project.

STATION GROUNDING

◊ After a few years' absence from ham radio, I have returned and am in the process of redesigning my test bench and operating desk space. I must admit that in the past I used the daisy chain method for interconnecting the various links in my transmitting and receiving equipment. That includes the usual collection of transceivers, power supplies, antenna tuners, amplifiers and so forth.

With the idea in mind to do away with the daisy chain mentality, I researched various sources and wound up in the "Safety" chapter of my *ARRL Handbook*. In that chapter appears a line drawing illustration showing a ½ inch copper pipe attached to the back of a typical test/operating bench.[1] All of the equipment is grounded through individual braided cabling to the common ground copper pipe.

I needed a method for attaching the pipe to my operating bench. It would seem a simple task to approach, but I was fresh out of practical solutions so I went looking for ideas. My patient spouse, upon hearing about my frantic search, simply pointed up on the living room wall over a front window and asked, "Why can't you use one of those curtain rod holders?"

She essentially "flung" her JC Penney housewares catalog at me and there it was. The catalog lists it as an "Ornamental Drapery Rod Extender Bracket" and carries a part number of R735-5287. [It's an adjustable metal bracket with a curved end (tray) meant to hold a tube. — *Ed.*] I would imagine that there might be a variety of such items available from other drapery stores.

The bracket will extend up to about 6 inches from the wall and has threaded locking screws for holding the curtain rod in place. The tray portion of the extender brackets will accept up to a ¾ inch diameter rod, so our ½ inch copper tubing fits nicely. The user should wrap the copper tubing with electrical tape where it makes contact with the extender brackets as well as the locking screws.

On my operating bench I mount my rig in a shelf array, which was originally intended as a tabletop entertainment center. The open-air arrangement of the shelving assures good cooling for the equipment without going to any great lengths of ducting and so forth. Also, stacking your radio equipment vertically versus "all over the tabletop" gives you a lot more room for your collection of *QST*s.

It consists of a shelf about 19 inches high, about 2 feet wide and about 16 inches deep with one movable middle shelf. This also needs a common grounding device, and a 2 foot length of ½ inch copper tubing was

[1] *The ARRL Handbook for Radio Communications*, 86th Edition, 2009, Figure 3.8, p 3.8.

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

selected for that purpose. The tubing must be attached to the vertical sides of the shelf requiring some variation in the bracketing arrangement. For the shelf, I selected a pair of ½ inch suspension clamps, which come six pieces per pack and are described as a "pipe support system." They are used to hold ½ inch copper pipes onto wall studs or floor joists. The parts can be found in a hardware store. At the Orchard Supply Hardware (OSH) Web site (**www.osh.com**) they are called "Oatey #33914." The pieces are reasonably priced, made of durable plastic material and are predrilled for mounting nails or screws.

Attachment of the grounding braid to the copper tubing is accomplished with ⅝ inch adjustable stainless steel clamps (Orchard Supply Hardware 110000732799854389). I would suggest a minimum opening size of ⅝ inch; the ½ inch clamps don't leave much room for the grounding braid once the clamps are tightened.

Grounding Wire

The *ARRL Handbook* suggests using AWG 6 solid copper wire for connecting the copper pipe to outdoor ground stakes. At the time of my project Hurricane Katrina reconstruction had raised the cost of solid copper wire; for this reason I opted for AWG 6 stranded THHN insulated copper wire. The use of tinned copper braid (in various widths) and/or flat copper strap material has advantages for connecting the copper tube to outdoor ground stakes or cold water pipes.

I prefer the convenience and availability of crimp-on electrical connectors, but I wasn't able to locate any that would accommodate AWG 6 wire. The reader should be aware that higher numbered wire gauges pertain to smaller wire diameters; thus AWG 6 is a much heavier wire than, say, AWG 12. The largest size crimp-on connectors my sources stock is for AWG 12 wire. Thus, some substitution may be in order to use AWG 6 wire in our grounding systems.

A workable substitute for interconnecting AWG 6 wire to another electrical conductor might be Gardner-Bender GSLU-35 Mechanical Lugs (OSH's #0000032076017187). These devices accept AWG 6 through 14 on one end and have a flat lug that will accept a #10 bolt on the other end.

For wire smaller than AWG 6 I suggest Calterm #65654. The package contains five pieces of gold-plated terminals; one end is a crimp-on which will accept an AWG 8 wire, while the other end accepts a ¼ inch bolt. *— 73, Arthur McAlister, KD6SF, 7570 Dartmouth Ave, Rancho Cucamonga, CA 91730-1534*

HOMEBREW TRANSISTOR SOCKET

I recently built a DC40A QRP rig (**www.qrpkits.com**) and installed it in an Altoids tin. I love it. Making contacts with about 1 W while being crystal bound is one of the more exciting ham radio experiences. I also like to play with old gear and recently restored and put a Heathkit DX-60 on the air. A DX-60 was my first "good" transmitter 40+ years ago.

MARTIN HUYETT, KØBXB

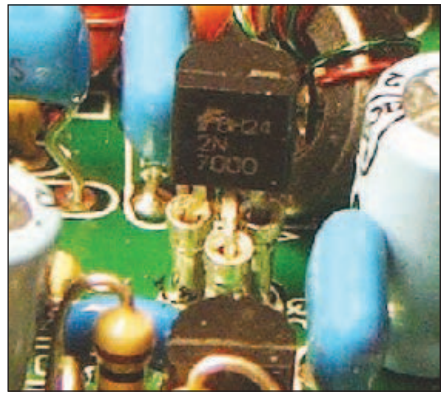


Figure 2 — The DX40A final transistor mounted in the recycled IC socket pins.

Unfortunately, the way I connected antennas, etc I ended up blowing the final 2N7000 FET in my DC40A — twice — and it is a real pain to remove the circuit board from the Altoids tin, remove the blown FET, reinstall one, etc. How I wished for a socket. Then it hit me. I have some old IC sockets around. Carefully using my wire cutters I destroyed one to get the pins. Then I simply soldered three of the pins into the DC40A circuit board (see Figure 2).

Now I can blow FETs to my heart's content knowing the next one will be easy to replace. *— 73, Martin Huyett, KØBXB, 7735 Big Pine Ln, Burlington, WI 53105,* **huyettmeh@tds.net**

While I think Martin is being facetious, this is a point of shack safety. Never operate any transmitter or amplifier without an appropriate load. It only takes a 1 microsecond error to produce many dollars of repairs. *— Ed.*

MORE ON RS-232 TRANSMIT CONTROL

◊ In response to a hint on using RS-232 interfaces for transmitter control, Ralph Dieter, K1RD, wrote in to clarify some issues.[2]

First, he points out that there is no guarantee that the signals will be + or − 6 V. In his experience he often sees +5 and −0.7 V interface signal levels with currents ranging from 40 mA down to 2 mA.

A second item that he points out is that the 1N34 diode is a germanium small signal diode, used mainly in receiver detectors. It typically has a peak inverse voltage (PIV) rating of 60 V. In some cases the inductive kickback generated by a 5 V relay may exceed this value. Your editor reviewed diode data and the 1N4445, a silicon signal diode with a PIV of 100 V, might be a good alternate.

Ralph's third point is that most RS-232 drivers are not designed to source large amounts of current. Your editor did a quick survey of drivers and found that typical source currents varied from 10 to 40 mA.

All in all, Ralph makes some noteworthy points. The bottom line of it all is that if you want to use Scott's circuit in your shack, you do need to do some homework on what the capabilities of your specific interface are and then modify Scott's design to accommodate them.

[2]S. McCann, W3MEO, "RS-232 Transmit Control," *QST*, Sep 2009, p 57.

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

New Products

CRYSTAL RADIO RECEIVER KIT FROM THE XTAL SET SOCIETY

◊ The My Marconi Crystal Radio Kit from the Xtal Set Society tunes the AM broadcast band. It's a double-tuned tank set, and each LC tank consists of a 250 µH ferrite toroid coil and a 365 pF air variable capacitor. The black-and-white front panel graphics are reminiscent of Marconi's Type 106 Radio Tuner. Tank components mount on a 10 × 7 inch hardboard chassis, while the air variable antenna capacitor and posts for a detector diode mount on the 10 × 6⅝ inch front panel. The kit includes chassis, front panel, side rails, metal and nylon hardware, two earphones, two ferrite toroids, a detector diode and capacitors, and an 18 page manual (including schematic and theory of operation). Price: $69.95. For more information, or to order, visit **www.midnightscience.com**.

VOX Populi

Enjoy hands-free hamming using voice operated transmitting.

Steve Sant Andrea, AG1YK

Voice operated transmitting, or VOX, is a system for keying your transmitter using only the sound of your voice. A VOX circuit frees up your hands permitting you to continue your contact, log your contact's name and have a sip of coffee all at once. Sound interesting? Well, you may already have VOX in your transceiver and, so, can start using it immediately — but there are a few things you should know beforehand.

How VOX Works

Sounds simple right? You just talk and the transmitter transmits, stop talking and the receiver switches on. As with all things in the world, the simplicity of the operation belies the complexity of the circuit needed to provide it. How loud do you need to talk? What happens when you take a short pause between words? What about the sound from the speaker? All these factors need to be considered.

Basically, a VOX circuit (see Figure 1) monitors your voice signal from the microphone in parallel with your microphone gain control. This prevents any adjustments you make to the VOX from affecting the quality of your transmitted signal. This voice signal is rectified into a dc voltage (positive, for example), which is proportional to the level of your voice. This dc voltage is fed into a summing circuit. Your speaker's audio is rectified into a negative dc voltage that is also fed to the summing circuit. When the sum of these two dc signals generates a positive output, that output activates a circuit triggering the transmit/receive (TR) relay and activating your transmitter.

For proper operation there are three adjustments you need to set, the VOX GAIN, VOX DELAY and ANTI-VOX. To begin, set the VOX GAIN to its minimum setting, set the ANTI-VOX to its maximum setting, set the VOX DELAY at about 50 percent and activate the VOX mode. Next, set your speaker volume to 0, reduce your transmit power to its minimum and connect your transmitter to a dummy load.

VOX Gain

The VOX GAIN adjustment controls how loud your voice must be at the microphone in order to "trip" the TR relay. To adjust this, place yourself in a comfortable operating position in front of your microphone. Begin talking in a *normal* voice. It is important that you maintain your usual voice level when adjusting the VOX GAIN. Now, while talking into the microphone, slowly raise the VOX GAIN until the TR relay trips and your transmitter is activated. You might want to nudge the gain up just a tweak more to compensate for small variations in your speech volume.

VOX Delay

In normal speech we all have short pauses. To our ears these are natural and we edit them out subconsciously. Unfortunately, electronic switches can't tell the difference between a short pause and the stopping of your transmission. The function of the VOX DELAY is to "smooth" out those natural pauses for the VOX switch in your transceiver. Without it, the TR relay would "chatter" along with every syllable of your voice, chopping your transmission to bits, creating quite a racket in your shack and overworking your TR relay.

To prevent this, the VOX DELAY circuit uses a timer that starts when you first speak into the microphone and holds the TR relay in the transmit position for a certain period *after* you finish speaking. To set the delay, connect your transmitter to the dummy load and begin speaking. Your voice will trip the TR relay. Now stop speaking. The TR relay should remain engaged for a short period after you stop talking and then it should drop out, placing the transceiver back into receive mode. You should adjust the delay setting until the transmitter stays on for less than a second after you finish speaking. The exact delay will depend on your operating style — longer for rag chews, shorter for contests.

Anti-VOX

The anti-VOX prevents sound from your speaker from tripping the TR relay. Note that not all transceivers are equipped with an ANTI-VOX and you may have to readjust your VOX GAIN setting and speak closer to the microphone to compensate for speaker pickup. To set the ANTI-VOX, adjust the speaker volume to a comfortable level and slowly reduce the ANTI-VOX until the transmitter comes on. Now increase the ANTI-VOX until the speaker volume no longer trips the transmitter.

Hamming Hands Free

Now that you have your VOX properly adjusted you can operate your transmitter by simply speaking into the microphone. Your hands are free to do whatever other chores are needed.

One more thing to remember: When you are using your VOX, extraneous noise in the shack or any odd comments you may make to friends or family in the background can trip the transmitter. This can lead to an embarrassing situation. The most famous example of VOX embarrassment was dramatized in the movie *Apollo 13*. Jim Lovell (Tom Hanks) goes into a tirade about Mission Control, only to find that his VOX had been on and he had transmitted the whole thing. So when using your VOX be careful of extraneous sounds or talk as they could become unwanted transmissions.

If you would like to learn more about how VOX circuits work, take a look at Ward Silver's "Hands-on Radio" column in the May 2006 *QST* and Joel Hallas's "Getting To Know Your Radio" column in the February 2006 *QST*.

Steve Sant Andrea, AG1YK, is ARRL Assistant Editor. He can be reached at **ag1yk@arrl.org**.

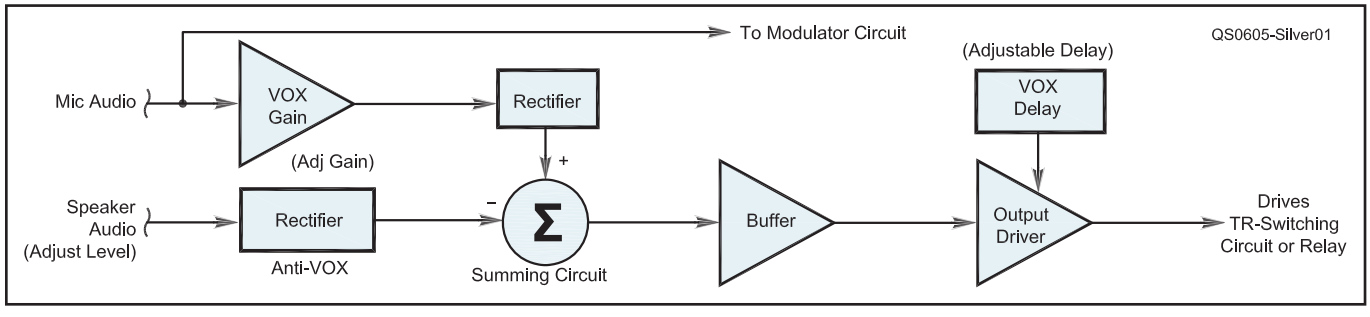


Figure 1 — A block diagram of a VOX circuit showing the VOX GAIN, VOX DELAY and ANTI-VOX controls.

Beijing Hams Donate Equipment to Earthquake Damaged School

Jiao Liangmei, BD1AYL

Zhang Yougui, the vice president of Shuangsheng Primary School, holds the student ham station license.

Tong Xiaoyong, BA1AA, was invited to be first to operate BY8CSS. "CQ CQ CQ this is BY8CSS" was on the air on May 4, 2009 from Shifang.

Sichuan Province is located in the southwest part of China. A terrible earthquake happened there on May 12, 2008. Many hams from different parts of China responded to the disaster area to supply much needed communications support to the stricken area.

A year later, amateurs from both Beijing and Chengdu [the capital of Sichuan Province — *Ed.*] went to the disaster area again to donate equipment for an Amateur Radio station to the students of Shuangsheng Primary School. The school is located in Shifang, much of which was destroyed during the earthquake. The station was issued the call sign BY8CSS and was put on the air May 4, 2009. The members of the Beijing Operators Club and other hams who contributed equipment to the new Shuangsheng Primary School station hope that it will encourage the students to learn more about radio communication and that this knowledge will help them in the future.

Wang Jing, BA1WJ, demonstrates the station equipment for a group of students.

The BY8CSS station license issued by the Chinese government.

Yang Guang, BA8AG, shows some of the students proper operating technique.

All photos are courtesy Jiao Liangmei, BD1AYL.

Jiao Liangmei, BD1AYL, started in ham radio by learning the Morse code in 1958. She operated from BY1PK between 1982 and 1983. Jiao prefers to operate CW at her home station. Her husband Tong Xiaoyong, BA1AA, who was the first chief operator of BY1PK visited both the ARRL and IARU headquarters in the US in 1987. Both of them are retired and are always taking part in ham activities around China. Jiao has two daughters Tong Yu and Tong Sheng but neither is licensed. Jiao can be reached at **jlm@chinahobby.com**.

Observation of Long Delayed Echoes on 80 Meters

The dit heard 'round the world — twice.

Poul-Erik Karlshøj, OZ4UN

I had an extraordinary experience on the evening of January 10, 2009 on 80 meters. While in a contact with EA2IF on 3512 kHz at 1845 UTC I noticed what I at first thought was another station transmitting on my frequency. But I soon realized that it was the echoes of my own signal.

My Setup

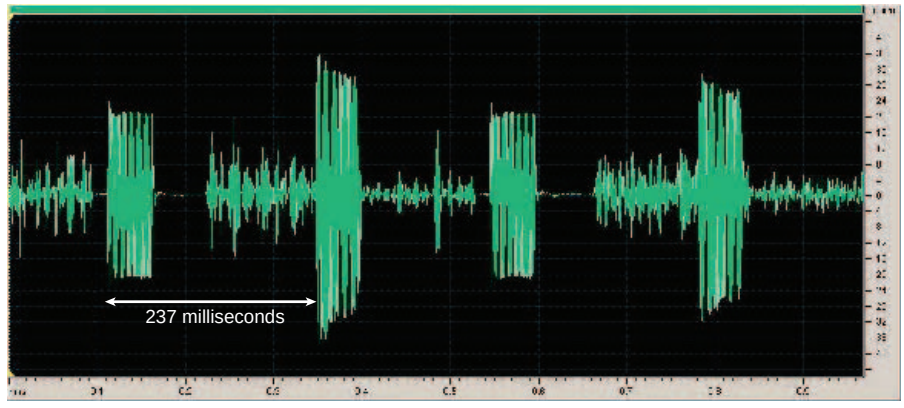
I was using an Elecraft K2 transceiver with 100 W output to an 80 meter circumference loop antenna. The loop is supported by trees in an east-west vertical plane with an irregular somewhat triangular shape. It is fed in the midpoint of the lower wire, that is, the loop is horizontally polarized. The antenna apex is between 12 and 18 meters above sloping ground and performs well on 80 meters, especially to the western hemisphere.

The Echoes

EA2IF did not hear any echoes on my signal and I did not hear any echoes on his signal. Since I realized that this was indeed something unusual I quickly finished the contact and went for the adapter I use for audio grabbing (connecting AUDIO OUT and AUDIO IN on the PC soundcard). I then started searching for more echoes.

The echoes were not present constantly. But from approximately 1845 UTC to 1945 UTC I heard echoes during several periods, the longest and strongest ones being a little over 1 minute long around 1931 UTC. The local time of sunset in Copenhagen on January 10 is 1500 UTC.

Many of the echoes were quite strong, stronger than my sidetone, and their tone was clean. Toward the end of the period OZ7BQ, who lives about 12 km southeast of me, called me. I was testing by sending single dits and he told me that he did not hear any echoes. But while answering him, new echoes started to build up gradually. When I noticed the echoes I stopped my transmission and started sending single dits. Then he could also hear the echoes for about 5 seconds, though not as clear and strong as I received them. I did not hear any echoes on the signal from OZ7BQ, even at a time when my echoes were quite strong. I was sending dits on top of his transmission and heard my echo but not an echo on his signal.



QS0911-Karlshoj01

Figure 1 — This oscillograph shows two dits each followed by an echo delayed 237 ms.

I am now very glad that I recorded the audio from 1927 to 1945 UTC. I have listened to the audio again and again.

Figure 1 shows two dits each followed by an echo (stronger than my sidetone) delayed by 237 ms. The short periods with zero audio level immediately ahead and after the transmitted dit are due to the K2 break-in system, which was set to 40 ms.

I have measured the delay to be 237 ms using an audio editor program (*Expstudio Audio Editor Free* from **www.expstudio.com**). Since the audio editor measures the width of the recorded dit as 52 ms corresponding to a CW speed of 24 WPM (which probably was the speed I was using), I think the value of 237 ms is accurate.

This delay corresponds to 71,100 km of propagation, which is far more than one trip around the Earth, but less than two. At first I thought (with quite some skepticism, though) that it might be a round-the-world echo. But honestly — with just 100 W and operating on 80 meters; it couldn't be true. What also rules out an even wilder echo from two laps around the globe is the fact that there was no echo after 135 ms corresponding to one lap, and furthermore 71,100 km just isn't long enough for a second trip. The break-in delay of the K2 was set to 40 ms, so I should have seen an echo after a single roundtrip, had there been any.

From the Contact with OZ7BQ

Figure 2 shows part of my contact with OZ7BQ January 10, 2009 at 1927 UTC, about 40 minutes after I first noticed echoes. Echoes build up during this transmission and are clearly heard for quite a while before I finally stop (this is very clear on to the recorded audio). The echoes were present for about 1 minute. The transmitted text is in Danish and reads: *Nu er det der igen*, which means "Now it is there again." The echoes are marked by colored circles. Note that after the last letter N, the first echo is the last part after the echo after the "dah" and the last echo is that after the "dit."

What is an MDE?

I must admit that my knowledge of LDEs was limited. Luckily, I had a contact with Vic, W9RGB, on 20 meters 2 days later. He told me that Alan, VE3HX, has a long-standing interest in Long Delayed Echoes. I therefore sent the short e-mail and the audio clips I had already sent to Chris, G4BUE, to Alan, who immediately sent me a lot of information about this phenomenon, which is known as magnetospheric delayed echoes (MDEs).

The phenomenon is described in detail in a *QST* article.[1] I located a more scientific article with the title "Generation of Long-Delay Echoes" that describes the mechanism behind MDEs.[2] A more recent contribution to the subject was given in *RadCom* by Peter Martinez, G3PLX, who has done a great job in setting up transmissions to capture echoes and describing them in statistical terms.[3]

[1]Notes appear on page 73.

On the Internet, you should visit the site **www.vhfdx.net/discuss/lde.html**, which among interesting discussions about LDEs, also has copies of the papers by Villard et al and by Muldrew.

As I am by no means an expert, here is my understanding of the phenomenon, as explained by Don Muldrew:

> There is no doubt that these echoes are due to your HF signal being trapped in an ionospheric/magnetospheric ionization duct. In the ionosphere/magnetosphere tubes of low electron density can exist that are aligned with the earth's magnetic field lines. They are a kilometer or two (in the ionosphere) in diameter and extend all the way along the field line from the F region in one hemisphere to the F region in the conjugate hemisphere. The electron density in the duct is about 1% below the surrounding ambient density. This is enough to trap the MF/HF waves up to about 5 MHz. The F layer critical frequency in the close hemisphere is low enough to let the MF/HF waves through. They travel to the conjugate hemisphere where they are reflected in the topside ionosphere and then return to the starting point.

The Duct

Don discovered the existence of these ionized ducts using data from the Canadian satellites *Alouette 1* and *2* that were launched in 1962 and 1965 respectively. The ionospheric entry point is along the magnetic field line through the transmitter, which makes an angle of about 70° with the ground at my location. I can conclude that my 80 meter loop antenna does not have a very low radiation angle or that only a weak signal is required to receive a ducted echo. Once the signal is trapped in a duct there is no spatial attenuation and absorption due to collisions is almost negligible.

The observed delay time of 237 ms agrees with the theory of MDE. The path length from my location up the magnetic field lines, over the equator and down to the top of a reflecting ionosphere in the southern hemisphere and back again has been calculated by Alan, VE3HX, to be around 227 ms. This is based on a dipole magnetic field that takes into account the difference between geographic and geomagnetic latitude.

Since the Earth's magnetic field is not a simple dipole field, Don has made a more accurate calculation using an accurate magnetic field model. Fortuitously, he calculated exactly the same delay as obtained by observation, that is 237 ms. The error in this calculation is expected to be a few milliseconds because the average propagation velocity would be slightly less than the free space velocity of light, which was assumed and it was also assumed that the signal was reflected at a height of 400 km in the conjugate hemisphere.

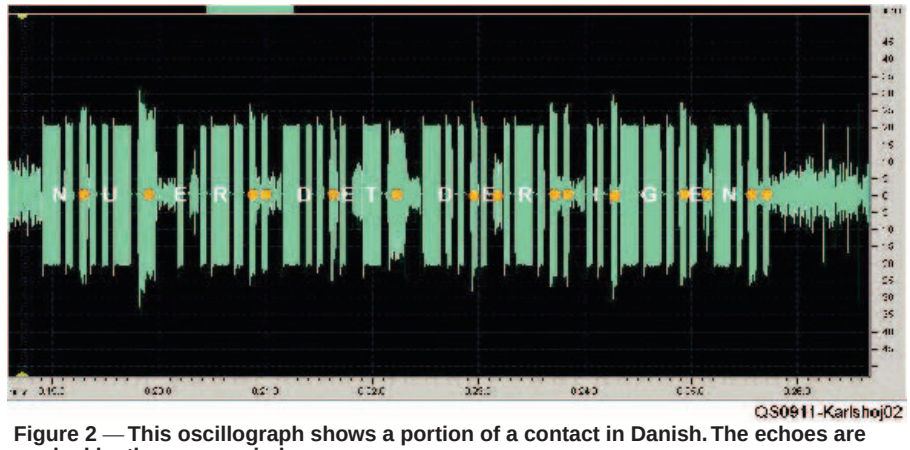


Figure 2 — This oscillograph shows a portion of a contact in Danish. The echoes are marked by the orange circles.

My home near Copenhagen is at 56.0°N, 12.3°E, which is about 55°N geomagnetic latitude. The conjugate point in the southern hemisphere is about 47°S and 13°E in the South Atlantic Ocean.

When do MDEs Occur?

In my early investigation I contacted the Danish meteorology remote station in Danmarkshavn (77°N), because I had been there, knew the people and had an idea that they might have seen something unusual in their radiosonde measurements. Unfortunately, they only launched balloons around 1200 and 2400 UTC and nothing unusual was noted. They did say that around the time I heard the echoes they had observed exceptional propagation in their communication on 4 MHz with Station Nord (82°N) and Mestersvig (72°N). This probably means that the ionosphere was in a very quiet state at the time.

The extensive work done by Peter Martinez, G3PLX, shows that MDEs are primarily found during the period 2000-2100 UTC in the UK (that would be at 1900-2000 UTC in Denmark for the same sun-angle) during the months of December and January. I would expect that they also were more frequent in periods of low solar activity. So it seems that I picked the right time of day, time of the year and maybe also the right time in the solar cycle.

Recommendation

With modern transceivers it is easy to operate fast break-in CW. I recommend you check for MDEs as often as you can. If you normally operate semi break-in then make a quick check with full break-in especially around the times indicated above (4 to 5 hours after sunset) and when you are operating on 80 or 160 meters. Keep some kind of audio recording on standby. The audio grabbing feature in *Ham Radio Deluxe* is very useful and it is free to download. I assure you that if you are lucky to trap some echoes, you will be thrilled. Also, if you have experienced echoes in the past, I would urge you to let us all know, by writing to *QST* for example.

This event on January 10 was the most surprising and exciting I have ever experienced in the 45 years I have been a ham. It is certainly the longest DX I have made on 80 meters or any other band for that matter. Actually, I did observe MDEs again for about 10 minutes on February 1 at 1730 UTC.

An *mp2* and two *wav* audio recordings can be heard on the *QST* binaries site **www.arrl.org/files/qst-binaries**.

Notes

[1]O. G. Villard Jr, W6QYT; D. B. Muldrew, and F. W. Waxham Jr, K7DS, "The Magnetospheric Echo Box — A Type of Long-Delayed Echo Explained," *QST,* Oct 1980, pp 11-14.
[2]D. B. Muldrew, "Generation of Long-Delay Echoes," *Journal of Geophysical Research*, Sep 1979.
[3]P. Martinez, G3PLX, "Long Delayed Echoes," *RadCom*, Oct 2007, pp 60-63.

All images and audio files are by Poul-Erik Karlshøj, OZ4UN.

Poul-Erik Karlshøj, OZ4UN, was born in Denmark in 1945 and was first licensed in 1963. He obtained an Electrical Engineering degree from Tech University of Denmark in 1972 and is presently working as an engineer at TELE Greenland in the field of satellite ground segment and communications. He is mainly concerned with satellite communication between Denmark and Greenland. Poul-Erik is married and has two sons, one living in W6-land. He operates almost exclusively CW and enjoys CW discussions of interesting subjects. Poul-Erik finds unusual propagation exciting. He can be reached at Bagerstræde 12A, 3480 Fredensborg, Denmark, **pka@tek.tele.gl**.

Frequency Measuring Test 2009 — FMT Classic

Budding metrologists take note: The FMT is coming!

BACKGROUND COURTESY KIM HAGAR

H. Ward Silver, NØAX

The Frequency Measuring Test has taken several different formats over the past few years. This year it returns to the "classic" FMT — measuring the frequency of an unmodulated carrier. Accurate frequency measurement is required of all hams for both regulatory compliance ("stay in the band!") and operating convenience, particularly on the new digital modes.

The basic techniques for making carrier frequency measurements are the same as described back in 2002. The FMT announcement for that year gave detailed instructions on how to make them. All previous "how-to" FMT announcements are available for download from **www.arrl.org/fmt**. This page also includes an FAQ (Frequently Asked Questions) list.

You don't need a basement full of sophisticated lab equipment to make a surprisingly accurate measurement. The frequency accuracy of most radios sold in the past decade is specified as ±10 ppm or better. By calibrating your radio to a known frequency reference such as WWV (**www.boulder.nist.gov/timefreq/stations/wwv.html**) or CHU (**www.nrc-cnrc.gc.ca/eng/services/inms/time-services/short-wave.html**) and letting it reach an even, stable temperature, your measurements can be within 1 ppm or even better! (The 2006 FMT announcement includes a sidebar on calibrating your receiver to an over-the-air frequency reference.)

Schedule

The W1AW FMT will run on November 12, 2009 at 0245Z (this is Wednesday evening, November 11, 2009 at 9:45 PM EST). It will replace any W1AW bulletin normally scheduled for that time. It is recommended that participants listen to W1AW's transmissions prior to the event to get an idea of conditions to see which band (or bands) will be best for measurement purposes.

Format and Schedule

The FMT will begin with a general W1AW (QST) call beginning exactly at 0245Z sent simultaneously on two amateur frequencies. The test will consist of 20 second key-down transmissions, followed by a series of Vs, followed by station identification. W1AW will identify before, during and after the transmissions. The test will last for a period of approximately 5 minutes total. The approximate frequencies for the carriers will be:

80 meters 3597 kHz ■ 40 meters 7097 kHz

Thanks to volunteer Mike Fahmie, WA6ZTY, a 40 meter-only West Coast run will follow the W1AW transmissions by 15 minutes, beginning at 0300Z and following the same format as W1AW. The approximate frequency will be 7096 kHz. (See the sidebar about possible changes to the FMT.)

Reporting and Results

Your report should be submitted via the FMT Report form on the FMT Reporting and FMT Results Web site, **www.b4h.net/fmt/index.php**, no later than 2359Z on November 15. Along with your call sign and e-mail address, enter your most accurate frequency measurements on each band and indicate whether you measured the W1AW or WA6ZTY signal. There will be a window to list your equipment, describe the method you used to make the measurements and enter any Soapbox comments. After the entry page has been closed, the Web site will then automatically calculate the measurement error of each report and display the actual transmission frequencies. The information entered by each reporting station will also be displayed as in previous FMTs. (You can read the results for recent FMTs on the W1AW FMT page.) QST

Frequency Measuring Test Update

Watch the FMT home page (**www.arrl.org/w1aw/fmt**) for changes. We are trying to add more stations to improve coverage of the signals. This may result in changes to the transmission schedule and format.

A Club Project?

The regular FMTs make a great club project to demonstrate basic frequency measuring techniques. Hams who might not feel comfortable making measurements on their own can get some hands-on FMT Elmering. *QST* featured the WØBLK club FMT story in the 2007 FMT Announcement as an example of what you can do.

Resolution, Accuracy and Stability

- Resolution is the smallest difference in frequency that can be displayed or measured.
- Accuracy is a measure of how close the displayed frequency displayed is to the actual frequency.
- Stability is the ability to remain at a specific frequency over time.

2009 Teachers Institute Introduces Advanced Satellite Workshop

An earth-bound education about satellite communication.

Mark Spencer, WA8SME
ETP Program Coordinator

In the summer of 2009 the ARRL Education & Technology Program (ETP) offered eight Teachers Institutes seminars for 94 teachers from 30 states. As in the past, Teachers Institutes were held at various venues across the country with sessions in Arizona, California, Florida, Michigan, New Mexico, Ohio and wrapped up with a session at the ARRL headquarters in Connecticut. This increased tempo of offerings was made possible by the addition of instructors Miguel Enriquez, KD7RPP, and Nathan McCray, K9CPO, who joined the author to expand the Teachers Institute instructor team.

The basic Teachers Institute workshop is an intensive 4 day session of professional development training for classroom teachers. It provides them with a foundation in basic electronics, the science of radio, methods for bringing space technology into the classroom, microcontroller programming and basic robotics. This year the space in the classroom unit was expanded for a few previous Teachers Institute graduates who attended an advanced workshop, known as the "TI-2."

Above: The TI-2 participants with their antennas, rotators and Yaesu ground stations — all smiles after successfully completing their first AO-51 contacts. From the left are Kenneth De Lucca, WA3KD; Bob Houghton, AD6QF; Joel Wagoner, N2IAG; Matt Severin, N8MS; Michael Riley, N9LTT; James Fitzgerald, KC8WWJ; Nathan McCray, K9CPO; Miguel Enriquez, KD7RPP and Rod Marty, NA9N.

Miguel Enriquez, KD7RPP, and Jim Fitzgerald, KC8WWJ, make last minute adjustments to prepare their station for the next pass of the satellite.

TI-2: Bringing Satellites to Students

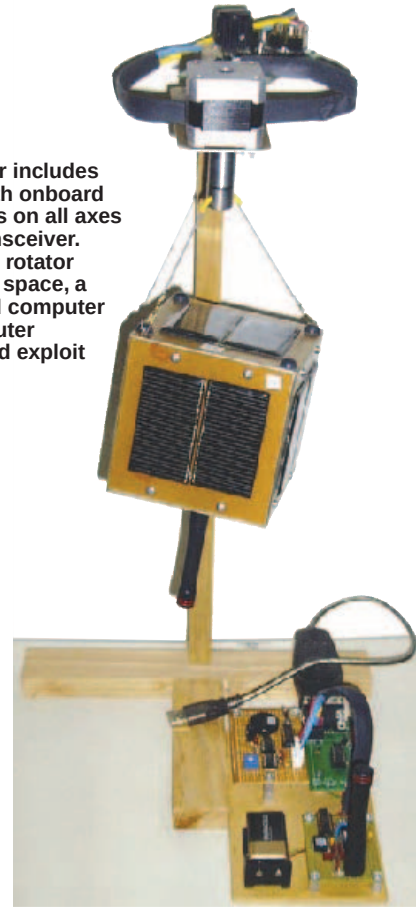
The inaugural TI-2 focused on assembling and integrating the equipment and software required to set up a satellite ground station and on how to operate the ground station to communicate with other hams via ham radio satellites. Then participants learned how to intercept, copy, decode, interpret and use satellite telemetry in the classroom.

An additional goal of this Institute was to test and verify a model curriculum for possible use in future Teachers Institutes. This new curriculum prepares teachers to participate more fully in the Amateur Radio on the International Space Station (ARISS) program, giving them the training to play a more active and pivotal role in the preparation for the ARISS contact (how to assemble and use a ground station) and in the execution of the ARISS contact. The curriculum also offers tools and resources that will allow the teachers to develop a portfolio of space-related activities.

At the TI-2 workshop, each of the participants successfully assembled *their* station. Each participant received the station to take home and set up in their home school — a special thanks to Yaesu and Ham Radio Outlet for their generous support, making the purchase of this equipment affordable. The stations included a Yaesu G-5500 rotator, rotator controller interface, a Yaesu VR-5000 receiver, Arrow antenna and ancillary cables and coax to complete the station.

Once the stations were assembled, each participant successfully completed on-the-air contacts with fellow ham radio operators on AO-51 and AO-27. Finally, each participant successfully copied the telemetry sent from numerous CubeSats. They received instruction in receiving satellite telemetry sent via Morse code and then how to put those new learned skills into

This picture says it all — Matt Severin, N8MS, making a contact on the satellite ground station he assembled — now on to the classroom.



The CubeSat Simulator includes a full size CubeSat with onboard computer, solar panels on all axes and UHF data link transceiver. The system includes a rotator to simulate rotation in space, a telemetry receiver and computer interface, and a computer program to display and exploit telemetry data.

practice to decode the satellite telemetry and understand the satellite system's operational measurements. And the learning is just beginning. Once the satellite system measurements are in the hands of the students, students can graph and interpret what the telemetry is telling them about the health and operating condition of the particular satellite.

CubeSat Simulator

Additionally, a CubeSat Simulator that is being developed through the ETP was unveiled at the TI-2. The CubeSat Simulator is an affordable resource that will soon be made available to schools through the ETP grant program. It is designed to allow teachers to simulate satellite operations in the classroom by allowing the students to "experience" satellite telemetry transmission in either binary format or Morse code to better prepare them for "live" telemetry transmissions from spacecraft.

The Teachers Institute program is one component of the grant offerings within the Education & Technology Program. The ETP makes a variety of resources available to schools and school teachers to help integrate wireless technology into school curricula using ham radio as an educational tool. The ETP is possible only because of the generous donations of individuals and clubs who share in the passion of ham radio.

Was It Worthwhile?

The success of the Teachers Institutes is best told by the participants themselves. Teachers shared these comments:

"I learned a lot more about operating satellites than I expected. It was both interesting and exciting. I am looking forward to my students having this experience."

"If there were one thing I would want my students to take away from my classroom, it would be this kind of resourceful thinking that facilitates problem-solving. I believe Ham Radio is one of the few places where a student can build experience with practical, hands-on problem-solving. TI-2 provided a vehicle for developing that skill as an important added benefit to the excitement of learning about satellites. Thanks to you and to those who made this program possible."

"Thanks for putting TI-2 together for us; I am really excited to get my station up and running at school to share my new knowledge with my kids. Having you to take us through setting up our station step by step saved countless hours of trial and error, and really keeps my motivation and enthusiasm high. I see so much potential for my school as I plan to incorporate this unique tool into my school."

"I also think incorporating the satellite simulator will be a huge plus. I can imagine all kinds of ways to use it if I were still teaching Earth Science. I will be interested to get my hands on one once you are ready for production... I want to see if I can figure out the best way to use it at the Elementary level."

"Like the original Teacher's Institute, I found TI-2 to be a very satisfying experience on both a personal and professional level. I liked that there was an expectation that the participants already had a good foundation in wireless technology. I have been to many workshops where the pace was so slow that my attention drifted. There was absolutely no chance of that happening at TI-2! This was like graduate school for Amateur Radio! The workshop is a great follow-on for TI for teachers who want to further their understanding of orbital mechanics and space communications."

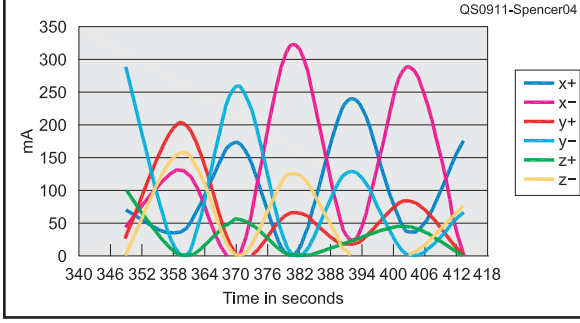
"In a short period of time, I am sure that many of us will probably be looking for other additional things we can do to build on what we learned. For example, I will very soon be trying some satellite packet, and looking into SSTV."

"I am convinced that the NASA Aerospace Education Services Project would benefit from further professional development in the areas of Amateur Radio and electronics. As I have started to read the book that was provided I am amazed at the part amateur radio has played in the spacecraft communications accomplishments. I am also encouraged to spend more time developing my own AR skills and equipment."

"Thanks again for an awesome session. It was everything that I expected."

Now the real work begins — applying what was learned during the Teachers Institutes in the classroom.

Find more information about ARRL's Education & Technology Program at **www.arrl.org/ETP**.



The real value of the TI-2 experience is using the collected information, such as this telemetry plot, in the classroom — hands-on learning.

All photos by Mark Spencer, WA8SME.

Mark Spencer, WA8SME, is ARRL Education & Technology Program Coordinator. He is an ARRL member and holds an Amateur Extra class license. You can reach Mark at 774 Eastside Rd, Coleville, CA 96107 or at **mspencer@arrl.org**.

ARRL Announces the New, Improved Bill Leonard Media Award

At its July 2009 meeting, the ARRL Board of Directors approved some significant changes to this venerable award.

Allen Pitts, W1AGP

Since 1999 when Jeff Holland, former city editor for *The Enquirer-Journal* in Monroe, North Carolina, was named the first winner of the Bill Leonard, W2SKE Professional Media Award, there has been only one award given out each year. The award, which honors the late Bill Leonard, a former president of CBS News, recognizes a professional journalist whose outstanding coverage best reflects the enjoyment, importance and public service value of the Amateur Radio Service.

At the time, printed newspapers were still a main news source. Now there is the Internet, a host of blogs and news sites, audio and video streaming, cell phone alerts, and many more news outlets still in development. The world of media and news reporting has been caught in the rip-currents of technology and it's causing the overnight erosion of old models while creating new opportunities.

While it once was a major accomplishment for an Amateur Radio Public Information Officer (PIO) to get a few column inches in ink, the same positive PR outcomes now can be achieved by placement on community Web sites and inclusion in blogs. In the meantime, video capabilities have become available to almost anyone with a cell phone and ever more media outlets are incorporating video clips into their product.

The ARRL Public Relations Committee recognized that one award, looking at only one medium, was no longer the best fit to the current realities of PR, and the best way to update the Leonard Award was to solicit input from the very professionals who worked in this new media arena. They created a subcommittee of nationally recognized reporters and media managers: Walter Palmer, W4ALT, Chairman and member of the PRC, retired radio and TV broadcaster; Howard Price, KA2QPJ, Director of Crisis Management for the ABC Television Network in New York; Bob Josuweit, WA3PZO, professional writer on Amateur Radio; Ted Randall, WB3PUM, international radio broadcaster; Ian Urbina, Mid-Atlantic Bureau Chief and a National Correspondent for *The New York Times*; Roy Clem, Director of Commercial Broadcast Operations, University of Alabama, WUVA; Bill Colley of WGMD FM; I. J. Hudson, K9ICF, TV journalist from WRC-TV, an NBC affiliate in Washington, DC; Kenneth Venit, adjunct professor of communications at Quinnipiac University in Connecticut, retired TV broadcaster and president of a TV news and talent consulting firm, and Steven D. Kalb, Broadcast Journalism Instructor at the University of Connecticut, Storrs.

Bill Leonard, W2SKE

The subcommittee looked not only at the award itself, but also at ways to make it a catalyst for even more coverage of Amateur Radio topics in the future. Their recommendations were presented to the ARRL Board of Directors this past July. To address both current and coming news modalities, the award was split into three areas:

Audio formats — primarily something you listen to

Visual formats — primarily something you watch

Print and Text formats — primarily something you read

Each category will have an honorarium of $250 for the best selection within that category, but the PRC can also exercise discretion to withhold an award within a category in any given year based on the quality and content of submissions.

Many news outlets have strict rules against reporters receiving any cash or other material prizes from outside sources. What may be a "prize" to one person could be seen as "kickback" to another. So the Leonard honorariums will no longer go to the recipients, but rather to Internal Revenue Service 501[c](3) recognized non-profit organizations of the recipients' choosing. The three recipients will still receive personalized plaques. In this way the recipient can donate the $250 to their favorite charity (or even back to the ARRL). This avoids burdening nominated reporters with any ethics issues.

Wire releases, mailings and advertising/announcements in trade journals will be made to raise awareness of the Leonard Award within the professional journalism community.

The Bill Leonard, W2SKE Professional Media Award

This national level, annual award honors three professional journalists whose outstanding coverages in audio, video and print formats best reflect the enjoyment, importance and public service value of the Amateur Radio Service.

The Award is divided into three categories, each with its own award

- Audio formats
- Visual formats
- Print and Text formats

Nominations are judged by members of the ARRL national PR Committee, and the final decision will be made by the ARRL Board of Directors at their meeting

in January 2010. The winners each receive an engraved plaque, and a donation of $250 will be made in each of their names to the charity of their choice. The deadline for nominations is December 11, 2009.

The award was created as a tribute to the late CBS News President Bill Leonard, W2SKE, an avid Amateur Radio operator.

Rules for Entry

The award is called the Bill Leonard, W2SKE, Professional Media Award.

Each recipient must be a professional journalist in print, electronic media or multimedia. The term "professional" refers to full time, part time, stringers, freelancers and contract journalists. In the case of a group project, the recipient may be the group, but only one prize will be awarded.

The recipients will receive the award based on their work that appeared in the English language and covers the topics of Amateur Radio in (a) an audio format such as broadcast radio or podcasting; (b) a visual format such as television, movie and other video media; (c) print and text format such as newspapers, news Web site, magazine or journal. The scope of the work nominated may be a single story or series. The work must have appeared between December 8, 2008 and December 11, 2009 in a commercially published book, recognized general circulation (non-trade) daily or weekly newspaper, general or special interest magazine (except publications predominantly about Amateur Radio), commercial or public radio or television broadcast (including services delivered via cable), Internet World Wide Web site operated by a generally recognized journalistic organization (for example, newspaper, magazine, broadcast station or network), or multimedia format (for example, CD-ROM), intended for and readily accessible to the general public within the United States.

"Amateur Radio" means the activities of licensees, clubs and other organized groups participating in the activity of licensed Amateur Radio, as governed by Part 97 of the *Code of Federal Regulations*.

The story must be truthful, clear and accurate, reflecting high journalistic standards. The award will be granted to the work deemed the best reflection of the enjoyment, importance and public service value of Amateur Radio. Submission may be by the author of the work, or on his or her behalf by another individual who believes the work merits the award.

The winner will be selected by the ARRL Public Relations Committee. The award will be approved by the ARRL Board of Directors at its January meeting. Individuals on the committee who may be related to or have a professional relationship with any applicant will excuse themselves from the deliberations.

Only one submission per entrant will be accepted. A group award will count as a single entry. Submit completed application form with appropriate work sample:

Audio format: Submit CD with audio file(s) in mp3 format with name of candidate written on each disk.

Visual format: Submit CD with mp4 file or DVD of the work with name of candidate written on each disk.

Print article: Submit clear, easily readable copy of printed text, any related Web addresses and 8.5 × 11 inch sheets displaying the writing *in situ* as it appeared to the public.

The ARRL reserves the right to withhold the awards for any reason, to grant duplicate awards or to disqualify any entry. Incomplete nomination submissions will not be considered. All decisions are final.

Each of the award winners will receive a plaque, and a donation in their name of $250 will go to an Internal Revenue Service 501[c](3) recognized non-profit organization of the recipient's choosing. A winning group entry will receive a single plaque and donation.

Submit entries to: ARRL PR Committee, c/o Manager of Media Relations, American Radio Relay League, 225 Main St, Newington, CT 06111.

Entries may be submitted at any time up to a postmark deadline of December 11, 2009.

For more information about the award, or to obtain a nomination form and the official rules for entry, contact ARRL's Media & Public Relations Department, **apitts@arrl.org**, or call 860-594-0328.

Allen Pitts, W1AGP, is ARRL Media and Public Relations Manager. He can be reached at **apitts@arrl.org**.

What They're Saying about the New Leonard Award

♦"As a retired network television broadcaster, one of the newest members of the League's National PR Committee and a ham of 13 years, I was proud to volunteer to chair the ad hoc committee to study and comment on one of the ARRL's oldest awards. Choosing a blue ribbon team consisting of hams and non-hams, broadcast radio and television consultants, reporters, news directors, a talk radio host, network crisis manager, 3 university professors, a former PR Committee member and the bureau chief of a major newspaper, provided a robust and knowledgeable team. In lively email debate the panel covered a number of award issues which were presented to the League for consideration and action.

"The resulting actions of the Leonard ad hoc committee not only sparked timely updates to the award but proved that interoperability is alive and well within the Public Relations community when it comes to Amateur Radio." — *Walt Palmer W4ALT, Member, ARRL National PR Committee; PIC, Delaware Section*

♦We in Amateur Radio have to face the reality that many of today's reporters are unfamiliar with Ham Radio. The emerging generation of journalists has had cell phone access all of their lives, and many have never had a personal landline. With so many communications alternatives available to younger journalists, it's really not surprising that they have not had exposure to Amateur Radio. This is why the Leonard Award was restructured both to cater to those journalists whose work appears in non-traditional channels, and to encourage them to investigate Amateur Radio and report on it.

Since the Leonard Award is now three awards — video, audio and text — there is triple the opportunity to ignite the interest of a reporter or blogger to talk about Amateur Radio. There is so much material that can be presented to a journalist who hasn't covered Amateur Radio before. Autumn contains many events which can attract their interest: Contests like the November Sweepstakes, SET exercises, JOTA, public service support like walks and marathons. Add to these events profiles of Hams doing interesting modes of operation or other activities, and you have a recipe for coverage. Try sending out one announcement per week now through Thanksgiving about Amateur Radio to at least five reporters/journalists/bloggers/videographers/etc in your area. Include with each release a copy of this article about the Leonard Award. Before you know it, the public will begin to see stories about the many facets of Amateur Radio, and the spirit of Bill Leonard will live on. — *Bill Morine, N2COP, Chairman of the ARRL Public Relations Committee; PIC, North Carolina Section*

FCC to Utilities: Don't Look to Hams to Pay for Your Testing

In a case that goes back more than 10 years, the FCC has told a Pennsylvania utility that the utility is responsible for paying for "efforts to locate and correct instances of [power line] noise." At least one amateur has been complaining to the FCC since before 2000 regarding harmful radio interference, possibly caused by power line equipment that is maintained by Pittsburgh's Duquesne Light Company (DLC).

Bob Thacker, K3GT, of Allison Park, Pennsylvania — a suburb just northeast of Pittsburgh — first noticed harmful interference back in 1996. He told the ARRL that DLC would come out and fix things, but that he would soon hear noise again. After a few years of this, he complained to the FCC, and in 2005, the FCC notified DLC of the complaint. A month later, DLC responded to the FCC, detailing their efforts to resolve the matter and indicated that the most recent complaint was the result of changed conditions, not the continuation of an old problem.

According to the FCC, DLC again communicated with the FCC in a letter dated June 2, 2005, explaining the efforts they had taken to repair three lightning arrestors. During the latter half of 2005 and into 2006, Thacker continued to experience interference and continued to report these instances to DLC, requesting that DLC correct the problems. In 2007, he located a specific pole as one source of noise and advised a Mr Luther of DLC of this fact; Mr Luther advised Thacker that he would submit a work order.

S. KHRYSTYNE KEANE, K1SFA

ARRL Lab Engineer Mike Gruber, W1MG, locates some harmful interference radiating from a power line.

In March 2008, DLC contacted Thacker, indicating that it had swept the area where the suspected pole was located and discovered no noise. Rather, DLC indicated that the noise source was a neon light. Finally, DLC stated that it had spent "significant amounts of time and money" attempting to address his concerns and that DLC would require him to pay for any additional efforts to locate and correct instances of noise.

FCC Special Counsel of Amateur Enforcement Laura Smith responded to DLC in July of this year: "Such a response is not acceptable. Given the fact this case has been ongoing for quite some time without resolution and DLC has had ample time to locate the instances of interference and make the necessary repairs," Smith told the utility, "you are directed to respond to [me] within 60 days of receipt of this letter, detailing what steps you have taken to resolve the remaining instances of interference that are reported as being caused by your equipment. Should the remaining interference problems not be resolved within those 60 days, DLC will be required to provide [me] with a status update every two weeks going forward as to what progress, if any, has been made to resolve the matter."

ARRL Lab Engineer and power line noise expert Mike Gruber, W1MG, was pleased with Smith's decision, and said that amateurs should not be made to pay fees to the utilities to test for harmful interference by the same utilities: "It is not the responsibility of an Amateur Radio operator to track down and get rid of power line noise — that's the utilities' job. I am pleased with the precedent that Laura Smith and the FCC have set here. Now maybe more utilities will take power line noise interference more seriously in the future."

ARRL VICE DIRECTOR ELECTIONS SET FOR NOVEMBER

Responding to solicitations in the July and August issues of *QST*, ARRL members in the Central, Hudson, New England, Northwestern and Roanoke Divisions have nominated 11 candidates for the 10 positions of Director and Vice Director of each of the five divisions. Seven incumbents have been declared elected without opposition, while there will be balloting for Vice Director in the Central and Roanoke Divisions. Ballots will be counted on Friday, November 20, 2009, and those elected will serve three-year terms beginning at noon on January 1, 2010.

The ARRL Ethics and Elections Committee has reviewed and confirmed the eligibility of all 11 candidates and has declared the following re-elected: Central Division Director George R. Isely, W9GIG; Hudson Division Director Frank Fallon, N2FF, and Vice Director Joyce Birmingham, KA2ANF; New England Division Director Tom Frenaye, K1KI, and Vice Director Mike Raisbeck, K1TWF; Northwestern Division Director Jim Fenstermaker, K9JF, and Roanoke Division Director Dennis Bodson, W4PWF. The rules state that if a candidate is running unopposed, he or she shall be declared the winner without balloting. No one from the Northwestern Division requested a petition form for the Vice Director position, so that position will become vacant at noon on January 1, 2010; William J. Sawders, K7ZM, is the current Northwestern Division Vice Director. The ARRL President is empowered by the ARRL Articles of Association to appoint someone to fill the vacant position.

Roanoke Division Vice Director Patricia Hensley, N4ROS, decided not to seek another term. Nominated to succeed her are South Carolina Section Manager James

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

FCC News

♦**FCC Takes Advantage of Social Networking**: In August, the Federal Communications Commission jumped on the technological bandwagon and began "Tweeting," "YouTubing" and blogging. Twitter allows text-based posts of up to 140 characters displayed on the author's profile page and delivered to the author's "followers"; to date, almost 3000 people are following the FCC on Twitter. The FCC's blog — called *Blogband* — is, according to Chairman Julius Genachowski (who made the first post), "part of the FCC's commitment to an open and participatory process. *Blogband* will keep people up-to-date about the work the FCC is doing and the progress we're making. But we want it to be a two-way conversation." The FCC is also on YouTube, and in September joined the popular social networking site Facebook. Find the FCC on Twitter (**twitter.com/fcc**), Facebook (**www.facebook.com/FCC**), YouTube (**www.youtube.com/FCCdotgovvideo**) and the blogosphere (**blog.broadband.gov**).

FCC Chairman Julius Genachowski promotes the FCC in a video that appears on the Commission's YouTube channel.

James F. Boehner, N2ZZ

Hal Turley, W8HC

Howard S. Huntington, K9KM

Kermit Carlson, W9XA

F. Boehner, N2ZZ, of Aiken, and former West Virginia Section Manager Hal Turley, W8HC, of Huntington.

In the Central Division, incumbent Vice Director Howard S. Huntington, K9KM, of Hawthorn Woods, Illinois, is being challenged by VHF/UHF Advisory Committee (VUAC) Chairman Kermit Carlson, W9XA, of Batavia, Illinois.

The policies of the League are established by 15 Directors who are elected to the Board on a geographical basis to represent their divisions and constituents. These 15 Directors serve three year terms, with five standing for election each year. Vice Directors, who succeed the Director in the event of a mid-term vacancy and serve as Director at any Board meeting the Director is unable to attend, are elected at the same time.

Full members of the ARRL in the Central and Roanoke Divisions were mailed ballots in late September. Ballots must be returned so as to be received at ARRL HQ no later than noon Eastern Standard Time on Friday, November 20. The count will be conducted on that date under the supervision of three tellers and a certified public accountant.

NATIONAL SAFETY COUNCIL RESPONDS TO ARRL: NO EVIDENCE OF "SIGNIFICANT CRASH RISKS" WHILE OPERATING MOBILE

ARRL President Joel Harrison, W5ZN, wrote a letter to National Safety Council (NSC) President Janet Froetscher in July expressing the ARRL's concerns that Amateur Radio not become an unintended victim of the growing public debate over what to do about distracted drivers. Froetscher replied in August, saying the NSC does not support bans or prohibitions on the use of Amateur Radios while driving.

Noting that there is significant evidence that talking on cell phones while driving poses a crash risk four times that of other drivers, Froetscher observed that the NSC position calling for bans on the use of cell phones while driving is grounded in science. "We are not aware of evidence that using amateur radios while driving has *significant* crash risks," Froetscher wrote in her letter. "We also have no evidence that using two-way radios while driving poses *significant* crash risks. Until such time as compelling, peer-reviewed scientific research is presented that denotes significant risks associated with the use of amateur radios, two-way radios or other communication devices, the NSC does not support legislative bans or prohibition on their use."

Froetscher said that while "the specific risk of radio use while driving is unmeasured and likely does not approach that of cell phones, there indeed is some elevated risk to the drivers, their passengers and the public associated with 650,000 amateur radio operators who may not, at one time or another, concentrate fully on their driving." She points out that the "best safety practice is to have one's full attention on their driving, their hands on the wheel and their eyes on the road. Drivers who engage in any activity that impairs any of these constitutes an increased risk."

ARRL Chief Executive Officer David Sumner, K1ZZ, said the ARRL "appreciates NSC President and CEO Janet Froetscher's clear statement that the NSC does not support legislative bans or prohibitions on the use of Amateur Radio while driving. We applaud the NSC for taking positions that are grounded in science. At the same time, all radio amateurs should heed her call to concentrate fully on driving while behind the wheel. It is possible to operate a motor vehicle safely while using Amateur Radio, but if it becomes a distraction we owe it those with whom we share the road, as well as to our passengers, to put safety first."

AMATEURS WITH GENERAL CLASS LICENSES ELIGIBLE TO OPERATE IN SOME CEPT COUNTRIES

On September 10, the Federal Communications Commission released a new *Public Notice* implementing changes in Conference of Postal and Telecommunications Administrations (CEPT) reciprocal operating arrangements for US citizens who hold an FCC-issued General, Advanced or Amateur Extra class Amateur Radio license. When an Amateur Radio operator with US citizenship holds an Advanced or Amateur Extra class license, they will continue to be granted CEPT Radio Amateur License privileges in accordance with *CEPT Recommendation T/R 61-01 (as amended)*. There is no change in reciprocity for those license classes. What has changed is that US citizens holding a General class license — who had lost all CEPT reciprocal privileges in 2008 — are now granted CEPT Novice Radio Amateur License privileges in accordance with *ECC Recommendation (05)06 (as amended)*. US amateurs who hold Technician class licenses are not covered under these agreements and as such, are not granted reciprocity.

ARRL Regulatory Branch Manager Dan Henderson, N1ND, said that it is important to note two things about *ECC Recommendation (05)06*: "First, not all European countries have implemented this recommendation. Therefore, a US General class operator does not have reciprocal privileges in many countries, including popular US travel destinations like Italy, the UK or France. Second, as with any reciprocal operation, the band frequencies and privileges are those allowed by your host country — they are not the frequencies and privileges extended by your FCC license. Travelers need to make sure they are familiar with the authorized privileges for the CEPT Novice Radio Amateur License if operating using *ECC Recommendation (05)06* or *T/R 61-01*."

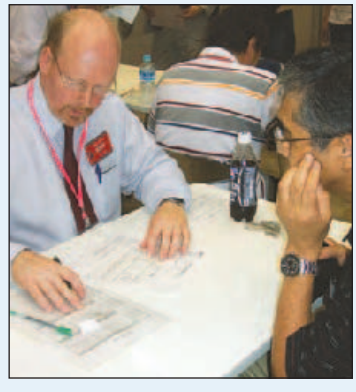
The *Public Notice* states that while operating an amateur station in a CEPT country, the person "must have in his or her possession a copy of [the] *Public Notice*, proof of US citizenship and evidence of an FCC-issued Amateur Radio license." These documents must be shown to proper authorities upon request. A list of which countries that participate in *T/R 61-01* and *ECC Recommendation (05)06*, as well as a link to *Public Notice DA-09-2031*, can be found on the ARRL Web site (**www.arrl.org/news/stories/2009/09/10/11065/?nc=1**).

In Brief

● **HR 2160 Gains Four More Cosponsors**: In September, four more Congressmen — Geoff Davis (R-KY-4), Tom Latham (R-IA-4), Bill Posey (R-FL-15) and Michael Turner (R-OH-3) — pledged their support for HR 2160, *The Amateur Radio Emergency Communications Enhancement Act of 2009*, bringing the total number of cosponsors to 25, including original sponsor Sheila Jackson-Lee (D-TX-18). HR 2160 is also sponsored by W. Todd Akin (R-MO-2), Michael Arcuri (D-NY-24), Roscoe Bartlett (R-MD-6), John Boozman (R-AR-3), Madeleine Bordallo (D-Guam), Bob Filner (D-CA-51), Bart Gordon (D-TN-6), Brett Guthrie (R-KY-02), Maurice Hinchey (D-NY-22), Michael Honda (D-CA-15), Mary Jo Kilroy (D-OH-15), Zoe Lofgren (D-CA-16), Blaine Luetkemeyer (R-MO-9), Thaddeus McCotter (R-MI-11), Charlie Melancon (D-LA-3), Dennis Moore (D-KS-3), Bennie Thompson (D-MS-2), Peter Welch (D-VT), David Wu (D-OR-1) and Don Young (R-AK). For more information on how to encourage your Congressional representative to sponsor HR 2160, visit the ARRL Web site (**www.arrl.org/news/stories/2009/05/12/10818**).

● **IARU, ARRL Officials Attend Ham Fair, GAREC in Japan**: ARRL Chief Executive Officer David Sumner, K1ZZ, attended Ham Fair in Tokyo, Japan, August 22-23, at the invitation of Japan Amateur Radio League (JARL) President Shozo Hara, JA1AN. "Ham Fair is by far the largest event of its kind in Asia. It is generally regarded as one of the 'Big Three' internationally, the other two being Dayton and Friedrichshafen," Sumner said. According to JARL, more than 31,000 people attended the two-day event, with more than 20,000 coming on the first day. IARU President Tim Ellam, VE6SH/G4HUA, and ARRL Membership and Volunteer Programs Manager Dave Patton, NN1N, also were in attendance; while in Japan, Patton received more than 250 DXCC applications. The 2009 Global Amateur Radio Emergency Conference (GAREC) was held in conjunction with Ham Fair, with about 30 delegates from 14 countries present.

DAVID SUMNER, K1ZZ



Dave Patton, NN1N, checks DXCC applications at the 2009 Ham Fair.

SECTION MANAGER NOMINATION NOTICE

To all ARRL members in the Eastern New York, Eastern Pennsylvania, Louisiana, North Carolina, Pacific, San Diego, South Dakota and Virginia sections: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the section concerned. Photocopied signatures are not acceptable. No petition is valid without at least five signatures, and it is advisable to have a few more than five signatures on each petition. Petition forms FSD-129 are available on request from ARRL Headquarters but are not required. A sample nomination form is available on the ARRL Web site, **www.arrl.org/FandES/field/org/smterms.html#sample**.

We suggest the following format:

(Place and Date)

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

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

(Signature___ Call Sign___ City__ ZIP__)

Any candidate for the office of Section Manager must be a resident of the Section, an Amateur Radio licensee of Technician class or higher and a full member of the League for a continuous term of at least two years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on December 4, 2009. If more than one member is nominated in a single section, ballots will be mailed from Headquarters on or before January 4, 2010, to full members of record as of December 4, 2009, which is the closing date for nominations. Returns will be counted February 23, 2010. Section Managers elected as a result of the above procedure will take office April 1, 2010.

If only one valid petition is received from a section, that nominee shall be declared elected without opposition for a two-year term beginning April 1, 2010. If no petitions are received from a section by the specified closing date, such section will be resolicited in the April 2010 *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. Vacancies in any Section Manager's office between elections are filled by the Membership and Volunteer Programs Manager.
— David Patton, NN1N, Membership and Volunteer Programs Manager QST

2009 National Conference on Community Preparedness

The 2009 National Conference on Community Preparedness: The Power of Citizen Corps was held August 9-13, in Arlington, Virginia. This conference was hosted by the Federal Emergency Management Agency's Community Preparedness Division. The conference was open to all who are interested in making their communities safer, stronger and better prepared for all types of hazards.

An ARRL Headquarters representative, WV1X, League members and many Amateur Radio operators were all in attendance and fully participated in the meetings that covered 5 days. Since 2003, ARRL has been an affiliate organization of Citizen Corps, an initiative of the Department of Homeland Security to enhance the public preparedness and safety.

According to the Citizen Corps Web site (**www.citizencorps.gov/nccp**):

> The conference brought together approximately 600 state and local elected officials, emergency management professionals, police and fire services, public health and emergency medical services, non-governmental organizations, private business and industry, advocacy groups and members of the public.
>
> This conference enabled attendees to share best practices on collaborative emergency planning, discuss preparedness outreach and education for targeted populations, learn innovative approaches to funding, hear updates on DHS/FEMA initiatives, get updates on findings from citizen preparedness research, network with other Citizen Corps participants and much more.
>
> The National Conference on Community Preparedness offered over nearly 100 presentations and 160 speakers providing the latest updates and best practices on community preparedness from across the nation.

Workshop Featured Amateur Radio

One specialized training workshop during the conference had an Amateur Radio component. Herbert Cole, AI6AT, the ARRL East Bay Section Emergency Coordinator and Danielle Bell, KI6FYR, presented a talk entitled, "Emergency Communications: Integrating ARES into CERT." This discussion focused on how ARES® works with the San Ramon Valley Citizen Corps Council and how ARES is integrated with the Community Emergency Response Team (CERT) to provide communications for the CERT as well as for the regional and county Office of Emergency Services and beyond.

The presentation explained the role of Amateur Radio as demonstrated during their 2008 Simulated Emergency Test where an earthquake was the featured scenario. "As emergency communications traffic flows from regional ARES nets into the County Office of Emergency Services (OES), this allows the OES to develop an overall picture of the current damage and response."

In addition to his SEC responsibilities in East Bay, Herbert, AI6AT, serves as Emergency Training Coordinator for the Contra Costa County ARES/RACES program and is a Lead Instructor and Division Supervisor for the San Ramon Valley Fire Protection District CERT program. Danielle, KI6FYR, manages the CERT for the San Ramon Valley Protection District. A copy of the presentation may be found at **www.citizencorps.gov/pdf/nccp/CERT_Cole.pdf**.

National Citizen Corps Achievement Award Winner

Congratulations to the Cottonwood Heights Citizen Corps (Utah) for winning the Collaborative Preparedness Planning Award. Roger Kehr, N3AOQ, accepted the award at the National Conference on Community Preparedness on August 11 on behalf of the Cottonwood Heights Citizen Corps. Cottonwood is a town of around 40,000 people that is south of Salt Lake City. Roger explained how Amateur Radio plays an important role for handling communications in the CERT's emergency and disaster response plan.

According to Citizen Corps' Web page:

> The National Citizen Corps Achievement Awards — Celebrating Resilient Communities recognize innovative practices and achievements of Citizen Corps Councils across the nation that are making our communities safer, stronger and better prepared to manage any emergency situation.
>
> Winning Citizen Corps Councils exemplify excellence in community emergency planning, foster successful public-private partnerships, prioritize collaboration, demonstrate creative and innovative local problem solving, and implement sound programs that can be modeled for use by other communities.
>
> Deputy Administrator of FEMA's National Preparedness Directorate Timothy Manning, NEMA Incoming President David Maxwell and IAEM President Russ Decker announced the award winners in each category at a ceremony during the 2009 National Conference on Community Preparedness (NCCP).

STEVE EWALD, WV1X

Roger Kehr, N3AOQ, accepted the Collaborative Preparedness Planning Award on behalf of the Cottonwood Heights Citizen Corps (Utah) at the 2009 National Conference on Community Preparedness in Arlington, Virginia.

Steve Ewald, WV1X ♦ Public Service Specialist ♦ sewald@arrl.org

National Partners Roundtable

National representatives of all the Citizen Corp partners and affiliated organizations were invited to a roundtable to meet one another face-to-face and to help re-establish or begin new working relationships. Steve Ewald, WV1X, represented ARRL at this meeting. This was a chance for all the organizations and groups to explore expectations and to try to define strategies for working together through common goals.

As noted in the Conference Program, "Citizen Corps partners with five national programs which support building capacity for first responders." Those partners include CERT, Fire Corps, USAonWatch (UOW)-Neighborhood Watch, Medical Reserve Corps (MRC) and Volunteers in Police Service (VIPS).

"The Citizen Corps Affiliate Program expands the resources and materials available to states and local communities by partnering with 26 national Programs and Organizations that offer resources for public education, outreach, and training; represent volunteers interested in helping to make their community safer; or offer volunteer service opportunities to support first responders, disaster relief activities, and community safety efforts."

More information on these Citizen Corps partner and affiliated organizations may be found at **www.citizencorps.gov/programs** and **www.citizencorps.gov/programs/affiliate.shtm**.

PREPARATIONS UNDERWAY FOR 2010 WINTER OLYMPICS

Monte Simpson, K2MLS, Assistant Section Manager, Western Washington

Fifty four Amateur Radio emergency communications volunteers from the US and Canada gathered at the Skagit County Department of Emergency Management in Mount Vernon, Washington, on Saturday, June 13, 2009, for communications planning training. The training was provided by the Department of Homeland Security, Office of Emergency Communications for leaders of the Amateur Radio Emergency Service (ARES®), Radio Amateur Civil Emergency Service (RACES), Auxiliary Communications Service (ACS) and British Columbia's Provincial Emergency Program (PEP), Provincial Emergency Radio Communications Service. This training was made possible by Mr Robert Schwent, Washington State Patrol, and Mr Charles Radabaugh, FBI, who co-chaired the 2010 Olympics Communications Interoperability Work Group.

Team leaders invited to this training were from the counties of the State of Washington that are most likely to be impacted by the 2010 Winter Olympics and comprise homeland security regions 1, 2, 5 and 6. These regions are the most northwestern portion of the state of Washington. Vancouver, British Columbia, will be host city of the 2010 Winter Olympics that will be held from February 12-28.

MONTE SIMPSON, K2MLS

Lester Crawford, AB7Y (left) ARRL Emergency Coordinator and Radio Officer of Kitsap County and Christopher McGraw, KB2SKP, Assistant EC for Kitsap County, confer during the training session in Mount Vernon, Washington.

The following Western Washington Section ARES and State RACES leadership also participated in the training: Robert Purdom, AD7LJ, Assistant Section Manager/State RACES Radio Officer; Ken Dahl, K7TAG, Section Emergency Coordinator/Assistant State RACES Radio Officer; Marina Zuetell, N7LSL, Assistant Section Emergency Coordinator for Medical Services; John Rader, AA7ZV, State Emergency Management Division RACES Radio Station Manager.

The training session was comprised of the following topics:

- Introduction to the 2010 Olympics Integrated Interoperable Communications Plan (IICP)
- Introduction to the ICS 205 Incident Communications Plan
- Review of the 2010 Olympics ARES Communications Plan

While the Integrated Interoperable Communications Plan is US specific, the other topics are items applicable to emergency communications leaders in British Columbia and Washington. The 2010 Olympics ARES Communications Plan was prepared to a county level and the British Columbia hams participating were requested to provide input as to how their communications plans can be integrated with the Washington State plan. Paul Peters, VE7BZ, Communications Group Coordinator, Public Safety Department, Cowichan Valley Regional District, Duncan, British Columbia, made a presentation showing how his current communications plan already provides for interoperability with ARES/RACES groups in Washington counties adjacent to southwest British Columbia.

Other British Columbia hams attending the training included Bill Gipps, VE7ISV, RAC Director for British Columbia/Yukon; Onno Onneken, VA7OC, Regional Emergency Radio Representative (RERR), and Leonard McCabe, VE7LHM, Assistant Regional Radio Representative (AERR) from the PEP Southwest Region. Onneken has played an active part in starting and co-chairing the Cross Border Communications Group (CBCG), an informal group of hams from Southwest BC and Whatcom County. The group meets quarterly to discuss ways radio resources can be shared with each other during an emergency or disaster in those areas. The energy and drive of the CBCG lead to the formation of the 2010 Winter Olympics Amateur Radio Emergency Communications Planning Group that has coordinated efforts of EMCOMM groups in Northwest Washington and most recently in Southwest British Columbia.

No tasking has been identified for Amateur Radio organizations during the 2010 Winter Olympics, but leaders from northwest Washington and southwest British Columbia have joined together to proactively prepare for service as needed during the Olympics Games. The mission statement of the group is: "We stand ready to provide interoperable backup communications services to our stakeholders when normal systems are overloaded or have become inoperative."

Those who attended the training would like to acknowledge valuable contributions made by the course instructors: Mr Ross Merlin, WA2WDT, Ms Patti Morris, Ms Julie Stinson.

The ARES/RACES/ACS leaders that attended this session left with some homework to document how their teams will integrate and become interoperable with public safety and emergency management in the event of an emergency or disaster during and after the 2010 Winter Olympics. They will also be working with Assistant Section Manager Monte Simpson, K2MLS, to prepare and hold an exercise prior to the Olympics to apply the skills they have learned. This training was an excellent opportunity for networking by those who attended. SEC Ken Dahl summed up the value of this training by saying, "I have not talked to a single person who was not ecstatic about the presentation in Mt Vernon."

Inquiries regarding the efforts of the 2010 Olympics Amateur Radio Service Emergency Communications Planning Group may be directed to Western Washington Section ASM Monte Simpson at **k2mls@arrl.net**. QST

Strays

COURTESY KEN LINE, W7MHW

ARRL member Caitlyn Line, AE7AT, earned her Amateur Extra class license recently…at age 11. Her Elmer (and grandfather), Ken, W7MHW, tells us that she is on her way to WAS on 20 meters, and also enjoys 6. "She also helps me in putting up antennas," he writes. Caitlyn is a member of the Yavapai ARC.

BILL SHAHEEN, N1CQ

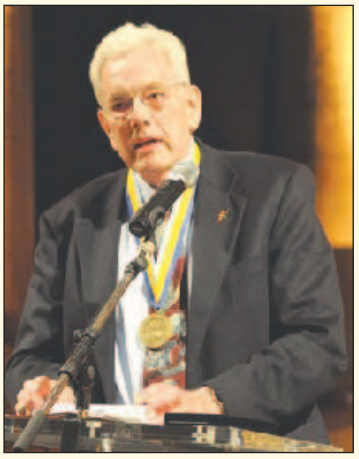
Trout feast: **ARRL Volunteer Consulting Engineer Bill Shaheen, N1CQ, of Granby, Massachusetts, arrived home one day to find an eagle feasting on a trout at 162 feet!**

KEVIN BALMFORTH, N6ER

Show-off! **Someone in Connecticut, perhaps even a member of the ARRL HQ staff, seems to want to let the rest of us know of his or her CW prowess!**

CAL COTNER, K4JSI, RECEIVES PRESTIGIOUS SATELLITE AWARD

BOB PETERS



ARRL member Cal Cotner, K4JSI, of Silver Spring, Maryland, accepts the Aerospace Communications Award from the American Institute of Aeronautics and Astronautics at the International Communications Satellite Systems Conference in Edinburgh, Scotland.

◊Long-time active ham and ARRL member Cal Cotner, K4JSI, was honored recently with the 2009 American Institute of Aeronautics and Astronautics' prestigious Aerospace Communications Award "For meritorious technical and strategic leadership, advancing earth station technology and effectively guiding international cooperation in satellite communications from its emergent years to the present." It was presented "for an outstanding contribution in the field of aerospace communications."

Cal shares the distinction of winning this award with Arthur C. Clarke, famed science fiction writer and the first (1945) to suggest the use of geostationary orbits for communication satellites, and other luminaries.

Cal started his career with ITT Federal Laboratories, nearly 50 years ago, where he worked on early earth station design for the Relay satellite, and also did a number of experiments with moon-bounce communications. After joining COMSAT Laboratories, Cal made pioneering, and key enabling contributions to unattended C-band earth station systems design. These contributions allowed earth stations to operate with significantly reduced staff and costs which, consequently, accelerated the affordability and acceptance of satellite communications. In later years, Cal served as the US Representative on the Technical Advisory Committee to the INTELSAT Board of Directors, an influential post where he helped shape international cooperation in the world of telecommunications.

Now retired, Cal spends his time working QRP CW. — *Nils Jespersen, N3BS*

MOPAR SHOW CAR FEATURES HAM TRANSCEIVER

◊Our show car is a 1970 Plymouth Roadrunner with 440 magnum engine, Hurst pistol grip 4 speed and air grabber hood. With the exception of the engine, it is a "matching numbers" car, meaning that it has all original equipment as originally sold. With an added extra: a Kenwood TM-733A dual band transceiver installed beneath the aftermarket stereo/CD player.

I often get asked "is that a CB?" providing the opportunity to tell them about the benefits of Amateur Radio and how they can become a ham, too. I carry ARRL literature with me just in case. — *Don Carlson, KQ6FM, ARRL Life Member, NV Section EC/ RACES Officer Public Information coordinator/ARRL National PR Committee*

DON CARLSON, KQ6FM

Don Carlson, KQ6FM, wouldn't think of driving his fully restored 1970 Plymouth Roadrunner to a car show without a ham transceiver.

This Month in Contesting

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

NOVEMBER SWEEPSTAKES — THE CROWN JEWEL OF W/VE CONTESTING

As I sit in my office writing this on a beautiful September day, it scarcely seems possible that the November Sweepstakes is upon us yet again. Last year was the 75th running of this venerable event and what a grand time we all had. Participation was the highest in over 20 years, with 3209 logs received from efforts large and small. And thanks to ICOM America, the long-standing Principal Awards Sponsor of Sweepstakes, lots of deserving contesters received a beautiful plaque for their efforts.

If you have never operated SS, you are missing out on one of the truly great on-air events with a deep, rich history in Amateur Radio. Let me walk you through the basics of this great contest.

The November Sweepstakes is split into two weekends, one for CW and one for Phone. The contest is 30 hours long and all stations may operate a maximum of 24 hours. There are six different entry categories (see the sidebar), including a separate category for School Clubs. We'll spend more time on the School Club category in a bit.

Stations throughout the US and Canada are welcome to enter. You get 2 points for every QSO you make and the multipliers are the 80 ARRL/RAC sections. One of the goals of Sweepstakes is to see if you can get a "Clean Sweep" by working all 80 sections in a single weekend. Last year, over 650 Clean Sweeps were made.

The SS exchange is one of the longest in Amateur Radio contesting and has its roots in the early 1930s, when actual messages were sent as part of the competition. The current exchange is made up of the following pieces, in this order:

1. The call sign of the station you're working.
2. A serial number, beginning with 1. This number goes up every time you make a QSO; your first QSO gets #1, your second QSO gets #2, and so on.
3. Precedence, a letter indicating your entry class (A, B, Q, U, M or S).
4. Your own call sign.
5. Check, the last two numbers of the year you were first licensed. If you got your first license in 2004, your check is 04.
6. Your ARRL Section.

Say I'm tuning around and I find NØAX calling CQ. Ward has already worked 147 stations, and I have already worked 136. Ward is class A and I am class B. An SSB QSO between us would sound like this:

Ward: CQ SS CQ SS, November Zero Alfa X-ray.
Me: Kilo X-ray Nine X-ray.
Ward: Kilo X-ray Nine X-ray, number 1-4-8 Alfa from November Zero Alfa X-ray, check 76 Western Washington.
Me: Roger. November Zero Alfa X-ray, number 1-3-7 Bravo from Kilo X-ray Nine X-ray, check 82 Connecticut.
Ward: Thanks. CQ SS from November Zero Alfa X-ray.

Sweepstakes Precedences

A = Single Operator, Low Power (<150 W)
B = Single Operator, High Power (<1500 W)
Q = Single Operator, QRP (<5 W)
U = Single Operator, Unlimited
M = Multioperator
S = School Club

Spotting assistance is allowed for U, M and S categories. No spotting assistance is allowed for A, B and Q categories. U, M and S stations may all run up to 1500 W and are not subdivided based on power.

On CW, it would look like this:
Ward: CQ SS CQ SS NØAX
Me: KX9X
Ward: KX9X 148 A NØAX 76 WWA
Me: R NØAX 136 B KX9X 82 CT
Ward: TU NØAX SS

Pretty easy, once you get the rhythm. Send your exchange information only once; do not repeat elements of the exchange (NUMBER 1-3-7, THAT'S 1-3-7, ALFA, ALFA etc). Remember, this is a contest and efficient use of time is critical. If a station misses a part of your exchange information, they will ask you for a repeat.

The School Club Category

For over 10 years, there has been a separate category in Sweepstakes exclusively for clubs that are associated with a school. This category has traditionally seen low numbers of entries; an average of 17 during Phone SS and only 6 for CW. As a result, many certificates and plaques go unclaimed; in fact, several Sections have *never* had a School Club entry. Think of all those Section and Division-level records that are waiting to be claimed! If your school has an Amateur Radio club, SS is one of the great ways to get club members united for a common purpose and have a lot of fun at the same time. If you're a current student, faculty or staff member of a school, I encourage you to read the rules on the School Club category in the official SS rules and get your club involved in Sweepstakes this year. Call or e-mail me if I can answer any questions.

Changes to the 2009 Event

We've received many reports that participants want results faster. Beginning this year, we're going to try to meet that request. We are aiming to have a PDF of SS scores on the ARRL Web site in only 60 days. This will be just the scores; the contest analysis and commentary will still appear around May and June in *QST* and online.

To meet this deadline we need to receive logs sooner. **Logs will now be due 15 days after the contest. For CW, logs must be at ARRL by 0300Z Tuesday, November 24. For SSB, the deadline is 0300Z Tuesday, December 8.** We are strongly encouraging all applicants to submit an electronic Cabrillo-formatted log. Paper logs will never be turned away, but they slow the data processing down considerably. If you are knowledgeable in submitting electronic logs, please consider helping your fellow club members that are less experienced in Cabrillo to submit their logs. The ARRL Contest Web site will have guidelines and templates available to assist you in submitting an electronic log. Again, we will never turn away a paper log, but electronic logs make the job of getting results faster much easier.

Sweepstakes is a lot of fun for a lot of reasons. See if you can work 100 QSOs and qualify for a participation pin. Maybe a cross-town rivalry with a friend or other club members is in order. Can you work a Clean Sweep? Maybe you can take top honors in your Section. Or maybe you just want to get on and work on your code speed and your operating skills; copying the SS exchange will do wonders for your ability to handle traffic for public service, EmComm or other facets of Amateur Radio. However you look at it, participation in Sweepstakes leads to the same result: Fun!

In the November/December "Contesting 101"

Mistakes. The smart ones learn from their mistakes; the wise ones learn from the mistakes of others. Kirk Pickering, K4RO, gives you the top 10 rookie mistakes in contesting and how to avoid them. Contesting 101 can be found in the *National Contest Journal,* published six times per year. For subscription information, visit **www.arrl.org/ncj**.

Operating Tip of the Month

*"**Laying a trap":** Many rare multipliers in SS don't call CQ — they "search and pounce," and often with a pattern. If you are tuning the bands and hear a new multiplier that isn't running their own pileup, try going up a few kHz and call CQ yourself. There are good odds the station you need started at the bottom of the band and is working their way up."*

CONTEST CORRAL

in association with the *National Contest Journal*

NOVEMBER 2009

Start and Finish	HF	VHF+	Contest Title	Phone	CW	Digital	Exchange	Sponsor's Web Site
Nov 7, 0000Z - Nov 8, 2400Z		2.3G+	ARRL EME Contest	✘	✘	✘	Both call signs, sig rpt, acknowledgement	arrl.org/contest
Nov 7, 0600Z - Nov 8 1800Z	3.5-28		IPA Contest	✘	✘		RST and serial or "IPA" and state	www.ipa-rc.de
Nov 7, 1200Z - Nov 8, 1200Z	1.8-28		Ukranian DX Contest	✘	✘		RST and serial or Ukraine oblast	www.ucc.zp.ua
Nov 7, 1700Z - Nov 8, 0500Z			Radio Club of America QSO Party	✘			RST, QTH, name, equipment	www.radioclubofamerica.org
Nov 7, 2100Z - Nov 9, 0300Z	1.8-28		ARRL November Sweepstakes		✘		Serial, category, call, check, ARRL sec	arrl.org/contest
Nov 7, 2100Z - Nov 9, 0300Z	1.8-28		Collegiate ARC Championship		✘		See ARRL Sweepstakes	www.collegiatechampionship.org
Nov 8, 0900Z - Nov 8 1700Z	3.5-28		High Speed Club CW Contest		✘		RST and MSC member nr or "NM"	www.dl3bzz.de/html/hscconte.html
Nov 8, 1100Z - Nov 8, 1700Z	28		DARC 10-Meter Digital "Corona"			✘	RST and serial	www.darc.de/referate/ukw-funksport
Nov 14, 0000Z - Nov 15, 2400Z	3.5-28		Worked All Europe DX Contest			✘	RST and serial (see Web for QTC rules)	www.waedc.de
Nov 14, 0000Z - Nov 14, 2359Z	1.8-28	50,144	FOC Bill Windle QSO Party		✘		RST, name, and FOC number if member	www.firstclasscw.org.uk
Nov 14, 0700Z - Nov 15, 1300Z	3.5-28		Japan International DX Contest	✘			RST and JA prefecture or CQ Zone	jidx.org
Nov 14, 1200Z - Nov 15, 1200Z	1.8-28		OK-OM DX Contest		✘		RST and serial or OK/OM district	okomdx.crk.cz
Nov 14, 1400Z - Nov 15, 0200Z	1.8-28	50	Kentucky QSO Party	✘	✘		RST and serial or KY county	www.wkdxa.com
Nov 14, 1900Z - Nov 16, 0500Z	1.8-28	50-440	CQ WE (Western Electric)	✘	✘	✘	Call, name, Bell QTH, yrs of svc (see Web)	cqwe.cboh.org
Nov 21, 0000Z - Nov 22, 2359Z	1.8-28		Mongolia DX Contest	✘	✘		RS(T) and CQ Zone	
Nov 21, 1200Z - Nov 22, 1200Z	3.5-28		LZ DX Contest	✘	✘		RST and ITU Zone or LZ district	lzdx.bfra.org
Nov 21, 2100Z - Nov 23, 0300Z	1.8-28		ARRL November Sweepstakes	✘			Serial, category, call, check, ARRL sec	arrl.org/contest
Nov 21, 2100Z - Nov 23, 0300Z	1.8-28		Collegiate ARC Championship	✘			See ARRL Sweepstakes	www.collegiatechampionship.org
Nov 21, 2100Z - Nov 22, 0100Z	1.8		RSGB 1.8MHz Contest		✘		RST, serial, UK district	www.vhfcc.org/hfcc
Nov 29, 0000Z - Nov 30, 2400Z	1.8-28		CQ WW CW		✘		RST and CQ zone	cqww.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 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

■ **State QSO Party this month:** Kentucky
2009 is the Year of the State QSO Party! Visit **www.arrl.org/ysqso** for details!

■ **ARRL November Sweepstakes (CW = November 7-9, SSB = November 21-23):** See this month's column for all the reasons you should participate in this excellent event!

■ **Japan International DX Contest, Phone (November 14-15):** The world points their beams to JA and works all they can hear. Non-JAs send a signal report and CQ Zone. See how many Japan prefectures (states) you can work!

■ **CQ World Wide DX Contest, CW (November 29-30):** The biggest CW contest on Earth. Everybody works everybody in this 48 hour extravaganza. An excellent contest to work on that rusty fist, as the DX will simply be too plentiful to pass up.

Sweepstakes Reminder!

2009 November Sweepstakes logs are due within **15 days**, not 30 as in the past. Logs must be at ARRL HQ by:

CW — 0300 UTC Tuesday, November 24

SSB — 0300 UTC Tuesday, December 8

Questions? E-mail **contests@arrl.org**.

NOVEMBER 2009 QUALIFYING RUNS

♦ W1AW Qualifying Runs are 9 AM EST Wednesday, November 4 (1400Z) (35-10 WPM) (and 7 PM EST Tuesday, November 17 (0000Z November 18). The West Coast Qualifying Run will be transmitted on 3590 and 7047.5 kHz by station K6YR at 9 PM PDT Wednesday, November 11 (0500Z November 12). Unless otherwise indicated, code speeds are from 10-35 WPM.

2009 ARRL 10 Meter Contest

0000 UTC Saturday, December 12 – 2359 UTC Sunday, December 13

- Get in on the 10 meter fun, even at the bottom of the sunspot cycle!
- Work stations throughout North America as well as DX.
- Technicians can operate from 28.3-28.5 MHz.
- Don't miss this chance to work stations on one of the great HF bands!

MIRKO HOLTE, DJ1AA

Complete rules may be found at **www.arrl.org/contests**.

Logs must be postmarked no later than 2359 UTC Tuesday, January 12, 2010.

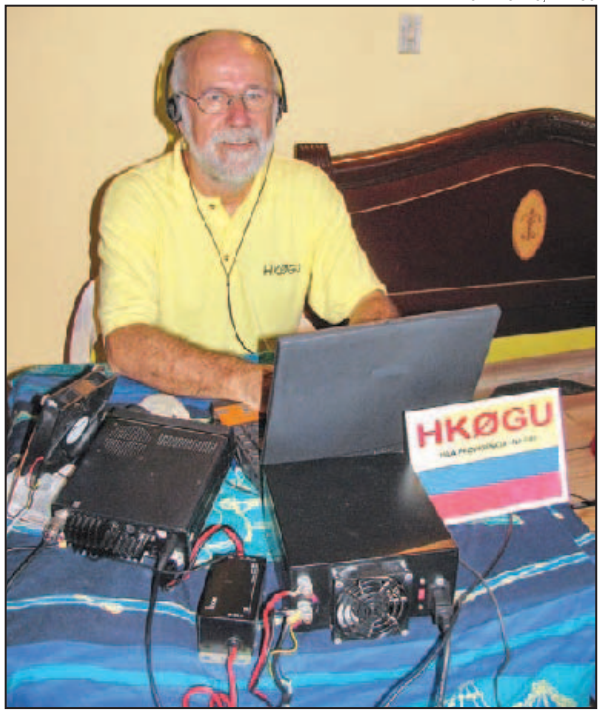
Send electronic Cabrillo-formatted logs to **10meter@arrl.org**.

Paper logs to ARRL 10 Meter Contest, 225 Main St, Newington, CT 06111.

NASA/US GEOLOGICAL SURVEY

2009 ARRL 160 Meter Contest

GERD UHLIG, DL7VOG



2200 UTC Friday, December 4 – 1600 UTC Sunday, December 6

- Top Band is Top Dog this December weekend! Stations will be out in force working as many ARRL/RAC sections and DX countries as they can.
- No room for a 160 antenna? Use an antenna tuner and load up what you have! Many 160 meter QSOs have been made with small antennas and 100 W!

Complete rules may be found at **www.arrl.org/contests**.

E-mail Cabrillo-formatted electronic logs to **160meter@arrl.org**. Send paper logs to ARRL 160 Meter Contest, 225 Main St, Newington, CT 06111. *All logs must be postmarked no later than 1600 UTC Tuesday, January 5, 2010*.

W3UR

HOW'S DX?

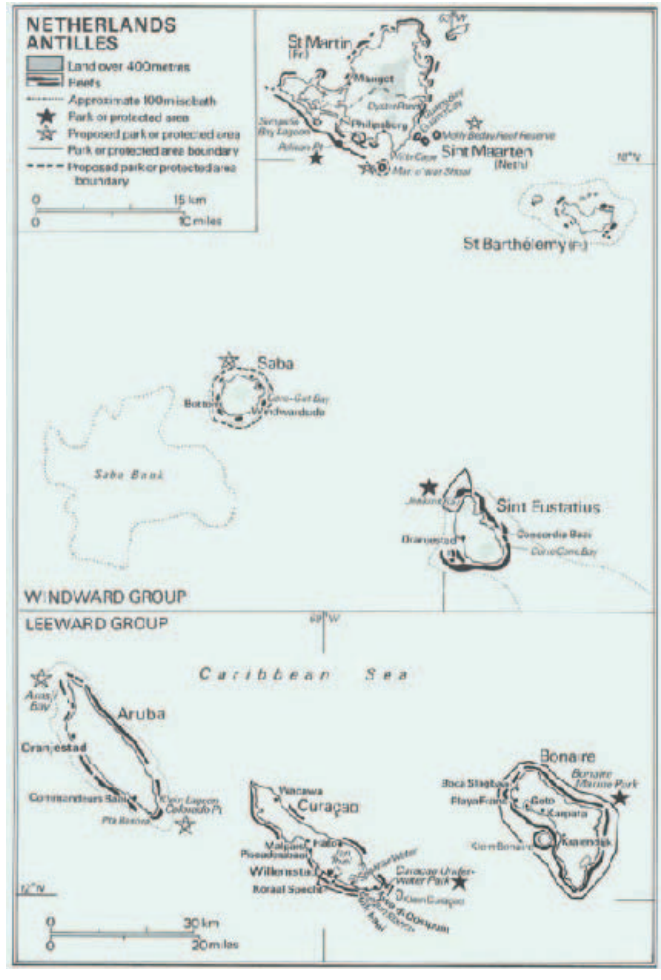
The Dissolution of Netherlands Antilles and the Creation of as Many as Four New Countries

The July 16 edition of *The Daily Herald* (an online news source based in Philipsburg, St Maarten) reported "St. Maarten (PJ7) and Curaçao (PJ2) are destined to become countries within the Dutch Kingdom by October 2010 as long as the criteria set by the Dutch government are met." The expected date is October 10 or "10/10/10." The Netherlands Antilles, which currently includes Curaçao (PJ2), Bonaire (PJ4), St Maarten (PJ7), Saba (PJ6) and St. Eustatius (PJ5), would then "cease to exist," as both St Maarten and Curaçao would become two new countries "in the Dutch Kingdom" with the "Dutch public entities — Bonaire, St Eustatius and Saba (BES Islands)" emerging.

The news of the dismantling of the Netherlands Antilles (PJ) is stirring up some questions. Now before I go on let me just state that we have been down this road before regarding the independence of Curaçao and St Maarten, which could be pushed back yet again. I would also point out it is still a little early to know exactly what is going to happen. Having said that, here are my thoughts on what will probably happen based on the information we currently know about the Netherlands Antilles.

First off, here is a little DXCC history. The original postwar (WWII) DXCC list had Netherlands West Indies PJ (Netherlands Antilles) listed. This included the islands of Aruba, Bonaire, Curaçao, St Maarten, Saba and St Eustatius. In the May 1955 issue of *QST* the DXCC Desk announced the separation of the PJs, which would take effect on July 1, 1955, but was backdated to the beginning of DXCC — November 15, 1945. This was because of the distance between the two groups of islands. This was well before the 225 mile (now 350 kilometer) rule. So there were two Netherlands Antilles DXCC Entities — one in North America listed as "St Maarten, Saba, St Eustatius" and the other in South America listed as "Aruba, Bonaire, Curaçao." On January 1, 1986 Aruba gained its independence and was added to the ARRL DXCC list as a new country. Aruba was assigned the P4 prefix by the ITU.

So as of January 1, 1986, through today, there were/are still two PJ DXCC entities.



With the recent news, we now know the plans to eliminate the Netherlands Antilles, which is made up of the islands of Bonaire, Curaçao, St Maarten, Saba and St Eustatius. This is expected to take place on October 10, 2010. If this happens then both PJ island groups would most likely be deleted from the DXCC list, as this was the original reason for adding them to the DXCC list. There will no doubt be two new DXCC entities (countries). They will be Curaçao and St Maarten. Just because they claim and will be recognized by the Kingdom of the Netherlands as separate, however, does not mean they would automatically be added to the DXCC list. Something else needs to happen.

Most likely Curaçao and St Maarten will not become members of the United Nations. It will probably take several months for the two islands to obtain a new prefix from the ITU. More than likely, the United States Department of State will recognize the change and add both Curaçao and St Maarten to their "Dependencies and Areas of Special Sovereignty" list (**www.state.gov/s/inr/rls/10543.htm**) just hours after the expected 10/10/10 date. You will notice I did not even mention the UN's Nonself-Governing Territories list (**www.un.org/depts/dpi/decolonization/trust3.htm**), which is also part of rule 1C, as this list has not been changed since 2002. As the true blue DXers know any one of the above scenarios will put Curaçao and St Maarten on the ARRL DXCC list.

But what about the remaining BES Islands? I believe more than likely we will see the following happen. Bonaire, St Eustatius and Saba are clearly more than 350 km away from mainland Netherlands (PA), so this qualifies under rule 2 b i. That makes three new countries. But wait! What is the distance between St Eustatius or Saba and the distant Bonaire. St Eustatius and Saba are less than 30 km apart, so they will both count as the same DXCC Entity. Bonaire is just over 800 km from St Eustatius and Saba. So that would be another DXCC counter.

So again I want to reiterate that this is just my opinion based on the information as we know it as of this writing. It looks to me as though we will have four new counters and two deletes. The deletes would be PJ2/PJ4

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— Netherlands Antilles, which includes the islands of Curaçao and Bonaire in CQ Zone 9 (South America) and PJ5/PJ6/PJ7 — St Eustatius, Saba and St Maarten in CQ Zone 8 (North America). The new ones look to be Curaçao, St Maarten, Bonaire and Saba and St Eustatius. Obviously, the final decision will come next year and will be made by the ARRL Membership and Volunteer Programs Department.

Table 1

Call Sign	Island	IOTA	Dates	QSL via
P29VCX	Tanga	OC-102	October 22-26	SM6CVX
P29VLR	Green	OC-231	October 27-31	SM6CVX
P29NI	Woodlark	OC-205	November 2-9	G3KHZ

Afterwards, SM6CVX will continue on to three more islands of Papua New Guinea. They are:

Call Sign	Island	IOTA	Dates	QSL via
P29VCX	Hastings	OC-117	November 11-13	SM6CVX
P29VCX	D'Entrecasteaux	OC-116	November 13-14	SM6CVX
P29VCX	Loloata	OC-249	November 15-16	SM6CVX

They have a Web site with complete details at **www.425dxn.org/dxped/p29_2009**.

DX NEWS FROM AROUND THE GLOBE

3V — TUNISIA

Members of the Rhein Ruhr DX Association (RRDXA) have announced plans for the CQ World Wide CW DX Contest from Tunisia. German ops DJ7IK, DL9USA, DJ8NK and DJ9CB will be joining up with 3V8SS and possibly other operators using special call 3V3S. This will be a multi-single effort.

3W — VIETNAM

Sigi, DL7DF, has announced his team will be operating from Phu Quoc Island (AS-128), Vietnam in November. Joining him will be DK1BT, DL4WK, DL5CW and DL7UFR. They will be QRV on 1.8 through 28 MHz on CW and SSB and one station on RTTY, PSK31 and SSTV. As of press time they did not know their call sign. The dates will be November 4 to 17. They have a Web page at **www.dl7df.com/xv/index.html**. QSL via DL7DF either direct or via the DL QSL bureau.

5R — MADAGASCAR

Eric, F6ICX, is heading back to Madagascar and plans to be QRV again as 5R8IC. He'll be operating from Saint Marie Island (AF-090) from November 17 to December 15. Look for him on 3.5 through 28 MHz. QSL via F6ICX.

9G — GHANA

An Italian team is heading to Abokwa Island (AF-084), Ghana in November. The team met and has released more details of their November 13 to 27 operation. The operators will be I1HJT, I2YSB, IK1AOD, IK2CIO, IK2CKR, IK2DIA, IK2HKT and IZ2CHO. They will be operating from both the island and mainland. 9G5XX will be used on Abokwa and 9G5TT from the mainland. Operations from the island are expected to be on 20 meters only. "The time of operation on the island will be planned day by day, pending the sea condition and weather forecast." Look for them to be QRV from the mainland on 3.5 through 28 MHz on all modes. Their license does not cover 1.8, 5 or 50 MHz. They have a Web page with details at **www.i2ysb.com/index.php?option=com_content&task=view&id=89&Itemid=185**. QSL via I2YSB.

CEØY — EASTER ISLAND

There has been a change of call signs for the late October early November Easter Island (CEØY) DXpedition, headed up by SQ8X and SV2KBS. Originally the two were going "to be QRV as CEØY/homecall from October 31 to November 15." They have announced that they will be using special call XRØY. Joining the "lightweight" DXpedition team will be NI1L, CE6TBN, PA3C and SP7HOV. They have secured special permission from the Radio Club de Chile for activity on 10 MHz and so the team will be concentrating on 30 meters, especially toward Europe. They also have a Web site at **http://rapanui2009.org/**. The team plans to "announce exact QSL routes" shortly.

CYØ — SABLE ISLAND

The October 19 DXpedition to Sable Island by NØTG, AA4VK and WA4DAN is "being placed on hold." NØTG's son, Carter, part of the KP5 expedition of 1992, has developed kidney cancer that has spread to his lungs. The team appreciates the support and prayers that "will strengthen this family and successfully bring all through this trial." The Web site, **www.CY0dxpedition.com**, is being left up and updates on Carter's progress will be added from time to time, as well as plans to reschedule the CYØ operation. Randy says, "Our hope is that Carter will beat this disease and be able to join us at Sable Island."

FK — CHESTERFIELDS

TX3A on Chesterfield Island, a "two-man show" by AA7JV and HA7RY, will focus on the low bands, as they have in the past in their upcoming November 23-December 6 operation. Look for the possibility of FK/AA7JV and FK/HA7RY before and after that timeframe. Remember this is their DXpedition and they plan a serious effort on the low bands. No need for anyone to complain if this group doesn't operate enough on the higher bands! They have a Web site at **www.TX3A.com**.

GD — ISLE OF MAN

Tom, GM4FDM, and Ronald, PA3EWP, have announced their plans for a mini expedition to the Isle of Man. The two will be QRV as GD4FDM and MD/PA3EWP from November 6 to 9. "The guys will be concentrating on CW on the LF bands and GD4FDM will do some RTTY," says Tom. They will be QRV from Alex's, GD3UMW, QTH. QSL GD4FDM via GM4FDM and MD/PA3EWP via PA7FM.

P2 — PAPUA NEW GUINEA

Allan Mason, VK2GR (H44MA, ZK1GGR), will be working for Australian Doctors International (**www.adi.org.au**) on an assignment in Kiunga (QI03pv), Western Province, Papua New Guinea between now and the end of December 2009. He will be QRV in his spare time as P29CW. This is a re-issued call as the previous owner was Peter Linden, VK3AMX/WA7VDF, who was tragically killed in a plane crash in 1996. "Due to the availability of power, P29CW will not be active on the many field trips during this period of operation," says Allan. QSL cards should be sent direct only to VK2IR with either three US green stamps or one new IRC.

P2 — PAPUA NEW GUINEA

A European team is heading to multiple islands belonging to Papua New Guinea between mid-October and mid-November. The team, which is headed by G3KHZ, includes CT1AGF, G3USR, MØTVG and SM6CVX. They will operate as shown in Table 1.

PACIFIC ISLANDS DXPEDITION

An international team is heading to Samoa (5W), Tonga (A3) and South Cooks (E5) between mid-November and mid-December. The team includes Andrea, IK1PMR; Claudia, K2LEO/PA3LEO; Wil, PAØBWL; Joe, AA4NN; Franz, OE2SNL; Gerhard, DJ5IW, and Kenneth, OZ1IKY. First stop Samoa between November 10 and 17. Next will be Tonga from November 18 to December 1 and then Rarotonga, South Cooks starting around December 2 to 5 for one week. Plans are to have two stations QRV with amps for activity on 1.8 through 28 MHz. Call signs have not been finalized yet. Andrea has a Web page with more details at **www.ik1pmr.com/plans/a3/**.

VK9X — CHRISTMAS ISLAND

German ops Harry, DM5TI; Tom, DL2RMC; Rene, DL2JRM, and Sid, DM2AYO, are heading to Christmas Island (VK9). The team plans to be there between November 21 and December 5. Plans are to have two similar stations (K3, THP HL1.1) running them 24/7 on all modes on 1.8 through 28 MHz. They will be focusing on the low bands, mostly on CW. Harry says they will not spare any effort to erect good antennas as they will be using verticals on 160 through 30 meters and a 2 element Moxon beam at 40 feet for activity on 20 through 10 meters. They have applied for their call signs and are expecting to use VK9XX during the DXpedition and VK9XW for the CQ World Wide CW DX Contest. They also plan to have a Web site with an online log search.

W3ZZ

THE WORLD ABOVE 50 MHz

DXpeditions of Summer

Each year between May and August the E-skip (E_s) season brings the opportunity to work new countries and new grids on 6 meters. Thus it is no surprise that summer is the prime time for expeditions to needed DX entities. Spurred by the Fred Fish Memorial Award (FFMA — see the April 2009 column) issued for working all the grids in the contiguous 48 US states, this past summer also saw an unusual number of expeditions to rare and not so rare US grids. Any grid that had little 6 meter activity was a potential target. In this column I review most of the DXpeditions that could be worked from someplace in the US and a few of the FFMA Gridpeditions.

What Does it Take?

A DXCC entity or a particular grid is a rare one for anyone who doesn't have it. So we all owe a debt of gratitude to the folks who go on one of these expeditions. To one extent or another it can require substantial sums of money and real planning. The FFMA Gridpeditions require finding a suitable spot, preferably clear in all directions or at least in the direction of maximum population, packing needed equipment and supplies, getting into one's car and going. It must be remembered, as the April 2009 column detailed, the rarest grids are rare for a reason. Most are isolated, some cover very little area and are bad RF locations, and some are just dangerous to access.

For DXpeditions the locations can be a beautiful spot on some tropical island or a difficult trek to a sometimes dangerous location. Physical operating conditions can vary from adequate to rudimentary. Because 6 meter propagation is chancy even in summer, one must choose a location where there is a good chance of propagation to highly populated areas like North America (NA) or Europe (EU). Going to the austral Antarctic islands during the summer provides no normal propagation to either as well as winter polar conditions so it's not a good idea.

If you go to Africa you may work into EU, but unless you are fairly far west you won't get E_s propagation into NA. The DXpeditions we will cover did choose propagationally advantageous locations and tried hard to work areas that needed those entities. For instance Caribbean island expeditions emphasized Europe whenever possible and this year the propagation gods often smiled on them. As noted below, most DXpeditions and Gridpeditions made good use of digital modes: JT65a on EME and FSK441 on meteor scatter as appropriate.

This Month

November 7-8	ARRL International EME Contest
*November 8	Good EME conditions
November 17	Leonids Meteor Shower

*Moon data from W5LUU

DXpeditions

C37NL (Andorra). José Peris, EA7KW, was active June 8-14 from C37NL at a beautiful location high in the hills of Andorra (JN02sk) called Naturlandia. He credits the remarkable hospitality of the Andorran league (URA) members for the success of his operation. He made 1290 SSB Qs and 1156 CW Qs (2449 total) with 2000 unique stations. In NA he worked only 42 US stations and 4 KP4s. States represented were RI, NY, NJ, VA, FL, MS, TX, NM, OH and IL; of these 26 were in FL. ODX was N7KA (DM65qf) at 5429 mi/8737 km. The sole EME contact was with W7GJ in MT. The US was worked only on June 9 and 12. To show the vagaries of propagation, a few days after he left there was a big opening from the entire east coast and the nearby Midwest to C3; had he still been there he would have worked hundreds of North Americans.

8R1DB/8R1TO (Guyana). The 6 Meter Beacon Project, Inc operation in GJ06wt extended from June 16-26 with Dave Craig, N3DB/Chris Patterson, W3CMP (8R1DB) and June 27-July 6 with Ken Reecy, K4RX/Terry Posey, K4RX (8R1TO) (see Figure 1). They worked 2690 Qs in 71 DXCC entities, many quite far away, from Eastern Europe (UT), Africa (EA8, EL) and throughout the rest of Europe and both Americas. Dave regrets being unable to complete contacts with 4J, 4X, ZC4 and many other UTs heard due to noise and fading. They used 120-400 W depending on generator constraints to a 6M7JHV at 50 feet from an oceanfront location.

They were pleased with the many long distance contacts but 8R1DB had little direct propagation aside from northeast EU and EU proper. They worked W7 facing Iceland, the US East Coast and all over northern and eastern Europe all on the same beam heading. Beam headings were checked repeatedly and only appeared to vary once due to unusually high winds. The 8R1TO team observed skew only when working HA and 9A while facing W4; all else for them was direct.

TZ6EI (Mali). Arliss and Holly Thompson, W7XU/NØQJM, and Ed Gray, WØSD, operated from the Hotel Mande in Bamako (IK62ap) from June 26 to July 6 (see Figure 2). They worked 546 unique call signs, all on CW, in 40 DXCC countries on 6 meters. They worked as far east as 4X4DK and the US, VE and CO (CO8LY) to the west. Their nearest QSO was to EA8 about 1170 mi away. The best terrestrial ODX was KJ9I (EN53ql) at 5160 mi/8304 km. KØHA

DAVID CRAIG, N3DB

Figure 1 — The crew in Guyana. From left: 8R1TO/AC4TO, 8R1WD, 8R1DB/N3DB, W3CMP and K4RX.

Gene Zimmerman, W3ZZ ♦ 33 Brighton Dr, Gaithersburg, MD 20877 ♦ w3zz@arrl.org; (301-948-2594)

ARLISS THOMPSON, W7XU

Figure 2 — A view of the hotel location of TZ6EI during an afternoon thunderstorm. The 6 meter antenna not visible was mounted on the roof.

(EN10lx) in NE heard them at 5504 mi/8858 km. They worked into W1, 2, 3, 4, 9 in FL, ME, NH, NJ, NY, PA, RI, WI and VEs in NS and QU.

The first completed Mali-US QSO was on 26 June at 2212Z with W7GJ using JT65a on EME; his was the only EME contact. Terrestrial QSOs were all E_s: The first terrestrial QSO with the US was 1037Z June 27 with N1BUG and the first VE was VE1PZ 1108Z June 27. Six meter conditions from Mali were generally not very good. Being a landlocked country certainly did not help. It is also a long way even to the closest activity (6W — not heard) from Bamako. The best conditions were on June 27 and July 4.

5JØBV (San Andres). Undeterred by dreadful conditions last year, Dennis Motschenbacher, K7BV, returned to San Andres (EK92dm) this summer from June 18 to July 6 (see Figure 3). Once again he encountered problems with RFI, uncooperative neighbors, dangerous power lines and

DENNIS MOTSCHENBACHER, K7BV

Figure 3 — K7BV at his operating position at 5JØBV.

other similar difficulties, which forced him to change locations twice before finding an excellent one. In response, he added a third week of operation. His amplifier died the 2nd day of operation so he ran the FT450 barefoot at 100 W.

Once started, he got 1291 Qs in 23 DXCC entities. The third week tripled the number of contacts he made. Before getting settled he lost a few big European openings mid-month so he was limited to two good European openings, the first starting with two big Italian stations, IW5DHN and IKØFTA, coming in right after sunrise. Both openings lasted until propagation shifted and he began to hear KP4s. Europe is approaching a 5-hop contact from San Andres.

Two fantastic US openings provided the majority of the QSOs. The best US path during a band opening was double hop to W8, 9 with nothing heard in-between. This path frequently was present early in the morning, then complete silence in all directions throughout the day, then open again as late as 1-2 hours after his sundown. This activity was very much a N-S event; rotating the beam to the East Coast or farther west to the Midwest would produce nothing.

V29JKV (Antigua). Well-known 6 meter DXpeditioner Jimmy Treybig, W6JKV, activated Antigua (FK97) from June 25 to July 4. He was located on the north side of the island at an altitude of more than 100 ft looking at ocean water toward the USA and Europe and was running 1 kW to an M^2 6M8GJ Yagi (see Figure 4). Jimmy says this was his best summer expedition ever in terms of propagation and QSOs: 1840 Qs primarily CW with about half to Europe and Africa. The band was open every day with strong signals out to 6500 miles. There were three openings to the West Coast (W6, 7 and VE7). Into Europe he worked three SMs, an OY, 10 UTs and many LZs and YUs.

VP9/WA4PGM (Bermuda). Lyle Chavis, WA4PGM, activated Bermuda (FM72) July 10-20 running 100 W into a 5 element Cushcraft Yagi at 3 meters. He made 726 six meter contacts in 170 grids and 18 countries. He had only a few short openings into Europe as far east as SP. Stations in CO and NM were the farthest west in the US. The CQ VHF weekend was a bust with poor conditions.

Gridpeditions

K5N (EL58). EL58, a tiny spit of land in the south Louisiana delta, has been activated by expedition only once before, in 1985. See a picture in the April column. On May 29-31, an operating team of WN2E, WA4EWV, K5YG, K5QE, KE5KDM, N5OMG and N5SIX with land support from NØIRS, W5TFM, AC5TM and WA5UFH set up a nonstop operation that yielded 482 Qs on 6 meters in 40 states and 118 grids. Two of these were EME and 56 were digital meteor scatter. This took a huge amount of planning, accessing the location by sea and bringing all supplies and equipment to a difficult site. EL58 was once a top 5 most wanted grid but no longer.

KB7Q. Between June 14 and August 17, Gene Shea, KB7Q, and his wife, Joyce, completed a journey through MT and western ND amassing 1224 Qs in 17 grids (DN28, 34, 35, 36, 44, 45, 46, 56, 57, 67, 68, 76, 77, 85, 86, 96, EN06, 07). Three of these DN35, 67, 68 are among the rarest US grids

DREW TREYBIG

Figure 4 — Looking north from the V29JKV location. Those are Jimmy's sons Cody (left) and Davis. The portable 6M8 M^2 Yagi is pointed toward the US.

and 6 others are in the next rarest category. Gene uses all modes to great advantage with 591 CW, 417 SSB, 201 FSK441 and 15 JT65a Qs, the latter both terrestrial and EME. He finds that FSK441 really helps keep the interest level up on non-E_s days. Even with 100 W and the 3 element Yagi he has reached as far as 1160 miles at times.

K6LMN/m. Roger Wagner, K6LMN, activated 51 grids in a trip through the west and south from June 20-July 6. None were on the most wanted list but several were on the rarish side. He was running 100 W to a 46 inch vertical whip, much of it mobile in motion. Prior to this trip Roger had activated 950 grids in the US and Europe.

NQ7R/m. Tom Kramer, NQ7R, activated 12 grids July 20-25 on a trip to Crater Lake, OR; of these four DN00, 02, 03, 04 are on the most wanted list. He made 91 Qs (56 SSB-1 CW-34 digital) in 16 states running 60 W to either an M^2 loop or 3 element Yagi. The MS ODX was 1450 km from DN04 to W5WVO DM65. A nice opening the evening of July 23 in DN04 gave some double hop to the east for W1, 2, 3, 4 and 8.

ON THE BANDS

August produced a big tropo event in the East and Midwest and a better than average Perseids meteor shower. Let's take a look.

Tropospheric Ducting. A major tropo event began about 0200Z Aug 24 and ran through about 0600Z Aug 26. It was marked by a large slow moving high pressure system at the junction of IL, IN, MI trapped between two fronts, one at the NE/WY border and the other along the East Coast with a hurricane lurking off shore.

Openings began north/south extending as far north as EN37/56 down to EM12, 25 and DM98 and eventually expanding east/west as far as VE1 (FN76) well into New England and PA. It appeared to reach MD only about 3 hours before the western front passed through W9 and ended it. KFØM says a friend while flying over KS noted that the temperature at 6000 ft was 10°F warmer than at ground level. Unlike many such openings this one was strong throughout its duration, day or night. For some like Bill, WAØKBZ (EM48) and John, W9RPM (EN43) it was superb and Sam, K5SW (EM25) said it was like a zoo on 144.200 (see last month's column).

August 25 Herb, K2LNS, at WA2FGK (FN21be) worked W9ZIH (EN51nv) at 676 mi/1087 km on 10 GHz, one of the longer overland US contacts ever on that band. Herb also worked 50 W9/Ø on 144, MN, IL, MO on 222; IL, MO, WI out to 1596 km on 432; and IL, MO on 1296. Bill, KØAWU (EN37ed) worked AR, MO, IL on 432 and NØIRS (EM29se) at 562 mi/904 km on 1296. Edd, N8LIQ (EN56) worked OK, KS, MO, IN, OH, TN on 2. Bill, WAØKBZ (EM48) worked as far as VE2DSB (FN35) 1069 mi/1720 km on 2 meters and 22 new grids on 432. John, W9RPM (EN43) worked LA (EL39), OH, PA, NJ, CT on 2.

Farther south Steve, W5KI (EM36) worked well into the Midwest with an ODX of 1587 km to KA2LIM. Dave, K1WHS (FN43mj) worked OH, IN, IL, MI, MO with an ODX to NØIRS of 1253 mi/2016 km; he worked WI, IN, IL, OH on 222 and IL, MO on 432. Ron, WZ1V (FN31mp) was into IL, IN, OH, MO with an ODX of 1140 mi/1835 km. Ken, KA2LIM (FN12) worked 93 stations in 14 states and 39 grids on 2 meters. Chad, NØYK (DM98) experienced loud signals from central TX. Sam, K5SW, was at the edge of the opening, working into MO, MN, IA, IL, IN, WI, MI, OH but not farther east.

Meteor Scatter. This year's Perseids was better than the last several years. Three peaks were detected: major ones at 0800Z and about 1800Z August 12 with ZHRs approaching 200 and a minor one at 1100Z. Jon, NØJK, and his son Kegan worked FN12 on SSB and saw lots of visual meteors. But most of the activity was on FSK441. KB7Q/m worked 40 stations on Perseids rocks from Yellowstone (DN44kr) with ODX N8JX (EN64vj) 1225 mi/1972 km. Bill, WAØKBZ, worked RI, his last East Coast station and #44 terrestrial. Arliss, WØXU (EN13lm) worked 8 Qs on 2 meters (ODX VE7SL (CN88iu) 1305 mi/2100 km) and two AZ Qs on 222.

6 Meters. The Magic Band slowed down in August. JAs moved west: KØGU's (DN70) last opening was 13 JAs on Aug 13. Bob, K6QXY (CM88) worked 6 JAs on Aug 4/5. JAs were into the Pacific Northwest. Tim, K7XC (DM09) had JAs on the 6th and double hop into the mid-Atlantic on the 13th. Al, K3TKJ (FM28) and Dave, N3DB (FM18) were among those who worked CT1HZE on the 18th. Jon, NØJK, notes that Bill, KØHA (EN10) worked EA8 on the 18th.

HERE AND THERE

Leonids Meteor Shower. The Leonids, predicted to peak November 17 around 2140Z, should be at its best since its 33 year peak 1999-2001 with half-storm levels at ZHRs of about 500. Increased activity is attributed to passage through the 1466 stream. Fire up your radios.

2009 ARRL International EME Contest. The second EME contest weekend will take place 0000Z to 2359Z November 7-8 on 2.3 GHz and up. Further information is in the previous column and in the detailed rules at **www.arrl.org/contests/rules/2009/eme.html**. Both digital and analog contacts are encouraged.

Beacon News. W4HHK/B has returned to the air in EM55 on 50.070 (0.2 W) and 144.080 (2 W). N4MW/B (FM17kn) is back active on 10368.280 GPS locked. [Tnx K3CB, K4PZT, N4MW]. Former WB2UMX/B (FM23xc) now has a new call: K2DLL/B. K2DLL/B is operational on approximately 144.290, 222.050 and 1296.300.

W9YF (ex W9YYF) SK. From Al, W5LUA, we learn that we lost Jack Spencer, W9YF, on August 8. Jack was very active from the Chicago area on VHF and EME especially on 2 meters where many remember his big signal. I never worked him on VHF but I did work him on 160 at a time when I used a short random wire antenna and had a signal a lot weaker than the average EME signal.

W5SFW SK. Phil Patterson, W5SFW, a well-known VHF/UHF pioneer, recently passed away. Phil held 6 meter WAS #22 and was a consistent voice on 2 meter E_s. I worked him twice on 2 meters from his DM95 location. Farewell "Slew Foot Willie." [Thanks K7ICW] QST

New Products

JETSTREAM HIGH CURRENT 13.8 V POWER SUPPLY

♢The Jetstream JTPS75BCMMKII power supply is rated to deliver 13.8 V at 65 A continuous or 75 A surge. Power output connectors include binding posts, spring loaded terminals and a cigarette lighter jack. Features include overvoltage and overcurrent protection, a quiet internal cooling fan and switchable ac input voltage (120 or 240 V ac). Price: $249.95. For more information, see your favorite dealer or visit **www.jetstream-usa.com**.

SPECIAL EVENTS

Contact these stations and help commemorate history. Many provide a special QSL card or certificate!

Oct 16-Oct 18, 1300Z-2100Z, Gautier, MS. Magnolia DX Association, K5W. Operating from MS Sandhill Crane NWR for National Wildlife Refuge Week. 18.140 14.240 14.040 7.240. QSL. Randy Becnel, W5UE, PO Box 170, Kiln, MS 39556. **w5ue.net/k5w/index.html**

Oct 17, 1200Z-2000Z, Woodbridge, VA. National Wildlife Refuge Amateur Radio Club, K4NWR. National Wildlife Refuge Week. 14.240 14.073 7.240. QSL. Brad Farrell, K4RT, 7423 Salford Ct, Alexandria, VA 22315. *Listen for other NWR Week special event stations Oct 10-18!* **www.w4ava.org/k4nwr/k4nwr.htm**

Oct 17, 1400Z-2000Z, New York, NY. USCG Auxiliary Flotilla 014-05-11, W2K. 70th Anniversary USCG Auxiliary. 28.330 21.330 14.270 7.270. QSL. John Kiernan, KE2UN/W2K, 110 Cabrini Blvd Apt A, New York, NY 10033-3446. **ke2un@msn.com**

Oct 17-Oct 18, 1300Z-2100Z, Hunting Island, SC. Beaufort Radio Amateur Group, K4L. 150th Anniversary Hunting Island Lighthouse. 14.190 14.070 7.190 7.070. QSL. K3LLH, 2 Treadlands, Beaufort, SC 29906. **pws.prserv.net/K4L**

Oct 17-Oct 18, 1800Z-0100Z, Richmond, CA. Boy Scouts of America, W6BSA. 52nd Jamboree On The Air from the Red Oak Victory Ship. 21.360 18.140 14.290 7.190. QSL. Red Oak Victory Radio Club, 801 Payne Ct, Richmond, CA 94806. **jotaforever01@yahoo.com**

Oct 20-Oct 22, 1230Z-2000Z, Moultrie, GA. Colquitt County Ham Radio Society, KØW. Sunbelt Ag-Expo. 146.79 28.400 14.225 7.250. QSL. Dale Culp, 1148 Paul Murphy Rd, Moultrie, GA 31768. **wd4kow@wd4kow.org** *or* **www.wd4kow.org**

Oct 21-Oct 26, 1200Z-2359Z, Lynchburg, TN. Coffee County Amateur Radio Emergency Service, W4J. 21st Annual Jack Daniels World Championship Invitational BBQ. 14.250 14.080 7.240 SSB CW RTTY. QSL. Jimmy Floyd, PO Box 511, Tullahoma, TN 37388. **www.mtars.org**

Oct 24, 1500Z-2000Z, Punta Gorda, FL. Octagon Wildlife Sanctuary, W8OWS. 31 years of care for abused and abandoned animals. 14.330 7.230. QSL. Tad Burik, K3QC, 2235 Virginia Ave, Fort Myers, FL 33905. **www.octagonwildlife.org**

Oct 24-Oct 25, 0000Z-2359Z, Smithville, TX. Bastrop County Amateur Radio Club, KE5FKS. Brotherhood of Amateur Radio. 28.300 21.025 14.225 7.225. QSL. BCARC, PO Box 307, Smithville, TX 78957. BCARC@YahooGroups *or* **www.repeater.org/austinhams/bcarc/index.html**

Oct 30, 1700Z-2200Z, Las Vegas, NV. Las Vegas Radio Amateur Club, N7V. Celebrating Navada Day — 144th anniversary of Nevada statehood. 14.250 14.050 7.250 7.050. QSL. LVRAC, PO Box 27342, Las Vegas, NV 89126-1342. **www.lvrac.org**

Oct 31-Nov 1, 1700Z-0500Z, Transylvania, LA. Northeast Louisiana ARES Foundation, WA5WX. It's a spooky night in Transylvania. 14.260 21.360 7.260 3.960. QSL. Kevin Thomas, 1573 Brownlee Rd, Calhoun, LA 71225. **www.ares-nela.org**

Nov 1-Nov 16, 1700Z-0300Z, Sevierville, TN. 470 Amateur Radio Group, W4H. 2nd Anniversary of the 470 ARG Net. 24.450 14.260 14.070 7.260 7.070 3.860. QSL. *Send QSL to operator working W4H station.* **www.470arg.com**

Nov 5-Nov 8, 1700Z-1700Z, Whitefish Point, MI. Stu Rockafellow Amateur Radio Society, N8F and K8F. Remembering the *Edmund Fitzgerald*. 18.160 14.260 7.260 3.860. Certificate. Richard Barker, W8VS, 264 N East St, Brighton, MI 48116. **www.qsl.net/w8njh**

Nov 6, 1700Z-2300Z, Marietta, GA. Lockheed Martin Employees Amateur Radio Club, W4LMA. Veterans Day and Marietta built F-22, C-130, C-5. 21.320 14.280 7.250. QSL. David Pearce, ABØNG, PO Box 5213, Marietta, GA 30061. **ab0ng@arrl.net** *or* **www.w4mfc.com**

Nov 7, 1200Z-2200Z, Iowa City, IA. ACT, NØT. 50th anniversary of the 1st administration of the ACT test. 14.260 14.075 14.020 21.300. QSL. Art Peters, 308 E Burlington St #284, Iowa City, IA 52240. **k0acp@arrl.net**

Nov 7, 1500Z-2000Z, Livonia, MI. Livonia Amateur Radio Club, W8F. Sinking of the *Edmund Fitzgerald* in Lake Superior. 14.260 14.040 7.250 7.125. Certificate. Bruno Walczak, WA8DHP, 16601 Golfview, Livonia, MI 48154-2139. *Will operate on 10, 15, 20, 40 and 80 m as conditions permit.* **www.livoniaarc.com**

Nov 7, 1700Z-2359Z, San Diego, CA. USS *Midway* (CV 41) Museum Radio Operations Room, NI6IW. Veterans Day and US Marine Corps Birthday 1775. SSB 14.320 7.250 PSK-31 7.050 CW 14.060 7.055 D-STAR 2m/70cm SOCAL rep. QSL. USS *Midway* Museum Radio Room, 910 N Harbor Dr, San Diego, CA 92101. **kk6fz@arrl.net**

Nov 7-Nov 8, 1500Z-2200Z, Waterloo, IA. Five Sullivan Brothers Amateur Radio Club, WØFSB. Veterans Day and Marine Corps Birthday. 14.240 7.240. Certificate. Vernon McNulty, 4015 Independence Ave, Waterloo, IA 50703. **t-mc-nulty@msn.com**

Nov 7-Nov 9, 1600Z-0200Z, Split Rock, MN. Stillwater Amateur Radio Association, WØJH. Remembering the *Edmund Fitzgerald*, 35th Anniversary, from Split Rock Lighthouse. 21.360 14.260 7.260 3.860. Certificate. Stillwater Amateur Radio Association, WØJH, 1618 West Pine St, Stillwater, MN 55082. **w0jh@arrl.net** *or* **www.radioham.org**

Nov 9-Nov 12, 1300Z-2359Z, Spiro, OK. D.W. Greenwood, W5M. Commemorating US Marine Corps Birthday. 28.390 21.360 14.315 7.230. QSL. D. W. Greenwood, 19299 Greenwood Rd, Spiro, OK 74959.

Nov 10-Nov 12, 1700Z-2100Z, Iron Mountain, MI. Mich-A-Con Amateur Radio Club, K8V. UP Veterans Memorial atop Pine Mountain. 14.230 14.060 7.230 7.060. Certificate. Thomas Martin, 812 West B St, Iron Mountain, MI 49801. **w8jwn@arrl.net** *or* **www.qsl.net/ka1ddb**

Nov 11, 1200Z-2359Z, Nutley, NJ. Robert D. Grant United Labor Amateur Radio Association, N2UL. CQ Veterans Day. Freedom is not free; it's paid for by our veterans. 28.460 14.260 7.250 EchoLink W2NJR-R. Certificate. RDGULARA, 112 Prospect St, Nutley, NJ 07110-0716.

Nov 11, 1300Z-1700Z, Stratford, CT. Greater Bridgeport Amateur Radio Club and Derby Office of Emergency Management, N1S. Sikorsky Aircraft Military Appreciation Day. 14.255 7.255. Certificate. Frank Krasnicki, K1CRU, 94 Andrasko Rd, Beacon Falls, CT 06403. *Event also sponsored by Sikorsky Aircraft's Veteran's Association to honor all Vets and servicemen presently deployed.* **www.gbarc.net**

Nov 11, 1400Z-2200Z, Emporia, KS. Emporia Amateur Radio Society, KØV. Veterans Day. 14.268 7.262 3.920. QSL. Conrad Steinel, KØUER, 950 Oxford Dr, Emporia, KS 66801. **www.qsl.net/emporiaars**

Nov 11, 1500Z-2245Z, Baton Rouge, LA. Baton Rouge and USS *Kidd* Amateur Radio Clubs, W5KID. Veterans Day. SSB: 15 20 40 m Gen and above RTTY subband CW: QRP sub bands. QSL. W5KID, 305 S River Rd, Baton Rouge, LA 70802. *Primary frequency is 20 meters.* **www.lsu.edu/brarc/uss_kidd.htm**

Nov 11-Nov 12, 0800Z-0759Z, Santa Cruz, CA. United Veterans Council, K6V. Veterans Day. 14.280 7.250. QSL. Veterans Emergency Radio Room, 846 Front St, Santa Cruz, CA 95060. **vetshall.org**

Nov 11-Nov 15, 1600Z-2100Z, Arlington Heights, IL. Armored Force Amateur Radio Net, KA9NLX. Veterans Day in honor of all military veterans. 14.325 7.283 MT63 / Olivia / MFSK 10.133 and 2 meters. Certificate. John Paskevicz, 1423 N Ridge Ave, Arlington Heights, IL 60004. **jpaskev@aol.com**

Nov 11-Nov 15, 1600Z-2200Z, Indianapolis, IN. USS *Indy* Amateur Radio Station, WW2IND. Veterans Day. 14.260 7.260. Certificate. USS *Indy* Radio, 6455 Madison Ave, Indianapolis, IN 46227. **www.ussindyradio.org**

Nov 13-Nov 15, 0000Z-2359Z, Burley, WA. Burley Amateur Radio Club, W1E. Commemorating historical significance of Friday the 13th. 28.313 14.313 7.263 3.913. QSL. Tom Sanders, 4072 SE Saxon Ct, Port Orchard, WA 98366. **tjsand@wavecable.com**

Nov 14, 1200Z-1800Z, Azle, TX. Tri-County Amateur Radio Club, WC5C. 12th Annual NCTECH Station honoring Emergency Communicators. 14.260 7.260 147.16. QSL. NCTECH 2009, c/o David Johnson, KB5YLG, 820 Wood Ln, Azle, TX 76020. *NCTECH is an annual ARRL sanctioned hamfest and on-the-air event to honor Amateur Radio Operators involved in Emergency Communications.* **www.wc5c.org**

Nov 14, 1400Z-1900Z, Guthrie, OK. Edmond Amateur Radio Society, K5EOK. Commemoration of Oklahoma Statehood Day. 21.285 14.265 7.265 3.865. Certificate. EARS, PO Box 48, Edmond, OK 73083. **k5eok@arrl.net** *or* **www.k5eok.org**

Nov 14-Nov 15, 1400Z-1900Z, Bridgeport, CT. Greater Bridgeport Amateur Radio Club, Inc and Derby Office of Emergency Management, N1Z. Celebrating the Connecticut Beardsley Zoo. 28.440 21.350 14.255

Maty Weinberg, KB1EIB ♦ Special Events ♦ events@arrl.org

3.855. Certificate. Greater Bridgeport Amateur Radio Club, Inc, c/o John G. Russo, KA1JXW, 104 Woodside Ave, Waterbury, CT 06708. **www.beardsleyzoo.org** *or* **www.gbarc.net**

Nov 14-Nov 23, 1800Z-0200Z, Utica, NY. Utica Amateur Radio Club, K2IQ. Commemorating the 75th anniversary of the UARC 1934-2009. SSB 14.275 7.275 3.875 CW 14.034 7.034 3.534 RTTY 14.075. QSL. UARC, PO Box 71, Utica, NY 13501. **www.uticaarc.org**

Nov 16-Nov 22, 0000Z-2359Z, Civitavecchia, Italy. INORC, IIØTRM. In memory of T. R. McElroy, World's Champion Telegrapher. 14.045 10.115 7.025 3.563. QSL. Fabio Bonucci, IKØIXI/KØIXI, via delle Sterlizie, 10, Civitavecchia, RM I-00053, Italy. **www.qrz.com/II0TRM**

Nov 17, 1500Z-2300Z, Paulden, AZ. Yavapai Amateur Radio Club, K7NRA. NRA's 138th birthday. 21.335 14.250 7.250. Certificate. Michael Campbell, K7NRA, 404 Lampliter Village, Clarkdale, AZ 86324. *Operating from Gunsite Academy.* **www.w7yrc.org/nra_birthday.htm**

Nov 20-Nov 22, 1900Z-1900Z, Washington, DC. Radio Club of America, W2RCA. Centennial Celebration of the Radio Club of America. 14.285 7.225 3.885. QSL. Radio Club of America, PO Box 621074, Littleton, CO 80162. **www.radioclubofamerica.org**

Nov 21, 1300Z-2100Z, Moultrie, GA. South Georgia United Methodist Amateur Radio Society, WG4UM. Historic Moultrie Automotive Swap Meet. 28.425 18.150 14.240 7.185. Certificate. Randy Woods, 5410 Little Oak Way, Lake Park, GA 31636. **aj4rw@bellsouth.net**

Nov 27, 1300Z-2000Z, Eastham, MA. KM1CC Marconi Cape Cod Radio Club, W1P. 111th anniversary of the sinking of the Steamer *Portland*. 14.310 14.030 7.260 7.030. QSL. Henry Brown, K1WCC, 19 Sao Paulo Dr, East Falmouth, MA 02536. **k1wcc@arrl.net**

Nov 28, 1500Z-2200Z, Manitowoc, WI. USS *Cobia* Amateur Radio Club, NB9QV. 66th Birthday of USS *Cobia* WWII Submarine. 14.260 7.250. QSL. Fred Neuenfeldt, W6BSF, 4932 S 10th St, Manitowoc, WI 54220-9121. **www.qrz.com/nb9qv**

Nov 28-Nov 29, 0001Z-2359Z, All US call areas. Ten-Ten Club, W6OI. 10-10 Special Event. 10 m. Certificate. Jack Moore, K5CC, 371 Ridge Creek Ln, Bulverde, TX 78163. *QSL and certificate available.* **www.ten-ten.org**

Nov 28-Nov 29, 1400Z-2000Z daily, Plymouth, MA. Whitman Amateur Radio Club, WA1NPO. First Pilgrim Landing at Plymouth, MA. 18.140 14.280 7.250 3.860. Certificate. Whitman ARC, PO Box 48, Whitman, MA 02382. **www.wa1npo.org**

Nov 29-Nov 30, 0459Z-0459Z, The Villages, FL. The Villages Amateur Radio Club, K4VRC. 14th anniversary of the club, from Sumpter Landing Square. 14.310 7.250 3.940. Certificate. Dennis Hardoin, 601 Lacy Pl, The Villages, FL 32162. **vicepresident@tvarc.net** *or* **www.tvarc.net**

Certificates and QSL cards: To obtain a certificate from any of the special-event stations offering them, send your QSO information along with a 9 ×12 inch self-addressed, stamped envelope to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's 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 **Jan** *QST* would have to be received by **Nov 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 Sep 10. You can view all received Special Events at **www.arrl.org/contests/spev.html**. QST

New Products

UNIVERSAL WINDOW FEEDTHROUGH PANEL FROM MFJ

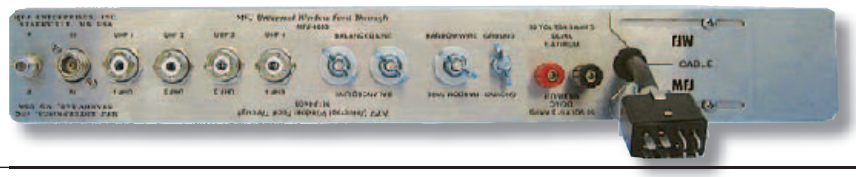
◊ The MFJ-4603 Universal Window Feedthrough Panel is designed to provide a convenient way to bring antenna connections into your station without drilling holes through walls. Place the panel in a window sill and close the window to secure it. The panel may be cut to fit any horizontal or vertical window opening up to 48 inches and edges are sealed by weather-stripping. The MFJ-4603 includes feedthroughs for four SO-239 coax connectors, one N connector and one F connector. It also has a pair of high-voltage ceramic feedthrough insulators for parallel feed line, a random wire antenna ceramic feedthrough insulator and two 5-way binding posts for dc or control signals. There's also an adjustable "adaptive cable feedthru" for bringing in a rotator or control cable without removing connectors. The panel is grounded via a ground lug. Several other versions with different connector configurations are available. Price: $89.95. To order, or for your nearest dealer, call 800-647-1800 or see **www.mfjenterprises.com**.

HEAVY DUTY TELESCOPING FIBERGLASS POLE FROM SPIDERBEAM

◊ Spiderbeam has expanded its family of collapsible fiberglass masts with a new pole that expands to 26 meters (85 feet). Construction is similar to Spiderbeam's 12 and 18 meter long portable fiberglass poles. The 26 meter pole weighs 40 pounds and has a collapsed length of 6½ feet. It's designed to be easily transported to remote locations. Suggested applications include supporting a top-loaded 160 meter vertical or other low band wire antenna, or a quad loop for 20/15/10 meters. According to Spiderbeam, the prototype was successfully tested for several months in stormy conditions on the coast of the Baltic Sea. Price: $899. For more information, visit **www.spiderbeam.us**.

FOOT SWITCH FROM JETSTREAM

◊ Jetstream's JTFT1 foot switch can be used for keying an amplifier or transceiver. It comes with 10 feet of cable terminated with a ¼-inch phone plug. An adapter for phono jacks is included. Price: $19.95. For more information, see your favorite dealer or visit **www.jetstream-usa.com**.



AT THE FOUNDATION

Amateur Radio Clubs Make a Difference

When it comes to reaching radio amateurs there is no stronger link than to the hundreds of Amateur Radio clubs across the country. Now as the application period for ARRL Foundation Scholarships opens (until February 1, 2010), club newsletters and e-mail bulletins to club members are an effective and important tool to remind young hams that there are more than 50 scholarships to be awarded in the spring of 2010.

If your club membership has high schools seniors and adult hams pursuing continuing education, remind them that the application period for the 2010 scholarship awards closes promptly on February 1, 2010. All the information about ARRL Foundation Scholarships, including application instructions and forms, can be found on the Web at **www.arrl.org/arrlf**. Candidates should review the descriptions of all the scholarships and apply only those for which they qualify. Note that a recent transcript is required with all applications.

Another vital role your club can play in the scholarship program is to encourage club members — and the club itself — to make contributions to the ARRL Foundation Scholarship Fund. Contributions in any amount to the ARRL Foundation are an important source of revenue to strengthen the scholarship program. New $1000 scholarships are added every year and your club might think about sponsoring one with an annual donation or by endowing an award with a larger gift.

Note: The William R. Goldfarb Memorial Scholarship is open only to high school seniors who must complete the application for that award and include a FAFSA or SAR based on the most recent family financial information, along with a full high school transcript.

The ARRL Foundation is an IRS-designated 501(c)(3) organization holding tax ID #23-7325472. Contributions to the ARRL Foundation are tax-deductible to the full extent of the law.

Mary M. Hobart, K1MMH ♦ Secretary, ARRL Foundation Inc ♦ mhobart@arrl.org

Strays

ONE SIMPLE THING

◊I believe there's one simple thing that almost all hams could only have to do once, but would result in many years of residual advertising and welcome exposure that our hobby could desperately use these days.

"What could that be?" you ask.

Get yourself a call letter ham tag license plate for your vehicle.

For a one-time fee of only $20 (in Pennsylvania), you could have an attractive, personalized, shiny, new State License Plate bearing your unique FCC issued Amateur Radio call sign for all the world to admire anytime you drive and anywhere you park your vehicle. Let everyone know that ham radio is alive and well. You may even be able to get one for each vehicle, as I did!

PETE VAROUNIS, NL7XM

Pete, NL7XM, found that good things started happening to him after he obtained call sign license plates.

Since I got mine, bugs don't stick to the windshield and I get better gas mileage. Pretty girls ask for rides while I'm stopped at red lights. Perfect strangers wave to me and other drivers don't blow their horns anymore except for an occasional "CQ."

OK... I'm lying about the girls... — *Pete Varounis, NL7XM, Easton, Pennsylvania*

LINKED AT 40,000 FEET

◊On July 16, 2009 I was in route from Detroit to Atlanta on a Delta flight that was equipped with wireless Internet capabilities. I opened my laptop and decided to give it a try. As I was checking e-mail and surfing different Web sites I decided to open EchoLink. I tried connecting to the EchoLink Test Server with no avail, so I decided to try a Proxy Server. I don't remember the exact Proxy Server I used, but the connection with the Test Server was successful.

I saw that my friend Rick, N3RO, was on so I connected to him at 14:48:33 ET with no problem. He was in conference with Jeff, KB3FIO, at the time. I had my earphones in and heard N3RO acknowledge my connection. Abiding by the airlines rules of using no voice I responded with an EchoLink text message to Rick to confirm the contact. After a couple of exchanges we ended the contact and disconnected at 14:50:14 ET.

Since Delta had just recently equipped a very few planes with Internet capabilities I believe this could have been the first EchoLink contact from a commercial airliner. — *Marvin (Nick) Bettis, KR4MS*

OVER TO YOU, NS8T

◊A couple of months ago, I sent Arnie Hayward, NS8T, a letter explaining that I used to hold his call sign. As NS8T, I had a wooden call sign plaque built, and when I changed my call I decided to keep it for whoever was the next owner of that call. — *Bill Jones, K8CU,* **www.realhamradio.com**

ARNIE HAYWARD, NS8T

The call sign plaque has a place of honor on the wall at NS8T.

K2TQN

VINTAGE RADIO

Bud Waite, W2ZK, Polar Pioneer (SK)

Like spokes on a wheel, everything in radio history is somehow connected together and somewhat dependent on each other. Amory H. (Bud) Waite is one of these spokes.

I first heard about Bud Waite from some of the older hams when I was much younger. He was well-known around the tri-state area for visiting local ham clubs and presenting interesting talks about his adventures in Antarctica with Admiral Richard E. Byrd.

Bud was born in 1902, in Newton, Massachusetts. As a young boy he taught himself about electricity by reading books from the library. With three buddies he erected wires stretching about a mile between their houses so they could talk together using telegraph and Morse code. Entering the Navy in 1919 he studied radio. After 4 years in the service he entered Lowell Institute and later MIT. In 1926 he helped build the first State Police Radio Station in Massachusetts.

JOHN DILKS, K2TQN

Bud Waite relaxing at home in New Jersey.

Enter Art Collins

Art Collins was a teenage ham attending high school in Cedar Rapids, Iowa, in 1923. Art read all about Don Mix in *QST* and tried to contact him. Long wave WNP signals in 1923 were not favoring the Iowa area that year. He read about the success of 15 year old Everett Sutton of Port Angeles, Washington and wanted to do the same.

"During the winter of 1924-25, Collins had become familiar with John Reinartz, a 31 year old German immigrant who was prominent in radio circles because he developed a 'tuner' or receiver capable of predictable selectivity and reception. Reinartz had authored several articles on the subject for radio magazines. Reinartz and Collins carried on experiments, particularly in the use of short wavelengths."[1]

When he heard that John Reinartz was to be the radio operator for Donald MacMillan's North Pole expedition, this time going with Lt Cdr Richard E. Byrd, the Navy and airplanes, he wanted to be part of it.

Art later recalled, "My parents obligingly arranged our spring vacation so that we would be at Wiscasset, Maine, when the *Bowdoin* sailed for Etah. I met Reinartz on the *Bowdoin* and carefully worked out schedules, wavelengths…."[2]

For the length of that expedition, Art Collins would be a key relay station for the *Bowdoin* using 20 meters. Because of his reliability he caught the attention of Lt Cdr Richard E. Byrd.

Byrd's Second Trip to Antarctica in 1933

Byrd figured he could find more sponsors for the expedition if he could broadcast

OOTC

Bud Waite in Antarctic gear.

[1]Ken C. Braband, *The First 50 Years: A History of Collins Radio Company and the Collins Divisions of Rockwell International*, Communications Dept, Avionics Group, Rockwell International, 1983.

[2]Ben W. Stearns, *Arthur Collins Radio Wizard*, Ben W. Stearns, 2002.

John Dilks, K2TQN ♦ 125 Wharf Rd, Egg Harbor Township, NJ 08234-8501 ♦ k2tqn@arrl.org

from Antarctica directly into the homes of America. He approached CBS and set the wheels in motion. Having heard of the success of a new company in Iowa called Collins Radio (he remembered Art), he contacted the still young Art Collins and arranged for Art to build special transmitters, strong enough to broadcast directly from Byrd's base in Antarctica, through a relay in Buenos Aires to Long Island and then into the CBS network. Art built a custom 20B, a 1-kW refrigerator sized transmitter and two 100 W 150B transmitters for Byrd.

The radio shows were successful and reported to be heard sharp and clear, though somewhat corny, as there were no professional actors, just regular men performing. (I have located one broadcast which survives. Check my Web page, **www.k2tqn.com**, for a link to hear it yourself.)

Enter Bud Waite

It was fortunate for both Bud Waite and Richard Byrd that Bud Waite was selected to be one of the radio operators on the expedition. Bud was an outstanding selection, as he was an experienced radio operator with an engineering degree, able to perform many jobs.

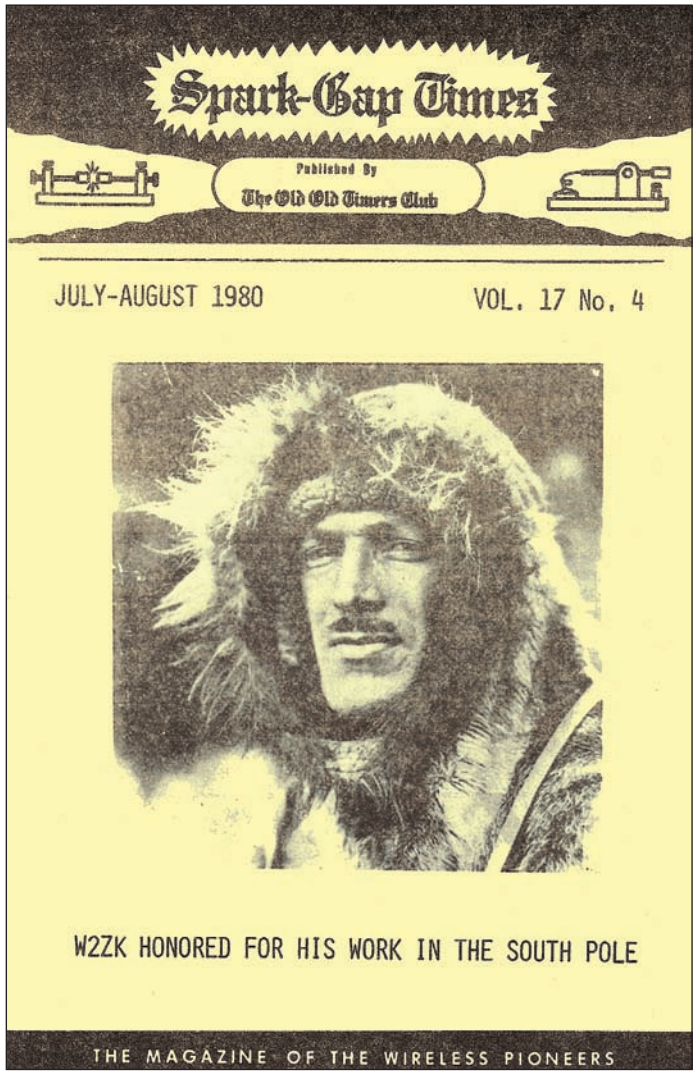
During the Antarctic winter of 1934, Byrd elected to spend it alone at the Advanced Base taking weather observations, or "obs" as he called them. Each day he would climb out of his 9 × 12 foot hut buried in the Ross Ice Shelf, due south of Little America. Being a pilot, he knew how important weather was and was interested to see how Antarctic weather affected the rest of the world. Byrd took meteorological observations twice daily and maintained a radio schedule with Little America three times a week. Once the sun set in April, Byrd also maintained a regular schedule of auroral observations.

As time went by, from March into June, he was losing his strength. He didn't know it, but carbon monoxide, probably from his stove, was poisoning him. Back at the base Waite and others realized something was wrong as Byrd's communications became erratic and did not make sense. Waite and two others set out on a rescue mission in the dead of the Antarctic night. It took three attempts to finally arrive at Byrd's camp, due to drifting snow, tractors falling into hidden crevasses and –75° blizzard temperatures.

Byrd was in such poor condition that they felt he would not make it back to the base, so they stayed with him and nursed him back to health. Bud said he received frostbite on his hands, feet and face on the mission, including losing a large piece of flesh from his hand when it stuck to a piece of frozen metal and he had to pull it away to get free.

Byrd would go on to become a Rear Admiral and continue to explore Antarctica. Bud Waite would move to Fort Monmouth, New Jersey and become the Radio Engineer in charge of the US Army Signal Corps Arctic and Antarctic research teams. He would go on a total of 23 polar expeditions from 1933 to 1965. He experimented with radio waves (radar) penetrating the ice cap and instigated the first airborne survey of the same.

OOTC



OOTC *Spark Gap Times* cover July-August 1980.

He was awarded a Bronze Star for his achievement as a Civilian in Combat by President Harry Truman for setting up a newly developed multichannel FM radio relay system that kept General Eisenhower in direct communications with his commanders on the battlefield during the D-day invasion of France. He was elected as a Fellow of the Royal Geographical Society and a Fellow of the Radio Club of America. Waite was also honored in 1960 with the naming of a part of Antarctica, "Cape Waite," for his part in rescuing Byrd. The committee of geographical names made him the proud possessor of five islands, 100 miles northwest of his Cape, to be known henceforth as the "Waite Islands."

Bud Waite retired to Venice, Florida, set up a ham station and spent his final days hamming and diving for ancient fossils in the warm waters just off his new home. He died in 1984.

Conclusion

While I was researching this article, I was amazed how things tie together. The common hub is ham radio. I will have more on John Reinartz, Art Collins and Collins Radio in future columns. Check my Web page for more information, **www.k2tqn.com**. QST

Strays

HPM PRINT AVAILABLE

♢The print of the drawing of ARRL co-founder Hiram Percy Maxim, W1AW [Up Front in QST, Sep 2009, p 20] is available at my Web site, **www.VoganStudio.com**. — *Charles Vogan, KD5KA*

I would like to get in touch with…

♢any radio amateurs of Hellenic origin. — *Joe Contogenis, NU6L*, **nu6lkb6vfz@gmail.com**

♢anyone who might have a copy of two QSL cards for the home page of The K4AMG Memorial ARC, **k4amg.com**: W8QDI from 1930-1968 and K4AMG from 1968-2006. Robert Siff lived in Dayton, Ohio until 1968 and then moved to Sarasota, Florida. Please e-mail a copy of the card to **richard.siff@verizon.net**. — *Rich Siff, WA4BUE*

♢anyone involved in financial services who is interested in a Wall Street club. Please contact George Gero, WA2FEF, **george.gero@rbc.com**, or Jay Nathan, K2HVM, at **jay.nathan@rbc.com**.

WB8IMY

ECLECTIC TECHNOLOGY

Deconstructing the Digital Tower of Babel

One of the frustrations of digital operating is the plethora of modes you encounter on the air. Sometimes you can identify the mystery signals and configure your software to decode them, but sometimes not.

A number of columns ago I mentioned RSID (Reed-Solomon Identification) as a possible means to automatically identify digital signals. The good news is that RSID is finally showing up in various multimode applications. Andy O'Brien, K3UK, explains…

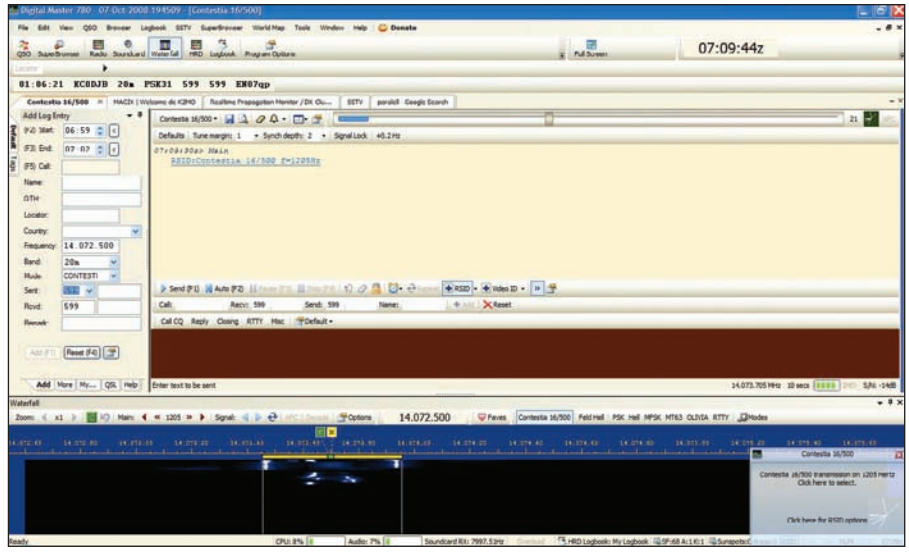
A common problem among digital operators, especially new hams, is the inability to determine which digital mode they are receiving. Is that odd noise Feld-Hell, PSK125, DominoEx or Olivia? Thanks to Patrick Lindecker, F6CTE, a solution known as RSID is now available and it's appearing in several digital software applications.

The history of RSID begins in late 2006 when Patrick devised a method of encoding a short burst of information that would be sent at the beginning of any transmission. The 1.4-second MFSK burst of Reed-Solomon encoded data contained the parameters of the mode in question (designation, bandwidth, number of tones, etc). When decoded by a receiving station, the information would allow the operator to instantly identify the mode being used.

Patrick has been sharing his work with Amateur Radio software developers. As a result, his innovative RSID creation is now incorporated within *DM780* (**www.ham-radio-deluxe.com**), *Fldigi* (**www.w1hkj.com/Fldigi.html**), *Pocketdigi* (**www.n0hr.com/PocketDigi/PocketDigi_intro.htm**) and, of course, Patrick's own *MultiPSK* (**http://f6cte.free.fr/index_anglais.htm**).

To implement RSID the user simply activates it via a mouse click. The MFSK burst has a bandwidth of 172 Hz and is quite robust; decoding can be achieved all the way down to a –18 dB signal-to-noise ratio, a sensitivity equal or better than the majority of the digital modes.

Any RSID compatible software that is scanning the band at the time will decode the burst and alert its operator. Most applications alert you visibly on screen, but some are adding audible alerts or a computer voice that might announce, "Olivia 1000/32 detected at 1173 Hz." Simon Brown, HB9DRV, of *DM780/Ham Radio Deluxe* fame, is actively working on advanced implementation of RSID over the wide frequency ranges afforded by Software Defined Radios.



In this screen capture from *Digital Master 780* (*Ham Radio Deluxe*), the software has picked up an RSID burst and identified the mode as Contestia 16/500. Look in the lower right corner and you'll see a pop-up identifying the mode and giving the operator the option to instantly begin decoding the transmission.

For RSID to achieve its full potential in the ham world, it needs to be widely used. It is of little help if a ham is transmitting with RSID turned on, but no one is decoding it. To increase use of RSID the authors of *DM780*, *Fldigi*, *Pocketdigi* and *MultiPSK* have worked collaboratively and should be commended for their contributions. This collaboration now means that RSID is becoming available to a wide audience. *DXLab* users can also seamlessly integrate RSID into their suite of applications via *MultiPSK*.

Digital enthusiasts are encouraging all hams to use RSID, especially when CQing. PSK31 and RTTY are common and easy to identify, so RSID may not be needed, but if you are using other modes it significantly increases the chances of someone actually responding. For the digital dial twirler, RSID means an end to manually cycling thorough dozens of mode combinations only to have the station stop calling just as you figured it out! As implemented in *MultiPSK*, for example, RSID detects BPSK31 through BPSK250; QPSK31 through QPSK250; MT63 500 through MT63 2000; PSKAM; Chip 64/128; CW; PACTOR 1; ASCII; RTTY 45/50 and 75 baud; Throb 1, 2 and 4; 2ThrobX; Contestia; RTTYM; all Olivia configurations; PAX 1 and 2; DominoEX; Feld Hell; PSK Hell; FM Hell and Hell 80; packet; ALE; THOR; MFSK 8 through 32; DTMF and JT65A, B and C.

For technical details of how RSID has been implemented, visit the *MultiPSK* Web site. For further discussion on how RSID is used on the air, join the K3UK Digitalradio reflector at **groups.yahoo.com/group/digitalradio**.

Windows 7 Update

By the time you receive this issue of *QST*, *Windows 7* will be on the streets. The early word is that the new operating system is being well received. As one ham put it, "This is what *Vista* was supposed to be."

It is going to be interesting to see how this plays out with Amateur Radio applications. In the interest of serving my readers, I may eventually take the plunge and let you know! In the meantime, Jon Maguire, W1MNK, has created a *Windows 7* group on Yahoo to share information. You'll find it at **http://groups.yahoo.com/group/Winham7**. QST

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

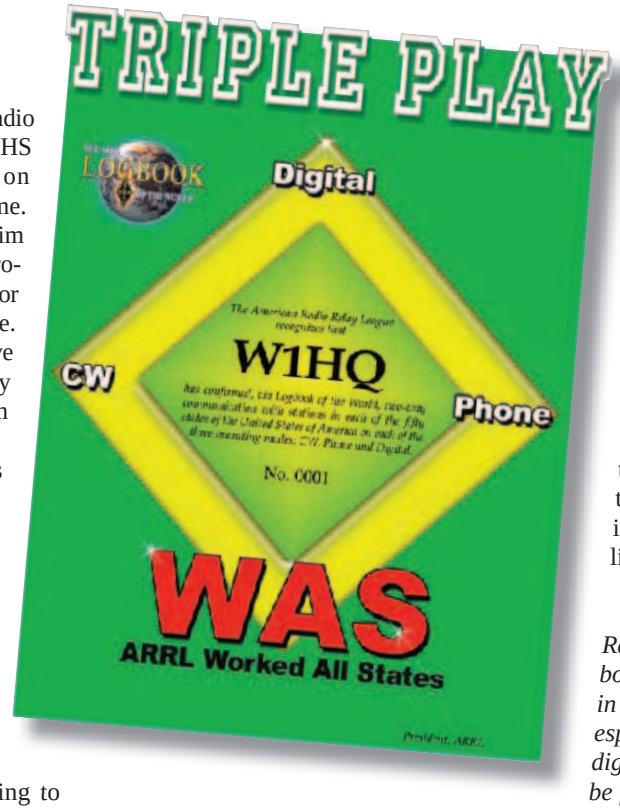
OP-ED

Hams Help Hams Achieve Triple Play WAS Award

Rabbi Cy Stanway, VE3IFS/W2
rabbicy@msn.com

I have been involved in Amateur Radio ever since I was born. My father, VE3LHS (ex-VE3DLS), used to announce on 2 meters where he was on the way home. I would write it down and then show him the list I had heard. As the years progressed, I earned my own license and, for more than 33 years, I have been active. Although there are many things I have not done, there are also a great many that I have. Lately, though, I have been having more fun than usual.

When I read about the ARRL's Logbook of the World (LoTW) Triple Play WAS Award (TPA) I thought it would be a long term goal, something that would take a year or so to achieve. Working all 50 states on CW, SSB and a digital mode seemed a little daunting. I decided to pace myself and to see if I could achieve it. I soon discovered the chat room at **www.obriensweb.com** and was able to connect with someone willing to make contact on a certain band or mode. It was a whole new kind of "search and pounce." What I discovered there was a group of men and women, both in the US and DX, who were the most giving and inviting people. We were all searching after the same thing and we all knew how important it was to help one another.



As the list got shorter and shorter, some of the modes in some of the states got a bit more challenging. Personally, I never thought that finding a digital mode from South Dakota would take almost a week. Still, with a little perseverance and the near-instantaneous upload and matching through the LoTW service, the chart was soon filled and I had finished the award.

When we finish something, it is too common to simply walk away from the support that helped you get there. Not so with the **www.obriensweb.com** amateurs. Even though many of them have completed their TPA, they are still often found on the bulletin board offering their services, modes and states. In fact, the only time most of us say we can't do something immediately is if the band is not cooperative or it's dinnertime. (It did happen once that a station wanted an SSB contact with me but I had to offer either CW or digital because my 12 year old daughter, KC2PVX, was practicing her drums.) Stations in Alaska, Hawaii, New Mexico, Vermont and other "rare" states are often found there and more than happy to make that contact for the award.

The ARRL has really hit on something with the TPA — it has been a great deal of fun. I have been invited to contact others using modes I never used before, such as Feld-Hell and PSK125. The LoTW site recognizes these modes and, once again, I am looking for all 50 states with these less-used modes. I don't expect to finish up the PSK125 TPA in 3 weeks, as I did before, but I am looking forward to the challenge and the fun.

If you are looking for something new, I encourage you to sign up for the LoTW Triple Play WAS Award, try out a new mode, work all 50 states in three (or more) modes and put a little more wallpaper up in the shack.

See you in the pileup.

Rabbi Cy Stanway, VE3IFS/W2, was born in 1959 and was first licensed in 1974. He is active on all bands and especially enjoys working CW and digital modes although he is often to be found on the phone bands as well. He has three children, two of whom are hams, Abraham, KC2LLG, and SaraAnn, KC2PVX, who is now working on her General and with whom Cy operates contests such as Field Day and Canada Day. Cy is the rabbi of Temple Beth Miriam in Elberon, New Jersey. He can be reached at 44 Lambert Johnson Dr, Ocean Township, NJ 07712.

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). QST

CONVENTION AND HAMFEST CALENDAR

Abbreviations
Spr = Sponsor
TI = Talk-in frequency
Adm = Admission

ALABAMA STATE CONVENTION

November 14, Montgomery

D F H S T V

The Alabama State Convention, sponsored by the Montgomery ARC, will be held at the Garrett Coliseum, 1555 Federal Dr. Doors are open for setup Friday 3-9 PM, Saturday 7-8:50 AM; public 9 AM-3 PM. Features include Hamfest and Computer Show, flea market, tailgating ($5 per space), new equipment vendors, forums, VE sessions (8 AM), RV overnight camping (334-242-5598), handicapped accessible, free parking. Talk-in on 146.84, D-Star 146.92. Admission is $6 (under 16 free). Tables are $15 in advance for the 1st table, $10 for each additional table; $15 each at the door. Contact Rik Doll, KU4PY, 142 Oldfield Dr, Montgomery, AL 36117; 334-277-0864; **ku4py@arrl.net**; or Phil Salley, K4PO, 334-272-7980 (after 5 PM); **hamfest@w4ap.org**; **www.w4ap.org**.

Connecticut (Gales Ferry) — Oct 31 H R V
8 AM-2:30 PM. *Spr:* Tri City ARC. Gales Ferry Fire Company, 1772 Rte 12. Auction. *TI:* 147.06 (156.7 Hz). *Adm:* $2. Darryl Del Grosso, WA1DD, 13 Linda Ave, Waterford, CT 06385; 860-443-7799, **ddelgrosso@sbcglobal.net**.

Florida (Coral Gables) — Nov 21. Bill Moore, WA4TEJ, 305-264-4465; **wa4tej@juno.com**; **www.FlamingoNet.8m.net**.

Florida (Oakland Park) — Nov 14 F V
7 AM-1 PM. *Spr:* Broward ARC. Collins Center, 3900 NE 3rd Ave. "Cy Harris Memorial Free Flea," ARRL booth. *TI:* 146.79. *Adm:* Free. Al Flapan, KN4FA, 4460 NW 72nd Ave, Lauderhill, FL 33319; 954-748-7218; **kn4fa@arrl.net**; **www.eagle3.net/barc**.

Florida (Okeechobee) — Nov 28 F R T V
8 AM-4 PM. *Spr:* Okeechobee ARC. Freedom Ranch, 11655 Hwy 441 SE. "Hamfest in the Woods," Cracker Cowboy tours available. *TI:* 147.195 (100 Hz). *Adm:* $5. Charles Whipple, WA4IYY, 32801 Hwy 441 N, Lot 48, Okeechobee, FL 34972; 863-467-2487; **charles.whipple4@embarqmail.com**; **www.k4oke.com**.

FLORIDA STATE CONVENTION

December 5-6, Palmetto

D F H Q S T V

The Florida State Convention (34th Annual Tampa Bay Hamfest), sponsored by the Florida Gulf Coast AR Council, will be held at the Manatee Civic Center, US 301 and Haben Blvd. Doors are open Saturday 8 AM-5 PM, Sunday 9 AM-2 PM. Features include large electronics flea market, paved tailgating ($20 per space plus admission for the entire weekend; opens Saturday at 7 AM, Sunday at 8 AM; **tailgate@fgcarc.org**), commercial exhibit booths ($175 each; **commercial_booths@fgcarc.org**), vendors, forums and programs, VE sessions (three sessions on Saturday at 9 AM, 11 AM, and 3 PM; Sunday 9 AM only; $15 fee, walk-ins accepted on Saturday but reserved basis only on Sunday; **testing@fgcarc.org**), ARECC Testing (Saturday 2-3 PM; $14 fee), card checking (DXCC, WAS, VUCC; both days), handicapped accessible, free parking. Talk-in on 146.955 (100 Hz). Admission is $7 in advance, $8 at the door (good all weekend; **tickets@fgcarc.org**). Tables are $25 each for the weekend, plus admission (electricity available for $32 per outlet for the weekend; **tables@fgcarc.org**). Contact Keating Floyd, KC4HSI, c/o FGCARC, Box 22042, Tampa, FL 33622-2042; 813-765-8916; **kc4hsi@hamclub.org**; **www.tampabayhamfest.org**.

Illinois (Litchfield) — Nov 8. Scott Millick, K9SM, 217-324-2412; **smillick@wamusa.com**. (Banquet/Swap)

Indiana (Evansville) — Nov 28 D F R T V
Set up Friday 3:30-7:30 PM, Saturday 6-8 AM; public 8 AM-1 PM. *Sprs:* Electronic Applications Radio Service (EARS) and The Ham Station. Vanderburgh County 4-H Center Auditorium, 201 E Boonville-New Harmony Rd. 17th Annual Hamfest. *TI:* 145.15, 146.925, 443.925 (107.2 Hz on all frequencies). *Adm:* $7. Tables: $12 (8-ft, includes chairs). Neil Rapp, WB9VPG, 2744 Pinehurst Dr, Bloomington, IN 47403; 812-333-4116; **ears@w9ear.org**; **w9ear.org/hamfest.htm**.

INDIANA STATE CONVENTION

November 14-15, Fort Wayne

D F S V

The Indiana State Convention (37th Annual Fort Wayne Hamfest and Computer Expo), sponsored by the Allen County AR Technical Society, will be held at the Allen County War Memorial Coliseum, 4000 Parnell Ave (corner of Coliseum Blvd). Doors are open for setup on Friday evening and Saturday morning; public Saturday 9 AM-4 PM, Sunday 9 AM-3 PM. Features include over 750 commercial and flea market tables; new and used radio, computer, and general electronics items; vendors; several international ham equipment manufacturers; many forums and meetings; VE sessions (Saturday); parking ($4). Talk-in on 146.88. Admission is $6 for both days or $4 for just Sunday (at the door only); under 12 free when accompanied by an adult. Flea market tables are $25, premium tables are $50; $27.50 for electricity (advance reservations required; no table sales at the door). Send inquiries to AC-ARTS/Fort Wayne Hamfest, Box 10342, Fort Wayne, IN 46851-0342; or contact James Boyer, KB9IH, 260-579-2196; **chairman@fortwaynehamfest.com**; **www.fortwaynehamfest.com**.

Michigan (Mount Clemens) — Dec 6 F V
8 AM-noon. *Spr:* L'Anse Creuse ARC. L'Anse Creuse High School, 38495 L'Anse Creuse St. 37th Annual Amateur Radio Swap/Hamfest. *TI:* 147.08 (100 Hz). *Adm:* $5. Tables: $14. Marty Folz, K8HVI, 40360 Ryan Rd, Sterling Heights, MI 48310; 586-268-0544; **k8hvi@arrl.net**; **www.n8lc.org**.

Mississippi (Ocean Springs) — Nov 20-21
D F H R S T V
Friday 5-9 PM, Saturday 8 AM-2 PM. *Spr:* Jackson County ARA. St Martin Community Center, Lemoyne Blvd. Fall Hamfest. *TI:* 145.11 (123 Hz). *Adm:* $4. Tables: $10. Chris Swift, K5MOZ, 21328 Old River Rd, Vancleave, MS 39565; 228-826-4116; **k5moz@arrl.net**; **www.jcmsara.org**.

New Hampshire (Deerfield) — Oct 16-17. Michael Crestohl, W1RC, **w1rc@near-fest.com**; **www.near-fest.com**.

North Carolina (Benson) — Nov 15
D F H R T V
6 AM-4 PM. *Spr:* Johnston ARS. American Legion, 605 N Wall St. 22nd Annual "JARSFEST." *TI:* 147.27. *Adm:* advance $5, door $6. Tables: $10. Bill Lambert, AK4H, 8917 NC 50 N, Benson, NC 27504; 919-894-3352; fax 919-894-3219; **blambert1@mindspring.com**; **www.jars.net**.

Oklahoma (Enid) — Nov 7 D F H R S V
8 AM-5 PM. *Spr:* Enid Hamfest Group. Garfield County Fairgrounds Hoover Bldg, 200 E Oxford. *TI:* 145.29. *Adm:* $2. Tables: $2. Tom Worth, N5LWT, 2302 Eucalyptus Ave, Enid, OK 73701; 580-542-5410; **enidhamfest@yahoo.com**; **www.enidhamfest.com**.

Tennessee (Chattanooga/Hixson) — Oct 24 T
8 AM-noon. *Spr:* Chattanooga ARC. Burks United Methodist Church, 6433 Hixson Pike. *TI:* 146.79, 146.61. *Adm:* Free. Jim Knight, KD4EHN, **jknight@chatt.net**; **www.w4am.org/Swapfest%20Chattanooga%202009.htm**.

Texas (Azle) — Nov 14 D F S V
7 AM-1 PM. *Spr:* Tri-County ARC. Azle Community Center, 404 W Main St. NCTECH 2009, emergency communications. *TI:* 147.16 (110.9 Hz). *Adm:* $5. Tables: $10. David Johnson, KB5YLG, 820 Wood Ln, Azle, TX 76020; 817-444-5165; **kb5ylg@yahoo.com**; **www.wc5c.org**.

Texas (Corpus Christi) — Nov 14
D F H R S T V
8 AM-5 PM. *Spr:* South Texas ARC. Hilltop Community Center, 11425 Leopard St. 11th Annual Coastal Bend Hamfest. *TI:* 147.82 (107.2 Hz). *Adm:* $5. James Ermis, AD5TC, Box 2182, Corpus Christi, TX 78403; 361-906-0297; **jsinterc@yahoo.com**; **n5crp.org**.

Wisconsin (Appleton) — Nov 1 D H R V
Set up 6 AM; public 8 AM. *Spr:* Fox Cities ARC. The Wave Bar and Ballroom, 2350 N Casaloma Dr. *TI:* 146.76 (100 Hz). *Adm:* advance $5, door $6. Tables: $10. Anthony Mach, AB9IO, 773 Yorkshire Rd, Neenah, WI 54956; 920-722-0482; **ab9io@yahoo.com**; **www.fcarc.us/hamfest.php**.

Wisconsin (Milwaukee) — Nov 14 D F H R
8 AM-2 PM. *Spr:* Milwaukee Repeater Club. Elk's Lodge, 5555 W Good Hope Rd. *TI:* 146.91 (127.3 Hz). *Adm:* $6. Tables: $10. Ken Jaeger, KC9MXZ, 5810 S 37th Ct, Milwaukee, WI 53221; 414-491-0686; **kc9mxz@arrl.net**; **www.mrc91.org**.

Coming ARRL Conventions

November 7-8
Georgia Section, Lawrenceville*

*See October *QST* for details.

D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

Gail Iannone ♦ Convention and Hamfest Program Manager ♦ giannone@arrl.org

75, 50 AND 25 YEARS AGO

November 1934

■ The cover photo shows Ross Hull working on his latest Yagi antenna for 224 Mc. — its stiff wire elements are held in place with a wooden framework.

■ The editorial discusses the role of A.R.R.L. Directors, and how important it is for you, the member, to cast your votes wisely in upcoming Director elections.

■ Ross Hull tells us about "Practical Considerations on the 224-Mc. Band," providing information on high-gain Yagi antennas and receivers. A sidebar to the article proclaims, "Five-Meter Performance Hits New Levels," as a result of the new directive antennas.

■ In "High Power from the Crystal Oscillator," Don Edmondo Ruspoli reports that he can run 200 watts on 40 meters with only 75 milliamperes of crystal current flowing.

■ Kenneth Conroy, W8DYH, tells us how "Detroit Police and Amateurs Cooperate for Emergencies."

■ Ed Handy, W1BDI, announces the "A.R.R.L. All-Section Sweepstakes Contest," the fifth annual QSO party.

■ "The Directive Antenna at KA1NA," by D. C. Redgrave, tells about obtaining excellent results on 7 Mc. using a wire V beam, during the time he was stationed in Japan with the U.S. Navy.

■ "High-Power 'Phone Deluxe," by A. W. Anthony, W1CTE, takes a ham's-eye view of the massive antennas and 15-kilowatt transmitters of the current commercial transatlantic telephone system.

■ In "D.C. Measurements with the Ham Station Analyzer," D. A. Griffin, W2AOE, describes his auxiliary unit for current, voltage, and resistance checking.

November 1959

■ The cover photo shows a log periodic antenna, described by W1FVY in this issue.

■ The editorial explains the operation of the ARRL QSL Bureau, for those who still don't understand how it works.

■ Carl Milner, W1FVY, explains "Log Periodic Antennas," and tells the reader how to design his or her own LP.

■ Adelbert Kelley, K4EEU, tells us how he built "A Phasing-Type Sidebander."

■ Louis Breetz, W3KDZ/W8QLP, explains "Possible Errors in V.S.W.R. Measurements."

■ Guy Falcioni, W2CZM, describes his transistor mobile modulator, in "25 Watts Audio — 90 Cubic Inches."

■ Richard Smith, W1FTX, discusses methods of finding and suppressing "Power-Line Noise."

■ "The 'Gimmick,'" by E. B. Blett, tells us about his pocket tuning aid for the sightless that has many uses.

■ Lew McCoy, W1ICP, explains how Novices can convert two popular military surplus transmitters for their use, in "Crystal Control for the BC-457 and BC-459."

■ In a "Strays" item, W8DCB tells of calling CQ and being called simultaneously by KØTOM and WØTOM!

November 1984

■ The cover photo shows an IC and a spider in the spider's web, to illustrate that "Tiny ICs do big jobs."

■ The editorial announces a new monthly column *and* a new ARRL book — "Up Front in *QST*" and the 1985 *ARRL Handbook for the Radio Amateur*, respectively.

■ Chuck Lobe, KN6H, reports on "Amateur Radio and the Games of the XXIII Olympiad," held in Los Angeles. Patty Winter, N6BIS, provides another view of the effort, in "Amateurs at the Stanford Olympics: The Rewards of Service."

■ Rick Olsen, N6NR, discusses "Digital Signal Processing for the Experimenter."

■ Doug DeMaw, W1FB, provides tips about finding parts for radio projects, in "Improvisation, and Finding Parts."

■ In "The Effect of Real Ground on Antennas" (Part 5), James Rautio, AJ3K, looks at how to use the *Annie* program for antenna analysis.

■ In "Meet the Curtain-Quad Antenna," Ross Anderson, W1HBQ, shows us that, after all, there is something new under the sun.

■ In a "Strays" item, "TA Profiles," we read about Emil Pocock, W3EP, his VHF/UHF work, and his other interests.

Al Brogdon, W1AB ♦ Contributing Editor

Field Organization Reports

AUGUST 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/.**

905
KT2D
700
W7TVA
515
WB7WOW
436
W4CAC
415
KØIBS
349
W2MTA
340
AC8AR
335
N2LTC
305
KA2ZNZ
256
WB8RCR
255
N7CM
254
KI4GEM
252
NC4VA
235
K7EAJ
230
KØLQB
218
KB2ETO
215
W5DY
KI4HGO
210
K2HJ
AK2Z
205
K7OAH
202
KL7JFT
196
K2ABX
195
KE5HYW
190
K2AN
185
WA2BSS
K8MFK
175
K8RDN
171
W9AL
170
WB9JSR
166
W2DWR
165
K7BFL
162
KA8ZGY

160
KB2RTZ
N1UMJ
KGØGG
KJ8O
155
WD9FLJ
AB8JR
151
WA4UJC
KC7ZZ
150
KE4PAP
W6DOB
148
K8AMR
145
WB2KNS
WF5X
142
K4DND
140
N2GJ
KK1X
WØLAW
138
K2BRG
135
W3YVQ
WB9FHP
AC8AL
134
W8CPG
N2JBA
WD8USA
W7EKB
132
W3CB
130
K6JT
WB2FTX
W7JSW
WM2C
KA5EXI
W4FAL
125
NN7H
W7EKB
KD1LE
W4DNA
120
KA4FZI
AG9G
W8UL
K2UL
KK3F
KW1U
W1GMF
N1LKJ
K7BC
KI4GWC
K4GK
K4IWW
KB8GT
119
W2KFV

118
KK5NU
115
K9LGU
N8IO
N3RB
114
NA9L
W7ELI
113
KB5PGY
KD7THV
112
W6SX
111
KK7DEB
N7XG
N7YSS
KB1KRS
110
N7EIE
W7QM
W7GB
K5KV
N5NVP
W5PY
KE5YTA
N8OD
N7BEC
KB2BAA
N1IQI
K1YCQ
K1HEJ
KB1NMO
N4ABM
WA4WNE
KF7GC
K2TV
W2EAG
WB4GHU
KC8FYQ
109
KI4ZJI
108
K4BEH
107
K9EOH
106
W5XX
KBØDTI
105
KE4CB
AD4BL
KE5DKV
N8GUZ
KG4TND
104
N2VC
N4HUB
101
N8NMA
100
K5MC
NX9K
N5OUJ
W5ESE

N2GS
N3SW
W3TWV
W7GHT
AA3SB
WB4FDT
NX1Q
K4BG
WØCLS
NØMEA
N2VGA
KB2KLH
W2DSX
WB6UZX
KI4YV
W4TTO
N9MN
NR2F
W1SGC
KM1N
K4SCL
KO4OL
99
WC5M
98
KI4PRX
96
N7IE
W2LIE
K2VX
95
WG8Z
N2YJZ
93
K2GW
W9ILF
K8VFZ
92
KD8AAD
91
KC5OZT
90
KE7DVV
N9VC
WB8SIQ
N8DD
WD8Q
N1JX
W2CC
WB8OIF
KA8WNO
WD8DHC
WA2CUW
N3ZOC
K3IN
KB3LNM
KA1RMV
NM1K
KA1GWE
W7VSE
WB4BIK
K1JPG
NU8K
W3GQJ
W8IM
KB8POD

86
W5GKH
K2RRM
85
KB9KEG
N2RDB
84
KK7TN
K4MSG
K6RAU
83
KB3LFG
82
KB8NDS
NY3H
81
KI6RUW
KJ7NO
80
KE5PWL
KS3V
KA1EHR
KD8ATI
WB8SBI
K8KV
79
WA2NDA
N7ATK
WA1JVV
78
W9WXN
NS7K
N2DW
77
KA3NZR
W2SFD
76
KT5SR
N2VQA
75
WDØGUF
73
KC4PZA
72
AE5NS
KI4JQB
WB2WAK
70
NS7K
KK1A
WØADZ
NØDUW
NØDUX
NUØF
KAØFUI
NIØI
KBØJKO
NØMHJ
KØPTK
KØOR
KØRXC
NØUKO
WAØVKC
KD7ZUP
KB2CCD
W1PLW
N7BEC

The following stations qualified for PSHR in previous months, but were not recognized in this column: (July) W4KLB 100, N4MEH 90.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AK, AL, AR, AZ, CO, CT, EB, ENY, EPA, EWA, GA, ID, IN, KS, KY, LA, MDC, MI, MN, MS, NC, NFL, NH, NLI, NNJ, NNY, NTX, OR, ORG, SD, SFL, SJV, SNJ, STX, TN, UT, VA, WCF, WI, WMA, WNY, WV, WY.

Section Emergency Coordinator Reports

The following ARRL Section Emergency Coordinators reported: AZ, EWA, GA, IA, IN, KS, LA, MDC, ME, MI, MO, NC, OH, NLI, NTX, SFL, SNJ, SV, WPA, WNY, WTX, WV.

Brass Pounders League

he 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.

KA9EKG 1404, K7BDU 1179, W1GMF 1172, N1IQI 890, KK3F 807, W8UL 748, KS1U 729, N1UMJ 678, WB9JSR 585.

The following station qualified for BPL by achieving100 or more points by originations plus deliveries: NM1K 132, K8PJ 105, K8LJG 104. (July) K8LJG 106.

SILENT KEYS

It is with deep regret that we record the passing of these amateurs:

♦W1BAT **Maier**, David U., Greene, RI
WB1CMB **Santos**, Edmund J. "Bud," Barnstable, MA
WB1CYM **Kerrigan**, Selwyn "Sel" E., Port Charlotte, FL
WA1EZE **Natola**, Mario R., Derry, NH
KB1IB **Lynott**, John T., Indian Lake Estates, FL
N1IPH **Harrington**, Evelyn E., Boylston, MA
W1RRU **Goetz**, William R. Sr, Manchester, NH
WA1TWF **Muto**, Antonio N., Cumberland, RI
W1ZH **Gagnon**, Richard L. Sr, Danvers, MA
N2JYU **Stephens**, Richard H., Niles, OH
W2OSB **Gernant**, Edwin S., Lewisburg, PA
W2PHE **Siembor**, Joseph A., Oswego, NY
W2RBK **Cook**, George W., Syracuse, NY
K2RXG **Swartz**, Clarence E., Baldwinsville, NY
WB2SMR **Parker**, Fred, Schenectady, NY
NN2T **Miller**, Howard F., Waldwick, NJ
WB3DYB **Derr**, Douglas S., Coatesville, PA
NB3G **Benjamin**, Dr Wallace F., Scranton, PA
KB3JTX **Weaver**, Louis H., Coopersburg, PA
W3PPK **Page**, Arthur H. III, Edgewater, MD
KC3QL **Suggs**, John R., Camp Hill, PA
AF3U **Giering**, Gary J., Lancaster, PA
K4ADE **Ageton**, Robert W., Arlington, VA
WD4DJG **Terrell**, Robert W. Sr, Macon, GA
N4EAL **Cleveland**, Charles R. "Dick," Sweetwater, TN
KA4GAO **Hicks**, James J., Alexander, NC
W4GYB **Richards**, Allen, Philadelphia, TN
W4HS **Simmons**, Henry A. Jr, Goldsboro, NC
♦WA4IUM **Brown**, Samuel G., Knoxville, TN
WB4JHI **Forehand**, Jasper W., Marshallberg, NC
KE4KPU **Holt**, Bobby R., Benson, NC
W4LAD **Hoglen**, Wilburn C., Maryville, TN
K4LPT **Cable**, Stanley A., Baker, FL
K4NQV **Maggard**, Robert Dean, Bowling Green, KY
AC4OF **Roth**, Arthur L., Cocoa Beach, FL
W4PRV **Inman**, Joseph R. Sr, Pensacola, FL
KC4QQL **Hancock**, Earl "Barney" L., Kingsport, TN
WA4SYH **Miley**, Frank R., Ormond Beach, FL
W4UEI **Dorman**, Layton B. "Buck," Elberta, AL
W4UKI **Daugherty**, Charles H., Georgetown, TN
KB4UTC **Moon**, Harold, Goose Creek, SC
KA4WSI **McCaskey**, Andrew L. Sr, Weyers Cave, VA
♦W4ZJY **Knight**, David H., Decatur, AL
K5BIR **Price**, Richard C. Sr, Hattiesburg, MS
N5BRE **Mazur**, Edward F., Mena, AR
WD5CDL **McMillan**, Robert L. Jr, Lucedale, MS
W5CDX **Johnson**, Wadsworth "Wads" M., Crowley, LA
W5CKA **Fay**, Louis E. III, Mary Esther, FL
WA5CXB **Morgan**, Charles L., Oklahoma City, OK
WB5DMO **Ellis**, Derek G., Carrollton, TX
KE5MWL **Smith**, Maurice "Mori" R., Cloudcroft, NM
KB5NGE **Middlebrooks**, Philip W., Benton, AR
W5NVL **Rotz**, Joseph, Wichita Falls, TX
W5ORM **Goggin**, John C., Dallas, TX
W5SFW **Patterson**, Philip W., Amarillo, TX
KD5VBE **McCollough**, Howard R., Catoosa, OK
N5ZBO **Doub**, John Mark, Show Low, AZ
KH6AQ **Smith**, Warren O., Kailua, HI
KA6CHK **Roehl**, Adolf, Livermore, CA
K6GBG **Gillespie**, Gordon B., Pasadena, CA
♦K6HLE **Macheel**, Douglas M., Folsom, CA
♦W6IQH **Allen**, James H., Sacramento, CA
W6QFX **Simonson**, Henry "Hank" E., Fort Bragg, CA
♦W6RJY **Becker**, Floyd E., Santa Rosa, CA
K6RQ **Glass**, Frank W., Los Gatos, CA
WA6SHP **Carlson**, Merrill "Mert" R., Coalinga, CA
WA6SMG **Behlen**, Mervin L., Fresno, CA
WO6T **Hicks**, Mickey Carl, Bakersfield, CA
K6VM **Smith**, Cdr Chester R. USN, El Cajon, CA
WB6VOW **Tibbits**, Robert E., Weldon, CA
KF6VYL **Bishop**, William R., Sparks, NV
W6WFV **Steunenberg**, Cal A., Whittier, CA
N6XD **Allen**, William "Bill" T. Jr, Oxnard, CA
W7CET **Cowherd**, William Harry, McMinnville, OR
W7ER **Bruce**, Clifford A., Hemet, CA
WA7ESJ **Thompson**, Charles D., Portland, OR
KD7GPM **Blackert**, Jerry David, Overgaard, AZ
K7IOK **Salzman**, Philip C., Union Gap, WA
KL7JKE **Hilpert**, Conrad R., Butte, MT
KA7LNI **Snow**, Doris M., Spokane, WA
W7QMP **Navarre**, Lewis A., Kent, WA
W8IHJ **Charavay**, Frederick "Jean," Yerington, NV
K8MGH **Pierce**, Louis E., North Ridgeville, OH
♦AI8T **Crowther**, Herbert Allan Jr, Orange City, FL
KA8TWN **Leath**, Stephen K., Washington Court House, OH
K8VKA **Schleppi**, Edwin J., Canal Winchester, OH
KF8WT **Jones**, Glenn, Middletown, OH
KC8ZMC **Haynes**, Sara L., Dayton, OH
KB8ZYH **Cantrell**, Donald E., Milford, OH
W9ATV **Cronk**, Edward R., Venice, FL
WA9CCP **Myers**, Yolanda P., Darien, IL
W9EDA **Berg**, Jack O., Dekalb, IL
KA9FIQ **Villar**, Jose H., Addison, IL
WA9JEZ **Sopocko**, George, Glendale Heights, IL
NV9K **McCarty**, Eugene "Mac" C., Franklin, IN
K9RPX **Radkey**, Robert B., Mountain Home, AR
WB9YDU **Rohleder**, Donald H. "Casper," Milwaukee, WI
♦W9YF **Spencer**, Jack L., Minooka, IL
KB9ZAZ **Larson**, Stanley "Bud," Cushing, WI
WDØBWU **Lyman**, John B., Belle Plaine, IA
KGØII **Farnham**, Robert W., Lamoni, IA
WØINC **Howard**, Roy A. Jr, Akron, CO
KØLLS **Hageman**, Dwayne L., Lenexa, KS
♦WAØMWP **Cox**, James C., Madison, KS
WØOCD **Karwacki**, Fred, Tavares, FL
KØPRE **Rupert**, Jack G., Overland Park, KS
WAØQOU **Ireland**, Edward M., Kansas City, MO
KØRPG **Sanazaro**, Andrew J. Sr, Cuba, MO
WBØWFS **Hernes**, Betty L., Blair, NE
NØWSZ **Snyder**, Max G. Jr, Clay Center, KS
KMØX **White**, James C. Jr, Orange Beach, AL
KCØYRS **Beaver**, Tim J., Fremont, NE

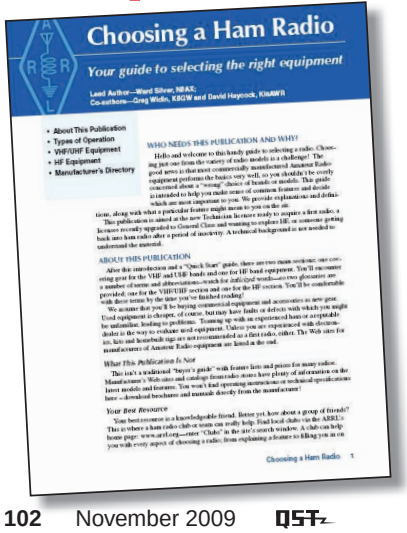
♦ Life Member, ARRL

Note: Silent Key reports must confirm the death by one of the following means: a letter or note from a family member, a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. If you wish to make a contribution in a friend or relative's memory, you can designate it for an existing youth scholarship, the Jesse A. Bieberman Meritorious Membership Fund, the Victor C. Clark Youth Incentive Program Fund, or the General Fund. Contributions to the Foundation are tax-deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc, 225 Main St, Newington, CT 06111. QST

Gail Iannone ♦ Silent Keys Administrator ♦ sk@arrl.org

Strays



The Ham Radio License Manual **now includes a bonus section, "Choosing a Ham Radio: Your Guide to Selecting the Right Equipment." It is available to ARRL members at www.arrl.org/members-only/choosingaradio/. The new section was written by H. Ward Silver, NØAX, with assistance from Greg Widin, KØGW, and David Haycock, KI6AWR. You can purchase the book at www.arrl.org/shop/?item=9639.**

MIKE MORRIS, WA6ILQ

How the editor gets to work each morning? **He wishes! ARRL Life Member Mike Morris, WA6ILQ, spotted this vehicle and notable license plate. The limo belongs to the Quest Limousine Service, based in San Francisco.**

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**.

The Antenna Dipper

Antenna analyzer — Test instrument designed to measure the impedance and standing wave ratio (SWR) of an antenna or an antenna and feed line combination as a function of frequency. See **www2.arrl.org/members-only/prodrev/pdf/pr0505.pdf**.

FT-243 — WW2 vintage holder type for piezoelectric quartz radio frequency crystals. Unlike current holders, in which crystals are permanently fixed to the holder, these were fixed between two removable plates making it feasible to grind the crystal to a new frequency and return it to the holder.

Perforated prototype board — Phenolic material with predrilled holes designed to facilitate wiring up components for prototypes and other low quantity development.

Spotting oscillator — An oscillator that generates a signal at a known frequency. This allows a variable tuned receiver or transceiver to be pretuned to a known frequency in anticipation of a future radio transmission.

A Closer Look at Window Transmission Line

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

Balun — *BAL*anced to *UN*balanced transformer. Provides a transition between balanced transmission lines such as ladder line or open wire line and unbalanced transmission lines such as coaxial cable. See **www.arrl.org/tis/info/pdf/7902015.pdf**.

Center fed Zepp — Antenna type, properly applied to a one wavelength long antenna fed in the center by a ¼ wave long matching section of open wire line used to transform the high impedance to a low impedance that can be coupled to a transmitter. Currently often used to describe a center fed antenna of any length fed by any length of window or open wire line and an antenna tuner for multiband operation.

Pi-network — Generally wide ranging adjustable three element matching network in which a shunt input capacitor is followed by a series inductor then by a shunt output capacitor. Used as an output tuning device in vacuum tube transmitters and amplifiers to match the high plate impedance to a nominal 50 Ω load, it could tune loads quite removed from that value. Also used as an antenna or interstage tuner.

Strip-line transmission line — Transmission line used for connections at VHF and above on printed circuit boards. Sometimes called *microstrip*.

TLW — Transmission line for *Windows*, a software program provided with *The ARRL Antenna Book* that analyzes the losses and impedance levels of transmission lines.[2] A particularly useful application was described in a *QST* article.[3]

The Doctor is IN

Ground plane antenna — A kind of antenna in which the primary element is a quarter wave vertical monopole located above an artificial ground of typically three or four quarter wave *radials*. See **www.arrl.org/tis/info/pdf/ab18-16.pdf**.

The Finger Wiggle Paddle

Infrared (IR) emitting LED — A diode from which infrared light is emitted when current flows. See **hyperphysics.phy-astr.gsu.edu/hbase/electronic/leds.html**.

IR detecting photo transistor — Solid state device in which current flows in an output circuit if infrared light is applied to a specially prepared surface of the device.

TTL — Transistor-transistor logic. Family of solid state logic circuit elements in which the active gates are transistor terminals.

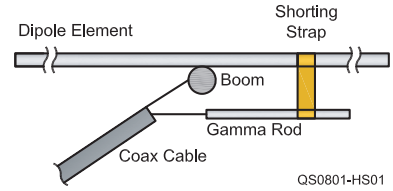
Hints and Kinks

Inductive "kickback" — Term used to describe the phenomenon that occurs if an attempt is made to instantaneously open the circuit of an inductor. An inductor stores energy in its magnetic field. If the circuit providing current to an inductor is opened, the magnetic field collapses, creating a voltage across the inductor of the opposite polarity of the source and forcing a current in the circuit. The current can not change instantaneously and will often arc across the opening switch or relay contacts.

Improving a 30 Year Old, 2 Meter, Four Element Beam

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**.

Gamma match — Antenna impedance matching arrangement for connecting an unbalanced line such as coaxial cable to the center of an unbroken, usually ½ wavelength, antenna.



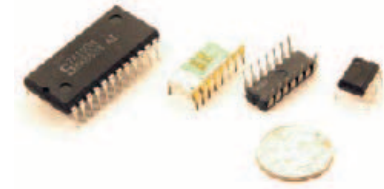
SWR — Standing wave ratio. This is a measure of how well a load, such as an antenna, is matched to the design impedance of a transmission line. An SWR of 1:1 indicates a perfect match. Coaxial cables, depending on length, type and frequency can often work efficiently with an SWR of 3:1, sometimes higher. Transmitters sometimes require an SWR of 2:1 or less for proper operation. See **www.arrl.org/tis/info/pdf/49470.pdf**.

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.

YW — Yagi for *Windows* software program provided with *The ARRL Antenna Book* that provides an estimate of gain, match and front to back ratio based on physical parameters of a Yagi antenna.[4]

The Rockless, a VFO Controlled Low Power Transceiver

DIP (Dual in-line) package — Integrated circuit package characterized by two rows of connecting pins.



Frequency offset — In order to hear an audible tone while listening to radiotelegraph signals, a receiver oscillator must be tuned away from the other station's transmit frequency by the pitch of the desired note, typically 600 to 800 Hz.

Potentiometer — Variable resistor with three terminals, two of which are attached to a fixed resistance element and the third moves along the element, presenting a different resistance to each of the fixed terminals.

Toroid core — A circular donut shaped structure made from metal oxides in a ceramic material. It is used as the basis for inductors that have the property that they are self shielding in that the magnetic fields stay within the core.

Varactor diode — A solid state two terminal device used in non-conducting mode. The capacitance between the terminals is changed by applying a different voltage to them. This results in voltage variable capacitor.

Variable frequency oscillator (VFO) — Oscillator with frequency established by resonant inductor-capacitor circuit. One or the other elements is adjustable to vary the frequency over a range, typically as wide as an amateur band.

[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**.

[2] R. D. Straw, Editor, *The ARRL Antenna Book,* 21th 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**.

[3] J. Hallas, W1ZR, "I Know What's Happening at the Shack — What's Happening at the Other End of my Feed Line?" *QST*, Feb 2007.

[4] See Note 2.

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- HF 100W (20W battery)
- Optional P.S. + Tuner • TCXO Built-in

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- 3 roofing filters built-in
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Competitive pricing!

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50/2M/220/440 HT

- Wideband RX - 900 Memories
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Ultra compact HF, VHF, UHF

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• Proven performance • 160-10M*/6M/2M/70CM • All mode w/DSP • HF/6M @ 100W, 2M @ 50W, 440 MHz @ 20W • CTCSS encode/decode w/tone scan • Auto repeater • 107 alphanumeric memories

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• D-STAR & GPS upgradeable 2M/70CM • 50/15/5W RF output levels • RX: 118-173.995, 375-549.995, 810-999.99 MHz** • Analog/digital voice with GPS (optional UT-123) • 500 alphanumeric memories

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• 160-6M @ 200W • Four 32 bit IF-DSPs+ 24 bit AD/DA converters • Two completely independent receivers • +40dBm 3rd order intercept point

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• 100W HF/6m Transceiver, gen cov. receiver • Dual DSP 32 bit • Three roofing filters- 3, 6, 15khz • 5.8 in WQVGA TFT display • Hi-res real time spectrum scope

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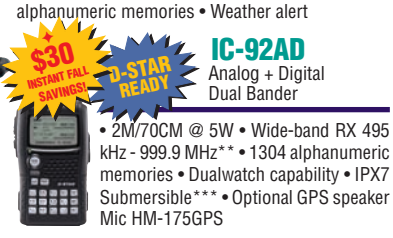

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• 2M/70CM @ 5W • Wide-band RX 495 kHz - 999.9 MHz** • 1304 alphanumeric memories • Dualwatch capability • IPX7 Submersible*** • Optional GPS speaker Mic HM-175GPS

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• 160-10M • 100W • Simple & tough with IF DSP • AGC Loop Management • Digital IF Filter • Digital Twin PBT • Digital Noise Reduction • Digital Noise Blanker • USB Port for PC Control

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2M @ 7W • CTCSS/DTCS encode/decode w/tone scan • Also available in a sport version and a 70CM version (IC-U82)

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- Advanced APRS Features
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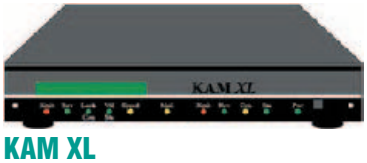

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55 Foot Dual Band ThunderBolt™ 80/40 Meter Vertical

Special Introductory Pricing—Just $799.00

Now you can have a high-performance vertical antenna specifically for the 75/80 meter and 40 meter bands! The DX Engineering Dual Band Vertical Antenna supplies the highest possible performance this side of our mono-band vertical antennas—perfect for areas where there is no room for individual verticals. Achieve the strongest possible presence at your power level and be competitive!

High Efficiency Design
- Massive high efficiency trap assembly—strongest signal possible
- 5kW SSB and CW rated—unparalleled reliability
- Instant automatic band switching
- DX Engineering Adjustable Matching Network configures the lowest SWR
- Broad 2:1 SWR bandwidth—400 kHz on 40m, 300 kHz on 80m
- External tuner not required for CW/SSB QSY
- Lowest possible take-off angle reduces domestic QRM signals

DXE-VRW-1

High Strength Pivoting Fixture
- Self supporting—will withstand steady-state winds in excess of 50 mph without guying (guying required under extreme wind speed conditions)
- Extremely high strength heavy wall tubing made to DX Engineering specs
- Massive fiberglass channel insulator

We also offer an affordable manual winch for easy one-person raising and lowering of the antenna. You can move the winch between similar antennas in a multi-antenna installation.

DXE-8040VA-1	Dual Band High Performance Vertical Antenna	**$799.00**
DXE-VRW-1	Manual Winch Assembly	**$169.99**
DXE-7580-THK	CW Optimizer Capacity Hat	**$59.95**

55 Foot Monoband Thunderbolt™ 75/80 Meter Vertical

Special Introductory Pricing—Just $699.00

The perfect solution—use singly or in a phased array for full, no-compromise 80 meter performance. Achieve the strongest possible presence at your power level and be competitive!

High Efficiency Design
- Center loaded—self supporting at 50 mph+ steady winds
- 5kW SSB and CW rating for unparalled reliability
- Broad 300 kHz 2:1 SWR bandwidth
- Lowest possible take-off angle reduces domestic QRM signals

New!

High Strength Pivoting Fixture
- Uses same optional, affordable winch as DXE-8040VA-1 Dual Band Thunderbolt
- Extremely high strength, heavy wall tubing made to DX Engineering specs

DXE-7580VA-1	Multi-Band High Performance Vertical Antenna	**$699.00**
DXE-VRW-1	Manual Winch Assembly Kit	**$169.99**
DXE-7580-THK	CW Optimizer Capacity Hat	**$59.95**

43 Foot Multi-Band Auto-Tune 10 to 80 Meter Vertical

Special Introductory Pricing—Just $679.00

A complete plug and play package with DX Engineering's 43 foot high performance vertical antenna, tilt base, and antenna mounted tuner to deliver maximum power with low SWR.
- 6063 T832 corrosion-resistant aircraft aluminum tubing and stainless steel hardware
- 43 foot optimal length vertical radiator for multi-band operation
- Freestanding to 90 mph
- Fully automatic band switching
- No coils or linear loading elements
- Handles up to 200 watts with ease
- Low SWR eliminates cable mismatch loss
- Plug and play installation

DXE-MBV-ATU-1

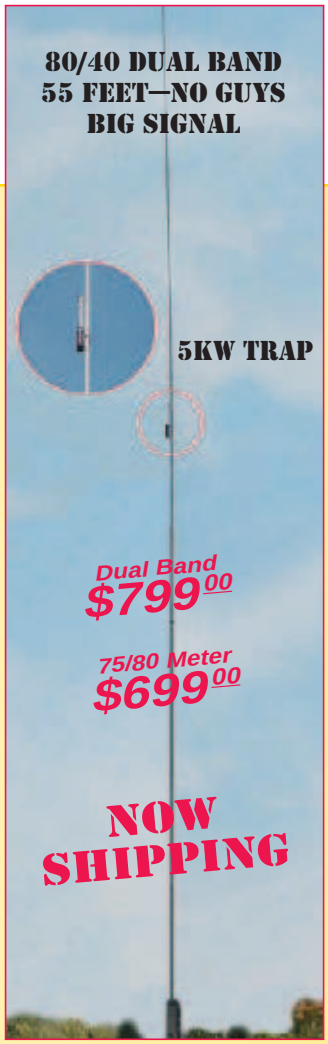
DXE-MBVE-1-3ATP		**$679.00**
DXE-MBV-ATU-1	Add-on Tuner kit for any 43 foot Zero Five, MFJ, Hy-Gain antenna	**$399.00**

AUTO TUNE
43 FEET
90 MPH
NO GUYS

$679.00 with Auto-Tuner

80/40 DUAL BAND
55 FEET—NO GUYS
BIG SIGNAL

5KW TRAP



Dual Band $799.00

75/80 Meter $699.00

NOW SHIPPING

Dual Band Thunderbolt™ 40/30 Meter High Performance Vertical

- Full band coverage on 40 and 30 meters with SWR under 1.5:1—No tuner needed
- 40 meter bandwidth greater than 750 kHz with SWR under 2:1
- Tunable above and below 7 MHz range for MARS and CAP frequencies
- Maximum legal power handling
- Optimum 30 ft. overall height—tilt base included
- Self-supporting design withstands winds up to 60 MPH without guying

DXE-4030VA-1 ..... just **$299.50**

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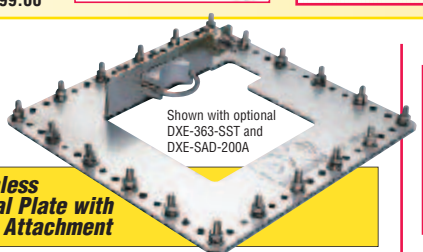
Best Antenna Value Anywhere!

DX Engineering now stocks replacement parts for all BTV antennas

Easiest assembly and tuning of any multi-band vertical!

HUS-4BTV	(10, 15, 20, 40m)	**$124.95**
HUS-5BTV	(10, 15, 20, 40, & 75-80m)	**$159.95**
HUS-6BTV	(10, 15, 20, 30, 40, & 75-80m)	**$189.95**
DXE-A0K-DCF	SO-239 Add-On Kit for BTV Base	**$22.95**
DXE-CBC-8XU2	Jumper, Radial Plate to DCF	**$18.99**
DXE-AOK-17M	17m Add-On Kit for BTVS	**$69.95**
DXE-AOK-60M	60m Add-On Kit for BTVS	**$74.95**
DXE-AOK-80M	80m Add-On Kit for 4-BTV	**$59.95**

Hustler BTV Direct Coax Attachment All Stainless — **$22.95**



Shown with optional DXE-363-SST and DXE-SAD-200A

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- Fits 2" pipe, 4x4 and 6x6 posts
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- Accommodates up to 120 radials
- Patented high current coax connection to radials

DXE-RADP-1P	Complete with 20 stainless bolt sets	**$54.50**

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Complete Radial Kits with Wire Lugs Attached Available now at DXEngineering.com

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- Connectors have silver plated body and barrel with center Teflon® dielectric
- Highest quality Belden coaxial cable is used
- All cable assemblies are high voltage tested to handle full rated power
- Watertight seal between connectors and coax
- Call to order custom cable/connector assemblies

Belden

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We have the highest quality and lowest prices available anywhere!

- 6063-T832 drawn aluminum tubing
- Exact 3 ft. and 6 ft. lengths
- Telescoping sizes from .375" to 2.125"
- Precise I.D. and O.D. for smooth fit
- Factory pre-slit at one end for element clamps
- Heavy duty wall tubing also available
- Low cost shipping worldwide

Aluminum Tubing, 3 Foot Lengths, 0.058" Wall			Cost/Foot
DXE-AT1240	0.375", no slit	$2.70	$0.90
DXE-AT1241	0.500", slit at 1 end	$3.30	$1.10
DXE-AT1242	0.625", slit at 1 end	$3.60	$1.20
DXE-AT1243	0.750", slit at 1 end	$3.90	$1.30
DXE-AT1244	0.875", slit at 1 end	$4.20	$1.40
DXE-AT1245	1.000", slit at 1 end	$4.50	$1.50
DXE-AT1246	1.125", slit at 1 end	$4.95	$1.65
DXE-AT1247	1.250", slit at 1 end	$5.55	$1.85
DXE-AT1248	1.375", slit at 1 end	$6.15	$2.05
DXE-AT1249	1.500", slit at 1 end	$6.75	$2.25
DXE-AT1250	1.625", slit at 1 end	$7.65	$2.55
DXE-AT1251	1.750", slit at 1 end	$8.40	$2.80
DXE-AT1252	1.875", slit at 1 end	$9.15	$3.05
DXE-AT1253	2.000", slit at 1 end	$9.90	$3.30
DXE-AT1254	2.125", slit at 1 end	$11.40	$3.80
Aluminum Tubing, 6 Foot Lengths, 0.058" Wall			**Cost/Foot**
DXE-AT1189	0.375", no slit	$5.40	$0.90
DXE-AT1205	0.500", slit at 1 end	$6.60	$1.10
DXE-AT1206	0.625", slit at 1 end	$7.20	$1.20
DXE-AT1207	0.750", slit at 1 end	$7.80	$1.30
DXE-AT1208	0.875", slit at 1 end	$8.40	$1.40
DXE-AT1209	1.000", slit at 1 end	$9.00	$1.50
DXE-AT1210	1.125", slit at 1 end	$9.90	$1.65
DXE-AT1211	1.250", slit at 1 end	$11.10	$1.85
DXE-AT1212	1.375", slit at 1 end	$12.30	$2.05
DXE-AT1213	1.500", slit at 1 end	$13.50	$2.25
DXE-AT1214	1.625" slit at 1 end	$15.30	$2.55
DXE-AT1215	1.750", slit at 1 end	$16.80	$2.80
DXE-AT1216	1.875", slit at 1 end	$18.30	$3.05
DXE-AT1217	2.000", slit at 1 end	$19.80	$3.30
DXE-AT1218	2.125", slit at 1 end	$22.80	$3.80
6061-T8 Aluminum Tubing, 0.120" Heavy Wall Telescoping			
DXE-AT1311	1.500" O.D. x 6 ft. no slit	$23.85	
DXE-AT1312	1.750" O.D. x 6 ft. no slit	$28.20	
DXE-AT1313	2.000" O.D. x 6 ft. no slit	$33.00	
DXE-AT1314	2.250" O.D. x 6 ft. no slit	$37.45	
DXE-AT1315	2.500" O.D. x 6 ft. no slit	$42.50	
DXE-AT1316	2.750" O.D. x 6 ft. no slit	$46.95	
DXE-AT1317	3.000" O.D. x 6 ft. no slit	$51.40	
DXE-AT1325	3.000" O.D. x 12 ft. no slit	$103.95	
6061-T8 Aluminum Tubing, 0.125" Heavy Wall			
DXE-AT1255	2.000" O.D. x 3 ft, no slit	$14.85	
DXE-AT1204	2.000" O.D. x 6 ft, no slit	$29.70	

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65 ft. Telescopic Aluminum Tubing Kit

- 65 ft. slow taper from HD 2" O.D. base to 7/8" O.D. top
- Build your own vertical antennas or arrays
- Use with DX Engineering Insulated Base Assemblies

DXE-ATK65 ..... $194.50

Insulated Vertical Base Assemblies for 2" O.D. Antenna Masts

Standard Base

- Tilt Base optional
- Two DXE-CAVS-1P mounting clamps required to attach base to mounting post

DXE-VE-BASE ..... Only $99.50

DXE-CAVS-1P V-Saddle Clamp $9.95

DXE-TB-3P Tilt Base Assembly $62.50

Heavy Duty Base

- Tilt Base included
- Two DXE-SSVC-2P mounting clamps required to attach base to mounting post

DXE-VA-BASE $149.50

DXE-SSVC-2P V-Saddle Clamp $11.45

COMPLETE 5 BAND KIT—$599.95

Hexx© 5-Band HF Beam Antenna Kits

- Pre-slit fiberglass—easy assembly
- Small turning radius—has a turning radius of 11 feet
- Light weight—less than 25 pounds fully assembled
- Can be turned with a light duty rotor—save money
- Has full length elements—no lossy coils or traps
- Requires no matching network—direct single 50 Ω coax feed
- Low noise results—approaches performance of closed loop antennas
- Good results at 20 to 30 feet above ground

DXE-HEXX-1HBP	Hub and Hardware Package	$99.95
DXE-HEXX-1SCP-2	Spreader and Center Post Package	$199.95
DXE-HEXX-1WRP	1-Band Wire & Wire Guide Package	$75.95
DXE-HEXX-5WRP	5-Band Wire & Wire Guide Package;	$149.95
DXE-HEXX-5CFP	5-Band Coax Feeder Package	$194.95
DXE-HEXX-1TAP	1-Band Total Antenna Package	$359.95
DXE-HEXX-5TAP	5-Band Total Antenna Package	$599.95

Receive Antenna Interface for Transceivers New!

Add a dedicated receive antenna to HF transceivers which lack a separate RX antenna input port! The DX Engineering RTR-1 Receive Antenna Interface is a unique, multi-purpose switch unit which automatically or manually switches the RF output antenna connector on any HF transceiver between reception using a separate receiving antenna system and transmitting with a standard transmitting antenna. Enjoy the improved reception that a low noise receiving antenna system offers. Connection to a Beverage, receive four-square, active receive antenna, or other receiving antennas and accessories is now possible.

- Heavy stainless steel enclosure
- Fast switching—QSK CW operation to 200 watts
- Supports CW full break-in
- Failsafe—prevents transmitting into receive antennas

DXE-RTR-1	Receive Transmit Relay Switch *Introductory Price*	$139.95
DXE-PSW-12D1A	AC Adapter 12VDC/1000mA	$19.99

Ground Strap Assemblies

- Three widths available in various lengths
- Ground your rig for RFI and lightning protection
- Ideal for vehicle noise reduction with mobile systems, ground radial plate or balun to antenna
- Preassembled with lugs for both #10 and 1/4" bolt sizes
- Call to order custom cable/connector assemblies

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Coaxial Cable Prep Tools New!

- Precision, two-step operation
- No nicks or scratches to conductor
- Premium, long lasting cutter blades
- For foam or solid dielectric cable preparation

DXE-UT-8213	Cable Stripper for RG-8, RG-213, etc	$39.95
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DXE-UT-80P	PL-259 Assembly Tool	$22.95
DXE-UT-80N	2-piece N Connector Tool	$22.95
DXE-CNL-911	Coax Cable Cutters	$23.75
DXE-170M	Precision Shear Side Cutters	$7.95

Now available in cost-saving tool kits with carrying case

DXE-UT-CASE	Molded carrying case only	$22.95
DXE-UT-KIT1	Basic Coax Cable Prep Kit	$99.95
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PSK-31 SSTV WSJT

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- Works with ALL radios
- Supports all sound card digital and voice modes
- Requires radio interface cable, sold separately below

Radio Interface Cables

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TIG-SL-CAB8R	8-pin round mic connector	$14.95
TIG-SL-CABRJ1	RJ-11 mic connector	$14.95
TIG-SL-CABRJ4	RJ-45 mic connector	$14.95
TIG-SL-CAB5PD	5-pin DIN	$14.95
TIG-SL-CAB8PD	8-pin DIN	$14.95
TIG-SL-CAB13I	13-pin DIN Icom	$19.95
TIG-SL-CAB13K	13-pin DIN Kenwood	$19.95
TIG-SL-CAB6PM	6-pin mini-DIN	$14.95
TIG-SL-CABNC	Unterminated cable	$7.95

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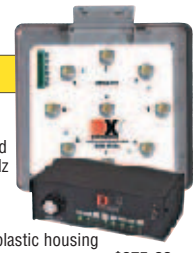
Remote Antenna Switches



- Best SWR and port isolation on the market
- 8-position switch, controller included
- Better than 1.1:1 SWR below 30 MHz

5 kW Key-Down RF Switch

- Better than 70 dB of port-to-port isolation
- High impact, copper coated thermoplastic housing

DXE-RR8A-HP-P $375.00

10 kW Key-Down RF Switch

- Better than 60 dB of port-to-port isolation
- Weatherproof, RF shielded stainless steel housing

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Intl *QST*	$62	$118	$167	Monthly *QST* via air mail for international members
Intl CD	$39	$76	$111	Annual CD-ROM (*QST*, *NCJ* and *QEX*) for international members
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Hybrids are used worldwide by serious contesters, DXers, and serious hams. With properly installed arrays, our hybrids offer 20dB F/B and up to 5dB gain at a lower cost than most low band beams at proper heights. Available for 160 through 10 meters.
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No space for a four-square phased vertical array? Try a PVS-2 2-element phased vertical system. It features three direction switching—selectable end-fire and broadside. Available for 160 meters through 10 meters.
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Stack Yagi Switches

The affordable STACK-2 switch is designed for tribanders, log periodics, or monobanders from 40 to 10 meters. Simply run equal lengths of 50 Ω coax from the STACK-2 to each antenna.

The SYS-3 is designed for monoband 3-stack Yagis. Based on K3LR's design, it allows you to select any one antenna, all antennas, or any combination of two antennas.

Switching of Yagi phasing allows you to adjust the vertical radiation angle of stacked Yagis to more closely match the angle of the incoming signals for maximum station performance. Indicator lights for each antenna tell you at a glance which antennas are selected.
COM-STACK-2.....**$221.95**
COM-SYS-3.....**$399.95**

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HEI-HM-10-DUAL	Desk Mic, HC4 & HC5 Elements	**$119.00**
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HEI-PR781	Dynamic Cardioid Studio Quality Mic	**$139.00**
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HEI-BM-10-5	Boom Mic/Headset, HC5	**$89.00**
HEI-BM-10-IC	Boom Mic/Headset/Adapter, ICOM Electret	**$99.00**
HEI-PROSET-4	Boom Mic/Headset, HC4;	**$125.00**
HEI-PROSET-5	Boom Mic/Headset, HC5;	**$125.00**
HEI-PROSETIC	Boom Mic/Headset/Adapter, ICOM Electret	**$139.00**
HEI-PROSETPLUS	Boom Mic/Headset, HC4 and HC5	**$189.00**
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HEI-SM-1	Shock Mount, GM/PR20	**$59.00**
HEI-SM-2B	Shock Mount, PR40	**$95.00**
HEI-TM-1	Tri-Mount Mic Adapter	**$14.00**
HEI-FS-2	Dual Switch Foot Switch	**$38.00**
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HEI-BAG1	Leatherette Bag for PROSET	**$25.00**
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- AA Battery Case • Memories: 107

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- Memories: 70 • Power: 2W with AA batteries, 6W with optional 13.8VDC cord

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- Power: 100W (HF/6M), 50W (2M), 20W (440 MHz)
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- Memories: 201
- 32-bit IF-DSPs + 24-bit AD/DA Converters
- USB Port for CI-V Format PC Control and Audio In/Out

IC-2200H 2M FM Mobile

- TX: 144-148 MHz • RX: 118-174 MHz
- Power: 65/25/10/5W • Memories: 207
- D-Star upgradable with optional UT-118

IC-756PROIII HF/6M Base

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-100W
- Memories: 101 • 5 inch color screen • 32-bit floating DSP
- Real time spectrum scope • Automatic antenna tuner
- Improved 3rd order intercept point • PS-125 included!

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-7600 HF/6M Base

- 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
- USB Keyboard Included!

IC-910H VHF/UHF All Mode

- TX: 144-148, 430-450 (1240-1320 with UX-910 option)
- RX: 136-174, 420-480 (1240-1320 with UX-910 option)
- Power: 5-100W on 2M, 5-75W on 440 (1-10W on 1.2 GHz with UX-910 option)
- Memories: 328 • Modes: SSB, CW, FM, FM-N
- Perfect for Satellite Operation

IC-7700 Multimode HF/6M Base

- TX: HF/6M • RX: 0.03-60 MHz • Power: 5-200W
- Memories: 101 • 7 inch color screen
- Two 32-bit floating DSPs
- Three roofing filters • External VGA connector
- Automatic antenna tuner • USB memory drive socket

AES

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CALL AES NOW FOR A QUOTE!

Radios by ICOM

FT-250R

FT-270R

FT-250R 2M FM HT
- TX: 144-148 • RX: 140-174
- Power: 5/2/0.5W • Memories: 209
- Increased AF output & added "Memory Only" mode

FT-270R 2M FM HT
- TX: 144-148 • RX: 136-174
- Power: 5/2/0.5W • Memories: 200
- Extra large LCD display & speaker
- Increased AF output & added "Memory Only" mode

FT-1900R 2M FM Mobile
- TX: 144-148 • RX: 136-174
- Power: 55/25/10/5W • Memories: 221
- Added "Memory Only" mode

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

FT-7900R 2M/440 FM Mobile
- TX: 144-148, 430-450 MHz
- RX: 108-520, 700-999 MHz (cell blocked)
- Power: 50/20/10/5W (2M), 45/20/10/5W (440 MHz)
- Memories: 1055 • YSK-7800 included!
- Added "Memory Only" mode

FT-857D 100W HF/VHF/UHF Mobile
- TX: HF/VHF/UHF • RX: 0.1-56, 76-108, 118-164, 420-470 MHz • Power: 5-100W (HF/6M), 5-50W (2M), 5-20W (440 MHz) • Memories: 200 • YSK-857 included!

FT-450 100W HF/6M Portable/Base
- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 500 • IF DSP Technology
- Selectable AGC, IF width & shift, contour, digital noise reduction, manual notch filter and clarifier
- Optional Auto Antenna Tuner (ATU-450)

FT-450AT
- The FT-450 except ATU-450 Antenna Tuner is installed

FT-950 100W HF/6M Base
- TX: HF/6M • RX: 0.03-56 MHz • Power: 10-100W
- Memories: 100 • Auto Antenna Tuner
- 32-bit Floating Point DSP • Requires 12VDC PS
- 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 Base
- 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

FT-2000D 200W HF/6M Base
- FT-2000 except RF output is 200W and supplied power supply is external

LDG ELECTRONICS

The #1 Line of Autotuners

NEW! KT-100

LDG's first dedicated autotuner for Kenwood Amateur transceivers. Easy to use - just right for an AT-300 compatible Kenwood transceiver. The KT-100 actually allows you to use the Tune button on the radio. The LEDs on the front panel indicate tuning status, and will show a match in seconds, or even less of you've tuned on or near that frequency before. Has 2,000 memories for instant recall of the tuning parameters for your favorite bands and frequencies. If you have an AT-300 compatible Kenwood radio, you can simply plug the KT-100 into your transceiver with the provided cable; the interface powers the tuner, and the Tune button on the radio begins a tuning cycle. The supplied interface cable makes the KT-100 a dedicated tuner for most modern Kenwood transceivers. ***Suggested Price $199.99***

NEW! Z-100Plus

LDG's popular Z-100 economy tuner is now the Z-100Plus. Still small and simple to use, the Z-100Plus sports 2000 memories that store both frequency and tuning parameters. It will run on any voltage source from 7 to 18 volts; six AA batteries will run it for a year of normal use. Current draw while tuning is less than 100ma. The Z-100Plus now includes an internal frequency counter so the operating frequency is stored with tuning parameters to make memory tunes a blazingly fast 0.1 seconds; full tunes take an average of only 6 seconds.
Suggested Price $159.99

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***

NEW! Z-817

The ultimate autotuner for QRP radios including the Yaesu FT-817(D). Tuning is simple; one button push on the tuner is all that is needed - the Z-817 takes care of the rest. It will switch to PKT mode, transmit a carrier, tune the tuner, then restore the radio to the previous mode! 2000 memories cover 160 through 6 meters. The Z-817 will also function as a general purpose antenna tuner with other QRP radios. Just transmit a carrier and press the tune button on the tuner. Powered by four AA internal Alkaline batteries (not included), so there are no additional cables required. A coax jumper cable is also induced for fast hook up. ***Suggested Price $129.99.***

NEW! Z-11ProII

Meet the Z-11Pro, everything you always wanted in a small, portable tuner. Designed from the ground up for battery operation. Only 5" x 7.7" x 1.5", and weighing only 1.5 pounds, it handles 0.1 to 125 watts, making it ideal for both QRP and standard 100 watt transceivers from 160 - 6 meters. The Z-11Pro uses LDG's state-of-the-art processor-controlled Switched-L tuning network. It will match dipoles, verticals, inverted-Vs or virtually any coax-fed antenna. With an optional LDG balun, it will also match longwires or antennas fed with ladder-line. All cables included. ***Suggested Price $179***

FREE Balun with purchase any new LDG tuner with a suggested retail value of over $150!

*Purchase any new LDG tuner with a suggested retail value of over $150 between Oct 15, 2009 and March 15, 2010 and receive a Free balun from LDG Electronics. Simply fill out form (available at www.ldgelectronics.com or via mail - write to 1445 Parran Rd., St. Leonard, MD 20685) and send to LDG along with a copy of your dated sales receipt and LDG will send you a Free RBA-1:1 or RBA-4:1. All forms must be received before March 31, 2010. Limit one free balun per household. Not Transferable.

Free Balun with Autotuner Purchase!*

AT-100Pro

This desktop tuner covers all frequencies from 1.8 – 54 MHz (including 6 meters), and will automatically match your antenna in no time. It features a two-position antenna switch, 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 $219***

radio not included

NEW! AT-897Plus for the Yaesu FT-897

If you own a Yaesu FT-897 and want a broad range automatic antenna tuner, look no further! The AT-897 Autotuner mounts on the side of your FT-897 just like the original equipment and takes power directly from the CAT port of the FT-897 and provides a second CAT port on the back of the tuner so hooking up another CAT device couldn't be easier. ***Suggested Price$199***

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

NEW FTL Meter For Yaesu FT-857(D) and FT-897(D). 4.5" face with calibrated scales for signal strength, discriminator reading on receive, and power output, SWR, modulation, ALC action and supply voltage on transmit, all selectable from the radio's menu.
Suggested Price $79.99

NEW! M-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

See AT-1000Pro Review in Nov. '08 CQ

AT-1000Pro

Building on the success of the AT-1000, LDG Electronics has refined and expanded its 1KW tuner. 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***

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

NEW! IT-100

Matched in size to the IC-7000 and IC-706, the new IT-100 sports a front panel push-button for either manual or automatic tunes, and status LEDs so you'll know what's going on inside. You can control the IT-100 and its 2000 memories from either its own button or the Tune button on your IC-7000 or other Icom rigs. It's the perfect complement to your Icom radio that is AH3 or AH-4 compatible.
Suggested Price $179.99

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Our pledge to you. At no additional charge, each Tokyo Hy-Power amplifier purchased from Array Solutions will be configured with the proper AC mains plug, set up for 230V or 115V and TESTED BEFORE IT'S SHIPPED TO YOU.

HL-1.1KFX
Lightweight HF Linear

This world-class compact HF amplifier has built-in switch mode power supply to save the weight. It is compatible with wide AC line of 100 to 250V, and is best suited for DX-peditioners.

HL-1.5KFX
HF/50MHz Linear

The amp utilizes an advanced 16 bit MPU (microprocessor) to run the various high speed protection circuits such as overdrive, high antenna SWR, DC overvoltage, band miss-set etc.

HL-2.5KFX
HF Linear Amplifier

The HL-2.5KFX is the lightest and most compact self-contained 1.5kW output HF LINEAR amplifier in its class. The amplifier's decoder changes bands automatically with most modern HF transceivers.

HL-1.2KFX
750W PEP HF Desktop Linear

This Solid State, world-class compact 750W HF amplifier is the easiest to handle and operate. The amplifier's broadband characteristics require no further tuning once the operating band is selected.

Tuners from TOKYO HY-POWER

HC-1.5KAT
HF 1.5KW Auto Tuner

HC-200AT
HF/6m 200W Auto Tuner

NEW!

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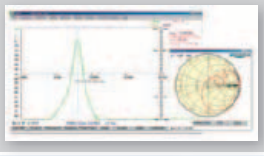
AA-200/AA-500 – A Powerful Handheld Antenna Analyzer designed for testing, checking, tuning or repairing antennas and antenna-feeder paths in 0.1 to 200 MHz range.

AIM 4170 Laboratory quality impedance analyzer for antennas and networks using our patent pending technology 5 kHz to 180 MHz.

NEW! **2 port VNA-2180** – vector network analyzer



RatPak
The leading remote coax switch. High isolation, high power, and reliable.

SixPak Series
2, 6, and 10 antenna switches. Use them to do SO2R or Multi-Op.

Low Band RX Antennas
AS-AYL-4 is used in backyards and on DX-peditions all over the world.

PowerMaster
VSWR/Watt Meter and Station monitor can save your amp, fast bright display and laboratory accuracy. 3kW, 10kW, and 20kW

StackMatch Series
2, 3, and more antenna switching and phasing. New StackMatch Plus with built-in broadband BIP BOP.

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Add QSK to any amplifier quickly and without heavy technical modification. Quiet down that clunky relay with our whisper quiet QSK machine.

BandMaster
Universal band decoder, with more features than any decoder made.

FilterMax Series
Bandpass filters that set the benchmark for performance, mono band or auto switching.

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Array Solutions is now an official stocking Phillystran distributor, we have also set up an East Coast Stocking distributor under us to help distribute this fine product in a fast and convenient way. We have guy cables from HTPG-1200I to HTPG-11,200I as well as the thimbles, big grips, end caps. We also have Nicro-press fitting and tools for the smaller 1200I which does not use grips.

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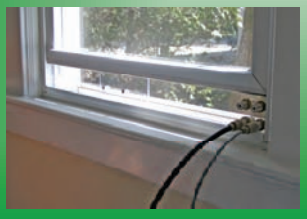
Time to upgrade your station? Our quality feedline and accessories put your power where it belongs. High grade baluns, 300Ω and 450Ω ladder line, coax, feed through panels, premium grade connectors and adapters, and more.

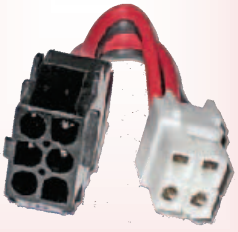
Hot tip: Replacing old lossy coax will boost performance on both transmit and receive.



DC Power Solutions!

Power Cables and Connectors for ICOM, Yaesu, Kenwood, Alinco, and others. Most HF, FM Mobile, and Handheld rigs. Red/Black Zip Cord in many sizes. Hard to find plugs and cables for older radios like the Kenwood TS-520/TS-820 and Yaesu FT-747/FT-757.

Connectors and cables for many air, marine, commercial and public service radios, too!



6-Pin to 4-Pin Power Adapter

Many new HF radios, including the IC-7000, FT-450, and TS-480, are using a new 4-pin plug for DC Power. If your shack is already wired up with the "standard" 6-pin plug, this is the adapter you need. Other configurations are also available.

Extension Cables for ICOM Tuners

Antenna Solutions!

To build the right wire antenna, you need the right antenna wire. We have a wide variety of styles and lengths. Plus insulators, UV-proof rope, marine-grade pulleys, and handy gadgets.

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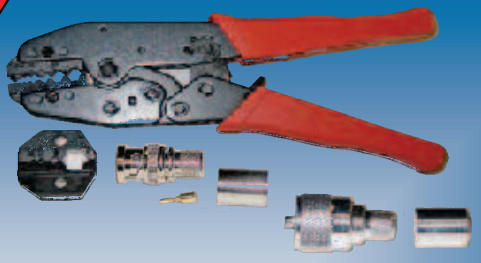
15A-30A-45A-50A-75A-120A
Panel, Cable & Chassis Mounts
Pre-Assembled Cables
More Powerpole Stuff Than
ANYBODY!

New! Exclusively from Quicksilver Radio, these handy Powerpole splitters are great in the shack, in the field, or in your go-kit. Compact heavy duty units, built to last.

New! 'Andy-Crimp Ratcheting tool for 15, 30, 50 and 75A Anderson Powerpoles.
That's right, ours does the 50 & 75A too!
Special Sale Price $35.
Regular price $50

Limited Time Sale!
West Mountain Radio Crimper for 15, 30, and 45A Powerpoles.
Regular Price $60
Special Sale Price $45



Commercial Grade Crimper with two dies.
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119 Piece Heat Shrink Tubing Set

Case with Lid Included
5/32, 3/16, 9/32 &
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Less than 2 Inches Long
Regular ~~$20~~
Online Sale $12

PowerPole Ratcheting Crimp Tool

I, Anderson P. Crimpp, designed this tool for crimping 15 and 30 amp PowerPoles. I called it 'Andy-Crimp'. It's a fast and easy way to install PowerPoles. See more details on the website under PowerPole Headquarters.
Regular ~~$50~~
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Can You Hear Me Now?
10 Watts, Repeats Messages
Rechargeable Battery
Details on Website
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Lightning Arrestor

Good Quality
Standard PL-259 &
SO-239 Connectors
Regular ~~$8~~
Online Sale $4

Anderson PowerPoles

Package deal with 10 sets of 30 amp size. This is my most popular size
Regular ~~$20~~
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Leather Tool Belt

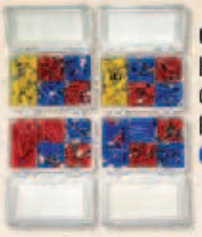
Genuine Top Grain Leather
10 Pockets
Details on Website
Regular ~~$30~~
Online Sale $10

RG8X Coax Cable

Ready To Go
100 Feet With Connectors Installed
Regular ~~$75~~
Online Sale $45

2 Position Coax Switch

Unused Position Is Grounded
Handles Legal Limit
Regular ~~$35~~
Online Sale $25



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Huge Assortment
Over 575 Pieces
Regular ~~$40~~
Online Sale $20

Pencil Torch

Uses Standard Butane
Great for Heat Shrink
Regular ~~$6~~
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Very Handy for Close-uo Work
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JTPS30M

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30 amp max,
25 amp continuous power supply.

Switching Power Supply, 30 amp surge, 25 amp continuous, Variable 9-15V or fixed at 13.8V, Over voltage protection, Over current protection, 110 or 220 Volts, One meter switchable voltage/current, High current jacks on the back, Lighter jack on the front, Low current quick connectors on the front.

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28 amp max,
25 amp continuous power supply.

28 amps max, 25 amps continuous, adjustable 9-15 VDC, Volt and current meters, Light weight, only 4 lbs!, Compact, only 5.75" x 4.5" x 7", Five way binding post for high current radios, Quick connectors for low current accessories, Over voltage protection, Over current protection, Quiet internal cooling fan with "fan on" LED, Switchable AC input voltage, 110 or 220 VAC, AC line fuse.

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Bluetooth Hands-Free Operation with GPS/APRS and Real RF-Dual Wideband Receive... The next generation Amateur Handheld transceiver from Yaesu, who has been introducing Leading -Edge Transceiver Technology for years.

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BH2 Bluetooth Headset Mono 82.95
BU1 Bluetooth Unit 71.95
CD40 Charger Cradle BH1 & BH2 ..... 25.95
CD41 Rapid Charger Cradle 32.95
CSC93 Softcase 14.95
FBA39 Alkaline Battery Tray 26.95
FGPS2 GPS Unit 79.95
FNB101LI 7.4V 1100mAh LI-Ion 57.95
FNB102LI 7.4V 1800mAh LI-Ion 69.95
MH74A7A Speaker Mic 43.95
NC85B Wall Charger for CD40 ..... 16.95

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The FT-60R includes wide receiver coverage, outstanding audio quality, the most CTCSS/DCS flexibility in the industry, and a new Emergency Automatic Identification (EAI) feature for search-and-rescue work.

ADMS1J Software/Cable 39.95
EDC5B DC Cable w/Noise Filter 23.95
EDC6 DC Cable 7.95
FBA25A AA Battery Case 21.95
FNB83 7.2V 1400mAh Ni-MH 39.95
MH34B4B Speaker Mic 33.95
VAC370B Rapid Charger 62.95

VX3R

The new ultra-compact VX-3R 2m/70cm FM HT Transceiver is loaded with convenience features. In addition to top quality performance on the 2m and 70cm, you will also be able to enjoy stereo FM and AM broadcast band.

ADMSVX3 Software/Cable 39.95
CSC92 Soft Case 14.95
EDC21 DC Cable w/Noise Filter 36.95
FBA37 AA Battery Case 17.95
FNB82LI 7.2V 1400mAh Ni-MH 34.95
MH34B4B Speaker Mic 33.95

FT8800R

If you're ready for the best in a Dual-Band FM Mobile Transceiver, the FT-8800R is ready for you! With easy operation, outstanding receiver performance, and cross-band repeat capability, the FT-8800R is the new standard of comparison!!

ADMS2I Software and cable 39.95
JTPS14M Jetstream Power Supply 49.95
MLS100 External Speaker 46.95
MMB60 Quick Release Mobile Bracket 29.95
YSK8900 Separation Kit 49.95

FT7900R

Yaesu's economically priced One-Touch Operation FT-7900R Dual band FM mobile. Back-lit push button controls ensure extraordinarily easy and safe operation while driving at night. The exceptionally wide receiver coverage provides all sorts of additional uses!

ADMS2K Programming software and cable ... 39.95
MEK2 Microphone Extension Kit 42.95
JTPS14M Jetstream Power Supply 49.95
MLS100 External Speaker 46.95
MMB60 Quick Release Mobile Bracket 29.95
YSK7800 Separation Kit 29.95

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FT2000/D

The FT-2000 (100 watts) and FT-2000D (200 watts) are the 2nd Generation in the proud lineage of the FTdx9000 Series! Featuring extensive DSP filtering, factory installed antenna tuner and power supply and a host of outstanding ergonomic and performance features, the FT-2000 series radios are destined to be the centerpiece of your HF/50 MHz station!

DMU2000 Data Management Unit ..... **Call**
FH2 Remote Keypad **84.95**
SP2000 External Speaker..... **175.95**
UTUNINGKIT A, B, or C model..... **479.95**
YF122C 500 hz CW filter **159.95**
YF122CN 300 hz CW filter..... **164.95**

FT950

The FT-950 has been developed to fit the needs of both the casual and serious DX enthusiasts as well as new licensees desiring a top notch first radio to discover the magic of the HF and 50MHz bands. This superb radio features DSP filtering, 100 Watts of power output, factory installed antenna tuner and many of the outstanding ergonomic and performance features first introduced in our FTdx-9000 and FT-2000 flagship radios.

DMU2000 Data Management Unit..... **Call**
FH2 Remote Keypad **84.95**
MD100A8X Desk top mic **129.95**
MD200A8X Desk top mic **379.95**
SP2000 External Speaker..... **175.95**
UTUNINGKIT A, B, or C model..... **479.95**

FT450/AT

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**
FNB78 NiMH Internal Battery **115.95**
FP30 Internal Power Supply **209.95**
MD100A8X Desk top mic **129.95**
MH59A8J Remote Control Mic..... **64.95**
YF122S 2.3 kHz SSB Filter..... **164.95**

FT857D

The FT-857D, the world's smallest HF/VHF/UHF mobile transceiver, provides base station-type performance from an ultra-compact package that's ideal for mobile or external battery portable work. Wide frequency coverage, outstanding receiver performance, and the convenience of optional remote-head operation make the FT-857D the expert's choice for high-performance mobile operation!

ADMS4B Programming software/cable **51.95**
ATAS120 Auto tuning antenna..... **299.95**
CT39 Packet Cable..... **9.95**
CT62 Computer Interface Cable..... **32.95**
FC30 Auto antenna tuner..... **189.95**
JTPS28 Jetstream Power Supply..... **84.95**
MH59A8J Remote Control Mic..... **64.95**
YF122S 2.3 kHz SSB Filter..... **164.95**
YSK857 Separation Kit..... **39.95**

FT817ND

The world's first self-contained, battery-powered, Multi-mode Portable Transceiver covering the HF, VHF, and UHF bands! Providing up to five watts of power output, designed for operation on the 160-10m HF bands, plus the 6m, 2m, and 70 cm bands.

CSC83 Soft Case..... **23.95**
CT39 Packet Cable..... **9.95**
CT62 Computer Interface Cable..... **32.95**
EDC5B Lighter Cable..... **23.95**
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MH36E8J DTMF Mic..... **56.95**
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FT2900R

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.

ADMSVX170 Software and cable **43.95**
EDC5B Cigarette Lighter Cable..... **23.95**
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MH57A4B Speaker Mic **27.95**
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- ☑ 12 div. x-axis display range
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- ☑ Trigger modes: slope, video, pulsewidth, logic, delayed, event
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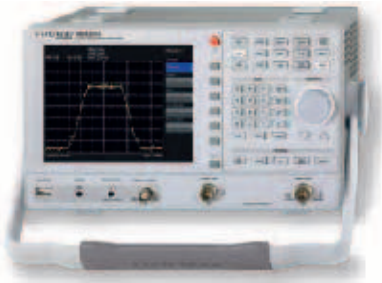
- ☑ 6 digit counter, Autoset, automeasurement, formula editor, ratiocursor
- ☑ Crisp 6.5" TFT VGA display, LED backlight, DVI output

3 GHz Spectrum Analyzer HMS 3000 / HMS 3010



1GHz: HMS1000 HMS1010

USB · USB Stick · optional IEEE-488 · optional TCP/IP · DVI Output · inclusive

- ☑ Frequency range 100 kHz...3 GHz
- ☑ Amplitude measurement range -114 dBm...+ 20 dBm
  DANL -135dBm with Preamp. Option HO3011
- ☑ Sweep time 20 ms...1000 s
- ☑ Resolution bandwidth 100 Hz...1 MHz in 1–3 steps, 200 kHz (- 3 dB)
  additional 200 Hz, 9 kHz, 120 kHz, 1 MHz (- 6 dB)
- ☑ Spectral purity < -100 dBc / Hz (@ 100 kHz)
- ☑ Video bandwidth 10 Hz...1 MHz in 1–3 steps
- ☑ Tracking Generator (HMS 3010) - 20 dBm / 0 dBm
- ☑ Integrated AM and FM demodulator (int. speaker)
- ☑ Detectors: Auto-, min-, max-peak, sample, RMS, quasi-peak

Progr. 2/3/4 Channel High-Performance Power Supply HMP Series

USB · RS-232 · optional IEEE-488 · optional TCP/IP · inclusive

- ☑ HMP2020: 1 x 0...32 V/0...10 A 1 x 0...5.5 V/0...5 A, max. 188 W
- ☑ HMP2030: 2 x 0...32 V/0...5 A 1 x 0...5.5 V/0...5 A, max. 188 W
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USB · USB Stick · optional IEEE-488 · optional TCP/IP · RS-232 · inclusive

- ☑ Frequency range 10 µHz...25 MHz / 50 MHz
- ☑ Output voltage 5 mV_{pp}...10 V_{pp} (into 50 Ω) DC Offset ± 5 mV...5 V
- ☑ Arbitrary waveform generator: 250 MSa/s, 14 Bit, 256 kPts
- ☑ Sine, Square, Pulse, Triangle, Ramp, Arbitrary
  waveforms incl. standard curves (white, pink noise etc.)
- ☑ Total harmonic distortion 0.04 % (f < 100 kHz)
- ☑ Burst, Sweep, Gating, external Trigger
- ☑ Rise time < 8 ns, in pulse mode 8 ns...500 ns variable-edge-time
- ☑ Pulse mode: Frequency range 100 µHz...12.5 MHz / 25 MHz,
  pulse width 10 ns...999 s, resolution 5 ns
- ☑ Modulation modes AM, FM, PM, PWM, FSK (int. and ext.)
- ☑ 10 MHz Timebase: ± 1 ppm TCXO, rear I/O BNC connector
- ☑ Front USB connector: save & recall of set-ups and waveforms
- ☑ 3.5" TFT: crisp representation of the waveform and all parameters

LCR - Bridge HM8118

incl. HZ188

USB · RS-232 · optional IEEE-488

- ☑ Basic Accuracy 0.05 %
- ☑ Measurement functions L, C, R, |Z|, X, |Y|, G, B, D, Θ, Δ, D, M, N
- ☑ Test frequencies 20 Hz...200 kHz
- ☑ Up to 12 measurements per second
- ☑ Parallel and Series Mode
- ☑ Binning Interface HO118 (optional) for automatic sorting of components
- ☑ Internal programmable voltage and current bias
- ☑ Transformer parameter measurement
- ☑ External capacitor bias up to 40 V
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1,2 GHz/3 GHz RF-Synthesizer HM8134-3/HM 8135

USB · RS-232 · optional IEEE-488

- ☑ Outstanding Frequency range 1 Hz...1,2 GHz/3 GHz
- ☑ Output power - 127 dBm...+ 13 dBm / - 135 dBm...+ 13 dBm
- ☑ Frequency resolution 1 Hz (accuracy 0.5 ppm)
- ☑ Input for external time base (10 MHz)
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- ☑ Rapid pulse modulation: typ. 200 ns
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- ☑ High spectral purity
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  Optional: OCXO (temperature stability: $\pm 1 \times 10^{-8}$)
- ☑ Galvanically isolated USB / RS-232 Interface, optional IEEE-488
- ☑ 10 configuration memories including turn-on configuration

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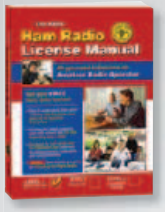

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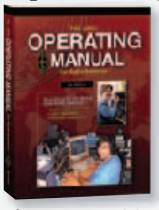

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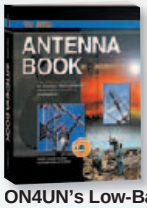

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Continued on page 134

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The MIRAGE B-5018-G gives you 160 Watts output for 50 Watts input on all modes -- FM, SSB, or CW!

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Heavy-duty heatsink spans entire length of cabinet. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Has adjustable delay *RF sense* Transmit/Receive switch *and* remote external keying. 16-20 Amps at 13.8 VDC.12x3x5½ inches.

B-5018-G **$329.95**

B-1018-G, $409.95. MIRAGE's most popular *dual purpose* HT or mobile/base amplifier. 160 Watts out for 10 Watts in. For 0.25-10 Watt rigs.

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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.

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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.

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- ***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.

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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.

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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.

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ARRL Publications—continued from page 132

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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.

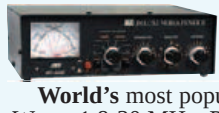
MFJ-993B
$259.95

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.

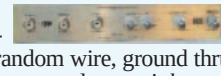


MFJ-949E
$179.95

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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10 Bands -- 1 MFJ Antenna!

Full size performance . . . No ground system or radials. Operate 10 bands: 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with one antenna . . . Separate full size radiators . . . End loading . . . Elevated top feed . . . Low Radiation Angle . . . Very wide bandwidth . . . Highest performance no ground vertical ever . . .

MFJ-1798
$299.95

Operate 10 bands -- 75/80, 40, 30, 20, 17, 15, 12, 10, 6 and 2 Meters with this MFJ-1798 vertical antenna and get *full size performance* with no ground or radials!

Full size performance is achieved using separate full size radiators for 2-20 Meters and highly efficient end loading for 30, 40, 75/80 Meters.

Get very low radiation angle for exciting DX, automatic bandswitching, omni-directional coverage, low SWR. Handles 1500 Watts PEP SSB.

MFJ's unique *Elevated Top Feed*™ elevates the feedpoint *all the way to the top* of the antenna. It puts the maximum radiation point high up in the clear where it does the most good -- your signal gets out even if you're ground mounted.

It's easy to tune because adjusting one band has minimum effect on the resonant frequencies of other bands.

Self-supporting and just 20 feet tall, the MFJ-1798 mounts easily from ground level to tower top -- small lots, backyards, apartments, condos, roofs, tower mounts.

Separate *full size* quarter wave radiators are used on 20, 17, 15, 12, 10 and 2 Meters. On 6 Meters, the 17 Meter radiator becomes a 3/4 wave radiator.

The active radiator works as a stub to decouple everything beyond it. In *phase* antenna current flows in all parallel radiators. This forms a very large equivalent radiator and gives you incredible bandwidths. Radiator stubs provide automatic bandswitching -- absolutely *no loss* due to loading coils or traps.

On 30, 40, 75/80 Meters, end loading -- the most efficient form of loading -- gives you highly efficient performance, excellent bandwidth, low angle radiation and automatic bandswitching.

MFJ's unique *Frequency Adaptive L-Network*™ provides automatic impedance matching for lowest SWR on these low bands. Tuning to your favorite part of these bands is simple and is done at the *bottom* of the antenna.

You don't need a ground or radials because an effective counterpoise that's 12 feet across gives you *excellent* ground isolation. You can mount it from ground level to roof top and get awesome performance.

The feedline is decoupled and isolated from the antenna with MFJ's exclusive *AirCore*™ high power current balun. It's wound with *Teflon*® coax and can't saturate, no matter how high your power.

Incredibly strong solid fiberglass rod and large diameter 6061 T-6 aircraft strength aluminum tubing is in the main structure.

Efficient high-Q coils are wound on tough *low loss* fiberglass forms using highly weather resistant *Teflon*® covered wire.

MFJ *6-Band* Halfwave Vertical Antenna

6 bands: 40, 20, 15, 10, 6, 2 Meters . . . No radials or ground needed

MFJ-1796
$229.95

MFJ-1796 is only 12 feet high and has a tiny 24 inch footprint! Mount anywhere -- ground level to tower top -- apartments, small lots, trailers. Perfect for field day, DXpeditions, camping.

Efficient end-loading, no lossy traps. Entire length always radiating. Full size halfwave on 2/6 Meters. High power *air-wound* choke balun eliminates feedline radiation. Adjusting one band has minimum effect on other bands.

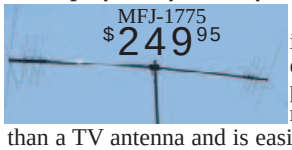
MFJ-1796W, $229.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ-1792, $189.95. Full size 1/4 wave radiator for 40 Meters. 33 ft., handles 1500 Watts PEP. Requires guying and radials.

MFJ-1793, $209.95. Like MFJ-1792 but has full size 20 Meter 1/4 wave also.

6-Band, 40-2 Meters ***Rotatable*** Mini-Dipole

Low profile 14 feet . . . 7 ft. turning radius . . . 40, 20, 15, 10, 6, 2 Meters . . . 1500 Watts . . .



MFJ-1775
$249.95

MFJ-1775 is inconspicuous and low profile -- not much bigger than a TV antenna and is easily turned by a lightweight rotator like Hy-Gain's *AR-35*.

It's no Wimp! Its *directivity* reduces QRM/noise and lets you *focus* your signal in the direction you want -- work some *real* DX.

You can operate 6 bands -- 40, 20, 15, 10, 6 and 2 meters -- and run *full 1500 Watts* SSB/CW on all HF bands!

Features automatic band switching and uses highly efficient end-loading with its *entire length* always radiating. With 6 and 2 Meters thrown-in, you have ham radio's most versatile *rotatable* dipole!

Each HF band uses a separate, efficient end-loading coil wound on fiberglass forms with *Teflon*™ wire, and capacitance hats at each end (no lossy traps). 6 and 2 meters are *full-length* halfwave dipoles.

Built-to-last -- incredibly strong solid rod fiberglass center insulator and 6063 T-6 aircraft strength aluminum tubing radiator. Assembles in an afternoon. Adjusting one band has little effect on other bands.

MFJ-1775W, $249.95. WARC band version for 12, 17, 30, 60 Meters only.

MFJ *80/40/20* Meter ***Rotatable*** Dipole

MFJ-1785
$369.95

Now you can operate the *low bands* on 80, 40, and 20 Meters with a true rotatable dipole that'll blend in with the sky! Take advantage of excellent low band propagation during this low sunspot cycle. Handles 1500 Watts SSB/CW. 80/40 meter end-loading coils are wound on fiberglass forms with *Teflon*™ wire, and resonated with capacitance hats to ensure extremely low-losses. Full-size on 20 Meters gives incredible DX. Balun included! 33 foot low-profile, inconspicuous. Easily rotatable with a medium duty rotator like Hy-gain's AR-40.

MFJ's Super High-Q Loop™ *Antennas*

MFJ-1786
$419.95

MFJ's *tiny* 36 inch diameter loop antenna lets you operate 10 through 30 MHz *continuously* -- including the WARC bands!

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes. Enjoy DX and local contacts mounted vertically. Get both low angle radiation for excellent DX and high angle radiation for local, close-in contacts. Handles 150 watts.

Super easy-to-use! Only MFJ's super remote control has *Auto Band Selection*™. It auto tunes to desired band, then beeps to let you know. No control cable is needed.

Fast/slow tune buttons and built-in two range Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency.

All welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter round radiator -- *gives you highest possible efficiency*.

Each plate in MFJ's tuning capacitor is welded for low loss and polished to prevent high voltage arcing, welded to the radiator, has nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor -- gives smooth precision tuning. Heavy duty thick ABS plastic housing has ultraviolet inhibitor protection.

Cover 40-15 Meters. MFJ-1788, $469.95. Like MFJ-1786 but covers 40 - 15 Meters continuous. Includes remote control.

MFJ's G5RV Antenna

MFJ-1778
$44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 M as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

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MFJ . . . the world leader in ham radio accessories!

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.

Dealer/Catalog/Manuals
Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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

• 1 Year *No Matter What*™ warranty • 30 day money back guarantee (less s/h) on orders direct from MFJ

MFJ ENTERPRISES, INC.
300 Industrial Pk Rd, Starkville, MS 39759 **PH:** (662) 323-5869
Tech Help: (662) 323-0549
FAX:(662)323-6551 8-4:30 CST, Mon.-Fri. ***Add shipping.***

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-998 1500 Watt *Legal Limit IntelliTuner*™

Only the MFJ-998 gives you fully automatic antenna tuning for your legal limit full 1500 Watts SSB/CW linear amplifier!

MFJ-998 $699.95

Ultra-fast Automatic Tuning

Instantly match impedances from 12-1600 ohms using MFJ's exclusive *IntelliTune*™, *Adaptive Search*™ and *InstantRecall*™ algorithms with over 20,000 *VirtualAntenna*™ Memories.

Safe auto tuning protects amp

MFJ's exclusive *Amplifier Bypass Control*™ makes tuning safe and "stupid-proof"!

Digital/Analog Meters

A *backlit* LCD meter displays SWR, forward/reflected power, frequency, antenna selected, an auto-ranging bargraph power indication, and much more.

Has quick-glance auto-ranging Cross-Needle SWR/Wattmeter.

MFJ VirtualAntenna™ Memory

MFJ new *VirtualAntenna*™ Memory system gives you 4 antenna memory banks for *each* of 2 switchable antenna coax connectors. Select up to 4 antennas on each antenna connector. Each antenna has 2500 memories, 20,000 total. Has binding post for end-fed long wire antennas.

Download & Upgrade Remotely

Download from internet and upgrade your MFJ-998 firmware as new features are introduced.

Plus Much More!

Built-in radio interface controls most transceivers.

Automatically bypasses with excessive tuning power.

Use balanced line antennas with external **MFJ-912, $59.95**, 1.5 kW 4:1 balun.

Small 13Wx4Hx15D inches easily fits into your ham station. 8 pounds. Requires 12-15VDC at 1.4 amps maximum or 110 VAC with **MFJ-1316, $21.95**.

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.

300 Watt...Best Seller

Digital Meter, Ant Switch, Balun

The *world's best selling* automatic antenna tuner is *highly acclaimed the world over* for its ultra high-speed, wide matching range, reliability, ease-of-use! Matches virtually *any* antenna.

MFJ-993B $259.95

300 Watt...*Extra* Wide Range

SWR/Wattmeter, 10000 VA Memories

***Extra** wide matching range at less cost.* Exclusive dual power level: 300 Watts/6-1600 Ohms; 150W/6-3200 Ohms. Cross-Needle SWR/Wattmeter.

MFJ-991B $219.95

200 Watt ...Compact

Digital Meter, Ant Switch, Wide Range

World's fastest compact auto tuner uses MFJ *Adaptive Search*™ and *InstantRecall*™ algorithms. 132,072 tuning solutions instantly match virtually any antenna with near perfect SWR.

MFJ-929 $219.95

200 Watt ...Econo

Small, Ant Switch, 20K VA Memories

High-speed, wide matching range and compactness at low cost! Leave in-line and forget it -- your antenna is *always* automatically tuned! 2-position antenna switch.

MFJ-928 $199.95

200 Watt *MightyMite*™

Matches IC-706, FT-857D, TS-50S

***No** extra space needed!* Just set your IC-706/7000, FT-857D, TS-50S on top of this matching low-profile automatic tuner -- it's all you need for a completely automated station using *any* antenna! Just tune and talk!

MFJ-925 $179.95

G5RV Antenna

MFJ-1778 $44.95

Covers all bands, 160-10 Meters with antenna tuner. 102 ft. long. Can use as inverted vee or sloper. Use on 160 Meters as Marconi.1500 Watts. Super-strong fiberglass center/feedpoint insulators. *Glazed ceramic* end insulators. All hand-soldered connections. Add coax, some rope and you're *on the air!*

MFJ-1778M, $39.95. G5RV Junior. Half-size, 52 ft. 40-10M with tuner, 1500 Watts.

200W...Weather-sealed

for Remote/Outdoor/Marine

MFJ-926B $399.95

***Fully** weather-sealed for remote Outdoor/Marine use*! Tough, durable, built-to-last the elements for years.

200 Watt...Remote

Coax/Wire Ant, No pwr cable needed

MFJ-927 $259.95

Weather protected fully automatic *remote* auto tuner for wire ***and*** *coax* antennas -- an MFJ exclusive. Powers through coax -- No separate power cable needed.

Free MFJ Catalog

Visit: http://www.mfjenterprises.com or call toll-free 800-647-1800

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http://www.mfjenterprises.com for instruction manuals, catalog, info

MFJ TUNERS

New, Improved MFJ-989D 1500 Watt *legal limit* Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D *legal limit* antenna tuner gives you better efficiency, lower losses and a new *true* peak reading meter. It easily handles *full* 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New dual 500 pF *air variable capacitors* give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved *AirCore*™ *Roller Inductor* gives you lower losses, higher Q and handles more power more efficiently.

New *TrueActive*™ peak reading Cross-Needle *SWR/Wattmeter* lets you read *true* peak power on all modes.

MFJ-989D $389.95

New high voltage *current balun* lets you tune balanced lines at high power with no worries.

New *crank knob* lets you reset your roller inductor quickly, smoothly and accurately.

New larger 2-inch diameter *capacitor knobs* with easy-to-see dials make tuning much easier.

New cabinet maintains components' high-Q. Generous air vents keep components cool. 12⅞Wx6Hx11⅝D 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. 10¾Wx4½Hx15 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. 10¾x4½x10⅞ 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. 3½Hx10½Wx9½D 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. 3½Hx10⅝Wx7D 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 10½Wx2½Hx7D 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 6x6½x2½ 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 4½x2¼x3 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. 7¼x2¼x2¾ 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. 8x2½x3 in.

MFJ-931 ***artificial*** RF Ground

MFJ-931 $109.95

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $209.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

Dealer/Catalog/Manuals

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Do You Operate on 40 Meters?

If you haven't been on 40 meters lately, you're in for a real treat!

It took years of patient effort by ARRL and members of IARU to free the band of broadcast interference, but it paid off! On the last weekend in March, commercial broadcasters began leaving the band.

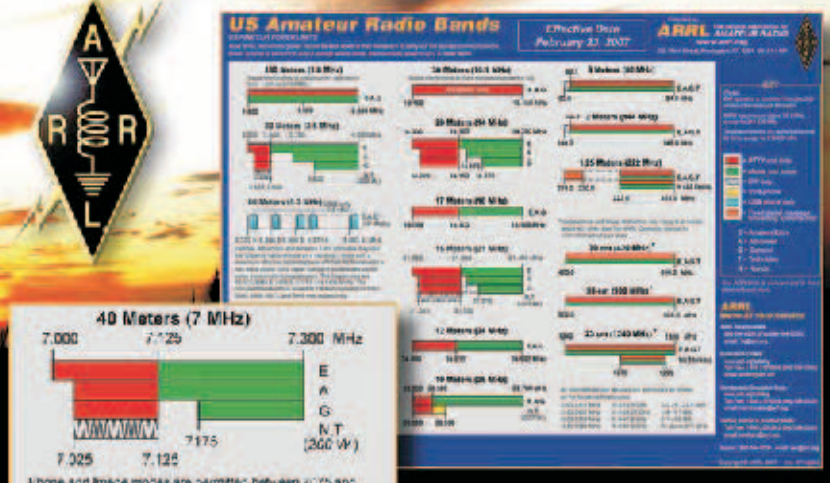
The change was dramatic—and expensive! Thanks to member contributions to the Spectrum Defense Fund, **40 meters is like a whole new band!**

For the first time in the history of radio communication, the HF broadcasting allocation was shifted to accommodate the needs of another radio service—**ours!**

We'd like to pursue new and improved ham bands, but most of our work must go to frequency defense. New uses of the radio spectrum are being conceived. And we must try to prevent the pollution of our Amateur Radio bands.

How can you help? **Your generous contribution to the Spectrum Defense Fund by November 30** will help ARRL meet the challenges that we are sure to face.

Thank you for giving as generously as you can—by mail, phone or on the web at **www.arrl.org/defense!**



For more information, contact:

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Telephone: **860-594-0397**
Email: **mhobart@arrl.org**

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.

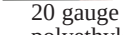
MFJ-16F01, $8.95. *Middle* insulator. High-strength coax connection at midpoint with SO-239, quadruple weave-through ladder line stress relief.

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 . . . The World Leader in Ham Radio Accessories

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.

New!
Giant 144/220/440 MHz SWR/Wattmeter
MFJ-867, $159.95. Like MFJ-868 giant SWR/Wattmeter, but covers 144/220/440 MHz.

www.mfjenterprises.com . . . World's largest selection of HF/VHF/UHF SWR Wattmeters!

MFJ-822
$59.95

Lighted 3" Cross-Needle Meter, SWR/Watts, 1.8-200 MHz, Fwd/Ref pwr, 30/300W. Compact.

MFJ-862
$59.95

Lighted Cross-Needle Meter, SWR/Watts, 144/220/440 MHz, 30/300 Watts Fwd, 60/6 W Ref.

MFJ-864
$99.95

Lighted Cross-Needle,SWR/Watts, 1.8-60/144/440 MHz, 30/300W Fwd, 6/60W Ref. Hook up HF&VHF/UHF rigs.

MFJ-815C
$109.95

Lighted 3" C/N Meter, SWR/Watts, 1.8-30 MHz, 300/3000W Fwd, 60/600W Ref. True Peak.

MFJ-812B
$39.95

VHF SWR Wattmeter, 2M/220 MHz, built-in field strength meter, Fwd/Ref, Pwr in 2 30/300W ranges.

MFJ-4416B *Super* Battery Booster

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, compensates for run down battery, wiring voltage drop, car off . . .

MFJ-4416B
$149.95

Boost battery voltage as low as 9 Volts back up to 13.8 VDC! Keeps your transceiver at full power output, provides full performance/efficiency, prevents output signal distortion and transceiver shutdown. Compensates for run-down battery, wiring voltage drop or when car is off. Provides up to 25 Amps peak with 90% efficiency. Selectable 9/10/11 Volts minimum input voltage prevents battery damage from over-discharging. RF sense turns MFJ-4416B off during receive to save power and increase efficiency. Adjustable 12 to 13.8 VDC output pass-through voltage improves efficiency and lets transceiver run cooler. Has output over-voltage crowbar protection. *Anderson PowerPoles*® and high-current 5-way binding posts for DC input, regulated output. 7¾Wx4Hx2⅛D inches.

100 Watts SSB from cigarette lighter socket!

MFJ-4403
$119.95

4-Farad capacitors supply 25 Amps needed for 100 Watts SSB peaks and replenished by 10 Amps average from cigarette lighter socket. Protects against reverse/over voltage, voltage transients, short circuits. Provides super noise/ripple filtering.

MFJ AC Line RFI Filter

Eliminate obnoxious power line and computer hash and noise by 6 S-units!

MFJ-1164B
$79.95

Filters and reduces AC power line RFI, hash, noise, transients, surges generated by computers, motors, RF transmitters, static/lightning by 30 db and up to 60-80 dB with a good earth ground. Super fast, *nano-second* overvoltage protection. Four 3-wire 15A, 120VAC outlets.

Transceiver Surge Protector

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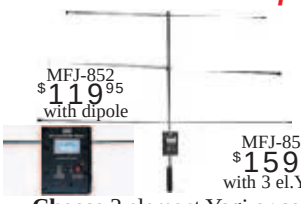

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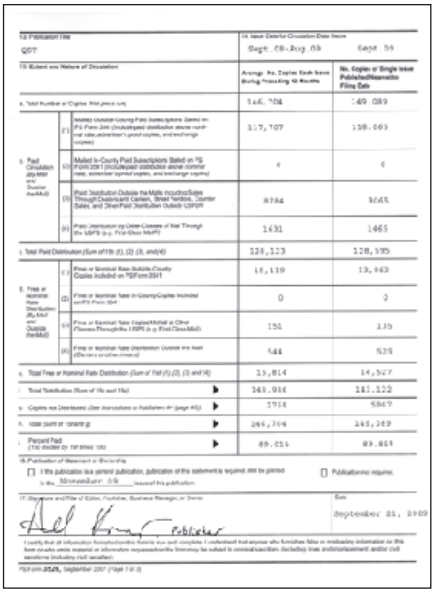

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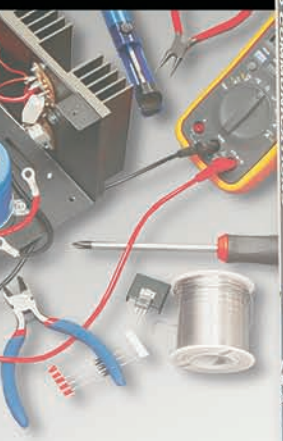

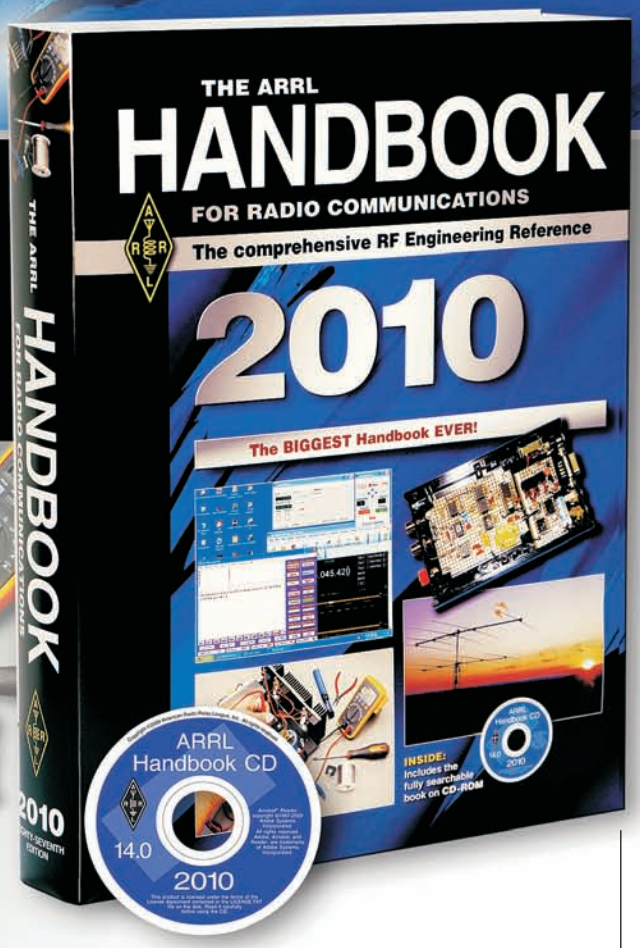

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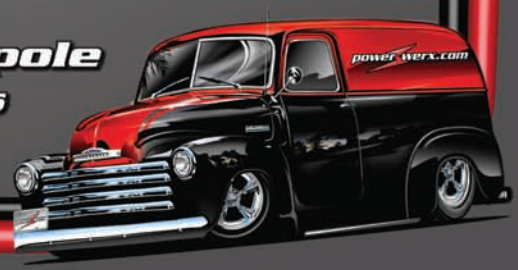

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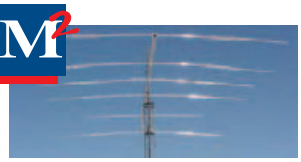

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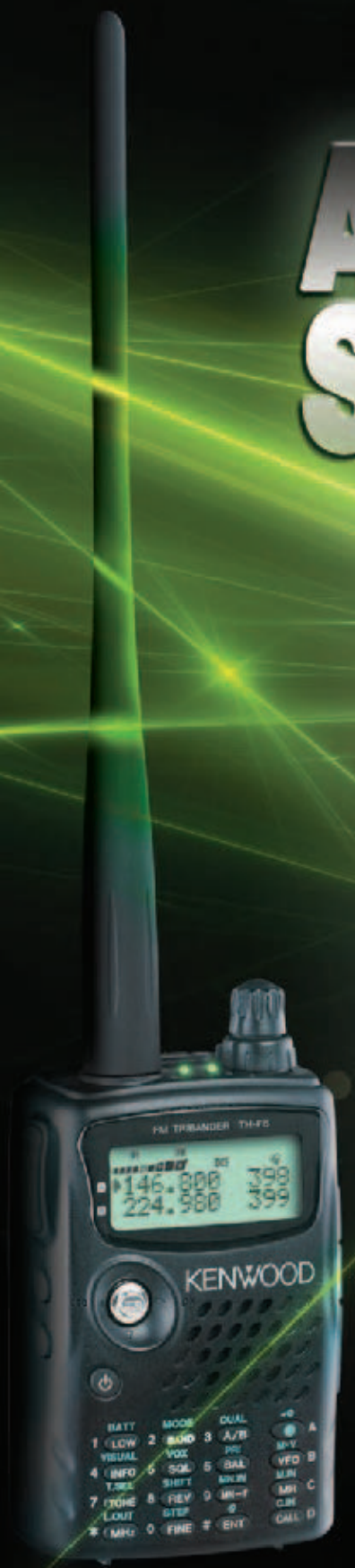

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